StorageWorks™ Array Controllers

HS Family of Array Controllers Service Manual

Order Number: EK–HSFAM–SV. D01

This manual contains necessary servicing information for the HS family of array controllers. Information included pertains to:

- Configuration
- Normal operating procedures
- Troubleshooting and error analysis
- Field replaceable units
- Removal and replacement procedures

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NOTE: This equipment generates, uses, and may emit radio frequency energy. The equipment has been type tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

Any changes or modifications made to this equipment may void the user's authority to operate the equipment.

Operation of this equipment in a residential area may cause interference, in which case the user at his own expense will be required to take whatever measures may be needed to correct the interference.

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Preface

This manual describes how to maintain and service the HS family of array controllers, including:

- Configuration
- Controls and indicators
- Normal operating procedures
- Error reporting
- Troubleshooting and fault isolation
- Field-replacable units
- Removal and replacement procedures

Intended Audience

This manual is intended for Digital™ Multivendor Customer Services personnel and customers who need assistance in operating and maintaining the HS array controllers.

Familiarity with the *HS Family of Array Controllers User's Guide* is assumed.

Structure

This manual contains the following chapters:

Chapter 1	Provides an overview of the HS controllers.
Chapter 2	Provides a technical explanation of HS controller hardware and firmware.
Chapter 3	Defines physical configuration rules for the HS controller subsystem.
Chapter 4	Provides operation and configuration instructions.
Chapter 5	Discusses how to translate error information and perform initial fault analysis.
Chapter 6	Details the diagnostics, inline exercisers, and utilities for the HS controllers.
Chapter 7	Provides procedures for the removal and replacement of FRUs.
Appendix A	Lists the HS controller FRUs, including part numbers and related FRUs.
Appendix B	Provides complete details for CLI commands and their usage.
Appendix C	Describes HSJ-Series controller error logging.
Appendix D	Describes HSD-Series controller error logging.
Appendix E	Describes HSZ-Series controller error logging.
Glossary	Defines acronyms and terms specific to the HS controllers.

Related Documentation

Table 1 lists documents containing information related to this product.

Table 1 Related Documentation

Document Title	Order Number
HSJxx Array Controller Software Product Description (SPD47.26.06)	AE–PYTGG–TE
HSD30 Array Controller Software Product Description (SPD53.53.02)	AE–Q6HKC–TE
HSZ40 Array Controller Software Product Description (SPD53.54.02)	AE–Q6HMC–TE
RAID/Write-Back Software Product Description (SPD54.38.00)	AE–QDA4A–TE
StorageWorks HSZ40 Array Controller Utility for DEC OSF/1 System Manager's Guide for HSZterm	AA–QC39A–TE
StorageWorks Array Controllers HS Family of Array Controllers User's Guide	EK–HSFAM–UG
StorageWorks Array Controllers HSJxx Array Controller Operating Firmware Release Notes	EK–HSFAM–RN
StorageWorks Array Controllers HSD30 Array Controller Operating Firmware Release Notes	EK–HSD30–RN
StorageWorks Array Controllers HSZ40 Array Controller Operating Firmware Release Notes	EK–HSZ40–RN
StorageWorks Solutions Building Block User's Guide	EK–SBB35–UG
StorageWorks Solutions Controller Shelf User's Guide	EK–350MA–UG
StorageWorks Solutions Configuration Guide	EK–BA350–CG
StorageWorks Solutions Shelf and SBB User's Guide	EK–BA350–UG
StorageWorks Solutions Shelf Metric Mounting Kit User's Guide	EK–35XRD–IG
StorageWorks Solutions SW300-Series RAID Enclosure Installation and User's Guide	EK–SW300–UG
StorageWorks Solutions SW500-Series Cabinet Cable Distribution Unit Installation Sheet	EK–SW5CU–IS
StorageWorks Solutions SW500-Series Cabinet Installation and User's Guide	EK–SW500–IG
StorageWorks Solutions SW800-Series Data Center Cabinet Cable Distribution Unit Installation Sheet	EK–SWCDU–IS
StorageWorks Solutions SW800-Series Data Center Cabinet Installation and User's Guide	EK–SW800–IG
The Digital Guide to RAID Storage Technology	EC–B1960–45
DECevent Translation and Reporting Utility for OpenVMS User and Reference Guide	AA–Q73KA–TE
VAXcluster Console System User's Guide	AA–GV45D–TE
VAXcluster Systems Guidelines for VAXcluster System Configurations	EK–VAXCS–CG

Documentation Conventions

The following conventions are used in this manual:

boldface type	Boldface type in examples indicates user input. Boldface type in text indicates the first instance of terms defined in either the text, the glossary, or both.
italic type	Italic type indicates emphasis, variables in command strings, and complete manual titles.
UPPERCASE	Words in uppercase text indicate a command, the name of a file, or an abbreviation for a system privilege.
Ctrl/*x*	Ctrl/*x* indicates that you hold down the Ctrl key while you press another key, indicated by *x*. For DILX and TILX, the caret symbol (^) is equivalent to the Ctrl key and these same instructions apply.
HSJ-Series	This refers to all CI-based controllers covered in this manual, as listed in Table 1–1.
HSD-Series	This refers to all DSSI-based controllers covered in this manual, as listed in Table 1–1.
HSZ-Series	This refers to all SCSI-based controllers covered in this manual, as listed in Table 1–1.

Manufacturer's Declarations

CAUTION

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

1

General Information and Subsystem Overview

This chapter contains general information and technical overview information on the hierarchical storage (HS) **controller**. For purposes of this manual, the term ''HS controller'' refers to several models, as shown in Table 1–1:

Table 1–1 HS Controller Models

Type	Model
HSJ™-series	HSJ40 HSJ30
HSD-series	HSD30™
HSZ™-series	HSZ40-A*x* (formerly HSZ40) HSZ40-B*x*
Controllers *not* covered in this manual	
Any HSC™ controller	
HSD05™	
HSZ1*x*	

1.1 Technical Overview

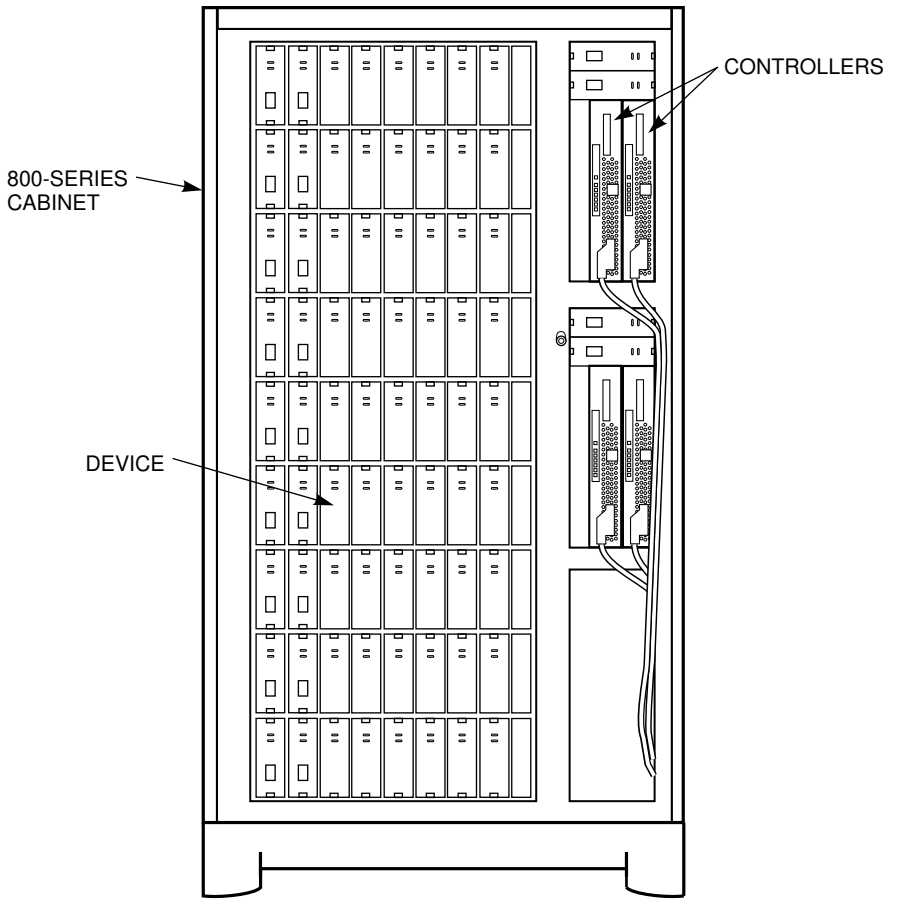
The HS controllers are an integral part of Digital's family of **array controllers**. The controllers connect **SCSI–2** (Small Computer System Interface generation 2) storage devices to a variety of **host** interfaces, including CI™, DSSI™, and SCSI.

Each HS controller consists of the following:

- A controller module
- (Optional) a read cache or a write-back cache module

The two modules are housed together in a **BA350–MA controller shelf** or an SW300 cabinet. The BA350-MA shelf can be inserted in different **StorageWorks**™ cabinets. Some cabinets are shown in Figures 1–1 and 1–2.

Figure 1–1 SW800-Series Data Center Cabinet



The Hierarchical Storage Operating Firmware (HSOF) that controls the HS controllers resides on a **PCMCIA** (Personal Computer Memory Card Industry Association) **program card**. The program card is a 2 MB EPROM card that fits into a Type II PCMCIA slot in the controller module.

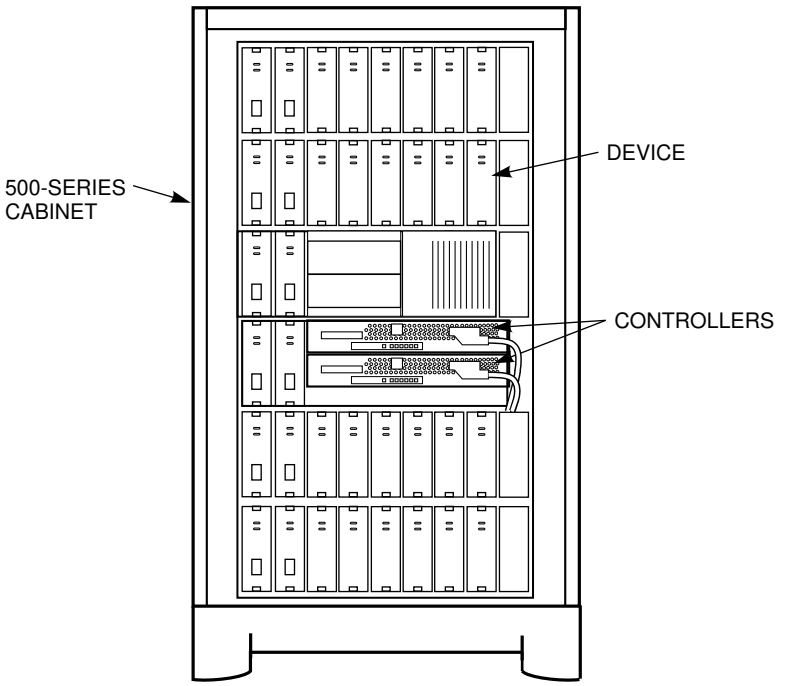
Each controller can operate alone (**nonredundant**), or in pairs (**dual-redundant**) for improved availability and fault protection. Digital recommends the dual-redundant configuration for all controllers.

Dual-redundant configurations support six SCSI–2 devices per **port** (device bus). For example, two six-port HSJ40 controllers in a dual-redundant configuration can control up to 36 devices. Nonredundant, low-availability configurations support up to seven devices per SCSI–2 port, but this setup sacrifices a convenient upgrade to high-availability and redundant/backup power options.

Note

In SW300 cabinet shelves, both dual-redundant and nonredundant configurations support up to four SCSI–2 devices per port.

Figure 1–2 SW500-Series Cabinet



Refer to your Software Product Description (**SPD**) and release notes for **supported devices**.

Table 1–2 summarizes the main features of each HS controller.

Table 1–2 Summary of HS Controller Product Features

Feature	HSJ40	HSJ30	HSD30	HSZ40
Host system bus	CI	CI	DSSI	SCSI–2 FWD
Host protocols	SCS, MSCP™, TMSCP™	SCS, MSCP, TMSCP	SCS, MSCP, TMSCP	SCSI–2
Storage device protocol	SCSI–2	SCSI–2	SCSI–2	SCSI–2
RAID level support	0/1/0&1/3/5	0/1/0&1/3/5	0/1/0&1/3/5	0/1/0&1/3/5
Number of SCSI device ports	6	3	3	6
Number of SCSI–2 devices per port (BA350–SB shelf)	6 (or 7)†	6 (or 7)†	6 (or 7)†	6 (or 7)†
Number of SCSI–2 devices per port (SW300 cabinet shelf)	4	4	4	4
Maximum number of SCSI–2 devices (BA350-series shelves)	36 (or 42)†	18 (or 21)†	18 (or 21)†	36 (or 42)†
Maximum number of SCSI–2 devices (SW300 cabinet shelf)	24	12	12	24
Dual-redundant configurations	Yes	Yes	Yes	Yes
Controller warm swap	Yes	Yes	Yes	Yes
Controller memory	8 MB	8 MB	8 MB	8 MB
Nonvolatile memory	32 KB	32 KB	32 KB	32 KB
Read cache module	16 or 32 MB	16 or 32 MB	16 or 32 MB	16 or 32 MB
Write-back cache module	16 or 32 MB	16 or 32 MB	16 or 32 MB	16 or 32 MB
Mixed disks and tapes‡	Yes	Yes	Yes	N/A
Sequential access tape media loaders	Yes	Yes	Yes	N/A
Random access tape media loaders	Yes	Yes	Yes	N/A
Command disks	Yes	Yes	Yes	N/A
Device warm swap	Yes	Yes	Yes	Yes
Controller-based device exercisers	Yes	Yes	Yes	Yes
Program card firmware update	Yes	Yes	Yes	Yes
Error correction code (ECC) on cache and shared memory	Yes	Yes	Yes	Yes
Error correction code (ECC) on program card	Yes	Yes	Yes	Yes
BBR/MSCP forced error support	Yes	Yes	Yes	N/A
Active device polling	Yes	Yes	Yes	N/A
Tagged command queuing	N/A	N/A	N/A	Yes
Power fail write nonvolatile journal	Yes	Yes	Yes	Yes
Data integrity and byte parity (all buses/memory)	Yes	Yes	Yes	Yes

†The dual-redundant controller configuration supports up to six devices per port. Nonredundant configurations support up to seven devices per port, but this sacrifices a convenient upgrade to high availability and redundant/backup power options.

‡On the same or different ports.

1.2 Maintenance Features

The HS controllers have the following features to aid in troubleshooting and maintenance:

- **Initialization diagnostics**

  Various levels of initialization diagnostics execute on the controller. These tests ensure that the subsystem is ready to come online after it has been reset, powered on, and so forth. You can elect to rerun many of the diagnostics after initialization completes in order to test controller operation. See Section 6.1.3.1 for more information about controller initialization.

- **Terminal access**

  You can use a **virtual terminal** (host terminal) or a **maintenance terminal** to check status and set operating parameters. The terminal connection provides access to the following:

  – Command line interpreter (**CLI**) (Chapter 4 and Appendix B)

  – Error messages (Chapter 5)

  – Error logs (Chapter 5 and Appendixes C through E)

- **Utilities**

  The VTDPY utility displays current controller state and performance data, including processor utilization, host port activity and status, device state, **logical unit** state, and cache and I/O performance.

  The configuration utility (CONFIG) checks the **SCSI device** ports for any device not previously added. This utility will add and name these devices.

  The Firmware Licensing System (FLS) enables and disables licensed controller features, including **RAID** (Redundant Array of Independent Disks), **mirroring** and write-back caching.

  The Fault Management Utility (FMU) controls some spontaneous error displays and displays controller last failure and memory system failure information.

  See Chapter 6 for detailed information on each utility.

- **Exercisers**

  The controller can run both a disk inline exerciser (**DILX**) and a tape inline exerciser (**TILX**). These exercisers simulate high levels of user activity, so running them provides performance information you may use to determine the health of the controller and devices attached to it. See Chapter 6 for more information about the exercisers.

- **Controller warm swap**

  You can safely remove and replace, or **warm swap**, one controller in a dual-redundant configuration. When you warm swap a controller, you are replacing a controller in the most transparent method available to the HS controller subsystem. Warm swapping a controller has minimal system and device impact. For more information on warm swapping, see Chapter 7.

- **Operator control panel**

  The operator control panel (**OCP**) on the front of the controller has LEDs for reporting controller and device conditions and buttons for controlling the SCSI ports. See Chapter 5 for a complete description of the OCP.

1.3 Controller Specifications

Table 1–3 lists the physical and electrical specifications for the HS controllers and their cache modules. Measurements in Table 1–3 are nominal measurements; tolerances are not listed.

Table 1–3 HS Controller Specifications

Hardware	Length	Width	Power	Current at +5 V	Current at +12 V
HSJ40 controller module	12.5 inches	9.50 inches	39.04 W	6.20 A	670 mA
HSJ30 controller module	12.5 inches	9.50 inches	39.04 W	6.20 A	670 mA
HSD30 controller module	12.5 inches	8.75 inches	20.87 W	4.15 A	10 mA
HSZ40 controller module	12.5 inches	8.75 inches	23.27 W	4.63 A	10 mA
Read cache, 16 MB	12.5 inches	7.75 inches	1.82 W	360 mA	2 mA
Read cache, 32 MB	12.5 inches	7.75 inches	2.02 W	400 mA	2 mA
Write-back cache, 16 MB (Battery charging)	12.5 inches	7.75 inches	2.28 W 8.52 W	360 mA 360 mA	40 mA 560 mA
Write-back cache, 32 MB (Battery charging)	12.5 inches	7.75 inches	2.48 W 8.72 W	400 mA 400 mA	40 mA 560 mA

Refer to the *StorageWorks Solutions Controller Shelf User's Guide* for power requirements for the BA350–MA controller shelf. Refer to the *StorageWorks Solutions SW300-Series RAID Enclosure Installation and User's Guide* for power requirements for the SW300 cabinet.

1.4 Controller Environmental Specifications

The HS controllers are intended for installation in a Class A computer room environment.

The StorageWorks product line environmental specifications listed in Table 1–4 are the same as for other Digital storage devices.

Table 1–4 StorageWorks Environmental Specifications

Condition	Specification
	Optimum Operating Environment
Temperature Rate of change	+18° to +24°C (+65° to +75°F) 11°C (20°F per hour)
Relative humidity	40% to 60% (noncondensing) with a step change of 10% or less (noncondensing)
Altitude	From sea level to 2400 m (8000 ft)
Air quality	Maximum particle count .5 micron or larger, not to exceed 500,000 particles per cubic ft of air
Inlet air volume	.026 cubic m per second (50 cubic ft per minute)
	Maximum Operating Environment (Range)
Temperature	+10° to +40°C (+50° to +104°F) Derate 1.8°C for each 1000 m (1.0°F for each 1000 ft) of altitude Maximum temperature gradient 11°C/hr (20°F/hr) ±2°C/hr (4°F /hr)
Relative humidity	10% to 90% (noncondensing) Maximum wet bulb temperature: 28°C (82°F) Minimum dew point: 2°C (36°F)
	Maximum Nonoperating Environment (Range)
Temperature	–40° to +66°C (–40° to +151°F) (During transportation and associated short–term storage)
Relative humidity Nonoperating	8% to 95% in original shipping container (noncondensing); otherwise, 50% (noncondensing)
Altitude	From –300 m (–1000 ft) to +3600 m (+12,000 ft) MS

2
Functional Description

This chapter provides a detailed functional description of the HS controller hardware and firmware.

2.1 Hardware

The controller provides a connection between a host computer and an array of SCSI–2 compatible storage devices. The hardware of each controller consists of core circuitry, as follows:

- Policy processor
- Program card
- Diagnostic registers
- Operator control panel
- Maintenance terminal port
- Dual controller port
- Nonvolatile memory (NVMEM)
- Bus exchangers
- Shared memory
- Value-added functions
- Device ports
- Cache (on a companion module)
- Host interface

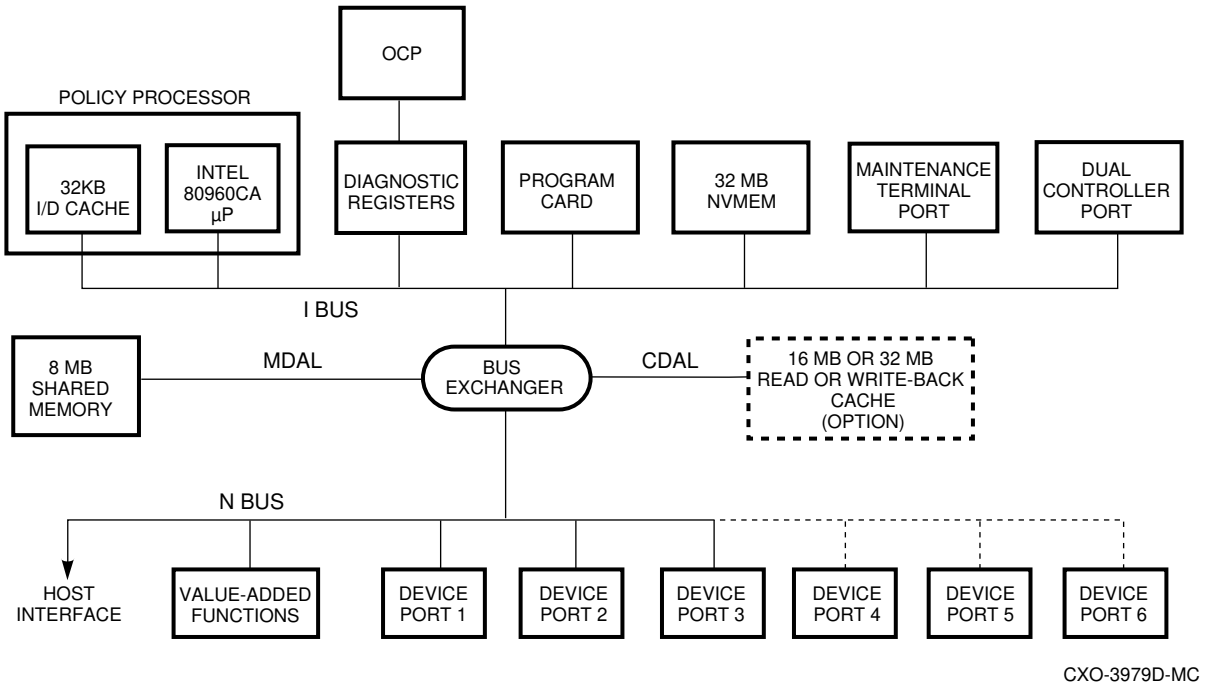
  The host interface on each controller module is tailored to the appropriate host system.

Figure 2–1 shows a block diagram of the HS controller hardware. Each component is described in the sections below.

2.1.1 Policy Processor

The policy processor consists of microprocessor hardware necessary for running the HS controller.

Figure 2–1 Common Hardware Block Diagram



2.1.1.1 Intel 80960CA

The heart of the policy processor is an Intel® 80960CA (i960) processor chip. This processor chip runs the firmware from the program card and provides a consistent instruction execution rate of 25 MIPs. The i960 chip controls all but low-level device and host port operations.

2.1.1.2 Instruction/Data Cache

Although the i960 chip has an internal cache, the internal cache is not large enough to offset performance degradation caused by shared memory. To compensate for this, the i960 chip utilizes a separate instruction/data (I/D) cache. This 32-KB static RAM (SRAM) cache helps the i960 chip achieve faster access to instructions and variables that are in immediate use. A **write-through cache** design maintains data coherency in the I/D cache.

2.1.2 Program Card

The program card is a PCMCIA standard program card device containing the firmware for operating the controller. The firmware is loaded from the program card into shared memory each time the controller initializes. Special error correction code corrects program card errors when possible.

2.1.3 Diagnostic Registers

The controller has two write and two read diagnostic registers. Diagnostic and functional firmware use the write diagnostic registers to manipulate controller and device operations. Certain bits in the registers activate test modes for forcing errors in the controller. Other bits control the operator control panel (OCP) LEDs. The policy processor examines the read diagnostic registers to determine the cause of an interrupt when an interrupt occurs, and at other times.

2.1.4 Operator Control Panel

The OCP includes the following:

- One reset button with embedded green LED
- One button per SCSI port
- Six amber LEDs[1]

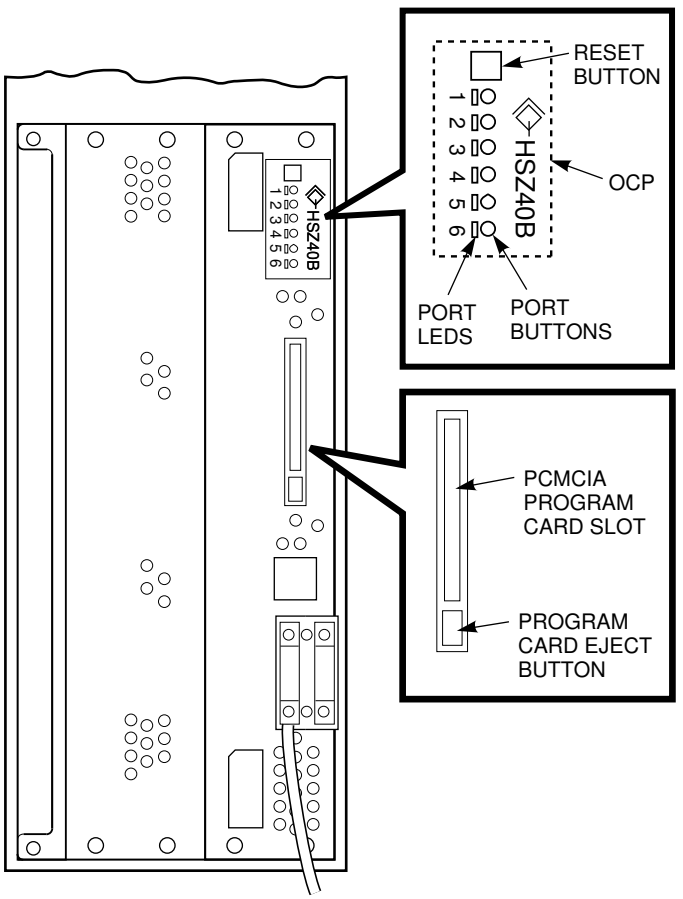
Figure 2–2 shows an example of the OCP from the HSZ40 controller.[2] The buttons and LEDs serve different functions with respect to controlling the SCSI ports and/or reporting fault and normal conditions:

- The green reset LED indicates normal operation and fault conditions.
- The amber port LEDs indicate errors and faults.
- The reset button halts all activity on the controller and causes it to reboot.
- Each of the port buttons quiesces (pauses) the associated device bus.

See Chapter 5 for further information on using the OCP.

[1] The HSJ-series has the amber LEDs embedded in the port buttons.
[2] The HSD-series OCP is identical.

Figure 2–2 Operator Control Panel (HSZ-Series)



2.1.5 Maintenance Terminal Port

With the exception of the HSZ40-B*x* controller, each HS controller has a modified modular jack (MMJ) on its front bulkhead that can support an EIA–423 compatible maintenance terminal. The HSZ40-B*x* controller has an RJ–11 jack for connecting a maintenance terminal.

You must connect a maintenance terminal during controller installation to set initial controller parameters. During normal operation, you may use either a maintenance terminal or a virtual (host) terminal to add devices and **storagesets**, or to perform other storage configuration tasks.

Note

If you connect a maintenance terminal to one controller in a dual-redundant configuration, and both controllers are functioning, you can change the configuration of both controllers.

You can also connect a VAXcluster™ console system (**VCS**) or serial interface also to the EIA–423 terminal port as a maintenance interface.

2.1.6 Dual Controller Port

The controller has an internal serial port for communication with a second controller of the same model. The second controller needs to be mounted in the same controller shelf, with communication passing through the shelf backplane. A dual-redundant configuration allows one controller to take over for another (failed) controller. The takeover process is called **failover**. During failover, the **surviving controller** supports the SCSI–2 devices linked to the failed controller. See Chapter 4 for more information on failover.

2.1.7 Nonvolatile Memory

The controller has 32 KB of nonvolatile memory (**NVMEM**). NVMEM is implemented using battery backed up SRAM. This memory serves two purposes:

- NVMEM stores parameter and configuration information such as device and **unit** number assignments entered by the user and by the controller firmware.
- NVMEM stores cache module metadata, which allows the controller to check for the correct cache module.

2.1.8 Bus Exchangers

Bus exchange devices allow high-speed communication between bus devices and shared memory. One bus exchanger handles address lines while the other bus exchanger handles data lines. The bus exchangers are classified as four-way cross-point switches, which means the bus exchangers allow connections between any two ports on the switch.

2.1.9 Shared Memory

Shared memory consists of a dynamic RAM controller and arbitration engine (DRAB) gate array controller and 8 MB of associated dynamic RAM (DRAM). Shared memory uses parity-protected 9-bit error correction code (**ECC**) and error detection code (**EDC**) for improved error detection and data recovery. The shared memory also stores the controller firmware and is shared between bus devices for data structures as well as data buffers.

One portion of shared memory contains instructions for the i960 chip, firmware variables, and data structures, including the look-up table for the i960 chip. In the absence of the cache module, another portion of shared memory acts as a cache. Otherwise, this portion contains cache module context for cache look-ups when a cache module is in place.

2.1.10 Value-Added Functions

This circuit acts as the accelerator for RAID XOR operations as well as disk and tape compare operations. To support recovery of a lost member of a RAID5 storageset, the controller will perform an XOR of parity data with the surviving **RAIDset** members' data to **reconstruct** the lost member.[3]

[3] You must have the write-back cache option to execute any RAID functions.

2.1.11 Device Ports

The controller SCSI–2 device ports are a combination of NCR® 53C710 SCSI port processors and SCSI transceivers. The 53C710 processors perform operations in 8-bit, single-ended normal or fast mode. The 53C710 processors execute scripts read from shared memory and under control of the policy processor.

Each SCSI–2 port can have up to six or seven attached devices depending on controller configuration (dual-redundant or nonredundant, respectively). In a dual-redundant configuration, device availability improves, because each controller has access to the other controller's devices.

2.1.12 Cache Module

The controller can run with a companion read or a **write-back cache** module. Either option is available in 16 or 32 MB.

2.1.12.1 Common Cache Functions

The cache module increases controller I/O performance. During normal operation, a host read operation accesses data either from the fast memory of the cache module or from an I/O device.

If a host read is a cache ''hit'' (data already in the cache), the data is supplied to the host immediately, improving I/O performance by reducing latency. If the host read is a cache ''miss'' (data not in the cache), the controller accesses the appropriate device to satisfy the request. Then the controller reads the data, returns it to the host, and writes it to the cache.

Cache entry sizes are fixed at 64 KB (128 logical **blocks**) for each logical unit. Read caching is enabled by default but can be optionally disabled using the CLI> SET command on a per-unit basis (see Appendix B).

The data replacement algorithm is a least recently used (**LRU**) replacement algorithm. When the cache is full and new data must be written, the LRU algorithm removes the oldest resident cached data with the least number of references and replaces it with the new data.

2.1.12.2 Read Cache Module

During a host write operation using the **read cache**, data is written to the disk *and* the cache. This is known as write-through caching, and it improves the performance of subsequent reads, because often the requested data was previously written to the cache.

The read cache consists of DRAM storage. However, the read cache is volatile. Subsystem power failures cause the loss of all data in the read cache.

2.1.12.3 Write-Back Cache Module

The write-back cache module increases subsystem performance as well as preserves data integrity under power failure situations.

In write-back caching, data is not always written to storage and cache simultaneously (as in write-through caching). Instead, data intended for storage may remain in the cache until the optimum time to write to a device occurs. When data is suspended in this way it is referred to as **unwritten cache data**. A power failure when there is unwritten cache data would cause the loss of the data. In RAIDset configurations, the impact of power failure is worsened by the possibility of **write hole** data loss as well.

For this reason, the write-back cache differs from the read cache by using onboard rechargeable batteries. The batteries power the memory to retain data when shelf backplane power is interrupted. The battery circuit automatically detects loss of shelf backplane power and switches to battery power.

Battery Discharging

During a power failure, the write-back cache batteries discharge very slowly, providing standby power to retain cache data. Digital guarantees that fully charged batteries will maintain cache data during a power outage for a minimum of 100 hours.

Studies performed by utility companies have noted that over 99 percent of all power outages last less than 1 minute. However, once power fails for more than 3 minutes (32 MB write-back cache) or 5 minutes (16 MB write-back cache) the controller will mark the cache batteries as ‘‘not fully charged’’ and will modify its operation upon restart in order to maximize data preservation:

- Stripesets and disk-based units with write-back caching enabled will be accessed in write-through (read cache) mode until the cache batteries are fully recharged. Once the batteries are recharged, write-back caching will resume.
- RAIDsets and Mirrorsets will be available either in write-through mode, or unavailable until the batteries are fully recharged from a long power failure, depending on the cache policy set for the controller. See Chapter 5 for a full explanation of write-back cache battery policy.

A battery failure in one cache module will cause HSJ- and HSD-based RAIDsets to fail over to the companion cache in a dual-redundant configuration, provided the other cache’s batteries are fully charged. Although this feature does not help during power outages (because both controllers will be down), it will keep your mirrorsets and RAIDsets on line if one battery becomes faulty.

HSZ-based RAIDsets do not fail over to the other controller in the event of a battery failure.

Battery Charging

Under normal conditions (power restored), a battery charge circuit senses the battery voltage and automatically activates a charger to achieve and maintain full battery charge. The relationship of power down time versus battery recharge time is given by the following two ratios:

16 MB write-back cache—24:1 (power down time versus time to fully charge)
32 MB write-back cache—12:1

For example, a two hour power outage results in approximately 10 minutes of recharge time for a 32 MB write-back cache. The recharge time is a safety precaution, taken to preserve the integrity of the controller subsystem for any and all power outages that may occur thereafter.

Note

Digital recommends replacing the write-back cache batteries at 5 year intervals.

See Chapter 7 for information on how to upgrade your cache option from read to write-back cache.

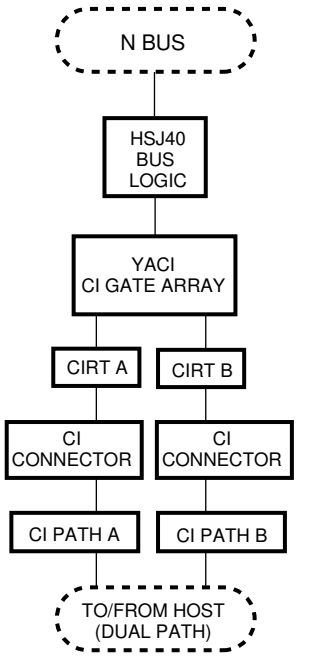
2.1.13 Host Interface

The following sections provide descriptions of the host interface hardware for each series of HS controller.

2.1.13.1 HSJ-Series (CI Interface)

Figure 2–3 shows a block diagram of the HSJ-series to CI host interface hardware.

Figure 2–3 HSJ-Series CI Host Interface Hardware Block Diagram



The CI interface for the HSJ-series controllers consists of a YACI CI gate array, and CI receiver/transmitter (**CIRT**) chips for the individual CI ports. The YACI gate array allows direct memory access of data between the host CI port and controller shared memory. Specialized host port firmware running on the policy processor sets up and maintains the CI port.

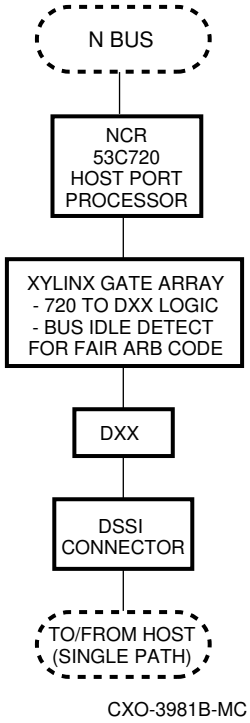
The HSJ-series controller supports dual data link (**DDL**) operations on the CI bus. With DDL, the controller can have operations in progress simultaneously on both CI paths (Path A and Path B).

Each CI path (Path A and Path B) runs in half duplex. This means the path can either be transmitting or receiving, but not both at the same time. However, one CI path can be receiving while the other is transmitting. A transmit/receive operation may be active to the same node if the node supports DDL operation (such as to a CIXCD **adapter**).

2.1.13.2 HSD-Series (DSSI Interface)

Figure 2–4 shows a block diagram of the HSD-series to DSSI host interface hardware.

Figure 2–4 HSD-Series DSSI Host Interface Hardware Block Diagram

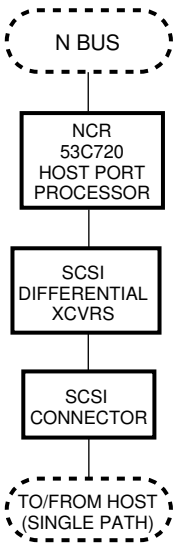


The DSSI interface consists of an NCR 53C720 chip plus specific DSSI logic and transceivers. The NCR 53C720 chip reads and runs scripts from controller shared memory to perform command and DMA operations on the DSSI interface. The policy processor sets up and maintains the operation of the NCR 53C720 chip.

2.1.13.3 HSZ-Series (SCSI–2 Interface)

Figure 2–5 shows a block diagram of the HSZ-series to SCSI–2 host interface hardware.

Figure 2–5 HSZ-Series SCSI–2 Host Interface Hardware Block Diagram



The HSZ-series controller interfaces with two types of host SCSI buses:

- A fast, wide, differential 16-bit SCSI bus (**FWD SCSI**)
- A fast, differential 8-bit SCSI bus (**FD SCSI**)

The hardware consists of the NCR 53C720 chip and transceivers, and functions in much the same way as the DSSI interface (refer to Section 2.1.13.2).

CAUTION

The HSD-series and HSZ-series controllers have identical connectors for the host trilink connector, but they are very different electrically. Take care not to accidentally connect an HSD-series controller to a SCSI bus, or an HSZ-series controller to a DSSI bus. Connecting to the wrong bus will cause equipment damage.

2.2 Firmware

The controller firmware, or hierarchical storage (HS) operating firmware, consists of functional code, diagnostics, utilities, and exercisers.

HS operating firmware is stored in a PCMCIA program card. Digital ships the card along with your controller. Each time HS operating firmware is updated, new cards are manufactured for each controller model. You can purchase the update cards on a per-release basis or through an update service contract.

Once the program card is installed in the controller, the contents are copied into shared memory. Special error correction code corrects program card errors when possible. Anytime you reset the controller, this loading process gets repeated. Because of this scheme, when the firmware executes, only part of the controller initialization diagnostics run directly from the program card. The remaining diagnostics, all functional code, and all utilities run from controller shared memory.

The HS operating firmware consists of five functional areas:

- Core functions
- Host interconnect functions
- Operator interface and subsystem management functions
- Device services functions
- Value-added functions

These functional areas are discussed in the following sections.

2.2.1 Core Functions

HS operating firmware provides the following core functions, in the order they are executed following turning on the controller:

1. Tests and diagnostics
2. Executive functions

2.2.1.1 Tests and Diagnostics

Controller tests and diagnostics are integrated in a controller self-test procedure performed when the controller initializes. The output of the self-test procedure is a simple go/no go status of the controller subsystem. The self-test procedure includes a test of the cache module. See Chapter 6 for additional initialization and self-test information.

2.2.1.2 Init Functions

After successful completion of the tests and diagnostics, the controller data structures are initialized and memory is allocated for controller functions.

2.2.1.3 Executive Functions

Firmware executive (**EXEC**) functions act as the operating system kernel for the HS controller. EXEC functions are common among the different controller models described in this manual. EXEC functions control firmware execution with respect to interrupts, thread control, queuing support, timers, and so forth. The EXEC functions establish the controller environment as a nonpreemptive interrupt-driven process.

2.2.2 Host Interconnect Functions

HS operating firmware supports three different host interconnections: CI, DSSI, and SCSI. The following list identifies the protocols used for host access of controller storage:

- **CI**—System Communication Services (**SCS**); Mass storage control protocol (**MSCP**) and/or tape mass storage control protocol (**TMSCP**) and DUP
- **DSSI**—SCS; MSCP and/or TMSCP and DUP
- **SCSI**—SCSI–2 protocol with SCSI passthrough software to the CLI, **tagged command queuing** on the host and device side, and mode select/sense support for SCSI

2.2.3 Operator Interface and Subsystem Management Functions

The operator interface and subsystem management functions support the user interface, subsystem management, subsystem verification, and error logging/fault management. These functions are presented in the following sections.

2.2.3.1 Command Line Interpreter

The command line interpreter (CLI) is the primary user interface for the controller. You can access the CLI through a maintenance terminal connected to the port on the front bulkhead of the controller, or from a host via the DUP or HSZterm utilities. The CLI firmware can respond to most management functions plus local program execution. Briefly, the CLI provides the following two types of commands:

- SET/SHOW commands for the controller itself. This includes setting and showing the controller ID, name, path controls, and other vital information.
- Configuration commands to add/delete devices, storagesets, and logical units.

See Appendix B for more information on the CLI and its commands.

2.2.3.2 Diagnostic Utility Protocol

Diagnostics and Utilities Protocol (**DUP**) from the host is supported over CI and DSSI buses (HSJ- and HSD-series controllers). DUP allows you to access the CLI and local programs through a remote host ''virtual'' terminal in much the same way as using a maintenance terminal. See Chapter 4 for more information on DUP.

2.2.3.3 HSZ-Series Virtual Terminal

A virtual terminal port can be created through a host-based application called HSZterm. This program uses SCSI diagnostic send and receive commands to deliver and receive characters to and from the HSZ-series CLI and local programs. See the *StorageWorks HSZ40 Array Controller Utility for DEC OSF/1 System Manager's Guide for HSZterm* for more information on the HSZterm application.

2.2.3.4 Local Programs

There are several local exercisers and utilities available for controller subsystem management/verification, as follow:

- **DILX** and **TILX** are disk and tape exercisers that allow you to test and verify operation of the controller with attached SCSI–2 storage under a high or low I/O load. These utilities place the load on the controller, bypassing the host port. Chapter 6 provides a full description of DILX and TILX.
- The **VTDPY** utility allows you to display current controller state and performance data, including processor utilization, host port activity and status, device state, logical unit state, and cache and I/O performance. See Chapter 6 for detailed information on this utility.
- The **controller warm swap** procedure (C_SWAP) allows you to safely remove and replace one controller in a dual-redundant configuration. When you perform a controller warm swap, you are replacing a controller in the most transparent method available to the controller subsystem. There is minimal system and device impact, as explained in Chapter 7.

  You can also use the warm swap procedure to upgrade from a single controller to a dual-redundant configuration, and to add or upgrade a cache module.

- The **Firmware Licensing System** (FLS) allows you to activate licensed features within HS operating firmware. Any feature turned on without entering a valid license code (key) causes a message to be sent to the host event log and to a connected terminal every hour. These notifications stop when a valid license key is entered. See Chapter 6 for more information on FLS.
- The **Configuration menu** (CFMENU) allows you to quickly configure storage devices attached to the controller. CFMENU presents configuration commands normally entered at the CLI in a menu-driven format. See Chapter 6 for more information on CFMENU.
- The **Code Load/Code Patch** utility (CLCP) allows you to install new firmware or repair small firmware areas without installing a new program card. Updated firmware and patches become active once you restart the controller. See Chapter 6 for more information on CLCP.

  The HSZ40-B*x* is the only controller model that supports code load. All controller models support code patch.
- The **Fault Management Utility** (FMU) allows you to control display of some spontaneous event, controller last failure, and memory system failure information. You can also use FMU to view recent last failure and event messages. See Chapter 6 for more information on FMU.
- The **Configure** utility (CONFIG) checks the SCSI device ports for any device not previously added. You can use this utility to add and name these devices. See Chapter 6 for more information on the CONFIG utility.
- The **Clone** utility (CLONE) creates a duplicate of any stripeset, mirrorset, or single-disk unit. You can use this utility to perform a backup of a unit (for example, a stripeset) without significantly impacting performance for users by first cloning the unit and then performing the backup from the clone. See Chapter 6 for more information on the CLONE utility.

2.2.3.5 Event Reporting and Fault Management

Event Reporting and Fault Management is an integrated function that controls reporting of significant events detected during controller operation. Fault Management firmware recommends repair actions when faults are detected. See Chapter 5 and Appendixes C through E for more information on these subjects.

2.2.4 Device Services

SCSI–2 device service firmware includes device port drivers, support for disks, tapes, tape loaders, CD–ROMs, and other devices on one controller, and physical device addressing and access. Device service consists of normal functions such as read and write operations, plus error recovery code. It also contains firmware for controlling and observing the **BA350–SB shelf** and StorageWorks building blocks (**SBBs**), such as LED, power, and **blower** monitoring. Specific features include:

- Normal SCSI–2, 8-bit, single-ended support.
- FAST, synchronous, 8-bit, single-ended device support.
- Tagged queuing for SCSI–2 devices.
- Support of specified devices per HS operating firmware release. Refer to your HS operating firmware release notes for a list of supported devices.

- Mixed disk and tape support. You can mix disk and tape storage on one controller. Furthermore, you can place disks and tapes together on any of the controller's SCSI–2 ports.

Note

Tapes are not currently supported for the HSZ-series controller. Refer to your firmware release notes for specific information and restrictions for tape drives.

- Device warm swap. You can remove and replace most devices without taking the subsystem offline (see Chapter 7). See your firmware release notes for any restrictions on devices that cannot be warm swapped.
- **Device shelf** and SBB observation and control. This service monitors SHELF_OK signals and alerts you of blower and power supply failures. This firmware also controls the fault LEDs on the SBBs for use in warm swap procedures and identifying device failures or configuration mismatches.
- Device error recovery. This service performs error recovery and read and write retries directly, making several attempts to serve data to and from the host before declaring an unrecoverable error or marking a device as failed.
- Command disks (HSJ and HSD only). Command disks allow jukeboxes and other generic SCSI devices to be attached to MSCP-based hosts. See Chapter 4 for more information on command disks.

2.2.5 Value-Added Functions

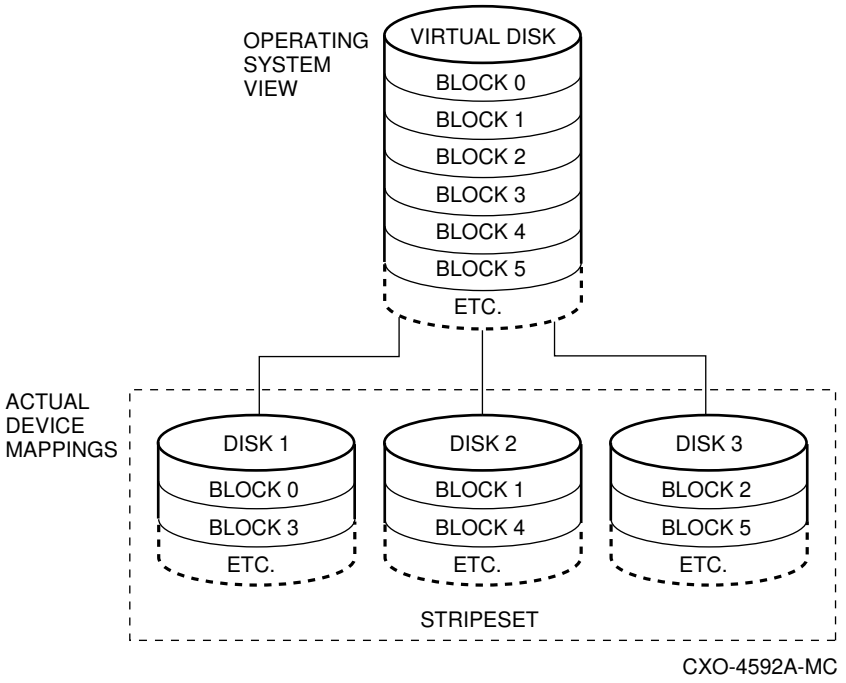
HS operating firmware contains value-added functions to enhance availability, performance, subsystem management and maintenance, and connectivity features of the controller subsystem. These value-added functions are presented in the following sections.

2.2.5.1 RAID

HS operating firmware supports levels of Redundant Array of Independent Disks (RAID) storage methods as follows:

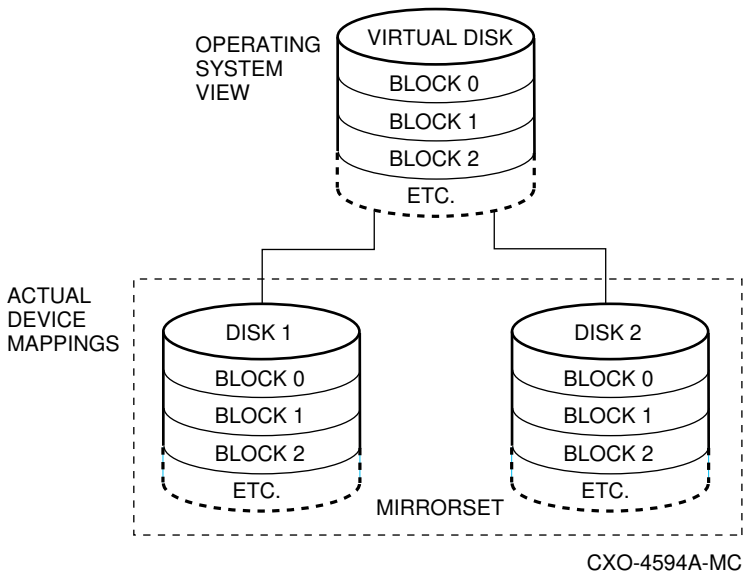
- RAID level 0 (striping). Striping spreads user data across multiple drives, as shown in Figure 2–6. Because reads and writes are done in parallel to all **stripeset** members, this feature enhances performance in the areas of latency and throughput. Stripesets can be from 2 to 14 members. Striping firmware is tuned to balance the load across devices and not for maximum data transfer bandwidth.

Figure 2–6 RAID 0—Striping



- RAID level 1 (mirroring). Mirroring achieves data redundancy and increases availabilty by maintaining at least two drives that have exactly the same data, as shown in Figure 2–7. Thus, if one drive fails, another drive can provide an exact copy of the lost data immediatley. Data is written to all drives in a mirrorset at once. Mirrorsets can have from 1 to 6 members.

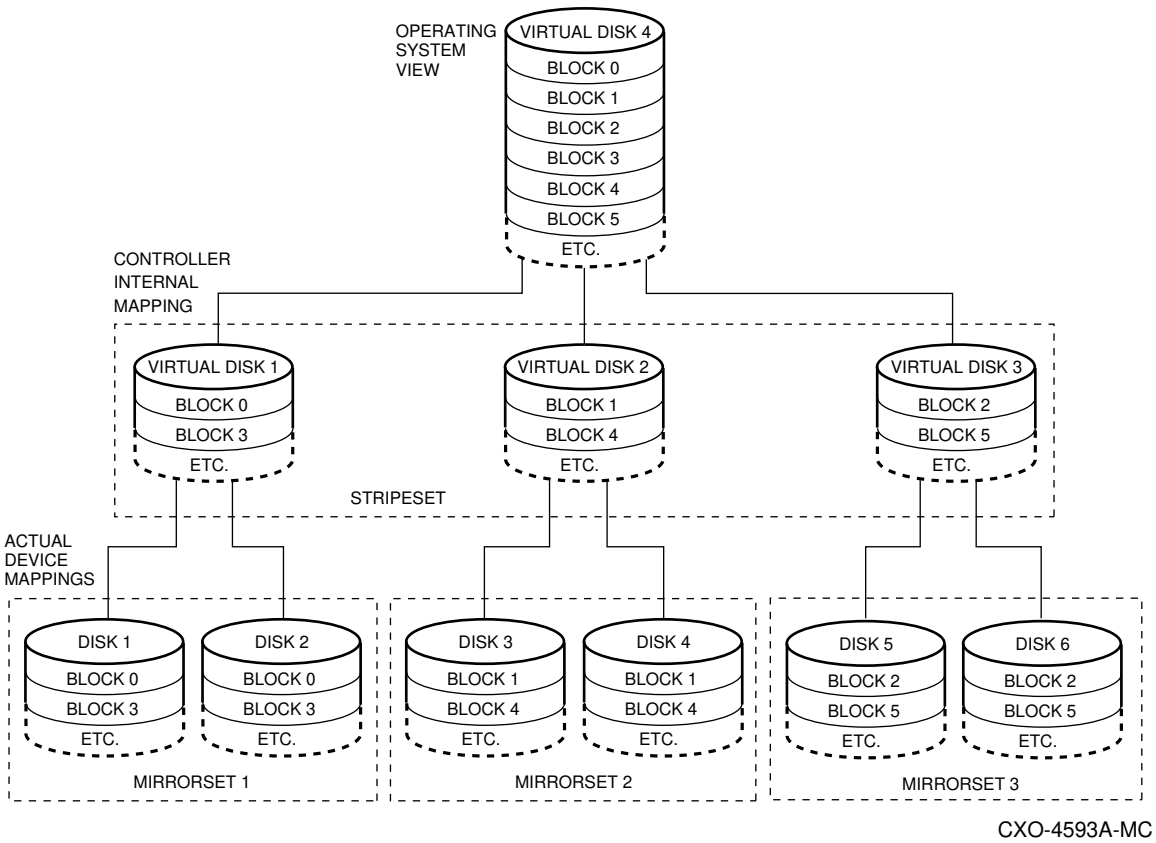
Figure 2–7 RAID 1—Mirroring



Mirroring requires the write-back cache module option to ensure data integrity. Both the write-back cache and mirroring are licensed firmware features.

By combining RAID level 0 and RAID level 1, you can create a striped mirrorset, in which each member of a stripeset is actually a mirrorset. This configuration is shown in Figure 2–8, and can provide both throughput and availability.

Figure 2–8 RAID 0&1—Striped Mirrorset

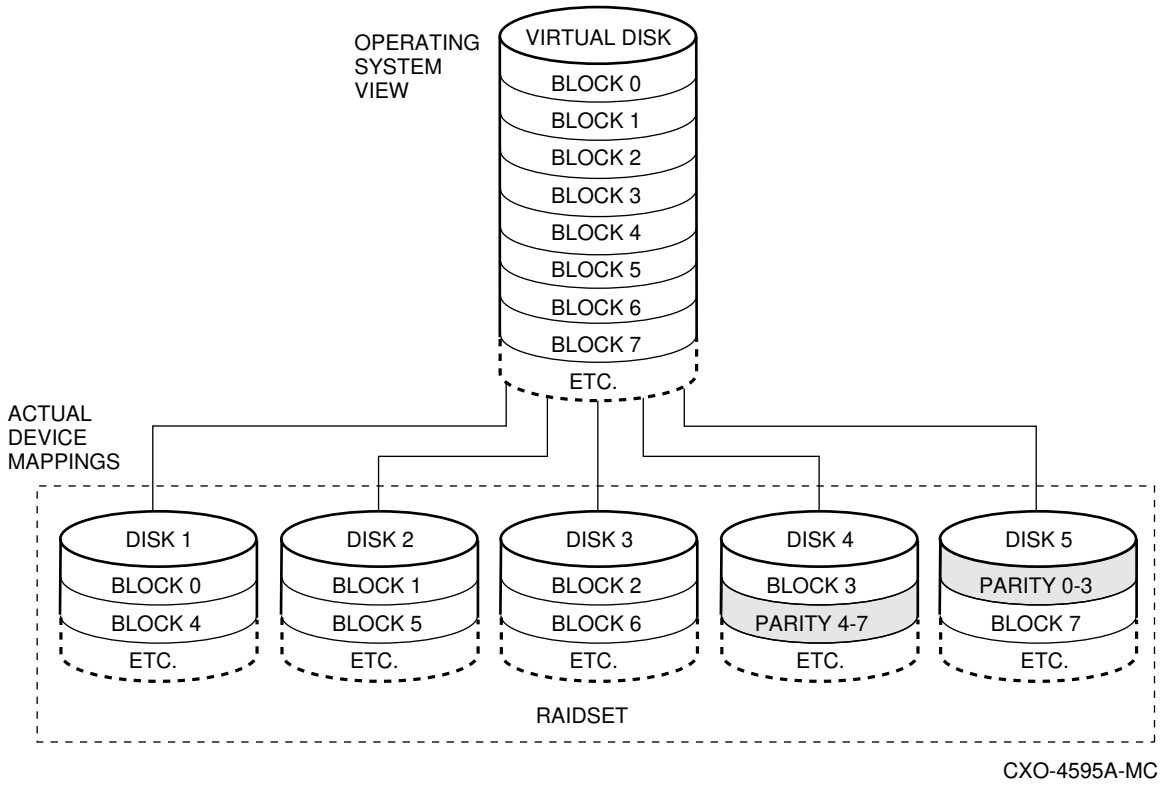


Mirroring is performed by the controller below the visibility of the host computer. Just as a host computer is not aware that a logical unit is actually a stripeset (as opposed to a single device), it also is not aware that a unit may be mirrored.

- Host-Based Volume Shadowing (**HBVS**) assistance, also referred to as RAID level 1a. With HBVS assistance, shadow copy operations requested by the host between two units under one controller run under direction from the controller. This leaves the host CPU free for other operations and improves the speed of shadow copies. The controller maintains a write-history log to ensure the consistency of HBVS.
- RAID level 5. RAID 5 provides increased availabilty and throughput (as compared to a single disk or an unassociated group of disks) by striping data across a set of drives, and calculating and storing the parity information for each stripe. A RAIDset uses the capacity of one member of the set to store

the parity information, but writes the parity blocks to different disks for each succesive data stripe, as shown in Figure 2–9.

Figure 2–9 RAID 5—Parity RAID



RAID 5 under HS operating firmware includes the following features:

- Fast initialization
- RAIDsets with 3 to 14 member
- Nonredundant write, read/modify/write, reconstruct/write
- Read, reconstruct read, repair
- Forced error promotion, which allows for redundancy even when a block has been marked with forced error
- Automatic removal of a member based on error history
- Automatic member **replacement** from spare disks
- **Reduced** operation of RAIDsets that are missing one member
- Reconstruct scanning, to restore a RAIDset to a consistent state

RAID 5 requires the write-back cache module option to ensure data integrity. Both the write-back cache and RAID5 are licensed firmware features.

- HS operating firmware also supports RAID level 3, because RAIDsets created with HS operating firmware can achieve the high-performance characteristics of RAID 3 depending on how I/O transfers are tailored:
  - Large I/O transfers (or many small transfers executed sequentially) will result in high bandwidth, RAID 3 performance.
  - Setting the RAIDset chunksize (see the INITIALIZE command in Appendix B) to a smaller value in conjunction with the large I/O transfers also will result in better RAID 3 performance.
  - You must enable RAIDset write-back caching to achieve RAID 3 performance.
  - The speed of your host interface can impact the degree of RAID 3 performance you will achieve.

  Note that by varying RAIDset chunksize, you can conveniently choose between more bandwidth-oriented or more throughput-oriented performance under the same RAIDset. Furthermore, by specifying an intermediate chunksize, you realize a combination of benefits—RAID 3 technology (for very large I/O operations) and RAID 5 technology (for small I/O operations).

Refer to *The Digital Guide to RAID Storage Technology* for a description of RAID and how the various levels of RAID improve data integrity and error recovery.

2.2.5.2 Failover

The two controllers in a dual-redundant configuration are linked together. The controllers exchange status signals and configuration information. When one controller fails, the surviving controller takes over service to the failed controller's devices and units. See Chapter 4 for more information on failover.

2.2.5.3 Caching

The cache firmware controls the following areas:

- Read caching.
- Write-through caching.
- Write-back caching with the battery backed up cache module. Write-back caching provides low write latency.
- Managing of up to 32 MB of cache.
- RAID assistance for improved performance.
- Logical Block Number (LBN) extent locking.
- Least Recently Used (LRU) replacement policy (refer to Section 2.1.12.1 for a description of the LRU algorithm).
- Write-back cache module failover.
- Caching enabled on a per-unit basis.

The cache policies are as follows:

- Transfer defined extent (TDE) based cache
- Transfer size-based data caching; maximum read/write size is changed on a per-unit basis
- I/O is subject to locking

2.3 Addressing Storage Within the Subsystem

This section provides an overview on how storage is addressed in a controller subsystem. Storage is seen in two different ways, depending on your perspective and controller model:

- At the physical device level from the controller SCSI device interface
- At the virtual device level from the host interface

Following are descriptions of both levels of storage addressing.

2.3.1 Controller Storage Addressing

Note

This section on controller storage applies to *all* controller models.

Figure 2–10 shows a typical physical storage device interface for a controller. Each of the controller's six device ports supports a SCSI bus connected with up to six devices. The devices typically reside in a StorageWorks BA350–SB storage shelf.

HS controllers support both single-LUN and multi-LUN devices. Most devices, including disks drives, are single-LUN devices and use the default address of LUN 0. Certain devices, such as some tape loaders, require multiple LUNs so that the host operating system can address both the loader mechanism and the drive as separate entitities.

Controller Port/Target/LUN Addressing

Controller port/target/LUN (PTL) addressing is the process by which the controller selects storage space within a specific, physical, storage device. The process takes place in three steps:

1. The port selection—The controller selects the SCSI bus port connected to a particular device.
2. The **target** selection—The controller selects the device's SCSI ID (that is, the target) on that port.
3. The LUN selection—The controller selects the desired LUN within that physical device, usually LUN 0.

Note that controller PTL addressing is always tied to a physical storage device.

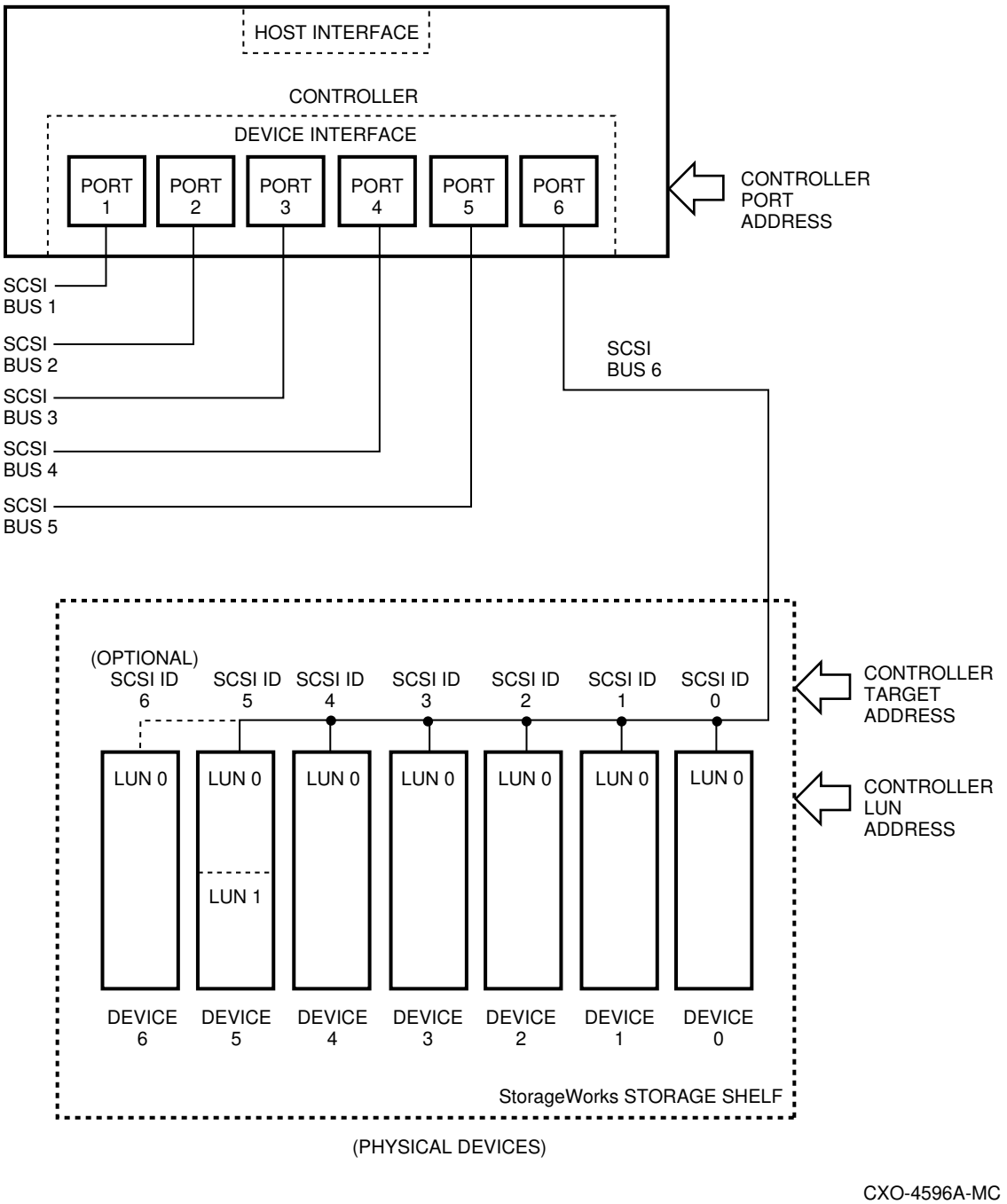
2.3.2 Host Storage Addressing

Note

The information in this section applies to all controllers. However, see Section 2.3.3 for additional, specialized information on how a SCSI host addresses storage.

A typical host device interface consists of a number of host ports each connected to a bus containing devices. From the host perspective, the controller is one of these devices.

Figure 2–10 Controller Storage Addressing



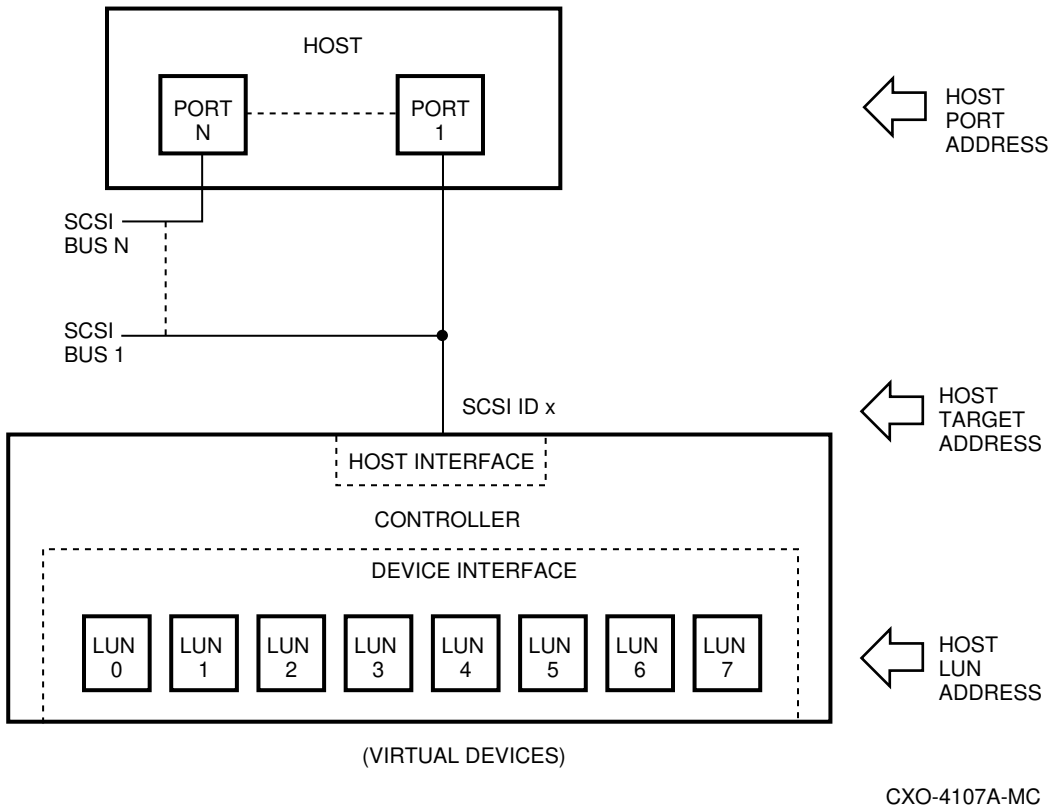
To support certain high-level storage subsystem functions such as RAID, the controller presents the devices (from Figure 2–10) to the host as **host logical units**. A host logical unit can consist of a single device or a storageset comprised of more than one physical device. For this reason, a host logical unit is often called a virtual device. You configure host logical units using the CLI.

2.3.3 Host Storage Addressing (HSZ-Series)

Figure 2–11 shows a typical connection between an HSZ-series controller and its host. In this case, the SCSI host device interface consists of device ports, each connected to a SCSI bus containing up to eight devices. The HSZ-series controller resides on one of the SCSI buses.

The HSZ-series controller can be assigned from one to four SCSI IDs on the bus. This allows the controller to present more LUNs to the host, because each SCSI ID can only support eight LUNs. A controller with four SCSI IDs can present a maximum of 32 LUNs to the host.

Figure 2–11 Host Storage Addressing (HSZ-Series)



Note

Although they share the same name, controller LUNs and SCSI host LUNs are names for two different storage structures. Controller LUNs exist on the *controller's* device interface, and SCSI host LUNs exist on a *host's* device interface.

Controller LUNs and SCSI host LUNs *may* represent the same structure, but only if the user configures controller devices in a one-to-one unit

relationship with the host. Your site may or may not have this type of configuration.

Host Port/Target/LUN Addressing (HSZ-Series)

Note

Non-SCSI hosts (CI, DSSI), though they access virtual devices, do not use a PTL addressing scheme. Any unit seen by these hosts is simply called a host logical unit (not a LUN).

Host PTL addressing is the process by which a SCSI host selects a logical unit made up of physical devices connected to an HSZ-series controller. The process takes place in three steps:

1. The port selection—The host selects its SCSI port that has the HSZ-series controller connected to it.
2. The target selection—The host selects the controller's SCSI ID (that is, the target) on that port/bus.
3. The LUN selection—The host presents the controller with the LUN of the desired host logical unit. The controller translates the LUN into the physical device addresses required to allow the host access to the virtual device.

3
Configuration Rules and Restrictions

This chapter describes rules and restrictions that apply to the physical configuration and connection of the following HS controller subsystem hardware:

- Cabinets
- Shelves
- Devices
- Controllers
- Hosts

The information in this chapter describes physical configurations with respect to both standard and nonstandard (customized) subsystems. Further information can be found in the specific StorageWorks cabinet, shelf, and configuration documentation.

Note

Configuration rules and restrictions apply to all controllers unless stated otherwise.

Digital provides the following configuration approaches for ordering controller subsystems:

- Preconfigured, packaged starter subsystems[1]
- Configured-to-order (CTO) subsystems (custom configurations)
- A combination of preconfigured and CTO subsystems

Refer to the *HS Family of Array Controllers User's Guide* for a list of preconfigured controller subsystem option numbers. Not all controller models have preconfigured subsystem option numbers.

[1] Preconfigured subsystems include a range of solutions for various capacities, performance levels, and availability.

3.1 Cabinets

The following sections present information to consider when installing BA350-series controller and storage shelves in SW800-series **data center cabinets** and SW500-series cabinets. The design of the SW300-series deskside RAID enclosure is such that the single shelf and its cabling are internal and fixed. Configuring shelves into an SW300 cabinet essentially is not required.

Note

Cabinets that have special cooling requirements may contain a fan tray assembly in place of one of the storage positions. The location of certain shelves in those cabinets may vary slightly from the illustrations shown here.

3.1.1 SW800-Series Data Center Cabinet

This section presents the rules that apply to subsystem configurations in SW800-series data center cabinets. Refer to the *StorageWorks Solutions SW800-Series Data Center Cabinet Installation and User's Guide* for more details.

Note

In Figures 3–1 through 3–5, ''S'' indicates a BA350–SB storage shelf, and ''C'' indicates a BA350–MA controller shelf.

Figure 3–1 shows the locations of storage and controller shelves in an SW800-series data center cabinet.

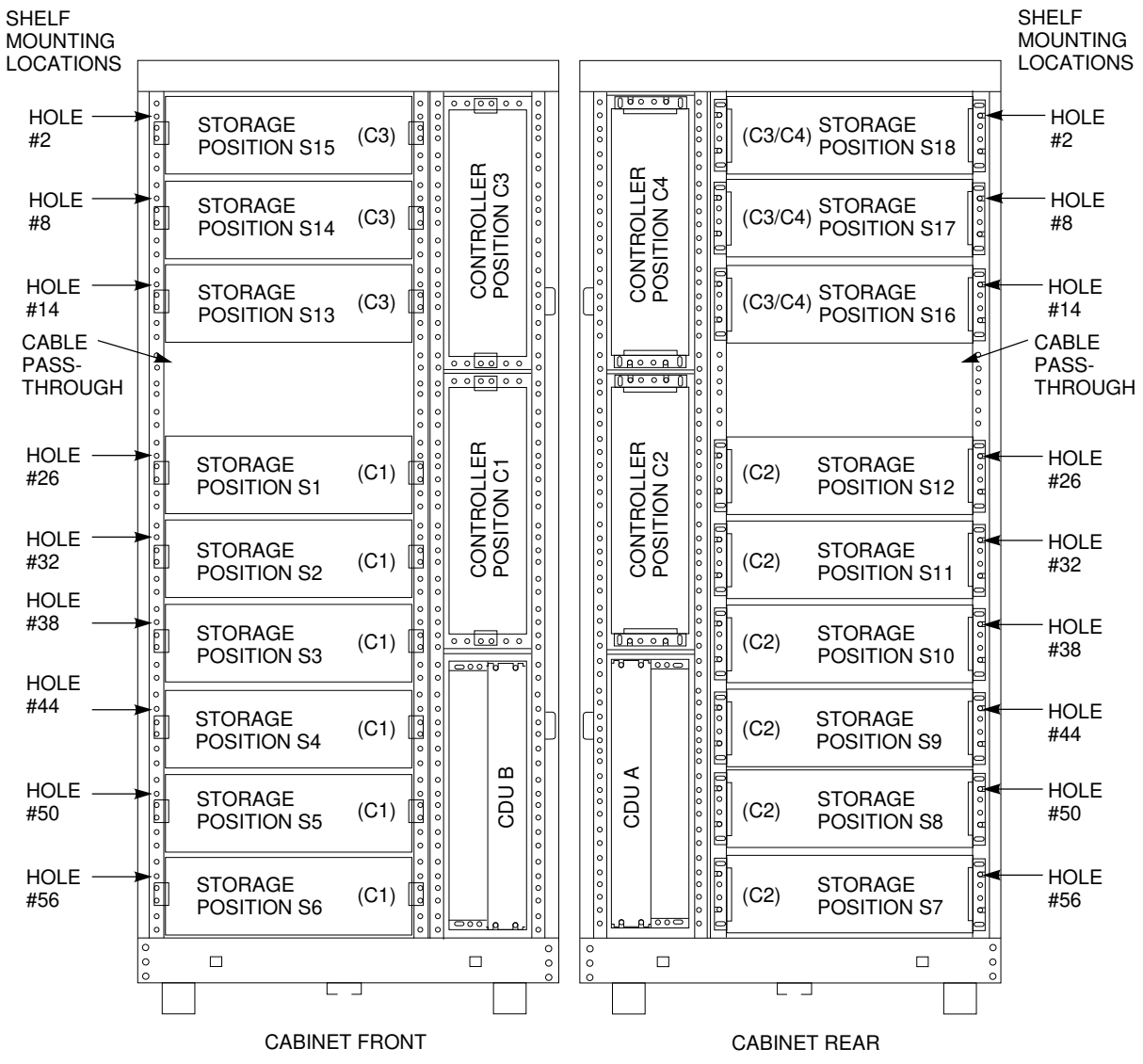
Figure 3–2 shows the locations of storage and controller shelves when one or two TZ8*xx*-series tape devices are installed.

Figure 3–3 shows the locations of storage and controller shelves when three or four TZ8*xx*-series tape devices are installed.

3.1.1.1 Standard Shelf Configuration

The standard SW800-series cabinet configuration consists of three (or four) BA350–MA controller shelves connected to 18 BA350–SB storage shelves in a single cabinet.

Figure 3–1 SW800-Series Data Center Cabinet Loading

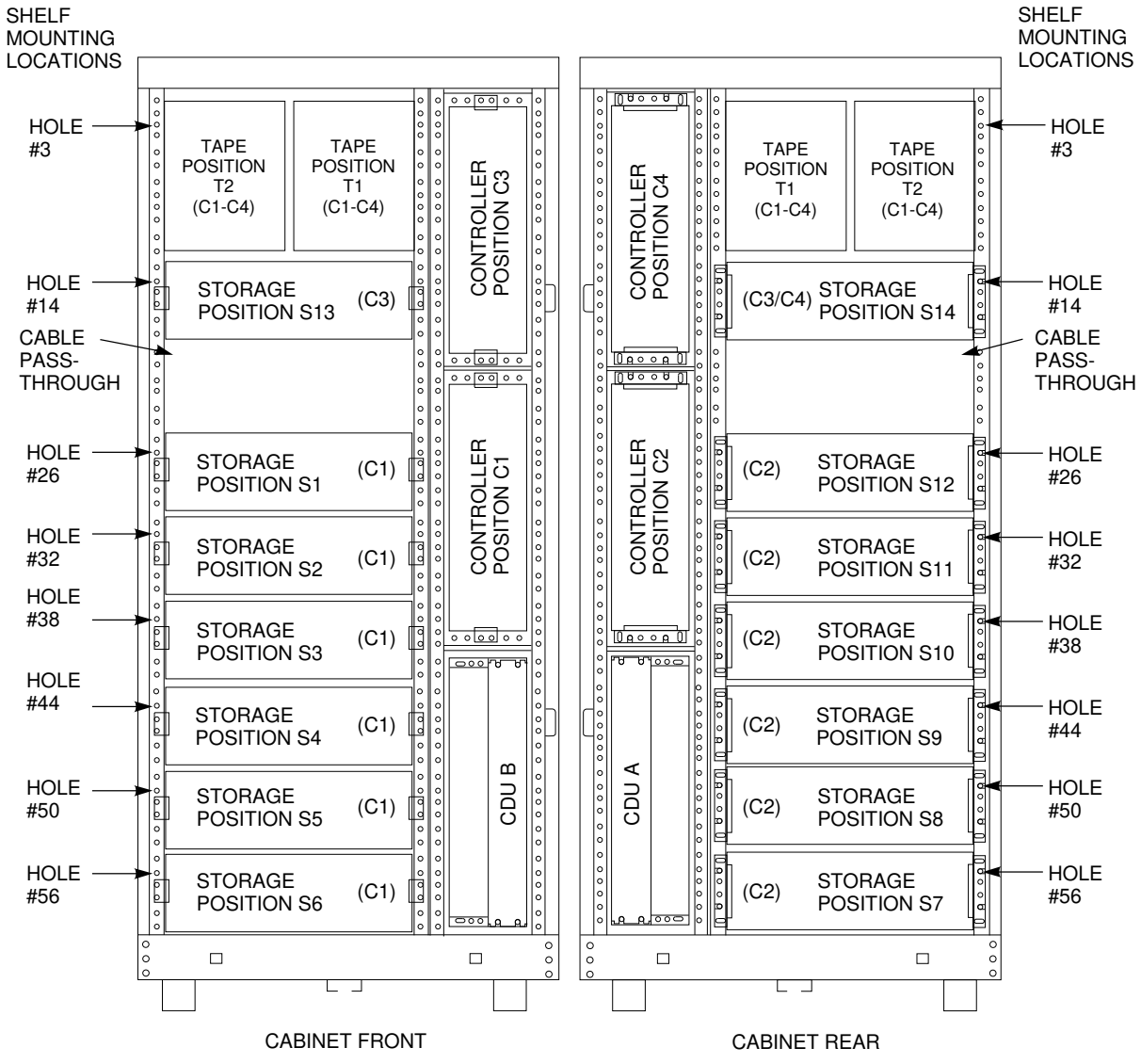


3.1.1.2 Device Shelf to Controller Port Relationships

- The SCSI–2 cable to the first BA350–SB storage shelf must be 1.0 meter or less.[2]
- The SCSI–2 cable from the first BA350–SB shelf to the second shelf must be 0.5 meters or less. The two shelves must be immediately adjacent to each other.
- The first BA350–SB storage shelf must be configured for an unterminated single SCSI cable.

[2] The associated BA350–MA controller shelf must be located near enough to satisfy this restriction.

Figure 3–2 SW800-Series Data Center Cabinet Controller/Storage/(1–2) Tape Drive Locations



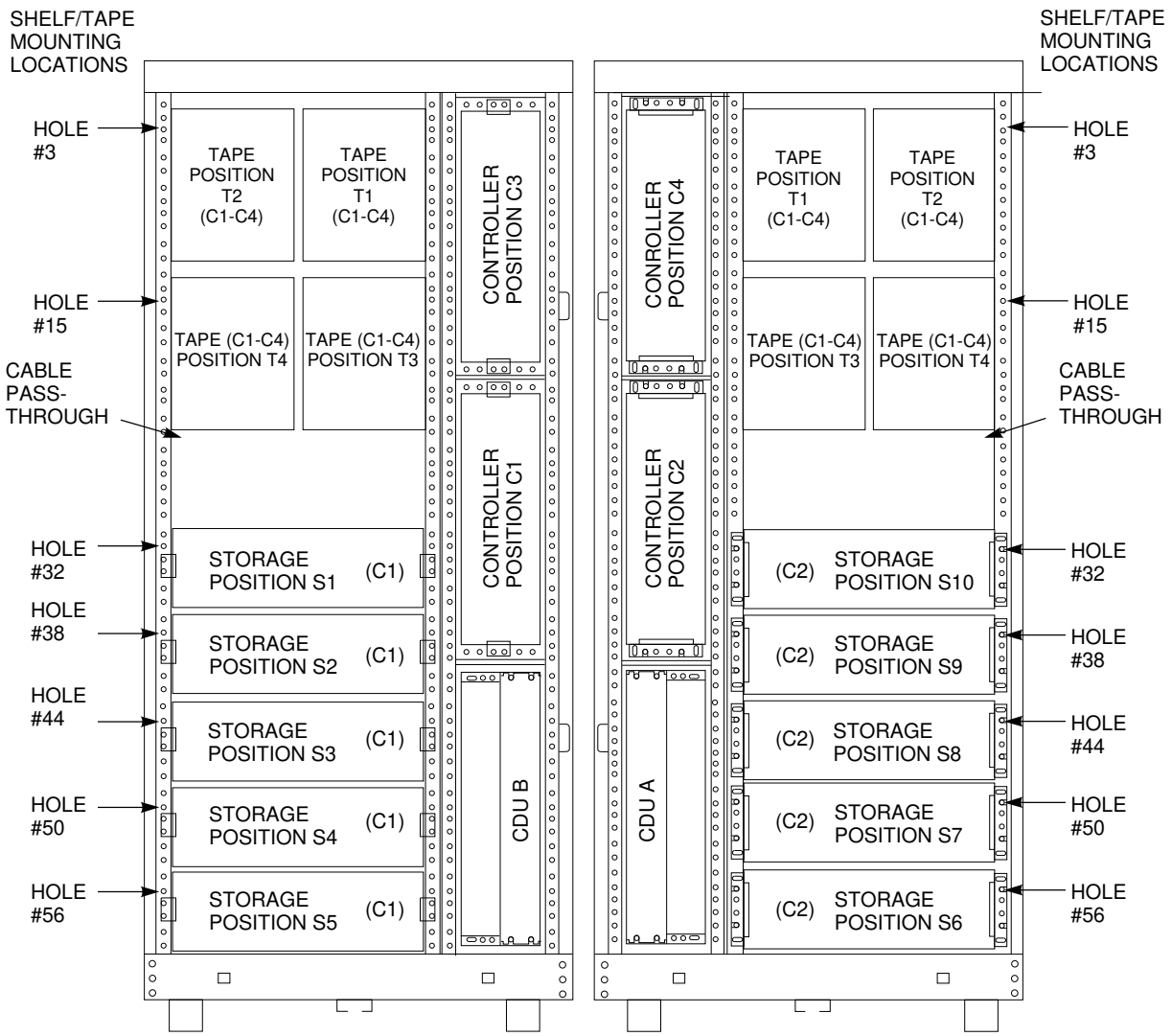
3.1.1.3 Location of TZ8*x*7 Half-Rack Tape Loaders

Any TZ8*x*7 half-rack tape loader device must be located at the top front positions filling two or four top BA350–SB shelf positions (front and back). Note that each tape loader occupies the full cabinet depth.

Up to four tape drive loader devices can be loaded in an SW800-series data center cabinet, displacing shelves S1 and S12–S18 (leaving 10 BA350–SB shelves remaining).

Single (or paired) TZ8*x*7 devices must be connected with a 0.2 meter (8-inch) SCSI–1-to-StorageWorks transition cable (order number 17–03831–01), then to a 2 meter SCSI–2 cable (order number BN21H–02) that connects to one of the controller SCSI–2 ports.

Figure 3–3 SW800-Series Data Center Cabinet Controller/Storage/(3–4) Tape Drive Locations



3.1.1.4 Use of an Upper Controller Shelf

By convention, controller shelf C3 uses (only) the top three (or four) storage shelves in the front of the cabinet, and the fourth controller shelf (C4) uses the top three (or four) storage shelves in the back of the cabinet.

3.1.1.5 Number of Devices

Up to 42 devices can be attached to a 6-port controller using 7 3½-inch SBBs in each of 6 BA350–SB shelves.[3]

[3] Redundant power and dual-redundant controllers are not supported when using 42 devices. This is not a recommended configuration.

3.1.1.6 Maximum Number of Device Shelves

Up to 18 horizontal BA350–SB device shelves can be installed. This number is reduced to 16 if one or two TZ8*x*7 tape loaders are present.

3.1.2 SW500-Series Cabinets

The rules presented in this section apply to subsystem configurations in SW500-series cabinets. Refer to the *StorageWorks Solutions SW500-Series Cabinet Installation and User's Guide* for more details.

Figure 3–4 shows the locations of storage and controller shelves in an SW500-series cabinet.

Figure 3–4 SW500-Series Cabinet Loading

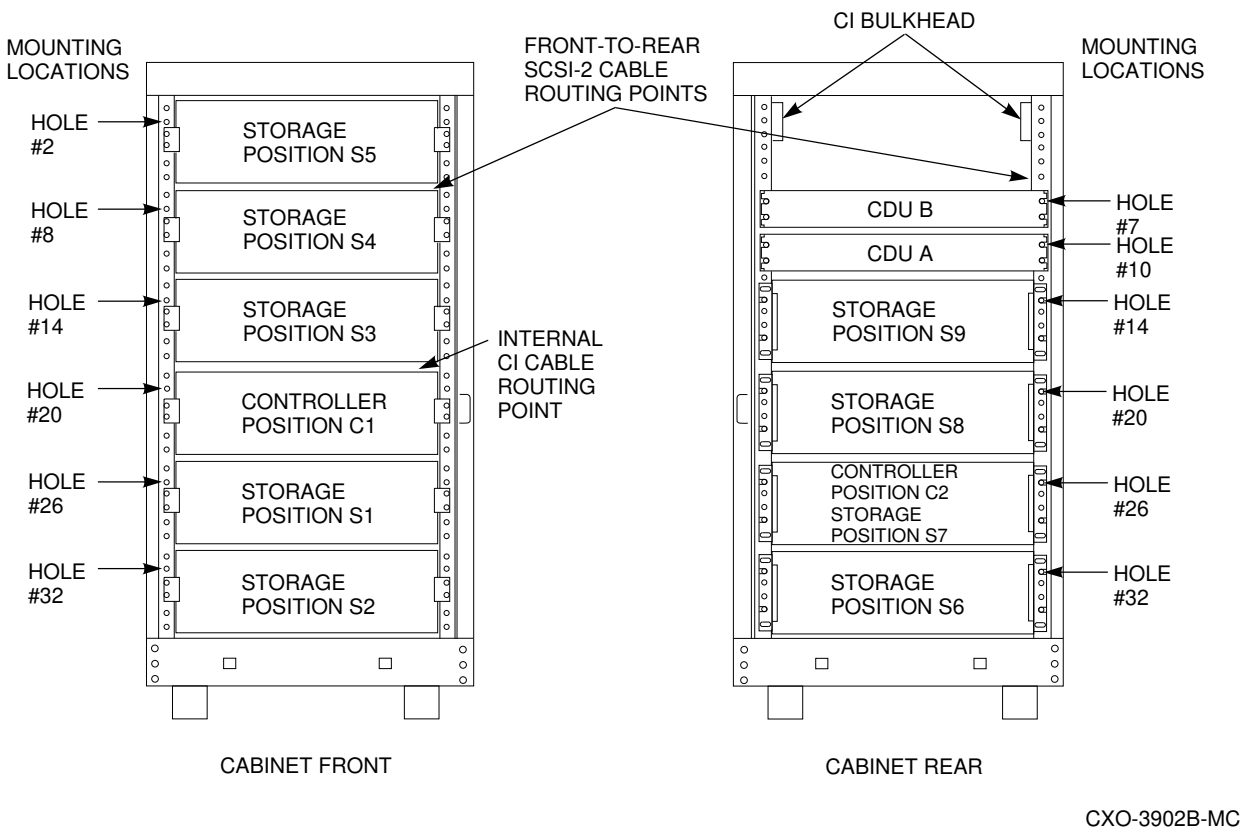


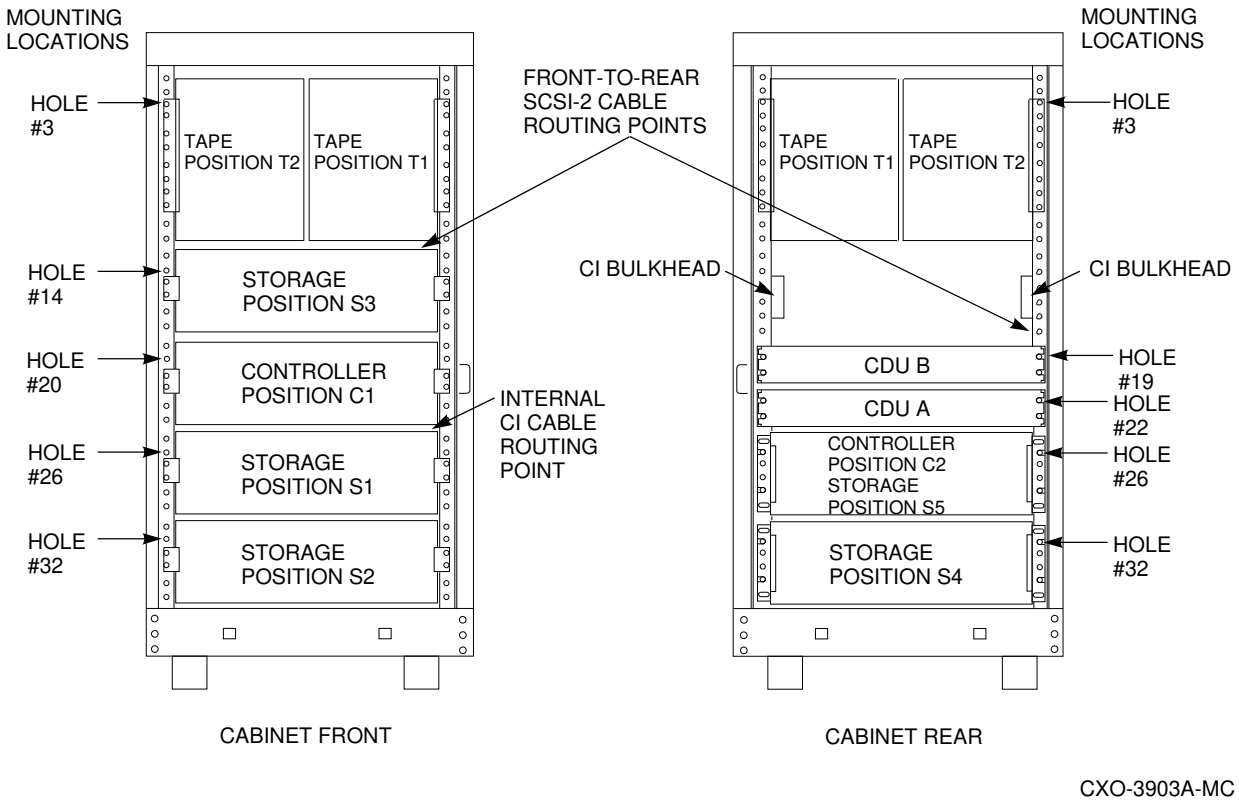
Figure 3–5 shows the locations of storage and controller shelves when TZ8*xx*-series tape devices are installed.

3.1.2.1 Standard Shelf Configuration

The standard SW500-series cabinet configuration consists of one BA350–MA controller shelf connected to six BA350–SB storage shelves.

Alternately, two BA350–MA shelves can be housed with a maximum of four BA350–SB shelves each as two subsystems.

Figure 3–5 SW500-Series Cabinet Controller/Storage/Tape Drive Locations



3.1.2.2 Device Shelf to Controller Port Relationships

Each controller port can access two BA350–SB shelves (jumpered pairs) with the following restrictions:

- The SCSI–2 cable to the first BA350–SB storage shelf must be 1.0 meter or less.[4]
- The SCSI–2 cable from the first BA350–SB shelf to the second shelf must be 0.5 meters or less. The two shelves must be immediately adjacent to each other.
- The first BA350–SB storage shelf is configured for unterminated single SCSI.
- Controller shelf position C1 can be used with the pairs S1–S2 and S3–S4, and controller shelf position C2 can be used with the pair S8–S9, to satisfy these restrictions. A single subsystem (C1) can thus accommodate up to 16 5¼-inch SBBs.

[4] The associated BA350–MA controller shelf must be located near enough to satisfy this restriction.

3.1.2.3 Location of TZ8*x*7 Half-Rack Tape Loaders

:

Any TZ8*x*7 half-rack tape loader must be located at the top front positions filling the two top BA350–SB shelf positions (front and rear). Note that each tape loader occupies the full cabinet depth (refer to Figure 3–5).

Up to two tape drive loader devices can be loaded in an SW500-series cabinet, displacing shelves S4, S5, and S8 to S9 (moving the cable distribution units [(**CDUs**] to shelf location S8). Single (or paired) TZ8*x*7 devices must be connected to a controller port, as in the SW800-series data center cabinet.

3.1.2.4 Use of a Second Controller Shelf

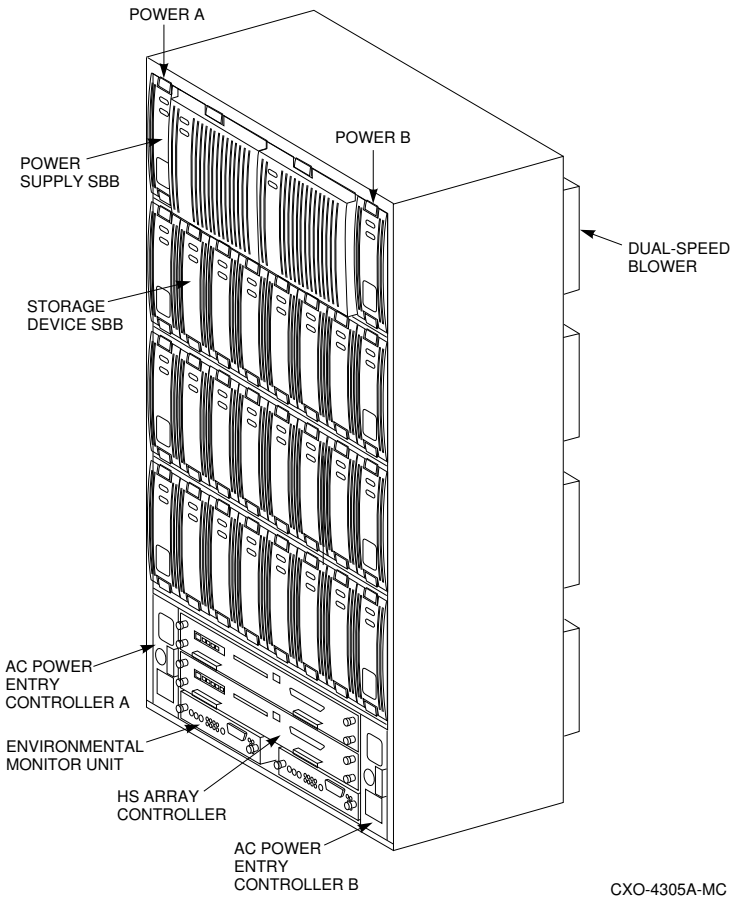
By convention, the first controller shelf (C1) is connected with positions S1 to S5, and the second controller shelf (C2) is connected with positions S6, S8, and S9. This permits two subsystems, one with up to 24 to 28 3½-inch SBB devices (in the front), and the other with 18 to 21 3½-inch SBB devices (in the rear).

3.1.3 SW300-Series Deskside RAID Enclosure

The SW300-series cabinet, as shown in Figure 3–6, is a modular enclosure designed to hold one integrated set of subsystem components. The integrated design of the SW300 cabinet virtually eliminates the need for complicated physical configuring by the operator.

The SW300-series cabinet does not accept the two BA350-series shelf types. See the *StorageWorks Solutions SW300-Series RAID Enclosure Installation and User's Guide* for more information on the SW300 deskside RAID enclosure.

Figure 3–6 SW300-Series Deskside RAID Enclosure



3.2 BA350-Series Shelves

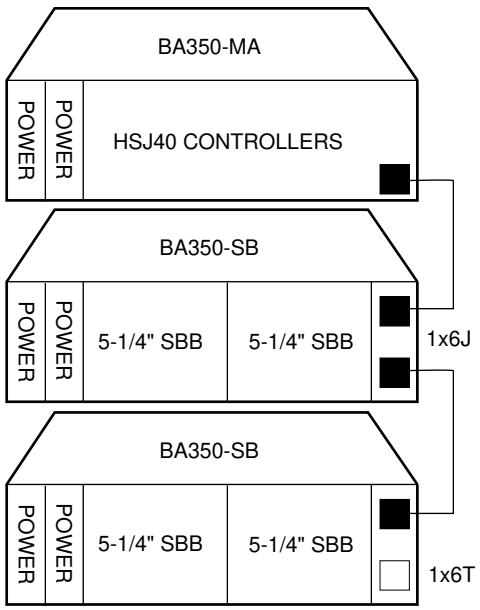
The following configuration rules apply to the arrangement of controller and device shelves in SW800– and SW500–series cabinets.

The SW300 cabinet shelf contains a single backplane for controller-to-storage connections. No external SCSI device cables are needed, and very little physical configuring is required, as described in Section 3.3.8. See the *StorageWorks Solutions SW300-Series RAID Enclosure Installation and User's Guide* for more information on the SW300 cabinet

BA350-series shelves can be arranged in any valid SCSI–2 configuration, subject to the following:

- No more than a single extension joining two BA350–SB device shelves is permitted. The two BA350–SB shelves must be physically adjacent to each other. Figure 3–7 shows an example of device shelves in a single extension configuration.

Figure 3–7 Single Extension from Device Shelf to Device Shelf

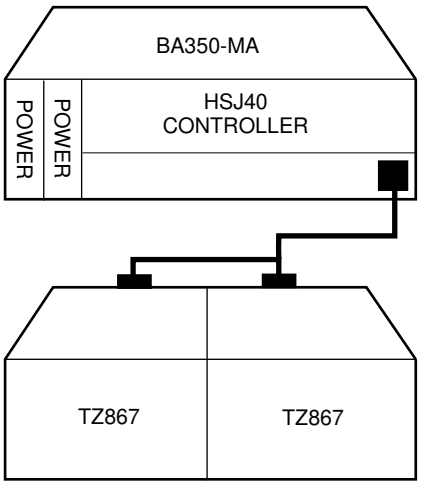


CXO-3750B-MC

- Half-rack/full-depth devices, for example all TZ867 tapes, cannot share controller ports with devices that have a different form factor, and cannot be connected as an extension from a BA350–SB shelf. Only two such devices (maximum) may be configured per controller port, and those devices must be physically adjacent to each other at the top of a cabinet.

  Figure 3–8 shows two adjacent tape drives attached to a single port of the controller shelf.

Figure 3–8 Adjacent Devices on a Single Port



CXO-3751A-MC

- To jumper two device shelves together, you must connect the first shelf to the controller shelf with a 1.0 meter cable. Use of a 2.0 meter cable does *not* permit shelf jumpering. (Required cable length will vary depending on cabinet type, device shelf position, and controller shelf position.)

3.3 Device Placement

The following sections describe recommended device configurations for 3½-inch and 5¼-inch SBBs.

Note

You can intermix disk SBBs and tape SBBs on the same controller port, provided that you followall other configuration rules in this chapter.

3.3.1 3½-Inch SBB Restrictions, BA350–SB

There are no restrictions for adding 3½-inch SBBs to a configuration. Refer to your SPD and release notes for a list of specific supported device types.

3.3.2 5¼-Inch SBB Restrictions, BA350–SB

The following restrictions apply when adding 5¼-inch SBBs to a configuration. Refer to your SPD and release notes for a list of specific supported device types.

- No more than two 5¼-inch SBBs per device shelf.
- No more than four 5¼-inch SBBs per controller port on two adjacent jumpered shelves.
- You can use both 5¼-inch and 3½-inch SBBs in the same device shelf, with a maximum of six devices per controller port (maximum of two shelves).

  You can use two 5¼-inch SBBs and four 3½-inch SBBs in two BA350–SB shelves, or one 5¼-inch SBB and four 3½-inch SBBs in one BA350–SB shelf.

- When using jumpered shelves, only five jumpered-pair shelves (for a total of ten shelves) can be used within each SW800-series data center cabinet. This leaves the sixth controller port unused. Alternately, four jumpered ports permit two single-shelf connections on the remaining two controller ports, which is preferable.

  This setup is only permitted in the lower front of the cabinet from the C1 controller position. Five such ports can take up to a maximum of ten front shelf locations, with no allowance for cable access to shelves or devices in the rear of the SW800-series cabinet. (Refer to Figure 3–1.)

  A more balanced configuration consists of four 5¼-inch SBBs on each of four ports, and two ports each with two 5¼-inch SBBs.

- When using jumpered shelves, only two jumpered-pair shelves (for a total of four shelves) can be used with an SW500-series cabinet.

- When five ports in an SW800 cabinet or two ports in an SW500 cabinet have doubled shelves for 5¼-inch SBBs (4+2), TZ8*x*7 tapes cannot be connected or even mounted in the cabinet because all or most (front) shelf locations are needed for the 5¼-inch SBBs.

3.3.3 Table Conventions

The following describes the designations used in Tables 3–1 through 3–6. The designation shows the possible devices in each shelf and the possible number of devices in similarly configured shelves.

```
(n)m x oT

(n)m x oJ
```

where:
n is the number of device shelves.
m is the number of SCSI–2 connections to a device shelf.
o is the number of devices on each SCSI–2 connection.
T indicates the device shelf is terminated.
J indicates the device shelf is jumpered.

According to the formula:

mxo = possible devices in each shelf.

$nxmxo$ = possible number of devices in similarly configured shelves.

3.3.4 3½-Inch SBBs

Tables 3–1 and 3–2 list some recommended configurations for 3½-inch SBBs in BA350–SB shelves.

Table 3–1 3½-Inch SBB Configurations, 6-Port Controller

Number of Devices	Number of BA350–SB Shelves*	Configure as**	Available for 3½-Inch SBBs***	Ports Used
1–2	1	(1)2x3T	5-4	1–2
3–4	2	(2)2x3T	9-8	3–4
5–18	3	(3)2x3T	13-0	5–6
19–24	4	(2)2x3T	5-0	6
		(2)1x6T		
25–30	5	(1)2x3T	5-0	6
		(4)1x6T		
31–36	6	(6)1x6T	5-0	6
37–42****	6	(6)1x7T	5-0	6

Notes

2x3T: Two (split) SCSI–2 connections, separately terminated in the shelf. The devices appear as IDs 0, 2, 4, and 1, 3, 5.

1x6T: Single path SCSI–2 connection terminated in the shelf. The devices appear as IDs 0 through 5.

1x7T: Single path SCSI–2 connection terminated in the shelf. The devices appear as IDs 0 through 6.

* Consult the *StorageWorks Solutions Shelf User's Guide* for BA350–SB shelf information.
** Each BA350–SB shelf's upper SCSI–2 port connector is cabled to a controller port. The lower SCSI–2 port connector is attached to a controller port for 2x3T configurations and is unused for a 1x6T or 1x7T.
*** Available for future expansion.
**** Nonredundant controller and power (not recommended).

Table 3–2 3½-Inch SBB Configurations, 3-Port Controller

Number of Devices	Number of BA350–SB Shelves*	Configure as**	Available for 3½-Inch SBBs***	Ports Used
1–2	1	(1)2x3T	5-4	1–2
3–12	2	(1)2x3T	9-0	3
		(1)1x6T		
13–18	3	(3)1x6T	5-0	3
19–21****	3	(3)1x7T	2-0	3

Notes

2x3T: Two (split) SCSI–2 connections, separately terminated in the shelf. The devices appear as IDs 0, 2, 4, and 1, 3, 5.

1x6T: Single path SCSI–2 connection terminated in the shelf. The devices appear as IDs 0 through 5.

1x7T: Single path SCSI–2 connection terminated in the shelf. The devices appear as IDs 0 through 6.

* Consult the *StorageWorks Solutions Shelf User's Guide* for BA350–SB shelf information.
** Each BA350–SB shelf's upper SCSI–2 port connector is cabled to a controller port. The lower SCSI–2 port connector is attached to a controller port for 2x3T configurations and is unused for a 1x6T or 1x7T.
*** Available for future expansion.
**** Nonredundant controller and power (not recommended).

3.3.5 5¼-Inch SBBs

Tables 3–3 and 3–4 list some recommended configurations for 5¼-inch SBBs in BA350–SB shelves.

Table 3–3 5¼-Inch SBB Configurations, 6-Port Controller

Number of Devices	Number of BA350–SB Shelves*	Configure as	Available for 5¼-Inch SBBs**	Ports Used
1–2	1	(1)2x3T	1-0	1–2
3–4	2	(2)2x3T	1-0	3–4
5–6	3	(3)2x3T	1-0	5–6
7–8	4	(2)1x6T	1-0	6
		(2)2x3T		
9–10	5	(4)1x6T	1-0	6
		(1)2x3T		
11–12	6	(6)1x6T	1-0	6
13–14***	7	(6)1x6T	1-0	6
		(1)1x6J		
15–16***	8	(6)1x6T	1-0	6
		(2)1x6J		
17–18***	9†	(6)1x6T	1-0	6
		(3)1x6J		
19–20***	10†	(6)1x6T	1-0	6
		(4)1x6J		

Notes

Each BA350–SB shelf has its upper connector cable attached to either the adjacent BA350–SB shelf's lower connector (1x6J), or a controller port connector (2x3T or 1x6T).

The lower connector cable is attached to either an adjacent BA350–SB shelf's upper connector (1x6J, as in the first note item), controller port connector (2x3T), or is unused (1x6T).

* Consult the *StorageWorks Solutions Shelf User's Guide* for BA350–SB shelf information.
** Available for additional 5¼-inch device.
*** When used with the controller in the C1 position in an SW800-series or SW500-series cabinet. (Refer to Figures 3–1 and 3–5.)
† Cannot be configured in SW500-series cabinets.

Table 3–4 5¼-Inch SBB Configurations, 3-Port Controller

Number of Devices	Number of BA350–SB Shelves*	Configure as	Available for 5¼-Inch SBBs**	Ports Used
1–2	1	(1)2x3T	1-0	1–2
3–4	2	(1)2x3T	1-0	3
		(1)1x6T		
5–6	3	(3)1x6T	1-0	3
7–8	4	(3)1x6T	1-0	3
		(1)1x6J		
9–10	5	(3)1x6T	1-0	3
		(2)1x6J		
11–12	6†	(3)1x6T	1-0	3
		(3)1x6J		

Notes

Each BA350–SB shelf has its upper connector cable attached to either the adjacent BA350–SB shelf's lower connector (1x6J), or a controller port connector (2x3T or 1x6T).

The lower connector cable is attached to either an adjacent BA350–SB shelf's upper connector (1x6J, as in the first note item), controller port connector (2x3T), or is unused (1x6T).

* Consult the *StorageWorks Solutions Shelf User's Guide* for BA350–SB shelf information.
** Available for additional 5¼-inch device.
† Cannot be configured in SW500-series cabinets.

3.3.6 Intermixing 5¼-Inch and 3½-Inch SBBs, BA350–SB

Use these guidelines for intermixing 5¼-inch and 3½-inch SBBs:

- Treat each 5¼-inch SBB as three 3½-inch SBBs.
- Each 5¼-inch SBB must have its SCSI–2 ID set manually using the address switch on the rear of the SBB, or by setting the switch to automatic and letting the slot connector dictate the device address. (Refer to the *StorageWorks Solutions Shelf and SBB User's Guide*.)
- A 5¼-inch SBB may be located in the same shelf with up to three or four 3½-inch SBBs.

3.3.7 Atypical Configurations

By unbalancing the number of devices per controller port, configurations can be devised with a smaller shelf count. This results in lower performance and/or availability. The minimum BA350–SB shelf count for various numbers of 3½-inch SBBs is listed in Tables 3–5 and 3–6.

Table 3–5 Small Shelf Count Configurations, 6-Port Controller

Number of Devices	Number of BA350–SB Shelves*	Configure as	Ports Used
1–6	1	1x6T	1
7–12	2	1x6T	2
13–18	3	1x6T	3
19–24	4	1x6T	4
25–30	5	1x6T	5
31–36	6	1x6T	6
37–42**	6	1x7T	6

Notes

* Consult the *StorageWorks Solutions Shelf User's Guide* for BA350–SB shelf information.
** Nonredundant controller and power configurations (not recommended).

Table 3–6 Small Shelf Count Configurations, 3-Port Controller

Number of Devices	Number of BA350–SB Shelves*	Configure as	Ports Used
1–6	1	1x6T	1
7–12	2	1x6T	2
13–18	3	1x6T	3
19–21**	3	1x7T	3

Notes

* Consult the *StorageWorks Solutions Shelf User's Guide* for BA350–SB shelf information.
** Nonredundant controller and power configurations (not recommended).

3.3.8 SW300 Deskside RAID Configuration

The SW300 cabinet shelf (refer to Figure 3–6) can accommodate storage, controller, and support hardware within the limits described in Table 3–7. (The previous rules, described in Sections 3.3.1 through 3.3.7, generally apply only when using BA350-series shelves.)

Table 3–7 SW300 Cabinet Shelf Configuration

Field Replaceable Unit	Minimum	Maximum
SBB Shelf Power Supplies	4	8
3½-Inch Storage SBBs	0 †	24
5¼-Inch Storage SBBs	0 †	8
HS Controllers	1	2
Controller Cache Modules	0	2
Environmental Monitor Units (EMUs)	1	2
AC Power Entry Controllers	1	2
Dual Speed Blowers	8	8

†You will, however, need at least one device (of either size) to have an active subsystem.

The SW300 cabinet shelf is called a ‘‘deskside RAID’’ configuration because its design allows for the easy creation of storagesets (stripesets and RAIDsets). Although you can configure 3½-inch and 5¼-inch SBBs in *any* combination within the SW300 cabinet shelf, Digital recommends that you take advantage of the shelf layout for storagesets.

The SW300 cabinet shelf includes an integrated backplane that contains six single-ended SCSI device buses. The backplane device buses eliminate the need for external device cabling to the controller device ports.

Each device bus runs vertically, attaching to up to four SCSI devices (IDs 0 through 3). The controller slots in the lower portion of the shelf occupy SCSI IDs 6 and 7, in much the same way as in a BA350–MA shelf.

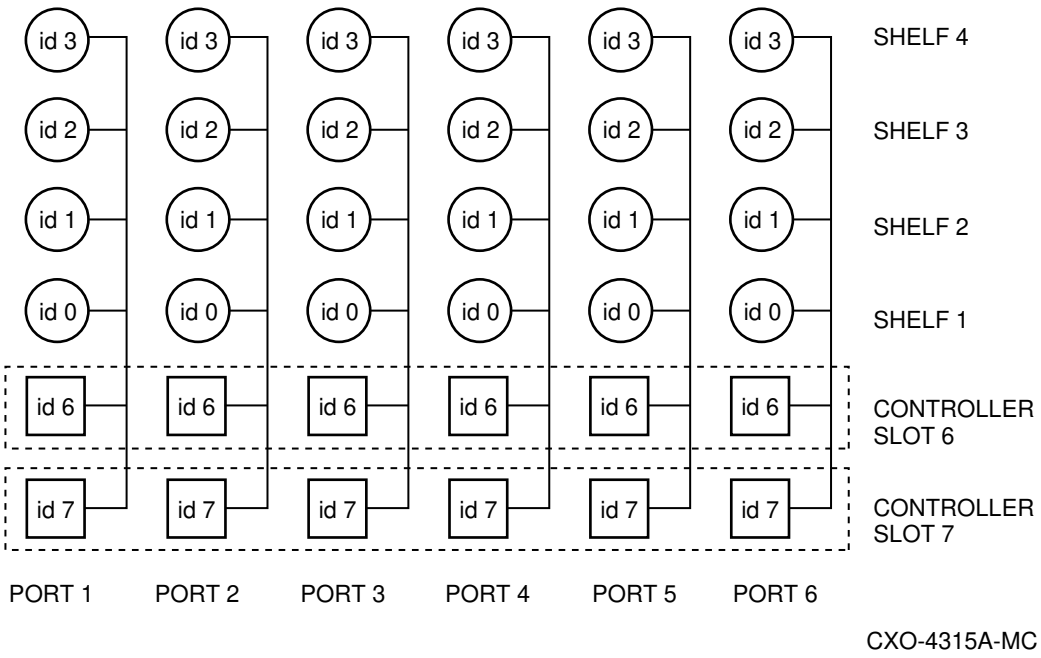
Note

The vertical arrangement of the SW300 cabinet device buses marks a departure from the convention established with BA350–SB device shelves. Devices arranged horizontally in a BA350–SB shelf are typically on the same controller port. However, horizontally arranged devices in an SW300 cabinet are each on a *different* controller port.

This layout allows storagesets, which normally consist of devices on different controller ports (for best performance and availability), to be arranged as horizontal groups of devices.

The SW300 cabinet SCSI device bus configuration appears in Figure 3–9.

Figure 3–9 SW300 Cabinet Shelf SCSI Buses



See the *StorageWorks Solutions SW300-Series RAID Enclosure Installation and User's Guide* for more information on the SW300 cabinet shelf.

3.4 Controllers

This section describes specifics of configuring the controllers.

3.4.1 Nonredundant Controllers

The following guidelines apply to nonredundant controllers:

- A single controller must be installed in the slot furthest from a BA350–MA shelf's SCSI connectors. This slot is SCSI ID 7. By using SCSI ID 7, SCSI ID 6 (the other controller slot) is available as an additional ID on the BA350–SB device shelf.
- (HSD-series) Only four HSD-series controllers per DSSI bus are allowed (four nonredundant controllers, one dual-redundant pair and two nonredundant controllers, or two dual-redundant pairs). Dual-redundant controllers can be on separate DSSI buses.
- The maximum recommended controller subsystem configuration using BA350-series shelves is six devices per controller port. This allows for the addition of another controller and additional power supplies in the storage shelves. A nonredundant controller configuration *can* support seven devices per port. However, Digital still recommends six devices per port to permit the ease of future upgrade.
- The maximum controller subsystem configuration using a SW300 cabinet shelf is four devices per controller port. The maximum is determined by the design of the SW300 cabinet shelf and backplane.

3.4.2 Dual-Redundant Controller Guidelines

The following guidelines apply to dual-redundant controllers:

- Dual-redundant controllers must be located in the same shelf and connected to each other through the shelf backplane. Both controllers have access to all the devices on each other's ports. This setup increases availability and provides for failover when one controller in the pair fails. (The surviving controller takes over service to all devices.)
- Dual-redundant configurations follow the same guidelines as nonredundant configurations, except there is no option to increase to seven devices per port (for BA350-series shelves).
- Both controller's cache modules must be the same type (read or write-back), have the same number of megabytes, and have the same firmware versions.
- Dual-redundant HSJ-series controllers must be on the same star coupler.
- Dual-redundant HSZ-series controllers must be on the same host SCSI bus.

3.4.3 Optimal Performance Configuration

For optimal performance, configure to the following guidelines:

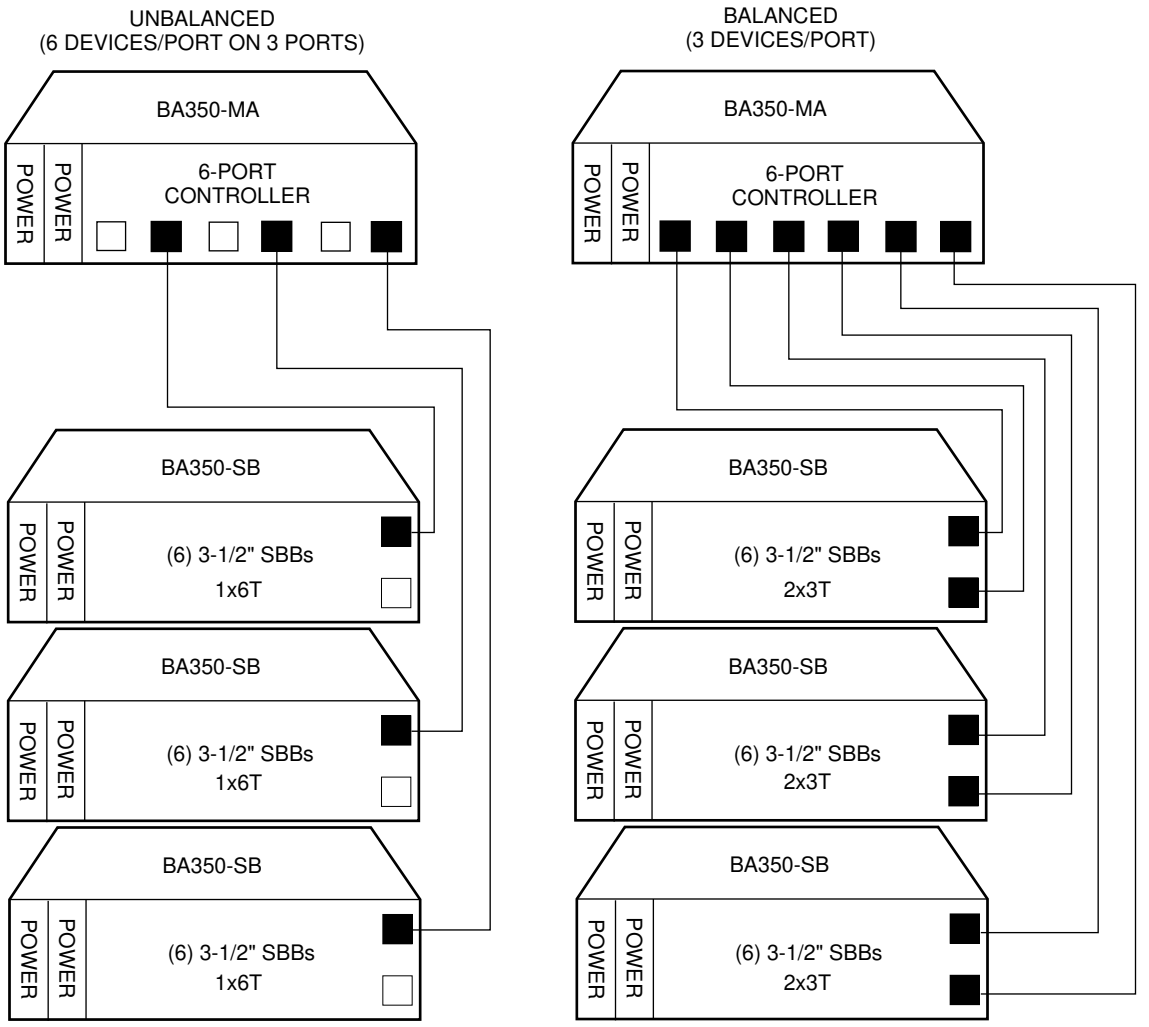
- Balance the number of devices on each port of a controller. For example, for 18 3½-inch SBBs, place 3 devices on each of 6 ports. This permits parallel activity on the controller's available ports to the attached devices. Figure 3–10 is an example of how to balance devices across ports.
- Evenly distribute higher performance devices across separate ports so that higher and lower performance devices are intermixed on the same port. (For example, put multiple solid state disks on separate ports.) This intermixing of higher and lower performance devices on the same port benefits overall performance. Use the guidelines in Table 3–8.

Table 3–8 High-Performance Devices per Port

Total High-Performance Devices	High-Performance Devices per Port (3-Port Controller)	High-Performance Devices per Port (6-Port Controller)
1 to 3	1	1
4 to 6	1	2
7 to 9	2	3
10 to 12	2	4
13 to 15	3	5
16 to 18	3	6

- Limit the number of devices per controller port to three in dual-redundant configurations. In doing so, both controllers access three devices per *each other's* port, maintaining six SCSI–2 devices combined total.
- Maximize the amount of cache memory per controller with the 32 MB cache module option.

Figure 3–10 Balanced Devices Within Device Shelves



CXO-3698C-MC

Highest Performance

To obtain the highest performance possible, use a dual-redundant configuration and balance the number of devices across the two controllers. Do this through your operating system by ordering how devices are mounted or sequenced and by setting preferred path definitions.

Following this guideline results in approximately half of the devices being accessed through each controller. If one controller fails, the surviving controller automatically assumes service to the failed controller's devices.

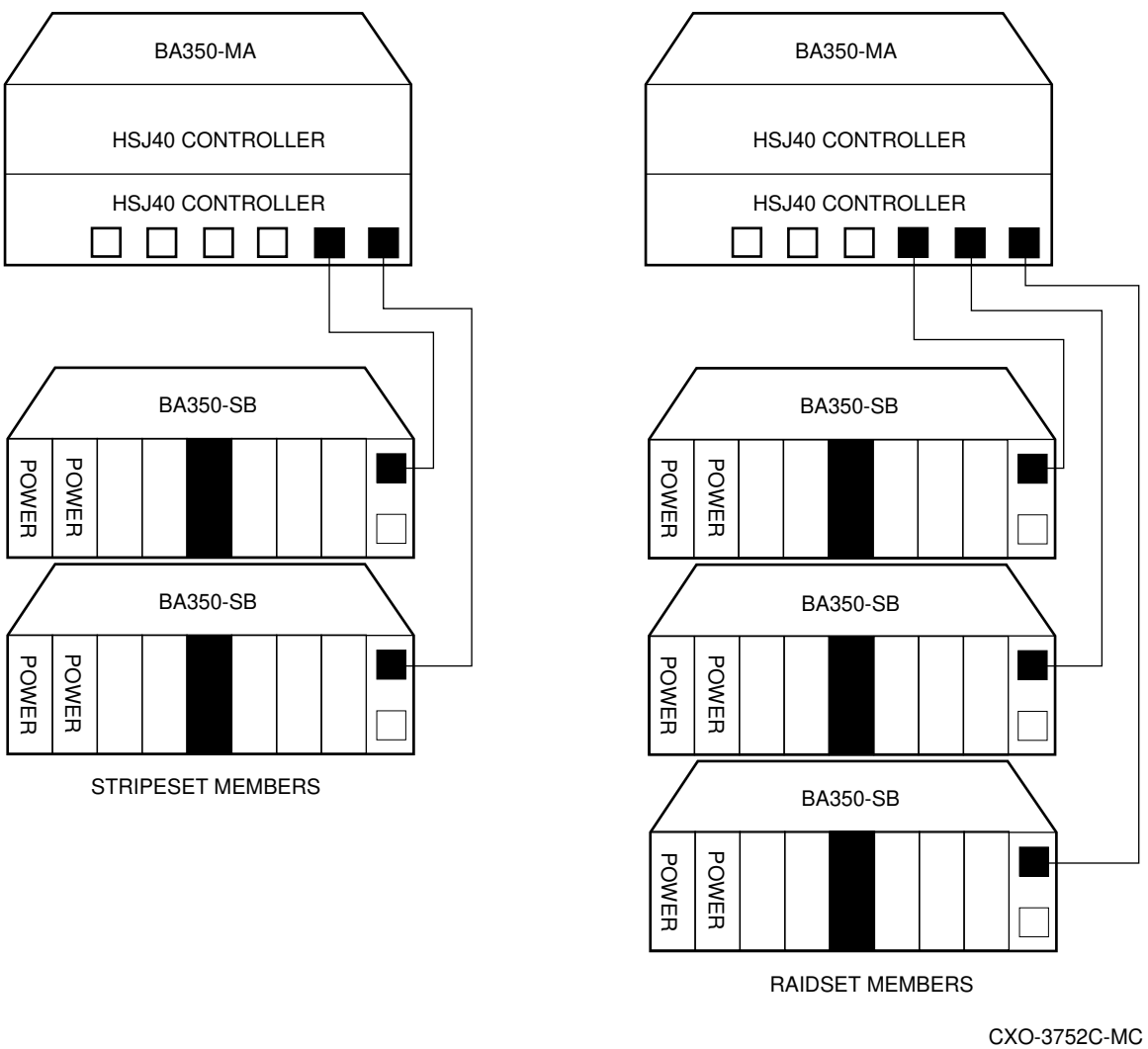
3.4.4 Optimal Availability Configuration

For optimal availability, configure to the following guidelines:

- Use dual-redundant controllers and redundant power supplies in all shelves.
- Place storageset members on different controller ports and different device shelves.
- Use predesignated spares on separate controller ports and device shelves.
- Place storageset members on separate controllers when implementing host-based RAID (for example, HBVS).

Figure 3–11 shows examples of optimal configurations for RAIDset members and designated spares on separate controller ports.

Figure 3–11 Optimal Availability Configurations



Highest Availability

For highest availability, especially with RAID implementations, follow these guidelines:

- For host-based RAID implementations, split the normal access path between controllers.
- Use redundant power supplies in all shelves.

3.5 Host Considerations

The following sections explain important considerations when configuring the HS controller and subsystem to the host CPU.

3.5.1 Host Cables

Following are special guidelines for configuring host cables/buses to and from the HS controller.

HSJ-series

- The internal CI cable length is 6 feet (1.83 meters).
- External CI cables can be a maximum of 147.64 feet (45 meters) from the star coupler to the internal CI cable.

HSD-series

- DSSI cable length between nodes/members on the DSSI bus must be no greater than 30 feet (9.14 meters).
- Total DSSI cable length (end-to-end) on one DSSI bus must be no greater than 60 feet (18.3 meters).

HSZ-series

The maximum length (end-to-end) of fast and slow buses is summarized in Table 3–9.

Table 3–9 SCSI Bus Maximum Lengths

Bus Type	Transfer Rate	Meters	Feet
8-bit, single-ended	5 MB/s	6	19.7
8-bit, single-ended	10 MB/s	3	9.8
16-bit, differential	20 MB/s	25	82.0

3.5.2 Host Adapters

The HSJ-series controllers support from 1 to 31 CI host nodes. Consult your HSJ-series controller SPD and release notes for specific restrictions and a current list of supported host adapters.

Also for the HSJ-series controllers, all host adapter CI ports in a CI configuration must have the quiet slot time set to 10. Some older systems may have the quiet slot time set to 7, which will cause incorrect operation of the CI.

4

Controller Operation and Initial Configuration

This chapter describes operating conditions and procedures for the HS controllers. Information is included about both storage and controller configurations.

The configurations discussed in this chapter are those set by the operator, employing user interfaces such as the CLI. Refer to Chapter 3 for *physical* configuration of the subsystem hardware.

Cross references are also given to other sections of this manual where more information about controller operation is provided.

4.1 Initialization

The following sections discuss the operating conditions surrounding initialization of the controller and subsystem.

4.1.1 Controller Initialization

The controller initializes after any of the following conditions:

- Power is turned on.
- The firmware resets the controller.
- The operator presses the green reset (//) button.
- The host clears the controller.

Note

Keep the program card in its slot during controller subsystem operation. If the program card is removed, the controller resets.

See Chapter 6 for a description of the initialization of both the controller and its cache module. (The process is described in Chapter 6, because some of the initialization diagnostics are available as a controller self-test function for the operator.)

4.1.2 Dual-Redundant Configuration Initialization

The controllers in a dual-redundant configuration run the same initialization sequence that is described in Chapter 6, except they exchange signals during their individual initialization sequences. The first signal occurs after one controller starts initializing. The signal informs the other controller that an initialization is occurring. This way, the other controller will not assume that the initializing controller has malfunctioned and will not attempt to disable it.

4.1.3 Subsystem Initialization

Full StorageWorks subsystem initialization takes place when the subsystem is switched on for the first time. In the event of a reset due to one of the following conditions, a subset of the initialization sequence is run:

- A partial or complete power failure
- Equipment failure
- An error condition

A complete StorageWorks subsystem initialization includes the following:

1. When the subsystem is turned on, all shelves in the subsystem are reset. Then, entities in the shelves (including storage devices, controllers, and cache modules) run their initialization and self-test sequences.
2. During initialization, the controller interrogates the entities with which it has connections, including other controllers in the subsystem.
3. When the initialization sequence on all entities is completed, the controller begins data transfer and other operations with the host.

4.2 Operator Control Panel

The operator can use the operator control panel (OCP) to reset the controller, quiesce the SCSI–2 device buses attached to the controller, and interpret error conditions that result in LED error codes. The OCP and its use are described in Chapter 5.

4.3 Maintenance Terminal

A maintenance terminal is an EIA–423 compatible terminal connected directly to the maintenance port on the front of the controller. You do not need a maintenance terminal for normal operation. However, you must connect a maintenance terminal for initial controller configuration. Thereafter, use either a maintenance terminal or a host (virtual) terminal to communicate with the controller.

Follow this procedure to connect a maintenance terminal:

1. Make sure the power switch on the back of the terminal is in the off (0) position.
2. Connect one end of the terminal cable to the back of the terminal.
3. Connect the other end of the terminal cable to the maintenance port on the controller.
4. Set your terminal at 9600 baud, 8 data bits, 1 stop bit, and no parity. Refer to your terminal documentation for terminal setup instructions.

4.4 Command Line Interpreter

The Command Line Interpreter (CLI) is the user interface to the controller. The CLI allows you to set storage and controller configurations through commands. The following sections explain how to use the CLI, and how it defines and modifies configurations. A detailed description of CLI commands is provided in Appendix B.

4.4.1 Accessing the CLI

You can access the CLI through a maintenance terminal (see Section 4.3) or through a virtual terminal (see Sections 4.6 and 4.7).

To access the CLI through a maintenance terminal (all controllers), connect the terminal and press the Return key. You must use a maintenance terminal to set the controller initial configuration. This is because a new controller arrives with an invalid ID, and host ports (HSJ- and HSD-Series controllers) initially off.

Thereafter, you can use a virtual (host) terminal to modify the configuration. The method of establishing the virtual terminal connection varies depending on your operating system and interface.

For example, for HSJ- and HSD-Series controllers under the OpenVMS VAX™ operating system, the following command connects a host terminal to the CLI:

Note

The following command requires the DIAGNOSE privilege. Also, the controller SCS node name *must* be specified.

```
$ SET HOST/DUP/SERVER=MSCP$DUP/TASK=CLI/
LOG=CONFIGURATION.INFO SCS_nodename
```

Where *SCS_nodename* is the node name of the controller. The qualifier /LOG=CONFIGURATION.INFO creates a log file of your CLI session. After you exit the CLI, you can open the log file to review the session. Reviews allow you to remember such information as how you configured your subsystem, results from diagnostics, and so on.

Establishing a virtual terminal for HSZ-Series controllers requires running the host-based HSZterm application. See the *StorageWorks HSZ40 Array Controller Utility for DEC OSF/1 System Manager's Guide for HSZterm* for more information on the HSZterm application.

Note

Your CLI prompt may be factory set to reflect your controller model, such as HSJ>, HSD>, or HSZ>. This manual uses the designation ''CLI>'' to identify the CLI prompt.

Appendix B provides details on how to change the prompt.

4.4.2 Exiting the CLI

When exiting the CLI, keep the following guidelines in mind:

- If you are using a maintenance terminal, you cannot exit the CLI. Entering the EXIT command merely restarts the CLI and redisplays the controller type and any last fail error information.
- If you are using the DUP connection (HSJ- and HSD-Series virtual terminal), enter the following command to exit the CLI and return the terminal to the host:

  ```
  CLI> EXIT
  ```

4.4.3 Command Sets

The CLI consists of the following command sets:

- Failover commands

  Failover commands support dual-redundant controller configurations.

- Controller commands
  - Set and show the basic controller parameters.
  - Set the controller ID (CI or DSSI node number or SCSI target ID).
  - Set the resident terminal characteristics.
  - Restart the controller.
  - Run resident diagnostics and utilities (see Chapter 6).
- Device commands

  Device commands specify and show the location of *physical* SCSI–2 devices attached to the controller. Devices locations are specified using their SCSI PTL designation.

- Storageset commands

  Storageset commands add, modify, rename, and show storagesets (stripesets, mirrorsets, and RAIDsets). These commands also apply (to some extent) to the **spareset** and **failedset**.

- Logical unit commands

  Logical unit commands add, modify, and show logical units built from devices and storagesets.

- Utility commands

  You can use the RUN command to invoke various exercisers and utilities, such as DILX and CLONE. These are fully described in Chapter 6.

4.4.4 Initial Configuration (Nonredundant Controller)

After installing a nonredundant controller, use the CLI to define its parameters in the following order (from a maintenance terminal).

CAUTION

Do not install HSJ-Series CI host port cables until after setting all parameters listed here. Failure to follow this procedure may result in adverse effects on the host/cluster.

Note

Not all steps are applicable to all controller models. Steps applicable to certain models are designated as such.

1. (HSJ-Series) Enter the following command to set the MAX_NODES:

   ```
   CLI> SET THIS_CONTROLLER MAX_NODES=n
   ```

   where *n* is 8, 16, or 32.

2. Enter the following command to set a valid controller ID:

   CLI> **SET THIS_CONTROLLER ID=*n***

   (HSJ-Series) where *n* is the CI node number (0 through (MAX_NODES – 1)).

   (HSD-Series) or *n* is the one-digit DSSI node number (0 through 7). Each controller DSSI node number must be unique among all devices on its DSSI interconnect.

   (HSZ-Series) or *n* represents the SCSI target IDs (0–7).

3. (HSJ- and HSD-Series) Enter the following command to set the SCS node:

   CLI> **SET THIS_CONTROLLER SCS_NODENAME="*xxxxxx*"**

   where *xxxxxx* is a one- to six-character alphanumeric name for this node. The node name must be enclosed in quotes with an alphabetic character first. Each SCS node name must be unique within its VMScluster.[1]

4. (HSJ- and HSD-Series) Enter the following command to set the MSCP **allocation class**:

   CLI> **SET THIS_CONTROLLER MSCP_ALLOCATION_CLASS=*n***

   where *n* is 0 through 255.

5. (HSJ- and HSD-Series) Enter the following command to set the TMSCP allocation class:

   CLI> **SET THIS_CONTROLLER TMSCP_ALLOCATION_CLASS=*n***

   where *n* is 0 through 255.

Note

Always restart the controller after setting the ID, SCS node name, or allocation classes.

6. Restart the controller either by pressing the green reset (//) button or by entering the following command:

   CLI> **RESTART THIS_CONTROLLER**

7. Enter the following command to verify the preceding parameters were set:

   CLI> **SHOW THIS_CONTROLLER FULL**

CAUTION

Unless there is a mating guide installed on the controller, you must disconnect power from all devices on a DSSI bus before making/breaking a host connection on the front of the controller.

Without the mating guide, if you accidentally short pins during aligning and inserting/removing a connector, you risk blowing the fuses of *all* members on the DSSI bus. With the mating guide installed, you may make or break a connection with power applied on the host bus. However,

[1] See Section 4.9.2 for important information about VMS™ node names.

Digital recommends carefully inserting or removing connectors *at all times*, even if the mating guide installed.

Note

Be aware that the trilink connector is the interface between the controller and two host cable connections. It is the *trilink* that you may safely replace when a mating guide is installed. In a power-on situation, you must work around any cable or terminator connections to the trilink without removing them.

Some cable and terminator connectors will not provide enough access to the trilink screws for you to install the trilink (without first removing the cable and/or terminator). In these cases, you have to disconnect power from all bus members and remove cables and terminators before installing the trilink.

8. Connect the host port cable to the front of the controller (see Chapter 7).
9. (HSJ-Series) Enter the following commands to enable CI paths A and B to the host:

```
CLI> SET THIS_CONTROLLER PATH_A
CLI> SET THIS_CONTROLLER PATH_B
```

(HSD-Series) Enter the following command to enable the host port path:

```
CLI> SET THIS_CONTROLLER PATH
```

(HSZ-Series) The host port path for HSZ-Series controllers is always on, so no command is needed.

4.4.5 Initial Configuration (Dual-Redundant Controllers)

In a dual-redundant configuration, you can use one terminal to set both controller configurations. After installing both controllers, use the CLI to define their parameters in the following order (from a maintenance terminal connected to one controller):

CAUTION

Do not install HSJ-Series CI host port cables until after setting all parameters listed here. Failure to follow this procedure may result in adverse effects on the host/cluster.

Note

Not all steps are applicable to all controller models. Steps applicable to certain models are designated as such.

1. (HSJ-Series) Enter the following command to set the MAX_NODES:

```
CLI> SET THIS_CONTROLLER MAX_NODES=n
```

where *n* is 8, 16, or 32.

2. Enter the following command to set a valid controller ID:

   ```
   CLI> SET THIS_CONTROLLER ID=n
   ```

   (HSJ-Series) where *n* is the CI node number (0 through (MAX_NODES – 1)).

   (HSD-Series) or *n* is the one-digit DSSI node number (0 through 7). Each controller DSSI node number must be unique among all devices on its DSSI interconnect.

   (HSZ-Series) where *n* is the superset of unique SCSI target IDs assigned to *both* controllers (range 0–7, up to four total). Then enter the following command:

   ```
   CLI> SET THIS_CONTROLLER PREFERRED_ID=n
   ```

   where *n* represents the unique SCSI target IDs from the superset assigned to only *this* controller (up to four total). The remaining IDs from the superset will automatically be assigned to the companion controller.

3. (HSJ- and HSD-Series) Enter the following command to set the SCS node:

   ```
   CLI> SET THIS_CONTROLLER SCS_NODENAME="xxxxxx"
   ```

   where *xxxxxx* is a one- to six-character alphanumeric name for this node. The node name must be enclosed in quotes with an alphabetic character first. Each SCS node name must be unique within its VMScluster.[2]

4. (HSJ- and HSD-Series) Enter the following command to set the MSCP allocation class:

   ```
   CLI> SET THIS_CONTROLLER MSCP_ALLOCATION_CLASS=n
   ```

   where *n* is 1 through 255.

   Digital recommends providing a unique allocation class value for every pair of dual-redundant controllers in the same cluster.

5. (HSJ- and HSD-Series) Enter the following command to set the TMSCP allocation class:

   ```
   CLI> SET THIS_CONTROLLER TMSCP_ALLOCATION_CLASS=n
   ```

   where *n* is 1 through 255.

   CAUTION

   The SET FAILOVER command establishes controller-to-controller communication and copies configuration information. Always enter this command on one controller only. COPY=*configuration-source* specifies where the *good* configuration data is located. *Never* blindly specify SET FAILOVER. Know where your good configuration information resides before entering the command.

6. Enter the following command to copy parameters to the other controller (the one *not* connected to):

[2] See Section 4.9.2 for important information about VMS node names.

```
CLI> SET FAILOVER COPY=THIS_CONTROLLER
```

Note

Always restart the controllers after setting the ID, SCS node name, or allocation classes.

7. Restart both controllers either by pressing the green reset (//) buttons, or by entering the following commands:

```
CLI> RESTART OTHER_CONTROLLER
CLI> RESTART THIS_CONTROLLER
```

8. Enter the following commands to verify the preceding parameters were set.

```
CLI> SHOW THIS_CONTROLLER FULL
CLI> SHOW OTHER_CONTROLLER FULL
```

CAUTION

Unless there is a mating guide installed on the controller, you must disconnect power from all devices on a DSSI bus before making/breaking a host connection on the front of the controller.

Without the mating guide, if you accidentally short pins during aligning and inserting/removing a connector, you risk blowing the fuses of *all* members on the DSSI bus. With the mating guide installed, you may make or break a connection with power applied on the host bus. However, Digital recommends carefully inserting or removing connectors *at all times*, even if you a mating guide is installed.

Note

Be aware that the trilink connector is the interface between the HSD-Series controller and two DSSI cable connections. It is the *trilink* that you may safely remove and replace when a mating guide is installed. In a power-on situation, you must work around any DSSI cable or terminator connections to the trilink without removing them.

Some cable and terminator connectors will not provide enough access to the trilink screws for you to remove the trilink (without first removing the cable and/or terminator). In these cases, you have to disconnect power from all bus members and remove cables and terminators before removing the trilink.

9. Connect the host port cables to the front of the controllers (see Chapter 7). Do *not* connect the two controllers in a dual-redundant pair to separate or different star couplers (HSJ-Series), or SCSI buses (HSZ-Series). You may connect two dual-redundant HSD-Series controllers to different DSSI buses.

10. Enter the following commands to enable CI paths A and B to the host (HSJ-Series):

```
CLI> SET THIS_CONTROLLER PATH_A
CLI> SET THIS_CONTROLLER PATH_B
CLI> SET OTHER_CONTROLLER PATH_A
CLI> SET OTHER_CONTROLLER PATH_B
```

Enter the following commands to enable the host port path (HSD-Series controllers):

```
CLI> SET THIS_CONTROLLER PATH
CLI> SET OTHER_CONTROLLER PATH
```

(HSZ-Series) The host port path for HSZ-Series controllers is always on, so no command is needed.

4.4.6 Configuring Storage Devices

To automatically configure devices on the controller, use either the CONFIG or CFMENU utility described in Chapter 6.

For manual configuration, the following steps add devices, storagesets, and logical units. Use the CLI to complete these steps so that the host will recognize the storage device. (These steps can be run from a virtual terminal.)

1. Add the physical devices by using the following command:

   ```
   CLI> ADD device-type device-name SCSI-location
   ```

   For example:

   ```
   CLI> ADD DISK DISK100 1 0 0
   CLI> ADD TAPE TAPE510 5 1 0
   CLI> ADD CD--ROM CD--ROM0 6 0 0
   ```

   where:

   device-type is the type of device to be added. This can be DISK, TAPE, LOADER, OPTICAL, or CD–ROM.

   device-name is the name to refer to that device. The name is referenced when creating units or storagesets.

   SCSI-location is the PTL for the device. When entering the PTL, separate the three numbers with spaces.

2. Add the storagesets for the devices. Storagesets include stripesets, mirrorsets, and RAIDsets.

   See Appendix B for examples of adding storagesets. (If you do not want storagesets in your configuration, skip this step.)

3. Enter the following command to initialize the containers (devices, storagesets, or both) prior to adding logical units to the configuration.

   CAUTION

   The INITIALIZE command destroys all data on a **container**. See Appendix B for specific information on this command.

   ```
   CLI> INITIALIZE container-name
   ```

   where *container-name* is a device or storageset that will become part of a unit.

When initializing a single-device container:

- If NOTRANSPORTABLE (the default) was specified when the device was added, a small amount of disk space was made inaccessible to the host and used for **metadata**. The metadata will now be initialized.
- If TRANSPORTABLE was specified, any metadata on the device will now be destroyed. See Appendix B for details on metadata and when INITIALIZE is required.

4. Add the units that use either the devices or the storagesets by entering the following command:

   ```
   CLI> ADD UNIT logical-unit-number container-name
   ```

   where:

   logical-unit-number is the unit number the host uses to access the device.

   container-name identifies the device or the storageset.

4.5 Acceptance Test

After you install and configure your controller, follow the guidelines in this section to perform an acceptance test on your subsystem.

1. Turn your system on. This resets all shelves and starts the spin-up cycle on devices within the shelves. This includes the initialization (diagnostics) on the controllers and device self-tests.
2. Run DILX using the default answers to the test questions (see Chapter 6). This tests all disk devices in your subsystem.
3. Run TILX using the default answers to the test questions (see Chapter 6). This tests all tape devices in your subsystem.

4.6 Virtual Terminal (HSJ- and HSD-Series)

After setting initial controller parameters through a maintenance terminal, you can access the controllers from a virtual host terminal through a DUP connection. Refer to Section 4.4.1 for information on making the virtual connection.

Establishing a virtual terminal session under the OpenVMS VAX and OpenVMS Alpha™ operating systems (SET HOST/DUP) requires the FYDRIVER. The following error indicates that the FYDRIVER has not been loaded:

```
%HSCPAD-F-DRVNOTLOAD, FYDRIVER not loaded
-SYSTEM-W-NOSUCHDEV, no such device available
```

If you receive this message, load the FYDRIVER as follows:

- For OpenVMS VAX:

  ```
  $ MCR SYSGEN
  SYSGEN> LOAD SYS$LOADABLE_IMAGES:FYDRIVER
  SYSGEN> CONNECT FYA0 /NOADAPTER
  SYSGEN> EXIT
  $
  ```

- For OpenVMS Alpha:

```
$ MCR SYSMAN
SYSMAN> IO CONNECT FYA0 /NOADAPTER/DRIVER=SYS$FYDRIVER
SYSMAN> EXIT
$
```

Once FYDRIVER is loaded, you may make the virtual terminal connection as follows:

```
$ SET HOST/DUP/SERVER=MSCP$DUP/TASK=CLI/LOG=CONFIGURATION.INFO SCS_nodename
```

4.7 Virtual Terminal (HSZ-Series)

A virtual terminal port can be created through a host-based application called HSZterm. This program uses SCSI diagnostic send and receive commands to deliver and receive characters to and from the HSZ-Series CLI and local programs. See the *StorageWorks HSZ40 Array Controller Utility for DEC OSF/1 System Manager's Guide for HSZterm* for more information on the HSZterm application.

4.8 VAXcluster Console System

You can run VAXcluster Console System (VCS) with any HS controller. If you are unfamiliar with VCS, refer to the *VCS Software Manual* for instructions. You may attach a VCS to the maintenance terminal port via a DECserver™ or terminal.

4.9 Operating Systems

The following sections describe particulars associated with host operating systems which may help in understanding and servicing the HS controllers.

The two primary operating systems that support the HS controllers are the OpenVMS and DEC OSF/1 operating systems. Support is provided at the version number or higher shown in Table 4–1.

Table 4–1 Operating System Support

Operating System	HSJ-Series	HSD-Series	HSZ-Series
OpenVMS Alpha	V1.5†	V1.5†	N/S
OpenVMS VAX	V5.5–2†	V5.5–2	N/S
VAX VMS	V5.5–1†	N/S	N/S
DEC OSF/1	N/S	N/S	V2.0

†Supported with limitations.

N/S = Not supported at time of printing.

Refer to your firmware release notes for restrictions and updates regarding operating system support.

Although certain specifics regarding operating systems are covered here, see the *StorageWorks Array Controllers HS Family of Array Controllers User's Guide* for complete information on operating system support.

4.9.1 Controller Disks as System Initialization Disks

The following considerations apply to using controller-attached devices as host initialization devices:

HSJ-Series

Controller-attached devices may serve as manual or automatic initialization devices for VAX 7000 and VAX 10000 systems. For a disk drive connected to an HSJ-Series controller to be both a VAX 7000/10000 manual *and* automatic initialization device, the following conditions must be met:

- HS operating firmware must be at Version 1.0B or higher.
- VAX 7000/10000 console code must be at Version 3.2 or higher.
- For console code Version 3.2, the operating system ''single path'' patch must be installed.
- The total capacity of the disk or storageset used as an initialization device cannot be greater than 4 GB.

Note

Contact Digital Multivendor Customer Services if you need to upgrade to Version 3.2 or greater VAX 7000/10000 console code.

If your VAX 7000/10000 console code version is earlier than Version 3.2, you are limited to manual initialization. To manually initialize, perform the following steps:

1. Make sure that the disk drives attached to the HSJ-Series controller are visible to the initialization driver by entering the SHOW DEVICE command repeatedly (from the virtual terminal) until the disk drives attached to the HSJ-Series controller are reported (usually two repetitions are sufficient).
2. Enter the default initialization device string. (Refer to the VAX console instructions in the VAX console documentation.)
3. Enter BOOT.

Refer to the *HS Family of Array Controllers User's Guide* for more information on VAX 7000/10000 initialization devices.

Controller-attached devices may serve as initialization devices for DEC 7000 and DEC 10000 systems provided the DEC 7000/10000 console code is at Version 3.1 or higher.

HSD-Series

Controller-attached devices currently will not reliably serve as initialization devices for VAX 7000 and VAX 10000 systems.

HSZ-Series

An HSZ-Series unit can be a DEC OSF/1 operating system initialization disk if the system unit is LUN 0 as seen by the host CPU.[3]

Controller-attached devices may serve as initialization devices for DEC 7000 and DEC 10000 systems provided the DEC 7000/10000 console code is at Version 3.1 or higher.

[3] See the HSZ-Series firmware release notes for restrictions.

4.9.2 Operating System Nodes (OpenVMS)

Be aware of the following conditions for HSJ-Series controllers:

- If a controller is already an active member of an OpenVMS cluster and you change its current CI node number but not its CI node name, and then restart the controller with the new node number, access to its devices and overall cluster operation will be adversely affected. This occurs because the OpenVMS operating system makes continuous attempts to establish new virtual circuits with new nodes, and it will find a known node name at a new node address. This operation is a security feature provided by the operating system to prevent one CI node from masquerading as another.
- If the controller CI node number and node name are both changed, and you restart the controller while the OpenVMS cluster remains operational, the operating system will establish communication with the controller using the new CI node address and CI node name. Normal operation will occur, with the exception that the controller's devices will be assigned new device names based on the controller's new node name.
- If it is necessary to change only the controller's CI node number, all CI host CPU nodes must be shut down and then restarted.

4.9.3 AUTOGEN.COM (OpenVMS)

The OpenVMS AUTOGEN.COM file must be edited for HSJ- and HSD-Series controller-attached disks to be recognized. If AUTOGEN is run without modification in a system that includes such controller-attached disk drives, the following error message is displayed:

```
"** WARNING ** - unsupported system disk type. Using speed and size
characteristics of an RK07."
```

The AUTOGEN program does not recognize the device types of the controller's attached devices. The OpenVMS DCL lexical F$GETDVI returns the following values:

```
OpenVMS VAX V6.0      VAX VMS V5.5-1
 OpenVMS VAX V6.1     OpenVMS VAX V5.5-2
 ----------------     ------------------
 141 - HSX00          35 - unknown device
 142 - HSX01          35 - unknown device
```

The AUTOGEN.COM DCL procedure must be modified as follows to support these values:

VAX VMS Version 5.5–1 and OpenVMS VAX Version 5.5–2

The AUTOGEN.COM DCL procedure will select a –1 (unsupported device) from the speed list. To circumvent this problem, perform the following steps:

1. Make a copy of the AUTOGEN.COM DCL file in case restoration of the original state is required.
2. The section of AUTOGEN.COM (from OpenVMS software Version 5.5–2) dealing with devices is shown below. Change one element in the speed list (the –1 shown enclosed in a box) to a 4.

```
$speed_list=" -1, 2, 2, 4, 4, 4, 4, 4, 4, 1, 1,-1,-1, 4,-1, 4,-1,-1, 1, 2"
$speed_list=speed_list + ", 4, 4, 4, 2, 2, 1,-1, 1, 1, 2, 4, 1, 1,-1,-1, -1, -1,-1, 4, 4"
$speed_list=speed_list + ", 1, 1, 1, 4, 4, 1, 4,-1, 4, 4, 4, 4,-1,-1, 4,-1, 4, 4,-1, 4"
$speed_list=speed_list + ", 4, 4,-1,-1, 4, 4, 2,-1,-1,-1, 4,-1, 1,-1, 4, 4, 4, 4, 4, 4"
$speed_list=speed_list + ", 4, 4, 4, 4,-1, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4"
$speed_list=speed_list + ", 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4"
$speed_list=speed_list + ", 4, 4, 4, 4, 4, 4, 4"
$diskspeed=-1
$temp = F$GETDVI("sys$sysdevice","DEVTYPE")
$IF (temp .LE. 126) .AND. (temp .GE. 1) -
THEN diskspeed = F$ELEMENT(temp,",",speed_list)
$disksize = F$GETDVI("sys$sysdevice","MAXBLOCK")
$IF diskspeed .NE. -1 THEN GOTO getdata30
```

3. Run the AUTOGEN program.

Completing this procedure causes the disk drives to be recognized as supported device types.

OpenVMS VAX Version 6.0

The AUTOGEN.COM DCL procedure does not support device types above 137 although HSX00 and HSX01 are properly defined in the speed list. To circumvent this problem, perform the following steps:

1. Make a copy of the AUTOGEN.COM DCL file in case restoration of the original state is required.
2. Edit the AUTOGEN.COM file. Change the value 137 in the following statement to 142.

   ```
   $IF  (temp  .LE.  137) .AND.  (temp .GE.  1) -
   ```

3. Run the AUTOGEN program.

This change will allow AUTOGEN to run successfully against the controller-attached disk drives used as system disks.

OpenVMS VAX Version 6.1

The OpenVMS VAX Version 6.1 operating system does not require modifications to AUTOGEN.COM as described in the previous sections.

4.9.4 Other Conditions (OpenVMS)

The following conditions and recommendations also apply to controllers running under the OpenVMS operating system:

- Storageset size

  The OpenVMS VAX operating system maximum capacity restriction for file-structured volumes, 16,777,216 blocks (about 8.5 GB), remains in effect for operating system versions prior to Version 6.0.

- The CLUSTER_SIZE qualifier for large devices or storagesets

  Digital recommends that the formula displayed by the OpenVMS HELP DEVICE INIT/CLUSTER_SIZE command be used to determine the proper OpenVMS file system cluster size. Using too small a file system cluster size may prevent some of the device or storageset capacity from being accessed; too large a cluster size usually wastes storage capacity by allocating large blocks of storage for small files.

- Shadowset operation

  In OpenVMS VAX operating system versions prior to Version 6.0, timed-out I/O requests to shadowset members may lead to member disks attached to controllers being dropped from shadowsets. In some cases, this may lead to host crashes.

  To avoid this possibility, Digital recommends changing the value of the SYSGEN parameter SHADOW_MBR_TMO to at least 120 (seconds) for systems running operating system versions earlier than Version 6.0. (Be aware that your system may temporarily pause during the 120 second interval.) Version 6.0 of the OpenVMS VAX operating system avoids this problem by retrying timed-out operations to shadowset members several times.

- PAPOLLINTERVAL and PANUMPOLL parameters

  Digital recommends that the SYSGEN parameters PAPOLLINTERVAL and PANUMPOLL be set such that all nodes in the cluster are polled within 30 seconds or less. This ensures proper operation of the HSJ-Series CI in the event of controller reinitialization. Failure to set this value may result in MSCP command timeouts. The default values are set to poll 16-node clusters every 5 seconds and 32-node clusters every 10 seconds.

4.10 Failover

Failover takes place when one controller fails in a dual-redundant configuration. To support failover, information is shared between the two controllers, such as:

- Physical device PTL configurations
- Storageset names
- Logical unit definitions

HSJ- and HSD-Series: Prior to failover, all resources are considered unbound to a particular controller, until a logical unit is brought online by the host through (one of) the controllers. At this point, all containers used by the logical unit become solely accessible through the one controller.

HSZ-Series: Prior to failover, resources are always bound to a particular controller, because the controller is a SCSI target of the host, and LUNs must communicate through the target ID. This is true whether or not a unit is currently interacting with the host.

In a failover configuration, all commands are shared between the two controllers except the following:

```
SET THIS_CONTROLLER
SET OTHER_CONTROLLER
SHOW THIS_CONTROLLER
SHOW OTHER_CONTROLLER
RESTART THIS_CONTROLLER
RESTART OTHER_CONTROLLER
SHUTDOWN THIS_CONTROLLER
SHUTDOWN OTHER_CONTROLLER
```

In these cases, the command will be directed to the correct controller:

- THIS_CONTROLLER refers to the controller to which the terminal is connected.

- OTHER_CONTROLLER refers to the other controller in the dual-redundant pair.

4.10.1 Setting Failover

To place two controllers into failover configuration, enter the following command:

```
CLI> SET FAILOVER COPY=configuration-source
```

where *configuration-source* is either THIS_CONTROLLER or OTHER_ CONTROLLER, depending on where the ''good'' copy of device configuration information resides.

CAUTION

Digital recommends that the controllers be set for failover before any device configuration commands are entered. Then, as devices, storagesets, and units are added to one controller's configuration, they are automatically added to the other controller's configuration.

Given two controllers, it is possible to fully configure one controller, and then enter the SET FAILOVER command, but if the wrong *configuration-source* is specified, all device configuration information will be lost (overwritten). *Never* blindly specify SET FAILOVER. Know where your good configuration information resides before entering the command. (A considerable amount of work and effort could easily be lost by overwriting good information.)

Note

Due to the amount of information that must be passed between the two controllers, the SET FAILOVER command may take up to 1 minute to complete.

When setting dual-redundant controllers for failover, make sure the target controller (the controller you are copying configuration to) has no cache errors or unwritten cache data. Delete any remaining, configured units on the target controller to verify there are no cache errors before entering the SET FAILOVER command. Deleting units from the target controller will not create problems because, after setting failover, you will not be accessing those units anyway. (The target controller will access only the copied units.)

HSZ-Series: Observe the following considerations when setting dual-redundant HSZ-Series controllers for failover:

- Subsystem performance will be better if you balance the assignment of target IDs across your dual-redundant pair. See Section 4.10.6 for information on preferred ID assignment.
- The controller you are copying configuration information to will automatically restart after entering the SET FAILOVER command.
- You must connect both controllers to the same host SCSI bus. If you connect the controllers in a dual-redundant pair to different host buses, and one controller fails, the attempted failover process will cause adverse effects on your subsystems.

4.10.2 Failing Over

A failed or unresponsive controller in a dual-redundant configuration is disabled by its companion controller. The functioning controller sends a signal to the other controller to induce failover. The functioning controller assumes control of the storage devices that were online to the disabled controller. Maintenance can now take place on the failed controller.

Failover normally completes in 30 seconds or less (15 seconds or less for three-port controllers). If there is no outstanding drive I/O activity at the time of controller failure, failover should require substantially less than 30 seconds. If drive I/O is in progress at the time of failure, the surviving controller must reset any SCSI buses with outstanding I/O. These bus resets can require up to 5 seconds per port to complete.

Whenever you need to revive a controller that was disabled, you must enter the following command from a terminal connected to the functioning controller:

```
CLI> RESTART OTHER_CONTROLLER
```

Then initialize the controller by pressing the reset (//) button on the controller to be revived.

You may test failover by removing the program card from one of the controllers. The other controller will assume service to the dormant controller's devices until you reinsert the program card and reinitialize/restart the controller.

4.10.3 Exiting Failover

You should rarely force a dual-redundant controller pair out of the failover configuration. However, the circumstances when you may safely do this are described below.

4.10.3.1 Before Failover Occurs

If you have two normally operating dual-redundant controllers set for failover, and you want to remove one controller for use somewhere else, you must shut down that controller (see Chapter 7). Shutting down one controller will force failover to occur, which preserves access to your entire configuration through the surviving controller.

4.10.3.2 After Failover Occurs

After one controller in your dual-redundant pair has failed or been shut down, the surviving controller will service your entire configuration. To take the controllers out of the failover configuration, enter the following command:

```
CLI> SET NOFAILOVER
```

You must consider the following before entering the SET NOFAILOVER command or removing one controller:

- You will not need to SET NOFAILOVER unless you must make configuration changes before you can replace the failed controller.
- If the surviving controller and its cache module are functioning normally, you can SET NOFAILOVER without special preparation.
- If the surviving controller is running with a low write-back cache battery (enter SHOW THIS_CONTROLLER to check the battery), you must replace /recharge the battery before entering SET NOFAILOVER and before removing the failed controller's cache module.

Entering SET NOFAILOVER removes the controller from the failover configuration (as well as the other controller, if it is reachable) and causes the other controller to shutdown. You may now make the configuration changes under the surviving controller.

4.10.4 Failover Setup Mismatch

During failover mismatch, one controller will function while the second controller will not recognize any devices. Although it is rare, a failover mismatch may occur during the following scenarios:

- If the controllers initialize at *exactly* the same time, one controller may be set for failover while the other is not.
- If one controller is running (operating normally) when the second controller is initialized, mismatch may occur. For example, this can happen after one controller has undergone maintenance.

To correct a failover mismatch, stop all processes on the devices for both controllers. Then enter the following commands to determine which controller has the desired, good configuration information:

```
CLI> SHOW UNITS
CLI> SHOW STORAGESETS
CLI> SHOW DEVICES
```

After deciding on one of the two configurations, use the SET FAILOVER command to copy the good information from one controller to the other.

4.10.5 Preferred Paths (HSJ- and HSD-Series)

Use the controller preferred path command (CLI> SET *unit* PREFERRED_PATH) to balance units between controllers for better performance in a dual-redundant configuration. Using preferred paths maintains unit-to-controller assignments when dual-redundant pairs are restored from the failover condition.

Once established, preferred paths are automatically activated, and remain stored in controller NVMEM.

4.10.6 Preferred Paths (HSZ-Series)

Preferred paths are set on HSZ-Series controllers through the controller's target ID on the host SCSI bus. A LUN under a controller is linked to a particular target ID as part of the addressing process, so the LUN cannot be accessed through any ''other'' controller unless the new controller assumes a new target ID (such as during failover).

To set preferred paths for dual-redundant HSZ-Series controllers, do the following:

1. Define the superset of *all* SCSI IDs (up to four) representing both controllers by entering the SET THIS_CONTROLLER ID=(*w,x,y,z*) and SET OTHER_ CONTROLLER ID=(*w,x,y,z*) commands.
2. Set the preferred IDs for one controller. For example, set up the controller your terminal session is connected to by entering the SET THIS_ CONTROLLER PREFERRED_ID=(*w,x,y,z*) command.

Each controller can have up to four preferred IDs, and they must come from the same superset of IDs defined when using the ID= parameter. IDs from the superset which are not attached to one controller via the PREFERRED_ID= parameter will automatically be attached to the companion controller. Subsystem performance will be best if you balance target IDs across both controllers.

4.11 Moving Devices Between Controllers

The moving of devices from one controller to another is supported under the following conditions:

- **Nontransportable devices**

  Under normal operation, the controller makes a small portion of a disk inaccessible to the host and uses this area to store metadata. Metadata improves error detection and media defect management. Devices utilizing metadata are called **nontransportable**. Initializing a device that is set as nontransportable will place or reset metadata on the device.

  When bringing other HS controller (nontransportable) devices to an HS controller subsystem, simply add the device to your configuration using the ADD command. Do not initialize the device or you will reset/destroy forced error information on the device.

  When adding devices, the controller firmware will verify that metadata is present. If in doubt, try to add the device so that the controller will check for metadata. If an error stating that there is no metadata occurs, initialize the device before adding it.

  A nontransportable device is interchangeable with an HSC™ K.scsi[4] module or another HS controller subsystem. Nontransportable devices are MSCP compliant and support forced error.

- **Transportable devices**

  A **transportable** feature is provided for transfer of devices between non-HS controller systems and HS controller arrays. Transportable devices do not have metadata on them, and initializing a device after setting it as transportable will destroy metadata (if any) on the device.

  Before moving devices from an HS controller subsystem to a non-HS controller system, delete the unit associated with the device and set the device as transportable. Then, initialize the device to remove any metadata.

  When bringing non-HS controller devices to an HS controller subsystem, initialize the device after setting it transportable, then copy the data on the device to another, nontransportable, unit. Then, reinitialize the device after setting it nontransportable (thereby putting metadata on the device). You *must* initialize these devices because they may contain intact metadata blocks, which can ‘‘fool’’ the controller into attempting to run with the device.

  CAUTION

  Do not keep any device set as transportable on an HS controller subsystem. Doing so sacrifices forced error support on all units attached

[4] For purposes of setting transportable/nontransportable devices, the HSC K.scsi controllers are compatible with HS controllers. However, the geometry of disk devices under these two subsystems is slightly different. To correct the geometry, always use the OpenVMS ANALYZE/DISK/REPAIR command on a disk after transfer between these two subsystems.

to the device. This is mandatory for HBVS and improving data integrity on the entire array.

A transportable device is interchangeable with any SCSI interface that does not utilize the device metadata (for example, a VAX workstation, an SZ200, or a PC). Transportable devices are not MSCP compliant, cannot have write-back caching enabled, may not be members of a shadowset or storageset, and do not support forced error. A controller error (see Chapter 5) will occur if the operating system attempts to write forced error information to a transportable device.

Transportable/nontransportable device support is summarized in Table 4–2.

Table 4–2 Transportable and Nontransportable Devices

Media Format	VAX or Alpha Workstation	HSC K.scsi	HSD05	HS Controller
Transportable	Yes	No	Yes	Yes
Nontransportable	No	Yes	No	Yes

4.12 Moving Devices Under the Same Controller

CAUTION

Do not use a controller failure situation as an opportunity to move devices or otherwise reconfigure your subsystem. Doing so will prevent the controller from communicating with its units once the fault is corrected.

You may physically relocate some or all of a storageset's member devices according to the following procedure. (This procedure also applies to reduced RAIDsets, but you must remember to add the RAIDset as REDUCED when you recreate it.)

CAUTION

Label any devices before you remove them. If you lose track of the storageset members at any point during this procedure, you will have to attempt to restore the storageset by guessing where its members are installed. There is currently no way to retrace your steps using the controller or HS operating firmware.

---

1. Make note of all devices comprising the storageset. Digital recommends marking them after using the CLI> LOCATE command to find all storageset members. Note the order of the devices in the storageset—which disk is the first member, which disk is the second member, and so on.
2. Delete the unit associated with the storageset.
3. Delete the storageset.
4. Delete the devices to be moved.
5. Move the devices to the new port/target/LUN (PTL) locations.

6. Add the devices using the new PTL location.
7. Recreate the storageset, making sure to add the members in their original order. Make sure you create it from the exact, original set of devices.

CAUTION

Do *not* initialize the storageset or you will destroy its data.

8. Recreate the unit.

The following example shows the unit ''D100'' made of stripeset ''STRIPE0.'' ''STRIPE0'' has member disks at PTLs 200 and 210. The member at PTL 210 can be relocated to PTL 300 as follows:

```
CLI> DELETE D100
CLI> DELETE STRIPE0
CLI> DELETE DISK210
```

(Move the disk to PTL 300.)

```
CLI> ADD DISK DISK300 3 0 0
CLI> ADD STRIPESET STRIPE0 DISK200 DISK300
CLI> ADD UNIT D100 STRIPE0
```

4.13 Command Disks (HSJ- and HSD-Series)

A special storage configuration is available for communication with generic SCSI devices. The concept centers around a virtual unit, called a **command disk**, that allows an MSCP-based host to control any physical SCSI device.

This feature uses the MSCP read and write operations as a transport for SCSI commands. In other words, the command disk will appear to the host as simply another disk behind the controller. However, the command disk resides entirely in approximately 10 KB of controller memory. The command disk exchanges SCSI commands, SCSI status, and data with the SCSI device. The setup is necessary in order for MSCP to transfer the SCSI information required when performing anything more than simple device reading or writing.

4.13.1 Uses for Command Disks

Although a command disk allows you to perform a number of operations, including downloading of microcode into a SCSI device's processor memory, the example presented in this manual is that of a tape library.

A tape library contains a standard tape drive (or drives) plus a robotic mechanism for selecting and loading cartridges from a pool of tapes. (Such mechanisms are also known as ''jukebox'' style **loaders**, or medium changers.) The loader is a good application for a command disk because SCSI commands are needed to control the robotic movement within the device.

In some tape library devices, the actual drive has one logical unit number (LUN), and the loader has a different LUN.

4.13.2 Creating a Command Disk

You must configure a command disk at the controller and the host level.

4.13.2.1 Controller Setup

The following precess explains what you must do at the controller level to create a command disk for a loader. Note that you can only assign one SCSI device to each command disk.

1. Add the tape device serviced by the loader robot.
2. Add the tape device as a unit visible to the host.
3. Add the loader mechanism using its PTL location.
4. Add a **passthrough** container, the bridge between the physical loader and the virtual unit.
5. Add the passthrough container as virtual unit visible to the host.

The following example shows the CLI commands necessary to add a tape library device to your configuration using a command disk. Note that the PTL addresses for devices in your storage subsystem probably will be different.

```
CLI> ADD TAPE320 3 2 0 ❶
CLI> ADD UNIT T322 TAPE320 ❷
CLI> ADD LOADER LDR321 3 2 1 ❸
CLI> ADD PASSTHROUGH PASS1 LDR321 ❹
CLI> ADD UNIT D332 LDR321 ❺
```

The commands in the example do the following:

❶ Adds the tape drive at PTL 3 2 0 to the list of known tape drives with the name TAPE320.

❷ Creates a host-visible unit called T322 that consists of TAPE320.

❸ Adds the tape laoder at PTL 3 2 1 to the list of known loaders with the name LDR321. Note that for this tape library device, both the drive from step 1 and the loader have the same Port and Target number; only the LUN is different.

❹ Creates a passthrough container (command disk) associated with LDR321 to allow the host direct access to the loader. The passthrough container is called PASS1.

❺ Creates a host-visible unit called D332 that consists of passthrough PASS1.

The host operating system will use *disk* unit 332 to exercise loader functions, and *tape* unit 332 for backups, etc.

4.13.2.2 Host Setup

To communicate with a loader through a command disk, you must have the following available at the host level:

- You must install the OpenVMS operating system JU driver. When you install JU driver, you must assign a JU device to the correct unit number (the unit number established through the CLI when you created the command disk):

```
Beginning installation of JUDRIVER V1.4 at 15:54
   .
   .
   .
For each command disk on your system, enter the DU device designation.
Type CTRL/Z when there are no more command disks.
   .
   .
   .
* Enter the first DU device designation: $6$DUA622❶
* Enter the next DU device or CTRL/Z if done:  Exit
%JUDRIVER-I-DEFINE, defining device JUA0❷
%JUDRIVER-I-LINK, Linking JUDRIVER ...
%JUDRIVER-I-LINK, Linking JUDRIVER_INIT ...
   .
   .
   .
```

❶ In this case, the loader mechanism resides under unit number D622.

❷ The command disk will be linked to JU device ''JUA0.''

- You must have special host-level application software[5] for controlling the particular loader. The application software can vary and is not provided with the HS controller or firmware. Simply stated, the application software will use the JU driver to manage the command disk protocol, controlling the loader in conjunction with the drives served by it.

[5] Your application software and JU driver probably will be packaged together.

Note

If the virtual unit in your configuration has not been linked to a JU device, you will receive the following message when you use your application software to output SCSI commands for the loader:

```
%SYSTEM-W-NOSUCHDEV, no such device available
```

4.13.3 Communicating with a Command Disk

The OpenVMS host's DU driver recognizes command disks as normal disk devices. However, because the true purpose of command disks is to provide a conduit for passing raw SCSI command descriptor blocks (CDBs) through to the underlying loader, communication operates as follows:

1. The host application that is the source of the SCSI commands issues CDBs to the JU driver similar to when communicating with a native SCSI device.
2. The JU driver packages these SCSI commands using the command disk protocol, and queues them through the DU driver to the controller.
3. Controller firmware processes and issues the commands to the loader's SCSI bus, completing the illusion that the host is directly attached to the loader's bus.

4.13.4 Performance

Command disks are most useful for loaders and other low-speed or infrequent uses, and are not optimized for speed. Implementing significant drive data movement through a command disk is not recommended because multiple MSCP operations are necessary for each SCSI command. Large data movement through command disks would require partitioning into smaller transfers because it is undesirable to allocate large buffers for the amount of time typically required by command disk applications.

4.13.5 Maintenance

Because command disks are essentially conduits for host commands, there is no controller-based diagnostic, test, or error notification capability for a command disk. However, the host application should be able to easily test the integrity of the command path with its own echo testing, if necessary.

5
Fault Isolation and Error Analysis

This chapter describes the errors, faults, and significant events that may occur during HS controller initialization and normal operation. It also includes a translation of the events, and in most cases, instructions for responding to specific events.

The error and event descriptions isolate failures to the field replaceable unit (FRU). However, in most cases, additional information for diagnosis beyond the FRU is given. This information will help increase your knowledge of controller functions and assist with your report to repair personnel.

CAUTION

Do not attempt to replace or repair components within FRUs, or equipment damage may result. Use the controller fault indications and error logs to isolate FRU-level failures.

5.1 Special Considerations

Some or all of the following situations may apply when your controller detects a fault:

- **Nonredundant Configurations**

  When a controller (or its cache module, or both) fails in a nonredundant configuration, a short period of system down time is needed to remove the faulty unit and install a replacement. The devices attached to that controller will be offline for the duration of the remove and replace cycle.

- **Dual-Redundant Configurations**

  When a controller fails in a dual-redundant configuration, there is no down time because failover takes place; the surviving controller takes over service to the failed controller's devices. Fault isolation and corrective actions are similar to a nonredundant configuration.

- **Cache Module Failures**

  If a cache module fails, its controller still functions using on-board cache; however, Digital recommends that you replace the cache module as soon as possible.

- **Write-Back Cache Battery Failures**

  When a write-back cache module's batteries fail or are low, the controller alters its operations until the batteries are fully charged:

  – Stripesets and disk-based units with write-back caching enabled are accessed in write-through (read cache) mode.

- HSJ- and HSD-based RAIDsets and mirrorsets fail over to the companion cache in a dual-redundant configuration, provided the other cache's batteries are fully charged. RAIDsets and mirrorsets on HSZ and nonredundant controller systems will not fail over.
- If the CACHE_POLICY on the controller is set to A and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is made inoperative.
- If the CACHE_POLICY on the controller is set to B and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is accessed in write-through (read cache) mode.
- If the batteries go low after the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is made inoperative, regardless of the cache policy.
- If the batteries are bad or missing, RAIDsets and mirrorsets are made inoperative.
- Write-back caching automatically resumes when the cache batteries are fully recharged or replaced.

5.2 Troubleshooting Basics

When an error occurs, use the following steps as top-level guidelines for fault isolation:

1. Make a note of all visual indicators (OCP, device LEDs, EMU, or error messages) available to you.
2. Extract and read host error logs (see Section 5.9).
3. For surviving controllers in dual-redundant pairs, try entering the RESTART OTHER_CONTROLLER command. The surviving controller may be keeping its companion from operating.
4. Errors can be intermittent; reset the controller to see if the error clears.[1]
5. See if the error indication changes after resetting the controller. If the error remains the same, look up information for that error. If the error indication changes, look up information for the newer error.
6. Always consider reseating the controller and/or cache module when troubleshooting. Poor connections between module and backplane can cause a variety of errors.

   See Sections 5.4 through 5.7 for detailed information about errors and repair actions.

NOTE

If the OCP, device LEDs, EMU, or event messages cannot help you determine the cause of a problem, review the host error logs. They provide the greatest level of detail about the controller and connected devices.

[1] Record which devices have lit/flashing fault LEDs before resetting, as resetting the controller may temporarily clear the LED even though the fault remains.

CAUTION

Do not use a controller failure situation as an opportunity to move devices or otherwise reconfigure your subsystem. Doing so will prevent the controller from communicating with its units once the fault is corrected.

5.3 Types of Error Reporting

The controller can notify you of an error through one or more of the following means:

- The OCP
- Device LEDs
- Environmental Monitor Unit (EMU)
- Event messages at a host virtual terminal, or
  event messages at a maintenance terminal (if attached)
- Host error logs

The following sections describe these error reporting mechanisms.

5.4 Operator Control Panel

The operator control panel (OCP) includes the following:

- One reset button with an embedded green LED
- One button per SCSI port (device bus)
- Six amber LEDs[2]

Figure 5–1 shows an example of an OCP (from the HSZ40 controller). The LEDs report normal and fault conditions as discussed in the following sections.

5.4.1 Normal Operation

The green LED reflects the state of the controller and the host interface. Once controller initialization completes and its firmware is functioning, the green button flashes continuously at 1 Hz (once per second). Pressing the green button while the controller is in normal operation resets the controller.

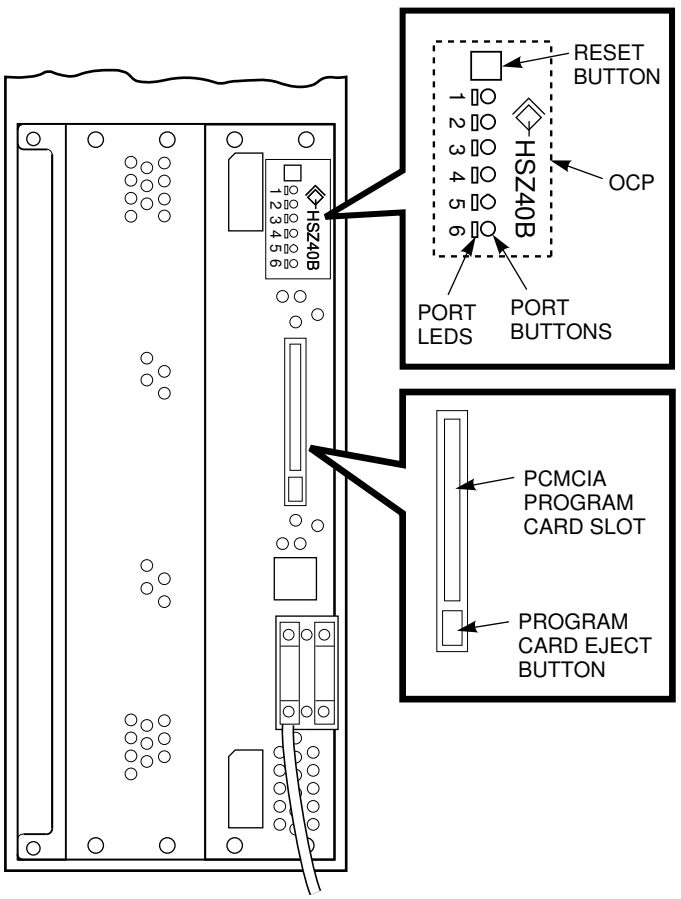
Under normal operation, the amber LEDs indicate the state of the respective SCSI–2 device buses attached to the controller. When the devices on the buses are functioning correctly, the amber LEDs will be off.

Pressing one of the port buttons[3] during normal operation will light its corresponding amber LED and momentarily quiesce its SCSI–2 port. You must quiesce a port to remove or warm swap a device on the SCSI–2 bus for that port. See Chapter 7 for a detailed description of removing and replacing devices.

[2] The HSJ-series controller has the amber LEDs embedded in the port buttons.

[3] Use a small pointed object to press the port buttons on the HSD- and HSZ-series controllers.

Figure 5–1 Operator Control Panel (HSZ-Series)



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5.4.2 Fault Notification

The OCP LEDs display information when the HS controller encounters a problem with a device configuration, a device, or the controller itself.

The amber LED for a device bus lights continuously when the controller detects a configuration mismatch, or when a device fault occurs.

The green reset LED lights continuously and the amber LEDs display a code when a controller problem occurs. Internal diagnostics and the operating firmware identify the problem and display the error codes in two different ways:

- The error code lights continuously for faults detected by internal diagnostic and initialization routines. See Figure 5–2 to determine what these codes mean.
- The error code flashes at 3 Hz for faults that occur during core diagnostics (MIST). See Figure 5–3 to determine what these codes mean.

Note

If the controller finds errors during initialization or self-test diagnostics, any flashing OCP codes momentarily stop flashing while the error messages are posted to the console. Normal flashing resumes once the

display completes. Do not attempt to look up OCP codes while this information is printing at the terminal.

Figure 5–2 Solid OCP Codes

Reset	1	2	3	4	5	6		Description of Error	Action
■	■	■	■	■	■	■	3F	DAEMON hard error.	Replace controller module.
■	■	■	■	■	■	□	3E	Repeated firmware bugcheck.	Replace controller module.
■	■	■	■	■	□	■	3D	NVMEM version mismatch.	Replace program card with later version.
■	■	■	■	■	□	□	3C	NVMEM write error.	Replace controller module.
■	■	■	■	□	■	■	3B	NVMEM read error.	Replace controller module.
■	■	■	■	□	■	□	3A	NMI error within firmware bugcheck.	RESET (//) the controller.
■	■	■	■	□	□	■	39	Inconsistent NVMEM structures repaired.[1]	RESET (//) the controller.
■	■	■	■	□	□	□	38	Bugcheck with no restart.	RESET (//) the controller.
■	■	■	□	■	■	■	37	Firmware induced restart following bugcheck failed to occur.	Replace controller module.
■	■	■	□	■	■	□	36	Hardware induced restart following bugcheck failed to occur.	Replace controller module.
■	■	■	□	■	□	■	35	Bugcheck within bugcheck controller.	RESET (//) the controller.
■	■	■	□	■	□	□	34	Mismatched controllers; cannot set failover.	Install same-model controllers.
■	□	□	□	□	□	□	00	No program card seen.[2]	Replace controller module.

□ Off ■ Lit continuously

DAEMON = Diagnostic and Execution Monitor
NVMEM = Nonvolatile Memory
NMI = Nonmaskable Interrupt

[1] A power failure or controller reset during an NVMEM update causes this error. If the error occurs on one controller in a dual-redundant configuration, a configuration mismatch will probably occur upon restart.
[2] Try the card in another module. If the problem moves with the card, replace the card. If the problem does not move with the card, replace the controller module.

Figure 5–3 Flashing OCP Codes

Reset	1	2	3	4	5	6		Description of Error	Action
■	□	□	□	□	□	◪	01	Program card EDC error.	Replace program card.
■	□	□	□	◪	□	□	04	Timer zero in the timer chip will run when disabled.	Replace controller module.
■	□	□	□	◪	□	◪	05	Timer zero in the timer chip decrements incorrectly.	Replace controller module.
■	□	□	□	◪	◪	□	06	Timer zero in the timer chip did not interrupt the processor when requested.	Replace controller module.
■	□	□	□	◪	◪	◪	07	Timer one in the timer chip decrements incorrectly.	Replace controller module.
■	□	□	◪	□	□	□	08	Timer one in the timer chip did not interrupt the processor when requested.	Replace controller module.
■	□	□	◪	□	□	◪	09	Timer two in the timer chip decrements incorrectly.	Replace controller module.
■	□	□	◪	□	◪	□	0A	Timer two in the timer chip did not interrupt the processor when requested.	Replace controller module.
■	□	□	◪	□	◪	◪	0B	Memory failure in the I/D cache.	Replace controller module.
■	□	□	◪	◪	□	□	0C	No hit or miss to the I/D cache when expected.	Replace controller module.
■	□	□	◪	◪	□	◪	0D	One or more bits in the diagnostic registers did not match the expected reset value.	Replace controller module.
■	□	□	◪	◪	◪	□	0E	Memory error in the nonvolatile journal SRAM.	Replace controller module.
■	□	□	◪	◪	◪	◪	0F	Wrong image seen on program card.	Replace program card.
■	□	◪	□	□	□	□	10	At least one register in the controller DRAB does not read as written.	Replace controller module.
■	□	◪	□	□	□	◪	11	Main memory is fragmented into too many sections for the number of entries in the good memory list.	Replace controller module.
■	□	◪	□	□	◪	□	12	The controller DRAB chip does not arbitrate correctly.	Replace controller module.

□ Off ■ Lit continuously ◪ Flashing

I/D = Instruction/Data (cache on the controller module)
DRAB = Dynamic RAM Controller and Arbitration Engine (operates controller shared memory)
ECC = Error Correction Code
EDC = Error Detection Code
SRAM = Static RAM
NXM = Nonexistent Memory

(continued on next page)

Figure 5–3 (Cont.) Flashing OCP Codes

Reset	1	2	3	4	5	6		Description of Error	Action
■	□	◪	□	□	◪	◪	13	The controller DRAB chip failed to detect forced parity, or detected parity when not forced.	Replace controller module.
■	□	◪	□	◪	□	□	14	The controller DRAB chip failed to verify the EDC correctly.	Replace controller module.
■	□	◪	□	◪	□	◪	15	The controller DRAB chip failed to report forced ECC.	Replace controller module.
■	□	◪	□	◪	◪	□	16	The controller DRAB chip failed some operation in the reporting, validating, and testing of the multibit ECC memory error.	Replace controller module.
■	□	◪	□	◪	◪	◪	17	The controller DRAB chip failed some operation in the reporting, validating, and testing of the multiple single-bit ECC memory error.	Replace controller module.
■	□	◪	◪	□	□	□	18	The controller main memory did not write correctly in one or more sized memory transfers.	Replace controller module.
■	□	◪	◪	□	□	◪	19	The controller did not cause an I-to-N bus timeout when accessing a “reset” host port chip.	Replace controller module.
■	□	◪	◪	□	◪	□	1A	The controller DRAB chip did not report an I-to-N bus timeout when accessing a “reset” host port chip.	Replace controller module.
■	□	◪	◪	□	◪	◪	1B	The controller DRAB did not interrupt the controller processor when expected.	Replace controller module.
■	□	◪	◪	◪	□	□	1C	The controller DRAB did not report an NXM error when nonexistent memory was accessed.	Replace controller module.
■	□	◪	◪	◪	□	◪	1D	The controller DRAB did not report an address parity error when one was forced.	Replace controller module.
■	□	◪	◪	◪	◪	□	1E	There was an unexpected nonmaskable interrupt from the controller DRAB during the DRAB memory test.	Replace controller module.
■	□	◪	◪	◪	◪	◪	1F	Diagnostic register indicates there is no cache module, but an interrupt exists from the nonexistent cache module.	Replace controller shelf backplane.
■	◪	□	□	□	□	□	20	The required amount of memory available for the code image to be loaded from the program card is insufficient.	Replace controller module.

□ Off ■ Lit continuously ◪ Flashing

I/D = Instruction/Data (cache on the controller module)
DRAB = Dynamic RAM Controller and Arbitration Engine (operates controller shared memory)
ECC = Error Correction Code
EDC = Error Detection Code
SRAM = Static RAM
NXM = Nonexistent Memory

(continued on next page)

Figure 5–3 (Cont.) Flashing OCP Codes

Reset	1	2	3	4	5	6		Description of Error	Action
■	◪	□	□	□	□	◪	21	The required amount of memory available in the pool area is insufficient for the controller to run.	Replace controller module.
■	◪	□	□	□	◪	◪	23	The required amount of memory available in the buffer area is insufficient for the controller to run.	Replace controller module.
■	◪	□	□	◪	□	□	24	The code image was not the same as the image on the card after the contents were copied to memory.	Replace ontroller module.
■	◪	□	□	◪	□	◪	25	Diagnostic register indicates that the cache module exists, but access to that cache module caused an error.	Replace controller shelf backplane.
■	◪	□	□	◪	◪	□	26	Diagnostic register indicates that the cache module does not exist, but access to that cache module did not cause an error	Replace controller shelf backplane.
■	◪	◪	□	□	□	□	30	The journal SRAM battery is bad.	Replace controller module.
■	◪	◪	◪	□	◪	□	3A	There was an unexpected interrrupt from a read cache or the present and lock bits are not working correctly.	Replace controller module.
■	◪	◪	◪	□	◪	◪	3B	There is an interrupt pending to the controller's policy processor when there should be none.	Replace controller module.
■	◪	◪	◪	◪	□	□	3C	There was an unexpected fault during initialization.	Replace controller module.
■	◪	◪	◪	◪	□	◪	3D	There was an unexpected maskable interrupt received during initialization.	Replace controller module.
■	◪	◪	◪	◪	◪	□	3E	There was an unexpected nonmaskable interrupt received during initialization.	Replace controller module.
■	◪	◪	◪	◪	◪	◪	3F	An illegal process was activated during initialization.	Replace controller module.

□ Off ■ Lit continuously ◪ Flashing

I/D = Instruction/Data (cache on the controller module)
DRAB = Dynamic RAM Controller and Arbitration Engine (operates controller shared memory)
ECC = Error Correction Code
EDC = Error Detection Code
SRAM = Static RAM
NXM = Nonexistent Memory

5.5 Device LEDs

The storage devices (SBBs) and their power supplies have LEDs to indicate power and status. You can use these LEDs in conjuction with the OCP indicators to isolate certain faults, as discussed in the following sections.

5.5.1 Storage SBB Status

As shown in Figures 5–4 and 5–5, each storage SBB has two LED indicators that display the SBB's status. These LEDs have three states: on, off, and flashing.

- The upper LED (green) is the device activity LED and is on or flashing when the SBB is active.

CAUTION

Do not remove a storage SBB when the upper LED is on or flashing. This can cause the loss or corruption of data.

- The lower LED (amber) is the fault LED and indicates an error condition when it is either on or flashing. When this LED indicates a fault, the amber LED on the controller for the device's port will be lit continuously as well.

Figure 5–4 3½-Inch Storage SBB LEDs

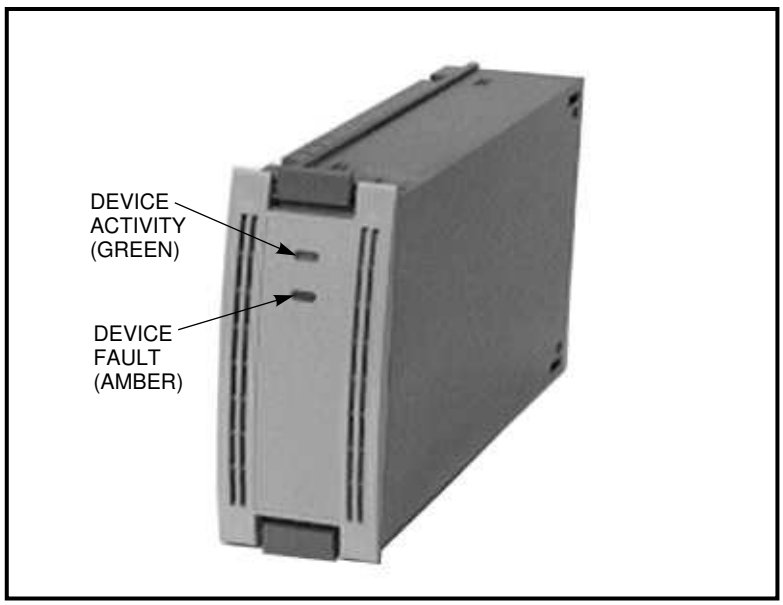

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Figure 5–5 5¼-Inch Storage SBB LEDs

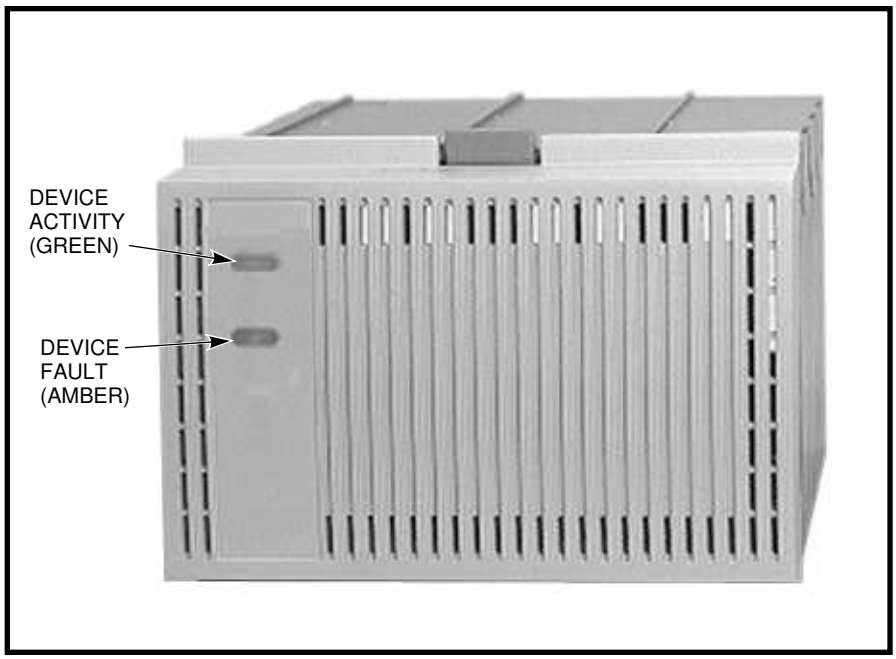

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Table 5–1 explains the SBB LED codes.

Table 5–1 Storage SBB Status LEDs

LED	Status	Indication
Device activity Device fault	On Off	SBB is operating normally.
Device activity Device fault	Flashing Off	SBB is operating normally.
Device activity Device fault	Off Off	SBB is operating normally. The SBB is inactive, and there is no fault.
Device activity Device fault	On On	Fault status. SBB is probably not responding to control signals. Digital recommends that you replace the SBB.
Device activity Device fault	Off On	Fault status. SBB is inactive and spun down. Digital recommends that you replace the SBB.
Device activity Device fault	On Flashing	Fault status. SBB is active and is spinning down because of the fault.

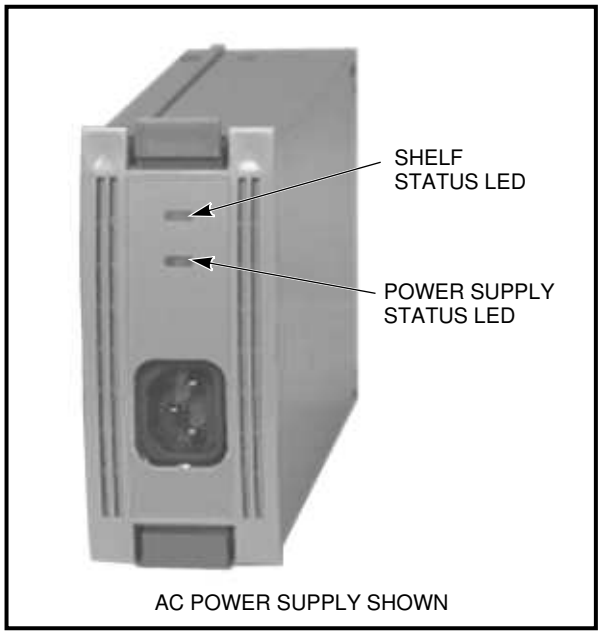
5.5.2 Device Shelf Status and Power Supply Status

The status of both the device shelf blowers and power supplies is displayed on the power supply LEDs, as shown in Figure 5–6. The upper LED displays the shelf status and the lower LED displays the power supply status.

Note

When a shelf has two power supplies, you must observe the LEDs on *both* power supplies to determine the status (see Table 5–3).

Figure 5–6 Power Supply LEDs



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Tables 5–2 and 5–3 explain the power supply LED codes.

Table 5–2 Shelf and Single Power Supply Status LEDs

Status LED	State	Indication
Shelf (upper) PS (lower)	On On	System is operating normally.
Shelf (upper) PS (lower)	Off On	Fault status. There is a shelf fault; there is no power supply fault. Replace blower as described in Chapter 7.
Shelf (upper) PS (lower)	Off Off	Fault status. Shelf and power supply fault. Replace power supply as described in Chapter 7.

Table 5–3 Shelf and Dual Power Supply Status LEDs

Status LED	PS1†	PS2‡	Indication
Shelf (upper) PS (lower)	On On	On On	Normal status. System is operating normally.
Shelf (upper) PS (lower)	Off On	Off On	Fault status. There is a shelf fault; there is no power supply fault. Replace blower as described in Chapter 7.
Shelf (upper) PS (lower)	Off On	Off Off	Fault status. PS1 is operational. Replace PS2 as described in Chapter 7.
Shelf (upper) PS (lower)	Off Off	Off On	Fault status. PS2 is operational. Replace PS1 as described in Chapter 7.
Shelf (upper) PS (lower)	Off Off	Off Off	Fault status. Possible PS1 and PS2 fault or input power problem.

† Shelf power supply installed in slot 7.

‡ Redundant power supply installed in slot 6.

5.6 Environmental Monitor Unit—SW300 Cabinets

The environmental monitor unit (**EMU**) provides increased protection against catastrophic subsystem faults in SW300 cabinet shelves. The EMU works with the HSZ40-B*x* controller to warn of various existing or impending cabinet–level failures. The controller responds to such conditions by displaying console event messages, and by controlling warning LEDs on the EMU and devices.

Note

Only the HSZ40-B*x* controller fully supports the EMU by activating LED status indicators and sending event messages to the console.

The EMU performs the following specific functions (SW300 cabinet shelves only):

- Monitors and controls the shelf blowers
- Monitors the condition of each power supply
- Senses shelf/cabinet temperature

5.6.1 Fault Notification

When the EMU detects a fault condition, it performs the following:

- Turns on the appropriate LED on the EMU panel
- Turns on the fault (amber) LED on the upper right corner of the cabinet
- Activates an audible alarm

Figure 5–7 shows the EMU front panel LEDs, which display information when the subsystem is turned on or encounters a problem. Table 5–4 lists the EMU control panel buttons and LEDs, their functions, and error descriptions. See the *StorageWorks Solutions SW300-Series RAID Enclosure Installation and User's Guide* for more information on the EMU.

Figure 5–7 EMU Control Panel LEDs and Switches

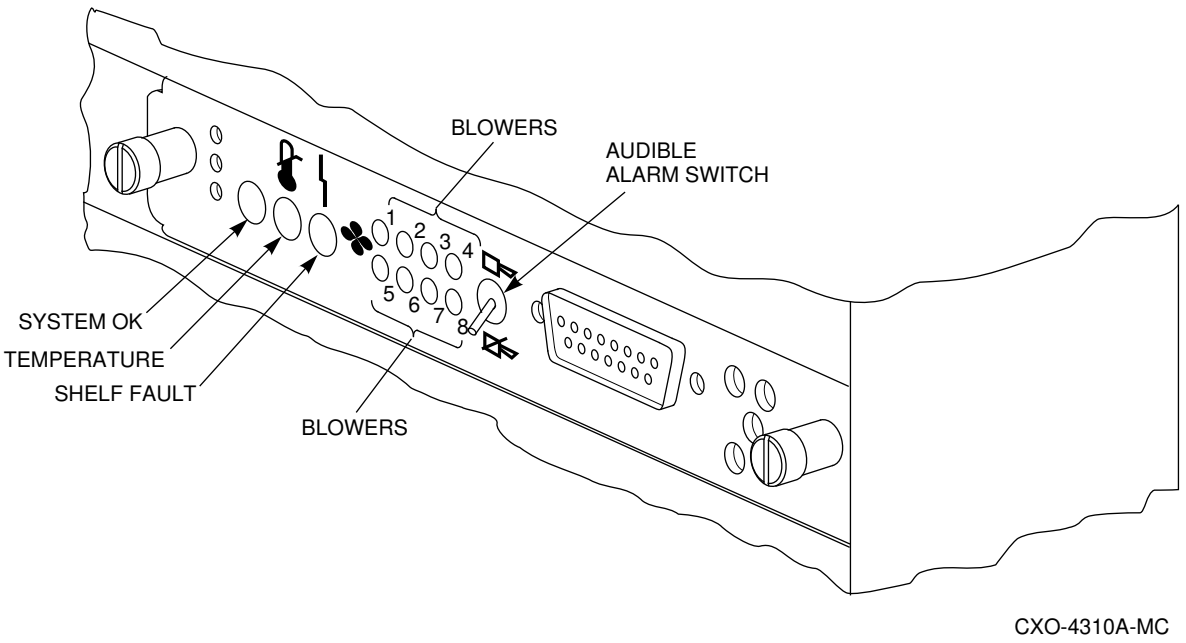


Table 5–4 EMU Control Panel LEDs/Switches and Error Descriptions

When the ...	Is	The subsystem ...
System OK (green) LED Shelf fault (amber) LED Blower 1 through 8 (amber) LEDs Temperature (amber) LED Audible alarm	ON OFF OFF OFF OFF	Is in the normal operating state.
Audible alarm	ON	Has a failed FRU. Check the EMU control panel LEDs to determine which FRU has failed.
System OK (green) LED	OFF	Has a failed FRU and one or more of the following error conditions exist: • The temperature is above the maximum safe operating level. • The +12 V dc power supply output is out of regulation. • The +5 V dc power supply output is out of regulation. • Fewer than four power supply SBBs are operational. • One controller may be defective. Check for any event messages on the terminal (if one is attached).
Blower *x* LED	ON	Has an individual blower *x* failure.
Blower 1, 2, 3, *and* 4 (amber) LEDs	ON	Has one of these four blowers either not installed or not connected.
Blower 5, 6, 7, *and* 8 (amber) LEDs	ON	Has one of these four blowers either not installed or not connected.
Temperature (amber) LED	ON	Operating temperature is too high. The blowers will operate at high speed to reduce the temperature.
Shelf fault (amber) LED	ON	Has one or more of the following faults: • A power supply SBB has failed (verify if any individual power supply SBB LEDs are off to confirm). • With HSZ40-B*x* controllers installed, this LED being lit can indicate a storage device SBB or one of the controllers has failed. Refer to Section 5.4 for additional information on status LEDs on the controller OCP. • Fewer than four power supply SBBs are operational.

5.6.2 HSZ40-B*x* Fault Notification

The HSZ40-B*x* controller is similar to the earlier HSZ40, except for its ability to interact with the EMU and its code loading capability. (See Chapter 6 for information on code loading.)

If the HSZ40-B*x* controller detects a storage device failure or a fault in the other controller in a dual-redundant configuration, it uses a controller fault drive signal to illuminate the fault (amber) LED on the EMU. When a special ''controller alive'' signal from either controller indicates to the EMU that a controller is not functioning, the EMU:

- turns off its System OK (green) LED
- turns on its fault (amber) LED
- activates an audible alarm

The HSZ40-B*x* controller will generate an error message on the terminal when it detects one of the following fault conditions:

- a power supply SBB has failed
- a blower has failed or is either not installed or not connected
- the operating temperature is too high

5.7 Event Messages

The HS operating firmware is designed to send both spontaneous and stored messages to your terminal session under certain fault conditions.

Spontaneous messages are part of a CLI error report (CER) system. The CER system causes the message text to appear on a maintenance terminal along with the CLI prompt, as shown in the following example. (Spontaneous messages do not appear on virtual terminals.)

```
%CER -- 13-JUL-1994 13:28:45 -- SWAP signal cleared - all SWAP interrupts reenabled

CLI>

%CER -- 13-JUL-1994 13:29:11 -- Other controller restarted

CLI>
```

The spontaneous CER messages appear only under the following conditions:

- You have a maintenance terminal connected for receiving messages.
- The subsystem has finished initializing.
- You are not currently running a utility program on the maintenance terminal.
- The maintenance terminal is not actively displaying input from another source, such as event logging or last failure logging.
- No CLI commands are in progress on a maintenance terminal.

If any one of the previous conditions are not met, the spontaneous CER message display will not occur. In this case, the HS operating firmware stores the messages. It displays the 15 most recent event messages when a virtual or maintenance terminal is connected and the Return key pressed.

```
SWAP signal cleared - all SWAP interrupts reenabled
Other controller restarted

CLI>
```

Often, error message review will continue to occur each time Return is pressed. To clear the terminal of the errors, enter the CLEAR_ERRORS CLI command. (You may want to make a note of the errors before clearing them, because you cannot recall them afterwards.)

Note

Because the severity of errors varies, the controller may or may not initialize or operate, or both, even though an error message appears.

For example, if the cache module fails during normal operation, the controller will continue to operate. However, if all of the SCSI ports, or the host port and local terminal port fail diagnostics, the controller will not operate.

The following section lists CER messages you may encounter. The controller sends these messages when the specific fault is detected, regardless of whether or not you are interactively viewing or using the virtual or maintenance terminal. These messages differ in this respect from the ones listed in Appendix B, which appear based on your interactive use of the CLI. The CER messages are

presented in alphabetic order to make them easy to locate, but they cover the following error categories:

- Configuration and CLI
- Last Failure Entry
- System Information Structure and System Information Page
- Diagnostic and intialization
- Failover
- NVPM
- Read cache
- Shelf
- Write-back cache
- Interactive CLI messages

Be aware that not all the event messages listed in this section will pertain to your model of controller. Some messages are specific to the HSJ-, HSD-, or HSZ-series controllers.

Consult your firmware release notes for updates to the list of event messages.

All NVPM components initialized to their default settings

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

Both HS*xxx* controllers are using SCSI address 6

Explanation: There is a hardware problem with the BA350–MA shelf. This problem probably involves the shelf backplane.

Both HS*xxx* controllers are using SCSI address 7

Explanation: There is a hardware problem with the BA350–MA shelf. This problem probably involves the shelf backplane.

Cache battery charge is low

Explanation: The write-back cache battery is partially discharged. Any unwritten cache data on the cache is flushed. Non-RAIDset units will be accessed in read cache mode. RAIDsets will be unavailable unless they have access to good batteries on a dual-redundant companion cache. Replace the cache battery.

Cache battery failed diagnostic testing

Explanation: The write-back cache battery has failed the diagnostic tests described in Chapter 6. Any unwritten cache data on the cache is flushed. Non-RAIDset units will be accessed in read cache mode. RAIDsets will be unavailable unless they have access to good batteries on a dual-redundant companion cache. Replace the cache battery.

Cache module failed diagnostic testing - half not accessible

Explanation: This message can appear for either read cache or write-back cache. Up to 50 percent of the cache memory has failed the diagnostic tests described in Chapter 6. If the controller has a write-back cache, unwritten data in the cache module is lost. Replace the cache module.

Cache module failed diagnostic testing

Explanation: This message can appear for either read cache or write-back cache. The cache has failed the diagnostic tests described in Chapter 6. If the controller has a write-back cache, unwritten data in the cache module is lost. Replace the cache module.

Cache module has metadata incompatible with this firmware

Explanation: The subsystem was not properly run down before changing firmware versions. There may be unwritten cache data which cannot be recovered, because the cache metadata format has changed along with the firmware. Correct the problem in one of two ways:

- Restore the previous firmware version, and properly run down the subsystem.
- Enter the CLI command CLEAR_ERRORS INVALID_CACHE, which allows you to use the cache module (although you will lose the unwritten cache data).

Cache modules are misconfigured

Explanation: This message will be generated in dual-redundant configurations under the following circumstances:

- The companion controller's cache module is not a write-back cache.
- The companion controller's write-back cache is not the same size as this controller's write-back cache.

Cache failover of unwritten cache data will not be performed if this message occurs. Correct the problem by replacing/adding cache to make sure both are compatible.

CI Path *x* has FAILED external loopback Diagnostics

Explanation: The CI path named by *x* has failed the loop-back diagnostics. *x* can be A or B. See Chapter 6 for more information on diagnostics.

Configuration information deleted due to internal inconsistencies

Explanation: This message is displayed if a test of nonvolatile memory shows corruption. The configuration information for the controller is deleted when this message is displayed.

Controller Characteristics component reformat failed during NVPM Revision Level 1 to 2 reformat

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

Controllers misconfigured. Type SHOW THIS_CONTROLLER

Explanation: If this message appears, examine the SHOW THIS_CONTROLLER display to determine the source of the misconfiguration.

Controller shelf fixed

Explanation: The controller shelf has been correctly repaired.

Controller shelf has a bad power supply or fan

Explanation: Troubleshoot the system to isolate and replace the failed component.

Device and/or Storageset names changed to avoid conflicts

Explanation: Digital adds new CLI keywords at each new HS operating firmware release that can conflict with existing device and/or storageset names. When this happens, HS operating firmware changes your device and/or storageset names and sends this message. The functional operation of your configuration is not changed when this message appears.

Disk mirroring option has been turned on without a valid license key

Explanation: Disk mirroring is a licensed feature. This message indicates that it has been turned on without entering a valid license key in the Firmware Licensing System (FLU).

EVL control block allocation failed

Explanation: The controller was unable to allocate enough memory to run the EVL utility. Report this error as a subsystem problem.

FMU control block allocation failed

Explanation: The controller was unable to allocate enough memory to run the FMU utility. Report this error as a subsystem problem.

Host Access Disabled

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

HOST port FAILED Diagnostics

Explanation: The host port of the controller has failed diagnostics. See Chapter 6 for more information on diagnostics.

Invalid cache—CLI command set reduced until INVALID_CACHE error is cleared

Explanation: Data in the cache does not match the controller image of cache data. Use the CLEAR_ERRORS INVALIDC_CACHE command to delete the cache data.

Last Failure Entry: *n* reset—power-on time reset

Explanation: The power-on time contained in the Last Failure Entry identified by *n*was greater than the current power on time. That condition renders the identified Last Failure Entry unusable, resulting in its being reset to default settings. Reset of Last Failure Entry should be reported as a subsystem problem.

Last Failure Entry: *n* reset—predecessor invalid

Explanation: The Last Failure Entry that immediately precedes the Last Failure Entry identified by *n* was found to be invalid. That condition renders the identified Last Failure Entry unusable, resulting in its being reset to default settings. Reset of Last Failure Entry should be reported as a subsystem problem.

Last Failure Entry: *n* reset—predecessor reset

Explanation: One or more of the Last Failure Entries that immediately precede the Last Failure Entry identified by *n* was reset to default settings. That condition renders the identified Last Failure Entry unusable, resulting in its being reset to default settings. Reset of Last Failure Entry should be reported as a subsystem problem.

Last Failure Entry: *n* reset—previously invalidated

Explanation: During termination of controller operation processing, the Last Failure Entry identified by *n* was reset to default settings for one or more of the reasons listed above. In this case, the reason for resetting the entry is not retained. Reset of Last Failure Entry should be reported as a subsystem problem.

Last Failure Entry: *n* reset—revision mismatch

Explanation: The revision level contained in the Last Failure Entry identified by *n* did not match the revision level understood by the current HSOF firmware. The identified Last Failure Entry is therefore not translatable and was reset to default settings. Reset of Last Failure Entry should be reported as a subsystem problem.

Licensing different between the two controllers

Explanation: The licensing features are set differently on two controllers of a dual-redundant pair.

Local Terminal Port FAILED Diagnostics

Explanation: The maintenance (EIA–423) terminal port has failed diagnostics. See Chapter 6 for more information on diagnostics.

Nonvolatile parameter/Write Journal Memory backup battery has failed.

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

NVPM *component-name* component initialized to default settings

Explanation: The NVPM component named by *component-name* has been reinitialized. Performing a controller reset may only clear this error message until the next time the controller is reset because the error could be caused by a fault in NVPM itself. If this error persists, replace the controller module.

NVPM cache information component initialized to default settings

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

NVPM Controller Characteristics component initialized to default settings

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

NVPM Failover Information component initialized to default settings

Explanation: The identity of the other controller in a dual-redundant pair has been lost. Enter the SET FAILOVER COPY=OTHER_CONTROLLER command to correct this problem. If the error persists, replace the controller module.

NVPM FMU Parameters component initialized to default settings

Explanation: FMU settings have been lost. Default FMU options will be in place until you run FMU to change them. If the error persists, replace the controller module.

NVPM Host Interconnect Parameters component initialized to default settings

Explanation: The SCS node name, CI node number, or Path A, or Path B enable settings for this controller have been lost.

To correct this problem, enter the SHOW THIS_CONTROLLER and SHOW OTHER_CONTROLLER commands to determine the current controller settings. Use the SET THIS_CONTROLLER and SET OTHER_CONTROLLER commands to restore settings. If the error persists, replace the controller module.

NVPM Host Protocol Parameters component initialized to default settings

Explanation: The tape and disk MSCP allocation class settings for this controller have been lost.

To correct this problem, enter the SHOW THIS_CONTROLLER and SHOW OTHER_CONTROLLER commands to determine the current controller settings. Use the SET THIS_CONTROLLER and SET OTHER_CONTROLLER commands to restore settings. If the error persists, replace the controller module.

NVPM Product Information component initialized to default settings

Explanation: The controller product identification setting has been reset. If the controller ''name'' is not what it used to be (for example, ''HSJ40'') replace the controller module immediately.

NVPM Recursive Bugcheck Information component initialized to default settings

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

NVPM Revision level updated from *n* to *N*

Explanation: The format of the NVPM has changed as a result of installing a newer program card (containing updated firmware). However, all subsystem configuration information has been retained.

NVPM System Information Page component initialized to default settings

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

NVPM User Interface Parameters component initialized to default settings

Explanation: Terminal setting information has been lost.

To correct this problem, enter the SHOW THIS_CONTROLLER and SHOW OTHER_CONTROLLER commands to determine the current terminal settings. Compare the terminal settings with the CONFIGURATION.INFO output information, and use the SET THIS_CONTROLLER and SET OTHER_CONTROLLER commands to restore terminal settings. If the error persists, replace the controller module.

NVPM Volume Serial Number component initialized to default settings

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

Other controller not responding - RESET signal asserted

Explanation: One controller in a dual-redundant configuration is locked up, not responding, or the kill line to it is asserted.

Other controller restarted

Explanation: The other controller in a dual-redundant pair has successfully restarted after failing or undergoing a bugcheck. See Section 5.9 for more information on this message.

PCMCIA ECC invoked successfully. Replacement of PCMCIA card is recommended.

Explanation: During controller initialization, the error correction code (ECC) detected and corrected an error in the firmware on the program card. The errors indicate that the card is becoming unreliable and should be replaced as soon as possible.

RAID5 option has been turned on without a valid license key

Explanation: RAID5 is a licensed feature. This message indicates that it has been turned on without entering a valid license key in the Firmware Licensing System (FLU).

Received LAST GASP message from other controller

Explanation: One controller in a dual-redundant configuration is attempting an automatic restart after failing or undergoing a bugcheck. See Section 5.9 for more information on this message.

Restart of the other controller required

Explanation: When changing some parameters, you must reinitialize the companion controller in a dual-redundant pair to have the parameter take effect.

Restart of the controller required to apply new patch

Explanation: You used the Code Patch utility to enter a firmware patch, but the patch will not be applied until you restart the controller.

Restart of this controller required

Explanation: A changed parameter requires reinitialization of this controller to take effect.

SCSI Device and HS*xxx* controller both configured at SCSI address 6

Explanation: This message appears when a device is accidentally configured as SCSI ID 6, and two controllers (SCSI IDs 6 and 7) are in a dual-redundant configuration.

SCSI port *n* FAILED Diagnostics

Explanation: A SCSI–2 port has failed diagnostics. This message can appear even if you do not have a host connection. The variable *n* indicates which port failed. See Chapter 6 for more information on diagnostics.

Serial number initialized due to format error

Explanation: An invalid serial number was entered for the second controller of a dual-redundant pair.

Shelf *xx* fixed

Explanation: Shelf number *xx* has been correctly repaired.

Shelf *xx* has a bad power supply or fan

Explanation: Troubleshoot the system to isolate and replace the failed component.

SWAP signal cleared - all SWAP interrupts re-enabled

Explanation: This message indicates that the swap signal is now cleared.

System Information Page and Last Failure entries reset to default settings.

Explanation: This message is reported in either of two cases:

- All structures contained in the SIP and the Last Failure entries have been reset to their default settings. This is a normal occurrence for the first time boot following manufacture of the controller module and during the transition from one firmware version to another if, and only if, the format of the SIP is different between the two versions.
- All structures contained in the SIP and the Last Failure entries have been reset to their default settings as the result of certain manufacturing configuration activities.

Report this CER message as a subsystem problem.

System Information structure reset to default settings

Explanation: The System Information structure within the SIP has been reset to default settings. The only known cause for this event is an I960 processor hang caused by an unimplemented memory region reference. Controller modules equipped with a watchdog timer will reboot within a few seconds. Controller modules without a watchdog timer will hang, as indicated by the OCP LEDs, and must be reset.

Report this CER message as a subsystem problem.

Taken out of failover due to serial number format error

Explanation: An invalid serial number format was entered for the second controller of a dual-redundant pair.

The following Firmware Licensing Service component elements were initialized to default settings: [*n* ...

Explanation: Licensing information for licensed features has been lost. To correct this problem, reenter your license keys through FLS.

The following NVPM Configuration Information component elements were initialized to default settings: [*n* ...

Explanation: The settings given by *n* have been initialized in connection with another NVPM error. To clear this error, perform the following procedure:

1. Enter the following commands:

```
CLI> SHOW DEVICES
CLI> SHOW UNITS
CLI> SHOW STORAGESETS
```

2. Compare the information displayed with a printout of the CONFIGURATION.INFO file or with a copy of the most current configuration.

3. Reconfigure the necessary devices, units, or storagesets. (See the CLI commands described in Appendix B.)

If the error persists, replace the controller module.

The following NVPM Manufacturing Failure Information component elements were initialized to default settings: *list of component elements*

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

This controller has a missing cache module

Explanation: The cache module is missing or is not seated properly. (Controller NVMEM indicates that a cache module is expected because there may be unwritten cache data.) You can either find/reseat the module, or enter the CLI command CLEAR_ERRORS INVALID_CACHE, which will allow you to run (in write-through mode) without a cache but without accessing RAIDsets.

This controller has an invalid cache module

Explanation: The wrong cache module is present. This means the serial number stored in controller NVMEM and in the cache do not match, and unwritten cache data exists. (This message also can occur for a new, uninitialized module.) Correct the problem in one of two ways:

- Replace this cache with the correct one for this controller.
- Enter the CLI command CLEAR_ERRORS INVALID_CACHE, which allows you to use the random module.

Unable to clear SWAP signal on shelf *xx* - all SWAP interrupts disabled

Explanation: The subsystem is unable to clear the swap signal for a swapped device, where *xx* is the shelf number. This could indicate an unsupported SBB or no power to the device shelf.

Unknown NVPM Revision Level

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

Unknown reformat stage encountered during NVPM Revision Level 1 to 2 reformat

Explanation: Replace the controller immediately if this NVPM message occurs. Do not continue to use the controller.

Write-back cache option has been turned on without a valid license key

Explanation: Write-back cache is a licensed feature. This message indicates that it has been turned on without entering a valid license key in the Firmware Licensing System (FLU).

5.7.1 Interactive CLI Messages

The previous sections detailed automatic messages you may encounter. For a list of other messages you may see during interactive use of the CLI, see Appendix B.

5.8 Other Spontaneous Messages

In addition to CER messages, Last Failure Logging and Event Logging messages may appear spontaneously on a terminal connected to a controller.

5.8.1 Last Failure Logging Messages

Last Failure Logging is enabled by default on all controllers. If you do not disable it via the Fault Management Utility (FMU), you may see maintenance terminal messages that begin with ‘‘%LFL,’’ as in the following example (maintenance terminal only):

```
%LFL--HSJ307> --24-AUG-1994 14:47:11-- Last Failure Code: 018B2580
 Power On Time: 0. Years, 22. Days, 5. Hours, 22. Minutes, 24. Seconds
 Controller Model: HSJ40
 Serial Number: ZG30355555 Hardware Version: 0000(00)
 Controller Identifier:
  Unique Device Number: 000130355555 Model: 40.(28) Class: 1.(01)
 Firmware Version: V25J(25)
 Node Name: "HSJ307" CI Node Number: 7.(07)
 Instance Code: 01010302 Description:
  An unrecoverable hardware detected fault occurred.
 Reporting Component: 1.(01) Description:
  Executive Services
    .
    .
    .
```

Note that values in parentheses are hexadecimal values.

In cases when an automatic hardware reset occurs (such as power failure, pressing the reset button, and so on) the last failure log display is inhibited, because automatic reset does not allow sufficient time to complete the display.

See Chapter 6 for more information on the FMU and last failure logging.

5.8.2 Event Logging Messages

Event Logging is enabled by default on all controllers. If you do not disable it via the Fault Management Utility (FMU), you may see maintenance terminal messages that begin with ‘‘%EVL,’’ as in the following example:

```
%EVL--HSJ307> --24-AUG-1994 14:57:36-- Instance Code: 4007640A
 Template: 50.(32) Description: CI Port/Port Driver Event
 Occurred on 24-AUG-1994 at 14:57:36
 Controller Model: HSJ40
 Serial Number: ZG30355555 Hardware Version: 0000(00)
 Controller Identifier:
  Unique Device Number: 000130355555 Model: 40.(28) Class: 1.(01)
 Firmware Version: E28J(FE)
 Node Name: "HSJ307" CI Node Number: 7.(07)
 Command Reference Number: 00000000 Sequence Number: 0000000B
 HIS Status: 000E0009 Description:
  VC closed due to NAK DDL retry transmit failure on Path B.
 Error ID: 200A5A40
 Source Node Number: 7.(07) Destination Node Number: 27.(1B)
 CI Opcode: 0.(00) Description: Reserved
 Virtual Circuit State: 133.(85) Description: VC_CLOSING, ID polling completed
 CI Port/Port Driver (PPD) Opcode: 0.(0000) Description: START
 Instance Code: 4007640A Description:
  CI Port detected error upon attempting to transmit a packet. This resulted
  in the closure of the Virtual Circuit.
 Reporting Component: 64.(40) Description:
  Host Interconnect Services
    .
    .
    .
```

Note that values in parentheses are hexadecimal values. In cases where SCSI sense data is displayed, multi-byte fields are displayed in big-endian form consistant with SCSI specifications.

Event log displays are inhibited during the execution of both CLI commands and utilities invoked from a maintenance terminal. Events that are reported while a maintenance terminal is in use will not appear when the terminal again becomes available. (The %EVL display will be lost.)

See Chapter 6 for more information on the FMU and event logging.

5.9 Host Error Logs

Events related to controller and device operation are recorded in the host error log. If the OCP, device LEDs, EMU, or event messages cannot help you determine the cause of a problem, review the host error logs. They provide the greatest level of detail about the controller and connected devices.

5.9.1 Translation Utilities

Translation utilities for log information will vary depending on your operating system. The translation tools currently available are as follows:

- **VAX VMS Version 5.5–1 or higher:** ERF
- **OpenVMS VAX Version 5.5–2 or higher:** ERF
- **OpenVMS Alpha Version 1.5 or higher:** ERF, DECevent
- **DEC OSF/1 Version 2.0 or higher:** uerf

ERF

OpenVMS-based systems have the Errorlog Report Formatter (ERF) to aid in error log translation. The tool provides bit-to-text translation of the (binary) log to give the operator more information about what the log means with respect to controller operation and repair.

The OpenVMS DCL command ANALYZE/ERROR_LOG invokes ERF. For a description of the VMS Analyze Error Log Utility, including more information about this command and its qualifiers, refer to the *VMS Error Log Utility Reference Manual*, or call Digital Multivendor Customer Services.

DECevent

OpenVMS Alpha-based systems include, in addition to ERF, the DECevent translation utility. DECevent provides another interface between you and the operating system event logger. Like ERF, DECevent allows you to translate events into ASCII reports (bit-to-text translation). However, DECevent reports are, in general, easier to read and provide more information than ERF error reports. The OpenVMS DIAGNOSE/TRANSLATE command invokes DECevent.

For more information about using DECevent, see the *DECevent Translation and Reporting Utility for OpenVMS User and Reference Guide*.

uerf

DEC OSF/1 systems use the UNIX Errorlog Report Formatter (uerf) to assist in error log translation. This tool also reads information from the log and provides the operator with indications as to what the log means with respect to controller/host operation. Invoke uerf using the uerf -R -o full command.

5.9.2 Fault Management Utility

FMU allows you to do the following:

- Control the spontaneous last failure logging (LFL) and event logging (EVL) displays
- Display controller last failure and memory system failure information

FMU can provide a convenient way to review some error log information during your terminal session. See Chapter 6 for information on running FMU.

5.9.3 Host Error Log Translation

The type of transmitted error information varies according to model of HS controller. Consequently, you will find the description of error logs, and how to read the logs, broken into separate appendixes for each model. See the following:

- For HSJ-series controllers, see Appendix C.
- For HSD-series controllers, see Appendix D.
- For HSZ-series controllers, see Appendix E.

Note

Host error log translations are correct as of the date of publication of this manual. However, log information may change with firmware updates. Refer to your firmware release notes for error log information updates.

6
Diagnostics, Exercisers, and Utilities

This chapter discusses the automatic and manual programs available to assist operation and diagnosis of the HS controller subsystem, including the following:

- Initialization and self-test routines
- Disk exerciser (HSJ- and HSD-series)
- Tape exerciser (HSJ- and HSD-series)
- Disk exerciser (HSZ-series)
- VTDPY utility
- CONFIG utility
- CFMENU utility
- Code Load/Code Patch utility (CLCP)
- Firmware Licensing System (FLS)
- Fault Management Utility (FMU)
- CLONE utility

6.1 Initialization

The controller initializes after any of the following conditions:

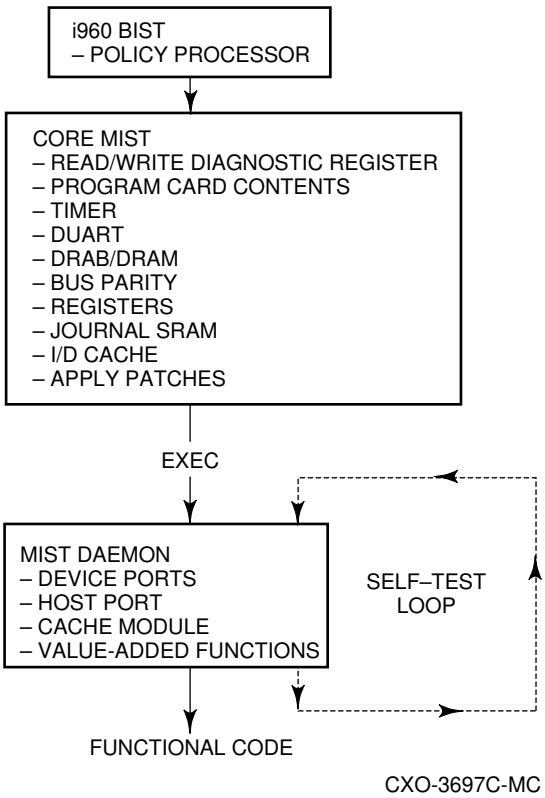
- Power is turned on.
- The firmware resets the controller.
- The operator presses the green reset button.
- The host clears the controller.

Whenever the controller initializes, it steps through a three-phase series of tests designed to detect any hardware or firmware faults. The three test areas are as follows:

- Built-in self-test (**BIST**)
- Core module integrity self-test (**MIST**)
- Module integrity self-test DAEMON

Initialization time varies depending on your model of controller and what size and type of cache module, if any, you are running. However, initialization always completes in under 1 minute. Figure 6–1 shows the initialization process.

Figure 6–1 Controller Initialization



6.1.1 Built-In Self-Test

The controller begins initialization by executing its policy processor's internal built-in self-test (BIST). BIST always executes upon initialization, because it is an integral part of the i960 chip microcode. BIST runs from the i960 chip and a small portion of the firmware program card.

Successful completion of BIST means the i960 chip is functioning properly. If BIST fails, the controller shows no activity, and all port indicators on the OCP are off. (The green reset LED is solidly lit.) BIST fails if an incorrect program card is present.

6.1.2 Core Module Integrity Self-Test

After BIST completes successfully, initialization routines and diagnostics expand to testing of the controller module itself. The tests are part of the program card firmware and are known as core module integrity self-test (MIST).

Just before beginning core MIST, the controller reads the initial boot record (**IBR**) to determine the address of hardware setup parameters and process control information. After reading the IBR, the firmware within the program card is initialized to the IBR parameters. Program card firmware then executes core MIST as follows:

1. MIST checks the initial state of the read/write diagnostic register.

2. The test validates program card contents by reading each memory location and computing an error detection code (EDC). The test then compares the computed EDC with a predetermined EDC. The program card contents are valid if both EDCs match.
3. Core MIST then tests and/or checks module hardware attached to the buses:
   - Timer operation
   - DUART operation
   - DRAB/DRAM (shared memory) operation
     - The test writes to and reads all legal addresses, then checks boundaries by attempting to access nonexistent addresses. To pass this test, the first two megabytes of memory must test good. If bad segments are found, the bad segments may divide total memory into no more than 16 good, continuous sections.
     - The test selects a device, then checks whether the bus has selected that device.
     - The test verifies that each allowable memory transfer size works and that illegal transfer sizes do not.
   - Bus parity
   - Registers (The test checks registers for frozen bits.)
   - Journal SRAM (The test writes to and reads all journal SRAM addresses.)
   - I/D cache
4. After core MIST successfully tests the program card and bus hardware, the initialization routine loads the firmware into the first two megabytes of controller shared memory. The initialization routine then uses the EDC method to compare the memory contents with the program card to confirm a successful download.
5. The initialization routine applies any memory-resident code patches for this firmware version, and updates the free memory list accordingly.
6. The i960 chip is initialized to the new parameters (the ones read from the IBR). At this time, control of initialization passes to the firmware executive (EXEC). EXEC runs from controller shared memory.

   If, at any time, a fault occurs during core MIST, the OCP displays a code (refer to Chapter 5). In addition, register contents are displayed at the terminal. The register contents should be reported to Digital Multivendor Customer Services personnel to help with module troubleshooting and repair.

   The following is an example of MIST diagnostic error output:

```
MIST Diag-err Error Code  0000000F
MIST Diag-err Parameter 1 01234567
MIST Diag-err Parameter 2 89ABCDEF
MIST Diag-err Parameter 3 00000001
```

```
MIST Diag-err Master/Cache DRAB register contents:
MIST Diag-err   DSR  2D170CBC, 2C17003D
MIST Diag-err   CSR  00000000, 00000000
MIST Diag-err   DCSR 00000000, 00003402
MIST Diag-err   DER  00001C00, 00001C76
MIST Diag-err   EAR  00800000, 00000000
MIST Diag-err   EDR  00800000, FFFFFFFF
MIST Diag-err   ERR  0000002F, 00000000
MIST Diag-err   RSR  09805432, 09805432
MIST Diag-err   CHC  00000000, 00000000
MIST Diag-err   CMC  00078006, 00000000

MIST Diag-err Read diagnostic register 0  E7FFFFFC
MIST Diag-err Read diagnostic register 1  FFFFFEF0
MIST Diag-err Write diagnostic register 0 C3FFF80F
MIST Diag-err Write diagnostic register 1 0002FF04

MIST Diag-err Halting.
```

6.1.3 Module Integrity Self-Test DAEMON

Once initialization control is passed to EXEC, EXEC calls the diagnostic and execution monitor (**DAEMON**). DAEMON tests the device port hardware, host port hardware, cache module, and value-added functions.

- To test the device ports, DAEMON checks each NCR 53C710 SCSI processor chip. Initialization continues unless *all* SCSI device ports fail testing. In other words, it is possible for the controller to run with only one functioning device port.
- DAEMON tests the host port hardware for the particular controller model. For HSJ-series controllers, this test focuses primarily on the YACI gate array chip. For the HSD- and HSZ-series controllers, the NCR 53C720 host processor chip is tested. Initialization continues even if the host port tests fail. However, DAEMON stops initialization if the dual universal asynchronous receiver transmitter (**DUART**) test (from core MIST) *and* the host port tests fail.
- DAEMON tests the cache module as follows:

Note

The controller still functions if the cache module fails its testing. In this case, the controller uses its on-board shared memory for caching operations.

  – Write-back cache

    DAEMON works in close conjunction with the cache manager, a program that runs in the background of controller firmware. DAEMON first asks the cache manager if unwritten cache data exists on the write-back cache.

    If unwritten cache data does not exist, DAEMON tests the DRAB (memory controller) on the cache module, followed by testing the write-back cache batteries. After DAEMON completes, and functional code takes control of the firmware, the cache manager tests the memory on the cache. At least the first megabyte of the memory must test good, or the cache is declared bad.

    If unwritten cache data exists, DAEMON tests only the batteries, and postpones other tests. Later, during functional code, the cache manager flushes the unwritten cache data after testing the DRAB and memory.

If cache is locked by the other controller (dual-redundant configurations), then all cache DAEMON diagnostics are postponed. During functional code, when the cache manager determines that the cache is unlocked, the cache manager tests the DRAB, batteries, and memory.

– Read cache

DAEMON tests the DRAB (memory controller) on the read cache module. After DAEMON completes, and functional code takes control of the firmware, the cache manager tests the memory on the cache. At least the first megabyte of the memory must test good, or the cache is declared bad.

The tests run by DAEMON and the cache manager are summarized in Table 6–1.

Table 6–1 Cache Module Testing

Test	DAEMON	Cache Manager
DRAB	• All memory is initialized. • Full address test.	• No memory is initialized. • Address test on diagnostic pages only.
Memory	• Never invoked.	• Always invokes all memory tests. • Read only or read/write.
Battery	• If battery is charged, full battery test. Otherwise, battery interrupt is checked.	• If battery is charged, full battery test except non-DRAB DRAM refresh circuitry is not tested. Otherwise, battery interrupt is checked.

DAEMON handles all interrupts and errors received during cache module testing. If DAEMON receives any interrupt, it stops initialization. DAEMON and/or the cache manager display any errors as a code on the OCP (refer to Chapter 5).

- To make sure of proper RAID functions, DAEMON tests the XOR operations of the value-added hardware and the associated buffer memory. Initialization stops if this test fails.

After successful test completion, DAEMON releases control. At this time, initialization is finished, and functional controller firmware takes over.

6.1.3.1 Self-Test

Self-test is a special function of DAEMON when you set DAEMON to run in a continuous loop. Self-test allows you to diagnose intermittent hardware failures, because the loop continues until an error is detected.[1]

In addition, self-test checks the controller hardware without affecting devices on any ports. Digital recommends you run self-test from the maintenance terminal because the host port disconnects once the controller begins self-test.

For self-test to properly execute, you must have a valid configuration and enable the host paths.

[1] The DAEMON battery tests only run once per self-test. They do not repeat or loop.

To run self-test, enter one of the following commands:

CAUTION

Do not use the OVERRIDE_ONLINE qualifier for the SELFTEST command, as customer data may be overwritten.

```
CLI> SELFTEST THIS_CONTROLLER
CLI> SELFTEST OTHER_CONTROLLER
```

See Appendix B for more information on the command and its qualifiers.

When you run self-test, all outstanding I/O operations complete. The controller also attempts to flush the cache. However, even if self-test fails to flush the cache, the program continues to execute.

Self-test halts if it detects a fault. Otherwise, the self-test loop continues until you press the reset (//) button or cycle the controller power off and on, after which the controller reinitializes.

6.2 Disk Inline Exerciser (HSJ- and HSD-Series)

The disk inline exerciser (DILX) is a diagnostic tool that exercises the data transfer capabilities of selected disks connected to an HSJ- or HSD-series controller. DILX exercises disks in a way that simulates a high level of user activity. DILX only operates on single-device units. DILX also can run on CD–ROM devices, but only in *read-only* mode. Thus, you can use DILX to determine the health of a controller and the disks connected to it and to acquire performance statistics. You can run DILX from a maintenance terminal, virtual terminal, or VCS.

DILX supports autoconfiguring of drives. This allows quick configuring and testing of all units at once. Be aware that *customer data will be lost* by running DILX using the Auto-Configure option. Digital recommends only using this option during initial installations.

There are no limitations on the number of units DILX can test at one time. However, Digital recommends only using DILX when no host activity is present. If you must run DILX during a live host connection, you should limit your testing to no more than half of any controller's units at one time. This conserves controller resources and minimizes performance degradation on the live units you are not testing.

DILX and the tape inline exerciser (TILX) can run concurrently, with one initiated from a maintenance terminal and the other from a virtual terminal connection. Digital recommends, however, that you *not* run the exercisers while normal I/O operations are in progress, as system performance degrades due to the heavy load the exercisers impose on the controller.

6.2.1 Invoking DILX

Note

Before running DILX, be sure that all units that you wish to test have been dismounted from the host.

The following describes how to invoke DILX from a maintenance terminal at the CLI> prompt or from a VCS, or from a virtual terminal through a DUP connection:

- To invoke DILX from a maintenance terminal, enter the following command at the CLI> prompt:

  ```
  CLI> RUN DILX
  ```

- To invoke DILX from a maintenance terminal using a VCS, enter the following command at the host prompt:

  ```
  > VCS CONNECT node-name
  CLI> RUN DILX
  ```

  where *node-name* is the controller's SCS node name.

  Consult the *VAXcluster Console System User's Guide* for complete details on using a VCS.

  Note

  The node name *must* be specified for a VCS.

- To invoke DILX from a virtual terminal using a DUP connection, enter the following command (for the OpenVMS operating system):

  ```
  $ SET HOST/DUP/SERVER=MSCP$DUP/TASK=DILX SCS_nodename
  ```

  Specify the controller's *SCS node-name* to indicate where DILX will execute.

6.2.2 Interrupting DILX Execution

Use the following guidelines to interrupt DILX execution:

Note

Do not use Ctrl/G from a VCS, because it will cause VCS to terminate. VCS acts on the sequence, and the sequence is never sent to DILX. Use Ctrl/T when invoking DILX from a VCS.

- Ctrl/G causes DILX to produce a performance summary. DILX continues normal execution without affecting the runtime parameters.
- Ctrl/C causes DILX to produce a performance summary, stop testing, and asks the ''reuse parameters'' question.
- Ctrl/Y causes DILX to abort. The ''reuse parameters'' question is not asked.
- Ctrl/T causes DILX to produce a performance summary. DILX then continues executing normally without affecting any of the runtime parameters.

6.2.3 DILX Tests

There are two DILX tests, as follow:

- The Basic Function test
- The User-Defined test

6.2.3.1 Basic Function Test—DILX

The Basic Function test for DILX executes in three or four phases. The four phases are as follow:

- **Initial Write Pass**—This is the only optional phase and is always executed first (if selected). The initial write pass writes the selected data patterns to the entire specified data space or until the DILX execution time limit has been reached. Once the initial write pass has completed, it is not reexecuted no matter how long the DILX execution time is set. The other phases are reexecuted on a 10-minute cycle.
- **Random I/O**—Simulates typical I/O activity with random transfers. The data size ranges from one byte to the maximum size I/O possible within the prevailing memory constraints. Note that the length of all I/Os is in bytes and is evenly divisible by the sector size (512 bytes). Read, write, access and erase commands are issued using random logical block numbers (LBNs).

  In the read/write mode, DILX issues the read and write commands and access and erase commands in the ratio specified during test configuration.

  When read-only mode is chosen, only read and access commands are issued.

  If compare operations are enabled, they are performed on write and read commands using the data compare modifier and DILX internal checks. The percentage of compares to perform is set from the command line. This phase

is executed first after the initial write pass has completed. It is reexecuted at 10-minute intervals with each cycle lasting approximately 6 minutes.

Intervals are broken down into different cycles. The interval is repeated until the user-selected time interval expires.

- **Data Intensive**—Designed to test disk throughput by selecting a starting LBN and repeating transfers to the next sequential LBN that has not been written to by the previous I/O. The transfer size of each I/O equals the maximum sized I/O that is possible within the prevailing memory constraints. This phase continues performing spiraling I/O to sequential tracks.

  Read and write commands are issued in read/write mode. This phase is executed 20 percent of the time after the initial write pass has completed. This phase always executes after the random I/O phase. It is reexecuted at 10-minute intervals with each cycle approximately 2 minutes.

- **Seek Intensive**—Designed to stimulate head motion on the selected disk units. Single sector erase and access commands are issued if the test is write enabled. Each I/O uses a different track on each subsequent transfer. The access and erase commands are issued in the ratio that you selected using the access/erase ratio parameter. This phase is executed 20 percent of the time after the initial write pass has completed. This phase always executes after the data intensive I/O phase. It is reexecuted at 10-minute intervals with each cycle approximately 2 minutes.

6.2.3.2 User-Defined Test—DILX

CAUTION

The User-Defined test must be run *only* by very knowledgeable personnel. Otherwise, customer data can be destroyed.

When this test is selected, DILX prompts you for input to define a specific test. In the DILX User-Defined test, a total of 20 or fewer I/O commands can be defined. Once all of the commands are issued, DILX issues the commands again in the same sequence. This is repeated until the selected time limit is reached. As you build the test, DILX collects the following information from you for each command:

- The I/O command name (write, read, access, or erase).
- The starting Logical Block Number (LBN).
- The size of the I/O in 512 byte blocks.
- The MSCP command modifiers.

6.2.4 DILX Test Definition Questions

The following text is displayed when running DILX. The text includes questions that are listed in the approximate order that they are displayed on your terminal. These questions prompt you to define the runtime parameters for DILX.

Note

Defaults for each question are given inside brackets [ ]. If you press the Return key as a response to a question, the default is used as the response.

After DILX has been started, the following message describing the Auto-Configure option is displayed:

```
The Auto-Configure option will automatically select, for testing, half
or all of the disk units configured.  It will perform a very thorough test
with *WRITES* enabled.  Only disk units with a single physical
device will be tested.  The user will only be able to select the run time
and performance summary options and whether to test a half or
full configuration. The user will not be able to specify specific
units to test. The Auto-Configure option is only recommended for
initial installations.
```

Do you wish to perform an Auto-Configure (y/n) [n] ?

Explanation: Enter ''Y'' if you wish to invoke the Auto-Configure option.

DILX next diplays the following information:

```
If you want to test a dual redundant subsystem, it is recommended that
you pick option 2 on the first controller and then option 2 on the
other controller. Auto-Configure options are:

1. Configure all disk units for testing. This is recommended for a
   single controller subsystem.

2. Configure half of all disk units for testing. This is recommended
   for a dual controller subsystem.

3. Exit Auto-Configure and DILX.
```

After you enter the desired Auto-Configure option, DILX will display the following caution statement:

```
 **CAUTION**
All data on the Auto-Configured disks will be destroyed. You *MUST* be sure
of yourself.
```

Are you sure you want to continue (y/n) [n] ?

Explanation: This question only appears if you select Auto-Configure option 1 or 2 from the previous question.

Use All Defaults and Run in Read Only Mode (y/n)[y]?

Explanation: Enter ''Y'' to run the test in read-only mode and use the defaults for DILX. Enter ''N'' to enter values for all options. DILX uses the following defaults for all units selected for testing:

- Execution time limit is 10 minutes.
- Performance summary interval is 10 minutes.
- Displaying hard or soft error Error Information Packets (**EIPs**) and end messages is disabled.
- The hard error limit is 65535. Testing will stop if the limit is reached.
- A hex dump of the extended error log information is disabled.
- The I/O queue depth is 4. A maximum of 4 I/Os will be outstanding at any time.
- The selected test is identical to the Basic Function test.
- Read-only mode.
- All user available LBNs are available for testing.

- Data compares are disabled.

Enter the execution time limit in minutes (1:65535)[10]?

Explanation: Enter the desired time you want DILX to run. The default run time is 10 minutes.

Enter performance summary interval in minutes (1:65535)[10]?

Explanation: Enter a value to set the interval for which a performance summary is displayed. The default is 10 minutes.

Include performance statistics in performance summary (y/n)[n]?

Explanation: Enter ''Y'' to see a performance summary that includes the performance statistics that include the total count of read, write, access, and erase I/O requests and the kilobytes transferred for each command. Enter ''N'' and no performance statistics are displayed.

Display hard/soft errors (y/n)[n]?

Explanation: Enter ''Y'' to enable error reporting, including end messages and EIPs. Enter ''N'' to disable error reporting, including end messages and EIPs. The default is disabled error reporting.

Display hex dump of Event Information Packet requester specific information (y/n)[n]?

Explanation: Enter ''Y'' to enable the hex dump display of the requester specific information contained in the EIP. Enter ''N'' to disable the hex dump.

When the hard error limit is reached, the unit will be dropped from testing. Enter hard error limit (1:65535) [65535] ?

Explanation: Enter a value to specify the hard error limit for all units to test. This question is used to obtain the hard error limit for *all* units under test. If the hard error limit is reached, DILX discontinues testing the unit that reaches the hard error limit. If other units are currently being tested by DILX, testing continues for those units.

When the soft error limit is reached, soft errors will no longer be displayed but testing will continue for the unit. Enter soft error limit (1:65535) [32] ?

Explanation: Enter a value to specify the soft error limit for *all* units under test. When the soft error limit is reached, soft errors are no longer displayed, but testing continues for the unit.

Enter IO queue depth (1:12) [4]?

Explanation: Enter the maximum number of outstanding I/Os for each unit selected for testing. The default is 4.

Enter unit number to be tested?

Explanation: Enter the unit number for the unit to be tested.

Note

When DILX asks for the unit number, it requires the number designator for the disk, where D117 would be specified as unit number 117.

Unit *x* will be write enabled.
Do you still wish to add this unit (y/n) [n]?

Explanation: This is a reminder of the consequences of testing a unit while it is write enabled. This is the last chance to cancel testing of the displayed unit. Enter ''Y'' to write enable the unit. Enter ''N'' to cancel testing that unit.

Select another unit (y/n) [n]?

Explanation: Enter ''Y'' to select another unit for testing. Enter ''N'' to begin testing the units already selected. The system will display the following test selections:

```
***Available tests are:
1.   Basic Function
2.   User Defined Test

Use the Basic Function 99.9% of the time.  The User Defined
test is for special problems only.
```

Enter test number (1:2) [1]?

Explanation: Enter ''1'' for the Basic Function test or ''2'' for the User-Defined test. After selecting a test, the system will then display the following message:

```
* IMPORTANT *  If you answer yes to the next question, user data
WILL BE destroyed.
```

Write enable disk unit (y/n) [n] ?

Explanation: Enter ''Y'' to write enable the unit. Write commands are enabled for the currently selected test. Data within your selected LBN range will be destroyed. *Be sure of your actions before answering this question.* This question applies to all DILX tests. Enter ''N'' to enable read only mode, in which read and access commands are the only commands enabled.

Perform initial write (y/n) [n] ?

Explanation: Enter ''Y'' to write to the entire user-selected LBN range with the user-selected data patterns. Enter ''N'' for no initial write pass.

If you respond with ''Y,'' the system performs write operations starting at the lowest user-selected LBN and issues spiral I/Os with the largest byte count possible. This continues until the specified LBN range has been completely written. Upon completion of the initial write pass, normal functions of the Random I/O phase start. The advantage of selecting the initial write pass is that compare host data commands can then be issued and the data previously written to the media can be verified for accuracy. It makes sure that all LBNs within the selected range are accessed by DILX.

The disadvantage of using the initial write pass is that it may take a long time to complete, because a large LBN range was specified. You can bypass this by selecting a smaller LBN range, but this creates another disadvantage in that the entire disk space is not tested. The initial write pass only applies to the Basic Function test.

The write percentage will be set automatically.
Enter read percentage for random IO and data intensive phase (0:100) [67] ?

Explanation: This question is displayed if read/write mode is selected. It allows you to select the read/write ratio to use in the Random I/O and Data Intensive phases. The default read/write ratio is similar to the I/O ratio generated by a typical OpenVMS system.

Enter data pattern number 0=all, 19=user_defined, (0:19) [0] ?

Explanation: The DILX data patterns are used in write commands. This question is displayed when write operations are enabled for the Basic Function or User-Defined tests. There are 18 unique data patterns to select from. These patterns were carefully selected as worst case or most likely to produce errors for disks connected to the controller. (See Table 6–2 for a list of data patterns.) The default uses all 18 patterns in a random method. This question also allows you to create a unique data pattern of your own choice.

Enter the 8-digit hexadecimal user defined data pattern [ ] ?

Explanation: This question is only displayed if you choose to use a user-defined data pattern for write commands. The data pattern is represented in a longword and can be specified with eight hexadecimal digits.

Enter start block number (0:highest_lbn_on_the_disk) [0] ?

Explanation: Enter the starting block number of the area on the disk you wish DILX to test. Zero is the default.

Enter end block number (starting_lbn:highest_lbn_on_the_disk)
[highest_lbn_on_the_disk] ?

Explanation: Enter the highest block number of the area on the disk you wish DILX to test. The highest block number (of that type of disk) is the default.

Perform data compare (y/n) [n] ?

Explanation: Enter ''Y'' to enable the use of the compare modifier bit with read and write commands. Enter ''N'' and no data compare operations are done.

This question only applies to the Basic Function test. If the compare modifier is set on write commands, the data is written to the disk. The data is then read from the disk and compared against the corresponding DILX buffers. On read commands, the data is read from the disk into the DILX buffers, read again, then compared against the corresponding DILX buffers. If a discrepancy is found, an error is reported. If the initial write was chosen for the Basic Function test and you enter ''Y'' to this question, compare host data commands are then enabled and data previously written to the media are verified for accuracy.

Enter compare percentage (1:100) [5] ?

Explanation: This question is displayed only if you choose to perform data compares. This question allows you to change the percentage of read and write commands that will have a data compare operation performed. Enter a value indicating the compare percentage. The default is 5.

The erase percentage will be set automatically.
Enter access percentage for Seek Intensive Phase (0:100) [90] ?

Explanation: This question only applies to the Seek Intensive phase if write operations are enabled. It allows you to select the percentage of access and erase commands to be issued. Enter a value indicating the access percentage.

Enter command number *x* (read, write, access, erase, quit) [ ] ?

Explanation: This question only applies to the User-Defined test. It allows you to define command *x* as a read, write, access, or erase command. Enter quit to finish defining the test.

Enter starting LBN for this command (0:highest_lbn_on_the_disk) [ ] ?

Explanation: This question only applies to the User-Defined test. It allows you to set the starting LBN for the command currently being defined. Enter the starting LBN for this command.

Enter the IO size in 512 byte blocks for this command (1:size_in_blocks) [ ] ?

Explanation: This question only applies to the User-Defined test. It allows you to set the I/O size in 512-byte blocks for the command currently being defined. Enter values indicating the I/O size for this command.

Enter in HEX, the MSCP Command Modifiers[0] ?

Explanation: This question only applies to the User-Defined test. It allows you to specify the MSCP command modifiers. You must understand the meaning of the MSCP command modifiers before you enter any value other than the default.

Reuse parameters (stop, continue, restart, change_unit) [stop] ?

Explanation: This question is displayed after the DILX execution time limit expires, after the hard error limit is reached for every unit under test, or after you enter Ctrl/C. These options are as follow:

- **Stop**—DILX terminates normally.
- **Continue**—DILX resumes execution without resetting the remaining DILX execution time or any performance statistics. If the DILX execution time limit has expired, or all units have reached their hard error limit, DILX terminates.
- **Restart**—DILX resets all performance statistics and restarts execution so that the test will perform exactly as the one that just completed. However, there is one exception. If the previous test was the Basic Function test with the initial write pass and the initial write pass completed, the initial write pass is not performed when the test is restarted.
- **Change_unit**—DILX allows you to drop or add units to testing. For each unit dropped, another unit must be added, until all units in the configuration have been tested. The unit chosen will be tested with the same parameters that were used for the unit that was dropped from testing. When you have completed dropping and adding units, all performance statistics are initialized and DILX execution resumes with the same parameters as the last run.

Drop unit #x (y/n) [n] ?

Explanation: This question is displayed if you choose to change a unit as an answer to the reuse parameters (previous) question. Enter the unit number that you wish to drop from testing.

The new unit will be write enabled. Do you wish to continue (y/n) [n] ?

Explanation: This question is displayed if you choose to change a unit as an answer to the reuse parameters question. It is only asked if the unit being dropped was write enabled. This question gives you the chance to terminate DILX testing if you do not want data destroyed on the new unit. Enter ''N'' to terminate DILX.

6.2.5 DILX Output Messages

The following message is displayed when DILX is started:

```
Disk Inline Exerciser - Version 2.5
```

This message identifies the internal program as DILX and gives the DILX software version number.

Change Unit is not a legal option if Auto-Configure was chosen.

Explanation: This message is displayed if the user selects the Auto-Configure option and selects the ''change unit response'' to the ''reuse parameters'' question. You cannot drop a unit and add a unit if all units were selected for testing.

DILX - Normal Termination.

Explanation: This message is displayed when DILX terminates under normal conditions.

Insufficient resources.

Explanation: Following this line is a second line that gives more information about the problem, which could be one of the following messages:

- Unable to allocate memory.

  DILX was unable to allocate the memory it needed to perform DILX tests. You should run DILX again but choose a lower queue depth and/or choose fewer units to test.

- Cannot perform tests.

  DILX was unable to allocate all of the resources needed to perform DILX tests. You should run DILX again but choose a lower queue depth and/or choose fewer units to test.

- Unable to change operation mode to maintenance.

  DILX tried to change the operation mode from normal to maintenance using the SYSAP$CHANGE_STATE( ) routine but was not successful due to insufficient resources. This problem should not occur. If it does occur, submit a CLD (error report), then reset the controller.

Unit *x* is not a valid disk unit for DILX testing.

Explanation: An attempt was made to allocate a unit for testing that does not exist on the controller.

Unit *x* successfully allocated for testing.

Explanation: All processes that DILX performs to allocate a unit for testing, have been completed. The unit is ready for DILX testing.

Unable to allocate unit.

Explanation: This message should be preceded by a reason why the unit could not be allocated for DILX testing.

DILX detected error, code *x*.

Explanation: The ''normal'' way DILX recognizes an error on a unit is through the reception of an EIP. This loosely corresponds to an MSCP error log. However, the following are some errors that DILX will detect without the reception of an EIP:

- Illegal Data Pattern Number found in data pattern header. Unit *x*

  This is code 1. DILX read data from the disk and found that the data was not in a pattern that DILX previously wrote to the disk.

- No write buffers correspond to data pattern Unit *x*.

  This is code 2. DILX read a legal data pattern from the disk at a place where DILX wrote to the disk, but DILX does not have any write buffers that correspond to the data pattern. Thus, the data has been corrupted.

- Read data do not match what DILX thought was written to the media. Unit *x*.

  This is code 3. DILX writes data to the disk and then reads it and compares it against what was written to the disk. This indicates a compare failure. More information is displayed to indicate where in the data buffer the compare operation failed and what the data was and should have been.

- Compare Host Data should have reported a compare error but did not. Unit *x*

  This is code 4. A compare host data compare was issued in a way that DILX expected to receive a compare error but no error was received.

DILX terminated. A termination, a print summary or a reuse parameters request was received but DILX is currently not testing any units.

Explanation: The user entered Ctrl/Y (termination request), Ctrl/G (print summary request), or Ctrl/C (reuse parameters request) before DILX had started to test units. DILX cannot satisfy the second two requests so DILX treats all of these requests as a termination request.

DILX will not change the state of a unit if it is not NORMAL.

Explanation: DILX cannot allocate the unit for testing, because it is already in Maintenance mode. (Maintenance mode can only be invoked by the firmware. If another DILX session is in use, the unit is considered in Maintenance mode.)

Unit is not available - if you dismount the unit from the host, it may correct this problem.

Explanation: The unit has been placed online by another user (or host) or the media is not present. The most common reason for this message is that the unit is mounted on the host.

Unit *x* is online to other controller.

Explanation: The unit has been placed online by another user (or host) that is accessing it through the other controller. The most common reason for this message is that the unit is mounted on the host, or DILX is running on the other controller and has the unit allocated for testing.

Soft error reporting disabled. Unit *x*.

Explanation: This message indicates that the soft error limit has been reached and therefore no more soft errors will be displayed for this unit.

Hard error limit reached, unit *x* dropped from testing.

Explanation: This message indicates that the hard error limit has been reached and the unit must be dropped from testing.

Soft error reporting disabled for controller errors.

Explanation: This message indicates that the soft error limit has been reached for controller errors. Thus, controller soft error reporting is disabled.

Hard error limit reached for controller errors. All units dropped from testing.

Explanation: This message is self explanatory.

Unit is already allocated for testing.

Explanation: This message is self explanatory.

No drives selected.

Explanation: DILX parameter collection was exited without choosing any units to test.

Maximum number of units are now configured.

Explanation: This message is self explanatory. (Testing will start after this message is displayed.)

Unit is write protected.

Explanation: The user wants to test a unit with a write commands, or erase commands, or both enabled but the unit is write protected.

The unit status and/or the unit device type has changed unexpectedly. Unit *x* dropped from testing.

Explanation: The unit status may change if the unit experienced hard errors or if the unit is disconnected. Either way, DILX cannot continue testing the unit.

Last Failure Information follows. This error was NOT produced by running DILX. It represents the reason why the controller crashed on the previous controller run.

Explanation: This message may be displayed while allocating a unit for testing. It does not indicate any reason why the unit is or is not successfully allocated, but rather represents the reason why the controller went down in the previous run. The information that follows this message is the contents of an EIP.

Disk unit numbers on this controller include:

Explanation: After this message is displayed, a list of disk unit numbers on the controller is displayed.

IO to unit *x* has timed out. DILX aborting.

Explanation: One of the DILX I/Os to this unit did not complete within the command timeout interval and when examined, was found not progressing. This indicates a failing controller.

DILX terminated prematurely by user request.

Explanation: Ctrl/Y was entered. DILX interprets this as a request to terminate. This message is displayed and DILX terminates.

Unit is owned by another sysap.

Explanation: DILX could not allocate the unit specified, because the unit is currently allocated by another system application. Terminate the other system application or reset the controller.

Exclusive access is declared for this unit.

Explanation: The unit could not be allocated for testing, because exclusive access has been declared for the unit.

The other controller has exclusive access declared for this unit.

Explanation: This message is self explanatory.

This unit is marked inoperative.

Explanation: The unit could not be allocated for testing, because the controller internal tables have the unit marked as inoperative.

The unit does not have any media present.

Explanation: The unit could not be allocated for testing, because no media is present.

The RUNSTOP_SWITCH is set to RUN_DISABLED.

Explanation: The unit could not be allocated for testing, because the RUNSTOP_SWITCH is set to RUN_DISABLED. This is enabled and disabled through the Command Line Interpreter (CLI).

Unable to continue, run time expired.

Explanation: A continue response was given to the ‘‘reuse parameters’’ question. This is not a valid response if the run time has expired. Reinvoke DILX.

Unit *x* is not operational.

Explanation: This message is self explanitory.

When DILX starts to exercise the disk units, the following message is displayed with the current time of day:

```
DILX testing started at: xx:xx:xx
    Test will run for x minutes
    Type ^T(if running DILX through a VCS) or ^G(in all other cases)
      to get a current performance summary
    Type ^C to terminate the DILX test prematurely
    Type ^Y to terminate DILX prematurely
```

6.2.6 DILX End Message Display

To interpret the end message fields correctly, you must contact Digital Multivendor Customer Services. Example 6–1 is an example of a DILX end message display.

Example 6–1 DILX End Message Display

```
Bad Value Added Completion Status for unit x, End message in hex

      Event Code                  x
      Op Code                     x
      Cmd Ref Number              x
      Byte Count                  x
      Error Byte Count            x
      Sequence Number             x
      Flags                       x
```

6.2.7 DILX Error Information Packet Displays

A DILX EIP display may or may not include a hex dump of the Requestor Specific Data. This is an option you can select as a DILX parameter.

The EIP will be in one of the following formats that corresponds to MSCP error log formats:

- Controller Error
- Memory Error
- Disk Transfer Error
- Bad Block Replacement (**BBR**) Attempt Error

Examples 6–2 through 6–5 are examples of each display. Each display includes the optional requestor specific information. In all cases, the **instance code**, **template** type, and all requestor specific information correspond to event (error) log device dependent parameters, while everything else has a one-to-one correspondence to error log fields. See Appendixes C and D for a translation of these codes.

Example 6–2 Controller Error

(continued on next page)

Example 6–2 (Cont.) Controller Error

```
Error Information Packet in hex

      Cmd Ref Number       x
      Unit Number          x
      Log Sequence         x
      Format               x
      Flags                x
      Event Code           x
      Controller ID        x
      Controller SW ver    x
      Controller HW ver    x
      Multi Unit Code      x
      Instance                    x
      Template Type               x
      Requestor Information Size  x
      Requestor Specific Data bytes 0 7   xx xx xx xx xx xx xx xx
      Requestor Specific Data bytes 8 15   xx xx xx xx xx xx xx xx
        :
        :
      Requestor Specific Data bytes xx xx   xx xx xx xx xx xx xx xx
```

Example 6–3 Memory Error

```
Error Information Packet in hex

      Cmd Ref Number       x
      Unit Number          x
      Log Sequence         x
      Format               x
      Flags                x
      Event Code           x
      Controller ID        x
      Controller SW ver    x
      Controller HW ver    x
      Multi Unit Code      x
      Memory Address       x
      Instance                    x
      Template Type               x
      Requestor Information Size  x
      Requestor Specific Data bytes 0 7   xx xx xx xx xx xx xx xx
      Requestor Specific Data bytes 8 15   xx xx xx xx xx xx xx xx
        :
        :
      Requestor Specific Data bytes xx xx   xx xx xx xx xx xx xx xx
```

Example 6–4 Disk Transfer Error

```
Error Information Packet in hex

      Cmd Ref Number       x
      Unit Number          x
      Log Sequence         x
      Format               x
      Flags                x
      Event Code           x
      Controller ID        x
      Controller SW ver    x
      Controller HW ver    x
      Multi Unit Code      x
      Unit ID[0]           x
      Unit ID[1]           x
      Unit Software Rev    x
      Unit Hardware Rev    x
      Recovery Level       x
      Retry Count          x
      Serial Number        x
      Header Code          x
      Instance                    x
      Template Type               x
      Requestor Information Size  x
      Requestor Specific Data bytes 0 7   xx xx xx xx xx xx xx xx
      Requestor Specific Data bytes 8 15   xx xx xx xx xx xx xx xx
        :
        :
      Requestor Specific Data bytes xx xx   xx xx xx xx xx xx xx xx
```

Example 6–5 Bad Block Replacement Attempt Error

```
Error Information Packet in hex

      Cmd Ref Number       x
      Unit Number          x
      Log Sequence         x
      Format               x
      Flags                x
      Event Code           x
      Controller ID        x
      Controller SW ver    x
      Controller HW ver    x
      Multi Unit Code      x
      Unit ID[0]           x
      Unit ID[1]           x
      Unit Software Rev    x
      Unit Hardware Rev    x
      Replace Flags        x
      Serial Number        x
      Bad LBN              x
      Old RBN              x
      New RBN              x
      Cause                x
      Instance                    x
      Template Type               x
      Requestor Information Size  x
      Requestor Specific Data bytes 0 7   xx xx xx xx xx xx xx xx
      Requestor Specific Data bytes 8 15   xx xx xx xx xx xx xx xx
        :
```

(continued on next page)

Example 6–5 (Cont.) Bad Block Replacement Attempt Error

```
      :
Requestor Specific Data bytes xx xx   xx xx xx xx xx xx xx xx
```

6.2.8 DILX Data Patterns

Table 6–2 defines the data patterns used with the DILX Basic Function or User-Defined tests. There are 18 unique data patterns. These data patterns were selected as worst case, or the ones most likely to produce errors on disks connected to the controller.

Table 6–2 DILX Data Patterns

Pattern Number	Pattern in Hexadecimal Numbers
1	0000
2	8B8B
3	3333
4	3091
5, shifting 1s	0001, 0003, 0007, 000F, 001F, 003F, 007F, 00FF, 01FF, 03FF, 07FF, 0FFF, 1FFF, 3FFF, 7FFF
6, shifting 0s	FIE, FFFC, FFFC, FFFC, FFE0, FFE0, FFE0, FFE0, FE00, FC00, F800, F000, F000, C000, 8000, 0000
7, alternating 1s, 0s	0000, 0000, 0000, FFFF, FFFF, FFFF, 0000, 0000, FFFF, FFFF, 0000, FFFF, 0000, FFFF, 0000, FFFF
8	B6D9
9	5555, 5555, 5555, AAAA, AAAA, AAAA, 5555, 5555, AAAA, AAAA, 5555, AAAA, 5555, AAAA, 5555, AAAA, 5555
10	DB6C
11	2D2D, 2D2D, 2D2D, D2D2, D2D2, D2D2, 2D2D, 2D2D, D2D2, D2D2, 2D2D, D2D2, 2D2D, D2D2, 2D2D, D2D2
12	6DB6
13, ripple 1	0001, 0002, 0004, 0008, 0010, 0020, 0040, 0080, 0100, 0200, 0400, 0800, 1000, 2000, 4000, 8000
14, ripple 0	FIE, FFFD, FFFB, FFF7, FFEF, FFDF, FFBF, FF7F, FEFF, FDFF, FBFF, F7FF, EFFF, BFFF, DFFF, 7FFF
15	DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D
16	3333, 3333, 3333, 1999, 9999, 9999, B6D9, B6D9, B6D9, B6D9, FFFF, FFFF, 0000, 0000, DB6C, DB6C
17	9999, 1999, 699C, E99C, 9921, 9921, 1921, 699C, 699C, 0747, 0747, 0747, 699C, E99C, 9999, 9999
18	FFFF
Default—Use all of the above patterns in a random method	

6.2.9 DILX Examples

This section provides DILX examples using different options.

6.2.9.1 DILX Example—Using All Defaults

In Example 6–6, DILX is run using all defaults. DILX is executed in read-only mode. No data on the units under test are destroyed. The entire user-available LBN range on each disk is accessible for DILX testing. DILX was invoked from a maintenance terminal.

Example 6–6 Using All Defaults—DILX

```
CLI> SHOW DISK
Name          Type          Port Targ  LUN                    Used by
-------------------------------------------------------------------------------

DISK100       disk             1    0    0                    D10
DISK120       disk             1    2    0                    D12
DISK140       disk             1    4    0                    D14
DISK210       disk             2    1    0                    D21
DISK230       disk             2    3    0                    D23
DISK610       disk             6    1    0                    D61
DISK630       disk             6    3    0                    D63

CLI> RUN DILX

Disk Inline Exerciser - Version 2.5

The Auto-Configure option will automatically select, for testing, half
or all of the disk units configured.  It will perform a very thorough test
with *WRITES* enabled.  Only disk units with a single physical
device will be tested.  The user will only be able to select the run time
and performance summary options and whether to test a half or
full configuration. The user will not be able to specify specific
units to test. The Auto-Configure option is only recommended for
initial installations.

Do you wish to perform an Auto-Configure (y/n) [n] ? N

Use all defaults and run in read only mode (y/n) [y] ? Y
Disk unit numbers on this controller include:
    10
    12
    14
    21
    23
    61
    63
Enter unit number to be tested ? 10
Unit 10 successfully allocated for testing
Select another unit (y/n) [n] ? Y
Enter unit number to be tested ? 12
Unit 12 successfully allocated for testing
Select another unit (y/n) [n] ? N

   DILX testing started at: 13-JAN-1993 04:47:57
    Test will run for 10 minutes
    Type ^T(if running DILX through VCS) or ^G(in all other cases)
      to get a current performance summary
    Type ^C to terminate the DILX test prematurely
    Type ^Y to terminate DILX prematurely
```

(continued on next page)

Example 6–6 (Cont.) Using All Defaults—DILX

```
   DILX Summary at 13-JAN-1993 04:49:14
   Test minutes remaining: 9, expired: 1

Unit 10     Total IO Requests 4530
  No errors detected
Unit 12     Total IO Requests 2930
  No errors detected
Reuse Parameters (stop, continue, restart, change_unit) [stop] ?

DILX - Normal Termination
CLI>
```

6.2.9.2 DILX Example—Using All Functions

In Example 6–7, all functions are chosen for DILX. DILX was invoked from the virtual terminal using the DUP connection from an OpenVMS system. This is an extensive (long) run because the initial write pass was chosen, and because there was enough time for the initial write pass to complete and for normal testing to continue for a reasonable length of time after the initial write pass.

CAUTION

This test writes to disks. All user data will be destroyed.

Example 6–7 All Functions—DILX

```
$ SHOW CLUSTER/CONTINUOUS

View of Cluster from system ID 9038  node: ENGHRN          7-APR-1993 14:54:01

      SYSTEMS       MEMBERS

  NODE   SOFTWARE   STATUS

 ENGHRN  VMS V5.5  MEMBER
 FORCE   HSC V700
 WODWND  VMS V5.5  MEMBER
 CYMBAL  VMS V5.5  MEMBER
 LUTE    VMS V5.5  MEMBER
 MASS2   HSJ TM4I
 MASS1   HSJ XM4I

(Entered Ctrl/C here.)

DUP> SET HOST/DUP/SERVER=MSCP$DUP MASS1/TASK=DILX
%HSCPAD-I-LOCPROGEXE, Local program executing - type ^\ to exit

Disk Inline Exerciser - Version 2.5

The Auto-Configure option will automatically select, for testing, half
or all of the disk units configured.  It will perform a very thorough test
with *WRITES* enabled.  Only disk units with a single physical
device will be tested.  The user will only be able to select the run time
and performance summary options and whether to test a half or
full configuration. The user will not be able to specify specific
units to test. The Auto-Configure option is only recommended for
initial installations.

Do you wish to perform an Auto-Configure (y/n) [n] ?
```

(continued on next page)

Example 6–7 (Cont.) All Functions—DILX

```
Use all defaults and run in read only mode (y/n) [y] ? N
Enter execution time limit in minutes (1:65535) [10] ? 45
Enter performance summary interval in minutes (1:65535) [10] ? 45
Include performance statistics in performance summary (y/n) [n] ? Y
Display hard/soft errors (y/n) [n] ? Y
Display hex dump of Error Information Packet requester specific
information (y/n) [n] ? Y
When the hard error limit is reached, the unit will be dropped from testing.
Enter hard error limit (1:65535) [65535] ?
When the soft error limit is reached, soft errors will no longer be
displayed but testing will continue for the unit.
Enter soft error limit (1:65535) [32] ?
Enter IO queue depth (1:20) [4] ? 10
  *** Available tests are:
    1. Basic Function
    2. User Defined

Use the Basic Function test 99.9% of the time. The User Defined
test is for special problems only.
Enter test number (1:2) [1] ? 1

NOTE: If writes are enabled, DILX will only test disk units with a single
physical device.

 **CAUTION**
If you answer yes to the next question, user data WILL BE destroyed.

Write enable disk unit(s) to be tested (y/n) [n] ? Y
The write percentage will be set automatically.
Enter read percentage for Random IO and Data Intensive phase (0:100) [67] ?
Enter data pattern number 0=ALL, 19=USER_DEFINED, (0:19) [0] ?
Perform initial write (y/n) [n] ? Y
The erase percentage will be set automatically.
Enter access percentage for Seek Intensive phase (0:100) [90] ?
Perform data compare (y/n) [n] ? Y
Enter compare percentage (1:100) [5] ?
Disk unit numbers on this controller include:
    10
    12
    14
    21
    23
    61
    63
Enter unit number to be tested ? 10
Unit 10 will be write enabled.
Do you still wish to add this unit (y/n) [n] ? Y
Enter start block number (0:1664214) [0] ?
Enter end block number (0:1664214) [1664214] ?
Unit 10 successfully allocated for testing
Select another unit (y/n) [n] ? Y
Enter unit number to be tested ? 12
Unit 12 will be write enabled.
Do you still wish to add this unit (y/n) [n] ? Y
Enter start block number (0:832316) [0] ?
Enter end block number (0:832316) [832316] ?
Unit 12 successfully allocated for testing
Select another unit (y/n) [n] ? N
```

(continued on next page)

Example 6–7 (Cont.) All Functions—DILX

```
   DILX testing started at: 13-JAN-1993 04:52:26
    Test will run for 45 minutes
    Type ^T(if running DILX through VCS) or ^G(in all other cases)
      to get a current performance summary
    Type ^C to terminate the DILX test prematurely
    Type ^Y to terminate DILX prematurely

   DILX Summary at 13-JAN-1993 04:56:20
   Test minutes remaining: 42, expired: 3

Unit 10     Total IO Requests 40794
  Read Count 0   Write Count 40793
  Access Count 0   Erase Count 0
  KB xfer   Read 0   Write 326344   Total 326344
  No errors detected
Unit 12     Total IO Requests 13282
  Read Count 0   Write Count 13281
  Access Count 0   Erase Count 0
  KB xfer   Read 0   Write 106248   Total 106248
  No errors detected
Reuse Parameters (stop, continue, restart, change_unit) [stop] ?

DILX - Normal Termination
CLI>
```

6.2.9.3 DILX Examples—Auto-Configure with All Units

In Example 6–8, DILX is run using the Auto-Configure option with the all units option.

Example 6–8 Auto-Configuration with All Units

```
CLI> RUN DILX

Disk Inline Exerciser - Version 2.5

The Auto-Configure option will automatically select, for testing, half
or all of the disk units configured.  It will perform a very thorough test
with *WRITES* enabled.  Only disk units with a single physical
device will be tested.  The user will only be able to select the run time
and performance summary options and whether to test a half or
full configuration. The user will not be able to specify specific
units to test. The Auto-Configure option is only recommended for
initial installations.

Do you wish to perform an Auto-Configure (y/n) [n] ? Y

 If you want to test a dual redundant subsystem, it is recommended that
 you pick option 2 on the first controller and then option 2 on the
 other controller. Auto-Configure options are:

      1. Configure all disk units for testing. This is recommended for a
           single controller subsystem.
      2. Configure half of all disk units for testing, this is recommended
         for a dual controller subsystem.
      3. Exit Auto-Configure and DILX.

Enter Auto-Configure option (1:3) [3] ? 1

     ****  C a u t i o n  ****
```

(continued on next page)

Example 6–8 (Cont.) Auto-Configuration with All Units

```
All data on the Auto-Configured disks will be destroyed.
You *MUST* be sure of yourself.

Are you sure you want to continue (y/n) [n] ? Y
Enter execution time limit in minutes (1:65535) [60] ?
Enter performance summary interval in minutes (1:65535) [60] ?
Unit 10 successfully allocated for testing
Unit 12 successfully allocated for testing
Unit 14 successfully allocated for testing
Unit 21 successfully allocated for testing
Unit 23 successfully allocated for testing
Unit 61 successfully allocated for testing
Unit 63 successfully allocated for testing

   DILX testing started at: 13-JAN-1993 04:42:39
    Test will run for 60 minutes
    Type ^T(if running DILX through VCS) or ^G(in all other cases)
      to get a current performance summary
    Type ^C to terminate the DILX test prematurely
    Type ^Y to terminate DILX prematurely

   DILX Summary at 13-JAN-1993 04:44:11
   Test minutes remaining: 59, expired: 1

Unit 10     Total IO Requests 9595
  No errors detected
Unit 12     Total IO Requests 5228
  No errors detected
Unit 14     Total IO Requests 10098
  No errors detected
Unit 21     Total IO Requests 9731
  No errors detected
Unit 23     Total IO Requests 5230
  No errors detected
Unit 61     Total IO Requests 11283
  No errors detected
Unit 63     Total IO Requests 5232
  No errors detected
Reuse Parameters (stop, continue, restart, change_unit) [stop] ?

DILX - Normal Termination
CLI>
```

6.2.10 Interpreting the DILX Performance Summaries

A DILX performance display is produced under the following conditions:

- When a specified performance summary interval elapses
- When DILX terminates for any conditions except an abort
- When Ctrl/G is entered (or Ctrl/T when running from a VCS)

The performance display has different formats depending on whether performance statistics are requested in the user-specified parameters and if errors are detected.

The following is an example of a DILX performance display when performance statistics were not selected and when no errors were detected:

```
   DILX Summary at 18-JUN-1993 06:18:41
   Test minutes remaining: 0, expired: 6

Unit 1     Total IO Requests 482
  No errors detected
Unit 2     Total IO Requests 490
  No errors detected
```

The following is an example of a DILX performance display when performance statistics were selected and when no errors were detected:

```
   DILX Summary at 18-JUN-1993 06:18:41
   Test minutes remaining: 0, expired: 6

Unit 1     Total IO Requests 482
  Read Count   292   Write Count 168
  Access Count 21   Erase Count 0
  KB xfer   Read 7223   Write 4981   Total 12204
  No errors detected
```

The following is an example of a DILX performance display when performance statistics were not selected and when errors were detected on a unit under test:

```
     DILX Summary at 18-JUN-1993 06:18:41
     Test minutes remaining: 0, expired: 6

  Unit 10     Total IO Requests 153259
           No errors detected
❶ Unit 40     Total IO Requests 2161368
           Err in Hex: IC:031A4002  PTL:04/00/00  Key:04  ASC/Q:B0/00  HC:0  SC:1
           Total Errs   Hard Cnt 0   Soft Cnt 1
❷ Unit 55     Total IO Requests 2017193
           Err in Hex: IC:03094002  PTL:05/05/00  Key:01  ASC/Q:18/89  HC:0  SC:1
           Err in Hex: IC:03094002  PTL:05/05/00  Key:01  ASC/Q:18/86  HC:0  SC:1
❸          Total Errs   Hard Cnt 0   Soft Cnt 2
```

where:

❶ Represents the unit number and total I/O requests to this unit.

❷ Represents information about the first two unique errors.

A line of this format may be displayed up to three times in a performance summary. There would be a line for each unique error reported to DILX for this unit, up to three errors.

❸ Represents the total hard and soft errors for this unit.

The following is an example of a DILX performance display when performance statistics were not selected and when a controller error was detected:

```
   DILX Summary at 18-JUN-1993 06:18:41
   Test minutes remaining: 0, expired: 6

Cnt err in HEX  IC:07080064  Key:06  ASC/Q:A0/05  HC:1  SC:0
  Total Cntrl Errs   Hard Cnt 1   Soft Cnt 0

Unit 1     Total IO Requests 482
  No errors detected
Unit 2     Total IO Requests 490
  No errors detected
```

For the previous examples, the following definitions apply. These codes are translated in Appendixes C and D.

- IC—The HSJ-/HSD-series Instance code

- ASC/Q—The SCSI ASC and ASCQ code associated with this error
- HC—The hard count of this error
- SC—The soft count of this error
- PTL—The location of the unit (port/target/LUN)

The performance displays contain error information for up to three unique errors. Hard errors always have precedence over soft errors. A soft error represented in one display may be replaced with information on a hard error in subsequent performance displays.

6.2.11 DILX Abort Codes

Table 6–3 lists the DILX abort codes and definitions.

Table 6–3 DILX Abort Codes and Definitions

Value	Definition
1	An I/O has timed out.
2	dcb_p->htb_used_count reflects an available HTB to test IOs but none could be found.
3	FAO returned either FAO_BAD_FORMAT or FAO_OVERFLOW.
4	TS$SEND_TERMINAL_DATA returned either an ABORTED or INVALID_BYTE_COUNT.
5	TS$READ_TERMINAL_DATA returned either an ABORTED or INVALID_BYTE_COUNT.
6	A timer is in an unexpected expired state that prevents it from being started.
7	The semaphore was set after a oneshot I/O was issued but nothing was found in the received HTB que.
8	A termination, a print summary, or a reuse parameters request was received when DILX was not testing any units.
9	User requested an abort via Ctrl/Y.

6.2.12 DILX Error Codes

Table 6–4 list the DILX error codes and definitions for DILX-detected errors.

Table 6–4 DILX Error Codes and Definitions

Value	Definition
1	Illegal Data Pattern Number found in data pattern header.
2	No write buffers correspond to data pattern.
3	Read data does not match write buffer.
4	Compare Host Data should have reported a compare error but did not.

6.3 Tape Inline Exerciser (HSJ- and HSD-Series)

TILX is a diagnostic tool that exercises the data transfer capabilities of selected tape drives connected to an HSJ- or HSD-series controller. TILX exercises tape drives in a way that simulates a high level of user activity. Thus, you can use TILX to determine the health of the controller and the tape drives connected to it. You can run TILX from a maintenance terminal or from a virtual terminal.

DILX and TILX can run concurrently, with one initiated from a maintenance terminal and the other from a virtual terminal connection. Digital recommends, however, that you *not* run the exercisers while normal I/O operations are in progress, as system performance will degrade due to the heavy load the exercisers impose on the controller.

6.3.1 Invoking TILX

Note

Before running TILX, be sure that all units you wish to test have been dismounted from the host.

The following describes how to invoke TILX from a maintenance terminal at the CLI> prompt or a VCS, or from a virtual terminal through the DUP connection.

- To invoke TILX from a maintenance terminal, enter the following command at the CLI> prompt:

  ```
  CLI> RUN TILX
  ```

- To invoke TILX from a maintenance terminal using a VCS, enter the following command at the host prompt:

  ```
  > VCS CONNECT node name
  CLI> RUN TILX
  ```

  where *node name* is the controller's SCS node name.

  Consult the *VAXcluster Console System User's Guide* for complete details on using a VCS.

  Note

  The node name *must* be specified for a VCS.

- To invoke TILX from a virtual terminal, enter the following command (for OpenVMS software):

  ```
  $ SET HOST/DUP/SERVER=MSCP$DUP/TASK=TILX SCS_nodename
  ```

  where *SCS_nodename* indicates where TILX will execute.

6.3.2 Interrupting TILX Execution

Use the following guidelines to interrupt TILX execution:

Note

Do not use Ctrl/G from a VCS because it will cause VCS to terminate. VCS acts on the sequence and the sequence is never sent to TILX. Use Ctrl/T when invoking TILX from a VCS.

- Ctrl/G causes TILX to produce a performance summary. TILX continues normal execution without affecting the runtime parameters.
- Ctrl/C causes TILX to produce a performance summary, stop testing, and asks the ''reuse parameters'' question.
- Ctrl/Y causes TILX to terminate. The ''reuse parameters'' question is not asked.
- Ctrl/T causes TILX to produce a performance summary. TILX then continues executing normally without affecting any of the runtime parameters.

6.3.3 TILX Tests

There are three TILX tests, as follow:

- The Basic Function test
- The User-Defined test
- The Read Only test

6.3.3.1 Basic Function Test—TILX

The Basic Function test executes a write pass followed by a read pass. The write pass executes in two phases, as follows:

- **Data Intensive**—The first one third of the records are written in this phase. All records written to the tape have a byte count of 16 kilobytes. With this high byte count and the default queue depth, this phase should test the streaming capability (if supported) of the tape unit.
- **Random**—This test is performed for the remaining two-thirds of the selected record count. It consists of write operations with random byte counts. Intermixed is the sequence *write, reposition back one record, read*. This sequence is performed three times in a row. Tape mark writing is intermixed in the test.

The write pass is complete when the selected record count is reached, or if the end of tape (EOT) is reached. The tape is rewound and the read pass is started.

The read pass consists of the following three phases:

- **Data Intensive**—Consists of read operations of fixed record sizes with a byte count equal to the expected tape record byte count. When tape marks are encountered, forward position commands are issued.
- **Random**—Begins at the point where random sized records were written to the tape. Most read operations are issued with a byte count equal to the expected tape record byte count. Occasionally, read operations will be intermixed with a byte count less than or greater than the expected tape

record byte count. When tape marks are encountered, forward position commands are issued.

- **Position Intensive**—Begins halfway down from the start of the area where random sized records are located. In the Position Intensive phase, read operations and position commands are intermixed so that the test gradually proceeds toward the EOT. When tape marks are encountered, forward position commands are issued.

In all phases, if the EOT is detected, the tape is rewound to the beginning of tape (BOT), and the write pass is again entered.

6.3.3.2 User-Defined Test—TILX

CAUTION

The User-Defined test must be run *only* by very knowledgeable personnel. Otherwise, customer data can be destroyed.

When you select the TILX User-Defined test, TILX prompts you for input to define the test. You can define up to 20 I/O commands. TILX issues the command sequence until the selected time limit is reached. You can define the following values for each command:

- The I/O command operation (write, read, reposition record, reposition file, write tape mark, rewind, quit. Note that quit is not a command; instead it indicates to TILX that you have finished defining the test).
- The number of times to repeat the command. (Applies only to write, read, and write tape mark.)
- The number of records or file marks to reposition.
- The data pattern to use.
- The direction of reposition operation (toward EOT or BOT).
- The size of the I/O in bytes.
- The TMSCP command modifiers.

6.3.3.3 Read Only Test—TILX

The Read Only test should only be used to verify that a tape is readable. The Read Only test reads records until the EOT or the selected record count is reached. At that point, the tape is rewound and another read pass proceeds. Tape marks are ignored. This test will most likely issue read operations with incorrect record sizes. If there are record size mismatches, they will be ignored. All other errors will be recorded.

6.3.4 TILX Test Definition Questions

The following section lists the questions that TILX asks to collect the parameters needed to perform a TILX test. Each of the following sections discusses specific TILX questions. The test questions are listed in the approximate order that they are displayed on your terminal. These questions prompt you to define the runtime parameters for TILX.

Note

Defaults for each question are given inside brackets [ ]. If you press the Return key as a response to a question, the default is used as the response.

Use all defaults (y/n) [y] ?

Explanation: Enter ''Y'' to run the test in read-only mode and use the defaults for TILX. Enter ''N'' to enter values for all options. TILX uses the following defaults for all units selected for testing:

- Execution time limit is 10 minutes.
- Performance summary interval is 10 minutes.
- Displaying performance statistics is disabled.

Note

This does not include total I/O requests.

- Displaying hard/soft EIPs and end messages is disabled.
- Hard error limit is 65535. Testing will stop if the limit is reached.
- Hex dump of extended error log information is disabled.
- I/O queue depth is 4. A maximum of 4 I/Os will be outstanding at one time.
- The selected test is identical to the Basic Function test.
- The record count is 4096.
- All data patterns are used.
- Data compares are disabled.

Enter execution time limit in minutes (1:65535) [10] ?

Explanation: Enter the desired time you want TILX to run. The default run time is 10 minutes.

Enter performance summary interval in minutes (1:65535) [10] ?

Explanation: Enter a value to set the interval for which a performance summary is displayed. The default is 10 minutes.

Include performance statistics in performance summary (y/n) [n] ?

Explanation: Enter ''Y'' to see a performance summary that includes the performance statistics that include the total count of read and write I/O requests and the kilobytes transferred for each command. Enter ''N'' and no performance statistics are displayed.

Display hard/soft errors (y/n) [n] ?

Explanation: Enter ''Y'' to enable error reporting, including end messages and EIPs. Enter ''N'' to disable error reporting, including end messages and EIPs. The default is disabled error reporting.

Display hex dump of Event Information Packet requester specific information(y/n) [n] ?

Explanation: Enter ''Y'' to enable the hex dump display of the requester specific information contained in the EIP. Enter ''N'' to disable the hex dump.

When the hard error limit is reached, the unit will be dropped from testing. Enter hard error limit (1:65535) [65535] ?

Explanation: Enter a value to specify the hard error limit for all units to test. This question is used to obtain the hard error limit for *all* units under test. If the hard error limit is reached, TILX discontinues testing the unit that reaches the hard error limit. If other units are currently being tested by TILX, testing continues for those units.

When the soft error limit is reached, soft errors will no longer be displayed but testing will continue for the unit. Enter soft error limit (1:65535) [32] ?

Explanation: Enter a value to specify the soft error limit for all units under test. If the soft error limit is reached for a unit under test, soft error reporting is disabled for that unit only. However, testing continues for that unit.

Enter IO queue depth (1:20) [4] ?

Explanation: Enter the maximum number of outstanding I/Os for each unit selected for testing. The default is 4.

Enter unit number to be tested ?

Explanation: Enter the unit number for the (tape drive) unit to be tested.

Note

When TILX asks for the unit number, it requires the actual number of the tape, where T177 would be specified as unit number 177.

Is a tape loaded and ready, answer Yes when ready ?

Explanation: This question is self explanatory.

Select another unit (y/n) [n] ?

Explanation: Enter ''Y'' to select another unit to test. Enter ''N'' to begin testing the units selected. The system will display the following test selections:

```
*** Available tests are:
    1.  Basic Function
    2.  User Defined Test
    3.  Read Only

Use the Basic Function test 99.9% of the time. The User-Defined test
is for special problems only.
```

Enter test number (1:3) [1] ?

Explanation: This question allows you to pick which TILX test you want to run on all selected units. The following questions define the TILX tests.

Enter data pattern number 0=all, 19=user_defined, (0:19) [0] ?

Explanation: The TILX data patterns are used in write commands. This question is displayed for the Basic Function and User-Defined tests. There are 18 unique data patterns from which to select. These patterns were carefully selected as worst case or most likely to produce errors for tapes connected to the controller. (See Table 6–5 for a list of the data patterns.) The default uses all 18 patterns in a random method. This question also allows you to create a unique data pattern of your choice.

Enter record count (1:4294967295) [4096] ?

Explanation: Enter the number of records to write to the tape.

Note

The record count does not include tape marks that are intermixed with the records written to the tape in the Basic Function test.

Enter the 8-digit hexadecimal user defined data pattern [ ] ?

Explanation: This question is only displayed if you choose to use a User-Defined data pattern for write commands. The data pattern is represented in a longword and can be specified with eight hexadecimal digits.

Perform data compare (y/n) [n] ?

Explanation: Enter ''Y'' to enable the compare modifier bit with the read and write commands. This question only applies to the Basic Function test. If the compare modifier is set on write commands, the data is written to the tape. The data is then read from the tape and compared against the corresponding TILX buffers. On read commands, the data is read from the tape into the TILX buffers, read again, and then compared against the corresponding TILX buffers. If a discrepancy is found, an error is reported. Enter ''N'' and the compare modifier bit is disabled. The default is to have the bit disabled.

Enter compare percentage (1:100) [2] ?

Explanation: This question is displayed only if you choose to perform data compares. It allows you to enter the percentage of read and write commands that will have a data compare operation performed.

Enter command number *x* (red, wrt, rew, wtm, rpr, rpf, quit) [ ] ?

Explanation: This question only applies to the User-Defined test. It allows you to define command *x* as a read, write, rewind, write tape mark, reposition records, or reposition file marks. Enter quit to finish defining the test.

Reposition towards EOT (y=EOT/n=BOT) [y] ?

Explanation: If you specify the reposition records or reposition file marks command in the User-Defined test, this question is displayed. Enter the direction of the reposition operation you want, either towards the end of tape (EOT) or at the beginning of tape (BOT).

Enter number of records to reposition (1:255) [1] ?

Explanation: If you specify the reposition records command in the User-Defined test, this question is displayed. The question is self explanatory.

Enter number of tape marks to reposition (1:255) [1] ?

Explanation: If you specify the reposition file marks command in the User-Defined test, this question is displayed. The question is self explanatory.

Enter IO size in bytes (1,65535) [ ] ?

Explanation: This question is only asked in the User-Defined test for read or write commands. The question is self explanatory.

Enter in HEX, the TMSCP Command Modifiers [0] ?

Explanation: This question only applies to the User-Defined test. It allows you to specify the TMSCP command modifiers. You *must* understand the meaning of the TMSCP command modifiers before entering any value other than the default. Contact Digital Multivendor Customer Services if you wish to use other than default values.

Reuse Parameters (stop, continue, restart, change_unit) [stop] ?

Explanation: This question is displayed after the TILX execution time limit expires after the hard error limit is reached for every unit under test, or after you enter Ctrl/C. The options are as follow:

- **Stop**—TILX terminates normally.
- **Continue**—TILX resumes execution without resetting the remaining TILX execution time or any performance statistics. If the TILX execution time limit has expired, or all units have reached their hard error limit, TILX terminates.
- **Restart**—TILX resets all performance statistics and restarts execution so that the test will perform exactly as the test that just completed.
- **Change_unit**—If you select this option, TILX allows you to drop a unit from testing and add a unit to testing. For each unit dropped, another unit must be added until all units in the configuration have been tested. The unit chosen will be tested with the same parameters chosen for the unit that was dropped from testing. When you have completed adding and dropping units, all performance statistics are initialized and TILX execution resumes with the same parameters as the last run.

Drop unit #*x* (y/n) [n] ?

Explanation: This question is displayed if you choose to change a unit as an answer to the ''reuse parameters'' question. It is asked for every unit that was tested. After entering ''Y,'' you are prompted for the unit number. Enter the unit number to drop from testing. Enter ''N'' if you do not wish to drop a unit from testing.

Note

For each unit dropped from testing, one must be added.

6.3.5 TILX Output Messages

The following message is displayed when TILX is started:

```
Tape Inline Exerciser - Version 2.5
```

This message identifies the internal program as TILX and gives the TILX software version number.

TILX - Normal Termination.

Explanation: This message is displayed when TILX terminates under normal conditions.

Insufficient resources.

Explanation: Following this line is a second line that gives more information about the problem, which could be one of the following messages:

- Unable to allocate memory.

  TILX was unable to allocate the memory needed to perform TILX tests. You should run TILX again but choose a lower queue depth and/or choose fewer units to test.

- Cannot perform tests.

  TILX was unable to allocate all of the resources needed to perform TILX tests. You should run TILX again but choose a lower queue depth and/or choose fewer units to test.

- Unable to change operation mode to maintenance.

  TILX tried to change the operation mode from normal to maintenance using the SYSAP$CHANGE_STATE( ) routine, but was not successful due to insufficient resources. This problem should not occur. If it does occur, submit an error report. Then reset the controller.

Tape unit *x* does not exist.

Explanation: An attempt was made to allocate a unit for testing that does not exist on the controller.

Unit *x* successfully allocated for testing.

Explanation: All processes that TILX performs to allocate a unit for testing have been completed. The unit is ready for TILX testing.

Unable to allocate unit.

Explanation: This message should be preceded by a reason why the unit could not be allocated for TILX testing.

Cannot enable eip notification.

Explanation: This message indicates that TILX was not successful in enabling EIP notification. This should only occur if another copy of TILX is running. Wait for the first copy to finish or terminate the second copy. If there are no copies of TILX running, submit a CLD (error report) and restart the controller.

TILX detected error, code *x*.

Explanation: The ‘‘normal’’ way TILX recognizes an error on a unit is through the reception of an EIP, which loosely corresponds to an error log. However, there are some errors that TILX will detect without the reception of an EIP. These errors are as follow:

- Illegal Data Pattern Number found in data pattern header. Unit *x*.

  This is code 1. TILX read data from the tape unit and found that the data was not in a pattern that TILX previously wrote to the tape.

- No write buffers correspond to data pattern. Unit *x*.

  This is code 2. TILX read a legal data pattern from the tape at a place where TILX wrote to the tape, but TILX does not have any write buffers that correspond to the data pattern. Thus, the data has been corrupted.

- Read data do not match what TILX thought was written to the media.

  This is code 3. TILX writes data to the tape and then reads it and compares it against what TILX thought it wrote to the tape. This indicates a compare failure. More information is displayed to indicate where in the data buffer the compare operation failed and what the data was and should have been.

- TILX/Tape record size mismatch.

  This is code 4. This error would only be detected on a read pass. Because TILX knows what was written to the tape, TILX expects to encounter the records (of different sizes), tape marks, and the EOT in exactly the same positions as previously written. This error most likely means that the tape unit has a positioning problem.

- A tape mark was detected in a place not expected by TILX.

  This is code 5. This error would only be detected on a read pass. Because TILX knows what was written to the tape, TILX expects to encounter the records, tape marks, and the EOT in exactly the same positions as previously written. This error most likely means that the tape unit has a positioning problem.

- Record Data Truncated not generated.

  This is code 6. This error would only be detected on a read pass. Occasionally, TILX issues a read with a byte count less than what TILX knows was written to the current tape record. Thus, TILX would expect to receive a Record Data Truncated status. If TILX does not receive the Record Data Truncated status when expected, this TILX detected error is reported.

- EOT encountered in unexpected position.

  This is code 7. This error would only be detected on a read pass. Because TILX knows what was written to the tape, TILX expects to encounter the records, tape marks, and the EOT in exactly the same positions as previously written. This error most likely means that the tape unit has a positioning problem.

TILX terminated. A termination, a print summary or a reuse parameters request was received but TILX is currently not testing any units.

Explanation: Ctrl/Y (termination request), Ctrl/G (print summary request), or Ctrl/C (reuse parameters request) was entered before TILX started to test units. TILX cannot satisfy the second two requests, so TILX treats all of these requests as a termination request.

TILX will not change the state of a unit if it is not NORMAL.

Explanation: TILX cannot allocate the unit for testing, because it is already in Maintenance mode. (Maintenance mode can only be invoked by the firmware. If another TILX session is in use, the unit is considered in Maintenance mode.)

Unit is not available - if you dismount the unit from the host, it may correct this problem.

Explanation: The unit has been placed online by another user (or host) or the media is not present.

Soft error reporting disabled. Unit *x*.

Explanation: This message indicates that the soft error limit has been reached and that no more soft errors will be printed for this unit.

Hard error limit reached, unit *x* dropped from testing.

Explanation: This message indicates that the hard error limit has been reached and the unit must be dropped from testing.

Soft error reporting disabled for controller errors.

Explanation: This message indicates that the soft error limit has been reached for controller errors. Controller soft error reporting is disabled.

Hard error limit reached for controller errors.
All units dropped from testing.

Explanation: This message is self explanatory.

Unit is already allocated for testing.

Explanation: This message is self explanatory.

No drives selected.

Explanation: TILX parameter collection was exited without choosing any units to test.

Maximum number of units are now configured.

Explanation: This message is self explanatory. (Testing will start after this message is displayed.)

Unit is write protected.

Explanation: The user wants to test a unit with write and/or erase commands enabled but the unit is write protected.

The unit status and/or the unit device type has changed unexpectedly.
Unit *x* dropped from testing.

Explanation: The unit status may change if the unit experienced hard errors or if the unit is disconnected. Either way, TILX cannot continue testing the unit.

Last Failure Information follows. This error, was NOT produced by running TILX. It represents the reason why the controller crashed on the previous controller run.

Explanation: This message may be displayed while allocating a unit for testing. It does not indicate any reason why the unit is or is not successfully allocated, but rather represents the reason why the controller went down in the previous run. The information that follows this message is the contents of an EIP.

Tape unit numbers on this controller include:

Explanation: After this message is displayed, a list of tape unit numbers on the controller is displayed.

IO to unit *x* has timed out. TILX aborting.

Explanation: One of the TILX I/Os to this unit did not complete within the command timeout interval and when examined, was found not progressing. This indicates a failing controller.

TILX terminated prematurely by user request.

Explanation: Ctrl/Y was entered. TILX interprets this as a request to terminate. This message is then displayed and TILX terminates.

Unit is owned by another sysap.

Explanation: TILX could not allocate the unit specified, because the unit is currently allocated by another system application. Terminate the other system application or reset the controller.

Exclusive access is declared for this unit.

Explanation: The unit could not be allocated for testing, because exclusive access has been declared for the unit.

The other controller has exclusive access declared for this unit.

Explanation: This message is self explanatory.

This unit is marked inoperative.

Explanation: The unit could not be allocated for testing, because the controller internal tables have the unit marked as inoperative.

The unit does not have any media present.

Explanation: The unit could not be allocated for testing, because no media is present.

The RUNSTOP_SWITCH is set to RUN_DISABLED.

Explanation: The unit could not be allocated for testing, because the RUNSTOP_SWITCH is set to RUN_DISABLED. This is enabled and disabled through the Command Line Interpreter (CLI).

Unable to continue, run time expired.

Explanation: A continue response was given to the ‘‘reuse parameters’’ question. This is not a valid response if the run time has expired. Reinvoke TILX.

When TILX starts to exercise the tape units, the following is displayed with the current time of day:

```
TILX testing started at: xx:xx:xx
    Test will run for x minutes
    Type ^T(if running TILX through a VCS) or ^G(in all other cases)
      to get a current performance summary
    Type ^C to terminate the TILX test prematurely
    Type ^Y to terminate TILX prematurely
```

6.3.6 TILX End Message Display

The Value Added Status field corresponds to the TMSCP end message status. Example 6–9 is an example of a TILX end message display.

Example 6–9 TILX End Message Display

```
Bad Value Added Completion Status for unit x, End message in hex

      Event Code                  x
      Op Code                     x
      Cmd Ref Number              x
      End Flags                   x
      Host Xfer Byte Count        x
      Tape Rec Byte Count         x
      Tape Position               x
      Sequence Number             x
```

6.3.7 TILX Error Information Packet Displays

Contact Digital Multivendor Customer Services for assistance in deciphering the EIP fields.

A TILX EIP display may or may not include a hex dump of the Requestor Specific Data. This is an option you can select for TILX selectable parameters.

The EIP will be in one of the following formats that corresponds to MSCP error log formats:

- Controller Error
- Memory Error
- Tape Error

Examples 6–10 through 6–12 are samples of each display. Each display includes the optional requestor specific information. In all cases, the Instance code, template type, and all requestor specific information correspond to event (error) log device dependent parameters, while everything else has a one-to-one correspondence to error log fields. See Appendixes C and D for a translation of these codes.

Example 6–10 Controller Error

```
Error Information Packet in hex

      Cmd Ref Number       x
      Unit Number          x
      Log Sequence         x
      Format               x
      Flags                x
      Event Code           x
      Controller ID        x
      Controller SW ver    x
      Controller HW ver    x
      Multi Unit Code      x
      Instance                    x
      Template Type               x
      Requestor Information Size  x
      Requestor Specific Data bytes 0 7   xx xx xx xx xx xx xx xx
      Requestor Specific Data bytes 8 15   xx xx xx xx xx xx xx xx
        :
        :
      Requestor Specific Data bytes xx xx   xx xx xx xx xx xx xx xx
```

Example 6–11 Memory Error

```
Error Information Packet in hex

      Cmd Ref Number       x
      Unit Number          x
      Log Sequence         x
      Format               x
      Flags                x
      Event Code           x
      Controller ID        x
      Controller SW ver    x
      Controller HW ver    x
      Multi Unit Code      x
      Memory Address       x
      Instance                    x
      Template Type               x
      Requestor Information Size  x
      Requestor Specific Data bytes 0 7   xx xx xx xx xx xx xx xx
      Requestor Specific Data bytes 8 15   xx xx xx xx xx xx xx xx
        :
        :
      Requestor Specific Data bytes xx xx   xx xx xx xx xx xx xx xx
```

Example 6–12 Tape Error

```
Error Information Packet in hex

      Cmd Ref Number       x
      Unit Number          x
      Log Sequence         x
      Format               x
      Flags                x
      Event Code           x
      Controller ID        x
      Controller SW ver    x
      Controller HW ver    x
      Multi Unit Code      x
      Unit ID[0]           x
      Unit ID[1]           x
      Unit Software Rev    x
      Unit Hardware Rev    x
      Recovery Level       x
      Retry Count          x
      Position             x
      Formatter SW version x
      Formatter HW version x
      Instance                    x
      Template Type               x
      Requestor Information Size  x
      Requestor Specific Data bytes 0 7   xx xx xx xx xx xx xx xx
      Requestor Specific Data bytes 8 15   xx xx xx xx xx xx xx xx
        :
        :
      Requestor Specific Data bytes xx xx   xx xx xx xx xx xx xx xx
```

6.3.8 TILX Data Patterns

Table 6–5 defines the data patterns used with the TILX Basic Function or User-Defined tests. There are 18 unique data patterns. These data patterns were selected as worst case, or the ones most likely to produce errors on tapes connected to the controller.

Table 6–5 TILX Data Pattern Definitions

Pattern Number	Pattern in Hexadecimal Numbers
1	0000
2	8B8B
3	3333
4	3091
5, shifting 1s	0001, 0003, 0007, 000F, 001F, 003F, 007F, 00FF, 01FF, 03FF, 07FF, 0FFF, 1FFF, 3FFF, 7FFF
6, shifting 0s	FIE, FFFC, FFFC, FFFC, FFE0, FFE0, FFE0, FFE0, FE00, FC00, F800, F000, E000, C000, 8000, 0000
7, alternating 1s, 0s	0000, 0000, 0000, FFFF, FFFF, FFFF, 0000, 0000, FFFF, FFFF, 0000, FFFF, 0000, FFFF, 0000, FFFF
8	B6D9
9	5555, 5555, 5555, AAAA, AAAA, AAAA, 5555, 5555, AAAA, AAAA, 5555, AAAA, 5555, AAAA, 5555, AAAA, 5555
10	DB6C
11	2D2D, 2D2D, 2D2D, D2D2, D2D2, D2D2, 2D2D, 2D2D, D2D2, D2D2, 2D2D, D2D2, 2D2D, D2D2, 2D2D, D2D2
12	6DB6
13, ripple 1	0001, 0002, 0004, 0008, 0010, 0020, 0040, 0080, 0100, 0200, 0400, 0800, 1000, 2000, 4000, 8000
14, ripple 0	FIE, FFFD, FFFB, FFF7, FFEF, FFDF, FFBF, FF7F, FEFF, FDFF, FBFF, F7FF, EFFF, BFFF, DFFF, 7FFF
15	DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D
16	3333, 3333, 3333, 1999, 9999, 9999, B6D9, B6D9, B6D9, B6D9, FFFF, FFFF, 0000, 0000, DB6C, DB6C
17	9999, 1999, 699C, E99C, 9921, 9921, 1921, 699C, 699C, 0747, 0747, 0747, 699C, E99C, 9999, 9999
18	FFFF
Default–Use all of the above patterns in a random method	

6.3.9 TILX Examples

This sections provides some TILX examples with different options chosen.

6.3.9.1 TILX Example—Using All Defaults

In Example 6–13, TILX is run using all defaults. This is a semi-extensive test even though the test only runs for 10 minutes. The only function not performed is data compares. Data compares are a time consuming operation with tapes. TILX is invoked from a maintenance terminal.

CAUTION

Do not run TILX using tapes that contain customer data. This test will write to the tape and destroy any data that exists on the tape.

Example 6–13 Using All Defaults—TILX

```
CLI> SHOW TAPE
Name          Type          Port Targ  LUN                    Used by
------------------------------------------------------------------------------

TAPE500       tape             5    0    0                    T50
TAPE520       tape             5    2    0                    T52

CLI> RUN TILX

Tape Inline Exerciser - Version 2.5

Use all defaults (y/n) [y] ?
Tape unit numbers on this controller include:
    50
    52
Enter unit number to be tested ? 50
Is a tape loaded and ready, answer Yes when ready ? Y
Unit 50 successfully allocated for testing
Select another unit (y/n) [n] ? Y
Enter unit number to be tested ? 52
Is a tape loaded and ready, answer Yes when ready ? Y
Unit 52 successfully allocated for testing
Maximum number of units are now configured

   TILX testing started at: 13-JAN-1993 04:35:08
    Test will run for 10 minutes
    Type ^T(if running TILX through VCS) or ^G(in all other cases)
      to get a current performance summary
    Type ^C to terminate the TILX test prematurely
    Type ^Y to terminate TILX prematurely

   TILX Summary at 13-JAN-1993 04:36:24
   Test minutes remaining: 9, expired: 1

Unit 50   Total IO Requests 868
  No errors detected
Unit 52   Total IO Requests 860
  No errors detected
Reuse Parameters (stop, continue, restart, change_unit) [stop] ?

TILX - Normal Termination
CLI>
```

6.3.9.2 TILX Example—Using All Functions

In Example 6–14, TILX is run using all functions and using a longer run time and higher record count than the default. The performance statistics and a performance summary are displayed every 15 minutes. TILX is invoked from a maintenance terminal. This is an extensive test.

Example 6–14 Using All Functions—TILX

```
CLI> RUN TILX

Tape Inline Exerciser - Version 2.5
Enter TILX hex debug flags (0:ffff) [0] ?
```

(continued on next page)

Example 6–14 (Cont.) Using All Functions—TILX

```
Use all defaults (y/n) [y] ? N
Enter execution time limit in minutes (10:65535) [10] ?
Enter performance summary interval in minutes (1:65535) [10] ?
Include performance statistics in performance summary (y/n) [n] ? Y
Display hard/soft errors (y/n) [n] ? Y
Display hex dump of Error Information Packet requester specific
information (y/n) [n] ? Y
When the hard error limit is reached, the unit will be dropped from testing.
Enter hard error limit (1:65535) [32] ?
When the soft error limit is reached, soft errors will no longer be
displayed but testing will continue for the unit.
Enter soft error limit (1:65535) [32] ?
Enter IO queue depth (1:20) [4] ? 6
Suppress caching (y,n) [n] ?
  *** Available tests are:
    1. Basic Function
    2. User Defined
    3. Read Only

Use the Basic Function test 99.9% of the time. The User Defined test
is for special problems only.
Enter test number (1:3) [1] ? 1
Enter data pattern number 0=ALL, 19=USER_DEFINED, (0:19) [0] ?
Enter record count (1:4294967295) [4096] ? 1000
Perform data compare (y/n) [n] ? Y
Enter compare percentage (1:100) [2] ? 1
Tape unit numbers on this controller include:
    50
    52
Enter unit number to be tested ? 50
Is a tape loaded and ready, answer Yes when ready ? Y
Unit 50 successfully allocated for testing
Select another unit (y/n) [n] ? Y
Enter unit number to be tested ? 52
Is a tape loaded and ready, answer Yes when ready ? Y
Unit 52 successfully allocated for testing
Maximum number of units are now configured

   TILX testing started at: 13-JAN-1993 04:38:15
    Test will run for 10 minutes
    Type ^T(if running TILX through VCS) or ^G(in all other cases)
      to get a current performance summary
    Type ^C to terminate the TILX test prematurely
    Type ^Y to terminate TILX prematurely

   TILX Summary at 13-JAN-1993 04:40:14
   Test minutes remaining: 9, expired: 1

Unit 50   Total IO Requests 724
  Read Count 3   Write Count 681   Reposition Count 3
  Total KB xfer 6718   Read 10   Write 6707
  No errors detected
Unit 52   Total IO Requests 731
  Read Count 3   Write Count 687   Reposition Count 3
  Total KB xfer 6743   Read 10   Write 6733
  No errors detected
Reuse Parameters (stop, continue, restart, change_unit) [stop] ?

TILX - Normal Termination
CLI>
```

6.3.10 Interpreting the TILX Performance Summaries

A TILX performance display is produced under the following conditions:

- When the user-selectable performance summary interval elapses
- When TILX terminates for any conditions except an abort
- When Ctrl/G is entered (or Ctrl/T when running from a VCS)

The performance display has different formats depending on whether performance statistics were requested in the user-specified parameters and if errors were detected.

The following is an example of a TILX performance display when performance statistics were not selected and when no errors were detected:

```
   TILX Summary at 18-JUN-1993 06:18:41
   Test minutes remaining: 0, expired: 6

Unit 1     Total IO Requests 482
  No errors detected
Unit 2     Total IO Requests 490
  No errors detected
```

The following is an example of a TILX performance display when performance statistics were selected and when no errors were detected:

```
   TILX Summary at 18-JUN-1993 06:18:41
   Test minutes remaining: 0, expired: 6

Unit 1     Total IO Requests 482
  Read Count   292   Write Count 168
  Access Count 21   Erase Count 0
  KB xfer   Read 7223   Write 4981   Total 12204
  No errors detected
```

The following is an example of a TILX performance display when performance statistics were not selected and when errors were detected:

```
     TILX Summary at 18-JUN-1993 06:18:41
     Test minutes remaining: 0, expired: 6

❶ Unit 10     Total IO Requests 153259
    No errors detected
❷ Unit 40     Total IO Requests 2161368
    Err in Hex: IC:031A4002  PTL:04/00/00  Key:04  ASC/Q:B0/00  HC:0  SC:1
    Total Errs   Hard Cnt 0   Soft Cnt 1
❸ Unit 55     Total IO Requests 2017193
    Err in Hex: IC:03094002  PTL:05/05/00  Key:01  ASC/Q:18/89  HC:0  SC:1
    Err in Hex: IC:03094002  PTL:05/05/00  Key:01  ASC/Q:18/86  HC:0  SC:1
    Total Errs   Hard Cnt 0   Soft Cnt 2
```

where:

❶ Represents the unit number and the total I/O requests to this unit.

❷ Represents the unit number and total I/O requests to this unit.

All values for the following codes are described in Appendixes C and D. This also includes the items associated with this error and the total number of hard and soft errors for this unit:

- The HSJ-/HSD-series Instance code (in hex)
- The port/target/LUN (PTL)

- The SCSI Sense (Key)
- The SCSI ASC and ASQ (ASC/Q) codes
- The hard and soft count for this error

❸ Represents information about the first two unique errors for this unit.

All values for the following codes are described in Appendixes C and D. This also includes the items associated with this error and the total number of hard and soft errors for this unit:

- The HSJ-/HSD-series Instance code (in hex)
- The port/target/LUN (PTL)
- The SCSI Sense (Key)
- The SCSI ASC and ASQ (ASC/Q) codes
- The hard and soft count for this error

A line of this format may be displayed up to three times in a performance summary. There would be a line for each unique error reported to TILX for this unit, up to three errors.

The following is an example of a TILX performance display when performance statistics were not selected and when a controller error error was detected:

```
   TILX Summary at 18-JUN-1993 06:18:41
   Test minutes remaining: 0, expired: 6

Cnt err in HEX  IC:07080064  Key:06  ASC/Q:A0/05  HC:1  SC:0
  Total Cntrl Errs   Hard Cnt 1   Soft Cnt 0

Unit 1     Serial Number 1   Total IO Requests 482
  No errors detected
Unit 2     Serial Number 2   Total IO Requests 490
  No errors detected
```

The performance displays contain error information on up to three unique errors. Note that hard errors always have precedence over soft errors. A soft error represented in one display may be replaced with information on a hard error in subsequent performance displays.

6.3.11 TILX Abort Codes

Table 6–6 list TILX abort codes and definitions.

Table 6–6 TILX Abort Codes and Definitions

Value	Definition
1	An I/O has timed out.
2	A HTB was not available to issue an IO when it should have been.
3	FAO returned either FAO_BAD_FORMAT or FAO_OVERFLOW.
4	TS$SEND_TERMINAL_DATA returned either an ABORTED or INVALID_BYTE_COUNT.
5	TS$READ_TERMINAL_DATA returned either an ABORTED or INVALID_BYTE_COUNT.
6	A timer is in an unexpected expired state that prevents it from being started.
7	The semaphore was set after a oneshot I/O was issued but nothing was found in the received HTB que.
8	A termination or a print summary or a reuse parameters request was received when TILX was not testing any units.
9	User requested abort via Ctrl/Y.

6.3.12 TILX Error Codes

Table 6–7 lists TILX defined error codes and definitions for TILX-detected errors.

Table 6–7 TILX Abort Codes and Definitions

Value	Definition
1	Illegal Data Pattern Number found in data pattern header.
2	No write buffers correspond to data pattern.
3	Read data do not match write buffer.
4	TILX/TAPE record size mismatch.
5	A tape mark was detected in a place where it was not expected.
7	EOT encountered in unexpected position.

6.4 Disk Inline Exerciser (HSZ-Series)

Note

The information on DILX for the HSZ-series controllers is presented separately because the messages and performance summaries differ from those of the HSJ- and HSD-series controllers.

DILX is a diagnostic tool used to exercise the data transfer capabilities of selected disks connected to an HSZ-series controller. DILX exercises disks in a way that simulates a high level of user activity. Using DILX, you can read from all customer-available data areas, and write to all single-device units. Thus, DILX can be used to determine the health of a controller and the disks connected to it and to acquire performance statistics. You can run DILX from a maintenance terminal.

DILX allows for autoconfiguring of drives. This allows for quick configuring and testing of all units at once. Please be aware that *customer data will be lost* by running this test. Digital recommends only using the Auto-Configure option during initial installations.

DILX performs read tests on logical units that may consist of storagesets of multiple physical devices. Error reports identify the logical units, not the physical devices. Therefore, if errors occur while running against a unit, its storageset must be reconfigured as individual devices, and then DILX run again against the individual devices. When run against individual devices, DILX performs both read and write tests.

There are no limitations on the number of units DILX may test at one time. However, Digital recommends only using DILX when no host activity is present. If you must run DILX during a live host connection, you should limit your testing to no more than half of any controller's units at one time. This conserves controller resources and minimizes performance degradation on the live units you are not testing.

6.4.1 Invoking DILX

To invoke DILX from a maintenance terminal, enter the following command at the CLI> prompt:

```
CLI> RUN DILX
```

6.4.2 Interrupting DILX Execution

Use the following guidelines to interrupt DILX execution.

Note

The symbol ''^'' is equivalent to the Ctrl key. You must press and hold the Ctrl key and type the character key given.

- Ctrl/G or Ctrl/T causes DILX to produce a performance summary. DILX continues normal execution without affecting the runtime parameters.
- Ctrl/C causes DILX to produce a performance summary, stop testing, and ask the ''reuse parameters'' question.

- Ctrl/Y causes DILX to abort. The ‘‘reuse parameters’’ question is not asked.

6.4.3 DILX Tests

There are two DILX tests, as follow:

- The Basic Function test
- The User-Defined test

6.4.3.1 Basic Function Test—DILX

The Basic Function test for DILX executes in two or three phases. The three phases are as follow:

- **Initial Write Pass**—Is the only optional phase and is always executed first (if selected). The initial write pass writes the selected data patterns to the entire specified data space or until the DILX execution time limit has been reached. Once the initial write pass has completed, it is not reexecuted no matter how long the DILX execution time is set. The other phases are reexecuted on a 10-minute cycle.
- **Random I/O**—Simulates typical I/O activity with random transfers from one byte to the maximum size I/O possible with the memory constraints DILX runs under. Note that the length of all I/Os is in bytes and is evenly divisible by the sector size (512 bytes).

  Read and write (if enabled) commands are issued using random logical block numbers (LBNs). In the read/write mode, DILX issues the read and write commands in the ratio specified previously under read/write ratio. When read-only mode is chosen, only read commands are issued.

  If compare operations are enabled, they are performed on read commands using DILX internal checks. The percentage of compares to perform can be specified. This phase is executed 80 percent of the time. It is the first phase executed after the initial write pass has completed. It is reexecuted at 10-minute intervals with each cycle lasting approximately 8 minutes.

  Intervals are broken down into different cycles. The interval is repeated until the user-selected time interval expires.

```
<--------------------------------10 min---------------------------------->
<-----------------8 min Random I/O---------------><--2 min Data Inten--->
```

- **Data Intensive**—Designed to test disk throughput by selecting a starting LBN and repeating transfers to the next sequential LBN that has not been accessed by the previous I/O. The transfer size of each I/O equals the maximum sized I/O that is possible with the memory constraints DILX must run under. This phase continues performing spiraling I/O to sequential tracks. Read and write commands are issued in read/write mode. This phase is executed 20 percent of the time after the initial write pass has completed. This phase always executes after the random I/O phase. It is reexecuted at 10-minute intervals with each cycle approximately 2 minutes.

6.4.3.2 User-Defined Test—DILX

CAUTION

The User-Defined test must be run *only* by very knowledgeable personnel. Otherwise, customer data can be destroyed.

When this test is selected, DILX prompts you for input to define a specific test. In the DILX User-Defined test, a total of 20 or fewer I/O commands can be defined. Once all of the commands are issued, DILX issues the commands again in the same sequence. This is repeated until the selected time limit is reached. As you build the test, DILX collects the following information from you for each command:

- The I/O command name (write, read, or quit). Quit is not a command; instead it indicates to DILX that you have finished defining the test.
- The starting logical block number (LBN).
- The size of the I/O in 512 byte blocks.

6.4.4 DILX Test Definition Questions

The following text is displayed when running DILX. The text includes questions that are listed in the approximate order that they are displayed on your terminal. These questions prompt you to define the runtime parameters for DILX.

Note

Defaults for each question are given inside [ ]. If you press the Return key as a response to a question, the default is used as the response.

After DILX has been started, the following message and prompt is displayed:

```
It is recommended that DILX only be run when there is no host activity
present on the HSZ-series controller. Do you want to continue (y/n) [n] ?
```

The following message describing the Auto-Configure option is displayed:

```
The Auto-Configure option will automatically select, for testing, half
or all of the disk units configured.  It will perform a very thorough test
with *WRITES* enabled.  Only disk units with a single physical
device will be tested.  The user will only be able to select the run time
and performance summary options and whether to test a half or
full configuration. The user will not be able to specify specific
units to test. The Auto-Configure option is only recommended for
initial installations.
```

Do you wish to perform an Auto-Configure (y/n) [n] ?

Explanation: Enter ''Y'' if you wish to invoke the Auto-Configure option.

After the Auto-Configure option is selected, DILX will display the following caution statement:

```
 **CAUTION**
All data on the Auto-Configured disks will be destroyed. You *MUST* be sure
of yourself.
```

Are you sure you want to continue (y/n) [n] ?

Explanation: This question is self explanatory.

Use All Defaults and Run in Read Only Mode (y/n)[y]?

Explanation: Enter ''Y'' to use the defaults for DILX, run in read-only mode, and most of the other DILX questions are not asked. Enter ''N'' and the defaults are not used. You must then answer each question as it is displayed. The following defaults are assumed for all units selected for testing:

- Execution time limit is 10 minutes.
- Performance summary interval is 10 minutes.
- Displaying sense data for hard or soft errors is disabled.
- The hard error limit is 65535. Testing will stop if the limit is reached.
- The I/O queue depth is 4. A maximum of 4 I/Os will be outstanding at any time.
- The selected test is identical to the Basic Function test.
- Read-only mode.
- All user available LBNs are available for testing.
- Data compares are disabled.

Enter the execution time limit in minutes (1:65535)[10]?

Explanation: Enter the desired time you want DILX to run. The default run time is 10 minutes.

Enter performance summary interval in minutes (1:65535)[10]?

Explanation: Enter a value to set the interval for which a performance summary is displayed. The default is 10 minutes.

Include performance statistics in performance summary (y/n)[n]?

Explanation: Enter ''Y'' to see a performance summary that includes the performance statistics that include the total count of read and write I/O requests and the kilobytes transferred for each command type. Enter ''N'' and no performance statistics are displayed.

Display hard/soft errors (y/n)[n]?

Explanation: Enter ''Y'' to enable displays of sense data and deferred errors. Enter ''N'' to disable error reporting. The default is disabled error reporting.

When the hard error limit is reached, the unit will be dropped from testing.
Enter hard error limit (1:65535) [65535] ?

Explanation: Enter a value to specify the hard error limit for all units to test. This question is used to obtain the hard error limit for *all* units under test. If the hard error limit is reached, DILX discontinues testing the unit that reaches the hard error limit. If other units are currently being tested by DILX, testing continues for those units.

When the soft error limit is reached, soft errors will no longer be displayed but testing will continue for the unit. Enter soft error limit (1:65535) [32] ?

Explanation: Enter a value to specify the soft error limit for *all* units under test. When the soft error limit is reached, soft errors are no longer displayed, but testing continues for the unit.

Enter IO queue depth (1:12) [4]?

Explanation: Enter the maximum number of outstanding I/Os for each unit selected for testing. The default is 4.

Enter unit number to be tested?

Explanation: Enter the unit number for the unit to be tested.

Note

When DILX asks for the unit number, it requires the number designator for the disk, where D117 would be specified as unit number 117.

Unit *x* will be write enabled.
Do you still wish to add this unit (y/n) [n]?

Explanation: This is a reminder of the consequences of testing a unit while it is write enabled. This is the last chance to back out of testing the displayed unit. Enter ''Y'' to write enable the unit. Enter ''N'' to back out of testing that unit.

Select another unit (y/n) [n]?

Explanation: Enter ''Y'' to select another unit for testing. Enter ''N'' to begin testing the units already selected. The system will display the following test selections:

```
***Available tests are:
1.   Basic Function
2.   User Defined Test

Use the Basic Function 99.9% of the time.  The User Defined
test is for special problems only.
```

Enter test number (1:2) [1]?

Explanation: Enter ''1'' for the Basic Function test or ''2'' for the User-Defined test. After selecting a test, the system will then display the following messages:

```
In the User-Defined test, you may define up to 20 commands.  They will be
executed in the order entered.  The commands will be repeated until the
execution time limit expires.

** CAUTION **
If you define write commands, user data will be destroyed.
```

Enter command number x (read, write, quit) [ ]?

Explanation: This question only applies to the User-Defined test. It allows you to define command *x* as a read or write command. Enter quit to finish defining the test.

After making your command selections, the following message is displayed by DILX:

```
* IMPORTANT *  If you answer yes to the next question, user data
WILL BE destroyed.
```

Write enable disk unit (y/n) [n] ?

Explanation: Enter ''Y'' to write enable the unit. Write commands are enabled for the currently selected test. Data within your selected LBN range will be destroyed. *Be sure of your actions before answering this question.* This question applies to all DILX tests. Enter ''N'' to enable read only mode, in which read and access commands are the only commands enabled.

Perform initial write (y/n) [n] ?

Explanation: Enter ''Y'' to write to the entire user-selected LBN range with the user-selected data patterns. Enter ''N'' for no initial write pass.

If you respond with ''Y,'' the system performs write operations starting at the lowest user-selected LBN and issues spiral I/Os with the largest byte count possible. This continues until the specified LBN range has been completely written. Upon completion of the initial write pass, normal functions of the Random I/O phase start. The advantage of selecting the initial write pass is that compare host data commands can then be issued and the data previously written to the media can be verified for accuracy. It makes sure that all LBNs within the selected range are accessed by DILX.

The disadvantage of using the initial write pass is that it may take a long time to complete, because a large LBN range was specified. You can bypass this by selecting a smaller LBN range, but this creates another disadvantage in that the entire disk space is not tested. The initial write pass only applies to the Basic Function test.

The write percentage will be set automatically.
Enter read percentage for random IO and data intensive phase (0:100) [67] ?

Explanation: This question is displayed if read/write mode is selected. It allows you to select the read/write ratio to use in the Random I/O and Data Intensive phases. The default read/write ratio is similar to the I/O ratio generated by a typical OpenVMS system.

Enter data pattern number 0=all, 19=user_defined, (0:19) [0] ?

Explanation: The DILX data patterns are used in write commands. This question is displayed when write operations are enabled for the Basic Function or User-Defined tests. There are 18 unique data patterns to select from. These patterns were carefully selected as worst case or most likely to produce errors for disks connected to the controller. (See Section 6.4.8 for a list of data patterns.) The default uses all 18 patterns in a random method. This question also allows you to create a unique data pattern of your own choice.

Enter the 8-digit hexadecimal user defined data pattern [ ] ?

Explanation: This question is only displayed if you choose to use a User-Defined data pattern for write commands. The data pattern is represented in a longword and can be specified with eight hexadecimal digits.

Enter start block number (0:highest_lbn_on_the_disk) [0] ?

Explanation: Enter the starting block number of the area on the disk you wish DILX to test. Zero is the default.

Enter end block number (starting_lbn:highest_lbn_on_the_disk) [highest_lbn_on_the_disk] ?

Explanation: Enter the highest block number of the area on the disk you wish DILX to test. The highest block number (of that type of disk) is the default.

Perform data compare (y/n) [n] ?

Explanation: Enter ''Y'' to enable data compares. Enter ''N'' and no data compare operations are done.

This question is only asked if you select the initial write option. Data compares are only performed on read operations. This option can be used to test data integrity.

Enter compare percentage (1:100) [5] ?

Explanation: This question is displayed only if you choose to perform data compares. This question allows you to change the percentage of read and write commands that will have a data compare operation performed. Enter a value indicating the compare percentage. The default is 5.

Enter command number x (read, write, quit) [ ] ?

Explanation: This question only applies to the User-Defined test. It allows you to define command *x* as a read, write, access, or erase command. Enter quit to finish defining the test.

Enter starting LBN for this command (0:highest_lbn_on_the_disk) [ ] ?

Explanation: This question only applies to the User-Defined test. It allows you to set the starting LBN for the command currently being defined. Enter the starting LBN for this command.

Enter the IO size in 512 byte blocks for this command (1:size_in_blocks) [ ] ?

Explanation: This question only applies to the User-Defined test. It allows you to set the I/O size in 512-byte blocks for the command currently being defined. Enter values indicating the I/O size for this command.

Reuse parameters (stop, continue, restart, change_unit) [stop] ?

Explanation: This question is displayed after the DILX execution time limit expires, after the hard error limit is reached for every unit under test, or after you enter Ctrl/C. These options are as follow:

- **Stop**—DILX terminates normally.
- **Continue**—DILX resumes execution without resetting the remaining DILX execution time or any performance statistics. If the DILX execution time limit has expired, or all units have reached their hard error limit, DILX terminates.

- **Restart**—DILX resets all performance statistics and restarts execution so that the test will perform exactly as the one that just completed. However, there is one exception. If the previous test was the Basic Function test with the initial write pass and the initial write pass completed, the initial write pass is not performed when the test is restarted.
- **Change_unit**—DILX allows you to drop or add units to testing. For each unit dropped, another unit must be added until all units in the configuration have been tested. The unit chosen will be tested with the same parameters that were used for the unit that was dropped from testing. When you have completed dropping and adding units, all performance statistics are initialized and DILX execution resumes with the same parameters as the last run.

Drop unit #x (y/n) [n] ?

Explanation: This question is displayed if you choose to change a unit as an answer to the ''reuse parameters'' (previous) question. Enter the unit number that you wish to drop from testing.

The new unit will be write enabled. Do you wish to continue (y/n) [n] ?

Explanation: This question is displayed if you choose to change a unit as an answer to the ''reuse parameters'' question. It is only asked if the unit being dropped was write enabled. This question gives you the chance to terminate DILX testing if you do not want data destroyed on the new unit. Enter ''N'' to terminate DILX.

6.4.5 DILX Output Messages

The following message is displayed when DILX is started:

```
Disk Inline Exerciser - Version 2.5
```

This message identifies the internal program as DILX and gives the DILX software version number.

Change Unit is not a legal option if Auto-Configure was chosen.

Explanation: This message is displayed if the user selects the Auto-Configure option and selects the ''change unit response'' to the ''reuse parameters'' question. You cannot drop a unit and add a unit if all units were selected for testing.

DILX - Normal Termination.

Explanation: This message is displayed when DILX terminates under normal conditions.

Insufficient resources.

Explanation: Following this line is a second line that gives more information about the problem, which could be one of the following messages:

- Unable to allocate memory.

  DILX was unable to allocate the memory it needed to perform DILX tests. You should run DILX again but choose a lower queue depth and/or choose fewer units to test.

- Cannot perform tests.

  DILX was unable to allocate all of the resources needed to perform DILX tests. You should run DILX again but choose a lower queue depth and/or choose fewer units to test.

- Unable to change operation mode to maintenance.

  DILX tried to change the operation mode from normal to maintenance using the SYSAP$CHANGE_STATE( ) routine but was not successful due to insufficient resources. This problem should not occur. If it does occur, submit a CLD (error report), then reset the controller.

Unit *x* is not a valid disk unit for DILX testing.

Explanation: An attempt was made to allocate a unit for testing that does not exist on the controller.

Unit *x* successfully allocated for testing.

Explanation: All processes that DILX performs to allocate a unit for testing, have been completed. The unit is ready for DILX testing.

Unable to allocate unit.

Explanation: This message should be preceded by a reason why the unit could not be allocated for DILX testing.

DILX detected error, code *x*.

Explanation: The ''normal'' way DILX recognizes an error on a unit is through the reception of SCSI sense data. This loosely corresponds to an MSCP error log. However, the following are some errors that DILX will detect using internal checks without SCSI sense data:

- Illegal Data Pattern Number found in data pattern header. Unit *x*

  This is code 1. DILX read data from the disk and found that the data was not in a pattern that DILX previously wrote to the disk.

- No write buffers correspond to data pattern Unit *x*.

  This is code 2. DILX read a legal data pattern from the disk at a place where DILX wrote to the disk, but DILX does not have any write buffers that correspond to the data pattern. Thus, the data has been corrupted.

- Read data do not match what DILX thought was written to the media. Unit *x*.

  This is code 3. DILX writes data to the disk and then reads it and compares it against what was written to the disk. This indicates a compare failure. More information is displayed to indicate where in the data buffer the compare operation failed and what the data was and should have been.

DILX terminated. A termination, a print summary or a reuse parameters request was received but DILX is currently not testing any units.

Explanation: You entered Ctrl/Y (termination request), Ctrl/G (print summary request) or Ctrl/C (reuse parameters request) before DILX had started to test units. DILX cannot satisfy the second two requests so DILX treats all of these requests as a termination request.

DILX will not change the state of a unit if it is not NORMAL.

Explanation: DILX cannot allocate the unit for testing, because it is already in Maintenance mode. (Maintenance mode can only be invoked by the firmware. If another DILX session is in use, the unit is considered in Maintenance mode.)

Unable to bring unit online.

Explanation: This message is self explanatory.

Soft error reporting disabled. Unit *x*.

Explanation: This message indicates that the soft error limit has been reached and therefore no more soft errors will be displayed for this unit.

Hard error limit reached, unit *x* dropped from testing.

Explanation: This message indicates that the hard error limit has been reached and the unit is dropped from testing.

Soft error reporting disabled for controller errors.

Explanation: This message indicates that the soft error limit has been reached for controller errors. Thus, controller soft error reporting is disabled.

Hard error limit reached for controller errors. All units dropped from testing.

Explanation: This message is self explanatory.

Unit is already allocated for testing.

Explanation: This message is self explanatory.

No drives selected.

Explanation: DILX parameter collection was exited without choosing any units to test.

Maximum number of units are now configured.

Explanation: This message is self explanatory. (Testing will start after this message is displayed.)

Unit is write protected.

Explanation: The user wants to test a unit with write and/or erase commands enabled but the unit is write protected.

The unit status and/or the unit device type has changed unexpectedly. Unit *x* dropped from testing.

Explanation: The unit status may change if the unit experienced hard errors or if the unit is disconnected. Either way, DILX cannot continue testing the unit.

Last Failure Information follows. This error was NOT produced by running DILX. It represents the reason why the controller crashed on the previous controller run.

Explanation: This message may be displayed while allocating a unit for testing. It does not indicate any reason why the unit is or is not successfully allocated, but rather represents the reason why the controller went down in the previous run. The information that follows this message is the contents of an EIP.

Disk unit numbers on this controller include:

Explanation: After this message is displayed, a list of disk unit numbers on the controller is displayed.

IO to unit *x* has timed out. DILX aborting.

Explanation: One of the DILX I/Os to this unit did not complete within the command timeout interval and, when examined, was found not progressing. This indicates a failing controller.

DILX terminated prematurely by user request.

Explanation: Ctrl/Y was entered. DILX interprets this as a request to terminate. This message is displayed and DILX terminates.

Unit is owned by another sysap.

Explanation: DILX could not allocate the unit specified, because the unit is currently allocated by another system application. Terminate the other system application or reset the controller.

This unit is reserved.

Explanation: The unit could not be allocated for testing, because a host has reserved the unit.

This unit is marked inoperative.

Explanation: The unit could not be allocated for testing, because the controller internal tables have the unit marked as inoperative.

The unit does not have any media present.

Explanation: The unit could not be allocated for testing, because no media is present.

The RUNSTOP_SWITCH is set to RUN_DISABLED.

Explanation: The unit could not be allocated for testing, because the RUNSTOP_SWITCH is set to RUN_DISABLED. This is enabled and disabled through the Command Line Interpreter (CLI).

Unable to continue, run time expired.

Explanation: A continue response was given to the ''reuse parameters'' question. This is not a valid response if the run time has expired. Reinvoke DILX.

When DILX starts to exercise the disk units, the following message is displayed with the current time of day:

```
DILX testing started at: xx:xx:xx
    Test will run for x minutes
    Type ^T(if running DILX through a VCS) or ^G(in all other cases)
      to get a current performance summary
    Type ^C to terminate the DILX test prematurely
    Type ^Y to terminate DILX prematurely
```

6.4.6 DILX Sense Data Display

To interpret the sense data fields correctly, refer to SCSI–2 specifications. Example 6–15 is an example of a DILX sense data display.

Example 6–15 DILX Sense Data Display

```
Sense data in hex for unit x

      Sense Key                    x
      Sense ASC                    x
      Sense ASQ                    x
      Instance                     x
```

6.4.7 DILX Deferred Error Display

Example 6–16 is an example of a DILX deferred error display.

Example 6–16 DILX Deferred Error Display

```
Deferred error detected, hard error counted against each unit.

      Sense Key                    x
      Sense ASC                    x
      Sense ASQ                    x
      Instance                     x
```

6.4.8 DILX Data Patterns

Table 6–8 defines the data patterns used with the DILX Basic Function or User-Defined tests. There are 18 unique data patterns. These data patterns were selected as worst case, or the ones most likely to produce errors on disks connected to the controller.

Table 6–8 DILX Data Patterns

Pattern Number	Pattern in Hexadecimal Numbers
1	0000
2	8B8B
3	3333
4	3091
5, shifting 1s	0001, 0003, 0007, 000F, 001F, 003F, 007F, 00FF, 01FF, 03FF, 07FF, 0FFF, 1FFF, 3FFF, 7FFF

(continued on next page)

Table 6–8 (Cont.) DILX Data Patterns

Pattern Number	Pattern in Hexadecimal Numbers
6, shifting 0s	FIE, FFFC, FFFC, FFFC, FFE0, FFE0, FFE0, FFE0, FE00, FC00, F800, F000, F000, C000, 8000, 0000
7, alternating 1s, 0s	0000, 0000, 0000, FFFF, FFFF, FFFF, 0000, 0000, FFFF, FFFF, 0000, FFFF, 0000, FFFF, 0000, FFFF
8	B6D9
9	5555, 5555, 5555, AAAA, AAAA, AAAA, 5555, 5555, AAAA, AAAA, 5555, AAAA, 5555, AAAA, 5555, AAAA, 5555
10	DB6C
11	2D2D, 2D2D, 2D2D, D2D2, D2D2, D2D2, 2D2D, 2D2D, D2D2, D2D2, 2D2D, D2D2, 2D2D, D2D2, 2D2D, D2D2
12	6DB6
13, ripple 1	0001, 0002, 0004, 0008, 0010, 0020, 0040, 0080, 0100, 0200, 0400, 0800, 1000, 2000, 4000, 8000
14, ripple 0	FIE, FFFD, FFFB, FFF7, FFEF, FFDF, FFBF, FF7F, FEFF, FDFF, FBFF, F7FF, EFFF, BFFF, DFFF, 7FFF
15	DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D
16	3333, 3333, 3333, 1999, 9999, 9999, B6D9, B6D9, B6D9, B6D9, FFFF, FFFF, 0000, 0000, DB6C, DB6C
17	9999, 1999, 699C, E99C, 9921, 9921, 1921, 699C, 699C, 0747, 0747, 0747, 699C, E99C, 9999, 9999
18	FFFF
Default—Use all of the above patterns in a random method	

6.4.9 Interpreting the DILX Performance Summaries

A DILX performance display is produced under the following conditions:

- When a specified performance summary interval elapses
- When DILX terminates for any conditions except an abort
- When Ctrl/G or Ctrl/T is entered

The performance display has different formats depending on whether performance statistics are requested in the user-specified parameters and if errors are detected.

The following is an example of a DILX performance display when performance statistics were not selected and when no errors were detected:

```
   DILX Summary at 18-JUN-1993 06:18:41
   Test minutes remaining: 0, expired: 6

Unit 1     Total IO Requests 482
  No errors detected
Unit 2     Total IO Requests 490
  No errors detected
```

The following is an example of a DILX performance display when performance statistics were selected and when no errors were detected:

```
   DILX Summary at 18-JUN-1993 06:18:41
   Test minutes remaining: 0, expired: 6

Unit 1     Total IO Requests 482
  Read Count   292   Write Count 168
  KB xfer   Read 7223   Write 4981   Total 12204
  No errors detected
```

The following is an example of a DILX performance display when performance statistics were not selected and when errors were detected on a unit under test:

```
     DILX Summary at 18-JUN-1993 06:18:41
     Test minutes remaining: 0, expired: 6

❶ Unit 10     Total IO Requests 153259
          No errors detected
❷ Unit 40     Total IO Requests 2161368
          Err in Hex: IC:031A4002  PTL:04/00/00  Key:04  ASC/Q:B0/00  HC:0  SC:1
          Total Errs   Hard Cnt 0   Soft Cnt 1
❸ Unit 55     Total IO Requests 2017193
          Err in Hex: IC:03094002  PTL:05/05/00  Key:01  ASC/Q:18/89  HC:0  SC:1
          Err in Hex: IC:03094002  PTL:05/05/00  Key:01  ASC/Q:18/86  HC:0  SC:1
❹         Total Errs   Hard Cnt 0   Soft Cnt 2
```

where:

❶ Represents the unit number and the total I/O requests to this unit.

❷ Represents the unit number and total I/O requests to this unit.

All values for the following codes are described in Appendix E. This also includes the following items associated with this error, and the total number of hard and soft errors for this unit:

- The HSZ-series Instance code (in hex)
- The port/target/LUN (PTL)
- The SCSI Sense Key
- The SCSI ASC and ASQ (ASC/Q) codes
- The total hard and soft count for this error

❸ Represents information about the first two unique errors for this unit.

All values for the following codes are described in Appendix E. This also includes the following items associated with this error, and the total number of hard and soft errors for this unit:

- The HSZ-series Instance code (in hex)
- The port/target/LUN (PTL)
- The SCSI Sense (Key)
- The SCSI ASC and ASQ (ASC/Q) codes
- The total hard and soft count for this error

A line of this format may be displayed up to three times in a performance summary. There would be a line for each unique error reported to DILX for up to three errors for each unit.

❹ Represents the total hard and soft errors experienced for this unit.

The following is an example of a DILX performance display when performance statistics were not selected and when a controller error was detected:

```
   DILX Summary at 18-JUN-1993 06:18:41
   Test minutes remaining: 0, expired: 6

Cnt err in HEX  IC:07080064  Key:06  ASC/Q:A0/05  HC:1  SC:0
  Total Cntrl Errs   Hard Cnt 1   Soft Cnt 0

Unit 1     Total IO Requests 482
  No errors detected
Unit 2     Total IO Requests 490
  No errors detected
```

For the previous examples, the following definitions apply. These codes are translated in Appendix E.

- IC—The HSZ-series Instance code.
- ASC/Q—The SCSI ASC and ASCQ code associated with this error.
- HC—The hard count of this error.
- SC—The soft count of this error.
- PTL—The location of the unit (port/target/LUN).

The performance displays contain error information for up to three unique errors. Hard errors always have precedence over soft errors. A soft error represented in one display may be replaced with information on a hard error in subsequent performance displays.

6.4.10 DILX Abort Codes

Table 6–9 lists the DILX abort codes and definitions.

Table 6–9 DILX Abort Codes and Definitions

Value	Definition
1	An I/O has timed out.
2	dcb_p->htb_used_count reflects an available HTB to test IOs but none could be found.
3	FAO returned either FAO_BAD_FORMAT or FAO_OVERFLOW.
4	TS$SEND_TERMINAL_DATA returned either an ABORTED or INVALID_BYTE_COUNT.
5	TS$READ_TERMINAL_DATA returned either an ABORTED or INVALID_BYTE_COUNT.
6	A timer is in an unexpected expired state that prevents it from being started.
7	The semaphore was set after a oneshot I/O was issued but nothing was found in the received HTB que.
8	A termination, a print summary, or a reuse parameters request was received when DILX was not testing any units.
9	User requested an abort via Ctrl/Y.

6.4.11 DILX Error Codes

Table 6–10 list the DILX error codes and definitions for DILX-detected errors.

Table 6–10 DILX Error Codes and Definitions

Value	Definition
1	Illegal Data Pattern Number found in data pattern header.
2	No write buffers correspond to data pattern.
3	Read data do not match write buffer.

6.5 VTDPY Utility

The VTDPY utility gathers and displays system state and performance information for the HS family of modular storage controllers. The information displayed includes processor utilization, host port activity and status, device state, logical unit state, and cache and I/O performance.

The VTDPY utility requires a video terminal that supports **ANSI** control sequences, such as a VT220, VT320, or VT420 terminal. A graphics display that provides emulation of an ANSI compatible video terminal can also be used. For DSSI and CI based HS controllers, VTDPY can be run on terminals either directly connected to the HS controller or on terminals connected through a host-based DUP connection. For SCSI based HS controllers, VTDPY can be run only on terminals connected to the HS controller maintenance terminal port.

Note

VCS can be used from a terminal or DECserver™ attached to the maintenance terminal port on the HS array controller.

The following sections show how to use the VTDPY utility.

6.5.1 How to Run VTDPY

You can run only one VTDPY session on each controller at one time. Prior to running VTDPY, set the terminal to NOWRAP mode to prevent the top line of the display from scrolling off of the screen.

To initiate VTDPY from a maintenance terminal at the CLI> prompt, enter the following command:

```
CLI> RUN VTDPY
```

To initiate VTDPY from a virtual terminal, refer to Chapter 4.

6.5.2 Using the VTDPY Control Keys

Use the following control key sequences with the VTDPY display:

Table 6–11 VTDPY Control Keys

Control Key Sequence	Function
Ctrl/C	Prompts for commands.
Ctrl/G	Updates the screen (same as Ctrl/Z).
Ctrl/O	Pauses or resumes screen updates.
Ctrl/R	Refreshes current screen display (same as Ctrl/W).
Ctrl/W	Refreshes current screen display (same as Ctrl/R).
Ctrl/Y	Terminates VTDPY and resets screen characteristics.
Ctrl/Z	Updates the screen (same as Ctrl/G).

Note

While VTDPY and a maintenance terminal interface support passing all of the listed control characters, some host-based terminal interfaces

restrict passing some of the characters. All of the listed characters have equivalent text string commands, defined in Table 6–12.

6.5.3 Using the VTDPY Command Line

VTDPY contains a command line interpreter that you can invoke by entering Ctrl/C any time after starting the program. The command line interpreter is used to modify the characteristics of the VTDPY display. Commands also exist to duplicate the function of the control keys listed in Section 6.5.2.

Table 6–12 VTDPY Commands

Command String	Function
DISPLAY CACHE	Use 132 column unit caching statistics display.
DISPLAY DEFAULT	Use default 132 column system performance display.
DISPLAY DEVICE	Use 132 column device performance display.
DISPLAY STATUS	Use 80 column controller status display.
EXIT	Terminates program (same as QUIT).
INTERVAL <seconds>	Changes update interval.
HELP	Displays help message text.
REFRESH	Refreshes the current display.
QUIT	Terminates program (same as EXIT).
UPDATE	Updates screen display.

The keywords in the command strings can be abbreviated to the minimum number of characters that are necessary to uniquely identify the keyword. Entering a question mark (?) after a keyword causes the parser to provide a list of keywords or values that can follow the supplied keyword. The command line interpreter is not case sensitive, so keywords can be entered in uppercase, lowercase, or mixed case.

Upon successful execution of a command other than HELP, the command line interpreter is exited and the display is resumed. Entering a carriage return without a command also exits the command line interpreter and resumes the display. If an error occurs in the command, the user prompts for command expansion help, or the HELP command is entered, the command line interpreter prompts for an additional command instead of returning to the display.

6.5.4 How to Interpret the VTDPY Display Fields

This section describes the major fields in the VTDPY displays. Examples of the VTDPY screens are shown followed by an explanation of each field of the screens.

Figure 6–2 VTDPY Default Display for CI Controllers

```
HSJ40 S/N: ZG33700938 SW: V20J HW: 00-00                                                
```

Figure 6–3 VTDPY Default Display for DSSI Controllers

```
HSD30 S/N: CX40300006 SW: V20D HW: 00-00                    03-FEB-1994 16:48:41
                                                                Up:    0  0:50.27
                    19.7% Idle          0 KB/S       0 Rq/S
                                                                
```

Figure 6–4 VTDPY Default Display for SCSI Controllers

```
HSZ40 S/N: CX12345678 SW: V20Z HW: 00-00
                                        61.4% Idle      927 KB/S      300 Rq/S                                  Up:    0  1:32.46
Pr   Name  Stk/Max Typ Sta  CPU% SCSI Target  2                 Unit  ASWC  KB/S  Rd% Wr% Cm% HT% Unit  ASWC  KB/S  Rd% Wr% Cm% HT%
 0    NULL   0/  0      Rn  61.4                                D0000 o^ b    112  62  37   0   0
 2   RECON  10/  1 FNC  Bl   0.0                                D0001 o^ b    118  61  38   0   0
 3    SHIS  40/  7 FNC  Rn  32.3 Xfer Rate                      D0002 o^ b    122  67  32   0   0
 8   VTDPY  10/  3 DUP  Rn   0.2  Id   Mhz                      D0003 o^ b    128  65  34   0   0
18  SCSIVT  10/  1 FNC  Bl   0.0  0 = Asynch                    D0004 o^ b     93  69  30   0   0
19   DS_HB  10/  1 FNC  Bl   0.0  1 = Asynch           Target  D0005 o^ b    112  67  32   0   0
24      VA  10/  1 FNC  Bl   0.0  2 = This             01234567 D0006 o^ b    156  66  33   0   0
25    DS_1  40/  6 FNC  Bl   5.5  3 = Asynch         P1D D D  H D0007 o^ b     83  71  28   0   0
26    DS_0  20/  1 FNC  Bl   0.4  4 = Asynch         o2 D D DDH
27 CLIMAIN  16/  7 FNC  Bl   0.0  5 = Asynch         r3D D D  H
28   NVFOC  10/  1 FNC  Bl   0.0  6 =  3.57          t4 D D  DH
29  REMOTE  10/  1 FNC  Bl   0.0  7 = Asynch          5D D D  H
30     FOC  20/  2 FNC  Bl   0.0                       6 D D DDH
31   DUART  10/  1 FNC  Bl   0.0
```

Figure 6–5 VTDPY Device Performance Display

```
HSJ40 S/N: ZG33700938 SW: V20J HW: 00-00                                                
```

Figure 6–6 VTDPY Unit Cache Performance Display

```
HSJ40 S/N: ZG33700938 SW: V20J HW: 00-00                                    03-FEB-1994 16:53:26
                                80.1% Idle      2719 KB/S      23 Rq/S          Up:    0  0:25.45
     Unit  ASWC  KB/S  Rd% Wr% Cm% HT% PH% MS% Purge BlChd BlHit Unit  ASWC  KB/S  Rd% Wr% Cm% HT% PH% MS% Purge BlChd BlHit
     D0410 a^ r     0    0   0   0   0   0   0     0     0 D0444 a^ r     0    0   0   0   0   0   0     0     0     0
     D0411 a^ r     0    0   0   0   0   0   0     0     0 D0445 a^ r     0    0   0   0   0   0   0     0     0     0
     D0413 a^ r     0    0   0   0   0   0   0     0     0 D0450 a^ r     0    0   0   0   0   0   0     0     0     0
     D0414 a^ r     0    0   0   0   0   0   0     0     0 D0451 a^ r     0    0   0   0   0   0   0     0     0     0
     D0415 a^ r     0    0   0   0   0   0   0     0     0 D0452 a^ r     0    0   0   0   0   0   0     0     0     0
     D0420 o^ r   483    0 100   0   0   0 100     0   132 D0453 a^ r     0    0   0   0   0   0   0     0     0     0
     D0421 o^ r   483    0 100   0   0   0 100     0   132 D0454 a^ r     0    0   0   0   0   0   0     0     0     0
     D0422 o^ r   476    0 100   0   0   0 100     0   132 D0455 a^ r     0    0   0   0   0   0   0     0     0     0
     D0423 o^ r   315    0  99   0   1   0  99     0   159 1 D0460 a^ r     0    0   0   0   0   0   0     0     0     0
     D0424 o^ r   483    0 100   0   0   0 100     0   132 D0461 a^ r     0    0   0   0   0   0   0     0     0     0
     D0425 o^ r   476    0 100   0   0   0 100     0   132 D0462 a^ r     0    0   0   0   0   0   0     0     0     0
     D0430 a^ r     0    0   0   0   0   0   0     0     0 D0463 a^ r     0    0   0   0   0   0   0     0     0     0
     D0431 a^ r     0    0   0   0   0   0   0     0     0 D0464 a^ r     0    0   0   0   0   0   0     0     0     0
     D0432 a^ r     0    0   0   0   0   0   0     0     0 D0465 a^ r     0    0   0   0   0   0   0     0     0     0
     D0433 a^ r     0    0   0   0   0   0   0     0     0
     D0434 a^ r     0    0   0   0   0   0   0     0     0
     D0435 a^ r     0    0   0   0   0   0   0     0     0
     D0440 a^ r     0    0   0   0   0   0   0     0     0
     D0441 a^ r     0    0   0   0   0   0   0     0     0
     D0442 a^ r     0    0   0   0   0   0   0     0     0
     D0443 a^ r     0    0   0   0   0   0   0     0     0
```

Figure 6–7 VTDPY Brief CI Status Display

```
                                                                                03-FEB-1994 16:52:50
                                                                                   Up:    0  0:25.09
                0.0% Idle      2717 KB/S          0 Rq/S
Pr  Name   Stk/Max Typ Sta  CPU%    Target    Unit   ASWC  KB/S  Unit   ASWC  KB/S
 0   NULL    0/  0      Rn   0.0  01234567  D0410 a^ r     0 D0444 a^ r     0
 2  RECON   10/  1 FNC  Bl   0.0 P1DDFDDDDhH D0411 a^ r     0 D0445 a^ r     0
 3    HPT   40/  4 FNC  Rn 100.0 o2DDDDDDDhH D0413 a^ r     0 D0450 a^ r     0
 9  VTDPY   10/  3 DUP  Rn   0.0 r3DDDDDDDhH D0414 a^ r     0 D0451 a^ r     0
17 FMTHRD  10/  1 FNC  Bl   0.0 t4DDDDDDDhH D0415 a^ r     0 D0452 a^ r     0
18  DS_HB  10/  1 FNC  Bl   0.0  5DDDDDDDhH D0420 o^ r   452 D0453 a^ r     0
19    DUP  10/  1 FNC  Bl   0.0  6DDDDDDDhH D0421 o^ r   452 D0454 a^ r     0
20    SCS  10/  1 FNC  Bl   0.0              D0422 o^ r   452 D0455 a^ r     0
21   MSCP  20/  1 FNC  Bl   0.0 Connections D0423 o^ r   452 D0460 a^ r     0
23     VA  10/  1 FNC  Bl   0.0  0123456789 D0424 o^ r   452 D0461 a^ r     0
24   DS_1  40/  3 FNC  Rn   0.0 0MVMMM..... D0425 o^ r   456 D0462 a^ r     0
25   DS_0  20/  2 FNC  Bl   0.0 1V.......C. D0430 a^ r     0 D0463 a^ r     0
26    HIS  10/  1 FNC  Bl   0.0 2....V.VV.. D0431 a^ r     0 D0464 a^ r     0
27 CLIMAIN 16/  2 FNC  Bl   0.0 3.V        D0432 a^ r     0 D0465 a^ r     0
28  NVFOC  10/  1 FNC  Bl   0.0            D0433 a^ r     0
29 REMOTE  10/  1 FNC  Bl   0.0 Path Status D0434 a^ r     0
30    FOC  20/  2 FNC  Bl   0.0  0123456789 D0435 a^ r     0
31  DUART  10/  1 FNC  Bl   0.0 0^^^^^.^... D0440 a^ r     0
                                1^.....^.^. D0441 a^ r     0
                                2....^.^^.. D0442 a^ r     0
                                3.^         D0443 a^ r     0
```

Figure 6–8 VTDPY Brief DSSI Status Display

```
                                                                  03-FEB-1994 16:49:04
                 0.0% Idle        0 KB/S        0 Rq/S          Up:    0  0:50.50
Pr   Name  Stk/Max Typ Sta  CPU%    Target   Unit  ASWC  KB/S  Unit  ASWC  KB/S
 0    NULL   0/  0      Rn   0.0   01234567  D2691 o^ r      0
 2   RECON  10/  1 FNC  Bl   0.0 P1 DDDDD H  D2692 o^ r      0
 3     HPT  40/  8 FNC  Rn   0.0 o2 DDDDD H  D2693 o^ r      0
 8   VTDPY  10/  3 DUP  Rn 100.0 r3 DDDDD H
17  FMTHRD  10/  1 FNC  Bl   0.0 t
18   DS_HB  10/  1 FNC  Bl   0.0
19     DUP  10/  1 FNC  Bl   0.0
20     SCS  10/  1 FNC  Bl   0.0
21    MSCP  20/  1 FNC  Bl   0.0 Connections
23      VA  10/  1 FNC  Bl   0.0  0123456789
24    DS_1  40/ 11 FNC  Rn   0.0 0.......M
25    DS_0  20/  1 FNC  Rn   0.0 1
26     HIS  10/  1 FNC  Bl   0.0 2
27 CLIMAIN  16/  2 FNC  Bl   0.0 3
28   NVFOC  10/  1 FNC  Bl   0.0
29  REMOTE  10/  1 FNC  Bl   0.0 Path Status
30     FOC  20/  2 FNC  Bl   0.0  0123456789
31   DUART  10/  1 FNC  Bl   0.0 0.......^
                                 1
                                 2
                                 3
```

Figure 6–9 VTDPY Brief SCSI Status Display

```
                60.9% Idle      861 KB/S      293 Rq/S         Up:    0  1:33.50
Pr   Name  Stk/Max Typ Sta  CPU%    Target   Unit  ASWC  KB/S  Unit  ASWC  KB/S
 0    NULL   0/  0      Rn  60.9   01234567  D0000 o^ b     98
 2   RECON  10/  1 FNC  Bl   0.0 P1D D D  H  D0001 o^ b    100
 3    SHIS  40/  7 FNC  Rn  32.7 o2 D D DDH  D0002 o^ b    115
 8   VTDPY  10/  3 DUP  Rn   0.1 r3D D D  H  D0003 o^ b     86
18  SCSIVT  10/  1 FNC  Bl   0.0 t4 D D  DH  D0004 o^ b     96
19   DS_HB  10/  1 FNC  Bl   0.0  5D D D  H  D0005 o^ b    141
24      VA  10/  1 FNC  Bl   0.0  6 D D DDH  D0006 o^ b    125
25    DS_1  40/  6 FNC  Bl   5.8             D0007 o^ b     97
26    DS_0  20/  1 FNC  Bl   0.1 Xfer Rate
27 CLIMAIN  16/  7 FNC  Bl   0.0  Id   Mhz
28   NVFOC  10/  1 FNC  Bl   0.0  0 = Asynch
29  REMOTE  10/  1 FNC  Bl   0.0  1 = Asynch
30     FOC  20/  2 FNC  Bl   0.0  2 = This
31   DUART  10/  1 FNC  Bl   0.0  3 = Asynch
                                  4 = Asynch
                                  5 = Asynch
                                  6 =  3.57
                                  7 = Asynch
```

Display Header

```
    HSJ40 ❶ S/N: CX00000002 ❷ SW: V20J ❸ HW:  A-02 ❹
VTDPY Monitor Copyright © 1994, Digital Equipment Corp.❺
```

Description

This subdisplay provides title information for the display. For 132 column displays, this subdisplay is all on one line.

❶ Controller model

❷ Controller serial number

❸ Controller firmware version

❹ Controller hardware version

❺ Copyright notice

Date and Time

```
29-JAN-1994 13:46:34 ❶
  Up:    1  3:45.19 ❷
```

Description

This subdisplay provides time information for the display.

❶ System date and time. This information is not displayed for SCSI based HS controllers.

❷ Time in days, hours, minutes, and seconds since the last controller boot.

Controller Performance Summary

```
47.2% Idle ❶ 1225 KB/S ❷106 Rq/S ❸
```

Description

This subdisplay provides total system performance information.

❶ Policy processor idle rate.

❷ Cumulative data transfer rate in kilobytes per second. When logical units are being displayed, this is the transfer rate between the host and the controller. When physical devices are being displayed, this is the transfer rate between the controller and the devices.

❸ Cumulative unit or device request rate per second.When logical units are being displayed, this is the request rate between the host and the controller. When physical devices are being displayed, this is the request rate between the controller and the devices.

Controller Threads Display

```
Pr❶ Name❷  Stk/Max❸ Typ❹ Sta❺ CPU%❻
 0     NULL    0/  0         Rn   47.2
 3      HPT   40/  7   FNC   Rn   40.3
 8    VTDPY   10/  3   DUP   Rn    0.1
18   FMTHRD   10/  2   FNC   Bl    0.0
19    DS_HB   10/  2   FNC   Bl    0.0
20      DUP   10/  2   FNC   Bl    1.3
21      SCS   10/  2   FNC   Bl    0.0
22     MSCP   20/  6   FNC   Bl    0.0
24       VA   10/  3   FNC   Bl    1.2
25     DS_1   40/  6   FNC   Rn    8.9
26     DS_0   20/  4   FNC   Bl    0.0
27      HIS   10/  2   FNC   Bl    0.0
28  CLIMAIN   16/  6   FNC   Bl    0.0
30      FOC   16/  4   FNC   Bl    0.0
31    DUART   10/  2   FNC   Bl    0.0
```

Description

This display shows the status and characteristics of the active threads in the controller. Threads that are not active, such as DUP Local Program threads are not displayed until they become active. If the number of active threads exceeds the available space, not all of them will be displayed.

❶ The **Pr** column lists the thread priority. The higher the number, the higher the priority.

❷ The **Name** column contains the thread name. For DUP Local Program threads, this is the name used to invoke the program.

❸ The **Stk** column lists the allocated stack size in 512 byte pages. The **Max** column lists the number of stack pages actually used.

❹ The **Typ** column lists the thread type. The following thread types may appear:

- **FNC**—Functional thread. Those threads that are started when the controller boots and never exit.
- **DUP**—DUP local program threads. These threads are only active when run either from a DUP connection or through the command line interpreter's **RUN** command.
- **NULL**—The NULL thread does not have a thread type because it is a special type of thread that only executes when no other thread is executable.

❺ The **Sta** column lists the current thread state. The following thread states may appear:

- **Bl**—The thread is blocked waiting for timer expiration, resources, or a synchronization event.
- **Io**—A DUP local program is blocked waiting for terminal I/O completion.
- **Rn**—The thread is currently executable.

❻ The **CPU%** column lists the percentage of execution time credited to each thread since the last screen update. The values may not add up to exactly 100 percent due to both rounding errors and the fact that there may not be enough room to display all of the threads. An unexpected amount of time may be credited to some threads because the controller's firmware architecture allows code from one thread to execute in the context of another thread without a context switch.

Table 6–13 describes the processes that may appear in the active thread display.

Note

It is possible that different versions of the controller firmware will have different threads or different names for the threads.

Table 6–13 Thread Description

Thread Name	Description
CLI	A local program that provides an interface to the controller's command line interpreter thread.
CLIMAIN	The command line interpreter (CLI) thread.
CONFIG	A local program that locates and adds devices to an HS array controller configuration.
DILX	A local program that exercises disk devices.
DIRECT	A local program that returns a listing of available local programs.
DS_0	A device error recovery management thread.
DS_1	The thread that handles successful completion of physical device requests.
DS_HB	The thread that manages the device and controller error indicator lights and port reset buttons.
DUART	The console terminal interface thread.
DUP	The DUP protocol server thread.
FMTHREAD	The thread that performs error log formatting and fault reporting for the controller.
FOC	The thread that manages communication between the controllers in a dual controller configuration.
HIS	The SCS protocol interface thread for CI and DSSI controllers.
HPT	The thread that handles interaction with the host port hardware and PPD protocol for CI and DSSI controllers.
MDATA	The thread that processes metada for nontransportable disks.
MSCP	The MSCP and TMSCP protocol server thread.
NULL	The process that is scheduled when no other process can be run.
NVFOC	The thread that initiates state change requests for the other controller in a dual controller configuration.
REMOTE	The thread that manages state changes initiated by the other controller in a dual controller configuration.

(continued on next page)

Table 6–13 (Cont.) Thread Description

Thread Name	Description
RMGR	The thread that manages the data buffer pool.
RECON	The thread that rebuilds the parity blocks on RAID 5 storagesets when needed and manages mirrorset copy operations when necessary.
SCS	The SCS directory thread.
SCSIVT	A thread that provides a virtual terminal connection to the CLI over the host SCSI bus.
SHIS	The host SCSI protocol interface thread for SCSI controllers.
TILX	A local program that exercises tape devices.
VA	The thread that provides host protocol independent logical unit services.
VTDPY	A local program thread that provides a dynamic display of controller configuration and performance information.

CI/DSSI Host Port Characteristics

```
Node HSJ501 ❶ Port 13 ❷
SysId 4200100D0720 ❸
```

Description

This subdisplay shows the current host port identification information. This subdisplay is available only for CI or DSSI based controllers.

❶ SCS node name

❷ Port number

❸ SCS system ID

SCSI Host Port Characteristics

```
Xfer Rate
T❶W❷I❸Mhz❹
1 W 7 10.00
2 W Async❺
```

Description

This subdisplay shows the current host port SCSI target identification, any initiator which has negotiated synchronous transfers, and the negotiated transfer method currently in use between the controller and the initiators. This subdisplay is available only for SCSI based HS controllers.

❶ SCSI host port target ID.

❷ Transfer width. **W** indicates 16 bit or wide transfers are being used. A space indicates 8 bit transfers are being used.

❸ The initiator with which synchronous communication has been negotiated.

❹ A numeric value indicates the synchronous data rate which has been negotiated with the initiator at the specified SCSI ID. The value is listed in megahertz (Mhz). In this example, the negotiated synchronous transfer rate is approximately 3.57 Mhz. To convert this number to the nanosecond period, invert and multiply by 1000. The period for this is approximately 280 nanoseconds.

❺ **Async** indicates communication between this target and all initiators is being done in asynchronous mode. This is the default communication mode and is used unless the initiator successfully negotiates for synchronous communications. If there is no communication with a given target ID, the communication mode is listed as asynchronous.

CI Performance Display

```
Path A Pkts  Pkts/S
RCV     5710    519 ❶
ACK    11805   1073 ❷
NAK     2073    188 ❸
NOR     1072     97 ❹

Path B Pkts  Pkts/S
RCV     5869    533
ACK    11318   1028
NAK     2164    196
NOR      445     40
```

Description

This display indicates the number of packets sent and received over each CI path and the packet rate. This display is available only on CI based controllers.

❶ Packets received from a remote node

❷ Packets sent to a remote node that were ACKed

❸ Packets sent to a remote node that were NAKed

❹ Packets sent to a remote node for which no response was received

DSSI Performance Display

```
DSSI   Pkts  Pkts/S
RCV     5710     519 ❶
ACK    11805    1073 ❷
NAK     2073     188 ❸
NOR     1072      97 ❹
```

Description

This display indicates the number of packets sent and received through the DSSI port and the packet rate. This display is available only on DSSI based controllers.

❶ Packets received from a remote node

❷ Packets sent to a remote node that were ACKed

❸ Packets sent to a remote node that were NAKed

❹ Packets sent to a remote node for which no response was received

CI/DSSI Connection Status

```
Connections
 0123456789 ❶
0........MM ❷
1..C.MV....
2..........
3..
```

Description

This display shows the current status of any connections to a remote CI or DSSI node. This display is available only on CI and DSSI based controllers.

❶ Each position in the data field represents one of the possible nodes to which the controller can communicate. To locate the connection status for a given node, use the column on the left to determine the high order digit of the node number, and use the second row to determine the low order digit of the node number. For CI controllers, the number of nodes displayed is determined by the controllers MAX NODE parameter. The maximum supported value for this parameter is 32. For DSSI controllers, the number of nodes is fixed at 8.

❷ Each location in the grid contains a character to indicate the connection status:

- **C** indicates one connection to that node. In this example, node 12 shows one connection. This usually happens if a host has multiple adaptors and it is using more than one adaptor for load balancing.
- **M** indicates multiple connections to that node. Because each host system can make a separate connection to each of the disk, tape, and DUP servers, this field frequently shows multiple connections to a host system. In this example, nodes 8, 9, and 14 show multiple connections.
- **V** indicates that only a virtual circuit is open and no connection is present. This happens prior to establishing a connection. It also happens when there is another controller on the same network and when there are systems with multiple adaptors connected to the same network. Node 15 demonstrates this principle.
- If a period (.) is in a position corresponding to a node, that node does not have any virtual circuits or connections to this controller.
- A space indicates the address is beyond the visible node range for this controller.

CI/DSSI Host Path Status

```
Path Status
 0123456789 ❶
0........^^ ❷
1..A.B^....
2.......X..
3..
```

Description

This display indicates the path status to any system for which a virtual circuit exists. This display is available only on CI and DSSI based controllers.

❶ Each position in the data field represents one of the possible nodes to which the controller can communicate. To locate the path status for a given node, use the column on the left to determine the high order digit of the node number, and use the second row to determine the low order digit of the node number. For CI controllers, the number of nodes displayed is determined by the controllers MAX NODE parameter. The maximum supported value for this parameter is 32. For DSSI controllers, the number of nodes is fixed at 8.

❷ Each location in the grid contains a character to indicate the path status:

- **A** indicates only CI path A is functioning properly. In this example, node 12 demonstrates this. This value is not displayed for DSSI based controllers.
- **B** indicates only CI path B is functioning properly. In this example, node 14 demonstrates this. This value is not displayed for DSSI based controllers.
- **X** indicates the CI cables are crossed. In this example, node 27 demonstrates this. This value is not displayed for DSSI based controllers.
- A circumflex (^) indicates the single DSSI path or both CI paths are functioning properly. In this example, nodes 8, 9, and 15 demonstrate this.
- If a period (.) is in a position corresponding to a node, that node does not have any virtual circuits or connections to this controller so either the path status cannot be determined, or neither path is functioning properly.
- A space indicates the address is beyond the visible node range for this controller.

Device SCSI Status

```
  Target
  01234567 ❶
P1 DDDDFhH ❷
o2TTT T hH
r3DDD   hH
t4DDDDDDhH
 5DDDD  hH
 6      hH❸
```

Description

This display shows what devices the controller has been able to identify on the device busses.

Note

The controller does not look for devices that are not configured into the nonvolatile memory using the CLI ADD command.

❶ The column headings indicate the SCSI target numbers for the devices. SCSI targets are in the range 0 through 7. Target 7 is always used by a controller. In a dual controller configuration, target 6 is used by the second controller.

❷ The device grid contains a letter signifying the device type in each port/target location where a device has been found:

- **C** indicates a CD–ROM device.
- **D** indicates a disk device.
- **F** indicates a device type not listed above.
- **H** indicates bus position of this controller.
- **h** indicates bus position of the other controller.
- **L** indicates a media loader.
- **T** indicates a tape device.
- A period (.) indicates the device type is unknown.
- A space indicates there is no device configured at this location.

❸ This subdisplay contains a row for each SCSI device port supported by the controller. The subdisplay for a controller that has six SCSI device ports is shown.

Unit Status (abbreviated)

```
Unit❶ ASWC❷ KB/S❸ Rd%❹ Wr%❺ Cm%❻ HT%❼
D0110  a^ r      0     0     0     0     0
D0120  a^ r      0     0     0     0     0
D0130  o^ r    236   100     0     0   100
T0220  av        0     0     0     0     0
T0230  o^      123     0   100     0     0
```

Description

This subdisplay shows the status of the logical units that are known to the controller firmware. It also indicates performance information for the units. Up to 42 units can be displayed in this subdisplay.

❶ The **Unit** column contains a letter indicating the type of unit followed by the unit number of the logical unit. The list is sorted by unit number. There may be duplication of unit numbers between devices of different types. If this happens, the order of these devices is arbitrary. The following device type letters may appear:

- **D** indicates a disk device.
- **T** indicates a tape device.
- **L** indicates a media loader.
- **C** indicates a CD–ROM device.
- **F** indicates a device type not listed above.
- **U** indicates the device type is unknown.

❷ The **ASWC** columns indicate respectively the availability, spindle state, write protect state, and cache state of the logical unit.

The availability state is indicated using the following letters:

- **a**—Available. Available to be mounted by a host system.
- **d**—Offline, Disabled by Digital Multivendor Customer Services. The unit has been disabled for service.
- **e**—Online, Exclusive Access. Unit has been mounted for exclusive access by a user.
- **f**—Offline, Media Format Error. The unit cannot be brought available due to a media format inconsistency.
- **i**—Offline, Inoperative. The unit is inoperative and cannot be brought available by the controller.
- **m**—Offline, Maintenance. The unit has been placed in maintenance mode for diagnostic or other purposes.
- **o**—Online. Mounted by at least one of the host systems.
- **r**—Offline, Rundown. The CLI SET NORUN command has been issued for this unit.
- **v**—Offline, No Volume Mounted. The device does not contain media.
- **x**—Online to other controller. Not available for use by this controller.

- A space in this column indicates the availability is unknown.

The spindle state is indicated using the following characters:

- **^**—For disks, this symbol indicates the device is at speed. For tapes, it indicates the tape is loaded.
- **>**—For disks, this symbol indicates the device is spinning up. For tapes, it indicates the tape is loading.
- **<**—For disks, this symbol indicates the device is spinning down. For tapes, it indicates the tape is unloading.
- **v**—For disks, this symbol indicates the device is stopped. For tapes, it indicates the tape is unloaded.
- For other types of devices, this column is left blank.

For disks and tapes, a **w** in the write protect column indicates the unit is write protected. This column is left blank for other device types.

The data caching state is indicated using the following letters:

- **b**—Both Read caching and Write Back caching are enabled.
- **r**—Read caching is enabled.
- **w**—Write Back caching is enabled.
- A space in this column indicates caching is disabled.

❸ **KB/S**—This column indicates the average amount of kilobytes of data transferred to and from the unit in the previous screen update interval. This data is available only for disk and tape units.

❹ **Rd%**—This column indicates what percentage of data transferred between the host and the unit were read from the unit. This data is contained only in the **DEFAULT** display for disk and tape device types.

❺ **Wr%**—This column indicates what percentage of data transferred between the host and the unit were written to the unit. This data is contained only in the **DEFAULT** display for disk and tape device types.

❻ **Cm%**—This column indicates what percentage of data transferred between the host and the unit were compared. A compare operation can be accompanied by either a read or a write operation, so this column is not cumulative with read percentage and write percentage columns. This data is contained only in the **DEFAULT** display for disk and tape device types.

❼ **HT%**—This column indicates the cache hit percentage for data transferred between the host and the unit.

Unit Status (full)

```
Unit❶ ASWC❷  KB/S❸ Rd%❹  Wr%❺ Cm%❻ HT%❼ PH%❽ MS%❾ Purge❿ BlChd⓫ BlHit⓬
D0003  o^ r    382     0   100     0     0     0     0       0    6880       0
D0250  o^ r    382   100     0     0     0     0   100       0    6880       0
D0251  o^ r    284   100     0     0     0     0   100       0    5120       0
D0262  a^ r      0     0     0     0     0     0     0       0       0       0
D0280  o^ r    497    44    55     0     0     0   100       0    9011       0
D0351  a^ r      0     0     0     0     0     0     0       0       0       0
D0911  a^ r      0     0     0     0     0     0     0       0       0       0
D1000  a^ r      0     0     0     0     0     0     0       0       0       0
```

Description

This subdisplay shows the status of the logical units that are known to the controller firmware. It also shows I/O performance information and caching statistics for the units. Up to 42 units can be displayed in this subdisplay.

❶ The **Unit** column contains a letter indicating the type of unit followed by the unit number of the logical unit. The list is sorted by unit number. There may be duplication of unit numbers between devices of different types. If this happens, the order of these devices is arbitrary. The following device type letters may appear:

- **D** indicates a disk device.
- **T** indicates a tape device.
- **L** indicates a media loader.
- **C** indicates a CD–ROM device.
- **F** indicates a device type not listed above.
- **U** indicates the device type is unknown.

❷ The **ASWC** columns indicate the availability, spindle state, write protect state, and cache state respectively of the logical unit.

The availability state is indicated using the following letters:

- **a**—Available. Available to be mounted by a host system.
- **d**—Offline, Disabled by Digital Multivendor Customer Services. The unit has been disabled for service.
- **e**—Online, Exclusive Access. Unit has been mounted for exclusive access by a user.
- **f**—Offline, Media Format Error. The unit cannot be brought available due to a media format inconsistency.
- **i**—Offline, Inoperative. The unit is inoperative and cannot be brought available by the controller.
- **m**—Offline, Maintenance. The unit has been placed in maintenance mode for diagnostic or other purposes.
- **o**—Online. Mounted by at least one of the host systems.
- **r**—Offline, Rundown. The CLI SET NORUN command has been issued for this unit.

- **v**—Offline, No Volume Mounted. The device does not contain media.
- **x**—Online to other controller. Not available for use by this controller.
- A space in this column indicates the availability is unknown.

The spindle state is indicated using the following characters:

- **^**—For disks, this symbol indicates the device is at speed. For tapes, it indicates the tape is loaded.
- **>**—For disks, this symbol indicates the device is spinning up. For tapes, it indicates the tape is loading.
- **<**—For disks, this symbol indicates the device is spinning down. For tapes, it indicates the tape is unloading.
- **v**—For disks, this symbol indicates the device is stopped. For tapes, it indicates the tape is unloaded.
- For other types of devices, this column is left blank.

For disks and tapes, a **w** in the write protect column indicates the unit is write protected. This column is left blank for other device types.

The data caching state is indicated using the following letters:

- **b**—Both Read caching and Write Back caching are enabled.
- **r**—Read caching is enabled.
- **w**—Write Back caching is enabled.
- A space in this column indicates caching is disabled.

❸ **KB/S**—This column indicates the average amount of kilobytes of data transferred to and from the unit in the previous screen update interval. This data is only available for disk and tape units.

❹ **Rd%**—This column indicates what percentage of data transferred between the host and the unit were read from the unit. This data is only contained in the **DEFAULT** display for disk and tape device types.

❺ **Wr%**—This column indicates what percentage of data transferred between the host and the unit were written to the unit. This data is only contained in the **DEFAULT** display for disk and tape device types.

❻ **Cm%**—This column indicates what percentage of data transferred between the host and the unit were compared. A compare operation may be accompanied by either a read or a write operation, so this column is not cumulative with read percentage and write percentage columns. This data is only contained in the **DEFAULT** display for disk and tape device types.

❼ **HT%**—This column indicates the cache hit percentage for data transferred between the host and the unit.

❽ **PH%**—This column indicates the partial cache hit percentage for data transferred between the host and the unit.

❾ **MS%**—This column indicates the cache miss percentage for data transferred between the host and the unit.

❿ **Purge**—This column shows the number of blocks purged from the write back cache in the last update interval.

⓫ **BlChd**—This column shows the number of blocks added to the cache in the last update interval.

⓬ **BlHit**—This column shows the number of cached data blocks ‘‘hit’’ in the last update interval.

Device Status

PTL❶	ASWF❷	Rq/S❸	RdKB/S❹	WrKB/S❺	Que❻	Tg❼	CR❽	BR❾	TR❿
D100	A^	0	0	0	11	0	0	0	0
D120	A^	0	0	0	0	0	0	0	0
D140	A^	0	0	0	0	0	0	0	0
D210	A^	11	93	0	1	1	0	0	0
D230	A^	0	0	0	0	0	0	0	0
D300	A^	11	93	0	2	1	0	0	0
D310	A^	0	0	0	0	0	0	0	0
D320	A^	36	247	0	12	10	0	0	0
D400	A^	11	93	0	2	1	0	0	0
D410	A^	0	0	0	0	0	0	0	0
D420	A^	36	247	0	10	8	0	0	0
D430	A^	0	0	0	0	0	0	0	0
D440	A^	0	0	0	0	0	0	0	0
D450	A^	0	0	0	0	0	0	0	0
D500	A^	11	93	0	1	1	0	0	0
D510	A^	0	0	0	0	0	0	0	0
D520	A^	0	0	0	0	0	0	0	0
D530	A^	47	0	375	6	5	0	0	0

Description

This subdisplay shows the status of the physical storage devices that are known to the controller firmware. It also shows I/O performance information and bus statistics for these devices. Up to 42 devices can be displayed in this subdisplay.

❶ The **PTL** column contains a letter indicating the type of device followed by the SCSI Port, Target, and LUN of the device. The list is sorted by port, target, and LUN. The following device type letters may appear:

- **D** indicates a disk device.
- **T** indicates a tape device.
- **L** indicates a media loader.
- **C** indicates a CD–ROM device.
- **F** indicates a device type not listed above.
- **U** indicates the device type is unknown.

❷ The **ASWF** columns indicate the allocation, spindle state, write protect state, and fault state respectively of the device.

The availability state is indicated using the following letters:

- **A**—Allocated to this controller.
- **a**—Allocated to the other controller.
- **U**—Unallocated, but owned by this controller.
- **u**—Unallocated, but owned by the other controller.
- A space in this column indicates the allocation is unknown.

The spindle state is indicated using the following characters:

- **^**—For disks, this symbol indicates the device is at speed. For tapes, it indicates the tape is loaded.
- **>**—For disks, this symbol indicates the device is spinning up. For tapes, it indicates the tape is loading.
- **<**—For disks, this symbol indicates the device is spinning down. For tapes, it indicates the tape is unloading.
- **v**—For disks, this symbol indicates the device is stopped. For tapes, it indicates the tape is unloaded.
- For other types of devices, this column is left blank.

For disks and tapes, a **W** in the write protect column indicates the device is hardware write protected. This column is left blank for other device types.

A **F** in the fault column indicates an unrecoverable device fault. If this field is set, the device fault indicator also is illuminated.

❸ **Rq/S**—This column shows the average I/O request rate for the device during the last update interval. These requests are up to eight kilobytes long and are either generated by host requests or cache flush activity.

❹ **RdKB/S**—This column shows the average data transfer rate from the device in kilobytes during the previous screen update interval.

❺ **WrKB/S**—This column shows the average data transfer rate to the device in kilobytes during the previous screen update interval.

❻ **Que**—This column shows the maximum number of transfer requests waiting to be transferred to the device during the last screen update interval.

❼ **Tg**—This column shows the maximum number of transfer requests queued to the device during the last screen update interval. If a device does not support tagged queuing, the maximum value is 1.

❽ **CR**—This column indicates the number of SCSI command resets that occurred since VTDPY was started.

❾ **BR**—This column indicates the number of SCSI bus resets that occurred since VTDPY was started.

❿ **TR**—This column indicates the number of SCSI target resets that occurred since VTDPY was started.

Device SCSI Port Performance

```
Port❶ Rq/S❷ RdKB/S❸ WrKB/S❹ CR❺ BR❻ TR❼
 1        0        0        0    0    0    0
 2       11       93        0    0    0    0
 3       48      341        0    0    0    0
 4       48      340        0    0    0    0
 5       58       93      375    0    0    0
 6        0        0        0    0    0    0
```

Description

This subdisplay shows the accumulated I/O performance values and bus statistics for the SCSI device ports. The subdisplay for a controller that has six SCSI device ports in shown.

❶ The **Port** column indicates the number of the SCSI device port.

❷ **Rq/S**—This column shows the average I/O request rate for the port during the last update interval. These requests are up to eight kilobytes long and are either generated by host requests or cache flush activity.

❸ **RdKB/S**—This column shows the average data transfer rate from all devices on the SCSI bus in kilobytes during the previous screen update interval.

❹ **WrKB/S**—This column shows the average data transfer rate to all devices on the SCSI bus in kilobytes during the previous screen update interval.

❺ **CR**—This column indicates the number of SCSI command resets that occurred since VTDPY was started.

❻ **BR**—This column indicates the number of SCSI bus resets that occurred since VTDPY was started.

❼ **TR**—This column indicates the number of SCSI target resets that occurred since VTDPY was started.

Help Example

```
VTDPY> HELP

Available VTDPY commands:

^C - Prompt for commands
^G or ^Z - Update screen
^O - Pause/Resume screen updates
^Y - Terminate program
^R or ^W - Refresh screen
DISPLAY CACHE - Use 132 column unit caching statistics display
DISPLAY DEFAULT - Use default 132 column system performance display
DISPLAY DEVICE - Use 132 column device performance display
DISPLAY STATUS - Use 80 column controller status display
EXIT - Terminate program (same as QUIT)
INTERVAL <seconds> - Change update interval
HELP - Display this help message
REFRESH - Refresh the current display
QUIT - Terminate program (same as EXIT)
UPDATE - Update screen display

VTDPY>
```

Description

This is the sample output from executing the HELP command.

6.6 CONFIG Utility

The CONFIG utility locates devices and adds them to the controller configuration. You should run the CONFIG utility whenever new devices are installed in the subsystem.

6.6.1 CONFIG Conventions

The CONFIG utility searches all PTL device combinations to determine what devices exist on the subsystem. It adds all new devices that are found, with the exception of tape loaders. The CONFIG utility does not initialize devices, and it does not add units or storagesets.

If a device somewhere in the cluster already has the PTL that the CONFIG utility plans to assign, the program will assign an alpha character after the numbers. For example, if another device is already called DISK100, the program will assign the name DISK100A to the new device. (The program compares DISK100A to other PTLs in the cluster, and if DISK100A has already been used, the program increments to DISK100B and so forth.) This avoids assigning duplicate PTLs in the same cluster.

6.6.2 Running the CONFIG Utility

You can run the CONFIG utility on either a virtual terminal or on a maintenance terminal.

Before running the CONFIG utility, you may use the SHOW DEVICES command to verify the list of devices that are currently configured on the controller, as shown in the following example. The example shows the CONFIG utility as it is run on an HSJ- or HSD-series controller.

```
CLI> SHOW DEVICES
No devices

CLI> RUN CONFIG

Config Local Program Invoked

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

add disk DISK100   1 0 0
add disk DISK120   1 2 0
add disk DISK140   1 4 0
add disk DISK210   2 1 0
add disk DISK230   2 3 0
add disk DISK500   5 0 0
add disk DISK520   5 2 0
add tape TAPE600   6 0 0
add tape TAPE610   6 1 0

Config - Normal Termination
CLI>
```

```
CLI> SHOW DEVICES
Name          Type          Port Targ  LUN                    Used by
-------------------------------------------------------------------------------

DISK100       disk             1    0    0
DISK120       disk             1    2    0
DISK140       disk             1    4    0
DISK210       disk             2    1    0
DISK230       disk             2    3    0
DISK500       disk             5    0    0
DISK520       disk             5    2    0
TAPE600       tape             6    0    0
TAPE610       tape             6    1    0
CLI>
```

After you run the CONFIG utility, you may have to initialize your containers using the INITIALIZE command as described in Appendix B.

6.7 Configuration Menu

The configuration menu (CFMENU) allows you to quickly configure storage devices attached to the controller. CFMENU uses a menu format to present configuration commands normally entered at the CLI.

The CFMENU utility requires a video terminal that supports ANSI control sequences, such as a VT220, VT320, or VT420 terminal. You can also use a graphics display that provides emulation of an ANSI compatible video terminal. For HSJ- and HSD-series controllers, you can run CFMENU on maintenance or virtual terminals. For HSZ-series controllers, you can only run CFMENU on terminals connected the the controller maintenance terminal port. Prior to running CFMENU, be sure the terminal is set in NOWRAP mode. Otherwise, the display may not appear correctly on the screen.

You should have a good understanding of the various CLI commands described in Appendix B before running CFMENU, because CFMENU will prompt you to choose options for devices, storagesets, and units based on the command qualifiers of the CLI.

This section presents an overview of one configuration, from start to finish. Only one example is described because of the many combinations of choices that can be made during any configuring situation. Note that the options for passthrough containers are not available for HSZ-series controllers.

6.7.1 Restrictions

The following restrictions apply to CFMENU:

- For dual-redundant configurations, do not run CFMENU on both controllers at the same time.
- You can only set options for existing devices, storagesets, and units when you first add them to the configuration. You cannot modify any options later. To change option settings, you must delete and recreate the item.
- You cannot use CFMENU to configure tape loaders. They will not show up in the list of available devices, and therefor you cannot add them or perform any other operations on them. You must configure tape loaders from the CLI.

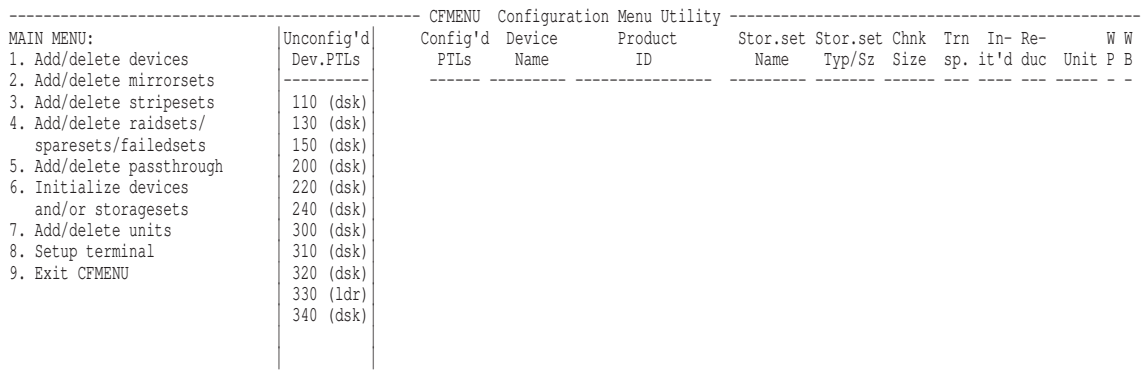
6.7.2 Main Menu

Run CFMENU during a terminal session by invoking it from the CLI prompt:

```
CLI> RUN CFMENU
```

The main menu appears as shown in Figure 6–10. Any attached devices that have not been added to your configuration will appear, with their PTLs, in the column to the right of the menu options.

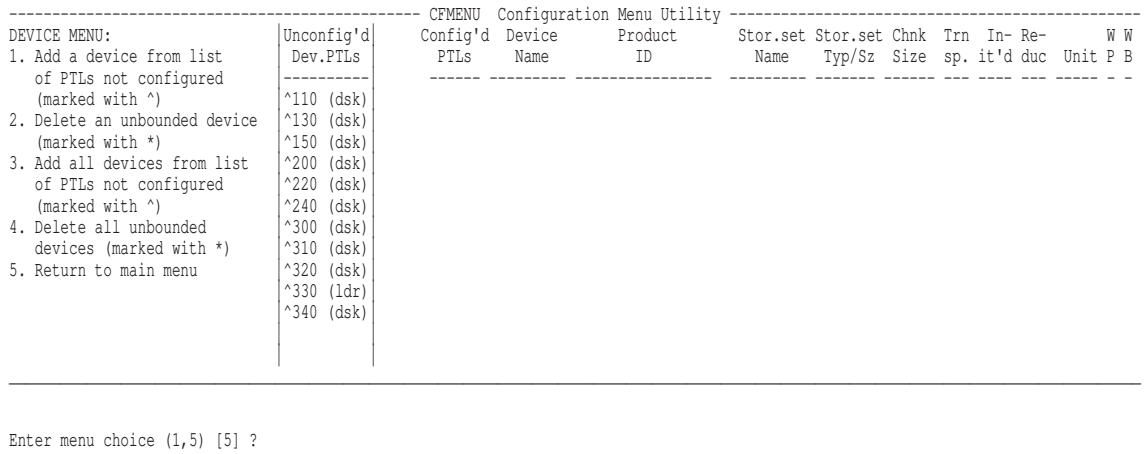
Figure 6–10 CFMENU Main Menu



6.7.3 Adding Devices

From the main menu, enter option 1 (press 1 followed by Return). The device menu appears as shown in Figure 6–11. The same list of unconfigured devices remains to the right of the options. When the list is too long to be shown on one screen, you can enter D or U to scroll the information down or up.

Figure 6–11 CFMENU Device Menu (Before Adding Devices)

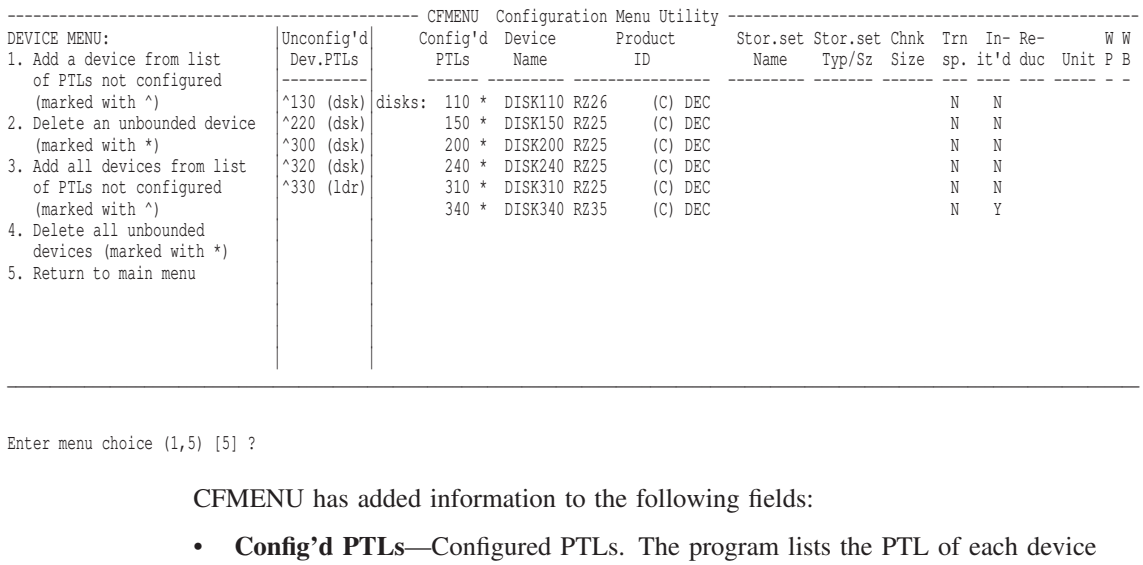



```
Enter menu choice (1,5) [5] ?
```

In Figure 6–11, none of the devices have been added to the configuration yet. If you enter option 1, CFMENU asks you whether to add each device on the list. If you enter option 3, CFMENU will add *all* the unknown devices, in the same way as the CONFIG utility (refer to Section 6.6).

After entering option 1 and adding some devices, the screen will resemble Figure 6–12.

Figure 6–12 CFMENU Device Menu



CFMENU has added information to the following fields:

- **Config'd PTLs**—Configured PTLs. The program lists the PTL of each device added to your configuration.
- **Device Name**—CFMENU automatically assigns a name to each device. The name contains both the device type and PTL. You cannot override the automatic CFMENU naming convention.
- **Product ID**—Information identifying the device model appears here.
- **Trnsp**—Transportable. This field identifies whether the device is transportable.
- **Init'd**—Initialized. This field identifies whether the device is initialized.

After adding devices, return to the main menu.

6.7.4 Adding Mirrorsets

Enter option 2 from the main menu to work with mirrorsets. From the mirrorset menu (see Figure 6–13), enter option 1 to add a mirrorset. CFMENU will prompt you for how many and which devices from the configured PTLs list you want to include in the mirrorset (two to six devices allowable). In Figure 6–13, two mirrorsets were created, one from disks at PTLs 110 and 300, and the other from disks at PTLs 130 and 150.

Figure 6–13 CFMENU Mirrorset Menu

```
------------------------------------------------ CFMENU  Configuration Menu Utility ------------------------------------------------
MIRRORSET MENU:                 |Unconfig'd|     Config'd  Device       Product       Stor.set Stor.set Chnk  Trn  In-  Re-       W W
1. Create a mirrorset (elig-    | Dev.PTLs |       PTLs     Name          ID            Name    Typ/Sz  Size  sp. it'd duc  Unit P B
   ible devices marked by ^)    |----------|      ------ --------- ----------------  --------- ------- ------ --- ---- --- ----- - -
2. Delete an unbounded          |          | disks:  200 ^  DISK200 RZ25     (C) DEC                          N    Y
   mirrorset (marked by *)      |          |         220 ^  DISK220 RZ25     (C) DEC                          N    Y
3. Delete all unbounded         |          |         240 ^  DISK240 RZ25     (C) DEC                          N    Y
   mirrorsets (marked by *)     |          |         310 ^  DISK310 RZ25     (C) DEC                          N    Y
4. Mirror a disk (eligible      |          |         320 ^  DISK320 RZ25     (C) DEC                          N    Y
   devices marked by +)         |          |         330 ^  DISK330 RZ26     (C) DEC                          N    Y
5. Unmirror a disk (eligible    |          |         340 ^  DISK340 RZ35     (C) DEC                          N    Y
   devices marked by -)         |          | miror:  110    DISK110 RZ26     (C) DEC *    M1    MIR/2               Y   N
6. Change membership of a       |          |         300    DISK300 RZ26     (C) DEC      "       "                 "   "
   mirrorset (submenu)          |          |         130    DISK130 RZ25     (C) DEC *    M2    MIR/2               N   N
7. Return to main menu          |          |         150    DISK150 RZ25     (C) DEC      "       "                 "   "
                                |          |
                                |          |
                                |          |
```

CFMENU updates the following fields after adding a mirrorset:

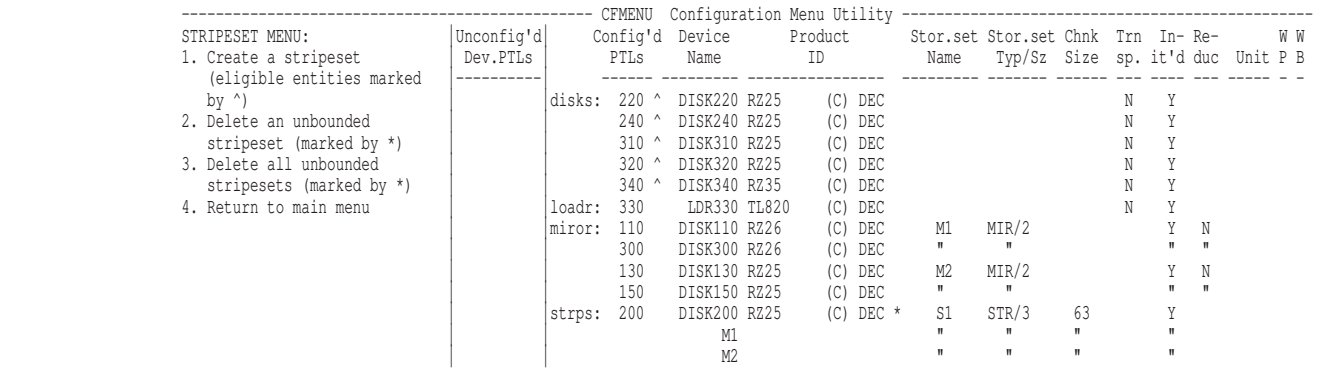
- **Stor.set Name**—Storageset name. CFMENU automatically assigns the name ''M*x*'' to a mirrorset. You cannot alter this automatic CFMENU naming convention.
- **Stor.set Typ/Sz**—Storageset type and size. This field will read ''MIR'' for storagesets that are mirrorsets and indicate the number of members in the mirrorset.

After adding mirrorsets, return to the main menu.

6.7.5 Adding Stripesets

Enter option 3 from the main menu to work with stripesets. From the stripeset menu (see Figure 6–14), enter option 1 to add a stripeset. CFMENU will prompt you for how many and which devices from the configured PTLs list you wish to include in the stripeset (2 to 14 devices allowable). In Figure 6–14, a stripeset was created from the disk at PTL 200 and the mirrorsets M1 and M2.

Figure 6–14 CFMENU Stripeset Menu



```
------------------------------------------------ CFMENU  Configuration Menu Utility -------------------------------------------------
STRIPESET MENU:                 |Unconfig'd|     Config'd  Device       Product       Stor.set Stor.set Chnk  Trn  In- Re-       W W
1. Create a stripeset           | Dev.PTLs |       PTLs     Name          ID            Name    Typ/Sz  Size  sp. it'd duc  Unit P B
   (eligible entities marked    |----------|      ------ --------- ----------------  --------- ------- ------ --- ---- --- ----- - -
   by ^)                        |          |disks:  220 ^  DISK220 RZ25     (C) DEC                          N    Y
2. Delete an unbounded          |          |        240 ^  DISK240 RZ25     (C) DEC                          N    Y
   stripeset (marked by *)      |          |        310 ^  DISK310 RZ25     (C) DEC                          N    Y
3. Delete all unbounded         |          |        320 ^  DISK320 RZ25     (C) DEC                          N    Y
   stripesets (marked by *)     |          |        340 ^  DISK340 RZ35     (C) DEC                          N    Y
4. Return to main menu          |          |loadr:  330     LDR330 TL820    (C) DEC                          N    Y
                                |          |miror:  110     DISK110 RZ26    (C) DEC      M1    MIR/2                 Y   N
                                |          |        300     DISK300 RZ26    (C) DEC      "     "                     "   "
                                |          |        130     DISK130 RZ25    (C) DEC      M2    MIR/2                 Y   N
                                |          |        150     DISK150 RZ25    (C) DEC      "     "                     "   "
                                |          |strps:  200     DISK200 RZ25    (C) DEC *    S1    STR/3     63          Y
                                |          |                    M1                       "     "       "           "
                                |          |                    M2                       "     "       "           "
```

CFMENU updates the following fields after adding a stripeset:

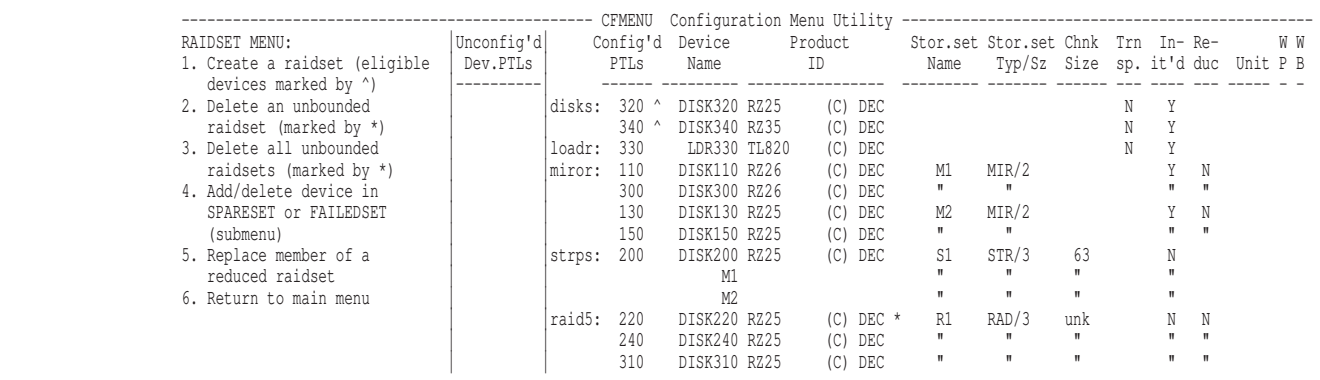
- **Stor.set Name**—Storageset name. CFMENU automatically assigns the name ''S*x*'' to a stripeset. You cannot alter this automatic CFMENU naming convention.
- **Stor.set Typ/Sz**—Storageset type and size. This field will read ''STR'' for storagesets that are stripesets, and indicate the number of members in the stripeset.
- **Chnk Size**—Chunk size. This field will read ''unk'' (unknown) until you initialize the stripeset.

After adding stripesets, return to the main menu.

6.7.6 Adding RAIDsets

Enter option 4 from the main menu to work with RAIDsets. From the RAIDset menu (see Figure 6–15), enter option 1 to add a RAIDset. CFMENU will prompt you for how many and which devices from the configured PTLs list you wish to include in the RAIDset (3 to 14 devices allowable). In Figure 6–15, a RAIDset was created from disks at PTLs 220, 240, and 310.

Figure 6–15 CFMENU RAIDset Menu



```
------------------------------------------------ CFMENU  Configuration Menu Utility -------------------------------------------------
RAIDSET MENU:                   |Unconfig'd|     Config'd  Device       Product       Stor.set Stor.set Chnk  Trn  In- Re-       W W
1. Create a raidset (eligible   | Dev.PTLs |       PTLs     Name          ID            Name    Typ/Sz  Size  sp. it'd duc  Unit P B
   devices marked by ^)         |----------|      ------ --------- ----------------  --------- ------- ------ --- ---- --- ----- - -
2. Delete an unbounded          |          |disks:  320 ^  DISK320 RZ25     (C) DEC                          N    Y
   raidset (marked by *)        |          |        340 ^  DISK340 RZ35     (C) DEC                          N    Y
3. Delete all unbounded         |          |loadr:  330     LDR330 TL820    (C) DEC                          N    Y
   raidsets (marked by *)       |          |miror:  110     DISK110 RZ26    (C) DEC      M1    MIR/2                 Y   N
4. Add/delete device in         |          |        300     DISK300 RZ26    (C) DEC      "     "                     "   "
   SPARESET or FAILEDSET        |          |        130     DISK130 RZ25    (C) DEC      M2    MIR/2                 Y   N
   (submenu)                    |          |        150     DISK150 RZ25    (C) DEC      "     "                     "   "
5. Replace member of a          |          |strps:  200     DISK200 RZ25    (C) DEC      S1    STR/3     63          N
   reduced raidset              |          |                    M1                       "     "       "           "
6. Return to main menu          |          |                    M2                       "     "       "           "
                                |          |raid5:  220     DISK220 RZ25    (C) DEC *    R1    RAD/3     unk         N   N
                                |          |        240     DISK240 RZ25    (C) DEC      "     "       "           "   "
                                |          |        310     DISK310 RZ25    (C) DEC      "     "       "           "   "
```

CFMENU updates the following fields after adding a RAIDset:

- **Stor.set Name**—Storageset name. CFMENU automatically assigns the name ''R*x*'' to a RAIDset. You cannot alter this automatic CFMENU naming convention.
- **Stor.set Typ/Sz**—Storageset type. This field will read ''RAD'' for storagesets that are RAIDsets, and indicate the number of members in the RAIDset.
- **Chnk Size**—Chunk size. This field will read ''unk'' (unknown) until you initialize the RAIDset.

6.7.7 Adding to Sparesets

Enter option 5 (HSJ- and HSD-series) or option 4 (HSZ-series) from the RAIDset menu to work with the sparesets and failedsets associated with RAIDsets. From the spareset/failedset menu (see Figure 6–16), you can, for example, enter option 1 to add a device to the spareset. CFMENU will prompt you for which devices from the configured PTLs list you wish to include in the spareset. In Figure 6–16, one device, PTL 320, was added to the spareset.

Figure 6–16 CFMENU Spareset/Failedset Menu

```
------------------------------------------------ CFMENU  Configuration Menu Utility ------------------------------------------------
SPARESET/FAILEDSET MENU:        |Unconfig'd|     Config'd  Device       Product       Stor.set Stor.set Chnk  Trn  In- Re-       W W
1. Add a device to the          | Dev.PTLs |       PTLs     Name          ID            Name    Typ/Sz  Size  sp. it'd duc  Unit P B
   SPARESET (eligible           |----------|      ------ ---------  ----------------  --------- ------- ------ --- ---- --- ----- - -
   devices marked by ^)         |          |disks:  340 ^  DISK340 RZ35     (C) DEC                          N    Y
2. Remove a device from the     |          |loadr:  330     LDR330 TL820    (C) DEC                          N    Y
   SPARESET                     |          |miror:  110    DISK110 RZ26     (C) DEC      M1    MIR/2               Y   N
3. Remove a device from a       |          |        300    DISK300 RZ26     (C) DEC      "       "                 "   "
   RAIDSET and place in the     |          |        130    DISK130 RZ25     (C) DEC      M2    MIR/2               Y   N
   FAILEDSET (eligible devices  |          |        150    DISK150 RZ25     (C) DEC      "       "                 "   "
   marked by *)                 |          |strps:  200    DISK200 RZ25     (C) DEC      S1    STR/3     63        N
4. Remove a device from the     |          |                    M1                      "       "       "         "
   FAILEDSET                    |          |                    M2                      "       "       "         "
5. Return to RAIDSET menu       |          |raid5:  220    DISK220 RZ25     (C) DEC      R1    RAD/3    unk        N   N
                                |          |        240    DISK240 RZ25     (C) DEC      "       "       "         "   "
                                |          |        310    DISK310 RZ25     (C) DEC      "       "       "         "   "
                                |          |spare:  320    DISK320 RZ25     (C) DEC
```

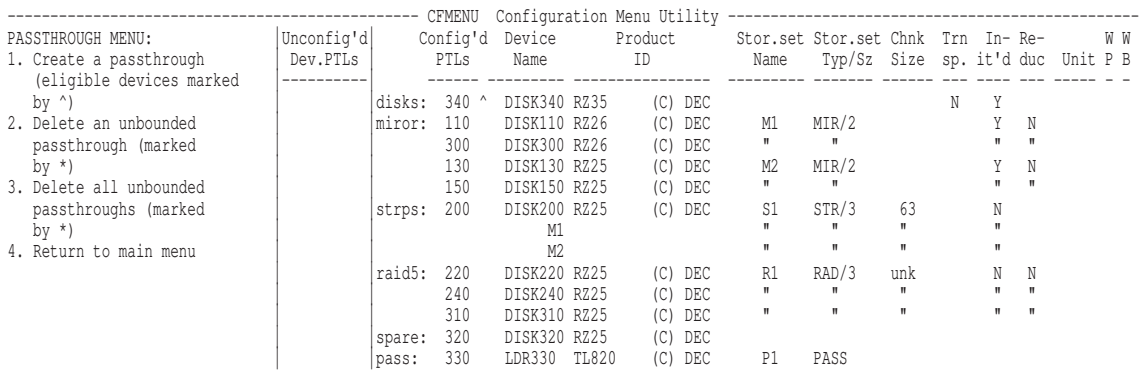
After adding sparesets, return to the main menu via the RAIDset menu.

6.7.8 Adding Passthroughs (HSJ- and HSD-Series)

Enter option 5 from the main menu to work with passthroughs. From the passthrough menu (see Figure 6–17), enter option 1 to add a passthrough. CFMENU will prompt you for which device from the configured PTLs list you wish to include in the passthrough.

Although you may add any generic SCSI device, you will normally add devices requiring the use of MSCP read and write operations as a transport for SCSI commands (such as ''jukebox'' style loaders). In Figure 6–17, a passthrough was created from the tape library (loader) at PTL 330.

Figure 6–17 CFMENU Passthrough Menu



```
------------------------------------------------ CFMENU  Configuration Menu Utility -----------------------------------------------
PASSTHROUGH MENU:              |Unconfig'd|     Config'd  Device       Product       Stor.set Stor.set Chnk  Trn  In- Re-       W W
1. Create a passthrough        | Dev.PTLs |       PTLs     Name          ID            Name    Typ/Sz  Size  sp. it'd duc  Unit P B
   (eligible devices marked    |----------|      ------ --------- ----------------  -------- ------- ------ --- ---- --- ----- - -
   by ^)                       |          |disks:  340 ^  DISK340 RZ35     (C) DEC                          N    Y
2. Delete an unbounded         |          |miror:  110    DISK110 RZ26     (C) DEC      M1    MIR/2               Y   N
   passthrough (marked         |          |        300    DISK300 RZ26     (C) DEC      "       "                 "   "
   by *)                       |          |        130    DISK130 RZ25     (C) DEC      M2    MIR/2               Y   N
3. Delete all unbounded        |          |        150    DISK150 RZ25     (C) DEC      "       "                 "   "
   passthroughs (marked        |          |strps:  200    DISK200 RZ25     (C) DEC      S1    STR/3     63        N
   by *)                       |          |                    M1                       "       "       "         "
4. Return to main menu         |          |                    M2                       "       "       "         "
                               |          |raid5:  220    DISK220 RZ25     (C) DEC      R1    RAD/3    unk        N   N
                               |          |        240    DISK240 RZ25     (C) DEC      "       "       "         "   "
                               |          |        310    DISK310 RZ25     (C) DEC      "       "       "         "   "
                               |          |spare:  320    DISK320 RZ25     (C) DEC
                               |          |pass:   330    LDR330  TL820    (C) DEC      P1    PASS
```

CFMENU updates the following fields after adding a passthrough:

- **Stor.set Name**—Storageset name. CFMENU automatically assigns the name ''P*x*'' to a passthrough. You cannot alter this automatic CFMENU naming convention.
- **Stor.set Typ/Sz**—Storageset type. This field will read ''PASS'' for passthroughs.

After adding passthroughs, return to the main menu.

6.7.9 Initializing Containers

Enter option 6 (HSJ- and HSD-series) or option 5 (HSZ-series) from the main menu to initialize containers (devices or storagesets). From the initialization menu (see Figure 6–18), enter option 1. CFMENU will ask you if you want to initialize each eligible container.

In addition, CFMENU will prompt you to decide on other operating qualifiers, depending on whether the container is a device, mirrorset, stripeset, or RAIDset. See the descriptions of the ADD or SET commands in Appendix B if you need help understanding the qualifiers.

In Figure 6–18, the mirrorsets created earlier (M1 and M2) are initialized. The disk at PTL 340 has been initialized throughout this example, because CFMENU detected its condition when it was added to the configuration.

Figure 6–18 CFMENU Initialization Menu

```
------------------------------------------------ CFMENU  Configuration Menu Utility ------------------------------------------------
INITIALIZATION MENU:          |Unconfig'd|     Config'd  Device       Product       Stor.set Stor.set Chnk  Trn  In- Re-       W W
1. Initialize a device or     | Dev.PTLs |       PTLs     Name          ID            Name    Typ/Sz  Size  sp. it'd duc  Unit P B
   storageset (eligible       |----------|      ------ --------- ----------------  --------- ------- ------ --- ---- --- ----- - -
   entities marked with ^)    |          |disks:  340 ^  DISK340 RZ35     (C) DEC                                N    Y
2. Return to main menu        |          |miror:  110    DISK110 RZ26     (C) DEC      M1    MIR/2                 Y   N
                              |          |        300    DISK300 RZ26     (C) DEC      "       "                   "   "
                              |          |        130    DISK130 RZ25     (C) DEC      M2    MIR/2                 Y   N
                              |          |        150    DISK150 RZ25     (C) DEC      "       "                   "   "
                              |          |strps:  200    DISK200 RZ25     (C) DEC ^    S1    STR/3     63          N
                              |          |                    M1                       "       "       "           "
   WARNING!  Initialization of|          |                    M2                       "       "       "           "
   any device or storageset   |          |raid5:  220    DISK220 RZ25     (C) DEC ^    R1    RAD/3    unk          N   N
   will destroy all of its    |          |        240    DISK240 RZ25     (C) DEC      "       "       "           "   "
   current data.              |          |        310    DISK310 RZ25     (C) DEC      "       "       "           "   "
                              |          |spare:  320    DISK320 RZ25     (C) DEC
                              |          |pass:   330    LDR330  TL820    (C) DEC      P1    PASS
```

After initializing containers, return to the main menu.

6.7.10 Adding Units

Enter option 7 (HSJ- and HSD-series) or option 6 (HSZ-series) from the main menu to work with units. From the unit menu (see Figure 6–19), enter option 1 to add a unit. CFMENU will prompt you for which initialized containers you wish to create units from.

CFMENU also will prompt you to assign a unit number. (The program automatically assigns a ''D'' or ''T'' to the unit number when listing the unit, as shown in Figure 6–19.) In addition, CFMENU will prompt you to decide on other unit qualifiers. See the description of the ADD *unit* or SET *unit* commands in Appendix B if you need help understanding the qualifiers.

Note

Do not use CFMENU to modify the write-back cache setting for units. Accept the default setting when creating units.

In Figure 6–19, a unit was created from stripeset S1.

Figure 6–19 CFMENU Unit Menu

```
------------------------------------------------ CFMENU  Configuration Menu Utility ------------------------------------------------
UNIT MENU:                          |Unconfig'd|     Config'd  Device       Product       Stor.set Stor.set Chnk  Trn  In- Re-       W W
1. Create a unit (eligible          | Dev.PTLs |       PTLs     Name          ID            Name    Typ/Sz  Size  sp. it'd duc  Unit P B
   entities marked by ^)            |----------|      ------ --------- ----------------  --------- ------- ------ --- ---- --- ----- - -
2. Delete a unit (eligible          |          |disks:  340 ^  DISK340 RZ35     (C) DEC                           N    Y
   units marked by *)               |          |miror:  110    DISK110 RZ26     (C) DEC      M1    MIR/2                Y   N
3. Return to main menu              |          |        300    DISK300 RZ26     (C) DEC      "       "                  "   "
                                    |          |        130    DISK130 RZ25     (C) DEC      M2    MIR/2                Y   N
                                    |          |        150    DISK150 RZ25     (C) DEC      "       "                  "   "
                                    |          |strps:  200    DISK200 RZ25     (C) DEC      S1    STR/3     63         Y     * D100 Y N
                                    |          |                    M1                       "       "       "          "        "   " "
                                    |          |                    M2                       "       "       "          "        "   " "
                                    |          |raid5:  220    DISK220 RZ25     (C) DEC ^    R1    RAD/3     63         Y   N
                                    |          |        240    DISK240 RZ25     (C) DEC      "       "       "          "   "
                                    |          |        310    DISK310 RZ25     (C) DEC      "       "       "          "   "
                                    |          |spare:  320    DISK320 RZ25     (C) DEC
                                    |          |pass:   330    LDR330  TL820    (C) DEC      P!    PASS
```

CFMENU updates the following fields after adding a unit:

- **Reduc**—Reduced. This field indicates whether a RAIDset is running reduced (missing one member).
- **Unit**—The unit number you assign appears here, preceded by the letter ''D'' or ''T.''
- **WP**—Write protect. This value indicates whether the unit is write protected.
- **WB**—Write-back. This value indicates whether the unit is set for write-back caching.

6.7.11 Terminal Setup

You can enter option 8 (HSJ- and HSD-series) or option 7 (HSZ-series) from the main menu to set the number of rows CFMENU will display. This feature is available primarily for terminals with the capability of displaying more than 24 rows.

6.7.12 Messages

This section lists the messages, other than the standard CLI messages, that CFMENU will display. However, most messages you will see will be those sent by the CLI, and are described in Appendix B.

CFMENU cannot complete request without exceeding array boundary.

Explanation: CFMENU detected an unexpected condition which would exceed an array boundary and possibly require controller reinitialization, so it aborted your request.

...CFMENU is updating its configuration tables. Please be patient...

Explanation: CFMENU is polling the SCSI ports to see what physical devices are in place, as well as checking the configuration information.

MIRROR license is not enabled; cannot create mirrorset.

Explanation: You may not configure any mirrorsets unless the Disk Mirroring license has been enabled by running the FLS utility.

Not enough eligible devices to complete the storageset.

Explanation: You chose to create a stripeset or a RAIDset and specified how many members to use, but there are not enough eligible devices to make up a storageset of this size. Eligible devices are disks that have the NOTRANSPORTABLE switch set, and that are not already used in any higher-level configuration such as a unit, storageset, spareset, or failedset.

Not enough members specified for a non-reduced RAIDset

Explanation: You chose to create a RAIDset and specified that it is not a previously reduced RAIDset. However, when choosing how many members to add to the RAIDset, you specified a number that is only legal for a reduced RAIDset and is too low for a nonreduced RAIDset.

...Polling for unconfigured devices...

Explanation: CFMENU is polling the SCSI ports to see what physical devices are in place.

Port *port#* is blocked. No devices will be configured on port *port#*

Explanation: In order to check each device bus to discover what devices are present, firmware must also see if any port is currently blocked. A port can be blocked for various reasons, such as when its bus is quiesced. When a port is blocked, CFMENU will not access devices on that bus.

RAID5 license is not enabled; cannot create RAID5 set.

Explanation: You may not configure any RAIDsets unless the RAID5 license has been enabled by running the FLS utility.

Received user request to terminate CFMENU...

Explanation: You pressed Ctrl/C or Ctrl/Y to abort CFMENU.

There are no devices available to use as a replacement.

Explanation: You chose to replace a member of a reduced RAIDset, but there are no disks eligible to use for the replacement member. Eligible disks must have the NOTRANSPORTABLE switch set and may not be part of any higher-level configuration such as units, storagesets, or the spareset or failedset.

There are no devices available to use in a passthrough

Explanation: You chose to create a passthrough container, but there are no devices eligible to be added to a passthrough. Eligible devices are any SCSI device that is not already used in any higher-level configuration such as a unit, storageset, spareset, or failedset. Disk devices must be set NOTRANSPORTABLE to be eligible.

There are no *devices/stripesets/RAIDsets/passthroughs* eligible for deletion.

Explanation: You chose to delete a device, stripeset, RAIDset, or passthrough; but there are none that are eligible for deletion. A stripeset, RAIDset, or passthrough may not be deleted if it is configured as a unit. A device may not be deleted if it is configured as a unit or if it is used in a storageset, spareset, or failedset.

There are no devices eligible to be added to the configuration.

Explanation: You chose to add a device, but there are no devices available to add. The only devices that are eligible to be added are devices that CFMENU has detected as being physically present on a SCSI port and that are not already configured as devices on the controller.

There are no devices eligible to be added to the spareset.

Explanation: You chose to add a device to the spareset, but no devices are eligible. The only devices that may be added to the spareset are disks that have the NOTRANSPORTABLE switch set, and that are not already used in any higher-level configuration such as a unit, storageset, spareset, or failedset.

There are no devices eligible to be mirrored.

Explanation: You chose to mirror a device but there are no devices eligible to be mirrored. Eligible devices are disks that have the NOTRANSPORTABLE switch set and are configured as units or as part of a stripeset unit.

There are no devices eligible to be unmirrored.

Explanation: You chose to unmirror a device but there are no devices eligible to be unmirrored. Eligible devices are the only members of 1-member mirrorsets that are configured as units or as part of a stripeset unit.

There are no devices in the failedset.

Explanation: You chose to delete devices from the failedset but the failedset currently is empty.

There are no devices in the spareset.

Explanation: You chose to delete devices from the spareset but the spareset currently is empty.

There are no entities eligible for initialization.

Explanation: You chose to initialize a device or storageset, but there are currently no devices or storagesets that are eligible to be initialized. Tapes, CD–ROMs, loaders, and passthrough devices may not be initialized. Optical memory devices, stripesets, and RAIDsets may be initialized, but only if they are not already configured as a unit. Disks may be initialized only if they are not already configured as a unit or as part of a storageset, spareset, or failedset.

There are no entities eligible to be added as units.

Explanation: You chose to add a unit, but there are no devices or storagesets that are eligible to become units. Tape and CD–ROM devices (HSJ- and HSD-series only) can be added as units unless they are already configured as units. Passthrough containers (HSJ- and HSD-series only) also can be added as units unless they are already configured as units. Disks, optical memory, stripesets, and RAIDsets must first be initialized before they can be added as units. Disks may not be made into units if they are currently in the spareset or the failedset.

There are no mirrorsets eligible for changing membership count.

Explanation: You chose to change the membership count of a mirrorset, but there are no mirrorsets eligible for this operation. To be eligible, a mirrorset must be associated with a unit and must not already have the maximum number of members allowed for a mirrorset.

There are no reduced *RAIDset/mirrorset* units with NOPOLICY set.

Explanation: You chose to replace a member of a reduced RAIDset. CFMENU is unable to find any RAIDsets that are eligible for a manual replacement. In order to be eligible, the RAIDset must be configured as a unit, it must be in a reduced state, and it must have the NOPOLICY switch set.

There are no storageset units with members that can be moved to the FAILEDSET.

Explanation: You chose to move a device from a storageset to the FAILEDSET, but there are no devices eligible for that operation. Eligible devices must be members of RAIDsets or mirrorsets that are associated with a unit. If the device is a member of a RAIDset, it must not be a reduced RAIDSET. If the device is a member of a mirrorset, removing the device from the mirrorset must leave at least one member of the mirrorset in a normal state.

There are no units to delete.

Explanation: You chose to delete a unit, but there are no units configured on the controller.

Unable to allocate memory, CFMENU terminating.

Explanation: There is not enough memory available for CFMENU to run.

User has not picked enough eligible devices to complete the storageset.

Explanation: You chose to create a stripeset or a RAIDset and specified how many members to use, but when CFMENU prompted for devices, you did not select enough to complete the storageset.

Waiting for completion of CLI command...

Explanation: Some CLI commands take a long time to complete, such as initializing a large RAIDset or adding a tape drive that needs to have the tape rewound. CFMENU prints out this message periodically to inform you that it is still waiting for the last CLI command to finish.

6.7.13 Exiting CFMENU

Enter the last option from the main menu to stop CFMENU and return to the CLI. (You also may enter Ctrl/C or Ctrl/Y to abort CFMENU.)

6.8 Code Load/Code Patch Utility

The Code Load/Code Patch (CLCP) utility allows you to perform two program modification functions in the controller:

- Code patching—You can alter programs stored in the controller's NVMEM while the controller is active.
- Code loading—You can upgrade the firmware in your controller's PCMCIA card via the maintenance port.

Note

The Code Load portion of the CLCP utility is only supported on HSZ40–B*x* array controllers with HSOF firmware Version 2.1 or greater.

6.8.1 Invoking the CLCP Utility

Invoke the CLCP utility using the RUN command from the CLI interface as follows:

```
CLI> RUN CLCP

 Select an option from the following list:

 Code Load & Code Patch local program Main Menu

 0: Exit
 1: Enter Code LOAD local program
 2: Enter Code PATCH local program

  Enter option number  (0..2) [0] ?
```

When you select the desired option number, the appropriate function of the utility executes, prompting for further inputs.

6.8.2 Code Load

CAUTION

The program card is shipped from the factory with the write protect switch in the write protect position. Before using the Code Load function, slide the write protect switch on the bottom right-hand end of the card (when the label is facing up) to the *left* (this can be done with the card still inserted in its slot). This action disables the write protection and allows you to write the new information. After running CLCP, remember to slide the switch back to the *right* (the write protect position).

The Code Load option of the CLCP utility is invoked from an external processor (typically a personal computer) connected to the maintenance terminal port on the front bezel of the controller. The processor must run a communication program that supports the KERMIT transfer protocol at 19,200 baud, with 8 data bits, no parity, and one stop bit.

To perform a Code Load operation, a file containing the new firmware image must be stored in the external processor. You can obtain the binary firmware image file from your Digital Equipment Corporation representative. Contact your representative for further details on the distribution of firmware updates.

You invoke the CLCP utility using the communication program on the external processor. The CLCP program prompts you to download the binary program file using KERMIT.

Once loaded into the controller's memory, the new image is written into the controller's PCMCIA program card. The Code Load program then automatically initializes the controller to place the new controller firmware into operation.

6.8.2.1 Using Code Load

Note

If you run the Code Load option of the CLCP utility from a personal computer, disable all screen savers while the Code Load program is running.

Operate the Code Load utility as follows:

1. Load the binary firmware image file into the external processor. Use file or network transfer utilities appropriate to the external processor.
2. Invoke the CLCP utility and select the Code Load option as follows:

```
CLI> RUN CLCP

 Select an option from the following list:

Code Load & Code Patch local program Main Menu

 0: Exit
 1: Enter Code LOAD local program
 2: Enter Code PATCH local program

Enter option number (0..2) [0] ? 1
---------------------------------------------------------------
You have selected the Code Load local program.  This program is
used to load a new firmware image on the program card currently
inserted in the controller.  The file transfer is performed using
a computer running the KERMIT file transfer protocol.  This computer
is connected via a serial communication line to the service port on
the controller board.

 Type ^Y or ^C (then RETURN) at any time to abort Code Load.

 Perform the following steps before continuing:
     * Access the new image file over the serial line from the host computer.
     * Configure KERMIT with the following parameters:
          Terminal speed 19200 baud, eight bit, no parity, 1 stop bit

 WARNING: Proceeding with Code Load will overwrite the current
          content of your program card with a new image.
          Enter Y (then RETURN) to continue [N] ? Y
 Start KERMIT now...
```

3. Using the KERMIT file transfer protocol from the external processor, download the binary firmware image file to the controller. The details of this action are specific to the operating environment of the external processor.
4. The Code Load program acknowledges the downloaded file and writes the new firmware image to the PCMCIA program card memory.

```
 KERMIT file transferred successfully.

 Program card is being re-programmed with new file.
  *** Do not interrupt this step ***

CLI>
```

6.8.3 Code Patching

The Code Patch function of the CLCP utility allows you to enter small changes (provided by Digital Equipment Corp.) to the executing controller code. The changes that you enter are placed directly into the controller's NVMEM, and become active after the next controller initialization.

The Code Patch function also allows you to list patches already installed and delete any of those patches.

You can run the Code Patch function of the CLCP utility from either a maintenance terminal or a virtual host terminal.

Note

The Code Patch function of the CLCP utility is supported on all HS array controller models.

6.8.3.1 Code Patch Considerations

Be aware of the following when using the Code Patch function of the CLCP utility:

- The controller reserves enough nonvolatile memory for approximately ten (10) patches. However, this number varies according to the size of the patches you enter.
- Each patch is associated with only one firmware version, and the Code Patch program verifies the patch against the currently installed firmware version.
- Patches are hierarchical. In other words, patch number one (1) must be entered before you enter patch number two (2), and so on. Furthermore, there are no ''0'' patches. Patches are always numbered sequentially beginning with the number ''1.''
- Because of the hierarchical patch structure, removing any patch also removes all higher numbered patches. For example, deleting patch number two (2) also removes patches three (3), four (4), and so on.
- Controllers in dual-redundant configurations must have the same patches applied. You must enter patches into each controller separately.

6.8.3.2 Using Code Load

1. Obtain the appropriate patch data for your controller's firmware version from your Digital Equipment Corporation representative.
2. Reach the Main Menu of the Code Patch function as follows:

```
CLI> RUN CLCP

 Select an option from the following list:

Code Load & Code Patch local program Main Menu
```

```
 0: Exit
 1: Enter Code LOAD local program
 2: Enter Code PATCH local program

Enter option number  (0..2) [0] ? 2

 You have selected the Code Patch program.  This program is used
 to manage firmware code patches.  Select an option from the
 following list:

 Type ^Y or ^C (then RETURN) at any time to abort Code Patch.

 Code Patch Main Menu

       0: Exit
       1: Enter a Patch
       2: Delete Patches
       3: List Patches

  Enter option number (0..3) [0] ?
```

3. Select the desired Code Patch option by entering an option number and pressing RETURN.

Note

The patch data in these examples is provided only for the purposes of illustrating the code patch operation. Obtain actual code patch data for your controller's firmware version from your Digital representative.

6.8.3.3 Entering a Patch

The following is an example of entering a patch to the current firmware version loaded on your controller:

```
CLI> RUN CLCP

 Select an option from the following list:

Code Load & Code Patch local program Main Menu

 0: Exit
 1: Enter Code LOAD local program
 2: Enter Code PATCH local program

Enter option number  (0..2) [0] ? 2

 You have selected the Code Patch local program.  This program is
 used to manage firmware code patches.  Select an option from the
 following list:

 Type ^Y or ^C (then RETURN) at any time to abort Code Patch.

 Code Patch Main Menu

       0: Exit
       1: Enter a Patch
       2: Delete Patches
       3: List Patches

  Enter option number (0..3) [0] ? 1

 This is the Enter a Patch option.  The program prompts you
 for the patch information, one line at time.  Be careful
 to enter the information exactly as it appears on the patch release.
 Patches may be installed for any version of firmware; however,
 patches entered for firmware versions other than XLZ6   are not
 applied until the matching version of firmware is installed.
```

```
To enter any patch, you must first install all patches with lower patch
numbers, beginning with patch number 1, for the specific firmware version.
If you incorrectly enter the patch information, you are given
the option to review the patch one line at a time.

Type ^Y or ^C (then RETURN) at any time to abort Code Patch.

Do you wish to continue (y/n) [y] ? Y

Version:      ? XLZ6
Length:       ? 10
Patch Type:   ? 0
Patch Number: ? 1

Count:        ? 1
Address:      ? 10
Value[  0]    ? 0
Count:        ? 0

Verification: ? b2103761

The patch you just entered is not applied until
the controller is restarted.


Code Patch Main Menu

      0: Exit
      1: Enter a Patch
      2: Delete Patches
      3: List Patches

 Enter option number (0..3) [0] ?


 CLCP - Normal Termination
 Restart of the controller required to apply new patch

 CLI>
```

6.8.3.4 Listing Patches

The List Patches option allows you to display a listing of controller firmware versions, and the currently installed patches that apply to them.

The following is an example of the List Patches option:

```
CLI> RUN CLCP

 Select an option from the following list:

 Code Load & Code Patch local program Main Menu

 0: Exit
 1: Enter Code LOAD local program
 2: Enter Code PATCH local program
  Enter option number  (0..2) [0] ? 2

 You have selected the Code Patch local program.  This program is
 used to manage firmware code patches.  Select an option from the
 following list:

 Type ^Y or ^C (then RETURN) at any time to abort Code Patch.

 Code Patch Main Menu

       0: Exit
       1: Enter a Patch
       2: Delete Patches
       3: List Patches

  Enter option number (0..3) [0] ? 3

 The following patches are currently stored in the patch area:
```

```
  Firmware Version - Patch number(s)
       _______      _________
       123456  -      1
       XLZ6    -      2,1
Currently, 91% of the patch area is free.
```

Note

The SHOW THIS_CONTROLLER command also provides patch information in the form of a ''dash number'' following the firmware version. In the following example, firmware Version 2.5 has had patches applied up to patch number three (3):

```
CLI> SHOW THIS_CONTROLLER

Controller:
        HSZ40 ZG33400026 Firmware V25J-3, Hardware 0000
        .
        .
        .
```

6.8.3.5 Deleting a Patch

The Delete Patches option allows you to remove installed patches from controller non-volatile memory. The program displays the currently installed patches so that you can identify the patches to be deleted.

The following is an example of how to delete a patch and a firmware version that are no longer needed:

```
CLI> RUN CLCP

 Select an option from the following list:

 Code Load & Code Patch local program Main Menu

 0: Exit
 1: Enter Code LOAD local program
 2: Enter Code PATCH local program
  Enter option number  (0..2) [0] ? 2

 You have selected the Code Patch local program.  This program is
 used to manage firmware code patches.  Select an option from the
 following list:

 Type ^Y or ^C (then RETURN) at any time to abort Code Patch.

 Code Patch Main Menu

       0: Exit
       1: Enter a Patch
       2: Delete Patches
       3: List Patches

  Enter option number (0..3) [0] ? 2

 This is the Delete Patches option.  The program prompts you
 for the firmware version and patch number you wish to delete.
 If you select a patch for deletion that is required for another patch,
 all dependent patches are also selected for deletion.  The
 program lists your deletion selections and asks if you wish to continue.

 Type ^Y or ^C (then RETURN) at any time to abort Code Patch.

 The following patches are currently stored in the patch area:
```

```
  Firmware Version - Patch number(s)
        ______       _________
        123456  -      1
        XLZ6    -      2,1

Currently, 91% of the patch area is free.

Firmware Version of patch to delete ? 123456
Patch Number to delete ? 1

The following patches have been selected for deletion:

 Firmware Version - Patch #
        ______       _________
        123456  -      1

Do you wish to continue (y/n) [y] ? Y

The patch you have just deleted is currently applied, but will
not be applied when the controller is restarted.

Code Patch Main Menu

      0: Exit
      1: Enter a Patch
      2: Delete Patches
      3: List Patches

 Enter option number (0..3) [0] ? 3

The following patches are currently stored in the patch area:

  Firmware Version - Patch number(s)
        ______       _________
        XLZ6    -      2,1

Currently, 94% of the patch area is free.
```

6.8.3.6 Messages

The Code Patch utility does not allow you to incorrectly enter or delete patch information. The program provides messages to assist you with understanding any problems that you may encounter and suggests corrective actions.

Firmware Version *x* does not have any patches to delete.

Explanation: You cannot delete a patch because the firmware version entered does not have any patches entered.

Firmware Version *x* does not have patch number *x* to delete.

Explanation: You cannot delete this patch because the firmware version entered does not have the specified patch entered.

The patch you entered is already installed on this controller.

Explanation: The specified patch is already present in the patch area of controller memory. If you wish to reenter this patch, first use the Delete Patch option.

The patch you are entering requires other patches to be entered.

Explanation: You have attempted to enter a patch without first entering the lower numbered patches in the hierarchy. Enter all patches for this firmware version that have lower numbers than the current patch. Then enter the current patch.

WARNING The patch you are entering is not for the current firmware version *x*.

Explanation: The patch you are entering applies to a firmware version other than the one currently installed in the controller. Code Patch will allow you to enter the patch; however, the patch will not be applied until its correct firmware version is installed.

You incorrectly entered the patch information.

Explanation: The patch information was not entered exactly. The program prompts you for each line of the patch entry, with the default from your previous response. Verify that each entry is exactly the same as the patch release. If you choose not to continue, or if you abort during this review procedure, the patch information you entered is lost and you must enter the entire patch again. You may enter Ctrl/z followed by Return at any prompt to choose the default for the remaining entries.

The patch you have just entered is not applied until the controller firmware is changed to Version *x*.

Explanation: The patch entered applies to a firmware version other than the one currently installed in the controller. Code Patch will not apply the patch until its correct firmware version is installed.

You have requested deletion of a patch number that another patch requires.

Explanation: You are attempting to delete a patch in the hierarchy that has higher numbered patches entered. Code Patch will allow you to proceed; however, the program will delete all the higher numbered patches in the heirarchy (for this firmware version) along with the specified patch.

6.8.3.7 Exiting Code Patch

Exit Code Patch by choosing option 0 from the main menu. (Pressing Ctrl/C or Ctrl/Y at any time during Code Patch also will abort and exit the program.)

6.9 Firmware Licensing System (FLS)

The firmware licensing system (FLS) enables or disables the licensed value-added software features (RAID, mirroring, and write-back cache) of the HS array controller. You may use the FLS utility to perform the following tasks:

- Enable or disable optional functions for your controller
- Try an optional feature before purchasing the license to use it
- Change your license key for an option

Start FLS from the CLI prompt. After starting, the FLS display shows the current status of the value-added options for your controller and contains menu choices for each function of the utility.

6.9.1 Enabling Options

You can turn on any option at any time with FLS, but if you enable an option for which you are not licensed, an error message appears on your CLI console and an error is logged in the host error log. These error indications are repeated at least once each hour while the unlicensed option remains enabled.

6.9.2 Disabling Options

You cannot disable an option if that option is currently in use. The following table lists the conditions under which you can disable an FLS option.

Option	Conditions Required to Disable
RAID	No RAIDset configured
WBCA	Write-back caching not in use on any unit
MIRR	No mirrorset configured

6.9.3 License Key

When you first run FLS, the license key is cleared. If you purchase a license for a firmware option, you will receive a customer license key. This key contains two parts: a customer identification string from 6 to 32 characters long, and an 8-character **cyclic redundancy check** (CRC) string. You must enter the customer identification string with the CRC string appended to it when you use FLS.

6.9.4 Using the Menu

You can perform these operations from the FLS menu:

Select	Action	Submenu Choices	Result
1	Enable an option	List each option and its status	Selection enabled
2	Disable an option	List each option and its status	Selection disabled
3	Enter a license key	Prompt for new license key	Entered key checked for validity
4	Clear a license key	Prompt for license key to clear	Entered key becomes invalid

The following example shows the FLS main menu:

```
CLI> RUN FLS

------------------------------------------------------------------------------
      Firmware Licensing System (FLS) on node BERT
Option❶   State❷       License❸       Key❹
------------------------------------------------------------------------------
 RAID      DISABLED      INVALID        *none*
 WBCA      ENABLED ******INVALID!****** *none*
 MIRR      ENABLED        VALID         ACME_WIDGET_CORP........

               RAID = RAID Option ❺
               WBCA = Writeback Cache Option
               MIRR = Disk Mirroring Option
------------------------------------------------------------------------------
    1. Enable a firmware option
    2. Disable a firmware option
    3. Enter a license key for a firmware option
    4. Clear a license key for a firmware option
    0. Exit FLS
Enter selection (0:4) [0] ?
```

❶ **Option**–The RAID, write-back cache (WBCA), and mirror (MIRR) options are available.

❷ **State**–Both MIRR and WBCA are enabled. You may use any option that is enabled, regardless of whether you have a valid license key.

❸ **License**–WBCA is running without a valid license. This status will show when you are running an option on a trial basis. The license becomes valid when you enter a license key that FLS verifies as valid. You receive this key when you purchase a software option.

❹ **Key+CRC**–The license key is ACME_WIDGET_CORP; the 8-character CRC portion of the key is shown as hidden text (.....).

❺ **Description of Option**–A short description of each option is given.

6.9.5 Example

To perform an operation, enter the choice number and any information requested by the submenu or prompts. The following example demonstrates how to enter a license key and enable write-back caching.

```
CLI> RUN FLS

------------------------------------------------------------------------------
      Firmware Licensing System (FLS) on node MASS
Option      State        License        Key
------------------------------------------------------------------------------
 RAID      DISABLED      INVALID        *none*
 WBCA      DISABLED      INVALID        *none*
 MIRR      DISABLED      INVALID        *none*

               RAID = RAID Option
               WBCA = Writeback Cache Option
               MIRR = Disk Mirroring Option
------------------------------------------------------------------------------
    1. Enable a firmware option
    2. Disable a firmware option
    3. Enter a license key for a firmware option
    4. Clear a license key for a firmware option
    0. Exit FLS
Enter selection (0:4) [0] ? 3
```

```
    1. Enter new license key+CRC for RAID   (current key is invalid)
    2. Enter new license key+CRC for WBCA   (current key is invalid)
    3. Enter new license key+CRC for MIRR   (current key is invalid)
    0. Return to main menu
Enter selection (0:3) [0] ? 2❶

Enter new WBCA key, including 8-character CRC, or enter 0
       to return to main menu: ACME_WIDGET_CORPVB8UWQ9C❷

*** License key verified ***

--------------------------------------------------------------------------------
      Firmware Licensing System (FLS) on node MASS
Option      State        License        Key
--------------------------------------------------------------------------------
 RAID      DISABLED      INVALID        *none*
 WBCA      DISABLED       VALID         ACME_WIDGET_CORP........
 MIRR      DISABLED      INVALID        *none*

               RAID = RAID Option
               WBCA = Writeback Cache Option
               MIRR = Disk Mirroring Option
--------------------------------------------------------------------------------
    1. Enable a firmware option
    2. Disable a firmware option
    3. Enter a license key for a firmware option
    4. Clear a license key for a firmware option
    0. Exit FLS
Enter selection (0:4) [0] ? 1

    1. Enable RAID
    2. Enable WBCA
    3. Enable MIRR
    0. Return to main menu
Enter selection (0:3) [0] ? 2❸
*** WBCA enabled ***

--------------------------------------------------------------------------------
      Firmware Licensing System (FLS) on node MASS
Option      State        License        Key
--------------------------------------------------------------------------------
 RAID      DISABLED      INVALID        *none*
 WBCA      ENABLED        VALID❹        ACME_WIDGET_CORP........
 MIRR      DISABLED      INVALID        *none*

               RAID = RAID Option
               WBCA = Writeback Cache Option
               MIRR = Disk Mirroring Option
--------------------------------------------------------------------------------
    1. Enable a firmware option
    2. Disable a firmware option
    3. Enter a license key for a firmware option
    4. Clear a license key for a firmware option
    0. Exit FLS
Enter selection (0:4) [0] ? Return
FLS - Normal Termination

CLI>
```

❶ The user chooses to enter a new license key for WBCA.

❷ The user enters the new license key, along with the customer license key, which is displayed as it is entered.

❸ The user enables write-back cache.

❹ This entry in the FLS display shows that write-back cache is enabled under a valid license.

6.9.6 Messages

This section lists the messages that you may receive from FLS.

option has been turned on without a valid license

Explanation: You have activated the option named by *option* without entering a valid license key. You can evaluate this option for a time to determine its value, and you will receive a valid license key when you purchase the license for the option.

Error *nnnn*: *option* support is not enabled on this controller

Explanation: The *option* you are attempting to use is not enabled in FLS. For example, if you try to turn on write-back caching, you will receive this error if write-back caching is not enabled by FLS.

WARNING: This is an invalid license Key+CRC

Explanation: The license key you entered is not between 6 and 32 characters, or the customer license key is not valid. Verify that the key is correct and reenter.

***Error: Disabling *option* is not possible at this time, option is in use ***

Explanation: You have attempted to disable the option named by *option* while it is in use. Refer to Section 6.9.2 for more information on disabling options.

6.10 Fault Management Utility

The Fault Management Utility (FMU) allows you to do the following:

- Control the spontaneous event logging and last failure logging displays
- Display controller last failure and memory system failure information

FMU also can provide a convenient way to review some event log information during a terminal session. Run FMU interactively during a terminal session by invoking it from the CLI prompt:

```
CLI> RUN FMU
```

FMU will only interpret errors that occur after you install and run controller firmware containing FMU. In other words, FMU cannot search for ''older'' errors, and you cannot install FMU in an attempt to troubleshoot a preexisting error.

After invoking FMU, you may perform the functions described in the following sections. Defaults are specified by ''D.''

6.10.1 SET Command

The SET command enables certain functions and parameters in the FMU utility, and controls the content of displays. The SET command works with two spontaneous displays:

- Event logging (EVL)
- Last failure logging (LFL)

Also, the SET command controls the options for the interactive displays available under the SHOW command.

SET EVENT_LOGGING
SET NOEVENT_LOGGING (D)

This command enables/disables the event log display on the maintenance terminal. With the event log display enabled, the controller spontaneously displays EIP information during your terminal session. The first line of an event log display begins with ''%EVL.''

Event log displays are inhibited during the execution of both CLI commands and utilities invoked from a maintenance terminal. Events that are reported while a maintenance terminal is in use will not appear when the terminal again becomes available. (The %EVL display will be lost.)

Note

Execution of a CLI command or utility does not begin until you press Return. If FMU reports an event during command line input before Return is pressed, the %EVL display will interrupt the input.

Following the %EVL display, the CLI prompt and command input entered prior to the interruption will be redisplayed. You can then complete the current command line (unless FMU reports another event).

SET LAST_FAILURE_LOGGING
SET NOLAST_FAILURE_LOGGING (D)

This command enables/disables the last failure log display on the maintenance terminal. With the last failure log display enabled, the controller spontaneously displays information relevant to the sudden termination of executing firmware. The first line of a last failure log display begins with ''%LFL.''

In cases where an automatic hardware reset occurs (such as power failure, pressing the reset button, and so on) the last failure log display is inhibited because automatic reset does not allow sufficient time to complete the display.

SET EVENT_LOGGING REPAIR_ACTION_DISPLAY
SET EVENT_LOGGING NOREPAIR_ACTION_DISPLAY (D)
SET LAST_FAILURE_LOGGING REPAIR_ACTION_DISPLAY
SET LAST_FAILURE_LOGGING NOREPAIR_ACTION_DISPLAY (D)

This command and qualifier enables/disables recommended repair action display for event logging and last failure logging displays. With recommended repair action display enabled, the controller displays all of the recommended repair actions associated with the Instance Code and/or Last Failure Code used to describe an event.

SET EVENT_LOGGING VERBOSE
SET EVENT_LOGGING NOVERBOSE (D)
SET LAST_FAILURE_LOGGING VERBOSE
SET LAST_FAILURE_LOGGING NOVERBOSE (D)

This command and qualifier enables/disables descriptive text for event logging and last failure logging displays.

The display always identifies the various fields and their numeric content that comprise an event/last failure log. With verbosity enabled, the controller also displays a description of the numeric value in each log field if appropriate.

SET PROMPT_DISPLAY
SET NOPROMPT_DISPLAY (D)

This command enables/disables the CLI prompt string display within the first line of event logging and last failure logging displays, as shown in the following example (using %EVL):

```
%EVL-- Instance Code: 01010302
%EVL--CLI> -- Instance Code: 01010302
```

SET TIMESTAMP_DISPLAY
SET NOTIMESTAMP_DISPLAY (D)

This command enables/disables current timestamp string display within the first line of event logging and last failure logging displays, as shown in the following example (using %EVL):

```
%EVL-- Instance Code: 01010302
%EVL--07-JUL-1994 07:44:48-- Instance Code: 01010302
```

You can use combinations of the SET [NO]PROMPT_DISPLAY and SET [NO]TIMESTAMP_DISPLAY commands to provide the following types of event logging and last failure logging first line displays (examples using %EVL):

```
%EVL--CLI> --07-JUL-1994 07:44:48-- Instance Code: 01010302

%EVL--07-JUL-1994 07:44:48-- Instance Code: 01010302

%EVL--CLI> Instance Code: 01010302

%EVL-- Instance Code: 01010302
```

The last example shown is recommended when VCS is in use, since the controller identification (prompt string) and timestamp information is already supplied by VCS.

SET FMU REPAIR_ACTION_DISPLAY
SET FMU NOREPAIR_ACTION_DISPLAY (D)

This command enables/disables the recommended repair action display for FMU SHOW LAST_FAILURE and SHOW MEMORY_SYSTEM_FAILURE command output. With recommended repair action display enabled, the command output displays all of the recommended repair actions associated with the Instance Code and/or Last Failure Code used to describe an event.

SET FMU VERBOSE
SET FMU NOVERBOSE (D)

This command enables/disables descriptive text for FMU SHOW LAST_FAILURE and SHOW MEMORY_SYSTEM_FAILURE command output. The output always identifies the various fields and their numeric content that comprise an event/last failure log. With verbosity enabled, the controller also displays a description of the numeric value in each log field if appropriate.

SET EVENT_LOGGING [qualifier ... qualifier] PERMANENT
SET NOEVENT_LOGGING PERMANENT
SET LAST_FAILURE_LOGGING [qualifier ... qualifier] PERMANENT
SET NOLAST_FAILURE_LOGGING PERMANENT
SET FMU [qualifier ... qualifier] PERMANENT

The PERMANENT qualifier stores the parameter setting specified by the primary keyword and optional qualifiers in nonvolatile memory so that the setting is preserved across controller resets. In addition, when PERMANENT is specified, the given setting takes effect immediately.

If the PERMANENT qualifier is not specified, the given setting takes effect immediately. However, it remains in effect only as long as the current FMU session remains active or until the setting is changed by a subsequent SET command.

When running FMU from a maintenance terminal, changing EVENT_LOGGING parameters without specifying the PERMANENT qualifier has no effect. However, the same action while running FMU from a virtual terminal is effective. This permits the EVENT_LOGGING operation to be changed on a temporary basis only from a virtual terminal.

You can specify multiple additional qualifiers on the same command line for the SET EVENT_LOGGING, SET LAST_FAILURE_LOGGING, and SET FMU commands. For example, the following are all valid commands:

```
FMU> SET EVENT_LOGGING PERMANENT
FMU> SET LAST_FAILURE_LOGGING NOREPAIR_ACTION_DISPLAY PERMANENT
FMU> SET EVENT_LOGGING REPAIR_ACTION_DISPLAY NOVERBOSE PERMANENT
```

6.10.2 SHOW Command

The SHOW command controls the interactive reviewing of last failure and memory system failure information.

SHOW LAST_FAILURE qualifier [additional qualifier]

This command interactively displays the last failure information stored in nonvolatile memory. Information related to the most recent and three previous last failure events is stored in a separate entry in nonvolatile memory.

Qualifier	Description
MOST_RECENT	Displays the most recent last failure information.
ALL	Displays the last four failure event entries. Events are displayed in descending order, starting with the most recent.
ENTRY *n*	Displays one of the last four entries. You must supply an entry number (range 1–4).

Additional Qualifier	Description
FULL	When included on the same command line with the MOST_ RECENT, ALL, or ENTRY qualifier, displays extended information valuable to Digital Multivendor Customer Services.

SHOW MEMORY_SYSTEM_FAILURE qualifier

This command interactively displays memory system failure information from any of the last failure entries stored in nonvolatile memory.

Qualifier	Description
MOST_RECENT	Displays the most recent memory system failure information contained in any of last failure information entries. (Note that the most recent memory system failure may not be the most recent last failure.)
ALL	Displays all memory system failure information contained in any or all of the four last failure information entries, in most recent to least recent order.
ENTRY *n*	Displays memory system failure information contained in one last failure information entry (range 1–4). Note that the FULL additional qualifier is not available with the SHOW MEMORY_SYSTEM_FAILURE command. To obtain the extended information associated with the selected memory system failure, perform a SHOW LAST_FAILURE ENTRY *n* FULL, where *n* is the last failure entry number identified in the memory system failure display.

Note

The following message appears when FMU cannot access error information for the SHOW command:

```
(***Last Failure Entry x EDC bad; translation terminated***)
```

SHOW PARAMETERS

This command displays the current/permanent setting of parameters affected by the SET command.

SHOW TIME

This command displays the current controller time (i.e., wall clock time) and the current controller power on time in the following format:

```
Time: 07-FEB-1995 10:14:20
Power On Time: 0.Years, 0. Days, 8. Hours, 27. Minutes, 8.Seconds
```

If the controller time has not yet been set when the show times command is issued, the format looks like this:

```
Time: 07-FEB-1995 10:14:20 (time not set)
 Power On Time: 0.Years, 0. Days, 8. Hours, 27. Minutes, 8.Seconds
```

6.10.3 DESCRIBE Command

The describe command displays decscriptive text for a numeric value contained in a particular event log field.

All Controllers:

DESCRIBE ASC_ASCQ_CODE[3]
DESCRIBE COMPONENT_CODE
DESCRIBE CONTROLLER_UNIQUE_ASC_ASCQ_CODE[3]
DESCRIBE DEVICE_TYPE_CODE
DESCRIBE EVENT_THRESHOLD_CODE
DESCRIBE INSTANCE_CODE
DESCRIBE LAST_FAILURE_CODE
DESCRIBE REPAIR_ACTION_CODE
DESCRIBE RESTART_TYPE
DESCRIBE SCSI_COMMAND_OPERATION_CODE[3]
DESCRIBE SENSE_DATA_QUALIFIERS[3]
DESCRIBE SENSE_KEY_CODE
DESCRIBE TEMPLATE_CODE

HSJ- and HSD-Series Controllers:

DESCRIBE CI_OPERATION_CODE
DESCRIBE CONNECTION_STATE_CODE
DESCRIBE HIS_STATUS_CODE
DESCRIBE PPD_OPERATION_CODE
DESCRIBE SCS_OPERATION_CODE
DESCRIBE VC_STATE_CODE

[3] Requires entry of multiple numeric values.

All DESCRIBE qualifiers require at least one numeric value parameter. DESCRIBE qualifiers requiring multiple numeric value parameters are footnoted as such.

Type a question mark (?) in place of a numeric value parameter in order to identify the value and range required, as shown in the following example. Note that when sequential values are required, you must supply values for the earlier parameters before entering a question mark for the later parameter in the sequence.

```
FMU> DESCRIBE ASC_ASCQ_CODE ?
Your options are:
   ASC value (range: 0 through FF hexadecimal)
FMU> DESCRIBE ASC_ASCQ_CODE 0 ?
Your options are:
   ASCQ value (range: 0 through FF hexadecimal)
FMU> DESCRIBE ASC_ASCQ_CODE 0 0 ?
Your options are:
   SCSI Device Type value (range: 0 through FF hexadecimal)
FMU>
```

6.10.4 EXIT Command

The EXIT command terminates FMU and returns you to the CLI prompt. (You also may enter Ctrl/C or Ctrl/Y to abort FMU.)

6.10.5 Examples

This section presents examples that show some of the output information available when using FMU. Values enclosed in parentheses are hexidecimal translations of decimal numbers.

```
FMU> SHOW LAST_FAILURE ENTRY 4

Last Failure Entry: 4❶ Flags: 0007FA80❷

%FMU-01-Last Failure Event, Instance Code: 01010302❸
 Power On Time: 0 Years, 41 Days, 4 Hours, 49 Minutes, 8 Seconds❹
 ❺Controller Model: HSJ40 Serial Number: ZG30355555 Hardware Version: 0000(00)
 Controller Identifier:
  Unique Device Number: 000130355555 Model: 40(28) Class: 1(01)
 HSOF Version: V20(20)❻
 Node Name: "HSJ307" CI Node Number: 7(07)❼
 Informational Report
 ❸Instance Code 01010302 Description:
  An unrecoverable hardware detected fault occurred.
 ❽Last Failure Code: 018800A0 (No Last Failure Parameters)
 Last Failure Code 018800A0 Description:
  A processor interrupt was generated with an indication that the program
  card was removed.
```

```
FMU> SHOW MEMORY_SYSTEM_FAILURE ENTRY 2

Last Failure Entry: 2❶ Flags: 0007FA8C❷
 Memory System Failure indicated

%FMU-14-Memory System Failure Event, Instance Code: 016E2D02❸
 Power On Time: 0 Years, 41 Days, 21 Hours, 5 Minutes, 39 Seconds❹
 ❺Controller Model: HSJ40 Serial Number: ZG30355555 Hardware Version: 0000(00)
 Controller Identifier:
  Unique Device Number: 000130355555 Model: 40(28) Class: 1(01)
 HSOF Version: V20(20)❻
 Node Name: "HSJ307" CI Node Number: 7(07)❼
 Reported via non-maskable interrupt
 ❾Memory Address: 40000000
 Byte Count: 0(00000000)
 DRAB Registers:
  DSR:  2D17403F  CSR:  8000A220 DCSR:  00003403  DER:  00001C00  EAR:  04000000
  EDR:  F4000003  ERR:  00000000  RSR:  09805432  CHC:  E7FFFFFC  CMC:  90A5FEF0
 Diagnostic Registers:
  RDR0: E7FFFFFC  RDR1: 90A5FEF0  WDR0: 7F021000  WDR1: FF06020D
 ❸Instance Code 016E2D02 Description:
  The CACHEA0 DRAB detected a Nonexistent Memory Error condition during an
  I960 attempt to read CACHEA0 memory.
```

❶ **Entry**—A number representing the last failure entry position.

❷ **Flags**—This value should be recorded and reported to Digital Multivendor Customer Services.

❸ **Instance Code**—The instance code (and description) associated with this failure.

❹ **Power On Time**—The time of failure.

❺ **Controller**—Information identifying your controller.

❻ **HSOF Version**—Firmware version.

❼ **Node Name**—Node identifier.

❽ **Last Failure Code**—Last failure code and description.

❾ **Memory Address**—The memory address, byte count, and register contents should be recorded and reported to Digital Multivendor Customer Services.

```
FMU> SHOW LAST_FAILURE ENTRY 4 FULL

Last Failure Entry: 4 Flags: 0007FA80

%FMU-01-Last Failure Event, Instance Code: 01010302
 Power On Time: 0 Years, 41 Days, 4 Hours, 49 Minutes, 8 Seconds
 Controller Model: HSJ40 Serial Number: ZG30355555 Hardware Version: 0000(00)
 Controller Identifier:
  Unique Device Number: 000130355555 Model: 40(28) Class: 1(01)
 HSOF Version: V20(20)
 Node Name: "HSJ307" CI Node Number: 7(07)
 Informational Report
 Instance Code 01010302 Description:
  An unrecoverable hardware detected fault occurred.
 Last Failure Code: 018800A0 (No Last Failure Parameters)
 Last Failure Code 018800A0 Description:
  A processor interrupt was generated with an indication that the program
  card was removed.
❶Current Thread: NULL Current I960 Priority: 001F0000
 Interrupt Stack Guard is intact
 Thread Stack Guard State Flags (ID# Bit; 0=intact,1=not intact): 00000000
 I960 Stack:
  Levels: 2
  Level 0:
   Return type: Interrupt
   PFP: 201C15F7  SP:  201FABD0  RIP: 200CF898  R3:  201C15F7
   R4:  00000000  R5:  00000000  R6:  00000000  R7:  00000000
   R8:  00000000  R9:  00000000  R10: 00000000  R11: 00000000
   R12: 00000000  R13: 00000000  R14: 00000000  R15: D87FA8FE
  Level 1:
   Return type: Local
   PFP: 00000000  SP:  201C1680  RIP: 200D0AC0  R3:  00000000
   R4:  00000000  R5:  00000000  R6:  00000000  R7:  00000000
   R8:  00000000  R9:  00000000  R10: 00000000  R11: 00000000
   R12: 00000000  R13: 00000000  R14: 00000000  R15: 00000000
   G0:  00000000  G1:  00000000  G2:  2011DFF4  G3:  00000000
   G4:  00000000  G5:  00400000  G6:  201148B0  G7:  00000003
   G8:  000000CC  G9:  00000001  G10: 00000004  G11: 2011F108
   G12: 200E969C  G13: 201D3D8C  G14: 00000000  FP:  201FAB50
 Diagnostic Registers:
  RDR0: E7FFFFFC  RDR1: E7FFFEF0  WDR0: 7F021000  WDR1: FF06020D
 Master DRAB Registers:
  DSR:  2D170CBC  CSR:  00000000 DCSR:  0009FFFF  DER:  00001C00  EAR:  00200400
  EDR:  00000000  ERR:  00000023  RSR:  00801432  CHC:  005BB41A  CMC:  002E853E
 CACHEA0 DRAB Registers:
  DSR:  2D17003F  CSR:  00000000 DCSR:  00003403  DER:  00001C76  EAR:  00000000
  EDR:  FFFFFFFF  ERR:  00000000  RSR:  09805432  CHC:  00000000  CMC:  00000000
 CACHEA1 DRAB Registers:
  Not Available.
 CACHEB0 DRAB Registers:
  DSR:  2C17003D  CSR:  00000000 DCSR:  00003402  DER:  00001C76  EAR:  00000000
  EDR:  FFFFFFFF  ERR:  00000000  RSR:  09805432  CHC:  00000000  CMC:  00000000
 CACHEB1 DRAB Registers:
  Not Available.
 FX Registers:
  PCX[0]:   00000000  PCX[1]:   00000001  PCX[2]:   00000201  PCX[3]:   00000401
  PCX[4]:   00000601  PCX[5]:   00000801  PCX[6]:   00000A01  PCX[7]:   00000000
  CSR:      0087E002  GEN_PCX:  00000000  UNUSED0:  00000000  UNUSED1:  00000000
  DILP:     00000000  DADDR:    00000000  DCMD:     00000000
 Host Port Registers (YACI):
  SET:    072E004A  CIA:    F8070700  PCS:    0505400F  RTS:    00000000
  RADILP: 201BEE08  RBDILP: 201BEE2C  TADILP: 201BEE50  TBDILP: 201BEE74
  RADFPA: 2063E760  RBDFPA: 20619560  TADFPA: 20637FA0  TBDFPA: 2062D5A0
  RADNPA: 2063E760  RBDNPA: 20619560  TADNPA: 20637FA0  TBDNPA: 2062D5A0
  REV:    00000003  DIAG:   00000000
 Device Port 0 Registers (NCR710):
```

```
 SCNTL0:  CA  SCNTL1:  20  SDID:    00  SIEN:    AF  SCID:    80  SXFER:   00
 SODL:    00  SOCL:    00  SFBR:    00  SIDL:    00  SBDL:    00  SBCL:    00
 DSTAT:   90  SSTAT0:  00  SSTAT1:  00  SSTAT2:  00  DSA:     00000000
 CTEST0:  70  CTEST1:  F0  CTEST2:  21  CTEST3:  08  CTEST4:  00  CTEST5:  00
 CTEST6:  FC  CTEST7:  80  TEMP:    00000000        DFIFO:   00  ISTAT:   00
 CTEST8:  21  LCRC:    00  DBC:     000000          DCMD:    54
 DNAD:    20578F50         DSP:     20578F50        DSPS:    0000015C
 SCRATCH: 00000000         DMODE:   80  DIEN:    27  DWT:     4E  DCNTL:   21
 ADDER:   205790AC
Device Port 1 Registers (NCR710):
 SCNTL0:  DA  SCNTL1:  20  SDID:    08  SIEN:    AF  SCID:    80  SXFER:   18
 SODL:    41  SOCL:    00  SFBR:    00  SIDL:    00  SBDL:    00  SBCL:    00
 DSTAT:   90  SSTAT0:  00  SSTAT1:  00  SSTAT2:  0F  DSA:     3E000000
 CTEST0:  70  CTEST1:  F0  CTEST2:  25  CTEST3:  41  CTEST4:  00  CTEST5:  00
 CTEST6:  B0  CTEST7:  80  TEMP:    205788B0        DFIFO:   00  ISTAT:   00
 CTEST8:  21  LCRC:    08  DBC:     000000          DCMD:    54
 DNAD:    205788B8         DSP:     205788B8        DSPS:    0000015C
 SCRATCH: 205788B0         DMODE:   80  DIEN:    27  DWT:     4E  DCNTL:   21
 ADDER:   20578A14
Device Port 2 Registers (NCR710):
 SCNTL0:  CA  SCNTL1:  20  SDID:    00  SIEN:    AF  SCID:    80  SXFER:   00
 SODL:    00  SOCL:    00  SFBR:    00  SIDL:    00  SBDL:    00  SBCL:    00
 DSTAT:   90  SSTAT0:  00  SSTAT1:  00  SSTAT2:  00  DSA:     00000000
 CTEST0:  70  CTEST1:  F0  CTEST2:  21  CTEST3:  08  CTEST4:  00  CTEST5:  00
 CTEST6:  FC  CTEST7:  80  TEMP:    00000000        DFIFO:   00  ISTAT:   00
 CTEST8:  21  LCRC:    00  DBC:     000000          DCMD:    54
 DNAD:    20578220         DSP:     20578220        DSPS:    0000015C
 SCRATCH: 00000000         DMODE:   80  DIEN:    27  DWT:     4E  DCNTL:   21
 ADDER:   2057837C
Device Port 3 Registers (NCR710):
 SCNTL0:  DA  SCNTL1:  20  SDID:    01  SIEN:    AF  SCID:    80  SXFER:   18
 SODL:    02  SOCL:    00  SFBR:    00  SIDL:    00  SBDL:    00  SBCL:    00
 DSTAT:   90  SSTAT0:  00  SSTAT1:  00  SSTAT2:  0F  DSA:     3E000000
 CTEST0:  70  CTEST1:  F0  CTEST2:  25  CTEST3:  02  CTEST4:  00  CTEST5:  00
 CTEST6:  80  CTEST7:  80  TEMP:    20577B80        DFIFO:   00  ISTAT:   00
 CTEST8:  21  LCRC:    01  DBC:     000000          DCMD:    54
 DNAD:    20577B88         DSP:     20577B88        DSPS:    0000015C
 SCRATCH: 20577B80         DMODE:   80  DIEN:    27  DWT:     4E  DCNTL:   21
 ADDER:   20577CE4
Device Port 4 Registers (NCR710):
 SCNTL0:  DA  SCNTL1:  20  SDID:    01  SIEN:    AF  SCID:    80  SXFER:   18
 SODL:    42  SOCL:    00  SFBR:    00  SIDL:    00  SBDL:    00  SBCL:    00
 DSTAT:   90  SSTAT0:  00  SSTAT1:  00  SSTAT2:  0F  DSA:     3E000000
 CTEST0:  70  CTEST1:  F0  CTEST2:  25  CTEST3:  42  CTEST4:  00  CTEST5:  00
 CTEST6:  E8  CTEST7:  80  TEMP:    205774E8        DFIFO:   00  ISTAT:   00
 CTEST8:  21  LCRC:    01  DBC:     000000          DCMD:    54
 DNAD:    205774F0         DSP:     205774F0        DSPS:    0000015C
 SCRATCH: 205774E8         DMODE:   80  DIEN:    27  DWT:     4E  DCNTL:   21
 ADDER:   2057764C
Device Port 5 Registers (NCR710):
 SCNTL0:  DA  SCNTL1:  20  SDID:    02  SIEN:    AF  SCID:    80  SXFER:   68
 SODL:    F6  SOCL:    00  SFBR:    00  SIDL:    00  SBDL:    00  SBCL:    00
 DSTAT:   90  SSTAT0:  00  SSTAT1:  00  SSTAT2:  0F  DSA:     3E000000
 CTEST0:  70  CTEST1:  F0  CTEST2:  25  CTEST3:  80  CTEST4:  00  CTEST5:  00
 CTEST6:  50  CTEST7:  80  TEMP:    20576E50        DFIFO:   00  ISTAT:   00
 CTEST8:  21  LCRC:    20  DBC:     000000          DCMD:    54
 DNAD:    20576E58         DSP:     20576E58        DSPS:    0000015C
 SCRATCH: 20576E50         DMODE:   80  DIEN:    27  DWT:     4E  DCNTL:   21
 ADDER:   20576FB4
```

❶ Information presented after this callout is extended information available with the FULL option. The output shows register contents for various hardware as well as other data. You should print a copy of this display so that Digital Multivendor Customer Services has more information with which to troubleshoot the controller.

6.11 CLONE Utility

CLONE is a utility that partially automates the process of mirroring units to create a snapshot copy of host unit data.

Using the mirroring facility to create a snapshot copy of host unit data is a multistep process described in the *StorageWorks Array Controllers HS Family of Array Controllers User's Guide*. If your data snapshot needs are straightforward, you can use CLONE to relieve you of much of the chore of performing this common operation. CLONE does nothing that cannot be achieved by issuing the appropriate CLI commands yourself; in fact, CLONE operates by issuing CLI commands for you. These commands are printed on the terminal as part of the program output so that you can see what it has done. This is useful both as a learning tool, and in the event that you need to recover an incomplete CLONE operation manually.

Any unit created by CLONE will have a mirrorset level in the configuration heirarchy, even if the original unit did not have mirroring. The CLONE utility uses mirrorsets during copying, and must maintain that structure when it adds the cloned disk as a newly-created unit. The steps below illustrate this concept:

1. CLONE is run on a single-disk unit.
2. CLONE creates a mirrorset from the single disk and adds the target disk to the mirrorset. The target disk is initialized *as a member of a mirrorset* when it is added.
3. The data on the first member of the mirrorset is copied to the new (target) member.
4. When the copy is complete, CLONE removes the target drive from the mirrorset, and then sets the original disk so that it is no longer a mirrorset.
5. Because the target disk was initialized as a mirrorset member, CLONE makes it into a single-member mirrorset to preserve the metadata before adding it as a unit.

The new mirrorset level only affects clones of single-disk units and stripesets. Mirrorsets and striped mirrorsets already use mirroring, and any clones from such units will have the same structure as the original units.

Although the operations involved in most CLONE processes are commonplace, the reaction in response to failures during the operation is heavily influenced by each installation's operational needs. For this reason, CLONE does not attempt to automate the error recovery process. If you encounter an error during a CLONE operation, you will need to resolve the situation by manually issuing the appropriate CLI commands.

The following circumstance will cause CLONE to cease operation:

1. If the controller is reset or there is a power loss.
2. If the host moves the unit being copied from one controller to the other.
3. If you change the configuration of the unit while CLONE is running.
4. If a disk device being used by CLONE fails.
5. If the CLONE utility is aborted via Ctrl/Y or Ctrl/C.
6. If the controller fails.

In most cases, CLONE can automate the operation entirely and will complete successfully without intervention. In those cases when it cannot complete, it stops at the point the error occured. The CLI commands performed up to that point remain on the screen.

Recovering partially completed CLONE operations requires you to be familiar with the data snapshot process as described in the *StorageWorks Array Controllers HS Family of Array Controllers User's Guide*. The recovery strategy is to decide what follow-on operations will best meet your operational needs. You can continue the data snapshot operation to completion by manually issuing the remaining commands in the sequence, or you can undo the actions CLONE has taken so far by issuing appropriate CLI commands to reverse them.

Note

CLONE will not operate on stripesets that have different types of members. All stripeset members must be single disks, or all must be mirrorsets.

Each of the four CLONE examples that follow contain a detailed discussion of the typical sequence of operations that CLONE will perform for each of the legal target configurations. If a CLONE operation does not complete, use these templace sequences and your knowledge of data snapshot operations in general to guide a manual recovery session.

Example 6–17 Cloning a Single Device Unit

```
CLI> RUN CLONE

Clone Local Program Invoked
Units available for cloning:
 110
 799
Enter unit to clone ? 110

Clone will create a new unit which is a copy of unit 110.
Enter the unit number which you want assigned to the new unit ? 797
The new unit may be added using one of the following methods:
  1. Clone will pause after all members have been copied. The user must
     then press RETURN to cause the new unit to be added.
  2. After all members have been copied, the unit will be added automatically.
Under which above method should the new unit be added [] ? 1
Devices available for clone targets:
  DISK300 (size=2050353)
  DISK330 (size=2050353)
Use available device DISK300(size=2050353) for
member DISK110(size=2050353) (y,n) [y] ? y
       mirror DISK110 C_M
       set C_M nopolicy
       set C_M members=2
       set C_M replace=DISK300
Copy in progress for each new member. Please be patient...
  copy from DISK110 to DISK300 is 6% complete
  copy from DISK110 to DISK300 is 12% complete
  copy from DISK110 to DISK300 is 19% complete
   .
   .
   .
  copy from DISK110 to DISK300 is 98% complete
  copy from DISK110 to DISK300 is 100% complete

Press RETURN when you want the new unit to be created
       reduce  DISK300
       unmirror DISK110
       add mirrorset C_M        DISK300
       init C_M       nodestroy
       add unit D797 C_M

D797 has been created. It is a clone of D110.

Clone - Normal Termination

HSJ>
```

The following is the list of commands (in sequential order) you would use if you need to manually clone the single device unit from Example 6–17:

1. SHOW DEVICES
2. SHOW STORAGESETS
3. MIRROR *disk-device-name1 container-name*
4. SET *mirrorset-container-name* POLICY= *policy-type*
5. SET *mirrorset-container-name* MEMBERSHIP= *number-of-members*
6. SET *mirrorset-container-name* REPLACE= *disk-device-name*

   Wait for member NORMALIZATION
7. REDUCE *disk-device-name*

8. UNMIRROR *disk-device-name*
9. ADD MIRRORSET *mirrorset-container-name disk-device-name*
10. INITIALIZE *container-name* NODESTROY
11. ADD UNIT *unit-number container-name*

The following is an example of the specific manual commands used to clone the single device unit from Example 6–17:

```
HSJ> SHOW DEVICES ❶
HSJ> SHOW STORAGESETS ❷
HSJ> MIRROR DISK110 C_M ❸
HSJ> SET C_M NOPOLICY ❹
HSJ> SET C_M MEMBERSHIP=2 ❺
HSJ> SET C_M REPLACE=DISK300 ❻
HSJ> REDUCE DISK300 ❼
HSJ> UNMIRROR DISK110 ❽
HSJ> ADD MIRRORSET C_M DISK300 ❾
HSJ> INITIALIZE C_M NODESTROY ❿
HSJ> ADD UNIT D797 C_M ⓫
```

❶ Displays the units available for cloning.

❷ Displays the storagesets that are currently configured.

❸ Converts the physical device DISK110 into a one-member mirrorset and names the mirrorset C_M.

❹ Sets the replacement policy for mirrorset C_M to NOPOLICY so that spareset members are not automatically added to the mirrorset

❺ Sets the nominal membership of mirrorset C_M to two members.

❻ Places disk DISK300 into mirrorset C_M. The controller automatically starts copying data from the original member to the new member.

❼ Removes DISK300 from mirrorset C_M, after a copy from the existing mirrorset member to DISK300 has completed.

❽ Converts the one-member mirrorset DISK110 back to a physical device.

❾ Creates a one-member mirrorset from DISK300 and names the mirrorset C_M.

❿ Initializes mirrorset C_M, but does not destroy any of the forced error metadata on the disk.

⓫ Creates a logical unit to the controller from the initialized mirrorset C_M and names the unit D797.

Example 6–18 Cloning a Stripeset

```
HSJ> SHOW STORAGESETS
Name          Storageset                    Uses             Used by
------------------------------------------------------------------------------

ST1           stripeset                     DISK130          D799
                                            DISK200
HSJ> run clone

Clone Local Program Invoked
Units available for cloning:
 110
 799
Enter unit to clone ? 799
Clone will create a new unit which is a copy of unit 799.
Enter the unit number which you want assigned to the new unit ? 798
The new unit may be added using one of the following methods:
  1. Clone will pause after all members have been copied. The user must
     then press RETURN to cause the new unit to be added.
  2. After all members have been copied, the unit will be added automatically.
Under which above method should the new unit be added [] ? 1

Devices available for clone targets:
  DISK220 (size=832317)
  DISK240 (size=832317)
  DISK310 (size=832317)
Use available device DISK220(size=832317) for
member DISK130(size=832317) (y,n) [y] ? y
        mirror DISK130 C_MA
        set C_MA nopolicy
        set C_MA members=2
        set C_MA replace=DISK220
Devices available for clone targets:
  DISK240 (size=832317)
  DISK310 (size=832317)
Use available device DISK240(size=832317) for
member DISK200(size=832317) (y,n) [y] ? y
        mirror DISK200 C_MB
        set C_MB nopolicy
        set C_MB members=2
        set C_MB replace=DISK240
Copy in progress for each new member. Please be patient...
  copy from DISK130 to DISK220 is 15% complete
  copy from DISK200 to DISK240 is 11% complete
  copy from DISK130 to DISK220 is 27% complete
  copy from DISK200 to DISK240 is 23% complete
   .
   .
   .
  copy from DISK130 to DISK220 is 100% complete
  copy from DISK200 to DISK240 is 100% complete

Press RETURN when you want the new unit to be created
        reduce  DISK220 DISK240
        unmirror DISK130
        unmirror DISK200
        add mirrorset C_MA       DISK220
        add mirrorset C_MB       DISK240
        add stripeset C_ST1  C_MA C_MB
        init C_ST1     nodestroy chunk=128
        add unit D798 C_ST1
```

(continued on next page)

Example 6–18 (Cont.) Cloning a Stripeset

```
D798 has been created. It is a clone of D799.

Clone - Normal Termination

HSJ> SHOW DEVICES

Name          Type          Port Targ  Lun                    Used by
------------------------------------------------------------------------------

DISK130       disk             1    3    0                    ST1
DISK200       disk             2    0    0                    ST1
DISK220       disk             2    2    0                    C_MA
DISK240       disk             2    4    0                    C_MB
DISK310       disk             3    1    0

HSJ> SHOW STRIPESETS

Name          Storageset                    Uses             Used by
------------------------------------------------------------------------------

C_ST1         stripeset                     C_MA             D798
                                            C_MB

ST1           stripeset                     DISK130          D799
                                            DISK200

HSJ>
```

To manually clone a stripeset, use the following commands in sequential order:

1. SHOW DEVICES
2. SHOW UNITS
3. MIRROR *disk-device-name1 container-name1*
4. SET *mirrorset-container-name1* NOPOLICY
5. SET *mirrorset-container-name1* MEMBERSHIP=
6. SET *mirrorset-container-name1* REPLACE=
7. MIRROR *disk-device-name2 mirrorset-container-name2*
8. SET *mirrorset-container-name2* NOPOLICY
9. SET *mirrorset-container-name2* MEMBERSHIP=
10. SET *mirrorset-container-name2* REPLACE=

    Wait for NORMALIZATION of *all* new mirrorset members.
11. REDUCE *disk-device-name disk-device-name[N]*
12. UNMIRROR *disk-device-name*
13. UNMIRROR *disk-device-name*
14. ADD MIRRORSET *mirrorset-container-name1 disk-device-name*
15. ADD MIRRORSET *mirrorset-container-name2 disk-device-name*
16. ADD STRIPESET *stripeset-container-name mirrorset-container-name1 mirrorset-container-name2*
17. INITIALIZE *stripeset-container-name* NODESTROY CHUNK=
18. ADD UNIT *unit-name stripeset-container-name*

The following is an example of the manual commands for cloning a stripeset:

```
HSJ> SHOW DEVICES ❶
HSJ> SHOW STORAGESETS ❷
HSJ> MIRROR DISK130 C_MA ❸
HSJ> SET C_MA NOPOLICY ❹
HSJ> SET C_MA MEMBERSHIP=2 ❺
HSJ> SET C_MA REPLACE=DISK220 ❻
HSJ> MIRROR DISK200 C_MB ❼
HSJ> SET C_MB NOPOLICY ❽
HSJ> SET C_MB MEMBERSHIP=2 ❾
HSJ> SET C_MB REPLACE=DISK240 ❿
...wait for NORMALIZATION OF DISK220 and DISK240...
HSJ> REDUCE DISK220 DISK240 ⓫
HSJ> UNMIRROR DISK130 ⓬
HSJ> UNMIRROR DISK200 ⓭
HSJ> ADD MIRRORSET C_MA DISK220 ⓮
HSJ> ADD MIRRORSET C_MB DISK240 ⓯
HSJ> ADD STRIPESET C_ST1 C_MA C_MB ⓰
HSJ> INITIALIZE C_ST1 NODESTROY CHUNK=128 ⓱
HSJ> ADD UNIT D798 C_ST1 ⓲
HSJ> SHOW DEVICES ⓳
HSJ> SHOW STRIPESETS ⓴
```

❶ Displays the units available for cloning.

❷ Displays the storagesets that are currently configured.

❸ Converts the physical device DISK130 into a one-member mirrorset and names the mirrorset C_MA.

❹ Sets the replacement policy for mirrorset C_MA to NOPOLICY so that spareset members are not automatically added to the mirrorset

❺ Sets the nominal membership of mirrorset C_MA to two members.

❻ Places disk DISK220 into mirrorset C_MA. The controller automatically starts copying data from the original member to the new member.

❼ Converts the physical device DISK200 into a one-member mirrorset and names the mirrorset C_MB.

❽ Sets the replacement policy for mirrorset C_MB to NOPOLICY so that spareset members are not automatically added to the mirrorset

❾ Sets the nominal membership of mirrorset C_MB to two members.

❿ Places disk DISK240 into mirrorset C_MB. The controller automatically starts copying data from the original member to the new member.

⓫ Removes DISK220 and DISK240 from their respective mirrorsets, after the copy operations from the existing mirrorset members has completed.

⓬ Converts the one-member mirrorset DISK130 back to a physical device.

⓭ Converts the one-member mirrorset DISK200 back to a physical device.

⓮ Creates a one-member mirrorset from DISK220 and names the mirrorset C_MA.

⓯ Creates a one-member mirrorset from DISK240 and names the mirrorset C_MB.

⑯ Creates a stripeset called C_ST1 from the two newly-created mirrorsets C_MA and C_MB.

⑰ Initializes stripeset C_ST1 with a chunksize of 128 blocks, but does not write new metadata onto the members.

⑱ Creates a logical unit for the host from the initialized stripeset C_ST1 and names the unit D798.

⑲ Shows the device configuration after the clone is complete.

⑳ Shows the stripesets after the clone is complete.

Example 6–19 Cloning a Mirrorset

```
HSJ> SHOW DEVICES
Name          Type          Port Targ  Lun                    Used by
------------------------------------------------------------------------------

DISK110       disk             1    1    0                    M1
DISK150       disk             1    5    0
DISK220       disk             2    2    0                    M1
DISK310       disk             3    1    0
DISK350       disk             3    5    0
DISK420       disk             4    2    0
DISK510       disk             5    1    0
DISK550       disk             5    5    0
DISK620       disk             6    2    0

HSJ>

HSJ> SHOW MIRRORSETS
Name          Storageset                    Uses             Used by
------------------------------------------------------------------------------

M1            mirrorset                     DISK110          D411
                                            DISK220
HSJ>

HSJ> RUN CLONE
```

(continued on next page)

Example 6–19 (Cont.) Cloning a Mirrorset

```
Clone Local Program Invoked
Units available for cloning:
 411
Enter unit to clone ?411
Enter the unit number which you want assigned to the new unit?499
The new unit may be added using one of the following methods:
  1. Clone will pause after all members have been copied. The user must
     then press RETURN to cause the new unit to be added.
  2. After all members have been copied, the unit will be added automatically.
Under which above method should the new unit be added []?2
Devices available for clone targets:
  DISK150 (size=832317)
  DISK310 (size=832317)
  DISK350 (size=832317)
  DISK420 (size=832317)
  DISK510 (size=832317)
  DISK550 (size=832317)
  DISK620 (size=832317)
Use available device DISK150(size=832317) for
member DISK110(size=832317) (y,n) [y] ?N
Use available device DISK310(size=832317) for
member DISK110(size=832317) (y,n) [y] ?Y
        set M1 nopolicy
        set M1 members=3
        set M1 replace=DISK310
Copy in progress for each new member. Please be patient...
  copy from DISK110 to DISK310 is 5% complete
  copy from DISK110 to DISK310 is 10% complete
  .
  .
  .
  copy from DISK110 to DISK310 is 97% complete
  copy from DISK110 to DISK310 is 100% complete
        reduce DISK310
        add mirrorset C_M1       DISK310
        init C_M1      nodestroy
        add unit D499 C_M1

D499 has been created. It is a clone of D411.

Clone - Normal Termination

HSJ>

HSJ> SHOW DEVICES

Name          Type          Port Targ  Lun                    Used by
------------------------------------------------------------------------------

DISK110       disk             1    1    0                    M1
DISK150       disk             1    5    0
DISK220       disk             2    2    0                    M1
DISK310       disk             3    1    0                    C_M1
DISK350       disk             3    5    0
DISK420       disk             4    2    0
DISK510       disk             5    1    0
DISK550       disk             5    5    0
DISK620       disk             6    2    0

HSJ>

HSJ> SHOW MIRRORSETS
```

(continued on next page)

Example 6–19 (Cont.) Cloning a Mirrorset

```
Name          Storageset                    Uses             Used by
------------------------------------------------------------------------------

C_M1          mirrorset                     DISK310          D499
M1            mirrorset                     DISK110          D411
                                            DISK220

HSJ>
```

To manually clone a mirrorset, use the following commands in sequential order:

1. SHOW DEVICES
2. SHOW MIRRORSETS
3. SET *mirrorset-container-name* NOPOLICY
4. SET *mirrorset-container-name* MEMBERSHIP=3
5. SET *mirrorset-container-name* REPLACE= *disk-device-name*
   Wait for NORMALIZATION.
6. REDUCE *disk-device-name*
7. ADD MIRRORSET *mirrorset-container-name disk-device-name*
8. INITIALIZE *mirrorset-container-name* NODESTROY CHUNK=
9. ADD UNIT *unit-name mirrorset-container-name*
10. SHOW DEVICES
11. SHOW MIRRORSETS

The following is an example of the commands for cloning a mirrorset:

```
HSJ> SHOW DEVICES ❶
HSJ> SHOW MIRRORSETS ❷
HSJ> SET M1 NOPOLICY ❸
HSJ> SET M1 MEMBERSHIP=3 ❹
HSJ> SET M1 REPLACE=DISK310 ❺
...wait for NORMALIZATION of M1...
HSJ> REDUCE DISK310 ❻
HSJ> ADD MIRRORSET C_M1 DISK310 ❼
HSJ> INITIALIZE C_M1  NODESTROY CHUNK=128 ❽
HSJ> ADD UNIT D499 C_M1 ❾
HSJ> SHOW DEVICES ❿
HSJ> SHOW MIRRORSETS ⓫
```

❶ Displays the units available for cloning.

❷ Displays the mirrorsets that are currently configured.

❸ Sets the replacement policy for mirrorset M1 to NOPOLICY so that spareset members are not automatically added to the mirrorset

❹ Sets the nominal membership of mirrorset M1 to three members.

❺ Places disk DISK310 into mirrorset M1. The controller automatically starts copying data to the new member to make it identical to the existing NORMAL members.

❻ Removes DISK310 from mirrorset M1 after the copy operation has completed.

❼ Creates a mirrorset called C_M1 from DISK310.

❽ Initializes mirrorset C_M1 with a chunksize of 128 blocks, but does not write new metadata onto the members.

❾ Creates a logical unit for the host from mirrorset C_M1 and names the unit D499.

❿ Shows the device configuration after the clone is complete.

⓫ Shows the mirrorsets after the clone is complete.

Example 6–20 Cloning a Striped Mirrorset

```
HSJ> SHOW DEVICES
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------

DISK110       disk             1    1    0                    M1
DISK150       disk             1    5    0
DISK220       disk             2    2    0                    M1
DISK310       disk             3    1    0                    M2
DISK350       disk             3    5    0
DISK420       disk             4    2    0                    M2
DISK510       disk             5    1    0                    M3
DISK550       disk             5    5    0
DISK620       disk             6    2    0                    M3

HSJ> SHOW MIRRORSETS
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------

M1            mirrorset                     DISK110          ST1
                                            DISK220

M2            mirrorset                     DISK310          ST1
                                            DISK420

M3            mirrorset                     DISK510          ST1
                                            DISK620

HSJ>

HSJ> SHOW STORAGESETS
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------

ST1           stripeset                     M1               D411
                                            M2
                                            M3
HSJ>

HSJ> RUN CLONE
```

(continued on next page)

Example 6–20 (Cont.) Cloning a Striped Mirrorset

```
Clone Local Program Invoked
Units available for cloning:
 411
Enter unit to clone ?411
Clone will create a new unit which is a copy of unit 411.
Enter the unit number which you want assigned to the new unit?499
The new unit may be added using one of the following methods:
  1. Clone will pause after all members have been copied. The user must
     then press RETURN to cause the new unit to be added.
  2. After all members have been copied, the unit will be added automatically.
Under which above method should the new unit be added []?1
Devices available for clone targets:
  DISK150 (size=832317)
  DISK350 (size=832317)
  DISK550 (size=832317)
Use available device DISK150(size=832317) for
member DISK110(size=832317) (y,n) [y] ?N
Use available device DISK350(size=832317) for
member DISK110(size=832317) (y,n) [y] ?Y
        set M1 nopolicy
        set M1 members=3
        set M1 replace=DISK350
Devices available for clone targets:
  DISK150 (size=832317)
  DISK550 (size=832317)
Use available device DISK150(size=832317) for
member DISK310(size=832317) (y,n) [y] ?Y
        set M2 nopolicy
        set M2 members=3
        set M2 replace=DISK150
Devices available for clone targets:
  DISK550 (size=832317)
Use available device DISK550(size=832317) for
member DISK510(size=832317) (y,n) [y] ?Y
        set M3 nopolicy
        set M3 members=3
        set M3 replace=DISK550
Copy in progress for each new member. Please be patient...
  copy from DISK110 to DISK350 is 7% complete
  copy from DISK310 to DISK150 is 6% complete
  copy from DISK510 to DISK550 is 5% complete
  .
  .
  .
  copy from DISK110 to DISK350 is 100% complete
  copy from DISK310 to DISK150 is 100% complete
  copy from DISK510 to DISK550 is 100% complete

Press RETURN when you want the new unit to be created
        reduce DISK350 DISK150 DISK550
        add mirrorset C_M1      DISK350
        add mirrorset C_M2      DISK150
        add mirrorset C_M3      DISK550
        add stripeset C_ST1     C_M1 C_M2 C_M3
        init C_ST1    nodestroy chunk=128
        add unit D499 C_ST1

D499 has been created. It is a clone of D411.

Clone - Normal Termination

HSJ>
```

(continued on next page)

Example 6–20 (Cont.) Cloning a Striped Mirrorset

```
HSJ> SHOW DEVICES
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

DISK110       disk             1    1    0                    M1
DISK150       disk             1    5    0                    C_M2
DISK220       disk             2    2    0                    M1
DISK310       disk             3    1    0                    M2
DISK350       disk             3    5    0                    C_M1
DISK420       disk             4    2    0                    M2
DISK510       disk             5    1    0                    M3
DISK550       disk             5    5    0                    C_M3
DISK620       disk             6    2    0                    M3

HSJ>

HSJ> SHOW MIRRORSETS
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------------

C_M           mirrorset                     DISK350          C_ST1

C_MA          mirrorset                     DISK150          C_ST1

C_MB          mirrorset                     DISK550          C_ST1

M1            mirrorset                     DISK110          ST1
                                            DISK220

M2            mirrorset                     DISK310          ST1
                                            DISK420

M3            mirrorset                     DISK510          ST1
                                            DISK620

HSJ>

HSJ> SHOW STORAGESETS
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------------

C_ST1         stripeset                     C_M1             D499
                                            C_M2
                                            C_M3

ST1           stripeset                     M1               D411
                                            M2
                                            M3
HSJ>
```

To manually clone a striped mirrorset, use the following commands in sequential order:

1. SHOW DEVICES
2. SHOW MIRRORSETS
3. SHOW STORAGESETS
4. SET *mirrorset-container-name1* NOPOLICY
5. SET *mirrorset-container-name1* MEMBERSHIP=
6. SET *mirrorset-container-name1* REPLACE=
7. SET *mirrorset-container-name2* NOPOLICY
8. SET *mirrorset-container-name2* MEMBERSHIP=
9. SET *mirrorset-container-name2* REPLACE=
10. SET *mirrorset-container-name3* NOPOLICY
11. SET *mirrorset-container-name3* MEMBERSHIP=
12. SET *mirrorset-container-name3* REPLACE=

    Wait for NORMALIZATION of *all* new mirrorset members.

13. REDUCE *disk-device-name disk-device-name[N] disk-device-name [N]*
14. ADD MIRRORSET *mirrorset-container-name disk-device-name*
15. ADD MIRRORSET *mirrorset-container-name disk-device-name*
16. ADD MIRRORSET *mirrorset-container-name disk-device-name*
17. ADD STRIPESET *stripeset-name mirrorset-container-name1 mirrorset-container-name2 mirrorset-container-name3*
18. INITIALIZE *stripeset-name* NODESTROY CHUNK=
19. ADD UNIT *unit-name stripeset-name*
20. SHOW DEVICES
21. SHOW MIRRORSETS
22. SHOW STORAGESETS

The following is an example of the commands for cloning striped mirrorsets:

```
HSJ> SHOW DEVICES ❶
HSJ> SHOW MIRRORSETS ❷
HSJ> SHOW STORAGESETS ❸
HSJ> SET M1 NOPOLICY ❹
HSJ> SET M1 MEMBERSHIP=3 ❺
HSJ> SET M1 REPLACE=DISK350 ❻
HSJ> SET M2 NOPOLICY ❼
HSJ> SET M2 MEMBERSHIP=3 ❽
HSJ> SET M2 REPLACE=DISK150 ❾
HSJ> SET M3 NOPOLICY ❿
HSJ> SET M3 MEMBERSHIP=3 ⓫
HSJ> SET M3 REPLACE=DISK550 ⓬
...wait for NORMALIZATION of M1, M2, and M3...
```

```
HSJ> REDUCE DISK350 DISK150 DISK550 ⓭
HSJ> ADD MIRRORSET C_M1  DISK350 ⓮
HSJ> ADD MIRRORSET C_M2  DISK150 ⓯
HSJ> ADD MIRRORSET C_M3  DISK550 ⓰
HSJ> ADD STRIPESET C_ST1 C_M1 C_M2 C_M3 ⓱
HSJ> INITIALIZE C_ST1 NODESTROY ⓲
HSJ> ADD UNIT D499 C_ST1 ⓳
HSJ> SHOW DEVICES ⓴
HSJ> SHOW MIRRORSETS ㉑
HSJ> SHOW STORAGESETS ㉒
```

❶ Displays the devices available for cloning.

❷ Displays the configured mirrorsets.

❸ Displays the configured storagesets.

❹ Sets the replacement policy for mirrorset M1 to NOPOLICY so that spareset members are not automatically added to the mirrorset

❺ Sets the nominal membership of mirrorset M1 to three members.

❻ Places disk DISK350 into mirrorset M1. The controller automatically starts copying data from existing NORMAL members to the new member.

❼ Sets the replacement policy for mirrorset M2 to NOPOLICY so that spareset members are not automatically added to the mirrorset

❽ Sets the nominal membership of mirrorset M2 to three members.

❾ Places disk DISK150 into mirrorset M2. The controller automatically starts copying data from existing NORMAL members to the new member.

❿ Sets the replacement policy for mirrorset M3 to NOPOLICY so that spareset members are not automatically added to the mirrorset

⓫ Sets the nominal membership of mirrorset M3 to three members.

⓬ Places disk DISK550 into mirrorset M3. The controller automatically starts copying data from existing NORMAL members to the new member.

⓭ Removes DISK350, DISK150, and DISK550 from their respective mirrorsets, after the copy operations from the existing NORMAL mirrorset members has completed.

⓮ Creates new one-member mirrorset C_M1 that contains DISK350.

⓯ Creates new one-member mirrorset C_M2 that contains DISK150.

⓰ Creates new one-member mirrorset C_M3 that contains DISK550.

⓱ Creates a stripeset called C_ST1 from the three new mirrorsets C_M1, C_M2, and C_M3.

⓲ Initializes stripeset C_ST1 with a chunksize of 128 blocks, but does not write new metadata onto the members.

⓳ Creates a logical unit for the host from stripeset C_ST1 and names the unit D499.

⓴ Shows the device configuration after the clone is complete.

㉑ Shows the mirrorsets after the clone is complete.

㉒ Shows the storagesets after the clone is complete.

7

Removing and Replacing Field Replaceable Units

This chapter describes how to remove and replace/install the following field replaceable units (FRUs) in both dual-redundant and nonredundant configurations:

- Controller module (including its mounting bracket, OCP, and bulkhead)
- Cache module (including write-back cache batteries)
- Program card
- Internal CI host cable
- External CI host cables
- DSSI host cable
- SCSI host cable
- SCSI device port cables
- Blowers
- Power supplies

CAUTION

Do not attempt to replace or repair components within FRUs or equipment damage may result. Use the controller fault indications and error logs to isolate FRU-level failures.

This chapter also discusses how to warm swap controllers and storage devices.

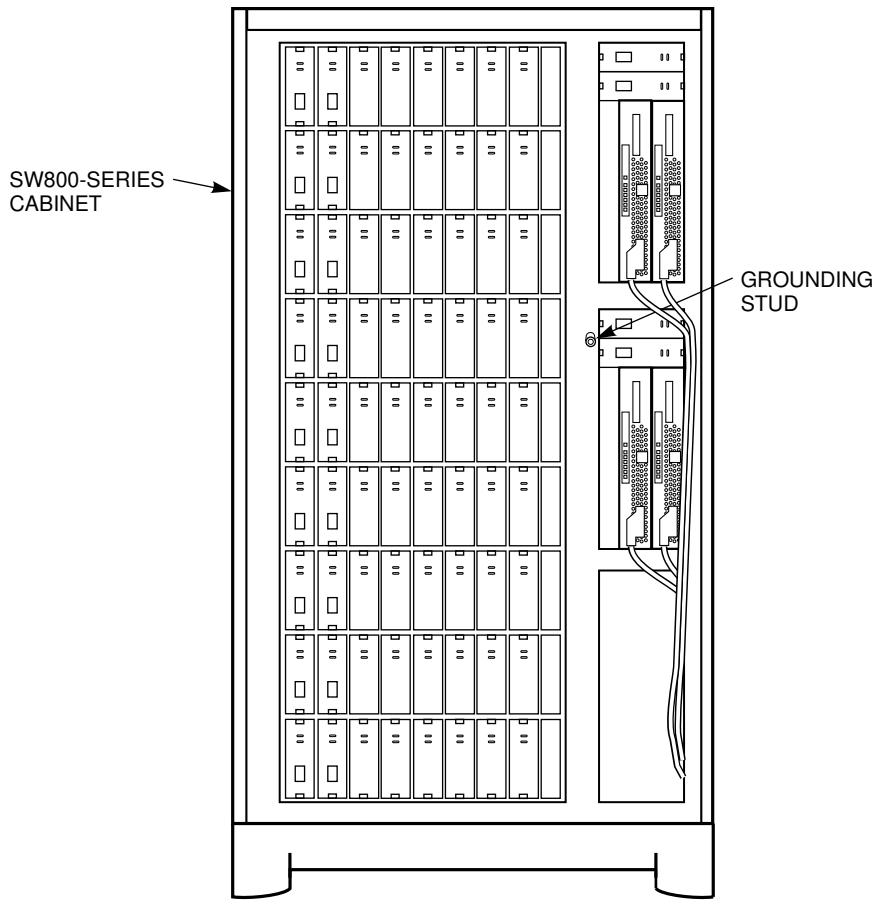
7.1 Electrostatic Discharge Protection

Electrostatic discharge (**ESD**) is a common problem for any electronic device and may cause data loss, system down time, and other problems. The most common source of static electricity is the movement of people in contact with carpets and clothing. Low humidity also increases the amount of static electricity. You must discharge all static electricity prior to touching electronic equipment.

Prior to handling a controller or cache module, follow these guidelines.

- Wear an ESD wrist strap on your wrist. Make sure the strap fits snugly.
- Plug the ESD strap into the grounding stud located on the vertical rail between the controller shelves and the device shelves. The stud is approximately halfway down the rail, as shown in Figure 7–1. [1]

Figure 7–1 Shelf Grounding Stud



- After removing a controller or cache 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.

[1] The grounding stud is moveable and can be relocated to another part of the cabinet.

7.2 Diagnosing Subsystem Errors

If you are presented with a controller failure, be aware of the following.

Generally, if the green OCP reset (//) button is lit continuously, the controller module needs replacing. However, you need to be as familiar as possible with the failure or reason for replacing the module. Be sure you have followed troubleshooting basics:

1. Make a note of all visual indicators (OCP, device LEDs, and/or error messages) available to you.
2. Extract and read host error logs (refer to Chapter 5).
3. For surviving controllers in dual-redundant pairs, try entering the RESTART OTHER_CONTROLLER command. The surviving controller may be keeping its companion from operating.
4. Errors can be intermittent. Reset the controller to see if the error clears. [1]
5. See if the error indication changes after resetting the controller. If the error remains the same, look up information for that error. If the indication changes, look up information for the newer error.
6. Always consider reseating the controller and/or cache module when troubleshooting. Poor connections between module and backplane can cause a variety of errors.

   Refer to Chapter 5 for detailed information about errors and repair actions.

CAUTION

Do not use a controller failure situation as an opportunity to move devices or otherwise reconfigure your subsystem. Doing so will prevent the controller from communicating with its units once the fault is corrected.

Before Proceeding

You should decide exactly what you will be servicing (a nonredundant controller, one dual-redundant controller, or both dual-redundant controllers) before proceeding to the following sections, as each procedure varies and has different consequences.

7.3 Using the Controller SHUTDOWN Command to Turn Off Controller Power

If you want to turn off the power to your controller subsystem for any reason (such as a long holiday, system move, replacing a bad SCSI host cable, and so forth), make sure you turn off the power properly by using the following steps:

CAUTION

If the correct steps for turning off the power to an HS array controller configuration with write-back cache are not followed, there is a potential

[1] Record which devices have lit/flashing fault LEDs before resetting, as resetting the controller may temporarily clear the LED even though the fault remains.

for loss of data that may exist on any devices connected to the HS array controllers.

---

1. Use the proper procedures for shutting down your operating system if the host system is also going to be turned off.

   If the host is not going to be turned off, a shut down of the host system is not necessary, but use the proper operating system procedures to dismount any units that are accessed through the HS array controllers.

2. When the dismount and/or the operating system shutdown procedures are complete, invoke the controller SHUTDOWN commands on the HS array controllers.

   CAUTION

   Do not turn off the power to the controller subsystem until all shutdown procedures have successfully completed!

---

3. When you enter the controller SHUTDOWN command, do not specify any nondefault qualifiers. The default qualifiers allow discovery of any errors that might be present so that proper recovery procedures can be implemented before turning off the power to the system.

4. If you have a dual-redundant controller configuration, shutdown each controller one at a time. If you have a single terminal CLI interface, such as a VAXcluster Console System (VCS), use the following commands:

   ```
   CLI> SHUTDOWN OTHER_CONTROLLER
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

   If you have a nonredundant controller configuration, only the SHUTDOWN THIS_CONTROLLER command is necessary.

5. Only when the controller SHUTDOWN command has successfully completed, may you turn off the power to the controller subsystem. If you are just shutting down the controller shelf and not the entire system, unplug the power supplies in the controller shelf.

6. If the controller configuration contains any devices or storagesets (RAIDsets, mirrorsets) that are write-back cache enabled, and the system is going to be turned off for an extended length of time, the batteries on the write-back cache modules will drain, causing the data in the cache modules to be lost.

   After restoring power to the system, and restarting the controllers, check the battery status before accessing the RAIDset or mirrorset units from the operating system. The battery status must say ''good,'' unless the CACHE_POLICY=B qualifier is set. Remember that if you have the CACHE_POLICY=B set, and you decide to use your RAIDsets or mirrorsets, you risk losing data if power should be lost before the batteries have recharged. To verify the status of the batteries, enter the following commands:

   ```
   CLI> SHOW THIS_CONTROLLER

   or

   CLI> SHOW OTHER_CONTROLLER
   ```

If the battery status is not ‘‘good,’’ you will not be able to access the RAIDset or mirrorset units until the batteries have recharged unless you have the SET THIS_CONTROLLER or SET OTHER_CONTROLLER CACHE_POLICY=B qualifier set.

Note

The CACHE_POLICY=A and CACHE_POLICY=B qualifiers are available for HS array controllers using firmware Version 2.5 or greater.

If you are not turning off the power and you want to quickly remove and replace *one* controller in a *dual-redundant* configuration, you may use the controller warm swap procedure (refer to Section 7.15.2.3), also called C_SWAP. This method provides the fastest, most transparent way of exchanging controllers with minimal system impact. Make sure the devices and storagesets for the failed controller fail over to the good controller before you start the C_SWAP program.

If you have a nonredundant controller configuration, use the controller SHUTDOWN command before removing the controller module from the controller shelf if the controller is still functioning.

If the controller in your nonredundant configuration has completely failed, simply remove it using the controller remove and replace procedures in this manual and replace it with a new controller module.

CAUTION

Make sure you keep a current copy of your configuration because you will need it to set the initial parameters for the new controller. You also need it to set all of your device and storageset assignments. Without a copy of your configuration, you have no way to recreate the previous configuration.

See Appendix B for a complete description of the SHUTDOWN command and its qualifiers. Be sure to understand the consequences to data and devices when using any qualifiers.

7.4 Using DISMOUNT or SHUTDOWN for Device Moves

Whenever you need to move devices to another shelf or another system, you must run down the metadata on those devices first.

- **For HSJ or HSD30 Array Controllers:** If you have RAIDset or mirrorset units, or single devices with write-back caching turned on, you must dismount all devices to run down write-back metadata so that metadata is cleared in the write-back cache modules and on the devices.
- **For HSZ Array Controllers:** If you have RAIDset or mirrorset units, or single devices with write-back caching turned on, you may use any of three methods to run down the metadata:
  - Use the controller SHUTDOWN command
  - Disable write-back caching on all units/devices

– Set NORUN on all units

CAUTION

You must follow all dismount and shutdown procedures to avoid leaving dirty data in your write-back cache modules and clear any errors before doing a run down.

7.5 Controller Modules

Servicing a controller module involves several considerations:

- Diagnosing the controller
- Shutting down the controllers
- Following the correct replacement procedure:
  - A nonredundant controller
  - One dual-redundant controller
  - Both dual-redundant controllers

7.5.1 Replacing a Nonredundant Controller

Nonredundant controllers in BA350–MA shelves are always installed in slot (SCSI ID) 7, the slot furthest from the SCSI device cable connectors. Nonredundant controllers in SW300 cabinet shelves are in either slot (SCSI ID) 6 or 7.

When you replace the controller module in a nonredundant configuration, device service is interrupted for the duration of the service cycle.

7.5.1.1 Tools Required

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

- Maintenance Terminal
- ESD strap
- 3/32-inch Allen wrench
- 5/32-inch Allen wrench (to unlock an SW800-Series cabinet)
- Flat-head screwdriver
- Small flat-head screwdriver

7.5.1.2 Precautions

Refer to Section 7.1 for ESD, grounding, and module handling guidelines.

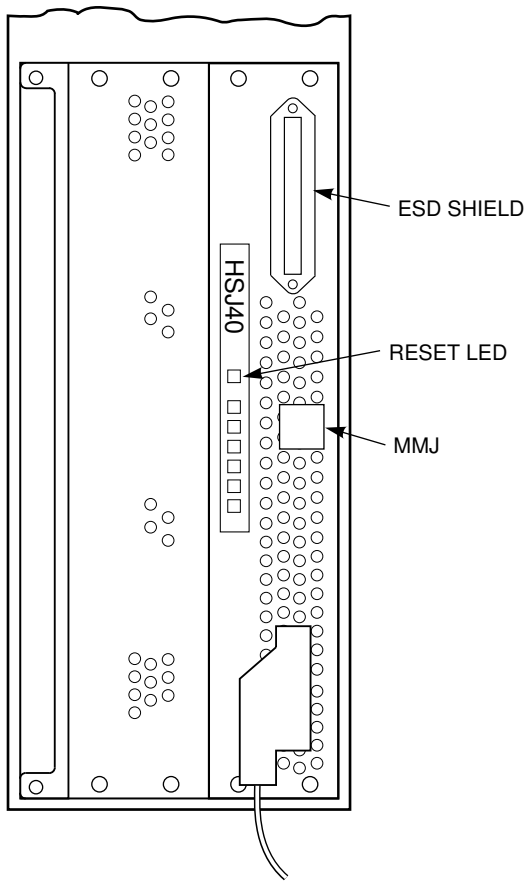
Ground yourself to the cabinet grounding stud (refer to Figure 7–1) before servicing the controller module.

7.5.1.3 Removing the Controller Module

Use the following procedure to remove the controller module:

1. Unlock and open the cabinet doors
2. Examine the green OCP reset (//) LED, shown in Figure 7–2, on the controller. If the green LED stays lit continuously after troubleshooting (refer to Section 7.2), the controller has failed and is already shut down. Proceed to step 7.

Figure 7–2 Reset LED, HSJ40 Controller



CXO-4117B-MC

3. If the controller is fully or partially functioning (green LED flashing), connect a maintenance terminal to the controller.
4. From the maintenance terminal, enter the following commands:

```
CLI> SHOW THIS_CONTROLLER FULL
CLI> SHOW DEVICES FULL
CLI> SHOW UNITS FULL
```

5. Record the output from the commands and keep it available for reference.

6. To shutdown the controller, enter the following command:

   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

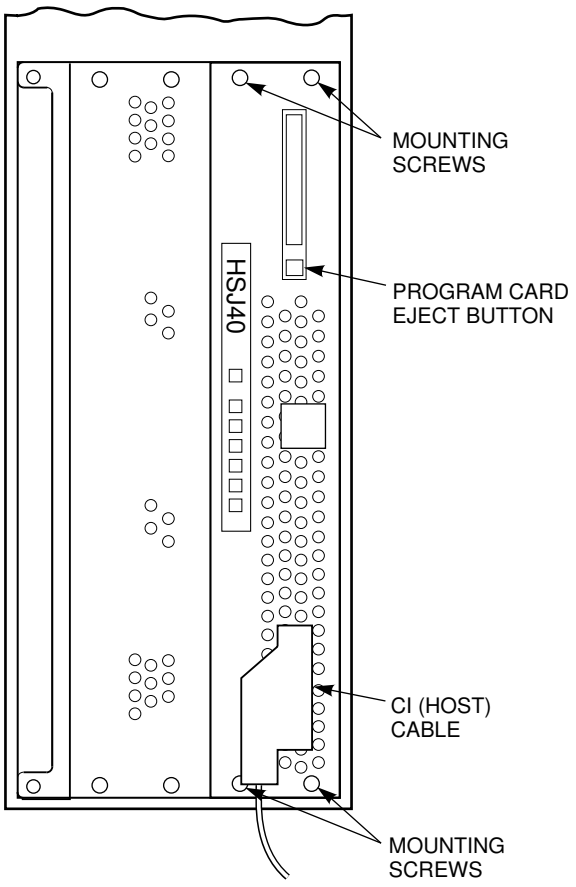
   The controller's green LED will light continuously when shutdown completes.

CAUTION

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

7. Unsnap and remove the program card ESD shield (see Figure 7–2).
8. Remove the program card by pushing the eject button, shown in Figure 7–3. Pull the card out and save it for use in the replacement controller module.

Figure 7–3 Eject Button, HSJ40 Controller



9. **HSJ-Series:** Loosen the captive screws on the CI cable connector, shown in Figure 7–3, with a flat-head screwdriver and remove the cable from the front of the controller module.

HSD-Series: If your controller does not have a mating guide on the host connector (see Figure 7–4), turn off power to all members on the DSSI bus. Then, with a small flat-head screwdriver, loosen the captive screws on the *trilink connector* (see Figure 7–5) and remove the trilink from the front of the controller. Do *not* remove cables or terminators from the trilink. You will have to work around any DSSI cable or terminator connections when removing the trilink.

Note

Some cable and terminator connectors will not provide enough access to the trilink screws for you to remove the trilink (without first removing the cable and/or terminator). In these cases, you *must* disconnect power from all bus members and remove cables and terminators before removing the trilink.

Figure 7–4 Mating Guide (HSD-Series)

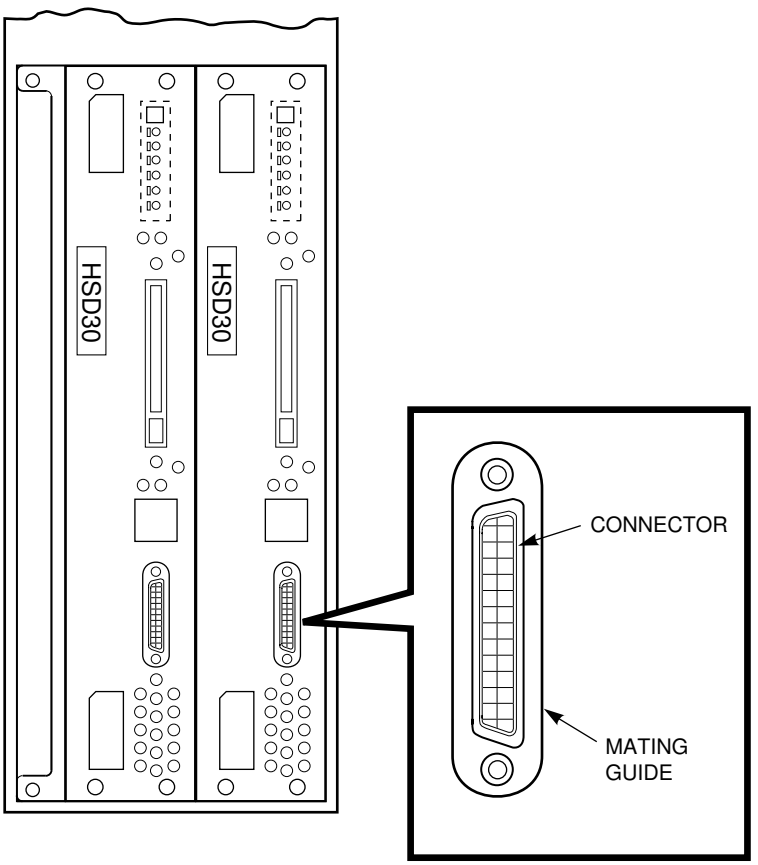
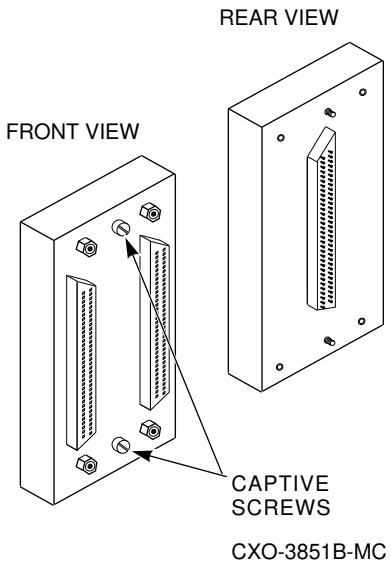


Figure 7–5 Trilink Connector (HSD- and HSZ-Series)



HSZ-Series: With a small flat-head screwdriver, loosen the captive screws on the *trilink connector* (see Figure 7–5) 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.

Note

Some cable and terminator connectors will not provide enough access to the trilink screws for you to remove the trilink (without first removing the cable and/or terminator). In these cases, you *must* disconnect power from all bus members and remove cables and terminators before removing the trilink.

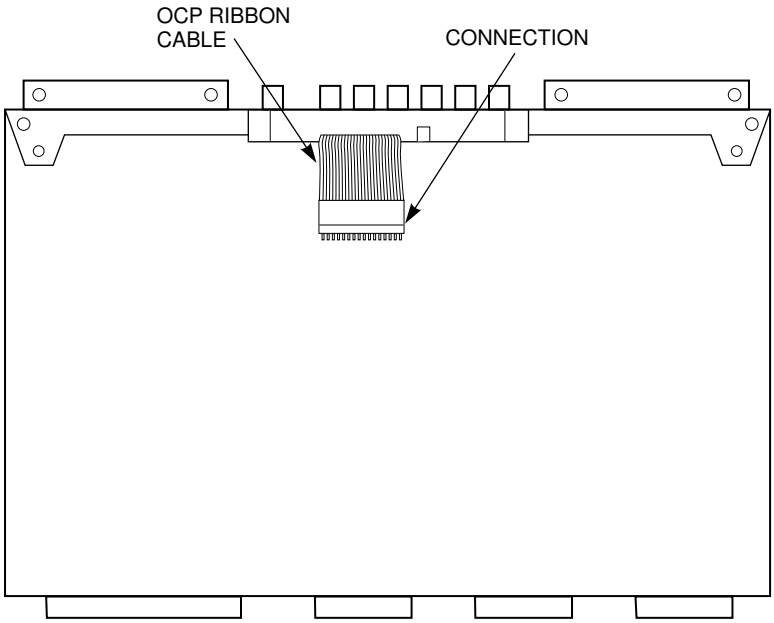
10. Remove the maintenance terminal cable (if attached).
11. Loosen the four mounting screws (refer to Figure 7–3) on each side of the front bulkhead with a 3/32-inch Allen wrench (HSJ-Series controllers) or flat-head screwdriver (HSD- and HSZ-Series).
12. Use a gentle up-and-down rocking motion to loosen the module from the shelf backplane.
13. Slide the module out of the shelf (noting which rails the module was seated in) and place it on an approved ESD work surface or mat.
14. If necessary, you may now remove the cache module as described in Section 7.6.1.3 or Section 7.6.2.3.

7.5.1.4 Replacing/Installing the Controller Module

Use the following procedure to replace or install the controller module:

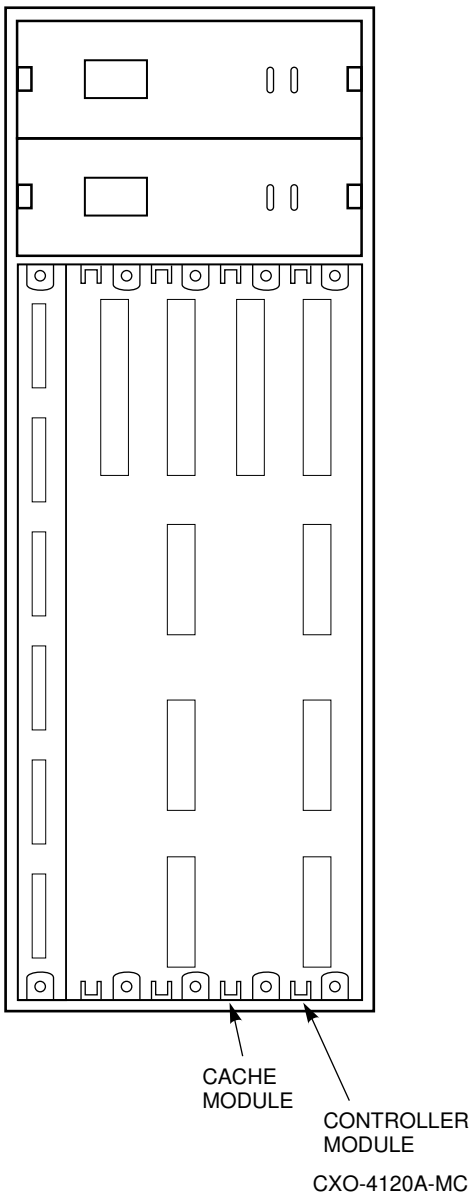
1. Replace the cache module now, if you removed it. See Section 7.6.1.4 or Section 7.6.2.8 for further information on replacing or installing the cache module.
2. (HSJ-Series only) Make sure the OCP cable is correctly plugged into the underside of the module, as shown in Figure 7–6.

Figure 7–6 OCP Cable, HSJ-Series Controller



3. Slide the controller module into the shelf using its slot's rightmost rails as guides (see Figure 7–7).
4. 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. Tighten the four screws on the front bulkhead using a 3/32-inch Allen wrench (HSJ-Series) or flat-head screwdriver (HSD- and HSZ-Series).
6. Connect a maintenance terminal to the new controller.
7. Press and hold the controller's green reset (//) button. Then insert the program card into the new controller. The program card eject button will extend when the card is fully inserted.
8. Release the reset button to initialize the controller.

Figure 7–7 Controller Shelf Rails



If the controller initializes correctly, its green reset LED will begin to flash at 1 Hz. If an error occurs during initialization, the OCP will display a code. If necessary, refer to Chapter 5 to analyze the code.

9. Snap the ESD shield into place over the program card.
10. Set initial controller parameters by following the steps in Section 7.5.1.5.
11. *After setting initial parameters*, reconnect the trilink connector and host cables.
12. If you want, you may disconnect the maintenance terminal. The terminal is not required for normal controller operation.

13. Close and lock the cabinet doors.

7.5.1.5 Restoring Initial Parameters (Nonredundant Controller)

A new controller module has no initial parameters, so you must use the maintenance terminal to enter them. Refer to information that you recorded before shutting down the controller, or the information in a CONFIGURATION.INFO file or on the configuration sheet packaged with your system, whichever is most current. Be sure to set the parameters the same for the replacement controller as they were in the removed controller.

After installing a nonredundant controller, use the CLI to define its parameters in the following order (from a maintenance terminal).

CAUTION

Do not install HSJ-Series CI host port cables until after setting all parameters listed here. Failure to follow this procedure may result in adverse effects on the host/cluster.

Note

Not all steps are applicable to all controller models. Steps applicable to certain models are designated as such.

1. Turn the controller on before entering parameters, if it is not already on.
2. (HSJ-Series) Enter the following command to set the MAX_NODES:

   ```
   CLI> SET THIS_CONTROLLER MAX_NODES=n
   ```

   where *n* is 8, 16, or 32.
3. Enter the following command to set a valid controller ID:

   ```
   CLI> SET THIS_CONTROLLER ID=n
   ```

   (HSJ-Series) where *n* is the CI node number (0 through (MAX_NODES – 1)).

   (HSD-Series) where *n* is the one-digit DSSI node number (0 through 7). Each controller DSSI node number must be unique among all devices on its DSSI interconnect.

   (HSZ-Series) where *n* represents the SCSI target IDs (0–7).
4. (HSJ- and HSD-Series) Enter the following command to set the SCS node:

   ```
   CLI> SET THIS_CONTROLLER SCS_NODENAME="xxxxxx"
   ```

   where *xxxxxx* is a one- to six-character alphanumeric name for this node. The node name must be enclosed in quotes with an alphabetic character first. Each SCS node name must be unique within its VMScluster.[2]
5. (HSJ- and HSD-Series) Enter the following command to set the MSCP allocation class:

   ```
   CLI> SET THIS_CONTROLLER MSCP_ALLOCATION_CLASS=n
   ```

   where *n* is 0 through 255.

[2] See Chapter 4 for important information about VMS node names.

6. (HSJ- and HSD-Series) Enter the following command to set the TMSCP allocation class:

   ```
   CLI> SET THIS_CONTROLLER TMSCP_ALLOCATION_CLASS=n
   ```

   where *n* is 0 through 255.

7. Restart the controller either by pressing the green reset (///) button or by entering the following command:

   ```
   CLI> RESTART THIS_CONTROLLER
   ```

8. Enter the following command to verify the preceding parameters were set:

   ```
   CLI> SHOW THIS_CONTROLLER FULL
   ```

9. Connect the host port cable to the front of the controller.

   HSJ-Series: Connect the CI cable and tighten its captive screws with a flat-head screwdriver.

   HSD-Series: If your controller does not have a mating guide on the host connector (see Figure 7–4), turn off power to all members on the DSSI bus. Then, with a small flat-head 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. You will have to work around any DSSI cable or terminator connections when removing the trilink.

   Note

   Some cable and terminator connectors will not provide enough access to the trilink screws for you to remove the trilink (without first removing the cable and/or terminator). In these cases, you *must* disconnect power from all bus members and remove cables and terminators before removing the trilink.

   HSZ-Series: Connect the SCSI cable trilink connector to the front of the controller and tighten its captive screws with a small flat-head screwdriver. 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 replacing the trilink.

10. (HSJ-Series) Enter the following commands to enable CI paths A and B to the host:

    ```
    CLI> SET THIS_CONTROLLER PATH_A
    CLI> SET THIS_CONTROLLER PATH_B
    ```

    (HSD-Series) Enter the following command to enable the host port path:

    ```
    CLI> SET THIS_CONTROLLER PATH
    ```

    (HSZ-Series) The host port path for HSZ-Series controllers is always on, so no command is needed.

To quickly configure devices on the controller, use either the CONFIG or CFMENU utility described in Chapter 6.

For manual configuration, the following steps add devices, storagesets, and logical units. Use the CLI to complete these steps so that the host will recognize the storage device. (You can run these steps from a virtual terminal.)

1. Add the physical devices by using the following command:

```
CLI> ADD device-type device-name SCSI-location
```

For example:

```
CLI> ADD DISK DISK100 1 0 0
CLI> ADD TAPE TAPE510 5 1 0
CLI> ADD CDROM CDROM0 6 0 0
```

where:

device-type is the type of device to be added.

device-name is the name to refer to that device. The name is referenced when creating units or storagesets.

SCSI-location is the PTL for the device. Separate the port, target, and LUN numbers with spaces.

2. Add the storagesets for the devices. Storagesets include stripesets, mirrorsets, and RAIDsets.

   See Appendix B for examples of adding storagesets. (If you do not want storagesets in your configuration, skip this step.)

CAUTION

The INITIALIZE command destroys all data on a container. See Appendix B for specific information on this command.

3. *If there is no user data that you want to keep on the devices,* enter the following command to initialize the containers (devices, storagesets, or both) prior to adding logical units to the configuration.

   ```
   CLI> INITIALIZE container-name
   ```

   where *container-name* is a device or storageset that will become a unit.

4. Add the host-visible units by entering the following command:

   ```
   CLI> ADD UNIT logical-unit-number container-name
   ```

   where:

   logical-unit-number is the unit number the host uses to access the device.

   container-name identifies the device or the storageset.

5. Use the following commands to verify that your configuration matches the earlier, printed configuration:

   ```
   CLI> SHOW DEVICES FULL
   CLI> SHOW UNITS FULL
   ```

7.5.2 Replacing One Dual-Redundant Controller

CAUTION

To perform the procedures in this section, at least one controller must be functioning.

To replace one controller in a dual-redundant configuration (or one at a time) while using the second controller to service devices, see the controller warm swap procedure in Section 7.15.2. Warm swap provides the fastest, most transparent way of exchanging controllers with minimal system impact and no down time.

When you replace one dual-redundant controller module using the instructions in this section, device service is interrupted for the duration of the service cycle.

CAUTION

If your operating system does not recover well when a device (controller) is removed momentarily, you should either dismount the device or shut down the operating system before carrying out this procedure.

7.5.2.1 Tools Required

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

- Maintenance terminal
- ESD strap
- 3/32-inch Allen wrench
- 5/32-inch Allen wrench (to unlock an SW800-Series cabinet)
- Flat-head screwdriver

7.5.2.2 Precautions

Refer to Section 7.1 for ESD, grounding, and module handling guidelines.

Ground yourself to the cabinet grounding stud (refer to Figure 7–1) before servicing the controller module.

7.5.2.3 Removing the Controller Module

Use the following procedure to remove the controller module:

1. Unlock and open the cabinet doors
2. Examine the green OCP reset (//) LED (refer to Figure 7–2) on both controllers. At least one green LED should still be blinking after basic troubleshooting (refer to Section 7.2). If both green LEDs stay lit continuously, both controllers have failed. Refer to Section 7.5.3.

CAUTION

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

3. If the controller you are removing is still functioning (green LED flashing), connect a maintenance terminal to the controller. If the controller is not functioning, connect the maintenance terminal to the other controller.
4. From the maintenance terminal, enter the following commands:

```
CLI> SHOW THIS_CONTROLLER FULL
CLI> SHOW DEVICES FULL
CLI> SHOW UNITS FULL
```

   If the controller you are removing is not functioning and your maintenance terminal is connected to the other controller, type SHOW OTHER_ CONTROLLER FULL in place the first command, above.

5. Record the output from the commands and keep it available for reference.

6. If the controller you are removing is still functioning, shutdown the controller by typing:

   ```
   CLI>SHUTDOWN THIS_CONTROLLER
   ```

   The controller's green LED will light continuously when shutdown completes.

7. Connect the maintenance terminal to the still functioning controller.

8. Shut down the controller you are *not* removing by typing:

   ```
   CLI>SHUTDOWN THIS_CONTROLLER
   ```

9. Unsnap and remove the program card ESD shield on the controller you are removing, (refer to Figure 7–2).

10. Remove the program card by pushing the eject button (refer to Figure 7–3) next to the card. Pull the card out and save it for use in the replacement controller module.

11. **HSJ-Series:** Loosen the captive screws on the CI cable connector (refer to Figure 7–3) with a flat-head screwdriver and remove the cable from the front of the controller module.

    HSD-Series: If your controller does not have a mating guide on the host connector (see Figure 7–4), turn off power to all members on the DSSI bus. Then, with a small flat-head screwdriver, loosen the captive screws on the *trilink connector* (see Figure 7–5 and remove the trilink from the front of the controller. Do *not* remove cables or terminators from the trilink. You will have to work around any DSSI cable or terminator connections when removing the trilink.

    Note

    Some cable and terminator connectors will not provide enough access to the trilink screws for you to remove the trilink (without first removing the cable and/or terminator). In these cases, you *must* disconnect power from all bus members and remove cables and terminators before removing the trilink.

    HSZ-Series: With a small flat-head screwdriver, loosen the captive screws on the *trilink connector* (see Figure 7–5 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.

    Note

    Some cable and terminator connectors will not provide enough access to the trilink screws for you to remove the trilink (without first removing the cable and/or terminator). In these cases, you *must* disconnect power from all bus members and remove cables and terminators before removing the trilink.

12. Remove the maintenance terminal cable (if attached).

13. Loosen the four screws (refer to Figure 7–3) on each side of the front bulkhead with a 3/32-inch Allen wrench (HSJ-Series) or flat-head screwdriver (HSD- and HSZ-Series).
14. Use a gentle up-and-down rocking motion to loosen the controller module from the shelf backplane.
15. Slide the module out of the shelf (noting which rails the module was seated in) and place it on an approved ESD work surface or mat.
16. If necessary, you may now remove the cache module as described in Section 7.6.1.3 or Section 7.6.2.3.

7.5.2.4 Replacing/Installing the Controller Module

Use the following procedure to replace the controller module:

1. Replace the cache module if you removed it. Refer to Section 7.6.1.4 or Section 7.6.2.8.
2. (HSJ-Series only) Make sure the OCP cable is correctly plugged into the underside of the module (refer to Figure 7–6).
3. Slide the controller module into the shelf using the slot's rightmost rails as guides (refer to Figure 7–7).
4. 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. Tighten the four screws on the front bulkhead using a 3/32-inch Allen wrench (HSJ-Series) or flat-head screwdriver (HSD- and HSZ-Series).
6. Connect a terminal to the controller you did *not* replace, and enter the following command:

   ```
   CLI> RESTART THIS_CONTROLLER
   ```

   (Wait for the controller you did not remove to initialize.)
7. Press and hold both controllers' green reset (//) buttons. Then insert the program card into the new controller. The program card eject button will extend when the card is fully inserted.
8. Release both reset buttons.
9. Snap the ESD shield into place over the program card.
10. Connect a maintenance terminal to the new controller.
11. Restore initial controller parameters by following the steps in Section 7.5.2.5.
12. Enter the following command to restart the controller:

    ```
    CLI> RESTART THIS_CONTROLLER
    ```

    If the controllers initialize correctly, their green LEDs will begin to flash at 1 Hz. If an error occurs during initialization, the OCP will display a code. If necessary, refer to Chapter 5 to analyze the code.
13. If you want, you may disconnect the maintenance terminal. The terminal is not required for normal controller operation.
14. Close and lock the cabinet doors.

7.5.2.5 Restoring Initial Parameters (One Dual-redundant Controller)

A new controller module has no initial parameters, so you must use a maintenance terminal to enter them.

CAUTION

Do not install host port cables until after setting all parameters listed here. Failure to follow this procedure may result in adverse effects on the host/cluster.

CAUTION

SET FAILOVER establishes controller-to-controller communication and copies configuration information. Always enter this command on one controller only. COPY=*configuration-source* specifies where the *good* configuration data is located. *Never* blindly specify SET FAILOVER. Know where your good configuration information resides before entering the command.

Note

Not all steps are applicable to all controller models. Steps applicable to certain models are designated as such.

1. Turn on the controller before entering parameters, if it is not already on.
2. Using a maintenance console connected to the *new* controller, enter the following command to copy configuration information to the new controller:

   ```
   CLI> SET FAILOVER COPY=OTHER_CONTROLLER
   ```

   HSZ-Series controllers will return to the dual-redundant configuration and restart after entering this command. Proceed to step 9 if you are working with HSZ-Series controllers.
3. (HSJ-Series) Enter the following command to set the MAX_NODES:

   ```
   CLI> SET THIS_CONTROLLER MAX_NODES=n
   ```

   where *n* is 8, 16, or 32.
4. (HSJ- and HSD-Series) Enter the following command to set a valid controller ID:

   ```
   CLI> SET THIS_CONTROLLER ID=n
   ```

   (HSJ-Series) where *n* is the CI node number (0 through (MAX_NODES − 1)).

   (HSD-Series) or *n* is the one-digit DSSI node number (0 through 7). Each controller DSSI node number must be unique among all devices on its DSSI interconnect.
5. (HSJ- and HSD-Series) Enter the following command to set the SCS node:

   ```
   CLI> SET THIS_CONTROLLER SCS_NODENAME="xxxxxx"
   ```

where *xxxxxx* is a one- to six-character alphanumeric name for this node. The node name must be enclosed in quotes with an alphabetic character first. Each SCS node name must be unique within its VMScluster.[3]

6. (HSJ- and HSD-Series) Enter the following command to set the MSCP allocation class:

   ```
   CLI> SET THIS_CONTROLLER MSCP_ALLOCATION_CLASS=n
   ```

   where *n* is 1 through 255.

   Digital recommends providing a unique allocation class value for every pair of dual-redundant controllers in the same cluster.

7. (HSJ- and HSD-Series) Enter the following command to set the TMSCP allocation class:

   ```
   CLI> SET THIS_CONTROLLER TMSCP_ALLOCATION_CLASS=n
   ```

   where *n* is 1 through 255.

8. (HSJ- and HSD-Series) Restart both controllers either by pressing the green reset (//) buttons, or by entering the following commands:

   ```
   CLI> RESTART OTHER_CONTROLLER
   CLI> RESTART THIS_CONTROLLER
   ```

9. Enter the following commands to verify the preceding parameters were set.

   ```
   CLI> SHOW THIS_CONTROLLER FULL
   CLI> SHOW OTHER_CONTROLLER FULL
   ```

10. Connect the host port cables to the front of the controllers. Do *not* connect the controllers in a dual-redundant pair to separate, different host CPUs.

    HSJ-Series: Connect the CI cable and tighten its captive screws with a flat-head screwdriver.

    HSD-Series: If your controller does not have a mating guide on the host connector (see Figure 7–4), turn off power to all members on the DSSI bus. Then, connect the trilink connector (with cables attached) to the controller bulkhead and use a small flat-head screwdriver to tighten the captive screws on the *trilink connector*. Do *not* remove cables or terminators from the trilink. You will have to work around any DSSI cable or terminator connections when removing the trilink.

    Note

    Some cable and terminator connectors will not provide enough access to the trilink screws for you to remove/replace the trilink (without first removing the cable and/or terminator). In these cases, you *must* disconnect power from all bus members and remove cables and terminators before removing the trilink.

    HSZ-Series: Connect the trilink connector (with cable attached) to the controller bulkehad and use a small flat-head screwdriver to tighten the captive screws on the *trilink connector*. 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.

[3] See Chapter 4 for important information about VMS node names.

Note

Some cable and terminator connectors will not provide enough access to the trilink screws for you to remove the trilink (without first removing the cable and/or terminator). In these cases, you *must* disconnect power from all bus members and remove cables and terminators before removing the trilink.

11. (HSJ-Series) Enter the following commands to enable CI paths A and B to the host:

```
CLI> SET THIS_CONTROLLER PATH_A
CLI> SET THIS_CONTROLLER PATH_B
CLI> SET OTHER_CONTROLLER PATH_A
CLI> SET OTHER_CONTROLLER PATH_B
```

(HSD-Series) Enter the following commands to enable the host port path:

```
CLI> SET THIS_CONTROLLER PATH
CLI> SET OTHER_CONTROLLER PATH
```

(HSZ-Series) The host port path for HSZ-Series controllers is always on, so no command is needed.

12. Use the following commands to verify your configuration matches the earlier, printed configuration before proceeding:

```
CLI> SHOW DEVICES FULL
CLI> SHOW UNITS FULL
```

7.5.3 Replacing Both Dual-Redundant Controllers

In the rare event that both controllers in your dual-redundant configuration fail, both controllers' green OCP reset (//) LEDs will be lit continuously. You will have to replace both controller modules.

CAUTION

Simultaneously replacing both controllers in a dual-redundant configuration causes system down time for the duration of the service cycle. Digital recommends only using this procedure if both controllers fail, or if your system is offline already for another reason.

Otherwise, to replace both controllers one at a time and maintain device service, follow the steps to warm swap the controllers in Section 7.15.2.

CAUTION

If your operating system does not recover well when a device (controller) is removed momentarily, you should either dismount the device or shut down the operating system before carrying out this procedure.

Use the following guidelines to simultaneously replace both controllers:

1. Examine the green OCP reset (//) LED on both controllers. Follow basic troubleshooting guidelines (refer to Section 7.2), if necessary.
2. If either of the controllers is functioning, connect a maintenance terminal to a functioning controller to record the configuration and shut down the controllers. If neither controller is functioning, skip to step 6.
3. Type the following commands to see the controller configuration. Note that the appropriate controller must be functioning for the SHOW THIS and SHOW OTHER commands to work.

```
CLI> SHOW THIS_CONTROLLER FULL
CLI> SHOW OTHER_CONTROLLER FULL
CLI> SHOW DEVICES FULL
CLI> SHOW UNITS FULL
```

4. Record the output from the commands and keep it available for reference.
5. Type the following commands to shut down the controllers:

```
CLI> SHUTDOWN THIS_CONTROLLER
CLI> SHUTDOWN OTHER_CONTROLLER
```

CAUTION

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

6. Remove both controllers by referring to steps 4 through 11 in Section 7.5.1.3.
7. Replace the first of the controllers as if this were a nonredundant configuration (refer to Section 7.5.1.4).

8. Replace the second controller by following the dual-redundant procedure (refer to Section 7.5.2.4).

7.6 Cache Module

Most controller modules have either a read or write-back cache module installed behind them in the controller shelf. Currently there are four cache modules available: 16 MB read, 32 MB read, 16 MB write-back, and 32 MB write-back modules.

7.6.1 Replacing a Read Cache Module

The following sections provide instructions for servicing a read cache module.

7.6.1.1 Tools Required

You need the following tools to remove or replace the read cache module:

- ESD strap
- Nonconductive ESD mat
- 3/32-inch Allen wrench
- 5/32-inch Allen wrench (to unlock an SW800-Series cabinet)
- Flat-head screwdriver

7.6.1.2 Precautions

Refer to Section 7.1 for ESD, grounding, and module handling guidelines.

Ground yourself to the cabinet grounding stud (refer to Figure 7–1) before servicing the read cache module.

7.6.1.3 Removing the Read Cache Module

Use the following procedure to remove a read cache module:

1. The controller module is seated in front of the read cache module. Any time you service a read cache, you must shut down the controller based on considerations of configuration, down time, and so on. Refer to Section 7.5.
2. To access the read cache module, remove its controller module. Refer to Section 7.5.
3. Use a gentle up-and-down rocking motion to loosen the cache module from the shelf backplane.
4. Slide the read cache module out of the shelf, noting which rails it was seated in, and place it on an approved ESD mat.

7.6.1.4 Replacing/Installing a Read Cache Module

Use the following procedure to replace the read cache module:

1. The controller module is seated in front of the read cache module. Any time you service a read cache, you must shut down the controller based on considerations of configuration, down time, and so on. Refer to Section 7.5.
2. To replace the read cache module, its controller module must already be removed.
3. Slide the read cache module into the shelf using its slot's leftmost rails as guides (refer to Figure 7–7). Be careful not to let the module contact the adjacent controller.
4. 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. Replace the controller module. Refer to Section 7.5.

7.6.2 Replacing a Write-back Cache Module

WARNING

Service procedures described in this manual that involve removing and replacing the write-back cache must be performed only by qualified service personnel.

CAUTION

In general, you should never service a write-back cache module that contains unwritten cache data, or data loss may result. Always use the SHOW THIS_CONTROLLER or SHOW OTHER_CONTROLLER command to check for unwritten cache data. (Note that RETRY_ERRORS UNWRITEABLE_DATA may flush unwritten cache data.)

In situations where losing unwritten cache data does not matter, you may proceed with service. However, the unwritten cache data can remain in the module (needlessly occupying memory) until you enter the CLEAR_ERRORS UNWRITEABLE_DATA command for that module. This command erases the data and allows you to use the full capacity of the module.

The following sections provide instructions for servicing a write-back cache module.

7.6.2.1 Tools Required

You need the following tools to remove or replace the write-back cache module:

- ESD strap
- Nonconductive ESD mat
- 3/32-inch Allen wrench
- 5/32-inch Allen wrench (to unlock an SW800-Series cabinet)
- Flat-head screwdriver

7.6.2.2 Precautions

Refer to Section 7.1 for ESD, grounding, and module handling guidelines.

Ground yourself to the cabinet grounding stud (refer to Figure 7–1) before servicing the write-back cache module.

7.6.2.3 Removing a Write-Back Cache Module

1. The controller module is seated in front of the write-back cache module. Any time you service a write-back cache, you must shut down controllers based on considerations of configuration, down time, and so on. Refer to Section 7.5.
2. To access the write-back cache module, remove its controller. Refer to Section 7.5.

WARNING

The write-back cache is a high energy module. Do not allow the write-back cache to contact any conductive surface, or injury and/or equipment damage may result.

CAUTION

The write-back cache batteries add weight to the module. Grasp the module firmly by the side where the batteries are seated any time you handle the module.

3. Use a gentle up-and-down rocking motion to loosen the module from the shelf backplane.
4. Slide the write-back cache module out of the shelf, noting which rails it was seated in, and place it on an approved *nonconductive* ESD mat.

7.6.2.4 Upgrading Cache Modules

You can upgrade a cache module by increasing memory and/or converting from read to write-back caching.

Note

Some of the upgrade options involve simply replacing your old cache module with a new one. However, others include installing batteries on an existing module.

Determine your cache module type by entering the CLI> SHOW THIS_CONTROLLER command. The following information appears:

```
CLI> SHOW THIS_CONTROLLER FULL

Controller:
        HSJ40 ZG34901786 Firmware V025-0,❶ Hardware  F01
        Configured for dual-redundancy with ZG31800221
            In dual-redundant configuration
        SCSI address 7
        Time: 31-JUL-1994 16:32:54
Host port:
        Node name: BRIANN, valid CI node 24, 32 max nodes
        System ID 420010180920
        Path A is ON
        Path B is ON
        MSCP allocation class    7
        TMSCP allocation class   7
Cache:
        32 megabyte❷  write cache❸, version 2❹
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Licensing information:
        RAID (Raid5 + Writeback Cache) is ENABLED, license key is VALID
        WBCA (Writeback Cache ONLY) is DISABLED, license key is VALID
        MIRR (Mirror + Writeback Cache) is DISABLED, license key is VALID
Extended information:
        Terminal speed 19200 baud, eight bit, no parity, 1 stop bit
        Operation control: 00000005  Security state code: 15723
```

Note the following information:

❶ Firmware version

❷ cache module size

❸ cache type

❹ cache version number

Note

An HSJ40 controller may have a version 1 or 2 cache module. All HSJ30, HSD30, and HSZ40 models will have version 2 cache modules.

You also must run HS operating firmware Version 1.4 or higher to operate *any* version 2 or higher cache module. (Version 1 cache modules also are compatible with firmware Version 1.4.)

See Table 7–1 to find and order the part number you need for the upgrade.

Table 7–1 Cache Module Upgrade

Current Cache	Desired Cache	Option Required
	HSJ40 Controller †	
16 MB read (Ver. 1)	32 MB read	HSJ40–XE
	16 MB write-back	HSJ40–YA
	32 MB write-back	HSJ40–XE and HSJ40–YC *
32 MB read (Ver. 1)	32 MB write-back	HSJ40–YB
16 MB read (Ver. 2 or greater)	16 MB write-back	HSJ40–YC *
	32 MB write-back	HSJ40–XE and HSJ40–YC *
32 MB read (Ver. 2 or greater)	32 MB write-back	HSJ40–YC *
16 MB write-back (Ver. 2 or greater)	32 MB write-back	HSJ40–XE * (transfer batteries from 16 MB module)
	HSJ30 Controller	
None	16 MB read	HSJ30–XD
	32 MB read	HSJ30–XF
	16 MB write-back	HSJ30–XD and HSJ30–YC *
	32 MB write-back	HSJ30–XF and HSJ30–YC *
16 MB read	16 MB write-back	HSJ30–YC *
	32 MB write-back	HSJ30–XE and HSJ30–YC *
32 MB read	32 MB write-back	HSJ30–YC *
16 MB write-back	32 MB write-back	HSJ30–XE * (transfer batteries from 16 MB module)
	HSD30 Controller	
None	16 MB read	HSD30–XD
	32 MB read	HSD30–XF
	16 MB write-back	HSD30–XD and HSD30–YX *
	32 MB write-back	HSD30–XF and HSD30–YX *
16 MB read	16 MB write-back	HSD30–YX *
	32 MB write-back	HSD30–XE and HSD30–YX *
32 MB read	32 MB write-back	HSD30–YX *
16 MB write-back	32 MB write-back	HSD30–XE * (transfer batteries from 16 MB module)
	HSZ40 Controller (including HSZ40-Bx)	
None	16 MB read	HSZ40–XD
	32 MB read	HSZ40–XF
	16 MB write-back	HSZ40–XD and HSZ40–YX *
	32 MB write-back	HSZ40–XF and HSZ40–YX *
16 MB read	16 MB write-back	HSZ40–YX *
	32 MB write-back	HSZ40–XE and HSZ40–YX *
32 MB read	32 MB write-back	HSZ40–YX *
16 MB write-back	32 MB write-back	HSZ40–XE * (transfer batteries from 16 MB module)

† Firmware Version 1.4 or higher is required for use or upgrade to Version 2 cache module.
* Battery installation required.

Module Return Procedure

If you upgrade from a 16 to 32 MB read cache module, you need to return the 16 MB module to Digital for replacement when you receive the 32 MB upgrade. Follow these steps to return a module:

1. Refer to Section 7.1 for module handling guidelines. Always ground yourself with an ESD strap before handling modules.
2. Reuse the new module's packaging to package the old module (the module you are returning).
3. Apply the ESD label to seal the bag containing the old module.
4. Seal the shipping box with packaging tape and cover all previous shipping information.
5. On the return address label, fill in the DEC number associated with this customer upgrade.
6. Apply the return address label to the shipping box. (If a label is not available, return the module to the following address. Be sure to include the DEC number.)

   Digital Equipment Corporation
   Attention: Returns Sort Center
   Route 127
   Dock Area DOO1
   Contoocook, NH 03229-9210

   DEC# _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

7. Advise the customer that they will be billed for the modules if they are not returned to Digital. Then, make sure the container is sent to the customer's shipping area for pickup.

Upgrade Installation

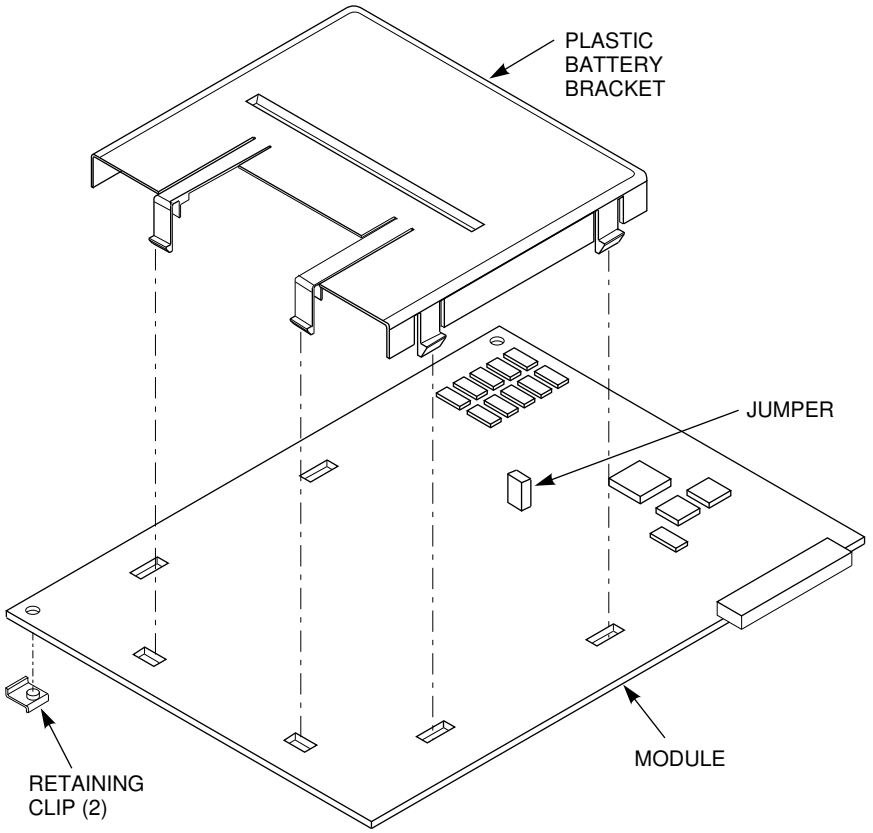
Install the cache module upgrade by following these steps:

1. If necessary, remove the cache module as described in Section 7.6.1.3 or 7.6.2.3.

   If you do not need to install the plastic battery bracket and batteries as part of your upgrade, proceed to step 7.
2. Snap the plastic battery bracket into the slots in the module as shown in Figure 7–8.
3. (HSJ-Series) If you have a newer HSJ-Series controller, the bulkhead will have an identification stamp or label and retaining tabs (see Figure 7–9).

   If you have an earlier controller (without identification or retaining tabs) you must snap the two retaining clips to the outer corners of the module (on the edge furthest from the connector edge). The clips hold the module tightly in its slot and keep the weight of the batteries from dislodging the module. (Be

Figure 7–8 Plastic Battery Bracket Installation



sure to transfer the retaining clips to replacement write-back cache modules, when necessary.)

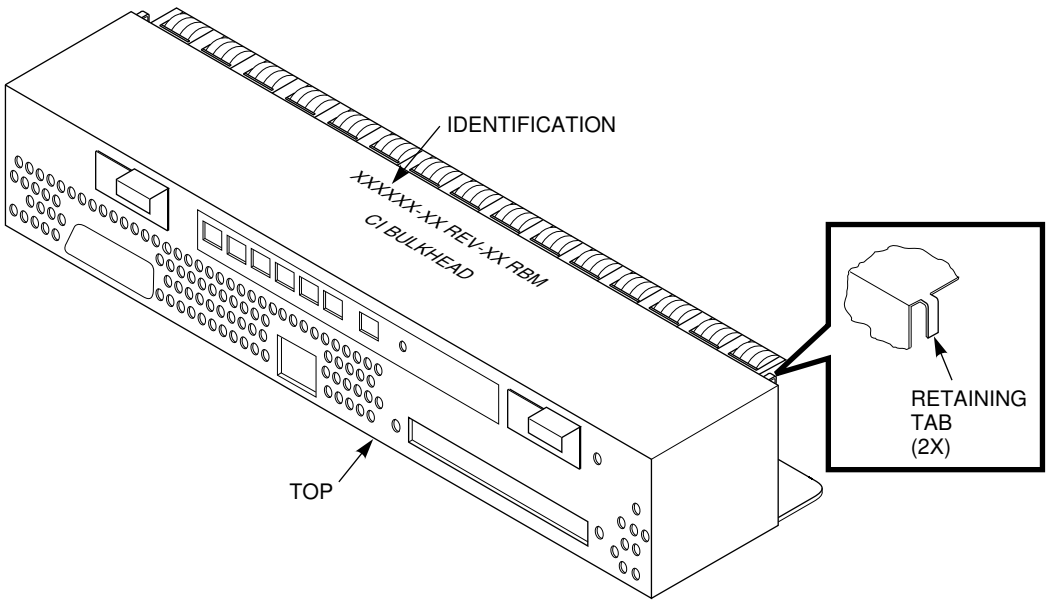
CAUTION

Never install the retaining clips in conjunction with newer HSJ-Series controllers (ones with identification and retaining tabs) or equipment damage will result.

4. Install the two lead acid batteries as described in Section 7.6.2.7.
5. Remove the jumper[4] on the component side of the module (see Figure 7–8).
6. Replace the jumper on its contact pins so that only one pin is covered. With the jumper now ‘‘side-stepped,’’ you will not lose the jumper.

[4] Preconfigured systems with write-back cache modules installed already have the jumper removed at the factory.

Figure 7–9 HSJ-Series Bulkhead



CXO-4358A-MC

Note

If you need to return the module for service, replace the jumper so that it covers both pins. When the jumper covers both pins, it disables the batteries and keeps them from discharging.

7. Insert the upgraded cache module by following the steps in Section 7.6.1.4 or Section 7.6.2.8.

7.6.2.5 Removing the Battery

You will receive a console message when the write-back cache batteries are low (refer to Chapter 5). However, to check the battery status, you may enter the SHOW THIS_CONTROLLER or SHOW OTHER_CONTROLLER command. The battery status will be ''GOOD,'' ''LOW,'' or ''BAD.''

The steps in this section explain how to remove the batteries.

WARNING

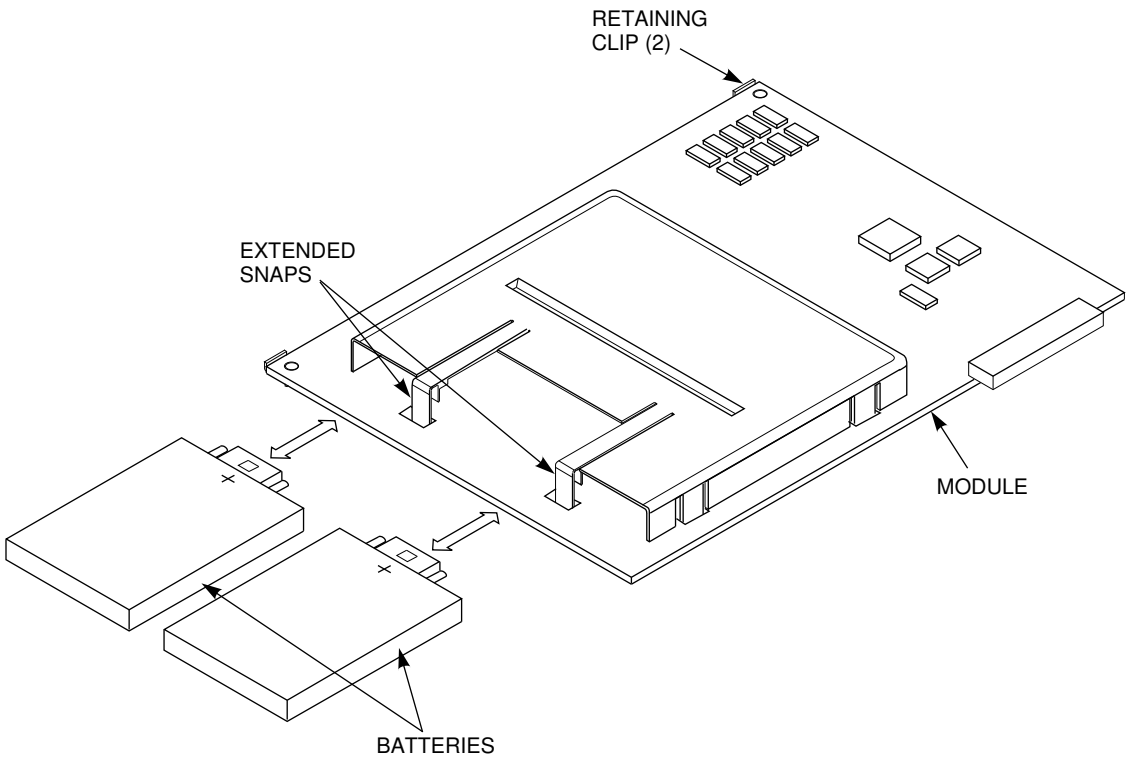
The write-back cache batteries are high energy devices. Do not allow the battery contacts to touch any conductive surface, or injury and/or equipment damage may result.

Note

Although service described in this manual is limited to removing and replacing batteries, it is mandatory that Digital Multivendor Customer Services *never* repair the write-back cache module while the batteries are installed.

1. Locate the two write-back cache batteries seated under the plastic bracket at one end of the module.
2. Disengage and gently lift the extended snaps on the plastic bracket, and pull the batteries straight out of the module (see Figure 7–10). Place the batteries on an approved *nonconductive* ESD mat.

Figure 7–10 Write-Back Cache Batteries



7.6.2.6 Disposing of the Battery

Dispose of batteries that are no longer capable of being recharged. The write-back cache batteries contain lead. Therefore, follow disposal regulations applicable to their composition and marking in accordance with your local recycling laws.

Consult your service policies regarding hazardous materials handling for details. Do not simply discard spent batteries in the trash unless permitted by local regulations.

7.6.2.7 Replacing/Installing the Battery

WARNING

The write-back cache batteries are high energy devices. Do not allow the battery contacts to touch any conductive surface, or injury and/or equipment damage may result.

Note

Although service described in this manual is limited to removing and replacing batteries, it is mandatory that Digital Multivendor Customer Services *never* repair the write-back cache module while the batteries are installed.

1. Disengage and gently lift the extended snaps on the plastic bracket and slide the batteries, positive (+) side up, straight into the module (refer to Figure 7–10).
2. If you received a new battery cover with your replacement batteries, remove the old cover by pressing in the four snaps (two on each side) and lifting if off the cache module.
3. Install the new battery cover in place of the old one.
4. Press the new batteries firmly into the module so they are seated and the extended snaps close easily around the batteries.

   If you accidentally install a battery upside down, you will not be able to firmly seat the battery or close the retaining clip.

7.6.2.8 Replacing/Installing the Module

1. The controller module is seated in front of the write-back cache module. Any time you service a write-back cache, you must shut down the controller. Refer to Section 7.5.
2. To replace the write-back cache module, its controller module must already be removed.

WARNING

The write-back cache is a high energy module. Do not allow the write-back cache to contact any conductive surface, or injury and/or equipment damage may result.

CAUTION

The write-back cache batteries add weight to the module. Grasp the module firmly by the side where the batteries are seated any time you handle the module.

3. Slide the write-back cache module into the shelf using its slot's leftmost rails as guides (refer to Figure 7–7). Be careful not to let the module contact any adjacent modules.
4. 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. Replace the controller module by referencing Section 7.5.

7.7 Program Card

Whenever you remove a failed controller module (refer to Section 7.5), you remove the PCMCIA program card. However, there are times when you need to remove *only* the program card, such as when you install updated firmware.

Note

When you update firmware, you must remove *both* program cards from a dual-redundant configuration. Furthermore, the two cards in a dual-redundant configuration *must* contain the same version of firmware.

Use the procedures in this section when you are removing and replacing *only* the program card.

7.7.1 Tools Required

You need a 5/32-inch Allen wrench to open the doors on an SW800-Series cabinet.

7.7.2 Precautions

Follow these guidelines when handling the program card.

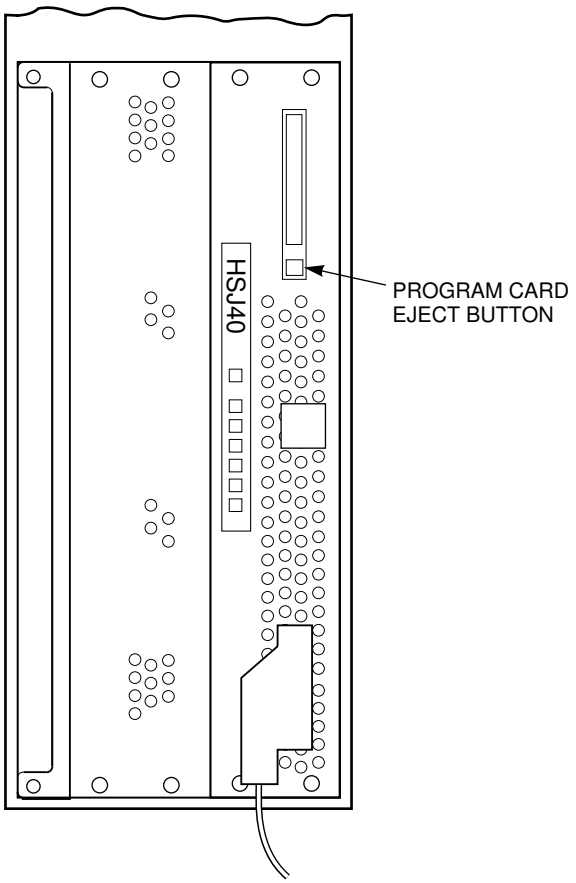
CAUTION

Damage to the program card and firmware may result if you do not follow the guidelines.

- Cover the program card with the ESD shield whenever the card is installed in the controller.
- Obtain and wear an ESD wrist strap on your wrist. Make sure the strap fits snugly.

  Plug the ESD strap into the grounding stud (see Figure 7–1) on the cabinet before removing, inserting, or handling the program card.
- Keep the program card in its original carrying case when not in use.
- Do not twist or bend the program card.
- Do not touch the program card contacts.
- Keep the program card out of direct sunlight.
- Do not immerse the program card in water or chemicals.
- Always push the program card eject button, shown in Figure 7–11, to remove the program card; do not pull on the program card.

Figure 7–11 Program Card Eject Button



7.7.3 Removing the Program Card

Use the following procedure to remove the program card:

1. Unlock and open the cabinet doors.
2. Examine the green OCP reset (//) LED on the controller. The LED should be flashing.

   If a green LED is lit continuously, its controller has failed. To service the controller, refer to Section 7.5.

   Note

   You do not need to record configuration information; the configuration information is not lost when removing a program card.

3. Connect a maintenance terminal to the controller you are removing the program card from, and shut down the controller by typing

   ```
   CLI>SHUTDOWN THIS_CONTROLLER
   ```

   The green LED should light continuously when shutdown completes.

4. Unsnap and remove the program card ESD shield (refer to Figure 7–2).
5. Remove the program card by pushing the eject button (refer to Figure 7–3) next to the card.
6. Pull the program card out.
7. If you are updating firmware, follow the instructions included with your new firmware for used card return or disposal.

7.7.4 Replacing/Installing the Program Card

Use the following procedure to replace the program card:

Note

If you are updating firmware, install your new program card by following the instructions included with the card.

Otherwise, you may use the following guidelines to replace the program card.

1. **Nonredundant configuration:**

   Press and hold the controller green OCP reset (//) button. Then insert the program card. The program card eject button will extend when the card is fully inserted.

   Dual-redundant configuration:

   Press and hold *both* green reset buttons at the same time, *even if you are replacing only one of the cards*. Then insert the program card. The program card eject button will extend when the card is fully inserted.

2. Release the reset button to initialize the controller.

   If the controller initializes correctly, the green reset LED will begin to flash at 1 Hz. If an error occurs during initialization, the OCP will display a code. If necessary, refer to Chapter 5 to analyze any codes.

3. Snap the ESD shield into place over the program card.
4. If you want, you may disconnect the maintenance terminal. The terminal is not required for normal controller operation.
5. Close and lock the cabinet doors.

7.8 External CI Cables (HSJ-Series)

Use the procedures in this section when you are removing and replacing external CI cables.

7.8.1 Tools Required

You need a 5/32-inch Allen wrench to unlock an SW800-Series cabinet.

7.8.2 Precautions

CAUTION

If the internal computer interconnect (**CI**) cable connectors become grounded, damage to the equipment can result.

Never leave external CI cables, terminated or not, attached at the star coupler and disconnected at the internal CI cable connector. This minimizes adverse effects on the **cluster** and prevents a short circuit between the two ground references.

Always terminate the connections of the star coupler when removing external CI cables.

When handling or moving the internal CI cables, it is very important that the connectors do not become grounded. *No metal* may contact the metal connectors on these cables other than an external CI host cable connector.

7.8.3 Removing the Cable

Use the following procedure to remove external CI cables:

1. The CI interface includes two connections (paths A and B). You should determine what paths are suspect before proceeding. Refer to Chapter 5 for troubleshooting guidelines.

   Note

   When only one external CI cable requires replacement, you only need to halt activity and disconnect cables for the (one) suspect path.

2. For the suspect paths, enter one or both of the following commands to halt activity on the suspect host paths:

   ```
   CLI> SET THIS_CONTROLLER NOPATH_A
   CLI> SET THIS_CONTROLLER NOPATH_B
   ```

   CAUTION

   Always disconnect the external CI cable from the star coupler *first*, then disconnect it from the internal CI cable *second*.

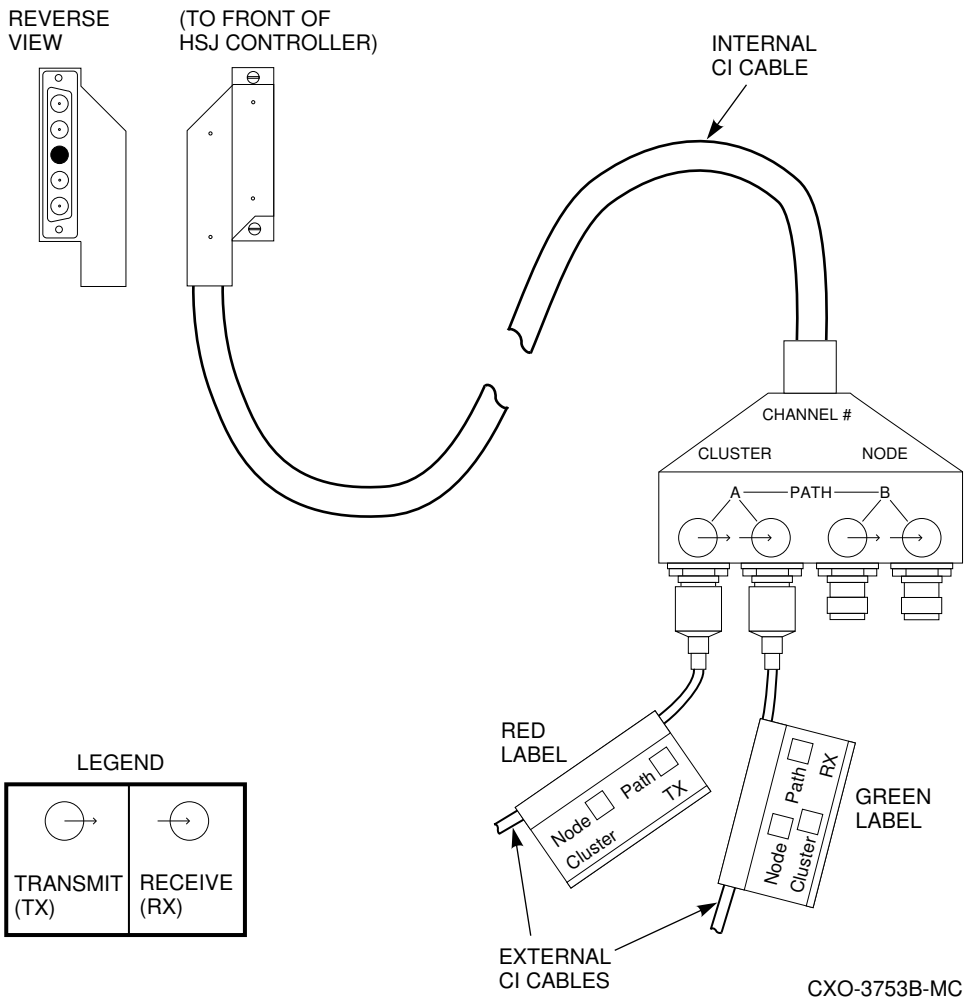
   Never leave unterminated paths on the star coupler. *Never* leave cables, terminated or not, attached at the star coupler and disconnected at the internal CI cable connector. This minimizes adverse effects on the cluster and prevents a short circuit between the two ground references.

3. Disconnect the external CI cable connectors from the star coupler *one at a time, in the following order* (see Figure 7–12):

   TXA
   RXA
   TXB
   RXB

4. Attach terminators to the open star coupler connectors.
5. If necessary to access the internal/external CI cable connector, unlock and open the cabinet.
6. Disconnect the external CI cables from the internal CI cable.
7. Remove the cable.

Figure 7–12 External and Internal CI Cables (HSJ-Series)



7.8.4 Replacing/Installing the Cable

Use the following procedure to replace the external CI cables:

CAUTION

Always connect the external CI cable to the internal CI cable *first*, then connect it to the star coupler *second*.

Never leave unterminated paths on the star coupler. *Never* leave cables, terminated or not, attached at the star coupler and disconnected at the internal CI cable connector. This minimizes adverse effects on the cluster and prevents a short circuit between the two ground references.

1. Connect the external CI cables to the internal CI cable.
2. Close and lock the cabinet doors.
3. Remove any terminators from the star coupler connections.
4. Connect the external CI cable connectors to the star coupler *one at a time, in the following order* (refer to Figure 7–12):

   RXB
   TXB
   RXA
   TXA

5. For the replaced paths, enter the following commands to resume activity on the replaced host paths:

```
CLI> SET THIS_CONTROLLER PATH_A
CLI> SET THIS_CONTROLLER PATH_B
```

7.9 Internal CI Cables (HSJ-Series)

Servicing internal CI cables causes down time for the affected controller because both host paths (A and B) must be disabled for the duration of the procedure. Use the procedures in this section when you are removing and replacing internal CI cables.

7.9.1 Tools Required

You need the following tools to remove or replace internal CI cables:

- 5/32-inch Allen wrench (to unlock an SW800-Series cabinet)
- Tie wrap cutters
- Flat-head screwdriver

7.9.2 Precautions

CAUTION

If the internal computer interconnect (**CI**) cable connectors become grounded, damage to the equipment can result.

Never leave external CI cables, terminated or not, attached at the star coupler and disconnected at the internal CI cable connector. This minimizes adverse effects on the **cluster** and prevents a short circuit between the two ground references.

Always terminate the connections of the star coupler when removing external CI cables.

When handling or moving the internal CI cables, it is very important that the connectors do not become grounded. *No metal* may contact the metal connectors on these cables other than an external CI host cable connector.

7.9.3 Removing the Cable

Use the following procedure to remove internal CI cables:

1. You should determine that paths are, in fact, suspect before proceeding. Refer to Chapter 5 for troubleshooting guidelines.
2. Enter the following commands to halt activity on *both* host paths:

```
CLI> SET THIS_CONTROLLER NOPATH_A
CLI> SET THIS_CONTROLLER NOPATH_B
```

CAUTION

Always disconnect the external CI cable from the star coupler *first*, then disconnect it from the internal CI cable *second*.

Never leave unterminated paths on the star coupler. *Never* leave cables, terminated or not, attached at the star coupler and disconnected at the internal CI cable connector. This minimizes adverse effects on the cluster and prevents a short circuit between the two ground references.

3. Disconnect the external CI cable connectors from the star coupler *one at a time, in the following order* (refer to Figure 7–12):

   TXA
   RXA
   TXB
   RXB

4. Attach terminators to the open star coupler connectors.
5. Unlock and open the cabinet doors.
6. Disconnect the external CI cables from the internal CI cable.
7. Loosen the captive screws on the internal CI cable where it attaches to the front of the controller using a flat-head screwdriver, and disconnect the internal CI cable from the controller.
8. Remove the internal CI cable from the cabinet, cutting tie wraps as necessary.

7.9.4 Replacing/Installing the Cable

Use the following procedure to replace internal CI cables:

1. Position and route the internal CI cable within the cabinet.
2. Connect the internal CI cable to the front of the controller, and tighten the captive screws on the internal CI cable where it attaches to the controller using a flat-head screwdriver.

CAUTION

Always connect the external CI cable to the internal CI cable *first*, then connect it to the star coupler *second*.

Never leave unterminated paths on the star coupler. *Never* leave cables, terminated or not, attached at the star coupler and disconnected at the internal CI cable connector. This minimizes adverse effects on the cluster and prevents a short circuit between the two ground references.

3. Connect the external CI cables to the internal CI cable.
4. Remove any terminators from the star coupler connections.
5. Connect the external CI cable connectors to the star coupler *one at a time, in the following order* (refer to Figure 7–12):

   RXB
   TXB
   RXA
   TXA

6. Install any tie wraps as necessary to hold the internal CI cable in place.
7. Close and lock the cabinet doors.
8. Enter the following commands to resume activity on the host paths:

```
CLI> SET THIS_CONTROLLER PATH_A
CLI> SET THIS_CONTROLLER PATH_B
```

7.10 DSSI Host Cables (HSD-Series)

Servicing DSSI host cables causes subsystem down time because the host path is disconnected from at least one controller for the duration of the procedure. Use the instructions in this section when you are removing and replacing DSSI host cables.

CAUTION

If you must restore power to the DSSI host buses before you have replaced a cable, be sure to terminate the cable end to maintain bus integrity.

7.10.1 Tools Required

You need the following tools to remove or replace DSSI host cables:

- 5/32-inch Allen wrench (to unlock an SW800-Series cabinet)
- Tie wrap cutters
- Flat-head screwdriver

7.10.2 Precautions

You must turn off all power to HSD-Series controllers and all other devices, including host CPUs, on a Digital Storage System Interconnect (**DSSI**) bus before replacing a DSSI cable.

7.10.3 Removing the Cable

Use the following procedure to remove DSSI host cables:

1. Enter the following command to halt activity on the host path:

   ```
   CLI> SET THIS_CONTROLLER NOPATH
   ```

2. Disconnect power from all members on the DSSI bus, including the HSD-Series controller and host.
3. Disconnect the DSSI host cable from the host or other device (the device at the other end of the cable from the controller).
4. Unlock and open the cabinet.
5. Loosen the captive screws on the DSSI host cable where it attaches to the trilink connector, and disconnect the cable.
6. Remove the DSSI host cable from the cabinet, cutting tie wraps as necessary.
7. (Optional) Loosen captive screws and remove the terminator or secondary DSSI host cable attached to the trilink connector.
8. (Optional) Loosen captive screws and remove the trilink connector from the front of the controller if you have not already done so.

7.10.4 Replacing/Installing the Cable

Use the following procedure to replace DSSI host cables:

1. Position and route the DSSI host cable within the cabinet.
2. Connect the DSSI host cable to the trilink connector, and tighten the captive screws on the DSSI host cable connector.
3. (Optional) Connect and tighten captive screws for the terminator or secondary DSSI host cable (at the open connection of the trilink connector).
4. Install any tie wraps as necessary to hold the DSSI host cable in place.
5. Close and lock the cabinet doors.
6. Connect the other end of the cable to the appropriate device on the bus.
7. Reapply power to the controller and devices on the DSSI bus.
8. Enter the following command to resume activity on the host path:

```
CLI> SET THIS_CONTROLLER PATH
```

7.11 SCSI Host Cables (HSZ-Series)

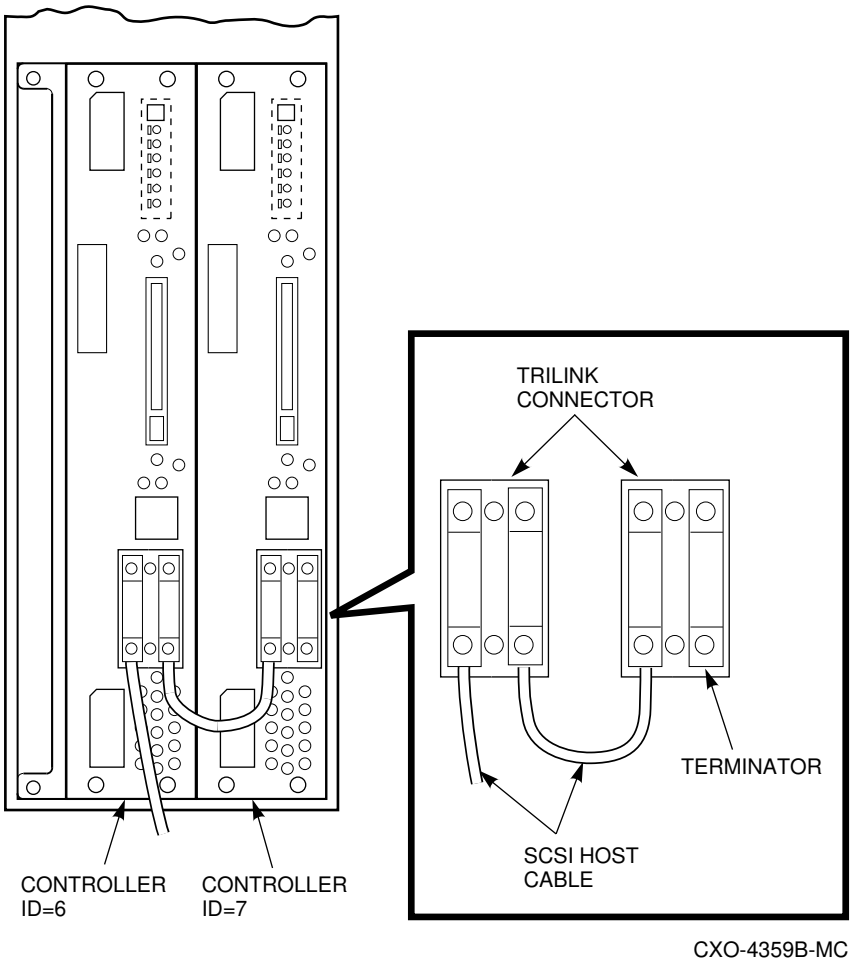
Servicing SCSI host cables (see Figure 7–13) may cause subsystem down time because the host path will be disconnected from at least one controller for the duration of the procedure. (If you have a dual-redundant configuration, you should consider shutting down one controller and using the surviving controller to service devices while you replace the cable to its companion.) Use the procedures in this section when you are removing and replacing SCSI host cables.

CAUTION

Never leave active SCSI host buses unterminated during service. How you service your cables, and what devices you may leave running, terminated, and so on, will depend on your configuration.

(Optional) The trilink connector may be considered part of the SCSI host cable during service.

Figure 7–13 SCSI Host Cables



7.11.1 Tools Required

You need the following tools to remove or replace SCSI host cables:

- 5/32-inch Allen wrench (to unlock an SW800-Series cabinet)
- Tie wrap cutters
- Flat-head screwdriver

7.11.2 Precautions

Always terminate open active SCSI connections to the host CPU when SCSI cables are removed.

7.11.3 Removing the Cable

Use the following procedure to remove SCSI host cables:

1. Disconnect the SCSI host cable from the host or other device (the device at the other end of the cable from the controller).
2. Unlock and open the cabinet.
3. Loosen the captive screws on the SCSI host cable where it attaches to the trilink connector on the front of the controller, and disconnect the cable.
4. Remove the SCSI host cable from the cabinet, cutting tie wraps as necessary.
5. (Optional) Loosen captive screws and remove the terminator or secondary SCSI host cable attached to the trilink connector.
6. (Optional) Loosen captive screws and remove the trilink connector from the front of the controller.

7.11.4 Replacing/Installing the Cable

Use the following procedure to replace or install SCSI host cables:

1. (Optional) Attach the trilink connector to the front of the controller and tighten its captive screws.
2. Position and route the SCSI host cable within the cabinet.
3. Connect the SCSI host cable to the trilink connector on the front of the controller, and tighten the captive screws on the SCSI host cable connector.
4. (Optional) Connect and tighten captive screws for the terminator or secondary SCSI host cable (at the open connection of the trilink connector).
5. Install any tie wraps as necessary to hold the SCSI host cable in place.
6. Close and lock the cabinet doors.
7. Connect the other end of the cable to the appropriate device on the bus, removing terminators as necessary.

7.12 SCSI Device Port Cables

Servicing SCSI device port cables causes subsystem down time because you must remove devices to access SCSI connectors on the BA350–MA (controller) and BA350–SB (device) shelf backplanes.

Note

If the desired cable connects to a device shelf in the lower part of a cabinet, it may be easier to remove the device shelf rather than attempt this procedure with the shelf installed. Refer to the *StorageWorks Solutions Shelf and SBB User's Guide* for procedures to remove a device shelf and for correct SCSI cable lengths.

7.12.1 Tools Required

You need the following tools to remove or replace device port cables:

- ESD strap
- 3/32-inch Allen wrench
- 5/32-inch Allen wrench (to unlock an SW800-Series cabinet)
- Flat-head screwdriver

7.12.2 Precautions

Refer to Section 7.1 for ESD, grounding, and module handling guidelines.

7.12.3 Removing the Cable

Use the following procedure to remove device port cables:

1. Unlock and open the cabinet.
2. Remove each controller and cache module by referencing the procedures described in Section 7.5 and Section 7.6.
3. Using a flat-head screwdriver, loosen the two captive screws on each side of the volume shield, and remove the shield (see Figure 7–14).
4. Remove the cable from the BA350–MA (controller) shelf backplane by pinching the cable connector side clips and disconnecting the cable.

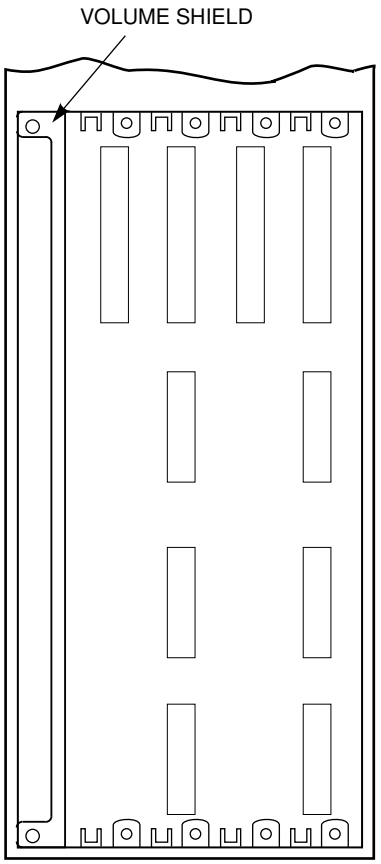
CAUTION

Digital recommends labeling devices to indicate what slot they were removed from. If SBBs are removed and then returned to a different slot, *customer data may be destroyed*.

Let disk drives spin down for at least 30 seconds prior to removing them from the device shelf. Gyroscopic motion from a spinning disk may cause you to drop and damage the SBB.

5. Remove any SBBs necessary to access the SCSI cable, as shown in Figure 7–15. (Press down on the two SBB mounting tabs to release it from the shelf, and pull the device straight out.)

Figure 7–14 Volume Shield



6. Remove the cable from the BA350–SB (device) shelf backplane by pinching the cable connector side clips and disconnecting the cable.

7.12.4 Replacing/Installing the Cable

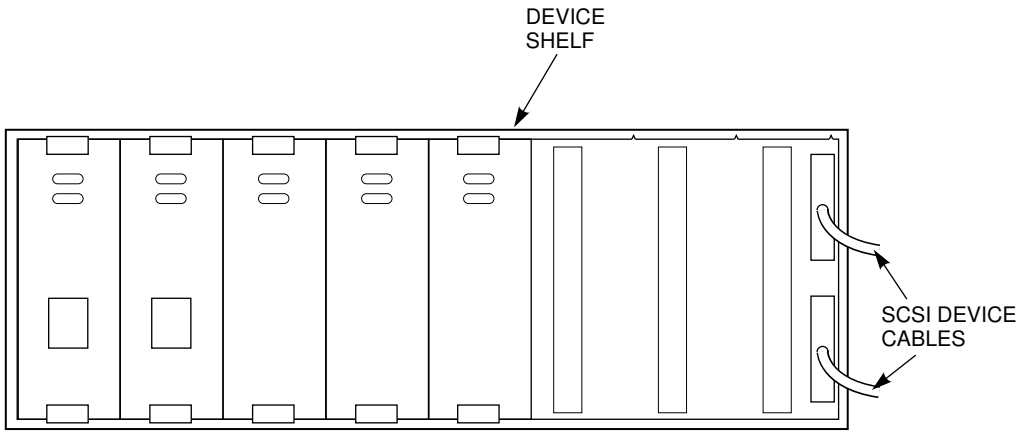
Use the following procedure to replace device port cables:

CAUTION

Be very careful when inserting cable connectors into the BA350–MA and BA350–SB shelves. Inserting a poorly aligned cable connector can damage the shelf connector. You must replace the entire shelf if its connectors are damaged.

1. For the device shelf connector, *gently* slide the cable connector in from one side to the other, and rock the connector from top to bottom to seat it. Listen for the connector to snap into place.

Figure 7–15 SCSI Device Cables



2. For the controller shelf connector, *gently* slide the cable connector in from one side to the other, and rock the connector from top to bottom to seat it. Listen for the connector to snap into place.

CAUTION

Return a device to the slot from which it was removed. If SBBs are removed and then returned to a different slot, *customer data may be destroyed*.

3. Insert the SBBs into the device shelf *making sure that all SBBs are returned to their original slots*.

   The SBB mounting tabs will snap into place as the SBBs are locked into the shelf.

4. Replace the volume shield in the controller shelf and lightly tighten the captive screws using a flat-head screwdriver (refer to Figure 7–14).
5. Replace the cache modules and controllers by referencing the procedures described in Section 7.5 and Section 7.6.
6. Close and lock the cabinet doors.

7.13 Blowers

WARNING

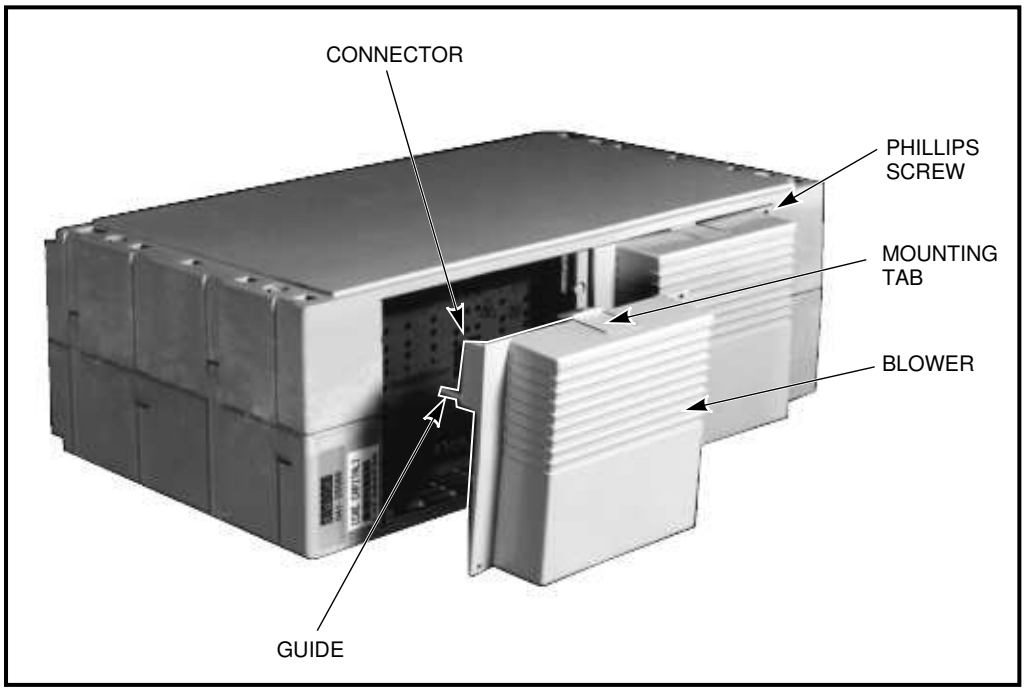
Service procedures that involve blower removal or access to the rear of the shelf must be performed only by qualified service personnel.

StorageWorks shelves have rear-mounted blowers that cool the controllers and storage devices (see Figure 7–16). Connectors on the shelf backplane provide +12 Vdc power to operate them.

When a blower in a BA350 series shelf fails, the shelf status (upper) LED on the power SBB turns off, and an error message is passed to the controller or host.

When a blower in a SW300 cabinet shelf fails, the condition is detected by the EMU and displayed on the EMU control panel.

Figure 7–16 Replacing a Blower



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As long as one blower in a BA350 series shelf is operating, there is sufficient air flow to prevent an overtemperature condition. If both blowers fail, the shelf can overheat in as little as 60 seconds.

7.13.1 Tools Required

You need the following tools to remove or replace the blower:

- 5/32-inch Allen wrench (to unlock an SW800-Series cabinet)
- Phillips screwdriver (#2)

7.13.2 Removing the Blower

WARNING

To reduce the risk of electrical energy hazard, disconnect the power cables from the shelf power supplies before removing shelf blower assemblies or performing service in the backplane area.

Use the following procedure to remove a blower:

1. Unlock and open the cabinet doors.
2. Disconnect the power cables from the shelf power SBBs. The primary power supply cord is black. The secondary power supply cord is gray.
3. If you cannot access the rear of the shelf, remove the shelf SCSI device cables as described in Section 7.12. Then remove the shelf as described in the *StorageWorks Solutions Shelf and SBB User's Guide*.
4. Use a Phillips screwdriver to remove the safety screw in the upper right corner or lower left corner of the blower.
5. Press the upper and lower blower mounting tabs together to release the blower.
6. Pull the blower straight out to disconnect it from the shelf power connector.

7.13.3 Replacing/Installing the Blower

WARNING

To reduce the risk of electrical energy hazard, disconnect the power cables from the shelf power supplies before replacing shelf blower assemblies or performing service in the backplane area.

Use the following procedure to replace a blower:

1. Align the replacement blower connector and push the blower straight in, making sure it is fully seated and that both mounting tabs lock in place.
2. Replace the safety screw in the corner of the blower using a Phillips screwdriver.
3. If you had to remove the shelf to access the blowers, replace the shelf as described in the *StorageWorks Solutions Shelf and SBB User's Guide*. Then replace its SCSI device cables as described in Section 7.12.
4. Connect the shelf power cables and verify that the shelf and all SBBs are operating properly.

Note

If the upper power supply LED (shelf status) does not come on and all the shelf power supplies are operating, the second blower may have failed or the wrong blower may have been replaced.

5. Close and lock the cabinet doors.

7.14 Power Supplies

There are two methods for replacing power supply SBBs: **hot swap** and **cold swap**.

- Hot swap allows you to remove defective power supplies while the other supplies furnish power. Hot swap does not disable the shelf or its contents. Use hot swap to replace a power supply *only* when there are redundant power supplies in a shelf.
- Cold swap means that you must remove power from the shelf and its contents to replace the power supply. Use cold swap when there are no redundant power supplies. In an SW300 cabinet shelf or BA350–MA controller shelf, the controller, cache module, and all associated SCSI buses are disabled during cold swap. On a BA350–SB device shelf, those devices on affected shelves are disabled, though their controller will still service devices on other shelves.

7.14.1 Tools Required

You need a 5/32-inch Allen wrench (to unlock an SW800-Series cabinet).

7.14.2 Removing the Power Supply

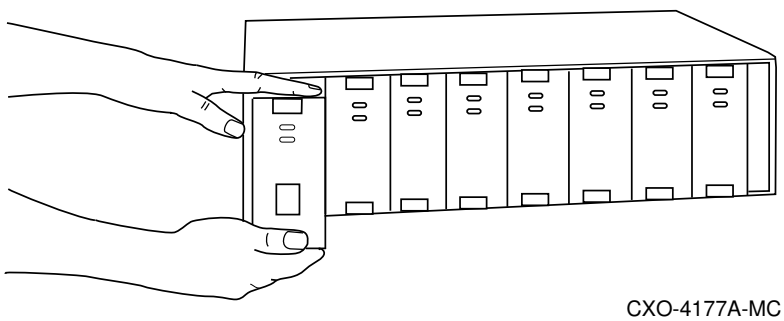
Use the following procedure to remove a power supply:

1. Unlock and open the cabinet doors.
2. If you are performing a cold swap and the controller and devices are still operating, connect a maintenance terminal to one of the controllers to perform a shutdown.
3. Type the following commands to shutdown the controllers

   ```
   CLI>SHUTDOWN OTHER_CONTROLLER
   CLI>SHUTDOWN THIS_CONTROLLER
   ```

4. Unplug the cord from the power supply.
5. Press the two mounting tabs together to release the power supply from the shelf.
6. Use both hands to pull the power supply out of the shelf (see Figure 7–17).

Figure 7–17 Power Supply Removal



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7.14.3 Replacing/Installing the Power Supply

Use the following procedure to replace a power supply (refer to Figure 7–17):

1. Hold the power supply in both hands and firmly push it into the shelf until you hear the mounting tabs snap into place.
2. Plug the power cord into the power supply.
3. Observe the power and shelf status LEDs to make sure both turn on. If both LEDs do not turn on, refer to Chapter 5 for troubleshooting basics.
4. Close and lock the cabinet doors.
5. If you performed a cold swap, verify that the controller comes up with the correct parameters and begins normal operation.

7.15 Warm Swap

Industry definitions of hot, warm, and cold swap may vary considerably. For purposes of this family of products, these terms are defined as follows:

- **Hot swap**—A replacement method in which the component is removed and replaced with no preparatory actions taken, and where the system remains powered on and fully active during product service. The component being removed or installed is the only item that cannot perform operations during this process.

  Only redundant power supply SBBs can be replace using the hot swap method, and only one at a time.

- **Warm swap**—a replacement method where a product can be added, removed, or replaced while system power is on, but while some system activity is *momentarily* suspended during the procedure. Some preparation may be necessary before the warm swap procedure, such as shutting down a controller or dismounting a unit.

  You can use the warm swap method to replace StorageWorks controllers and cache modules in a dual-redundant configuration, but only one at a time. You can also warm swap controller program cards and most storage SBBs. See your Release Notes for a list of those devices that you cannot replace using the warm swap method.

- **Cold swap**—a product replacement method where all system power and activity is totally removed for the duration of service. This method is used when conditions preclude the use of the warm swap or hot swap methods.

  All StorageWorks components can be replaced using the cold swap method. You *must* use the cold swap method to replace nonredundant controllers, power supply SBBs, and some storage devices.

When you warm swap a storage SBB or a controller, you quickly and safely remove the hardware and install a replacement. Warm swap is possible *without* taking your controllers out of service or adversely affecting activity on the rest of the subsystem. Using warm swap also preserves data integrity.

7.15.1 Device SBB Warm Swap

Device warm swap involves quickly removing and replacing a disk drive, tape drive, or other storage SBB. You can safely remove SBBs without taking your system or controller offline. [5]

CAUTION

Hot swapping devices (also called asynchronous removal) may create noise on the device bus from which the controller cannot recover. Always use warm swap to replace devices in your subsystem by following the instructions in this section.

Most devices can be warm swapped; however, you should see your firmware release notes for restrictions.

[5] You also may use the SBB warm swap procedure to add a device to an empty shelf slot.

Note

Warm swap allows you to remove and replace hardware; it does not change the device configuration. After warm swapping a device, you *must* update the configuration to bring the new device into service.

For example, if a controller detects a bad device in a RAIDset, it automatically removes that device from the RAIDset and adds it to the failedset. When you use warm swap to replace the bad device with a good one, the controller still considers the replacement device to be part of the failedset. You must delete it from the failedset and then add it to the RAIDset or to a spareset.

7.15.1.1 Tools Required

You need a 5/32-inch Allen wrench (to unlock an SW800-Series cabinet).

7.15.1.2 Removing the Device

CAUTION

You can only warm swap *one* SBB at a time. If you need to swap additional SBBs, you must repeat the entire warm swap procedure.

You must follow the steps in this section in their exact order to ensure the following:

- Preserve data integrity (especially for devices with older SCSI interface designs).
- Reduce chances of making a port unusable for a long period, which can render several devices inaccessible.
- Prevent the controller from performing unpredictably.

Use the following procedure to remove a device:

CAUTION

For all units except those using mirrorsets or RAIDsets and mirrorsets, you must dismount the units from the host *before* beginning this procedure. (For example, in VMS you use the DISMOUNT command.)

Refer to your operating system documentation for procedures to dismount a device.

RAIDsets adjust automatically to the removal of *one* device (the RAIDset goes reduced). If the RAIDset is not already running reduced, or if it is running reduced because of the bad device that you are replacing, there is no need to dismount the RAIDset.

Mirrorsets that have at least one NORMAL or NORMALIZING member other than the one being removed automatically adjust to removal of a device. In this case, there is no need to dismount the affected unit.

1. Unlock and open the cabinet doors.
2. Identify the device bus of the SBB that you are going to warm swap.

3. Quiesce the appropriate device bus by pressing and holding the controller port button for that bus. Continue holding the button until all amber OCP LEDs light.

Note

You can only quiesce one port (device bus) at any time.

If you do not hold the button long enough, or if you push several buttons in quick succession, the controller ignores *all* buttons and does not quiesce any ports. You must press and hold the button again to quiesce the port.

4. The selected port LED flashes for 10 seconds and all other port LEDs turn off. Wait until the chosen port LED flashes alternately with the other port LEDs (this indicates I/O has stopped). The alternating pattern flashes for approximately 30 seconds, during which you may remove the SBB.

   While the OCP LEDs are flashing, the status LEDs of any SBBs on the quiesced device bus will also flash.

Note

The length of time required for I/O to stop can vary from zero seconds to several minutes, depending on load, device type, and cache status.

If all of the amber LEDs do not light after a minute or two, another shelf is asserting a fault signal that prevents any quiesce function on this controller. To correct the problem, you must locate the suspect shelf and do one of three things:

- Remove all devices from the shelf.
- Disconnect the shelf's SCSI device cables (refer to Section 7.12).
- Repair/replace the shelf's power supply (refer to Section 7.14).

5. Remove the SBB from the shelf by pressing its two mounting tabs together and pulling it out using both hands (see Figure 7–18).

   After you remove the SBB, the flashing pattern on the OCP will stop and normal operation on the ports will resume. The port LED for the affected shelf will turn on to indicate that a configured device is missing. The LED will stay on until the SBB is replaced, or until the device is deleted from the configuration. The remaining port LEDs will turn off.

7.15.1.3 Replacing the Device

Use a replacement device of the same type as the removed device. Otherwise, subsystem activities, such as the establishment of storagesets, may fail. Use the following procedure to replace a device:

1. Quiesce the appropriate controller port by pressing and holding the port button. Continue holding the button until all amber OCP LEDs light.

Note

You can only quiesce one port at any time.

Figure 7–18 SBB Warm Swap

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If you do not hold the button long enough, or if you push several buttons in quick succession, the controller ignores *all* buttons and does not quiesce any ports. You must press and hold the button again to quiesce the port.

---

2. Wait until the chosen port LED flashes alternately with the other port LEDs (this indicates I/O has stopped). The alternating pattern flashes for approximately 30 seconds, during which time you may insert the SBB.

   While the OCP LEDs are flashing, the status LEDs of any SBBs on the quiesced device bus also will flash.

   Note

   The length of time required for I/O to stop can vary from zero seconds to several minutes, depending on load, device type, and cache status.

   If the pattern does not appear after a minute or two, another shelf is asserting a fault signal that prevents any quiesce function on this controller. To correct the problem, you must locate the suspect shelf and do one of three things:

   - Remove all devices from the shelf.
   - Disconnect the shelf's SCSI device cables (refer to Section 7.12).
   - Repair/replace the shelf's power supply (refer to Section 7.14).

3. Hold the SBB in both hands, and firmly push it into the shelf until you hear the mounting tabs snap into place.

7.15.1.4 Restoring the Device to the Configuration

After you insert the SBB, the flashing pattern on the OCP will stop, normal operation on the ports will resume, and the port LEDs will turn off.

- If you replaced a device that had gone bad and was therefore a member of the failedset, you must delete it from the failedset.

  ```
  CLI> DELETE device-name
  ```

- If the new disk is to be part of a storageset or spareset, you must add it to that set. The controller automatically initializes the device when you add it.
  - To add a device to a RAIDset, enter the following command:

    ```
    CLI> SET RAIDset-name REPLACE=disk-name
    ```

    Note that the RAIDset must already be running reduced.
  - To add a device to a mirrorset, enter the following command:

    ```
    CLI> SET mirrorset-name REPLACE=disk-name
    ```

    Note that the mirrorset must already be missing a member, and the auto-sparing policy must be NOPOLICY.
  - To add a device to a spareset, enter the following command:

    ```
    CLI> ADD SPARESET disk-name
    ```

- If you inserted a new device in a previously unused slot, the controller's port LED for that bus remains lit until you add the device by entering the following command (see Appendix B):

  ```
  CLI> ADD device
  ```

- If you inserted a tape SBB in a slot where a disk SBB was previously installed, the port LED remains lit until you add the device using the ADD command, *and* delete the previously installed disk device from the list of known devices, as follows:

  ```
  CLI> DELETE device-name
  ```

CAUTION

If you think you have failed to perform warm swap exactly as stated here, you must reinitialize the controller. Otherwise, the controller may perform unpredictably.

Remember to close and lock the cabinet doors after finishing the device warm swap procedure.

7.15.2 Controller Warm Swap

Use the warm swap procedure to safely remove and replace one controller in a dual-redundant configuration. When you warm swap a controller, you are replacing a controller in the most transparent method available to the HS controller subsystem.

Performing warm swap involves removing one controller, which forces the other controller into failover. The remaining controller assumes control of the absent controller's devices. This minimizes impact to system performance and down time.

Note

You can only warm swap one controller at a time. Never attempt to remove both controllers in your dual-redundant configuration using warm swap.

You must have a replacement controller available prior to starting warm swap. Otherwise, you must terminate the warm swap program and restart it later when you have a replacement.

HSD- and HSZ-Series: You cannot effectively warm swap some earlier controllers because interference from the companion controller's trilink connector prevents removal and replacement. Later controller models have a notched bulkhead to allow for controller warm swap.

7.15.2.1 Tools Required

You need the following tools to warm swap a controller:

- ESD strap
- 3/32-inch Allen wrench
- 5/32-inch Allen wrench (to open an SW800-Series cabinet)
- Flat-head screwdriver
- Small flat-head screwdriver

7.15.2.2 Precautions

CAUTION

HSD-Series: You must not warm swap HSD-Series controllers unless you have mating guides (refer to Section 7.10) installed on the controller host connectors. Without a mating guide, if you accidentally short DSSI connector pins during aligning and inserting/removing the trilink, you risk blowing the fuses of *all* members on the DSSI bus.

Furthermore, you must not warm swap HSD-Series controllers unless your DSSI cable and terminator connectors allow for trilink removal without first removing the other connectors (refer to Section 7.10).

Refer to Section 7.5 for ESD, grounding, and module handling guidelines.

Ground yourself to the cabinet grounding stud (refer to Figure 7–1) before servicing the controller module.

7.15.2.3 Removing the Controller

Use the following procedure to remove the controller. (This procedure uses the HSJ40 controller as its example.)

1. Unlock and open the cabinet doors.
2. If the controller you are removing has totally failed, proceed to step 4.

   If the controller you are removing is functioning (green LED blinking), has any I/O outstanding, or has devices online, connect a maintenance terminal to the controller to perform a shutdown.

3. Enter the following command to shutdown the controller:

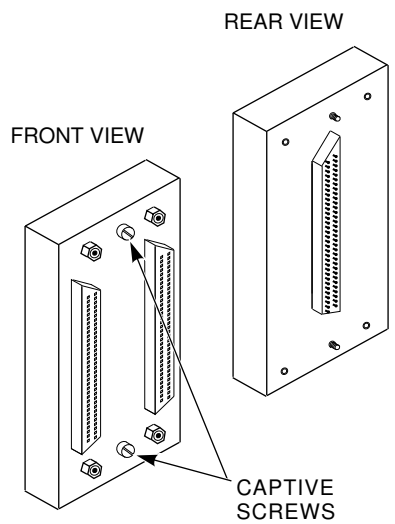
   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

4. Connect either a virtual terminal or a maintenance terminal to the controller you will *not* be removing.

5. (HSJ-Series) Loosen the captive screws on the CI cable connector with a flat-head screwdriver and remove the cable from the front of the controller module.

   (HSD- and HSZ-Series) With a small flat-head screwdriver, loosen the captive screws on the trilink connector (see Figure 7–19) and remove the trilink from the front of the controller. You will have to work around any host cable or terminator connections when removing the trilink. Do *not* remove cables or terminators from the trilink.

Figure 7–19 Trilink Connector (HSD- and HSZ-Series)



6. Loosen the four screws on each side of the front bulkhead. Be careful not to pull on the controller and disconnect it from the backplane.

7. Enter the RUN C_SWAP command. The system responds with the following:

   ```
   Controller Warm Swap, Software Version -V2.5
   *** Sequence to REMOVE other HSJ40 has begun. ***
   Do you want to REMOVE the other HSJ40 Y/N [N]?
   ```

8. Enter ‘‘Y’’ to continue the procedure.

   ```
   Will its cache module also be removed Y/N [N]?
   ```

9. Enter ‘‘Y’’ only if you will be removing the controller’s cache module as well.

```
Killing other controller.
Attempting to quiesce all ports.

   Port 1 quiesced.
   Port 2 quiesced.
   Port 3 quiesced.
   Port 4 quiesced.
   Port 5 quiesced.
   Port 6 quiesced.

All ports quiesced.

Remove the other HSJ40 (the one WITHOUT a blinking green LED) within
5 minutes.
```

Note

Do not remove the controller with the blinking green LED reset (//) button.

10. You have 5 minutes to remove the controller following the steps described in Table 7–2. Your terminal will update you with the time remaining to complete the removal procedure, as shown in the following example:

```
Time remaining 4 minutes, 40 seconds.
```

Note

If you fail to remove the controller within 5 minutes, the subsystem will restart the quiesced ports, and you will have to begin this procedure again.

Table 7–2 Module Removal

Step	Description
1	Ground yourself to the cabinet grounding stud (refer to Figure 7–1).
2	Unsnap and remove the program card ESD shield (refer to Figure 7–2).
3	Remove the program card by pushing the eject button (refer to Figure 7–3) next to the card. Pull the card out and save it for use in the replacement controller module.
4	Use a gentle up-and-down rocking motion to loosen the module from the shelf backplane.
5	Slide the module out of the shelf (noting which rails the module was seated in) and place it on an approved ESD work surface or mat. Be careful not to let the module touch any adjacent modules.
9	If necessary, you may now remove the cache module as described in Section 7.6.1.3 or 7.6.2.3.

Once you remove the controller, you will see the following displayed as the subsystem uses the remaining controller to service the quiesced ports:

```
Restarting ALL ports.
   Port 1 restarted.
   Port 2 restarted.
   Port 3 restarted.
   Port 4 restarted.
   Port 5 restarted.
   Port 6 restarted.
```

7.15.2.4 Replacing the Controller

Use the following procedure to replace the controller: (This procedure uses the HSJ40 controller as its example.)

1. The system will prompt you with the following to replace the controller:

   ```
   Do you have a replacement HSJ40 readily available [N]?
   ```

   Try to have a replacement available. If you do not have one, you must answer with ‘‘N.’’ Then, the warm swap sequence will terminate, and you must restart the routine later when you have a replacement.

   When you find a replacement, you can restart the sequence by entering the RUN C_SWAP command again. The system responds with the following:

   ```
   Do you have a replacement HSJ40 readily available [N]?
   ```

   Answer ‘‘Y’’ if you have the controller.

2. The following is displayed next:

   ```
   *** Sequence to INSERT other HSJ40 has begun. ***

   Do you want to INSERT the other HSJ40 [N]?
   ```

   Answer Y to insert the controller.

   ```
   Attempting to quiesce all ports.

      Port 1 quiesced.
      Port 2 quiesced.
      Port 3 quiesced.
      Port 4 quiesced.
      Port 5 quiesced.
      Port 6 quiesced.

   All ports quiesced.

   Insert the cache module, then insert the other HSJ40, WITHOUT its
   program card, and press Return
   ```

3. Insert the cache (if applicable) and controller now. Follow the steps outlined in Table 7–3.

Table 7–3 Module Replacement

Step	Description
1	Ground yourself to the cabinet grounding stud (refer to Figure 7–1).
2	Replace the cache module now, if you removed it. Refer to Section 7.6.1.4 or 7.6.2.8.
3	(HSJ-Series) Make sure the OCP cable is correctly plugged into side two of the module (refer to Figure 7–6).
4	Slide the controller module into the shelf using its slot's rightmost rails as guides (refer to Figure 7–7). Be careful not to let the module touch and adjacent modules.
5	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.
6	Tighten the four screws on the front bulkhead.

Once you insert the controller, you will see the following displayed as the subsystem restarts service on the quiesced ports:

```
Restarting ALL ports.

   Port 1 restarted.
   Port 2 restarted.
   Port 3 restarted.
   Port 4 restarted.
   Port 5 restarted.
   Port 6 restarted.

The configuration has two controllers.
```

4. Insert the program card into the controller. The program card eject button will extend when the card is fully inserted.
5. Follow the steps in the system message:

```
The Controller Warm Swap program has terminated. To restart the other
controller:

1) Enter the RESTART OTHER command.
 2) Press and hold the Reset button (//) while inserting the program card.
 3) Release Reset (//) and the controller will initialize.
 4) Configure new controller by referring to the StorageWorks Controller
    User's Guide.
```

   If the controller initializes correctly, its green reset LED will begin to flash at 1 Hz. If an error occurs during initialization, the OCP will display a code. If necessary, refer to Chapter 5 to analyze the code.

6. Snap the ESD shield into place over the program card.
7. Restore parameters for the new controller using the steps in Section 7.15.2.5.

7.15.2.5 Restoring Parameters

A new controller module has no initial parameters, so you must use a maintenance terminal to enter them. Refer to information in the CONFIGURATION.INFO file or on the configuration sheet packaged with your system, whichever is most current, for parameters. Be sure to use the same parameters from the removed controller when installing a replacement. Follow these steps:

CAUTION

Do not install HSJ-Series CI host port cables until after setting all parameters listed here. Failure to follow this procedure may result in adverse effects on the host/cluster.

CAUTION

SET FAILOVER establishes controller-to-controller communication and copies configuration information. Always enter this command on one controller only. COPY=*configuration-source* specifies where the *good* configuration data is located. *Never* blindly specify SET FAILOVER. Know where your good configuration information resides before entering the command.

Note

Not all steps are applicable to all controller models. Steps applicable to certain models are designated as such.

1. From a console connected to the existing controller (not the new one), enter the following command to copy configuration information to the new controller:

   ```
   CLI> SET FAILOVER COPY=THIS_CONTROLLER
   ```

   HSZ-Series controllers will return to the dual-redundant configuration and restart after entering this command. Proceed to step 8 if you are working with HSZ-Series controllers.

2. (HSJ-and HSD-Series) Enter the following command to set the MAX_NODES:

   ```
   CLI> SET OTHER_CONTROLLER MAX_NODES=n
   ```

   where *n* is 8, 16, or 32.

3. (HSJ- and HSD-Series) Enter the following command to set a valid controller ID:

   ```
   CLI> SET OTHER_CONTROLLER ID=n
   ```

   (HSJ-Series) where *n* is the CI node number (0 through (MAX_NODES – 1)).

   (HSD-Series) or *n* is the one-digit DSSI node number (0 through 7). Each controller DSSI node number must be unique among all devices on its DSSI interconnect.

4. (HSJ- and HSD-Series) Enter the following command to set the SCS node:

   ```
   CLI> SET OTHER_CONTROLLER SCS_NODENAME="xxxxxx"
   ```

   where *xxxxxx* is a one- to six-character alphanumeric name for this node. The node name must be enclosed in quotes with an alphabetic character first. Each SCS node name must be unique within its VMScluster.[6]

[6] See Chapter 4 for important information about VMS node names.

5. (HSJ- and HSD-Series) Enter the following command to set the MSCP allocation class:

   ```
   CLI> SET OTHER_CONTROLLER MSCP_ALLOCATION_CLASS=n
   ```

   where *n* is 1 through 255.

   Digital recommends providing a unique allocation class value for every pair of dual-redundant controllers in the same cluster.

6. (HSJ- and HSD-Series) Enter the following command to set the TMSCP allocation class:

   ```
   CLI> SET OTHER_CONTROLLER TMSCP_ALLOCATION_CLASS=n
   ```

   where *n* is 1 through 255.

7. (HSJ- and HSD-Series) Restart the new controller either by pressing the green reset (//) button or by entering the following command:

   ```
   CLI> RESTART OTHER_CONTROLLER
   ```

8. Enter the following command to verify the preceding parameters were set.

   ```
   CLI> SHOW OTHER_CONTROLLER FULL
   ```

9. Connect the host port cable to the front of the controller. Do *not* connect the controllers in a dual-redundant pair to separate, different host CPUs.

   HSJ-Series: Connect the CI cable and tighten its captive screws with a flat-head screwdriver.

   HSD- and HSZ-Series: Connect the host cable trilink connector to the front of the controller and tighten its captive screws with a small flat-head screwdriver. You will have to work around any host cable or terminator connections when replacing the trilink. Do *not* remove cables or terminators from the trilink.

10. (HSJ-Series) Enter the following commands to enable CI paths A and B to the host:

    ```
    CLI> SET OTHER_CONTROLLER PATH_A
    CLI> SET OTHER_CONTROLLER PATH_B
    ```

    (HSD-Series) Enter the following commands to enable the host port path:

    ```
    CLI> SET THIS_CONTROLLER PATH
    CLI> SET OTHER_CONTROLLER PATH
    ```

    (HSZ-Series) The host port path for HSZ-Series controllers is always on, so no command is needed.

11. If you want, you may disconnect the maintenance terminal. The terminal is not required for normal controller operation.

12. Close and lock the cabinet doors.

A

Field Replaceable Units

This appendix lists HS controller field replaceable units (FRUs), required tools and equipment, and related FRUs.

A.1 Controller Field Replaceable Units

The following FRUs come with the various controller modules. Part numbers are correct as of publication of this manual but are subject to change. Always verify your information in case part numbers or ordering methods have changed.

Table A–1 HSJ40 FRUs

FRU	Part Number	
HSJ40 CI SCSI controller module (including OCP and bulkhead)	70–30097–01	
16 MB read cache module (Version 1)	54–22229–02	(discontinued)
32 MB read cache module (Version 1)	54–22229–01	(discontinued)
16 MB cache module (Version 2)	54–22910–02	
32 MB cache module (Version 2)	54–22910–01	
StorageWorks HSJ40 program card	BG–PYU60–0A. J01 BG–PYU60–0A. H01 BG–PYU60–0A. F01	(firmware Version 2.0) (firmware Version 1.5) (firmware Version 1.4)
CI internal cables	GRAY–17–03427–02	
SCSI–2 device port cables	BN21H–02	
Battery, sealed lead acid	12–40235–01	
Plastic Bracket, dual battery	74–47465–01	
Retention clip	74–49039–01	
Cover, memory card (‘‘ESD shield’’)	74–46416–01	

Table A–2 HSJ30 FRUs

FRU	Part Number	
HSJ30 CI SCSI controller module (including OCP and bulkhead)	70–30097–02	
16 MB cache module	54–22910–02	
32 MB cache module	54–22910–01	
StorageWorks HSJ30 program card	BG–PYU60–0A. J01 BG–PYU60–0A. H01 BG–PYU60–0A. F01	(firmware Version 2.0) (firmware Version 1.5) (firmware Version 1.4)
CI internal cables	GRAY–17–03427–02	
SCSI–2 device port cables	BN21H–02	
Battery, sealed lead acid	12–40235–01	
Bracket, dual battery	74–47465–01	
Retention clip	74–49039–01	
Cover, memory card (‘‘ESD shield’’)	74–46416–01	

Table A–3 HSD30 FRUs

FRU	Part Number	
HSD30 DSSI SCSI controller module (including bulkhead and trilink connector)	70–31458–01	
16 MB cache module	54–22910–02	
32 MB cache module	54–22910–01	
StorageWorks HSD30 program card	BG–Q6HL0–0A. C01 BG–Q6HL0–0A. B01 BG–Q6HL0–0A. A01	(firmware Version 2.0) (firmware Version 1.5) (firmware Version 1.4)
SCSI–2 device port cables	BN21H–02	
Trilink connector	12–39921–02 (included in 70–31458–01)	
50-pin DSSI bus terminator	12–31281–01	
Battery, sealed lead acid	12–40235–01	
Bracket, dual battery	74–47465–01	
Mating guide	74–49066–01	
Cover, memory card (‘‘ESD shield’’)	74–46416–01	

Table A–4 HSZ40 FRUs

FRU	Part Number	
HSZ40 SCSI-to-SCSI controller module (including bulkhead and trilink connector)	70–31457–01	
16 MB cache module	54–22910–02	
32 MB cache module	54–22910–01	
StorageWorks HSZ40 program card	BG–Q6HN0–0A. C01 BG–Q6HN0–0A. B01 BG–Q6HN0–0A. A01	(firmware Version 2.0) (firmware Version 1.5) (firmware Version 1.4)
SCSI–2 device port cables	BN21H–02	
Trilink connector	12–39921–01 (included in 70–31457–01)	
68-pin SCSI bus terminator	12–37004–03	
Battery, sealed lead acid	12–40235–01	
Bracket, dual battery	74–47465–01	
Mating guide	74–49066–01	
Cover, memory card (‘‘ESD shield’’)	74–46416–01	

Table A–5 HSZ40-B*x* FRUs

FRU	Part Number
HSZ40-B*x* SCSI-to-SCSI controller module (including bulkhead and trilink connector)	70-31457-03
16 MB cache module	54–22910–02
32 MB cache module	54–22910–01
StorageWorks HSZ40 program card	BG-QHD30-0A. A01 (firmware Version 2.1)
SCSI–2 device port cables	BN21H–02
Trilink connector	12–39921–01 (included in 70–31457–01)
68-pin SCSI bus terminator	12–37004–03
Battery, sealed lead acid	12–40235–01
Bracket, dual battery	74–47465–01
Mating guide	74–49066–01
Cover, memory card (‘‘ESD shield’’)	74–46416–01

A.2 Required Tools and Equipment

The following tools and equipment are required for controller maintenance:

- Portable antistatic kit, part number 29–26246–00
- ESD mat—for all module replacement service
- 3/32-inch Allen wrench—for replacing HSJ-series controllers
- 5/32-inch Allen wrench—for opening the front door of a SW800 series data center cabinet.
- Flat-head screwdriver—for replacing host cables, HSD-series controllers, and HSZ controllers
- Small flat-head screwdriver—for replacing trilink connectors while SCSI or DSSI host cables are attached

An EIA–423 compatible terminal is needed for setting the initial configuration. When using this terminal, a connecting cable (between the terminal and the controller) that supports EIA–423 communication is required.

A.3 Related Field Replaceable Units

The following FRUs are related to the HS controllers. (Refer to the appropriate StorageWorks documentation for removal and replacement procedures for these components if not found in this manual.)

Table A–6 Controller–Related FRUs

FRU	Part Number
CI external cable	BLUE–17–01551–*xx*†
Controller shelf (with backplane)	BA350–MA
Device shelf (with backplane)	BA350–SB
Shelf power supply	H7429–AA
NULL modem DECconnect laptop 9-pin cable	H8571–J
DEC connect cable	BC16E–*xx*†
SCSI–1-to-SCSI–2 transition cable, 0.2 meter (8-inch)‡	17–03831–01
Phone Cable	17-03511-04
Coupler	12-43346-01

†Where *xx* equals the length in feet.

‡When using some devices, such as a TZ8*x*7, you must route a transition cable between the device and the SCSI–2 cable (because the device is SCSI–1).

B

Command Line Interpreter

This appendix provides the following information:

- A comprehensive list of all CLI commands
- CLI error messages the operator may encounter
- Examples of some common CLI-based procedures

An overview of using the CLI, as well as a description of how to access and exit the CLI, is provided in Chapter 4.

B.1 CLI Commands

The following sections describe each of the valid commands in the CLI, along with their required parameters and qualifiers. Examples are given after the command format, parameters, description, and qualifiers. Remember these two guidelines when using the CLI:

- You do not need to specify all configuration parameters on one line. You can enter them by using multiple SET commands.
- You only need to enter enough of each command to make the command unique (usually three characters). For example, SHO is equivalent to SHOW.

Note

Certain information related to the companion controller in a dual-redundant configuration does not always appear. When device or parameter information does not appear after entering a command from one controller, enter the same command from the other controller.

ADD CDROM

Adds a CDROM drive to the list of known CDROM drives.

Format

ADD CDROM *container-name SCSI-location*

Parameters

container-name
Specifies the name that is used to refer to this CDROM drive. This name is referred to when creating units. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

SCSI-location
The location of the CDROM drive to be added in the form PTL where **P** designates the port (1–6 or 1–3, depending on the controller model), **T** designates the target ID of the device, (0–6, in a nonfailover configuration, or 0–5 if the controller is in a failover configuration), and **L** designates the LUN of the device (must be 0).

When entering the PTL, at least one space must separate the the port, target, and LUN numbers.

Description

Adds a CDROM drive to the list of known CDROM drives and names the drive. This command must be used when a new SCSI–2 CDROM drive is to be added to the configuration.

Examples

1.
```
CLI> ADD CDROM CD_PLAYER 1 0 0
```
Adds a CDROM drive to port 1, target 0, LUN 0, and named CD_PLAYER.

ADD DISK

Adds a disk drive to the list of known disk drives.

Format

ADD DISK *container-name SCSI-location*

Parameters

container-name
Specifies the name that is used to refer to this disk drive. This name is referred to when creating units and stripesets. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

SCSI-location
The location of the disk drive to be added in the form PTL where **P** designates the port (1–6 or 1–3, depending on the controller model), **T** designates the target ID of the device, (0–6, in a nonfailover configuration, or 0–5 if the controller is in a failover configuration), and **L** designates the LUN of the device (must be 0).

When entering the PTL, at least one space must separate the the port, target, and LUN numbers.

Description

Adds a disk drive to the list of known disk drives and names the drive. This command must be used when a new SCSI–2 disk drive is to be added to the configuration.

Qualifiers

TRANSPORTABLE
NOTRANSPORTABLE (Default)
In normal operations, the controller makes a small portion of the disk inaccessible to the host and uses this area to store metadata, which improves data reliability, error detection, and recovery. This vast improvement comes at the expense of transportability.

If NOTRANSPORTABLE is specified and there is no valid metadata on the unit, the unit must be initialized.

Note

Digital recommends that you avoid specifying TRANSPORTABLE unless transportability of disk drive or media is imperative and there is no other way to accomplish moving the data.

ADD DISK

Examples

1. `CLI> ADD DISK RZ26_100 1 0 0`

   Adds a non transportable disk to port 1, target 0, LUN 0 and names it RZ26_100.

2. `CLI> ADD DISK DISK0 2 3 0 NOTRANSPORTABLE`

   Adds a non transportable disk to port 2, target 3, LUN 0 and names it DISK0.

3. `CLI> ADD DISK TDISK0 3 2 0 TRANSPORTABLE`

   Adds a transportable disk to port 3, target 2, LUN 0 and names it TDISK0.

ADD LOADER

Note

This command is valid for HSJ and HSD controllers only.

Adds a loader to the list of known loaders.

Format

ADD LOADER *container-name SCSI-location*

Parameters

container-name
Specifies the name that is used to refer to this loader. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

SCSI-location
The location of the loader to be added in the form PTL where **P** designates the port (1–6 or 1–3, depending on the controller model), **T** designates the target ID of the device, (0–6, in a nonfailover configuration, or 0–5 if the controller is in a failover configuration), and **L** designates the LUN of the device (must be 0).

When entering the PTL, at least one space must separate the the port, target, and LUN numbers.

Description

Adds a loader to the list of known loaders and names the loader. This command must be used when a new SCSI–2 loader is to be added to the configuration.

Examples

1.
```
CLI> ADD LOADER LOAD0 2 0 0
```

Adds a loader to port 2, target 0, LUN 0 and names it LOAD0.

ADD MIRRORSET

Binds a set of physical devices to a mirrorset specified by a container name.

Format

ADD MIRRORSET *container-name disk-device-name1 [disk-device-nameN]*

Parameters

container-name

Specifies the name that is used to refer to this mirrorset container. This name is referred to when creating mirrorsets. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

disk-device-name1 disk-device-nameN
The disk drives that make up this mirrorset. A mirrorset is made up of from 1 to 6 disk drives.

Description

Adds a mirrorset to the list of known mirrorsets and names the mirrorset. The number of members is set to the number of devices specified in the command. If the physical devices have never been initialized as a mirrorset, then a CLI INITIALIZE command must be issued for the mirrorset prior to binding the mirrorset to a higher level storage container.

Qualifiers

COPY=*copy_speed*

The COPY qualifier allows you to specify the speed at which mirrorset copies are performed. You may specify either NORMAL or FAST.

NORMAL uses relatively few controller resources to perform the copy, and has little impact on controller performance.

FAST uses more controller resources, which reduces the time it takes to complete the copy, but also reduces overall controller performance.

POLICY=BEST_FIT
POLICY=BEST_PERFORMANCE (Default)
NOPOLICY

The POLICY qualifier specifies the replacement policy to be used when a mirrorset member within the mirrorset fails.

BEST_FIT gives highest priority to finding a replacement device within the spareset that most closely matches the sizes of the remaining members of the mirrorset. If more than one device in the spareset is the correct size, the device that gives the best performance is selected.

BEST_PERFORMANCE (default) gives highest priority to finding a replacement device within the spareset that results in the best performance of the mirrorset (the device should be on a different port). If more than one device in the spareset has the best performance, the device that most closely matches the size of the remaining members of the mirrorset is selected.

NOPOLICY retries a failing device from the mirrorset without selecting a replacement. This causes the mirrorset to run with less than the nominal number of members until a BEST_FIT or BEST_PERFORMANCE policy is selected, or a member is manually replaced in the mirrorset.

READ_SOURCE=*read-source*

The READ_SOURCE qualifier allows you to control the read algorithm for the specified mirrorset. The following choices are allowed for read-source:

ROUND_ROBIN—Each NORMAL mirrorset member is the target of a read in sequential membership order. No preference is given to any NORMAL member. This is the default read-source.

LEAST_BUSY—The NORMAL mirrorset member with the least busy work queue is the target of the read.

device-container-name—All reads are done on *device-container-name*. If *device-container-name* fails out of the mirrorset, the READ_SOURCE algorithm reverts to LEAST_BUSY.

Examples

1.
```
CLI> ADD MIRRORSET MIRR1 DISK100 DISK210 DISK320
```

   Adds DISK100, DISK210, and DISK320 as a mirrorset with the name MIRR1.

ADD OPTICAL

Adds an optical drive to the list of known optical drives.

Format

ADD OPTICAL *container-name SCSI-location*

Parameters

container-name
Specifies the name that is used to refer to this optical drive. This name is referred to when creating units and stripesets. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

SCSI-location
The location of the optical drive to be added in the form PTL where **P** designates the port (1–6 or 1–3, depending on the controller model), **T** designates the target ID of the device, (0–6, in a nonfailover configuration, or 0–5 if the controller is in a failover configuration), and **L** designates the LUN of the device (must be 0).

When entering the PTL, at least one space must separate the the port, target, and LUN numbers.

Description

Adds an optical drive to the list of known optical drives and names the drive. This command must be used when a new SCSI–2 optical drive is to be added to the configuration.

Qualifiers

TRANSPORTABLE
NOTRANSPORTABLE (Default)
In normal operations, the controller makes a small portion of the optical disk inaccessible to the host and uses this area to store metadata, which improves data reliability, error detection, and recovery. This vast improvement comes at the expense of transportability.

If NOTRANSPORTABLE is specified and there is no valid metadata on the unit, the unit must be initialized.

Note

Digital recommends that you avoid specifying TRANSPORTABLE unless transportability of optical drive or media is imperative and there is no other way to accomplish moving the data.

Examples

1.
```
CLI> ADD OPTICAL OPT0 2 3 0 NOTRANSPORTABLE
```

   Adds a non transportable optical drive to port 2, target 3, LUN 0 and names it OPT0.

2.
```
CLI> ADD OPTICAL TOPT0 3 2 0 TRANSPORTABLE
```

   Adds a transportable optical drive to port 3, target 2, LUN 0 and names it TOPT0.

ADD PASSTHROUGH

Note

This command is valid for HSJ and HSD controllers only.

Creates a command disk (passthrough) container to allow direct access to a device.

Format

ADD PASSTHROUGH *container-name device-name*

Parameters

container-name
Specifies the name that is used to refer to this passthrough container. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

device-name
The device that receives passthrough commands. Only one device may be specified.

Description

Adds a passthrough container to the list of known passthrough containers and names the container. This command must be used when you want to communicate directly to a device using SCSI commands, such as a loader or a disk that is about to have new microcode downline loaded.

Note

A warning message (Warning 3010) may appear when you add a passthrough container. You can safely ignore the warning.

Examples

1.
```
CLI> ADD PASSTHROUGH PASS0 LDR421
```
Creates a passthrough container to loader LDR421 and names it PASS0.

ADD RAIDSET

Creates a RAIDset from a number of containers.

Format

ADD RAIDSET *container-name container-name1 container-name2 [container-nameN]*

Parameters

container-name
Specifies the name that is used to refer to this RAIDset. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

container-name1 container-name2 container-nameN
The containers that will make up this RAIDset. A RAIDset may be made up of from 3 to 14 containers.

Description

Adds a RAIDset to the list of known RAIDsets and names the RAIDset. This command must be used when a new RAIDset is to be added to the configuration.

Qualifiers

POLICY=BEST_FIT
POLICY=BEST_PERFORMANCE (Default)
NOPOLICY
Specifies the replacement policy to use when a member within the RAIDset fails.

BEST_FIT gives highest priority to finding a replacement device within the spareset that most closely matches the sizes of the remaining members of the RAIDset. After finding the most closely matching devices, the device that gives the best performance is selected.

BEST_PERFORMANCE (default) gives highest priority to finding a replacement device within the spareset that results in the best performance of the RAIDset. After finding the best performing devices, the device that most closely matches the size of the remaining members of the RAIDset is selected.

NOPOLICY retires a failing device from the RAIDset without selecting a replacement. This causes the RAIDset to run in a reduced state until a BEST_ FIT or BEST_PERFORMANCE policy is selected, or a member is manually replaced in the RAIDset (see SET *raidset-container-name*).

RECONSTRUCT=NORMAL (Default)
RECONSTRUCT=FAST
NORECONSTRUCT
Specifies the speed at which a RAIDset will be reconstructed when a new member is added to the RAIDset or immediately after the RAIDset is initialized.

RECONSTRUCT=NORMAL (default) balances overall performance of the controller against the demand of reconstructing the RAIDset.

RECONSTRUCT=FAST reconstructs the RAIDset at the fastest rate possible resulting in some loss of performance of the controller overall.

REDUCED
NOREDUCED (Default)
REDUCED specifies that the RAIDset being added is already missing one member. Use the REDUCED keyword when moving an already reduced RAIDset from one controller to another. NOREDUCED (default) identifies that all RAIDset members that make up the RAIDset are being specified.

Examples

1.
```
CLI> ADD RAIDSET RAID9 DISK0 DISK1 DISK2 DISK3
```

   Creates a RAIDset with four disks (DISK0, DISK1, DISK2, and DISK3). The replacement policy is BEST_PERFORMANCE.

2.
```
CLI> ADD RAIDSET RAID9 DISK0 DISK1 DISK2 DISK3 POLICY=BEST_FIT
```

   Creates a RAIDset with four disks (DISK0, DISK1, DISK2, and DISK3). The replacement policy is BEST_FIT, as specified.

3.
```
CLI> ADD RAIDSET RAID9 DISK0 DISK1 DISK2 DISK3 NOPOLICY
```

   Creates a RAIDset with four disks (DISK0, DISK1, DISK2, and DISK3). If a member within the RAIDset fails, a replacement will *not* be selected.

4.
```
CLI> ADD RAIDSET RAID9 DISK0 DISK1 DISK3 REDUCED
```

   Creates a four member RAIDset with a raidset that was already reduced.

ADD SPARESET

Adds a disk drive to the spareset.

Format

ADD SPARESET *disk-container-name0 [disk-container-nameN]*

Parameters

disk-container-name0 disk-container-nameN
The disk drive container names to add to the spareset. Any number of disks may be added to the spareset using only one command.

Description

The **SPARESET** is a pool of drives available to the controller to replace failing members of RAIDsets and mirrorsets. The ADD SPARESET command adds disk drives to the spareset and initializes the metadata on the drives.

Examples

1.
```
CLI> ADD SPARESET DISK220
```
Adds one disk to the spareset.

2.
```
CLI> ADD SPARESET DISK110 DISK210 DISK320 DISK430 DISK540
```
Adds five disks to the spareset.

ADD STRIPESET

Creates a stripeset from a number of containers.

Format

ADD STRIPESET *container-name container-name1 container-name2 [container-nameN]*

Parameters

container-name
Specifies the name that is used to refer to this stripeset. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

container-name1 container-name2 container-nameN
The containers that will make up this stripeset. A stripeset may be made up of from 2 to 14 containers.

Description

Adds a stripeset to the list of known stripesets and names the stripeset. This command must be used when a new stripeset is added to the configuration.

Examples

1. `CLI> ADD STRIPESET STRIPE0 DISK100 DISK110 DISK220 DISK340`

   Creates a STRIPESET with four disks (DISK100, DISK110, DISK220, and DISK340).

2. `CLI> ADD STRIPESET STRIPE1 MR1 MR2 MR3`

   Creates a STRIPESET with three members, each of which is a mirrorset.

ADD TAPE

Note

This command is valid for HSJ and HSD controllers only.

Adds a tape drive to the list of known tape drives.

Format

ADD TAPE *device-name SCSI-location*

Parameters

device-name
Specifies the name that is used to refer to this tape drive. This name is referred to when creating units. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

SCSI-location
The location of the tape drive to be added in the form PTL where **P** designates the port (1–6 or 1–3, depending on the controller model), **T** designates the target ID of the device, (0–6, in a nonfailover configuration, or 0–5 if the controller is in a failover configuration), and **L** designates the LUN of the device (must be 0).

When entering the PTL, at least one space must separate the the port, target, and LUN numbers.

Description

Adds a tape drive to the list of known tape drives and names the drive. This command must be used when a new SCSI–2 tape drive is to be added to the configuration.

Examples

1.
```
CLI> ADD TAPE TAPE0 1 0 0
```

Adds a tape drive to port 1, target 0, LUN 0 and names it TAPE0.

ADD UNIT

Adds a logical unit to the controller.

Format

ADD UNIT *unit-number container-name*

Parameters

unit-number (HSJ and HSD only)
The device type letter followed by the logical unit number (0–4094) that the host uses to access the unit. The device type letter is either ''D'' for disk devices (including CDROMs) or ''T'' for tape devices. Using this format, logical unit 3, which is made up of a disk or disks (such as a stripeset), would be specified as D3, and logical unit 7, which is made up of a tape device would be T7.

unit-number (HSZ only)
The unit number determines both the target (0–7) and the LUN (0–7) from which the device is made available. The hundreds place of the unit number is the target and the ones place is the LUN. The tens place is not currently used. For example, D401 would be target 4, LUN 1; D100 would be target 1, LUN 0, and D5 would be target 0, LUN 5.

Note

The only target numbers specified in the unit number *must* have been previously specified in the SET THIS_CONTROLLER ID=(*n*1, *n*2, ...) command. You can not specifiy a target number that has not been previously specified by the SET THIS_CONTROLLER ID=(*n*1, *n*2, ...) command.

container-name
The name of the container that is used to create the unit.

Description

The ADD UNIT command adds a logical unit for the host to access. All requests by the host to the logical unit number are mapped as requests to the container specified in the ADD UNIT command.

For disk devices (and stripesets and RAIDsets built from disk devices), the metadata on the container must be initialized before a unit may be created from it. If the container's metadata cannot be found, or is incorrect, an error is displayed and the unit is not created.

Qualifiers for a Unit Created from a CDROM Drive (HSJ and HSD only)

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

Qualifiers for a Unit Created from a TRANSPORTABLE Disk Drive

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

ADD UNIT

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

Qualifiers for a Unit Created from a NOTRANSPORTABLE Disk Drive

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

WRITEBACK_CACHE
NOWRITEBACK_CACHE (Default)
Enables and disables the controller's write-back cache on this unit.

Note

It may take up to 5 minutes to flush unwritten data from the write-back cache once you disable write-back caching.

ADD UNIT

Note

When initially added, NOWRITEBACK_CACHE is the default.

Qualifiers for a Unit Created from a TRANSPORTABLE Optical Drive

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

Qualifiers for a Unit Created from a NOTRANSPORTABLE Optical Drive

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

WRITEBACK_CACHE
NOWRITEBACK_CACHE (Default)
Enables and disables the controller's write-back cache on this unit.

Note

It may take up to 5 minutes to flush unwritten data from the write-back cache once you disable write-back caching.

Note

When initially added, NOWRITEBACK_CACHE is the default.

Qualifiers for a Unit Created from a RAIDset

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The

second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

Note

Writes may still be performed to a write-protected RAIDset to satisfy a reconstruct pass or to reconstruct a newly replaced member. However, write protect will disable the writing of any new data.

WRITEBACK_CACHE
NOWRITEBACK_CACHE (Default)
Enables and disables the controller's write-back cache on this unit.

Note

It may take up to 5 minutes to flush unwritten data from the write-back cache once you disable write-back caching.

Qualifiers for a Unit Created from a Stripeset

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

WRITEBACK_CACHE
NOWRITEBACK_CACHE (Default)
Enables and disables the controller's write-back cache on this unit.

Note

It may take up to 5 minutes to flush unwritten data from the write-back cache once you disable write-back caching.

Qualifiers for a Unit Created from a Tape Drive (HSJ and HSD only)

DEFAULT_FORMAT=*format*
DEFAULT_FORMAT=DEVICE_DEFAULT (Default)
Specifies the tape format to be used unless overridden by the host. Note that not all devices support all formats. The easiest way to determine what formats are supported by a specific device is to enter the ''SHOW <tape unit number> DEFAULT_FORMAT= ?'' command—the valid options will be displayed.

Supported tape formats are as follows:

- DEVICE_DEFAULT (default)

  The default tape format is the default that the device uses, or, in the case of devices that can be set via switches on the front panel, the settings of those switches.
- 800BPI_9TRACK
- 1600BPI_9TRACK
- 6250BPI_9TRACK
- TZ85
- TZ86
- TZ87_NOCOMPRESSION
- TZ87_COMPRESSION
- DAT_NOCOMPRESSION
- DAT_COMPRESSION
- 3480_NOCOMPRESSION
- 3480_COMPRESSION

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

ADD UNIT

Examples

1. `CLI> ADD UNIT D0 DISK0`

   Creates disk unit number 0 from container DISK0.

2. `CLI> ADD UNIT T0 TAPE12`

   Creates tape unit number 0 from container TAPE12.

3. `CLI> ADD UNIT D170 RAID9 WRITE_PROTECT`

   Creates disk unit number 170 from container RAID9 and write protects it.

CLEAR_ERRORS CLI

Stops displaying errors at the CLI prompt.

Format

CLEAR_ERRORS CLI

Description

Errors detected by controller firmware are displayed before the CLI prompt. These errors are displayed even after the error condition is rectified, until the controller is restarted or the CLEAR_ERRORS CLI command is issued.

Note

This command does not clear the error conditions, it only clears displaying the errors at the CLI prompt.

Examples

1.
```
CLI>

All NVPM components initialized to their default settings.
CLI> CLEAR_ERRORS CLI
CLI>
```

Clears the message ‘‘All NVPM components initialized to their default settings.’’ that was displayed at the CLI prompt.

CLEAR_ERRORS INVALID_CACHE

Clears all data from the cache and makes it usable by the specified controller.

Format

CLEAR_ERRORS INVALID_CACHE *controller*

Parameters

controller
Specifies which controller will clear the INVALID_CACHE condition. Either THIS_CONTROLLER or OTHER_CONTROLLER must be specified.

Description

CAUTION

This command causes loss of customer data.

Note

Because this command causes loss of customer data, ''INVALID_CACHE'' must be completely spelled out, not abbreviated.

If a write-back cache module with unwritten cache data from another controller is installed on this controller, or if the write-back cache module with unwritten cache data is removed from this controller, an INVALID_CACHE error results. CLEAR_ERRORS INVALID_CACHE clears the invalid cache error, however *all customer data that was in cache is lost*.

For this reason, use great caution when considering using this command.

Note

Entering the CLEAR_ERRORS INVALID_CACHE command on one controller causes the other controller to restart.

Examples

1. `CLI> CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER`

   Clears all cache information from this controller's cache and clears the invalid cache error.

CLEAR_ERRORS LOST_DATA

Clears the lost data error on a unit.

Format

CLEAR_ERRORS LOST_DATA *unit-number*

Parameters

unit-number
Specifies the logical unit number (for HSDs and HSJs D0–D4094 or T0–T4094, for HSZs D0–D7, D100-D107, and so forth) that will have the lost data error cleared. The *unit-number* is the name given the unit when it was created using the ADD UNIT command.

Description

CAUTION

This command causes loss of customer data.

Note

Because this command causes loss of customer data, ''LOST_DATA'' must be completely spelled out, not abbreviated.

It may take up to 5 minutes to clear lost data.

If customer data has been lost due to the removal or failure of the write-back cache, the lost data error is reported on the unit. CLEAR_ERRORS LOST_DATA clears the lost data error, however, *all customer data that had not been written to disk is lost*.

For this reason, use great caution when considering using this command.

Examples

1.
```
CLI> CLEAR_ERRORS LOST_DATA D13
```
Clears the lost data error on disk unit D13.

CLEAR_ERRORS UNKNOWN

Clears the UNKNOWN error from a device.

Format

CLEAR_ERRORS UNKNOWN *device-name*

Parameters

device-name
Specifies the device name of the device with the UNKNOWN error.

Description

Note

''UNKNOWN'' must be completely spelled out, not abbreviated.

If a device has a failure such that the controller marks the device as UNKNOWN, the device is never automatically checked again to see if it has been repaired or if the failure condition was rectified. When you rectifiy a condition that caused a device to be marked UNKNOWN, this command must be issued for the controller to recognize the device.

Examples

1.
```
CLI> CLEAR_ERRORS UNKNOWN DISK300
```
Causes the controller to recognize DISK300, a previously UNKNOWN device.

CLEAR_ERRORS UNWRITEABLE_DATA

Clears the unwriteable data error on a unit.

Format

CLEAR_ERRORS UNWRITEABLE_DATA *unit-number*

Parameters

unit-number
Specifies the logical unit number (for HSDs and HSJs D0–D4094 or T0–T4094, for HSZs D0–D7, D100-D107, and so forth) that will have the unwriteable data error cleared. The *unit-number* is the name given the unit when it was created using the ADD UNIT command.

Description

CAUTION

This command causes loss of customer data.

Note

Because this command causes loss of customer data, ''UNWRITEABLE_ DATA'' must be completely spelled out, not abbreviated.

If a container fails in a way that customer data in the write-back cache cannot be written to the container, the unwriteable data error is reported. CLEAR_ ERRORS UNWRITEABLE_DATA clears the unwriteable data error, however, *all customer data that has not been written to disk is lost*.

For this reason, use great caution when considering using this command.

Examples

1.
```
CLI> CLEAR_ERRORS UNWRITEABLE_DATA D13
```

Clears the unwriteable data error on disk unit D13.

DELETE *container-name*

Deletes a container from the list of known containers.

Format

DELETE *container-name*

Parameters

container-name
Specifies the name that identifies the container. This is the name given the container when it was created using the ADD command (ADD DEVICE, ADD STRIPESET, and so forth).

Description

Checks to see if the container is used by any other containers or a unit. If the container is in use, an error is displayed and the container is not deleted.

If the container is not in use, it is deleted.

Note

The spareset and failedset containers cannot be deleted. See DELETE SPARESET and DELETE FAILEDSET commands.

Examples

1. `CLI> DELETE DISK0`

   Deletes DISK0 from the list of known containers.

2. `CLI> DELETE STRIPE0`

   Deletes STRIPE0 from the list of known containers.

3. `CLI> DELETE RAID9`

   Deletes RAID9 from the list of known containers.

DELETE FAILEDSET

Delete a disk drive from the failedset.

Format

DELETE FAILEDSET *disk-container-name0 [disk-container-nameN]*

Parameters

disk-container-name0 disk-container-nameN
The disk drive container names to delete from the failedset. Any number of disks may be deleted from the failedset using only one command.

Description

The **FAILEDSET** is a group of drives that were removed from RAIDsets and mirrorsets, either because they failed or were manually removed via the SET command. Drives in the failedset should be considered defective and should be tested, then repaired or replaced. The DELETE FAILEDSET command removes drives from the failedset, typically before you remove them physically from the shelf for testing, repair, or replacement.

Examples

1. `CLI> DELETE FAILEDSET DISK220`

   Deletes one disk from the failedset.

2. `CLI> DELETE FAILEDSET DISK100 DISK210 DISK220 DISK330 DISK400`

   Deletes five disks from the failedset.

DELETE SPARESET

Delete a disk drive from the spareset.

Format

DELETE SPARESET *disk-container-name0 [disk-container-nameN]*

Parameters

disk-container-name0 disk-container-nameN
The disk drive container names to delete from the spareset. Any number of disks may be deleted from the spareset using only one command.

Description

The **SPARESET** is a pool of drives available to the controller to replace failing members of RAIDsets and mirrorsets. The DELETE SPARESET command removes disk drives from the spareset.

Examples

1. `CLI> DELETE SPARESET DISK230`

   Deletes one disk from the spareset.

2. `CLI> DELETE SPARESET DISK110 DISK210 DISK240 DISK320 DISK400`

   Deletes five disks from the spareset.

DELETE *unit-number*

Deletes a unit from the list of known units.

Format

DELETE *unit-number*

Parameters

unit-number
Specifies the logical unit number (for HSDs and HSJs D0–D4094 or T0–T4094, for HSZs D0–D7, D100-D107, and so forth) that is to be deleted. The *unit-number* is the name given the unit when it was created using the ADD UNIT command.

Description

The DELETE command flushes any user data from the write-back cache to the disk and deletes the logical unit. If the logical unit specified is online to a host, the unit is not deleted unless the OVERRIDE_ONLINE qualifier is specified. If any errors occur when trying to flush the user data, the logical unit is not deleted.

In order to delete a unit that has cache errors, you must clear all cache errors associated with the unit via a CLEAR_ERRORS command.

Qualifiers for HSD and HSJ controllers

OVERRIDE_ONLINE
NOOVERRIDE_ONLINE (Default)
If the logical unit is online to the controller, it is not deleted unless the OVERRIDE_ONLINE qualifier is specified.

If the OVERRIDE_ONLINE qualifier is specified, the unit is run down, the user data is flushed to disk, and the logical unit is deleted.

CAUTION

Customer data may be lost or corrupted if the OVERRIDE_ONLINE qualifier is specified.

Examples

1.
```
CLI> DELETE D12
```

   Deletes disk unit number 12 from the list of known units.

2.
```
CLI> DELETE T3 OVERRIDE_ONLINE
```

   Deletes tape unit number 3 from the list of known units even if it is currently online to a host.

DIRECTORY

Lists the diagnostics and utilities available on THIS_CONTROLLER.

Format

DIRECTORY

Description

The DIRECTORY command lists the various diagnostics and utilities that are available on THIS_CONTROLLER. A directory of diagnostics and utilities available on this controller is displayed.

For specific information about the diagnostics and utilities available, refer to Chapter 6.

Examples

1.
```
CLI> DIRECTORY
TILX   V25J   D
DILX   V25J   D
VTDPY  V25J   D
FLS    V25J   D
ECHO   V25J   D
DIRECT V25J   D
CLI    V25J   D
ECHO   V25J   D
CFMENU V25J   D
CHVSN  V25J   D
CLCP   V25J   D
CLONE  V25J   D
CONFIG V25J   D
CRASH  V25J   D
FMU    V25J   D
```

Displays directory listing.

EXIT

Exits the CLI and breaks the virtual terminal connection.

Format

EXIT

Description

When entering the EXIT command from a host using a virtual terminal connection, the connection is broken and control is returned to the host. If entered from a maintenance terminal, the EXIT command restarts the CLI, displaying the copyright notice, the controller type, and the last fail packet.

Examples

1.
```
CLI> EXIT

Copyright (C) Digital Equipment Corporation 1994
HSJ40 Firmware version V020-0, Hardware version 0000

Last fail code: 01800080

Press " ?" at any time for help.

CLI>
```

An EXIT command issued on a maintenance terminal.

2.
```
CLI> EXIT
Control returned to host
$
```

An EXIT command issued on a terminal that was connected to the CLI via a DUP connection.

HELP

Displays an overview for getting help.

Format

HELP

Description

The HELP command displays a brief description for using the question mark ‘‘?’’ to obtain help on any command or CLI function.

Examples

1.
```
CLI> HELP
Help may be requested by typing a question mark (?) at the CLI prompt.  This
will print a list of all available commands

For further information you may enter a partial command and type a space
followed by a "?" to print a list of all available options at that point in
the command.  For example:

          SET THIS_CONTROLLER ?

Prints a list of all legal SET THIS_CONTROLLER commands
```

Displaying help using the HELP command.

2.
```
CLI> SET ?
Your options are:
   FAILOVER
   OTHER_CONTROLLER
   NOFAILOVER
   THIS_CONTROLLER
   Unit number or container name
```

Getting help on the SET command, using the ‘‘?’’ facility.

INITIALIZE

Initializes the metadata on the container specified.

Format

INITIALIZE *container-name*

Parameters

container-name
Specifies the container name to initialize.

Description

The INITIALIZE command initializes a container so a logical unit may be created from it. During initialization, a small amount of disk space is used for controller metadata and is made inaccessible to the host.

If a single-disk container was set as TRANSPORTABLE, any metadata is destroyed on the device and the full device is accessible to the host.

CAUTION

The INITIALIZE command destroys all customer data on the container.

Note

It may take up to 2 minutes to initialize a RAIDset, stripeset, or mirrorset.

The INITIALIZE command is required when:

- A unit is going to be created from a newly installed disk
- A unit is going to be created from a newly created storageset, (RAIDset, stripeset, or mirrorset)

The INITIALIZE command is *not* required when:

- A unit has been deleted, and a new unit is going to be created from the same container
- A storageset that was initialized in the past is deleted, then added again using the same members that were in the original storageset

Qualifiers

CHUNKSIZE=*n*
CHUNKSIZE=DEFAULT (Default)
Specifies the chunksize to be used for RAIDsets and stripesets. The chunksize may be specified in blocks (CHUNKSIZE=*n*), or you can let the controller determine the optimal chunksize (CHUNKSIZE=DEFAULT). The CHUNKSIZE qualifier does not apply to mirrorsets.

INITIALIZE

DESTROY(Default)
NODESTROY
This qualifier prevents the user data and forced error metadata from being destroyed during the intialize. This allows the data on the container to be reused for a disk, stripeset, or mirrorset unit. (The NODESTROY qualifier is ignored for RAIDsets.) NODESTROY is only used when creating a unit out of devices that have been reduced from mirrorsets.

Examples

1. `CLI> INITIALIZE DISK0`

   Initializes container DISK0. If NOTRANSPORTABLE was specified (or allowed to default), metadata is written on the disk.

2. `CLI> INITIALIZE STRIPE0 CHUNKSIZE=20`

   Initializes container STRIPE0 and writes metadata on it. The default chunksize for stripesets is 128 blocks for HSOF V2.5.

3. `CLI> INITIALIZE RAID9 CHUNKSIZE=20`

   Initializes container RAID9 with a chunksize of 20 and writes metadata on it. The default chunksize for RAIDsets is 128 blocks for HSOF V2.5.

4. `CLI> INITIALIZE MIRROR1 NODESTROY`

   Initializes container MIRROR1 and does not write over the forced error metadata.

LOCATE

Locates units, storagesets, and devices by lighting the amber device fault LED on the front of the StorageWorks building block (SBB).

Format

LOCATE

Description

The LOCATE command illuminates the amber device fault LEDs (the lower LED on the front of an SBB) of the containers specified. The LOCATE command also can be used as a lamp test.

Qualifiers

ALL

The LOCATE ALL command turns on the amber device fault LEDs of all configured devices. This qualifier also can be used as a lamp test. See LOCATE CANCEL to turn off the LEDs.

An error is displayed if no devices have been configured.

CANCEL

The LOCATE CANCEL command turns off all amber device fault LEDs on all configured devices.

An error is displayed if no devices have been configured.

DISKS

The LOCATE DISKS command turns on the amber device fault LEDs of all configured disks. See LOCATE CANCEL to turn off the LEDs.

An error is displayed if no disks have been configured.

LOADERS

The LOCATE LOADERS command turns on the amber device fault LEDs of all configured loader devices. See LOCATE CANCEL to turn off the LEDs.

An error is displayed if no loader devices have been configured.

OPTICALS

The LOCATE OPTICALS command turns on the amber device fault LEDs of all configured optical drives. See LOCATE CANCEL to turn off the LEDs.

An error is displayed if no optical drives have been configured.

TAPES

The LOCATE TAPES command turns on the amber device fault LEDs of all configured tape devices. See LOCATE CANCEL to turn off the LEDs.

An error is displayed if no tape devices have been configured.

LOCATE

UNITS

The LOCATE UNITS command turns on the amber device fault LEDs of all devices used by units. This command is useful to determine which devices are not currently configured into logical units. See LOCATE CANCEL to turn off device the LEDs.

An error is displayed if no units have been configured.

PTL *SCSI-location*

The LOCATE PTL *SCSI-location* command turns on the amber device fault LEDs at the given SCSI location. *SCSI-location* is specified in the form PTL where **P** designates the port (1–6 or 1–3, depending on the controller model), **T** designates the target ID of the device (0–6 in a nonfailover configuration or 0–5 if the controller is in a failover configuration), and **L** designates the LUN of the device (0–7).

When entering the PTL, at least one space must separate the port, target, and LUN numbers. See LOCATE CANCEL to turn off the LEDs.

An error is displayed if the port, target, or LUN is invalid, or if no device is configured at that location.

device or storageset name or unit number (*entity*)

The LOCATE *entity* command turns on the amber device fault LEDs that make up the entity supplied. If a device name is given, the device's LED is lit. If a storageset name is given, all device LEDs that make up the storageset are lit. If a unit number is given, all device LEDs that make up the unit are lit. See LOCATE CANCEL to turn off the LEDs.

An error is displayed if no entity by that name or number has been configured.

Examples

1.
```
CLI> LOCATE DISK0
```

   Turns on the device fault LED on device DISK0.

2.
```
CLI> LOCATE D12
```

   Turns on the device fault LEDs on all devices that make up disk unit number 12.

3.
```
CLI> LOCATE DISKS
```

   Turns on the device fault LEDs on all configured disk devices.

MIRROR *disk-device-name1 container-name*

Allows you to convert a physical device to a one-member mirrorset.

Format

MIRROR *disk-device-name1 container-name*

Parameters

disk-device-name1
Specifies the name of the physical device that you wish to convert to a one member mirrorset. The device must be part of a unit.

container-name
Specifies the name that is used to refer to this mirrorset. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up pf letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_ _), for a total of nine characters.

Description

The MIRROR *disk-device-name1 container-name* command allows you to convert a physcial device specified by *disk-device-name* to a mirrorset with one member. The mirrorset name is specified by *container-name*. This command can be used on devices that are already members of higher level containers (stripesets or units).

After you convert the device to a mirrorset, increase the nominal number of members with the SET *mirrorset-container-name* MEMBERSHIP=*number-of-members* command. Use the SET *mirrorset-container-name* REPLACE=*disk-device-name* command to actually add more members to the mirrorset. Refer to SET *mirror-container-name* for details for using the MEMBERSHIP= *number-of-members* qualifier versus the REPLACE= *disk-device-name* qualifier.

NOTE

When this command is used to create mirrorsets from stripeset members that were created before HSOF Version 2.5, the stripeset will then be incompatible with prior firmware versions.

Qualifiers

COPY=*copy_speed*

The COPY qualifier allows you to specify the speed at which mirrorset copies are performed. You may specify either NORMAL or FAST.

NORMAL uses relatively few controller resources to perform the copy, and has little impact on controller performance.

FAST uses more controller resources, which reduces the time it takes to complete the copy, but also reduces overall controller performance.

MIRROR *disk-device-name1 container-name*

POLICY=BEST_FIT
POLICY=BEST_PERFORMANCE
NOPOLICY (Default)

The POLICY qualifier specifies the replacement policy to be used when a mirrorset member within the mirrorset fails.

BEST_FIT gives highest priority to finding a replacement device within the spareset that most closely matches the sizes of the remaining members of the mirrorset. If more than one device in the spareset is the correct size, the device that gives the best performance is selected.

BEST_PERFORMANCE (default) gives highest priority to finding a replacement device within the spareset that results in the best performance of the mirrorset (the device should be on a different port). If more than one device in the spareset has the best performance, the device that most closely matches the size of the remaining members of the mirrorset is selected.

NOPOLICY retries a failing device from the mirrorset without selecting a replacement. This causes the mirrorset to run with less than the nominal number of members until a BEST_FIT or BEST_PERFORMANCE policy is selected, or a member is manually replaced in the mirrorset.

Examples

1.
```
CLI> MIRROR DISK210 MIRROR5
```

   Creates a one member mirrorset from a DISK210 (a single disk).

REDUCE *disk-device-name1 [disk-device-nameN]*

Allows you to remove members from an existing mirrorset.

Format

REDUCE *disk-device-name1 [disk-device-nameN]*

Parameters

disk-device-name1
Specifies the name of the NORMAL mirrorset member to be removed.

[disk-device-nameN]
Specifies the name of the second mirrorset member to be removed.

Description

This command allows you to remove members from mirrorsets. For a consistent copy of a stripeset whose members are mirrorsets, all mirrorsets must be reduced at the same time with one command. It is similar to the SET *mirrorset-container-name* REMOVE=*disk-device-name* command, except that the nominal number of members in the mirrorset is decreased by the number of members removed, and the devices are not placed in the failedset.

Note

Mirrorsets have both a nominal number of members and an actual number of members. The nominal number of members in a mirrorset is the number given in the SET *mirrorset- name* MEMBERSHIP= *number-of-members* command. If devices have not been added to the mirrorset, or if a member is removed, the actual number of members may be less than the nominal number. The actual number of members can never be greater than the nominal number of members.

The disk devices to be removed need not be members of the same mirrorset. The devices MUST be part of the same unit (for example, the same stripeset). This is an atomic operation because the I/O to the unit associated with the given mirrorset members is stalled while the specified mirrorset members are removed. No auto-sparing occurs and each mirrorset membership is set to the new reduced number of members. The removed devices specified by *disk-device-name1* through *disk-device-nameN* are not placed in the failedset, but are left as unused devices.

Note that for each mirrorset that you reduce, the mirrorset must have at least one remaining NORMAL member after the reduction. If this is not true for all *disk-devices-names* specified, then none of the specified mirrorsets are reduced.

Note

A NORMAL member is a mirrorset member whose entire contents are guaranteed to be the same as all other NORMAL members. All NORMAL members have exactly the same contents.

REDUCE *disk-device-name1 [disk-device-nameN]*

Examples

1.
```
CLI> REDUCE DISK210 DISK110
```

DISK210 and DISK110 are removed from their respective mirrorsets.

RENAME

Renames a container.

Format

RENAME *old-container-name new-container-name*

Parameters

old-container-name
Specifies the existing name that identifies the container.

new-container-name
Specifies the new name to identify the container. This name is referred to when creating units and storagesets. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

Description

Gives a known container a new name by which to be referred.

Examples

1.
```
CLI> RENAME DISK0 DISK100
```

   Renames container DISK0 to DISK100.

RESTART OTHER_CONTROLLER

Restarts the other controller.

Format

RESTART OTHER_CONTROLLER

Description

The RESTART OTHER_CONTROLLER command flushes all user data from the other controller's write-back cache (if present), then restarts the other controller.

If any disks are online to the other controller, the controller does not restart unless the OVERRIDE_ONLINE qualifier is specified (HSD and HSJ only). If any user data cannot be flushed to disk, the controller does not restart unless the IGNORE_ERRORS qualifier is specified.

Specifying IMMEDIATE causes the other controller to restart immediately without flushing any user data to the disks, even if drives are online to the host.

The RESTART OTHER_CONTROLLER command does not cause a failover to this controller in a dual-redundant configuration. The other controller restarts and resumes operations where it was interrupted.

Qualifiers for HSD and HSJ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller is not restarted unless IGNORE_ERROR is specified.

If the IGNORE_ERRORS qualifier is specified, the controller restarts even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE_SHUTDOWN
NOIMMEDIATE_SHUTDOWN (Default)
If IMMEDIATE is specified, the controller is immediately restarted without checking for online devices or flushing user data from write-back cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

OVERRIDE_ONLINE
NOOVERRIDE_ONLINE (Default)
If any units are online to the controller, the controller is not restarted unless OVERRIDE_ONLINE is specified.

If the OVERRIDE_ONLINE qualifier is specified, the controller restarts after all customer data is written to disk.

CAUTION

Customer data may be lost or corrupted if the OVERRIDE_ONLINE qualifier is specified.

Qualifiers for HSZ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller is not restarted unless IGNORE_ERROR is specified.

If the IGNORE_ERRORS qualifier is specified, the controller restarts even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE_SHUTDOWN
NOIMMEDIATE_SHUTDOWN (Default)
If IMMEDIATE is specified, the controller is immediately restarted without checking for online devices or flushing user data from write-back cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

Examples

1. `CLI> RESTART OTHER_CONTROLLER`

   Restarts the other controller as long as the other controller does not have any units online.

2. `CLI> RESTART OTHER_CONTROLLER OVERRIDE_ONLINE`

   Restarts the other controller even if there are units online to the other controller.

RESTART THIS_CONTROLLER

Restarts this controller.

Format

RESTART THIS_CONTROLLER

Description

The RESTART THIS_CONTROLLER command flushes all user data from this controller's write-back cache (if present), then restarts this controller.

If any disks are online to the other controller, the controller does not restart unless the OVERRIDE_ONLINE qualifier is specified (HSD and HSJ only). If any user data cannot be flushed to disk, the controller does not restart unless the IGNORE_ERRORS qualifier is specified.

Specifying IMMEDIATE causes this controller to restart immediately without flushing any user data to the disks, even if drives are online to a host.

The RESTART THIS_CONTROLLER command does not cause a failover to the other controller in a dual-redundant configuration. This controller restarts and resumes operations where it was interrupted.

Note

If you enter the RESTART THIS_CONTROLLER command and you are using a virtual terminal to communicate with the controller, the connection is lost when the controller restarts.

Qualifiers for HSD and HSJ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller is not restarted unless IGNORE_ERROR is specified.

If the IGNORE_ERRORS qualifier is specified, the controller restarts even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE_SHUTDOWN
NOIMMEDIATE_SHUTDOWN (Default)
If IMMEDIATE is specified, the controller is immediately restarted without checking for online devices or flushing user data from write-back cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

OVERRIDE_ONLINE
NOOVERRIDE_ONLINE (Default)
If any units are online to the controller, the controller is not restarted unless OVERRIDE_ONLINE is specified.

If the OVERRIDE_ONLINE qualifier is specified, the controller restarts after all customer data is written to disk.

CAUTION

Customer data may be lost or corrupted if the OVERRIDE_ONLINE qualifier is specified.

Qualifiers for HSZ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller is not restarted unless IGNORE_ERROR is specified.

If the IGNORE_ERRORS qualifier is specified, the controller restarts even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE_SHUTDOWN
NOIMMEDIATE_SHUTDOWN (Default)
If IMMEDIATE is specified, the controller is immediately restarted without checking for online devices or flushing user data from write-back cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

Examples

1.
```
CLI> RESTART THIS_CONTROLLER
```

Restarts this controller as long as this controller does not have any units that are online.

2. `CLI> RESTART THIS_CONTROLLER OVERRIDE_ONLINE`

   Restarts this controller even if there are units online to this controller.

RETRY_ERRORS UNWRITEABLE_DATA

Tries to write the unwriteable data on a unit.

Format

RETRY_ERRORS UNWRITEABLE_DATA *unit-number*

Parameters

unit-number
Specifies the logical unit number (for HSDs and HSJs D0–D4094 or T0–T4094, for HSZs D0–D7, D100-D107, and so forth) which the write operation of the unwriteable data is attempted. The *unit-number* is the name given the unit when it was created using the ADD UNIT command.

Description

If a container fails in a way that customer data in the write-back cache cannot be written to the container, the unwriteable data error is reported. If possible the condition that is causing the unwriteable data should be corrected and the write operation should be attempted again. RETRY_ERRORS UNWRITEABLE_DATA attempts to write the unwriteable data error. No data is lost if the retry fails.

Examples

1.
```
CLI> RETRY_ERRORS UNWRITEABLE_DATA D13
```

   Attempts to write the cached data on disk unit D13 that was previously marked unwriteable.

RUN

Runs a diagnostic or utility on THIS_CONTROLLER.

Format

RUN *program-name*

Parameters

program-name
The name of the diagnostic or utility to be run. DILX and CLONE are examples of utilities and diagnostics that can be run from the CLI.

Description

The RUN command starts various diagnostics and utilities on THIS_CONTROLLER. Diagnostics and utilities can be run *only* on the controller where the terminal or DUP connection is connected.

For specific information about available diagnostics and utilities, refer to Chapter 6.

Examples

1.
```
CLI> RUN DILX
Disk Inline Exerciser - version 2.0
             .
             .
             .
```
Runs the DILX diagnostic.

SELFTEST OTHER_CONTROLLER

Runs a self-test on the other controller.

Format

SELFTEST OTHER_CONTROLLER

Description

The SELFTEST OTHER_CONTROLLER command flushes all user data from the other controller's write-back cache (if present), shuts down the other controller, then restarts it in DAEMON loop-on-self-test mode. The OCP reset (//) button must be pressed to take the other controller out of loop-on-self-test mode.

If any disks are online to the other controller, the controller does not self-test unless the OVERRIDE_ONLINE qualifier is specified (HSD and HSJ only). If any user data cannot be flushed to disk, the controller does not self-test unless the IGNORE_ERRORS qualifier is specified.

Specifying IMMEDIATE causes the other controller to self-test immediately without flushing any user data to the disks, even if drives are online to the host.

Qualifiers for HSD and HSJ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller does not start the self-test unless IGNORE_ERRORS is specified.

If the IGNORE_ERRORS qualifier is specified, the controller starts the self-test even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE
NOIMMEDIATE (Default)
If IMMEDIATE is specified, the controller will immediately start self-test without checking for online devices or flushing user data from write cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

OVERRIDE_ONLINE
NOOVERRIDE_ONLINE (Default)
If any units are online to the controller, the controller does not self-test unless OVERRIDE_ONLINE is specified.

SELFTEST OTHER_CONTROLLER

If the OVERRIDE_ONLINE qualifier is specified, the controller starts the self-test after all customer data is written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the OVERRIDE_ONLINE qualifier is specified.

Qualifiers for HSZ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller does not start the self-test unless IGNORE_ERRORS is specified.

If the IGNORE_ERRORS qualifier is specified, the controller starts the self-test even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE
NOIMMEDIATE (Default)
If IMMEDIATE is specified, the controller will immediately start self-test without checking for online devices or flushing user data from write cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

Examples

1. `CLI> SELFTEST OTHER_CONTROLLER`

   Starts the self-test on the other controller, as long as the other controller does not have any units online.

2. `CLI> SELFTEST OTHER_CONTROLLER OVERRIDE_ONLINE`

   Starts the self-test on the other controller even if there are units online to the other controller.

SELFTEST THIS_CONTROLLER

Runs a self-test on this controller.

Format

SELFTEST THIS_CONTROLLER

Description

The SELFTEST THIS_CONTROLLER command flushes all user data from this controller's write-back cache (if present), shuts down this controller, then restarts it in DAEMON loop-on-self-test mode. The OCP reset (///) button must be pressed to take this controller out of loop-on-self-test mode.

If any disks are online to this controller, the controller does not self-test unless the OVERRIDE_ONLINE qualifier is specified (HSD and HSJ only). If any user data cannot be flushed to disk, the controller does not self-test unless the IGNORE_ERRORS qualifier is specified.

Specifying IMMEDIATE causes this controller to self-test immediately without flushing any user data to the disks, even if drives are online to a host.

Note

If you enter a SELFTEST THIS_CONTROLLER command, and you are using a virtual terminal to communicate with the controller, the connection is lost when this controller starts the self-test.

Qualifiers for HSD and HSJ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller does not start the self-test unless IGNORE_ERRORS is specified.

If the IGNORE_ERRORS qualifier is specified, the controller starts the self-test even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE
NOIMMEDIATE (Default)
If IMMEDIATE is specified, the controller will immediately start self-test without checking for online devices or flushing user data from write cache to disk.

SELFTEST THIS_CONTROLLER

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

OVERRIDE_ONLINE
NOOVERRIDE_ONLINE (Default)
If any units are online to the controller, the controller does not self-test unless OVERRIDE_ONLINE is specified.

If the OVERRIDE_ONLINE qualifier is specified, the controller starts the self-test after all customer data is written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the OVERRIDE_ONLINE qualifier is specified.

Qualifiers for HSZ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller does not start the self-test unless IGNORE_ERRORS is specified.

If the IGNORE_ERRORS qualifier is specified, the controller starts the self-test even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE
NOIMMEDIATE (Default)
If IMMEDIATE is specified, the controller will immediately start self-test without checking for online devices or flushing user data from write cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

Examples

1. `CLI> SELFTEST THIS_CONTROLLER`

   Starts the self-test on this controller as long as this controller does not have any units online.

SET *disk-container-name*

Changes the transportable characteristics of a disk drive.

Format

SET *disk-container-name*

Parameters

disk-container-name
The name of the disk drive that will have its characteristics changed.

Description

Changes the characteristics of a disk drive.

Qualifiers

TRANSPORTABLE
NOTRANSPORTABLE (Default)
In normal operations, the controller makes a small portion of the disk inaccessible to the host and uses this area to store metadata, which improves data reliability, error detection, and recovery. This vast improvement comes at the expense of transportability.

If NOTRANSPORTABLE is specified and there is no valid metadata on the unit, the unit must be initialized.

Note

Digital recommends that you avoid specifying TRANSPORTABLE unless transportability of disk drive or media is imperative and there is no other way to accomplish moving the data.

Examples

1.
```
CLI> SET DISK130 TRANSPORTABLE
```

Sets DISK130 to transportable.

SET FAILOVER

Places THIS_CONTROLLER and OTHER_CONTROLLER into a dual-redundant configuration.

Format

SET FAILOVER *COPY=configuration-source*

Parameters

COPY=*configuration-source*
Specifies where the ''good'' copy of the device configuration resides.

If THIS_CONTROLLER is specified for *configuration-source*, all the device configuration information on THIS_CONTROLLER (the one that either the maintenance terminal is connected to or the virtual terminal is connected to) is copied to the other controller.

If OTHER_CONTROLLER is specified for *configuration-source*, all the device configuration information on the OTHER_CONTROLLER (the controller that either the maintenance terminal or the virtual terminal connection is *not* connected to) is copied to this controller.

Description

The SET FAILOVER command places THIS_CONTROLLER and the OTHER_CONTROLLER in a dual-redundant configuration. After entering this command, if one of the two controllers fail, the devices and cache (if any) attached to the failed controller become available to and accessible through the operating controller.

CAUTION

All device configuration information on the controller *not* specified by the COPY= parameter is destroyed and overwritten by the configuration information found in the controller specified by the COPY= parameter. **Make sure you know where your good configuration information is stored, or you have a complete copy of the device configuration, BEFORE entering this command**.

A considerable amount of work and effort is lost by overwriting a good configuration with incorrect information if the wrong controller is specified by the COPY= parameter.

Also note that due to the amount of information that must be passed between the two controllers, this command may take up to 1 minute to complete.

Examples

1. `CLI> SET FAILOVER COPY=THIS_CONTROLLER`

   Places two controllers into a dual-redundant configuration, where the ‘‘good’’ data was on the controller that the maintenance terminal or virtual terminal connection was connected to.

2. `CLI> SET FAILOVER COPY=OTHER_CONTROLLER`

   Places two controllers into a dual-redundant configuration, where the ‘‘good’’ data was on the controller that the maintenance terminal or virtual terminal connection was *not* connected to.

SET *mirrorset-container-name*

Changes the characteristics of a mirrorset.

Format

SET *mirrorset-container-name*

Parameters

mirrorset-container-name
The name of the mirrorset that will have its characteristics modified. The name must start with a letter (A–Z) and can then consist of up to eight more characters made up of letters A–Z, numbers 0–9, periods (.), dashes (-), or underscores (_), for a total of nine characters.

Description

Changes the characteristics of a mirrorset.

Qualifiers

MEMBERSHIP=*number-of-members*
Allows you to increase or decrease the nominal membership of a mirrorset to the number specified by *number-of-members*.

If the mirrorset membership is increased, and auto-sparing is turned on (by specifying POLICY=BEST_FIT or POLICY=BEST_PERFORMANCE), the mirrorset automatically brings in spares until either the new number of members is reached, or there are no more suitable spares.

If auto-sparing is turned off (by specifying NOPOLICY), then you must use the SET *mirrorset-container-name* REPLACE=*disk-device-name* command to bring the mirrorset up to the new nominal number of members.

You may not set the nominal number of members to be lower than the number of members physically present. Use the REMOVE=*disk-container-name* qualifier to reduce the number of devices that are part of the mirrorset.

REPLACE=*disk-device-name*
Specifies the replacement of a disk member into an existing mirrorset provided the following two conditions are met:

- The replacement policy must be set to NOPOLICY.
- The mirrorset must be missing at least one member.

If these two conditions are met, the device specified by *disk-device-name* is added to the mirrorset specified by *mirrorset-container-name*. The nominal number of members does not change.

Note

No other qualifiers to the SET *mirrorset-device-name* command may be specified if the REPLACE qualifier is specified.

REMOVE=*disk-container-name*

The SET *mirrorset-container-name* REMOVE=*disk-device-name* CLI command allows you to remove members from an existing mirrorset. The device specified by *disk-device-name* is removed from the mirrorset specified by *mirrorset-container-name*. If the physical device is not a member of the mirrorset, or if the mirrorset will not have a remaining NORMAL or NORMALIZING member, then an error is reported and no action is taken. On successful removal, the removed device is added to the failedset and a new member is auto-spared into the mirrorset (if applicable).

Note

A **NORMAL** member is a mirrorset member whose entire contents is guaranteed to be the same as all other NORMAL members. All NORMAL members have exactly the same contents.

NORMALIZING members only exist when a mirrorset is first created. One member is identified as NORMAL, and all other *original* mirrorset members are marked as NORMALIZING. All new data that is written to the mirrorset is written to all members. All data on the NORMAL member that existed before the mirrorset was created is copied to the NORMALIZING members. When all the blocks on the members are the same, the NORMALIZING members are marked as NORMAL.

(Members may also be marked as NORMALIZING if cache data is lost.)

Note that the nominal number of members in the mirrorset does not change. If auto-sparing does not occur, then when an acceptable spare becomes available or when the replacement policy changes, the mirrorset automatically adds the spare.

Note

No other qualifiers to the SET *mirrorset-device-name* command may be specified if the REMOVE qualifier is specified.

POLICY=BEST_FIT
POLICY=BEST_PERFORMANCE (Default)
NOPOLICY

The SET *mirrorset-container-name* POLICY=*policy-type* command specifies the replacement policy to be used when a mirrorset member within the mirrorset fails.

BEST_FIT gives highest priority to finding a replacement device within the spareset that most closely matches the sizes of the remaining members of the mirrorset. If more than one device in the spareset is the correct size, the device that gives the best performance is selected.

BEST_PERFORMANCE (default) gives highest priority to finding a replacement device within the spareset that results in the best performance of the mirrorset (the device should be on a different port). If more than one device in the spareset has the best performance, the device that most closely matches the size of the remaining members of the mirrorset is selected.

NOPOLICY retries a failing device from the mirrorset without selecting a replacement. This causes the mirrorset to run with less than the nominal number of members until a BEST_FIT or BEST_PERFORMANCE policy is selected, or a member is manually replaced in the mirrorset.

READ_SOURCE=*read-source*

The SET *mirrorset-container-name* READ_SOURCE=*read-source* command allows you to control the read algorithm for the specified mirrorset. The following choices are allowed for read-source:

ROUND_ROBIN—Each NORMAL mirrorset member is the target of a read in sequential membership order. No preference is given to any NORMAL member. This is the default read-source.

LEAST_BUSY—The NORMAL mirrorset member with the least busy work queue is the target of the read.

device-container-name—All reads are done on *device-container-name*. If *device-container-name* fails out of the mirrorset, the READ_SOURCE algorithm reverts to LEAST_BUSY.

COPY=*copy_speed*

The SET *mirrorset-container-name* COPY=*copy_speed* command allows you to specify the speed at which mirrorset copies are performed. You may specify either NORMAL or FAST.

NORMAL uses relatively few controller resources to perform the copy, and has little impact on controller performance.

FAST uses more controller resources, which reduces the time it takes to complete the copy, but also reduces overall controller performance.

Examples

1.
```
CLI> SET MIRR9 POLICY=BEST_FIT
```

   Changes mirrorset MIRR9's policy to BEST_FIT.

2.
```
CLI> SET MIRR9 REMOVE=DISK0
```

   Removes mirrorset MIRR9's member DISK0 from the mirrorset. If there is a replacement policy, a new disk is taken from the spareset and placed in the mirrorset automatically.

3.
```
CLI> SET MIRR9 REPLACE=DISK320
```

   Adds disk DISK320 to the reduced mirrorset, MIRR9. A reconstruct operation begins immediately on DISK320.

SET NOFAILOVER

Removes THIS_CONTROLLER and OTHER_CONTROLLER (if reachable) from a dual-redundant configuration.

Format

SET NOFAILOVER

Description

The SET NOFAILOVER command removes THIS_CONTROLLER and the OTHER_CONTROLLER (if currently reachable) from a dual-redundant configuration. Before or immediately after entering this command, one controller should be physically removed because the sharing of devices is not supported by single controller configurations.

The controller on which the command was entered is always removed from a dual-redundant state, even if the other controller is not currently reachable. No configuration information is lost when leaving a dual-redundant state.

Examples

1.
```
CLI> SET NOFAILOVER
```

   Removes the two controllers from a dual-redundant configuration.

SET OTHER_CONTROLLER

Changes the other controller's parameters (in a dual-redundant configuration, the controller that the maintenance terminal is *not* connected to, or the controller that is *not* the target of the DUP connection.

Format

SET OTHER_CONTROLLER

Description

The SET OTHER_CONTROLLER command allows you to modify the controller parameters of the other controller in a dual-redundant configuration.

Qualifiers for HSD Controllers

CACHE_FLUSH_TIMER=*n*
CACHE_FLUSH_TIMER=DEFAULT
Specifies how many seconds (1–65535) of idle time may elapse before the write-back cache flushes its entire contents to disk. After the specified time, the write-back cache flushes its contents to disk to ensure data integrity. You must restart the controller before changes to the CACHE_FLUSH_TIMER take effect.

CACHE_POLICY=A (Default)
CACHE_POLICY=B
Allows selection of the write-back cache battery policy used by the controller. The policy affects the availability of RAIDsets and mirrorsets when the battery condition is low during controller intialization.

Changing this policy on one controller in a dual-redundant controller configuration automatically changes it on the other controller. The parameter change takes effect immediately.

The CACHE_POLICY setting affects RAIDsets and mirrorsets as follows:

- If the CACHE_POLICY on the controller is set to A and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is made inoperative.
- If the CACHE_POLICY on the controller is set to B and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is accessed in write-through (read cache) mode.

Regardless of the CACHE_POLICY setting, a low or bad battery affects controller operation:

- Stripesets and disk-based units with write-back caching enabled are accessed in write-through (read cache) mode, as long as unwritten cache data has not been lost.
- HSJ- and HSD-based RAIDsets and mirrorsets fail over to the companion cache in a dual-redundant configuration, provided the other cache's batteries are fully charged. RAIDsets and mirrorsets on HSZ and nonredundant controller systems will not fail over.

If the batteries go low after controller initialization, unwritten cache data is flushed from the cache and any RAIDset or mirrorset that does not have access to good batteries is made inoperative, regardless of the cache policy.

- If the batteries are bad or missing, RAIDsets and mirrorsets are made inoperative.
- Write-back caching automatically resumes when the cache batteries are fully recharged or replaced.

CAUTION

There is some risk in setting CACHE_POLICY=B to allow access to mirrorsets and RAIDsets when the batteries are low. Because the batteries may be in an unknown state, there is no guarantee as to how long they will maintain data in the cache should a power failure occur. Fully charged batteries will maintain the data for a minimum of 100 hours.

ID=*n*
Specifies the DSSI node number (0–7).

MSCP_ALLOCATION_CLASS=*n*
Specifies the allocation class (0–255 in a single controller configuration or 1–255 in a dual-redundant configuration).

When first installed, the controller's MSCP_ALLOCATION_CLASS is set to 0.

PATH
NOPATH
Enables or disables the DSSI port.

When first installed, NOPATH is set.

PROMPT="*new prompt*"
Specifies a 1- to 16-character prompt enclosed in quotes that will be displayed when the controller's CLI prompts for input. Only printable ASCII characters are valid.

When first installed, the CLI prompt is set to the first three letters of the controller's model number (for example, HSJ>, HSD> or HSZ>).

SCS_NODENAME="*xxxxxx*"
Specifies a one- to six-character name for node.

TERMINAL_PARITY=ODD
TERMINAL_PARITY=EVEN
NOTERMINAL_PARITY
Specifies the parity transmitted and expected. Parity options are ODD or EVEN. NOTERMINAL_PARITY causes the controller to not check for, or transmit any parity on the terminal lines.

When first installed, the controller's terminal parity is set to NOTERMINAL_PARITY.

TERMINAL_SPEED=*baud_rate*
Sets the terminal speed to 300, 600, 1200, 2400, 4800, 9600 or 19200 baud. The transmit speed is always equal to the receive speed.

When first installed, the controller's terminal speed is set to 9600 baud.

TMSCP_ALLOCATION_CLASS=*n*
Specifies the allocation class (0–255 in a single controller configuration or 1–255 in a dual-redundant configuration).

When first installed, the controller's TMSCP_ALLOCATION_CLASS is set to 0.

Qualifiers for HSJ Controllers

CI_ARBITRATION=ASYNCHRONOUS (Default)
CI_ARBITRATION=SYNCHRONOUS
ASYNCHRONOUS arbitration is currently (Version 2.5) implemented in HSJ HSOF.

SYNCHRONOUS is for future CI host adapters.

CACHE_FLUSH_TIMER=*n*
CACHE_FLUSH_TIMER=DEFAULT
Specifies how many seconds (1–65535) of idle time may elapse before the write-back cache flushes its entire contents to disk. After the specified time, the write-back cache flushes its contents to disk to ensure data integrity.

CACHE_POLICY=A (Default)
CACHE_POLICY=B
Allows selection of the write-back cache battery policy used by the controller. The policy affects the availability of RAIDsets and mirrorsets when the battery condition is low during controller intialization.

Changing this policy on one controller in a dual-redundant controller configuration automatically changes it on the other controller. The parameter change takes effect immediately.

The CACHE_POLICY setting affects RAIDsets and mirrorsets as follows:

- If the CACHE_POLICY on the controller is set to A and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is made inoperative.
- If the CACHE_POLICY on the controller is set to B and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is accessed in write-through (read cache) mode.

Regardless of the CACHE_POLICY setting, a low or bad battery affects controller operation:

- Stripesets and disk-based units with write-back caching enabled are accessed in write-through (read cache) mode, as long as unwritten cache data has not been lost.
- HSJ- and HSD-based RAIDsets and mirrorsets fail over to the companion cache in a dual-redundant configuration, provided the other cache's batteries are fully charged. RAIDsets and mirrorsets on HSZ and nonredundant controller systems will not fail over.

If the batteries go low after controller initialization, unwritten cache data is flushed from the cache and any RAIDset or mirrorset that does not have access to good batteries is made inoperative, regardless of the cache policy.

- If the batteries are bad or missing, RAIDsets and mirrorsets are made inoperative.
- Write-back caching automatically resumes when the cache batteries are fully recharged or replaced.

CAUTION

There is some risk in setting CACHE_POLICY=B to allow access to mirrorsets and RAIDsets when the batteries are low. Because the batteries may be in an unknown state, there is no guarantee as to how long they will maintain data in the cache should a power failure occur. Fully charged batteries will maintain the data for a minimum of 100 hours.

ID=*n*
Specifies the CI node number (0 through (MAX_NODES - 1)).

MAX_NODES=*n*
Specifies the maximum number of nodes (8, 16, or 32).

When first installed, the controller's MAX_NODES is set to 16.

MSCP_ALLOCATION_CLASS=*n*
Specifies the allocation class (0–255 in a single controller configuration or 1–255 in a dual-redundant configuration).

When first installed, the controller's MSCP_ALLOCATION_CLASS is set to 0.

PATH_A
NOPATH_A
Enables or disables CI Path A.

When first installed, NOPATH_A is set.

PATH_B
NOPATH_B
Enables or disables CI Path B.

When first installed, NOPATH_B is set.

PROMPT="*new prompt*"
Specifies a 1- to 16-character prompt enclosed in quotes that will be displayed when the controller's CLI prompts for input. Only printable ASCII characters are valid.

When first installed, the CLI prompt is set to the first three letters of the controller's model number (for example, HSJ>, HSD> or HSZ>).

SCS_NODENAME="*xxxxxx*"
Specifies a one- to six-character name for node.

TERMINAL_PARITY=ODD
TERMINAL_PARITY=EVEN
NOTERMINAL_PARITY
Specifies the parity transmitted and expected. Parity options are ODD or EVEN. NOTERMINAL_PARITY causes the controller to not check for, or transmit any parity on the terminal lines.

When first installed, the controller's terminal parity is set to NOTERMINAL_PARITY.

TERMINAL_SPEED=*baud_rate*
Sets the terminal speed to 300, 600, 1200, 2400, 4800, 9600 or 19200 baud. The transmit speed is always equal to the receive speed.

When first installed, the controller's terminal speed is set to 9600 baud.

TMSCP_ALLOCATION_CLASS=*n*
Specifies the allocation class (0–255 in a single controller configuration or 1–255 in a dual-redundant configuration).

When first installed, the controller's TMSCP_ALLOCATION_CLASS is set to 0.

Qualifiers for HSZ Controllers

CACHE_FLUSH_TIMER=*n*
CACHE_FLUSH_TIMER=DEFAULT
Specifies how many seconds (1–65535) of idle time may elapse before the write-back cache flushes its entire contents to disk. After the specified time, the write-back cache flushes its contents to disk to ensure data integrity.

CACHE_POLICY=A (Default)
CACHE_POLICY=B
Allows selection of the write-back cache battery policy used by the controller. The policy affects the availability of RAIDsets and mirrorsets when the battery condition is low during controller intialization.

Changing this policy on one controller in a dual-redundant controller configuration automatically changes it on the other controller. The parameter change takes effect immediately.

The CACHE_POLICY setting affects RAIDsets and mirrorsets as follows:

- If the CACHE_POLICY on the controller is set to A and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is made inoperative.
- If the CACHE_POLICY on the controller is set to B and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is accessed in write-through (read cache) mode.

Regardless of the CACHE_POLICY setting, a low or bad battery affects controller operation:

- Stripesets and disk-based units with write-back caching enabled are accessed in write-through (read cache) mode, as long as unwritten cache data has not been lost.

- HSJ- and HSD-based RAIDsets and mirrorsets fail over to the companion cache in a dual-redundant configuration, provided the other cache's batteries are fully charged. RAIDsets and mirrorsets on HSZ and nonredundant controller systems will not fail over.

  If the batteries go low after controller initialization, unwritten cache data is flushed from the cache and any RAIDset or mirrorset that does not have access to good batteries is made inoperative, regardless of the cache policy.
- If the batteries are bad or missing, RAIDsets and mirrorsets are made inoperative.
- Write-back caching automatically resumes when the cache batteries are fully recharged or replaced.

CAUTION

There is some risk in setting CACHE_POLICY=B to allow access to mirrorsets and RAIDsets when the batteries are low. Because the batteries may be in an unknown state, there is no guarantee as to how long they will maintain data in the cache should a power failure occur. Fully charged batteries will maintain the data for a minimum of 100 hours.

ID=(*n1[,nN]*)
Specifies from one to four SCSI target IDs (0–7). If two or more target IDs are specified, they must be enclosed in parenthesis and separated by a comma.

Note

The unit number determines which target the LUN will be available under. For example, D203 would be target 2, LUN 3. D500 would be target 5, LUN 0. D5 would be target 0, LUN 5.

If two HSZ controllers are in a dual-redundant configuration, each controller will have the same IDs. When you change the IDs on one controller, the other will automatically be updated.

PREFERRED_ID=(*n1[,nN]*)
NOPREFERRED_ID
In a dual-redundant configuration, PREFERRED_ID defines which targets will be handled by the specified controller. If two or more PREFERRED_IDs are specified, they must be enclosed in parenthesis and separated by a comma. The only PREFERRED_IDs that can be specified must have already been configured using the ID= qualifier.

For example, if you configured a HSZ with IDs 0, 1, and 2, you could specify preferred ids 0, 1, and 2 in any combination on the two controllers. If one controller had preferred ids 0 and 1, it would handle unit numbers 0–7 and 100–107 and the other controller would handle unit numbers 200–207.

When you change the PREFERRED_IDs on one controller, the other controller will be automatically be updated to support the remaining (if any) IDs.

By specifying NOPREFERRED_ID the controller does not respond to any target ID on the host's SCSI bus. However, in a dual-redundant mode, if the controller with PREFERRED_IDs specified were to fail, the controller with NOPREFERRED_ID would pick up the targets of the failed controller.

PROMPT="*new prompt*"
Specifies a 1- to 16-character prompt enclosed in quotes that will be displayed when the controller's CLI prompts for input. Only printable ASCII characters are valid.

When first installed, the CLI prompt is set to the first three letters of the controller's model number (for example, HSJ>, HSD> or HSZ>).

TERMINAL_PARITY=ODD
TERMINAL_PARITY=EVEN
NOTERMINAL_PARITY
Specifies the parity transmitted and expected. Parity options are ODD or EVEN. NOTERMINAL_PARITY causes the controller to not check for, or transmit any parity on the terminal lines.

When first installed, the controller's terminal parity is set to NOTERMINAL_PARITY.

TERMINAL_SPEED=*baud_rate*
Sets the terminal speed to 300, 600, 1200, 2400, 4800, 9600 or 19200 baud. The transmit speed is always equal to the receive speed.

When first installed, the controller's terminal speed is set to 9600 baud.

TIME=*dd-mmm-yyyy:hh:mm:ss*
The TIME= commmand specifies the date and time. If the controller is in a dual-redundant configuration, the time is communicated to the other controller.

Examples

1.
```
CLI> SET OTHER_CONTROLLER PATH_A PATH_B SPEED=1200
```

   Modifies the other HSJ controller's two CI paths and sets the terminal speed to 1200 baud.

SET *RAIDset-container-name*

Changes the characteristics of a RAIDset.

Format

SET *RAIDset-container-name*

Parameters

RAIDset-container-name
The name of the RAIDset that will have its characteristics modified.

Description

Changes the characteristics of a RAIDset.

Qualifiers

POLICY=BEST_FIT
POLICY=BEST_PERFORMANCE (Default)
NOPOLICY
Specifies the replacement policy to use when a member within the RAIDset fails.

BEST_FIT gives highest priority to finding a replacement device within the spareset that most closely matches the sizes of the remaining members of the RAIDset. After finding the most closely matching devices, the device that gives the best performance is selected.

BEST_PERFORMANCE (default) gives highest priority to finding a replacement device within the spareset that results in the best performance of the RAIDset. After finding the best performing devices, the device that most closely matches the size of the remaining members of the RAIDset is selected.

NOPOLICY retires a failing device from the RAIDset without selecting a replacement. This causes the RAIDset to run in a reduced state until a BEST_ FIT or BEST_PERFORMANCE policy is selected, or a member is manually replaced in the RAIDset (see SET *raidset-container-name*).

RECONSTRUCT=NORMAL (Default)
RECONSTRUCT=FAST
NORECONSTRUCT
Specifies the speed at which a RAIDset will be reconstructed when a new member is added to the RAIDset or immediately after the RAIDset is initialized.

RECONSTRUCT=NORMAL (default) balances overall performance of the controller against the demand of reconstructing the RAIDset.

RECONSTRUCT=FAST reconstructs the RAIDset at the fastest rate possible resulting in some loss of performance of the controller overall.

REMOVE=*disk-container-name*
Specifies the removal of a disk member from a RAIDset. If the RAIDset is already in a reduced state, an error is displayed and the command is rejected. If a replacement policy is specified, the replacement is taken from the spareset to replace the removed member using the specified policy. If NOPOLICY is

specified, the RAIDset continues to operate in a reduced state until a replacement is manually specified (see SET *RAIDset-container-name*) REPLACE=) or a policy is specified (see SET *RAIDset-container-name* POLICY=).

The disk removed via the REMOVE= command is added to the failedset.

Note

No other qualifiers to the SET *RAIDset-container-name* command may be specified if REMOVE is specified.

REPLACE=*disk-container-name*

Specifies the replacement of a disk member into a reduced RAIDset. If the RAIDset is not in a reduced state, an error is displayed and the command is rejected. If a replacement policy is already specified, an error is displayed and the command is rejected. If the disk specified is already being used by a configuration (including a spareset), an error is displayed and the command is rejected. Otherwise, the disk specified is added as a member to the specified RAIDset and a reconstruct operation begins immediately.

Note

No other qualifiers to the SET *RAIDset-container-name* command may be specified if REPLACE is specified.

Examples

1.
```
CLI> SET RAID9 POLICY=BEST_FIT
```

   Changes RAIDset RAID9's policy to BEST_FIT.

2.
```
CLI> SET RAID9 REMOVE=DISK0
```

   Removes RAIDset RAID9's member DISK0 from the RAIDset. If there is a replacement policy, a new disk is taken from the spareset and placed in the RAIDset automatically.

3.
```
CLI> SET RAID9 REPLACE=SPAREDISK
```

   Adds disk SPAREDISK to the reduced RAIDset, RAID9. A reconstruct operation begins immediately on SPAREDISK.

SET THIS_CONTROLLER

Changes this controller's parameters (the controller that the maintenance terminal is connected to or the target of the DUP connection).

Format

SET THIS_CONTROLLER

Description

The SET THIS_CONTROLLER command allows you to modify controller parameters on THIS_CONTROLLER in single and dual-redundant configurations.

Qualifiers for HSD Controllers

CACHE_FLUSH_TIMER=*n*
CACHE_FLUSH_TIMER=DEFAULT
Specifies how many seconds (1–65535) of idle time may elapse before the write-back cache flushes its entire contents to disk. After the specified time, the write-back cache flushes its contents to disk to ensure data integrity.

CACHE_POLICY=A (Default)
CACHE_POLICY=B
Allows selection of the write-back cache battery policy used by the controller. The policy affects the availability of RAIDsets and mirrorsets when the battery condition is low during controller intialization.

Changing this policy on one controller in a dual-redundant controller configuration automatically changes it on the other controller. The parameter change takes effect immediately.

The CACHE_POLICY setting affects RAIDsets and mirrorsets as follows:

- If the CACHE_POLICY on the controller is set to A and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is made inoperative.
- If the CACHE_POLICY on the controller is set to B and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is accessed in write-through (read cache) mode.

Regardless of the CACHE_POLICY setting, a low or bad battery affects controller operation:

- Stripesets and disk-based units with write-back caching enabled are accessed in write-through (read cache) mode, as long as unwritten cache data has not been lost.
- HSJ- and HSD-based RAIDsets and mirrorsets fail over to the companion cache in a dual-redundant configuration, provided the other cache's batteries are fully charged. RAIDsets and mirrorsets on HSZ and nonredundant controller systems will not fail over.

  If the batteries go low after controller initialization, unwritten cache data is flushed from the cache and any RAIDset or mirrorset that does not have access to good batteries is made inoperative, regardless of the cache policy.

- If the batteries are bad or missing, RAIDsets and mirrorsets are made inoperative.
- Write-back caching automatically resumes when the cache batteries are fully recharged or replaced.

CAUTION

There is some risk in setting CACHE_POLICY=B to allow access to mirrorsets and RAIDsets when the batteries are low. Because the batteries may be in an unknown state, there is no guarantee as to how long they will maintain data in the cache should a power failure occur. Fully charged batteries will maintain the data for a minimum of 100 hours.

ID=*n*
Specifies the DSSI node number (0–7).

MSCP_ALLOCATION_CLASS=*n*
Specifies the allocation class (0–255 in a single controller configuration or 1–255 in a dual-redundant configuration).

When first installed, the controller's MSCP_ALLOCATION_CLASS is set to 0.

PATH
NOPATH
Enables or disables the DSSI port.

When first installed, NOPATH is set.

PROMPT="*new prompt*"
Specifies a 1- to 16-character prompt enclosed in quotes that will be displayed when the controller's CLI prompts for input. Only printable ASCII characters are valid.

When first installed, the CLI prompt is set to the first three letters of the controller's model number (for example, HSJ>, HSD> or HSZ>).

SCS_NODENAME="*xxxxxx*"
Specifies a one- to six-character name for node.

TERMINAL_PARITY=ODD
TERMINAL_PARITY=EVEN
NOTERMINAL_PARITY
Specifies the parity transmitted and expected. Parity options are ODD or EVEN. NOTERMINAL_PARITY causes the controller to not check for, or transmit any parity on the terminal lines.

When first installed, the controller's terminal parity is set to NOTERMINAL_PARITY.

TERMINAL_SPEED=*baud_rate*
Sets the terminal speed to 300, 600, 1200, 2400, 4800, 9600 or 19200 baud. The transmit speed is always equal to the receive speed.

When first installed, the controller's terminal speed is set to 9600 baud.

TMSCP_ALLOCATION_CLASS=*n*
Specifies the allocation class (0–255 in a single controller configuration or 1–255 in a dual-redundant configuration).

When first installed, the controller's TMSCP_ALLOCATION_CLASS is set to 0.

Qualifiers for HSJ Controllers

CI_ARBITRATION=ASYNCHRONOUS (Default)
CI_ARBITRATION=SYNCHRONOUS
ASYNCHRONOUS arbitration is currently (Version 2.5) implemented in HSJ HSOF.

SYNCHRONOUS is for future CI host adapters.

CACHE_FLUSH_TIMER=*n*
CACHE_FLUSH_TIMER=DEFAULT
Specifies how many seconds (1–65535) of idle time may elapse before the write-back cache flushes its entire contents to disk. After the specified time, the write-back cache flushes its contents to disk to ensure data integrity.

CACHE_POLICY=A (Default)
CACHE_POLICY=B
Allows selection of the write-back cache battery policy used by the controller. The policy affects the availability of RAIDsets and mirrorsets when the battery condition is low during controller intialization.

Changing this policy on one controller in a dual-redundant controller configuration automatically changes it on the other controller. The parameter change takes effect immediately.

The CACHE_POLICY setting affects RAIDsets and mirrorsets as follows:

- If the CACHE_POLICY on the controller is set to A and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is made inoperative.
- If the CACHE_POLICY on the controller is set to B and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is accessed in write-through (read cache) mode.

Regardless of the CACHE_POLICY setting, a low or bad battery affects controller operation:

- Stripesets and disk-based units with write-back caching enabled are accessed in write-through (read cache) mode, as long as unwritten cache data has not been lost.
- HSJ- and HSD-based RAIDsets and mirrorsets fail over to the companion cache in a dual-redundant configuration, provided the other cache's batteries are fully charged. RAIDsets and mirrorsets on HSZ and nonredundant controller systems will not fail over.

  If the batteries go low after controller initialization, unwritten cache data is flushed from the cache and any RAIDset or mirrorset that does not have access to good batteries is made inoperative, regardless of the cache policy.
- If the batteries are bad or missing, RAIDsets and mirrorsets are made inoperative.

- Write-back caching automatically resumes when the cache batteries are fully recharged or replaced.

CAUTION

There is some risk in setting CACHE_POLICY=B to allow access to mirrorsets and RAIDsets when the batteries are low. Because the batteries may be in an unknown state, there is no guarantee as to how long they will maintain data in the cache should a power failure occur. Fully charged batteries will maintain the data for a minimum of 100 hours.

ID=*n*
Specifies the CI node number (0 through (MAX_NODES - 1)).

MAX_NODES=*n*
Specifies the maximum number of nodes (8, 16, or 32).

When first installed, the controller's MAX_NODES is set to 16.

MSCP_ALLOCATION_CLASS=*n*
Specifies the allocation class (0–255 in a single controller configuration or 1–255 in a dual-redundant configuration).

When first installed, the controller's MSCP_ALLOCATION_CLASS is set to 0.

PATH_A
NOPATH_A
Enables or disables CI Path A.

When first installed, NOPATH_A is set.

PATH_B
NOPATH_B
Enables or disables CI Path B.

When first installed, NOPATH_B is set.

PROMPT="*new prompt*"
Specifies a 1- to 16-character prompt enclosed in quotes that will be displayed when the controller's CLI prompts for input. Only printable ASCII characters are valid.

When first installed, the CLI prompt is set to the first three letters of the controller's model number (for example, HSJ>, HSD> or HSZ>).

SCS_NODENAME="*xxxxxx*"
Specifies a one- to six-character name for node.

TERMINAL_PARITY=ODD
TERMINAL_PARITY=EVEN
NOTERMINAL_PARITY
Specifies the parity transmitted and expected. Parity options are ODD or EVEN. NOTERMINAL_PARITY causes the controller to not check for, or transmit any parity on the terminal lines.

When first installed, the controller's terminal parity is set to NOTERMINAL_PARITY.

TERMINAL_SPEED=*baud_rate*
Sets the terminal speed to 300, 600, 1200, 2400, 4800, 9600 or 19200 baud. The transmit speed is always equal to the receive speed.

When first installed, the controller's terminal speed is set to 9600 baud.

TMSCP_ALLOCATION_CLASS=*n*
Specifies the allocation class (0–255 in a single controller configuration or 1–255 in a dual-redundant configuration).

When first installed, the controller's TMSCP_ALLOCATION_CLASS is set to 0.

Qualifiers for HSZ Controllers

CACHE_FLUSH_TIMER=*n*
CACHE_FLUSH_TIMER=DEFAULT
Specifies how many seconds (1–65535) of idle time may elapse before the write-back cache flushes its entire contents to disk. After the specified time, the write-back cache flushes its contents to disk to ensure data integrity.

CACHE_POLICY=A (Default)
CACHE_POLICY=B
Allows selection of the write-back cache battery policy used by the controller. The policy affects the availability of RAIDsets and mirrorsets when the battery condition is low during controller intialization.

Changing this policy on one controller in a dual-redundant controller configuration automatically changes it on the other controller. The parameter change takes effect immediately.

The CACHE_POLICY setting affects RAIDsets and mirrorsets as follows:

- If the CACHE_POLICY on the controller is set to A and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is made inoperative.
- If the CACHE_POLICY on the controller is set to B and the batteries are low when the controller initializes, any RAIDset or mirrorset that does not have access to good batteries is accessed in write-through (read cache) mode.

Regardless of the CACHE_POLICY setting, a low or bad battery affects controller operation:

- Stripesets and disk-based units with write-back caching enabled are accessed in write-through (read cache) mode, as long as unwritten cache data has not been lost.
- HSJ- and HSD-based RAIDsets and mirrorsets fail over to the companion cache in a dual-redundant configuration, provided the other cache's batteries are fully charged. RAIDsets and mirrorsets on HSZ and nonredundant controller systems will not fail over.

  If the batteries go low after controller initialization, unwritten cache data is flushed from the cache and any RAIDset or mirrorset that does not have access to good batteries is made inoperative, regardless of the cache policy.
- If the batteries are bad or missing, RAIDsets and mirrorsets are made inoperative.

- Write-back caching automatically resumes when the cache batteries are fully recharged or replaced.

CAUTION

There is some risk in setting CACHE_POLICY=B to allow access to mirrorsets and RAIDsets when the batteries are low. Because the batteries may be in an unknown state, there is no guarantee as to how long they will maintain data in the cache should a power failure occur. Fully charged batteries will maintain the data for a minimum of 100 hours.

ID=(*n1[,nN]*)
Specifies from one to four SCSI target IDs (0–7). If two or more target IDs are specified, they must be enclosed in parenthesis and separated by a comma.

Note

The unit number determines which target the LUN will be available under. For example, D203 would be target 2, LUN 3. D500 would be target 5, LUN 0. D5 would be target 0, LUN 5.

If two HSZ controllers are in a dual-redundant configuration, each controller will have the same IDs. When you change the IDs on one controller, the other will automatically be updated.

PREFERRED_ID=(*n1[,nN]*)
NOPREFERRED_ID
In a dual-redundant configuration, PREFERRED_ID defines which targets will be handled by the specified controller. If two or more PREFERRED_IDs are specified, they must be enclosed in parenthesis and separated by a comma. The only PREFERRED_IDs that can be specified must have already been configured using the ID= qualifier.

For example, if you configured a HSZ with IDs 0, 1, and 2, you could specify preferred ids 0, 1, and 2 in any combination on the two controllers. If one controller had preferred ids 0 and 1, it would handle unit numbers 0–7 and 100–107 and the other controller would handle unit numbers 200–207.

When you change the PREFERRED_IDs on one controller, the other controller will be automatically be updated to support the remaining (if any) IDs.

By specifying NOPREFERRED_ID the controller does not respond to any target ID on the host's SCSI bus. However, in a dual-redundant mode, if the controller with PREFERRED_IDs specified were to fail, the controller with NOPREFERRED_ID would pick up the targets of the failed controller.

PROMPT="*new prompt*"
Specifies a 1- to 16-character prompt enclosed in quotes that will be displayed when the controller's CLI prompts for input. Only printable ASCII characters are valid.

When first installed, the CLI prompt is set to the first three letters of the controller's model number (for example, HSJ>, HSD> or HSZ>).

TERMINAL_PARITY=ODD
TERMINAL_PARITY=EVEN
NOTERMINAL_PARITY
Specifies the parity transmitted and expected. Parity options are ODD or EVEN. NOTERMINAL_PARITY causes the controller to not check for, or transmit any parity on the terminal lines.

When first installed, the controller's terminal parity is set to NOTERMINAL_PARITY.

TERMINAL_SPEED=*baud_rate*
Sets the terminal speed to 300, 600, 1200, 2400, 4800, 9600 or 19200 baud. The transmit speed is always equal to the receive speed.

When first installed, the controller's terminal speed is set to 9600 baud.

TIME=*dd-mmm-yyyy:hh:mm:ss*
The TIME= commmand specifies the date and time. If the controller is in a dual-redundant configuration, the time is communicated to the other controller.

Examples

1. `CLI> SET THIS_CONTROLLER PATH_A PATH_B SPEED=1200`

   Modifies this HSJ controller's two CI paths and sets the terminal speed to 1200 baud.

2. `CLI> SET THIS_CONTROLLER ID=5`

   Sets this HSZ controller so it responds to requests for target 5.

3. `CLI> SET THIS_CONTROLLER ID=(2,5)`

   Sets this HSZ controller so it responds to requests for targets 2 and 5.

SET *unit-number*

Changes the unit parameters.

Format

SET *unit-number*

Parameters

unit-number
Specifies the logical unit number (for HSDs and HSJs D0–D4094 or T0–T4094, for HSZs D0–D7, D100-D107, and so forth) to modify the software switches. The *unit-number* is the name given the unit when it was created using the ADD UNIT command.

Description

The SET command is used to change logical unit parameters.

Qualifiers for a Unit Created from a CDROM Drive

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

Qualifiers for a Unit Created from a TRANSPORTABLE Disk Drive

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The

second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

Qualifiers for a Unit Created from a NOTRANSPORTABLE Disk Drive

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The

second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

WRITEBACK_CACHE
NOWRITEBACK_CACHE (Default)
Enables and disables the controller's write-back cache on this unit.

Note

It may take up to 5 minutes to flush unwritten data from the write-back cache once you disable write-back caching.

Qualifiers for a Unit Created from a TRANSPORTABLE Optical Drive

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

Qualifiers for a Unit Created from a NOTRANSPORTABLE Optical Drive

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

WRITEBACK_CACHE
NOWRITEBACK_CACHE (Default)
Enables and disables the controller's write-back cache on this unit.

Note

It may take up to 5 minutes to flush unwritten data from the write-back cache once you disable write-back caching.

Qualifiers for a Unit Created from a RAIDset

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

Note

Writes may still be performed to a write-protected RAIDset to satisfy a reconstruct pass or to reconstruct a newly replaced member. However, write protect will disable the writing of any new data.

WRITEBACK_CACHE
NOWRITEBACK_CACHE (Default)
Enables and disables the controller's write-back cache on this unit.

Note

It may take up to 5 minutes to flush unwritten data from the write-back cache once you disable write-back caching.

Qualifiers for a Unit Created from a Stripeset

MAXIMUM_CACHED_TRANSFER=*n*
MAXIMUM_CACHED_TRANSFER=32 (Default)
Specifies the maximum size transfer in blocks to be cached by the controller. Any transfers over this size are not cached. Valid values are 1–1024.

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

READ_CACHE (Default)
NOREAD_CACHE
Enables and disables the controller's read cache on this unit.

RUN (Default)
NORUN
Enables and disables a unit's availibility to the host. When RUN (default) is specified, the devices that make up the unit will be spun up and the unit will be

made available to the host. If NORUN is specified, the devices that make up the unit will still be spun up, but the unit will not be made available to the host.

WRITE_PROTECT
NOWRITE_PROTECT (Default)
Enables and disables write protection of the unit.

WRITEBACK_CACHE
NOWRITEBACK_CACHE (Default)
Enables and disables the controller's write-back cache on this unit.

Note

It may take up to 5 minutes to flush unwritten data from the write-back cache once you disable write-back caching.

Qualifiers for a Unit Created from a Tape Drive (HSJ and HSD only)

DEFAULT_FORMAT=*format*
DEFAULT_FORMAT=DEVICE_DEFAULT (Default)
Specifies the tape format to be used unless overridden by the host. Note that not all devices support all formats. The easiest way to determine what formats are supported by a specific device is to enter the ''SHOW <tape unit number> DEFAULT_FORMAT= ?'' command—the valid options will be displayed.

Supported tape formats are as follows:

- DEVICE_DEFAULT (default)

  The default tape format is the default that the device uses, or, in the case of devices that can be set via switches on the front panel, the settings of those switches.
- 800BPI_9TRACK
- 1600BPI_9TRACK
- 6250BPI_9TRACK
- TZ85
- TZ86
- TZ87_NOCOMPRESSION
- TZ87_COMPRESSION
- DAT_NOCOMPRESSION
- DAT_COMPRESSION
- 3480_NOCOMPRESSION
- 3480_COMPRESSION

PREFERRED_PATH=THIS_CONTROLLER
PREFERRED_PATH=OTHER_CONTROLLER
NOPREFERRED_PATH (Default)

Note

The PREFERRED_PATH and NOPREFERRED_PATH qualifiers are valid for HSJ and HSD controllers only. The preferred path for HSZ controllers is determined by the unit number (the target portion of the unit number–the hundreds place) specified on the ADD UNIT command.

Specifies the preferred controller that the unit should be accessed through (PREFERRED_PATH=) or whether the unit may be accessed through either controller (NOPREFERRED_PATH).

The preferred path qualifier is used only if both controllers are running in a dual-redundant configuration. If one controller fails, then all the devices will be made accessible through the remaining controller, ignoring the preferred path setting.

When the failed controller is restarted, the drives automatically return to the controller specified by the preferred path qualifier.

Note

The PREFERRED_PATH qualifier may be specified on a single controller, however, the qualifier will not take effect until a second controller is added and the two controllers are configured for dual-redundancy. The second controller will inherit any PREFERRED_PATH settings, and the two controllers will operate using the preset PREFERRED_PATH options.

Examples

1.
```
CLI> SET D1 WRITE_PROTECT NOREAD_CACHE
```

   Sets the write protect and turns off the read cache on unit D1.

2.
```
CLI> SET T47 DEFAULT_FORMAT=1600BPI_9TRACK
```

   Sets unit T47 to 1600 bpi.

SHOW CDROMS

Shows all CDROM drives and drive information.

Format

SHOW CDROMS

Description

The SHOW CDROMS command displays all the CDROM drives known to the controller.

Qualifiers

FULL

If the FULL qualifier is specified, additional information may be displayed after each device.

Examples

1.
```
CLI> SHOW CDROM
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

CDROM230      cdrom            2    3    0                    D623
CDROM240      cdrom            2    4    0                    D624
```

Shows a basic listing of CDROMs.

2.
```
CLI> SHOW CDROM FULL
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

CDROM230      cdrom            2    3    0                    D623
          DEC      RRD44   (C) DEC  3593
CDROM240      cdrom            2    4    0                    D624
          DEC      RRD44   (C) DEC  3593
```

Shows a full listing of CDROMs.

SHOW *cdrom-container-name*

Shows information about a CDROM.

Format

SHOW *cdrom-container-name*

Parameters

cdrom-container-name
The name of the CDROM drive to be displayed.

Description

The SHOW *cdrom-container-name* command is used to show specific information about a particular CDROM drive.

Examples

1.
```
CLI> SHOW CDROM230
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

CDROM230      cdrom            2    3    0                    D623
          DEC      RRD44   (C) DEC  3593
```

A listing of CDROM CDROM230.

SHOW DEVICES

Shows physical devices and physical device information.

Format

SHOW DEVICES

Description

The SHOW DEVICES command displays all the devices known to the controller. First disks are shown, then tapes, then CDROMs and finally opticals.

Qualifiers

FULL

If the FULL qualifier is specified, additional information may be displayed after each device.

Information contained in the additional information is dependent on the device type.

Examples

1.
```
CLI> SHOW DEVICES
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

DI0           disk             1    0    0                    D100
DI1           disk             1    1    0                    D110
TAPE110       tape             3    1    0                    T110
TAPE130       tape             3    3    0                    T130
CDROM230      cdrom            2    3    0                    D623
CDROM240      cdrom            2    4    0                    D624
```

Shows a basic listing of devices attached to the controller.

2.
```
CLI> SHOW DEVICES FULL
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

DI0           disk             1    0    0                    D100
          DEC      RZ35     (C) DEC X388
DI1           disk             1    1    0                    D110
          DEC      RZ26     (C) DEC T386
TAPE110       tape             3    1    0                    T110
          DEC      TZ877    (C) DEC 930A
TAPE130       tape             3    3    0                    T130
          DEC      TZ877    (C) DEC 930A
CDROM230      cdrom            2    3    0                    D623
          DEC      RRD44    (C) DEC  3593
CDROM240      cdrom            2    4    0                    D624
          DEC      RRD44    (C) DEC  3593
```

Shows a full listing of devices attached to the controller.

SHOW DISKS

Shows all disk drives and drive information.

Format

SHOW DISKS

Description

The SHOW DISKS command displays all the disk drives known to the controller.

Qualifiers

FULL

If the FULL qualifier is specified, additional information may be displayed after each device.

Examples

1.
```
CLI> SHOW DISKS
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

DI0           disk             1    0    0                    D100
DI1           disk             1    1    0                    D110
```

Shows a basic listing of disks attached to the controller.

2.
```
CLI> SHOW DISKS FULL
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

DI0           disk             1    0    0                    D100
          DEC      RZ26     (C) DEC X388
        Switches:
          NOTRANSPORTABLE
        Size: 2050353 blocks
DI1           disk             1    1    0                    D110
          DEC      RZ26     (C) DEC T386
        Switches:
          NOTRANSPORTABLE
        Size: 2050353 blocks
```

Shows a full listing of disks attached to the controller.

SHOW *disk-container-name*

Shows information about a disk drive.

Format

SHOW *disk-container-name*

Parameters

disk-container-name
The name of the disk drive to be displayed.

Description

The SHOW *disk-container-name* command is used to show specific information about a particular disk.

Examples

1.
```
CLI> SHOW DI3
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

DI3           disk             1    3    0                   D130
          DEC      RZ26     (C) DEC X388
        Switches:
          NOTRANSPORTABLE
        Size: 2050353 blocks
```

Shows a listing of disk DI3.

SHOW FAILEDSET

Shows the members of the failedset.

Format

SHOW FAILEDSET

Description

The SHOW FAILEDSET command displays all the disk drives that are members of the failedset.

Examples

1.
```
CLI> SHOW FAILEDSET
Name          Storageset                    Uses             Used by
------------------------------------------------------------------------------

FAILEDSET     failedset                     DISK310
                                            DISK410
```

Shows a listing of the members of the failedset.

SHOW LOADERS

Note

This command is valid for HSJ and HSD controllers only.

Shows all loaders and loader information.

Format

SHOW LOADERS

Description

The SHOW LOADERS command displays all the loaders known to the controller.

Qualifiers

FULL
If the FULL qualifier is specified, additional information may be displayed after each device.

Examples

1.
```
CLI> SHOW LOADERS
Name          Type          Port Targ  Lun                    Used by
------------------------------------------------------------------------------
LDR511        loader           5    1    1                    CMD511
```

Basic listing of loaders.

2.
```
CLI> SHOW LOADERS FULL
Name          Type          Port Targ  Lun                    Used by
------------------------------------------------------------------------------

LDR511        loader           5    1    1                    CMD511
          DEC      TZ Media Changer 930A
```

Full listing of loaders.

SHOW *loader-container-name*

Note

This command is valid for HSJ and HSD controllers only.

Shows information about a loader.

Format

SHOW *loader-container-name*

Parameters

loader-container-name
The name of the loader to be displayed.

Description

The SHOW *loader-container-name* command is used to show specific information about a particular loader.

Examples

CLI> SHOW LDR511

1.
```
Name          Type          Port Targ  Lun                    Used by
------------------------------------------------------------------------------

LDR511        loader           5    1    1                    CMD511
          DEC      TZ Media Changer 930A
```

Listing of loader LDR511

SHOW MIRRORSETS

Shows all configured mirrorsets and any mirrorset-specific data related only to mirrorsets.

Format

SHOW MIRRORSETS

Description

The SHOW MIRRORSETS command displays all the mirrorsets known to the controller.

Qualifiers

FULL
If the FULL qualifier is specified, additional information may be displayed after each mirrorset.

Examples

1.
```
CLI> SHOW MIRRORSETS
Name       Storageset          Uses                 Used by
------------------------------------------------------------------------------
MIRR2      mirrorset           DISK110              STR0
                               DISK210
                               DISK310
                               DISK350

MIRR3      mirrorset           DISK120              STR0
                               DISK250

MIRR4      mirrorset           DISK330              STR0
```

MIRR2 is a four-member mirrorset. MIRR3 is a two-member mirrorset. MIRR4 is a one-member mirrorset. All three mirrorsets are members of stripeset STR0.

2.
```
CLI>SHOW MIRRORSETS FULL
Name          Storageset                    Uses             Used by
------------------------------------------------------------------------------
MIRR2         mirrorset                     DISK110          STR0
                                            DISK210
                                            DISK310
                                            DISK350
        Switches:
          POLICY (for replacement) = BEST_PERFORMANCE
          COPY (priority) = NORMAL
          READ_SOURCE = LEAST_BUSY
          MEMBERSHIP = 4, 4 members present
        State:
          DISK210   (member  0) is NORMAL
          DISK310   (member  1) is NORMAL
          DISK350   (member  2) is NORMAL
          DISK110   (member  3) is NORMAL
        Size: 2050353 blocks
```

```
MIRR3         mirrorset                      DISK120          STR0
                                             DISK250
        Switches:
          POLICY (for replacement) = BEST_PERFORMANCE
          COPY (priority) = FAST
          READ_SOURCE = LEAST_BUSY
          MEMBERSHIP = 2, 2 members present
        State:
          DISK250   (member  0) is NORMAL
          DISK120   (member  1) is NORMAL
        Size: 4109470 blocks
MIRR4         mirrorset                      DISK330          STR0
        Switches:
          POLICY (for replacement) = BEST_PERFORMANCE
          COPY (priority) = NORMAL
          READ_SOURCE = LEAST_BUSY
          MEMBERSHIP = 1, 1 member present
        State:
          DISK330   (member  0) is NORMAL
        Size: 2050353 blocks
```

Shows extended information for all mirrorsets known to the controller.

SHOW *mirrorset-container-name*

Shows the same information as SHOW MIRRORSETS FULL except that it only displays information on the mirrorset specified by *mirrorset-container-name*.

Format

SHOW *mirrorset-container-name*

Parameters

mirrorset-container-name
The name of the mirrorset to be displayed.

Description

The SHOW *mirrorset-container-name* command is used to show specific information about a particular mirrorset.

Examples

1.
```
CLI>SHOW MIRR0

Name          Storageset                    Uses             Used by
------------------------------------------------------------------------------
MIRR0         mirrorset                     DISK130          D290
        Switches:
          NOPOLICY (for replacement)
          COPY (priority) = NORMAL
          READ_SOURCE = LEAST_BUSY
          MEMBERSHIP = 2, 1 member present
        State:
          DISK130   (member  0) is NORMAL
        Size: 4109470 blocks
```

Shows a complete listing of the mirrorset named MIRR0.

SHOW OPTICALS

Shows all optical drives and drive information.

Format

SHOW OPTICALS

Description

The SHOW OPTICALS command displays all the optical drives known to the controller.

Qualifiers

FULL

If the FULL qualifier is specified, additional information may be displayed after each device.

Examples

1.
```
CLI> SHOW OPTICALS
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

OP0           optical          1    0    0                    D100
OP1           optical          1    1    0                    D110
```

Shows a basic listing of optical drives attached to the controller.

2.
```
CLI> SHOW OPTICALS FULL
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

OP0           optical          1    0    0                    D100
          DEC      RWZ52     (C)DEC 3404
OP1           optical          1    1    0                    D110
          DEC      RWZ52     (C)DEC 3404
```

Shows a full listing of optical drives attached to the controller.

SHOW *optical-container-name*

Shows information about an optical drive.

Format

SHOW *optical-container-name*

Parameters

optical-container-name
The name of the optical drive to be displayed.

Description

The SHOW *optical-container-name* command is used to show specific information about a particular optical drive.

Examples

1.
```
CLI> SHOW OP3
Name          Type          Port Targ  Lun                    Used by
-------------------------------------------------------------------------------

OP3           optical          1    1    0                    D110
          DEC      RWZ52     (C)DEC 3404
```

Shows a listing of optical drive DI3.

SHOW OTHER_CONTROLLER

Shows information for the other controller.

Format

SHOW OTHER_CONTROLLER

Description

Shows all controller, port, and terminal information for the other controller.

Qualifiers

FULL

If the FULL qualifier is specified, additional information is displayed after the basic controller information.

Examples

1.
```
CLI> SHOW OTHER_CONTROLLER
Controller:
        HSJ40    (C) DEC ZG01234567 Firmware V2.5, Hardware 0000
        Configured for dual-redundancy with ZG00100101
            In dual-redundant configuration
        SCSI address 7
        Time: 14-FEB-1995 18:03:57
Host port:
        Node name: HSJA1, valid CI node 5, 32 max nodes
        System ID 4200100501AF
        Path A is ON
        Path B is ON
        MSCP allocation class    4
        TMSCP allocation class   4
Cache:
        16 megabyte write cache, version 2
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache

        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)

 CACHE_POLICY = A

        CI_ARBITRATION = ASYNCRONOUS
```

Shows the basic HSJ controller information.

2.
```
CLI> SHOW OTHER_CONTROLLER
Controller:
        HSD30    (C) DEC ZG33400022 Firmware V2.5, Hardware 0000
        Configured for dual-redundancy with ZG33400026
            In dual-redundant configuration
        SCSI address 6
        Time: 14-FEB-1995 18:23:27
Host port:
        Node name: HSD000, valid DSSI node 0
        Host path is ON
```

```
        MSCP allocation class    9
        TMSCP allocation class   9
Cache:
        32 megabyte write cache, version 2
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache

        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)

        CACHE_POLICY = A
```

Shows the basic HSD controller information.

3.
```
CLI> SHOW OTHER_CONTROLLER
Controller:
        HSZ40    (C) DEC CX44332211 Firmware V2.5, Hardware 0000
        Configured for dual-redundancy with CX55555555
            In dual-redundant configuration
        SCSI address 6
        Time: NOT SET
Host port:
        SCSI target(s) (0, 1, 2, 3), Preferred target(s) (2, 3)
Cache:
        16 megabyte write cache, version 2
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
        CACHE_POLICY = A
```

Shows the basic HSZ controller information.

4.
```
CLI> SHOW OTHER_CONTROLLER FULL
Controller:
        HSJ40    (C) DEC ZG01234567 Firmware V2.5, Hardware 0000
        Configured for dual-redundancy with ZG00100101
            In dual-redundant configuration
        SCSI address 7
        Time: 14-FEB-1995 18:03:57
Host port:
        Node name: HSJA1, valid CI node 5, 32 max nodes
        System ID 4200100501AF
        Path A is ON
        Path B is ON
        MSCP allocation class    4
        TMSCP allocation class   4
Cache:
        16 megabyte write cache, version 2
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Licensing information:
        RAID (Raid option) is ENABLED, license key is VALID
        WBCA (Writeback Cache option) is ENABLED, license key is VALID
Extended information:
        Terminal speed 19200 baud, eight bit, no parity, 1 stop bit
        Operation control: 00000005  Security state code: 41891
```

Shows a full HSJ controller information listing.

SHOW PASSTHROUGH

Shows passthrough containers and container information.

Format

SHOW PASSTHROUGH

Description

The SHOW PASSTHROUGH command displays all the passthrough containers known by the controller.

Qualifiers

FULL

If the FULL qualifier is specified, additional information may be displayed after each storageset.

Examples

1.
```
CLI> SHOW PASSTHROUGH
MASS> sho pass
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------------

CMD100        passthrough                   DISK100          D610
CMD240        passthrough                   DISK240          D624
CMD310        passthrough                   CD310            D631
CMD320        passthrough                   CD320            D632
CMD640        passthrough                   LDR400           D640
```

Shows a listing of all passthrough containers.

SHOW *passthrough-container-name*

Shows information about a passthrough container.

Format

SHOW *passthrough-container-name*

Parameters

passthrough-container-name
The name of the passthrough container to be displayed.

Description

The SHOW *passthrough-container-name* command is used to show specific information about a passthrough container.

Examples

1.
```
CLI> SHOW CMD100
MASS> sho pass
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------------

CMD100        passthrough                   DISK100          D610
```

Shows a listing of passthrough container CMD100.

SHOW RAIDSETS

Shows RAIDsets and RAIDset information.

Format

SHOW RAIDSETS

Description

The SHOW RAIDSETS command displays all the RAIDsets known by the controller.

Qualifiers

FULL

If the FULL qualifier is specified, additional information may be displayed after each storageset.

Examples

1.
```
CLI> SHOW RAIDSETS
Name          Storageset                    Uses             Used by
------------------------------------------------------------------------------

R0            raidset                       DISK110          D401
                                            DISK220
                                            DISK310
                                            DISK400

R1            raidset                       DISK130
                                            DISK240
                                            DISK330
                                            DISK420
```

Shows a basic listing of all RAIDsets.

2.
```
CLI> SHOW RAIDSETS FULL
Name          Storageset                    Uses             Used by
------------------------------------------------------------------------------

R0            raidset                       DISK110          D401
                                            DISK220
                                            DISK310
                                            DISK400
        Switches:
          POLICY (for replacement) = BEST_PERFORMANCE
          RECONSTRUCT (priority) = NORMAL
          CHUNKSIZE = 63 blocks
        State:
          RECONSTRUCT 3% complete
          DISK220   (member  0) is RECONSTRUCTING
          DISK310   (member  1) is RECONSTRUCTING
          DISK400   (member  2) is RECONSTRUCTING
        Size: 2050353 blocks
```

SHOW RAIDSETS

```
R1            raidset                          DISK130
                                               DISK240
                                               DISK330
                                               DISK420
        Switches:
          POLICY (for replacement) = BEST_PERFORMANCE
          RECONSTRUCT (priority) = NORMAL
          CHUNKSIZE = 63 blocks
        State:
          NORMAL
          DISK130   (member  0) is NORMAL
          DISK240   (member  1) is NORMAL
          DISK330   (member  2) is NORMAL
          DISK420   (member  3) is NORMAL
        Size: 2050353 blocks
```

Shows a full listing of all RAIDsets.

SHOW *raidset-container-name*

Shows information about a RAIDset.

Format

SHOW *raidset-container-name*

Parameters

raidset-container-name
The name of the RAIDset to be displayed.

Description

The SHOW *raidset-container-name* command is used to show specific information about a particular RAIDset.

Examples

1.
```
CLI> SHOW RAID9
Name          Storageset                      Uses             Used by
-------------------------------------------------------------------------------

RAID9         raidset                         DISK130
                                              DISK240
                                              DISK330
                                              DISK420
        Switches:
          POLICY (for replacement) = BEST_PERFORMANCE
          RECONSTRUCT (priority) = NORMAL
          CHUNKSIZE = 63 blocks
        State:
          NORMAL
          DISK130   (member  0) is NORMAL
          DISK240   (member  1) is NORMAL
          DISK330   (member  2) is NORMAL
          DISK420   (member  3) is NORMAL
        Size: 2050353 blocks
```

Shows a listing of RAIDset RAID9.

SHOW SPARESET

Shows the members of the spareset.

Format

SHOW SPARESET

Description

The SHOW SPARESET command displays all the disk drives that are members of the spareset.

Examples

1.
```
CLI> SHOW SPARESET
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------------

SPARESET      spareset                      DISK150
                                            DISK350
                                            DISK440
```

Shows a list of the members of the spareset.

SHOW STORAGESETS

Shows storagesets and storageset information.

Format

SHOW STORAGESETS

Description

The SHOW STORAGESETS command displays all the storagesets known by the controller. A storageset is any collection of containers, such as stripesets, mirrorsets, RAIDsets, the spareset and the failedset.

Stripesets are displayed first, followed by mirrorsets, RAIDsets, sparesets, failedsets, and then passthrough containers.

Qualifiers

FULL

If the FULL qualifier is specified, additional information may be displayed after each storageset.

Examples

1.
```
CLI> SHOW STORAGESETS
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------------

S0            stripeset                     DISK500          D1
                                            DISK510
                                            DISK520
```

Shows a basic listing of all storagesets.

2.
```
CLI> SHOW STORAGESETS FULL
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------------

S0            stripeset                     DISK530
                                            DISK550
                                            DISK600
        Switches:
          CHUNKSIZE = 24 blocks
        State:
          NORMAL
          DISK530   (member  0) is NORMAL
          DISK550   (member  1) is NORMAL
          DISK600   (member  2) is NORMAL
        Size: 2050353 blocks
```

SHOW STORAGESETS

```
S1            stripeset                     DISK620
                                            DISK640
        Switches:
          CHUNKSIZE = 24 blocks
        State:
          NORMAL
          DISK620   (member  0) is NORMAL
          DISK640   (member  1) is NORMAL
        Size: 31304354 blocks

R0            raidset                       DISK110          D401
                                            DISK220
                                            DISK310
                                            DISK400
        Switches:
          POLICY (for replacement) = BEST_PERFORMANCE
          RECONSTRUCT (priority) = NORMAL
          CHUNKSIZE = 63 blocks
        State:
          NORMAL
          DISK110   (member  0) is NORMAL
          DISK220   (member  1) is NORMAL
          DISK310   (member  2) is NORMAL
          DISK400   (member  3) is NORMAL
        Size: 2050353 blocks

R1            raidset                       DISK130
                                            DISK240
                                            DISK330
                                            DISK420
        Switches:
          POLICY (for replacement) = BEST_PERFORMANCE
          RECONSTRUCT (priority) = NORMAL
          CHUNKSIZE = 63 blocks
        State:
          NORMAL
          DISK130   (member  0) is NORMAL
          DISK240   (member  1) is NORMAL
          DISK330   (member  2) is NORMAL
          DISK420   (member  3) is NORMAL
        Size: 2050353 blocks

SPARESET      spareset                      DISK150
                                            DISK350
                                            DISK440

FAILEDSET     failedset

CMD100        passthrough                   DISK100          D610

CMD240        passthrough                   DISK250          D624

CMD310        passthrough                   CD310            D631
```

Shows a full listing of all storagesets.

SHOW STRIPESETS

Shows stripesets and related stripeset information.

Format

SHOW STRIPESETS

Description

The SHOW STRIPESET command displays all the stripesets known by the controller.

Qualifiers

FULL

If the FULL qualifier is specified, additional information may be displayed after each storageset.

Examples

1.
```
CLI> SHOW STRIPESETS
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------------

S0            stripeset                     DISK500          D1
                                            DISK510
                                            DISK520

S1            stripeset                     DISK400          D17
                                            DISK410
                                            DISK420
```

Shows a basic listing of all stripesets.

2.
```
CLI> SHOW STRIPESETS FULL
Name          Storageset                    Uses             Used by
-------------------------------------------------------------------------------

S0            stripeset                     DISK530
                                            DISK550
                                            DISK600

        Switches:
          CHUNKSIZE = 24 blocks
        State:
          NORMAL
          DISK530   (member  0) is NORMAL
          DISK550   (member  1) is NORMAL
          DISK600   (member  2) is NORMAL
        Size: 2050353 blocks
```

SHOW STRIPESETS

```
S1            stripeset                      DISK620
                                             DISK640
        Switches:
          CHUNKSIZE = 24 blocks
        State:
          NORMAL
          DISK620   (member  0) is NORMAL
          DISK640   (member  1) is NORMAL
        Size: 2050353 blocks
```

Shows a full listing of all stripesets.

SHOW *stripeset-container-name*

Shows information about a specific stripeset.

Format

SHOW *stripeset-container-name*

Parameters

stripeset-container-name
The name of the stripeset to be displayed.

Description

The SHOW *stripeset-container-name* command is used to show specific information about a particular stripeset.

Examples

1.
```
CLI> SHOW STRIPE0
Name          Storageset                      Uses             Used by
-------------------------------------------------------------------------------

STRIPE0       stripeset                       DISK530
                                              DISK550
                                              DISK600
        Switches:
          CHUNKSIZE = 24 blocks
        State:
          NORMAL
          DISK530   (member  0) is NORMAL
          DISK550   (member  1) is NORMAL
          DISK600   (member  2) is NORMAL
        Size: 2050353 blocks
```

Shows a listing of stripeset STRIPE0.

SHOW TAPES

Note

This command is valid for HSJ and HSD controllers only.

Shows all tape drives and tape drive information.

Format

SHOW TAPES

Description

The SHOW TAPES command displays all the tape drives known to the controller.

Qualifiers

FULL

If the FULL qualifier is specified, additional information may be displayed after each device.

Examples

1.
```
CLI> SHOW TAPES
Name          Type          Port Targ  Lun                    Used by
------------------------------------------------------------------------------

TAPE200       tape             2    0    0
```

Shows a basic listing of tape drives.

2.
```
CLI> SHOW TAPES FULL
Name          Type          Port Targ  Lun                    Used by
------------------------------------------------------------------------------

TAPE200       tape             2    0    0
          DEC      TLZ06     (C)DEC 0491
```

Shows a full listing of tape drives.

SHOW *tape-container-name*

Note

This command is valid for HSJ and HSD controllers only.

Shows information about a specific tape drive.

Format

SHOW *tape-container-name*

Parameters

tape-container-name
The name of the tape drive to be displayed.

Description

The SHOW *tape-container-name* command is used to show specific information about a particular tape drive.

Examples

1.
```
HSJB0> SHOW TAPE200
Name          Type          Port Targ  Lun                    Used by
------------------------------------------------------------------------------

TAPE200       tape            2    0    0
          DEC      TLZ06     (C)DEC 0491
```

Shows a listing of TAPE200.

SHOW THIS_CONTROLLER

Shows information for this controller.

Format

SHOW THIS_CONTROLLER

Description

Shows all controller, port, and terminal information for this controller.

Qualifiers

FULL
If the FULL qualifier is specified, additional information is displayed after the basic controller information.

Examples

1.
```
CLI> SHOW THIS_CONTROLLER
Controller:
        HSJ40    (C) DEC ZG00100101 Firmware XMDV-0, Hardware 0000
        Configured for dual-redundancy with ZG01234567
            In dual-redundant configuration
        SCSI address 6
        Time: 18-AUG-1994 18:02:39
Host port:
        Node name: FREDDY, valid CI node 3, 32 max nodes
        System ID 420010031B85
        Path A is ON
        Path B is ON
        MSCP allocation class    4
        TMSCP allocation class   4
Cache:
        16 megabyte write cache, version 2
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
```

Shows the basic HSJ controller information.

2.

```
CLI> SHOW THIS_CONTROLLER
Controller:
        HSD30    (C) DEC ZG33400026 Firmware XMDV-0, Hardware 0000
        Configured for dual-redundancy with ZG33400022
            In dual-redundant configuration
        SCSI address 7
        Time: 18-AUG-1994 18:23:55
Host port:
        Node name: HSD001, valid DSSI node 1
        Host path is ON
        MSCP allocation class    9
        TMSCP allocation class   9
Cache:
        32 megabyte write cache, version 2
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
```

Shows the basic HSD controller information.

3.

```
CLI> SHOW THIS_CONTROLLER
Controller:
        HSZ40    (C) DEC CX44332211 Firmware XVDV-0, Hardware 0000
        Configured for dual-redundancy with CX55555555
            In dual-redundant configuration
        SCSI address 6
        Time: NOT SET
Host port:
        SCSI target(s) (0, 1, 2, 3), Preferred target(s) (2, 3)
Cache:
        16 megabyte write cache, version 2
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
```

Shows the basic HSZ controller information.

4.

SHOW THIS_CONTROLLER

```
CLI> SHOW THIS_CONTROLLER FULL
Controller:
        HSJ40    (C) DEC ZG00100101 Firmware XMDV-0, Hardware 0000
        Configured for dual-redundancy with ZG01234567
            In dual-redundant configuration
        SCSI address 6
        Time: 18-AUG-1994 18:02:39
Host port:
        Node name: FREDDY, valid CI node 3, 32 max nodes
        System ID 420010031B85
        Path A is ON
        Path B is ON
        MSCP allocation class    4
        TMSCP allocation class   4
Cache:
        16 megabyte write cache, version 2
        Cache is GOOD
        Battery is GOOD
        No unflushed data in cache
        CACHE_FLUSH_TIMER = DEFAULT (10 seconds)
Licensing information:
        RAID (Raid5 + Writeback Cache) is ENABLED, license key is VALID
        WBCA (Writeback Cache ONLY) is ENABLED, license key is VALID
Extended information:
        Terminal speed 19200 baud, eight bit, no parity, 1 stop bit
        Operation control: 00000005  Security state code: 67110
```

Shows a full listing of HSJ controller information.

SHOW UNITS

Shows all units and unit information.

Format

SHOW UNITS

Description

The SHOW UNITS command displays all the units known by the controller. First disks (including CDROMs) are listed, then tapes.

Qualifiers

FULL

If the FULL qualifier is specified after UNITS, additional information may be displayed after each unit-number, such as the switch settings.

Examples

1.
```
CLI> SHOW UNITS
MSCP unit                                       Uses
-----------------------------------------------------------------

  D401                                          R0
  T41                                           TAPE200
```

Shows a basic listing of units available on the controller.

2.
```
CLI> SHOW UNITS FULL
MSCP unit                                       Uses
-----------------------------------------------------------------

  D401                                          R0
        Switches:
          RUN                    NOWRITE_PROTECT        READ_CACHE
          NOWRITEBACK_CACHE
          MAXIMUM_CACHED_TRANSFER_SIZE = 32
        State:
          AVAILABLE
          No exclusive access
          NOPREFERRED_PATH
        Size: 2050353 blocks
  T41                                           TAPE200
        Switches:
          DEFAULT_FORMAT = DEVICE_DEFAULT
        State:
          AVAILABLE
          No exclusive access
          Current Format = DAT_DDS_NOCOMPRESSION
          NOPREFERRED_PATH
```

Shows a full listing of units available on the controller.

SHOW *unit-number*

Shows information about a specific unit.

Format

SHOW *unit-number*

Parameters

unit-number
The unit number of the unit that is to be displayed.

Description

The SHOW *unit-number* command is used to show specific information about a particular unit.

Examples

1.
```
CLI> SHOW D150
MSCP unit                                       Uses
-----------------------------------------------------------------

  D150                                          R0
        Switches:
          RUN                    NOWRITE_PROTECT        READ_CACHE
          NOWRITEBACK_CACHE
          MAXIMUM_CACHED_TRANSFER_SIZE = 32
        State:
          AVAILABLE
          No exclusive access
          NOPREFERRED_PATH
        Size: 2050353 blocks
```

Shows a listing of a specific disk unit.

2.
```
CLI> sho T110
MSCP unit                                       Uses
-----------------------------------------------------------------

  T110                                          TAPE200
        Switches:
          DEFAULT_FORMAT = DEVICE_DEFAULT
        State:
          AVAILABLE
          No exclusive access
          Current Format = DAT_DDS_NOCOMPRESSION
          NOPREFERRED_PATH
```

Shows a listing of a specific tape unit.

SHUTDOWN OTHER_CONTROLLER

Shuts down and does not restart the other controller.

Format

SHUTDOWN OTHER_CONTROLLER

Description

The SHUTDOWN OTHER_CONTROLLER command flushes all user data from the other controller's write-back cache (if present), then shuts down the other controller.

If any disks are online to the other controller, the controller does not shut down unless the OVERRIDE_ONLINE qualifier is specified (HSD and HSJ only). If any user data cannot be flushed to disk, the controller does not shut down unless the IGNORE_ERRORS qualifier is specified.

Specifying IMMEDIATE causes the other controller to shut down immediately without flushing any user data to the disks, even if drives are online to the host.

Qualifiers for HSD and HSJ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller is not shut down unless IGNORE_ERROR is specified.

If the IGNORE_ERRORS qualifier is specified, the controller shuts down even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE_SHUTDOWN
NOIMMEDIATE_SHUTDOWN (Default)
If IMMEDIATE is specified, the controller shuts down immediately without checking for online devices or flushing user data from write-back cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

OVERRIDE_ONLINE
NOOVERRIDE_ONLINE (Default)
If any units are online to the controller, the controller is not shutdown unless OVERRIDE_ONLINE is specified.

SHUTDOWN OTHER_CONTROLLER

If the OVERRIDE_ONLINE qualifier is specified, the controller shuts down after all customer data is written to disk.

CAUTION

Customer data may be lost or corrupted if the OVERRIDE_ONLINE qualifier is specified.

Qualifiers for HSZ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller is not shut down unless IGNORE_ERROR is specified.

If the IGNORE_ERRORS qualifier is specified, the controller shuts down even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE_SHUTDOWN
NOIMMEDIATE_SHUTDOWN (Default)
If IMMEDIATE is specified, the controller shuts down immediately without checking for online devices or flushing user data from write-back cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

Examples

1. `CLI> SHUTDOWN OTHER_CONTROLLER`

   Shuts down the other controller as long as the other controller does not have any units online.

2. `CLI> SHUTDOWN OTHER_CONTROLLER OVERRIDE_ONLINE`

   Shuts down the other controller even if there are units online to the other controller.

SHUTDOWN THIS_CONTROLLER

Shuts down and does not restart this controller.

Format

SHUTDOWN THIS_CONTROLLER

Description

The SHUTDOWN THIS_CONTROLLER command flushes all user data from this controller's write-back cache (if present), then shuts down this controller.

If any disks are online to this controller, the controller does not shut down unless the OVERRIDE_ONLINE qualifier is specified (HSD and HSJ only). If any user data cannot be flushed to disk, the controller does not shut down unless the IGNORE_ERRORS qualifier is specified.

Specifying IMMEDIATE causes this controller to shut down immediately without flushing any user data to the disks, even if drives are online to a host.

Note

If you issue a SHUTDOWN THIS_CONTROLLER command, communication with the controller is lost when this controller shuts down.

Qualifiers for HSD and HSJ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller is not shut down unless IGNORE_ERROR is specified.

If the IGNORE_ERRORS qualifier is specified, the controller shuts down even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE_SHUTDOWN
NOIMMEDIATE_SHUTDOWN (Default)
If IMMEDIATE is specified, the controller shuts down immediately without checking for online devices or flushing user data from write-back cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

SHUTDOWN THIS_CONTROLLER

OVERRIDE_ONLINE
NOOVERRIDE_ONLINE (Default)
If any units are online to the controller, the controller is not shutdown unless OVERRIDE_ONLINE is specified.

If the OVERRIDE_ONLINE qualifier is specified, the controller shuts down after all customer data is written to disk.

CAUTION

Customer data may be lost or corrupted if the OVERRIDE_ONLINE qualifier is specified.

Qualifiers for HSZ Controllers

IGNORE_ERRORS
NOIGNORE_ERRORS (Default)
If errors result when trying to write user data, the controller is not shut down unless IGNORE_ERROR is specified.

If the IGNORE_ERRORS qualifier is specified, the controller shuts down even if all customer data cannot be written to disk from the write-back cache.

CAUTION

Customer data may be lost or corrupted if the IGNORE_ERRORS qualifier is specified.

IMMEDIATE_SHUTDOWN
NOIMMEDIATE_SHUTDOWN (Default)
If IMMEDIATE is specified, the controller shuts down immediately without checking for online devices or flushing user data from write-back cache to disk.

CAUTION

Customer data may be lost or corrupted if the IMMEDIATE qualifier is specified.

Examples

1. `CLI> SHUTDOWN THIS_CONTROLLER`

   Shuts down this controller as long as this controller does not have any units online.

2. `CLI> SHUTDOWN THIS_CONTROLLER OVERRIDE_ONLINE`

   Shuts down this controller even if there are units online to this controller.

UNMIRROR *disk-device-name*

Converts a one member mirrorset back to a single device and deletes the mirrorset from the list of known mirrorsets.

Format

UNMIRROR *disk-device-name*

Description

Allows you to convert a mirrorset with one disk, specified by the disk name, *disk-device-name*, to a physical device. This command can be used on mirrorsets that are already members of higher level containers (stripesets or units).

Examples

1.
```
CLI> UNMIRROR DISK130
```

   Converts a DISK130 back to a single device. An error message prints if the disk is not a mirrorset.

B.2 CLI Messages

The following sections describe messages you can encounter during interactive use of the CLI.

B.2.1 Error Conventions

An Error *nnnn:* message means that the command did not complete. Except for a few of the failover messages (6000 series), no part of the command was executed. When encountering an error entering or exiting dual-redundant mode, some synchronization problems are unavoidable; the error message in such a case tells you what to do to get things back in synchronization.

Multiple error messages may result from one command.

Items in angle brackets (<>) are replaced at run time with names, numbers, and so on.

B.2.2 CLI Error Messages

Error 1000: The LUN portion of the unit number must be from 0 to 7
(for HSZ controllers)

Error 1000: Unit number must be from 0 to 4094
(for HSJ and HSD30 controller)

Explanation: This error results from an ADD UNIT command when the *n* in the D*n* or T*n* specified is out of range. The MSCP or TMSCP unit number after the ''D'' or ''T'' must be in the range of 0 to 4094.

Retry the ADD UNIT command with a correct number.

Error 1010: Maximum cached transfer size must be 1 through 1024 blocks

Explanation: This error results from a SET <unit number> or an ADD UNIT command when MAXIMUM_CACHED_TRANSFER_SIZE was specified. MAXIMUM_CACHED_TRANSFER_SIZE must be in the range 1 through 1024. Retry the SET or ADD command with a correct number.

Error 1020: CHUNKSIZE must be from <minimum> to <maximum>

Explanation: This error results from an INITIALIZE *storageset-container-name* command when CHUNKSIZE was specified. The chunk size must be DEFAULT or greater than 15. Retry the INITIALIZE command with DEFAULT or a correct number.

Error 1090: Tape unit numbers must start with the letter 'T'

Explanation: All tape unit numbers are of the form ''T*n*.'' This error is displayed if you add a tape unit that does not begin the unit number with the letter ''T.''

Retry the ADD command with the letter ''T'' at the start of the unit number.

Error 1100: Disk unit numbers must start with the letter 'D'

Explanation: All disk unit numbers are of the form ''D*n*.'' This error is displayed if you add a disk unit that does not begin the unit number with the letter ''D.''

Retry the ADD command with the letter ''D'' at the beginning of the unit number.

Error 1110: Unit numbers may not have leading zeros

Explanation: Tape and disk unit numbers may not be of the form ‘‘D03,’’ for example, ‘‘D3’’ should be specified.

Retry the ADD command without any leading zeros.

Error 1120: LUN <lun> is already used

Explanation: Lun number <lun> has already been used by a disk.

Retry the ADD command specifying a different LUN.

Error 1130: The unit number cannot exceed <max unit>

Explanation: You specified a unit number that was out-of-bounds.

Try to add the unit again using a unit number that is less than or equal to <max unit>.

Error 1140: Invalid unit number. Valid unit number range(s) are: <start> to <end>

Explanation: You attempted to create a unit out of the valid unit ranges. The valid unit ranges are given by the <start> and <end> values.

Retry the ADD command specifying a unit number in the correct range.

Error 1150: A restart of THIS_CONTROLLER is required before units may be added

Explanation: You changed the target IDs that THIS_CONTROLLER supports without restarting the controller, then tried to add a unit that is supported by the new target IDs. Before the new target ids may be used, a restart is required.

Restart the controller.

Error 1160: A restart of OTHER_CONTROLLER is required before units may be added

Explanation: You changed the target IDs that the OTHER_CONTROLLER supports without restarting the controller, then tried to add a unit that is supported by the new target IDs. Before the new target ids may be used, a restart is required.

Restart the controller.

Error 2000: Port must be 1 - <maximum port number>

Explanation: When adding a device, you specified a port less than 1 or greater than <maximum port number>.

Retry the command specifying a port within the range given.

Error 2010: Target must be 0 - <maximum target number>

Explanation: When adding a device, you specified a target greater than <maximum target number>.

In single controller configurations, <maximum target number> is 6. In dual-redundant configurations, <maximum target number> is 5.

Error 2020: LUN must be 0 - 7

Explanation: When adding a device, you specified a LUN greater than 7.

Error 2030: This port, target LUN combination already in use by another device

Explanation: When adding a device, you specified PTL that is already specified by another device.

Error 2040: Cannot set TRANSPORTABLE when device in use by an upper layer

Explanation: A disk cannot be set to TRANSPORTABLE when it is being used by an upper level (unit or storageset).

Error 2050: Cannot set NOTRANSPORTABLE when device in use by an upper layer

Explanation: A disk cannot be set to NOTRANSPORTABLE when it is being used by an upper level (unit or storageset).

Error 2060: Can only clear UNKNOWN errors on a device

Explanation: You attempted to clear UNKNOWN on a storageset or a unit.

Check the name of the device and reissue the command.

Error 3020: Cannot add <disk name>; This will cause too many members in MIRRORSET <mirrorset name>. Use a SET <mirrorset name> MEMBERSHIP=<new count> to command increase the membership count first

Explanation: You can not add more disks to a mirrorset than is specified by the mirrorset's membership count. In order to successfully do a SET <mirrorset name> REPLACE=<disk name>, to a ''full'' mirrorset, you must first increase the mirrorset count.

Error 3030: <disk name> is not a member of <mirrorset name>, cannot be used for the read source

Explanation: When specifying a specific disk as a read source for a mirrorset, the disk specified must be a member of the mirrorset.

Choose a disk that's a member of the mirrorset and retry the command.

Error 3040: Cannot set read source to a specific device if mirrorset not configured as a unit

Explanation: Setting a mirrorset's read source to a specific device cannot be accomplished if the mirrorset is not configured as a unit.

Create a unit from the mirrorset and try the command again.

Error 3050: <disk name> could not be initialized as a spare disk

Explanation: When adding spare disks to the spareset, they are initialized with special spare disk metadata. If the metadata cannot be written, error 3050 results.

Error 3060: <disk name> is not a member of the spareset

Explanation: You attempted to delete a disk drive from the spareset that was not a member of the spareset.

Error 3070: <disk name> is not a member of the failedset

Explanation: You attempted to delete a disk drive from the failedset that was not a member of the failedset.

Error 3080: <setname> can't be deleted

Explanation: You attempted to delete the spareset or the failedset. These containers cannot be deleted.

Error 3090: <licensable feature> support is not enabled on this controller

Explanation: You attempted to use a feature that requires a license, and the license was not enabled on this controller.

Error 3100: <licensable feature> support is not enabled on other controller

Explanation: You attempted to use a feature that requires a license, and the license was not enabled on the other controller.

Error 3110: <disk name> is not a member of <container name>, cannot remove it

Explanation: When issuing a SET <container name> REMOVE=<disk name>, the disk specified was not part of the container.

Check the device and container names and reissue the command.

Error 3120: <container name> is already reduced. Another member cannot be removed

Explanation: When issuing a SET <container name> REMOVE=<disk name>, the container was already in a reduced state. Add another disk before removing another member.

Error 3130: Unable to remove <disk name> from <container name>

Explanation: When issuing a SET <container name> REMOVE=<disk name>, the controller was unable to remove the device from the RAIDset.

Check for error conditions, and if none exist, contact Digital Multivendor Customer Services.

Error 3140: <disk name> is in a spareset. Remove it from the spareset first.

Explanation: When issuing a SET <container name> REPLACE=<disk name>, the disk specified was part of the spareset. A disk to be used as a replacement must not be part of any configuration.

Error 3150: <disk name> is still part of a configuration. Delete upper configuration first.

Explanation: When issuing a SET <container name> REPLACE=<disk name>, the disk specified was part of an existing configuration. A disk to be used as a replacement must not be part of any configuration.

Error 3160: <disk name> is not a disk. Can only use disks for replacement in a raidset.

Explanation: When issuing a SET <container name> REPLACE=<disk name>, the device identified by <disk name> was not a disk.

Error 3170: <container name> is not reduced. Cannot replace a member

Explanation: When issuing a SET <container name> REPLACE=<disk name>, the container specified was not reduced.

Remove a member before replacing it.

Error 3180: <container name> has a replacement policy specified. Cannot manually replace a member.

Explanation: When issuing a SET <container name> REPLACE=<disk name>, it was discovered that the container specified already had a replacement policy specified. A manual replacement cannot be done on a container with an automatic replacement policy.

Set the replacement policy for the container to NOPOLICY and try the replacement again.

Error 3190: Unable to replace <disk name> in <container name>

Explanation: When issuing a SET <container name> REPLACE=<disk name>, the controller was unable to replace the device into the RAIDset.

Check for error conditions, and if none exist, contact Digital Multivendor Customer Services.

Error 3200: No other switches may be specified on a REMOVE operation.

Explanation: When issuing a SET <container name> REMOVE=<disk name>, no other switches (such as POLICY) may be specified.

Error 3210: No other switches may be specified on a REPLACE operation.

Explanation: When issuing a SET <container name> REPLACE=<disk name>, no other switches (such as POLICY) may be specified.

Error 3220: A REPLACE may not be done on a raidset or mirrorset that is not configured as a unit

Explanation: A REPLACE operation may not be done on a RAIDset or MIRRORset that has not been configured as a unit.

Error 3230: <container name> is reconstructing <disk name>. Only <disk name> may be removed

Explanation: When issuing a SET <container name> REMOVE=<disk name> on a RAIDset that is already reconstructing, only the disk drive that is being reconstructed may be removed.

Error 3240: <storageset type> may not be initialized

Explanation: Sparesets and failedsets cannot be initialized.

Check the name of the container that you wish to initialize and try again.

Error 3250: A REMOVE may not be done on a raidset or mirrorset that is not configured as a unit

Explanation: A RAIDset or MIRRORset must be configured as a unit before a disk may be removed.

Create a unit from the RAIDset or MIRRORset and then remove the member.

Error 3260: <disk name> is a TRANSPORTABLE disk. TRANSPORTABLE disks cannot be used by storagesets. Do a SET <disk name> NOTRANSPORTABLE before using this disk in a storageset

Explanation: You cannot place a TRANSPORTABLE disk into a reduced RAIDset.

Set the disk NOTRANSPORTABLE and retry the command.

Error 3270: <disk name> not in NORMAL state. Only NORMAL state units may be specified as a read source

Explanation: You may not specify a MIRRORset member as a read source unless it's in NORMAL state.

Either wait for the desired disk to enter NORMAL state or choose another disk in the MIRRORset that's already in NORMAL state.

Error 3280: Cannot determine if <disk name> is in the NORMAL state

Explanation: Unable to determine at this point in time if the disk specified is in normal state.

Retry the command. If this error persists, call Digital Multivendor Customer Services.

Error 3290: Mirrorsets are limited to 6 members maximum

Explanation: A MIRRORset may only have 6 disks as members. If you try to exceed this amount the above message is printed.

Error 3300: Currently there are <current count> members in this mirrorset. You must specify a membership greater than or equal to <current count>.

Explanation: YOu attempted to set the number of MIRRORset members to less than the actual number of disk drives that make up this MIRRORset.

Either specify a number greater than or equal to the number of phsical disk drives that make up this MIRRORset or remove one or more disk disk drives, then reduce the member count.

Error 3310: No other switches may be specified on a MEMBERSHIP operation

Explanation: When specifying the number of members in a MIRRORset, no other switches may be specified.

Retry the command only specifying the membership count.

Error 3320: Unable to change membership on mirrorset <mirrorset name>

Explanation: Unable to set the membership count on the specified MIRRORset at this point in time.

Retry the command. If this error persists, call Digital Multivendor Customer Services.

Error 3330: Can only MIRROR disks. <disk name> is not a disk

Explanation: Only disks may be MIRRORed. If you specify a device other than a disk drive, the above error is printed.

Try the command again specifying a disk drive.

Error 3340: Can only UNMIRROR disks. <disk name> is not a disk

Explanation: Only disks may be unMIRRORed. If you specify a device other than a disk drive, the above error is printed.

Try the command again specifying a disk drive.

Error 3350 <disk name> must be configured under a mirrorset to UNMIRROR

Explanation: Only disk drives that are configured under mirrorsets may be unMIRRORed.

Specify a disk that is configured under a MIRRORset.

Error 3360: To UNMIRROR a disk, the mirrorset must contain only one member, the disk to be UNMIRROR. Mirrorset <mirrorset name> contains more than one member

Explanation: To unmirror a disk drive, only one disk may be a member of the MIRRORset.

REMOVE all disk drives but one and retry the command.

Error 3370: A MIRROR may not be done on a disk that is not configured as a unit

Explanation: To MIRROR a disk drive either it or the storageset that it belongs to must be configured as a unit.

Configure the disk drive or the storageset that it belongs to as a unit and retry the command.

Error 3380: An UNMIRROR may not be done on a disk that is not configured as a unit

Explanation: To UNMIRROR a disk drive either it or the storageset that it belongs to must be configured as a unit.

Configure the disk drive or the storageset that it belongs to as a unit and retry the command.

Error 3390: REDUCE of specified disks failed

Explanation: The requested REDUCE did not complete successfully.

Check the configuration to assure that it was not partially completed (some disks removed from the specified MIRRORset(s); if so, reconfigure and wait for all disks to return to the NORMAL state. If this error persists, call Digital Multivendor Customer Services.

Error 3400: <device name> is not a disk. Can only REDUCE disks

Explanation: Only disk drives may be specified on the REDUCE command.

Retry the command only specifying disks.

Error 3410: <disk name> was specified twice in the REDUCE command

Explanation: The disk drive name called out was specified twice in the REDUCE command line.

Retry the command with only specifying disk names once.

Error 3420: <disk name> is not part of the same unit as previous disks specified

Explanation: All disks specified on the REDUCE command must be used by one common unit. If the disks specified are in use by more than one unit, the above message is printed.

Retry the command specifying disks that all have one common unit as a parent.

Error 3430: A REDUCE may not be done on disks not configured as a unit

Explanation: A REDUCE command is only valid when the storageset is configured as a unit.

Configure the top most storageset as a unit and retry the command.

Error 3440: <disk name> is not a member of a mirrorset

Explanation: The disk drive specifed is not a member of a MIRRORset.

Retry the command only specifying disks that are members of MIRRORsets.

Error 3450: No NORMAL or NORMALIZING members would be left in MIRRORSET <mirrorset name>

Explanation: When reducing, at least one member that is in the NORMAL state must remain in each MIRRORset. This error results when the MIRRORset called out would not be left with at least one NORMAL member.

Make sure at least on NORMAL member will remain in each MIRRORset specified and retry the command.

Error 3460: !AC cannot be mirrored due to bad cache on <controller> controller

Explanation: In order to mirror a disk drive the writeback cache must be correctly operating on this, or if in a dual-redundant controller, both controllers. If it's not, the above error results.

Repair the cache on the problem controller(s) and retry the command.

Error 3470: Only 20 mirrorsets and raidsets total can be supported on a controller. This storageset not added.

Explanation: The total number of RAIDsets and MIRRORsets supported on the controller is 20; this error will result if you attempt to add an 21st MIRROR or RAIDset.

Delete unused RAID and MIRRORsets and retry the command.

Error 3480: Only 30 stripesets, mirrorsets and raidsets total can be supported on a controller. This storageset not added.

Explanation: The total number of RAIDsets, MIRRORsets and STRIPEsets supported on the controller is 30; this error will result if you attempt to add an 21st MIRROR, STRIPE or RAIDset.

Delete unused RAID, STRIPE and MIRRORsets and retry the command.

Error 4000: The CLI prompt must have 1 to 16 characters.

Explanation: This error results from a SET THIS_CONTROLLER or SET OTHER_CONTROLLER command with the qualifier PROMPT=. The length of the CLI prompt must be at least one character and may not exceed 16 characters.

Retry the command with the correct number of characters.

Error 4010: Illegal character in CLI prompt.

Explanation: A nonprintable character was specified. Only ASCII characters space '' '' through tilde ''~'' may be specified (hex 20–7E).

Error 4020: Terminal speed must be 300, 1200, 2400, 4800, 9600 or 19200

Explanation: This error results from a SET THIS_CONTROLLER or SET OTHER_CONTROLLER command with the argument TERMINAL_SPEED=. The only valid baud rates that may be specified are 300, 1200, 2400, 4800, 9600 or 19200 baud.

Retry the command with a correct terminal speed.

Error 4030: Controller ID must be in the range 0 to <max nodes minus 1>.

Explanation: The ID= was specified with a number greater than <max nodes minus 1>.

If increasing the controller's ID, set MAX_NODES first, then the controller's ID.

Error 4040: SCS nodename length must be from 1 to 6 characters.

Explanation: This error results from a SET THIS_CONTROLLER or SET OTHER_CONTROLLER command with the argument SCS_NODENAME=. The SCS node name must consist of one to six alphanumeric characters enclosed in quotes with an alphabetic character first.

Retry the command with a correct SCS node name length.

Error 4050: SCS nodename must start with an alpha character and contain only A-Z and 0-9

Explanation: This error results from a SET THIS_CONTROLLER or SET OTHER_CONTROLLER command with the argument SCS_NODENAME=. The SCS node name must consist of alphanumeric characters enclosed in quotes with an alphabetic character first.

Retry the command with a correct SCS node name.

Error 4060: Allocation class must be from <minimum> to 255

Explanation: An illegal MSCP or TMSCP allocation class was specified. The <minimum> is 0 for a single controller configuration, or 1 for a dual-redundant configuration.

Error 4070: Max nodes must be 2, 8, 16 or 32

Explanation: This error results from a SET THIS_CONTROLLER or SET OTHER_CONTROLLER command with the argument MAX_NODES=. Max nodes must be 2, 8, 16 or 32 nodes.

Retry the command with a correct max node number.

Error 4080: Current node ID too large for requested max nodes setting.

Explanation: This error results from a SET THIS_CONTROLLER or SET OTHER_CONTROLLER command with the arguments MAX_NODES= or ID=. MAX_NODES= was specified with a number less than the controller's ID or the controller's ID was specified with a number greater than MAX_NODES—1.

If decreasing MAX_NODES, set the controller's ID first, then MAX_NODES.

Error 4090: Module has invalid serial number. This controller cannot be used Call field service

Explanation: This error is typically the result of faulty Non-Volatile memory. This error cannot be fixed in the field.

A replacement controller must be orderd. Contact Digital Multivendor Customer Services.

Error 4100: Unable to RESTART other controller.

Explanation: A communication error occurred when trying to restart the other controller.

Retry the RESTART command.

Error 4110: Unable to SHUTDOWN other controller.

Explanation: A communication error occurred when trying to shutdown the other controller.

Retry the SHUTDOWN command.

Error 4120: Unable to SELFTEST other controller.

Explanation: A communication error occurred when trying to self-test the other controller.

Retry the SELFTEST command.

Error 4130: Unable to setup controller restart.

Explanation: A communication error occurred when trying to restart or self-test the other controller.

Retry the RESTART or SELFTEST command.

Error 4140: Unable to lock the other controller's NV memory

Explanation: Most configuration commands such as ADD, DELETE, and SET require both controllers in a dual-redundant configuration to be running so configuration changes can be recorded in both controllers. If one controller is not running, the above message results when you attempt to change the configuration.

Restart the other controller and try the command again, or SET NOFAILOVER on the remaining controller.

Error 4150: Unable to rundown the following units on the other controller: <list of problem units>

Explanation: When attempting to shut-down, restart or selftest the other controller, some units could not be successfully run down. This can be caused either by online units or errors when trying to rundown the units. Either rectify the problems on the problem units or issue the SHUTDOWN, RESTART or SELFTEST command with the OVERRIDE_ONLINE or IGNORE_ERRORS qualifiers.

Error 4160: Unable to rundown the following units on this controller: <list of problem units>

Explanation: When attempting to SHUTDOWN, RESTART or SELFTEST this controller, some units could not be successfully run down. This can be caused either by online units or errors when trying to rundown the units.

Either rectify the problems on the problem units or issue the SHUTDOWN, RESTART or SELFTEST command with the qualifier OVERRIDE_ONLINE or IGNORE_ERRORS.

Error 4170: Only <max targets> targets may be specified

Explanation: When setting THIS_CONTROLLER or OTHER_ CONTROLLER ID=, you specified too many IDs; you can only specify up to <max targets> IDs.

Retry the SET THIS_CONTROLLER ID= command with no more than <max targets> IDs specified.

Error 4180: Invalid unit number(s) still present that must be deleted before the controller ID may be changed. All unit numbers must be in the range(s): <start> to <end>

Explanation: You attempted to change the controller IDs when there were still units using those IDs. The current valid unit ranges are given by the <start> and <end> values.

Either delete the units that use the ID that will no longer be specified, or Retry the SET THIS_CONTROLLER ID= specifying the ID being used by the existing units.

Error 4190: The time must be specified in the format dd-mmm-yyyy:hh:mm:ss

Explanation: On the HSZ controllers only, the time must be specified as shown.

Retry the command using the correct time format.

Error 4200: CACHE_FLUSH_TIMER must be in the range 1 to 65535

Explanation: The value given for the CACHE_FLUSH_TIMER is out of range.

Reissue the command specifying a number in the range shown.

Error 4210: Only targets defined by the ID= command may be specified on the!/ PREFERRED_ID= qualifier"

;)

Explanation: HSZ only. The PREFERRED_IDs specified must be a subset of the IDs (targets) supported by the controller. When changing either the supported targets or the preferred ids, it was found that the PREFERRED_ IDs were not a subset of the IDs.

Reissue the command with valid PREFERRED_ID= arguments or change the IDs supported by the controller.

Error 5000: A program name must be from 1 to 6 characters in length

Explanation: This error results from a ‘‘RUN <program name>.’’

Error 5010: The requested program is currently busy.

Explanation: This error results from a ‘‘RUN <program name>.’’ The program requested is being run by someone else.

Error 5020: The requested program is unknown.

Explanation: This error results from a ‘‘RUN <program name>.’’

Enter ‘‘DIR’’ to get a list of available programs.

Error 5030: Insufficient memory for request.

Explanation: This error results from a ‘‘RUN <program name>’’ resource problem. Retry the command later.

Error 6000: Communication failure with the other controller.

Explanation: There was a communication problem with the other controller. This typically happens if the other controller is shutting down. If these messages happen often when the other controller is not shutting down, call Digital Multivendor Customer Services.

Error 6010: Other controller not present

Explanation: When asked to communicate with another controller (the result of any one of a number of commands), the other controller was found not to be running.

If the other controller is in the process of restarting, retry the command later. If the other controller is shut down or turned off, start it. If the other controller is no longer present, enter a SET NOFAILOVER command to take it out of dual-redundant mode.

Error 6020: Initial failover handshake not yet complete

Explanation: For a short period of time after start up, the two controllers must communicate to set up a dual-redundant mode. This setup time is typically less than 1 minute. If commands that require controller-to-controller communication are entered during this setup time, error 6020 results.

Retry the command later.

Error 6030: Unable to communicate with the other controller to setup FAILOVER

Explanation: Could not setup FAILOVER due to communication problems between the controllers.

Retry the command later.

Error 6040: The write of the other controller’s configuration information did not succeed; information may be in an inconsistent state. Before further use both controllers should be removed from dual-redundant mode (SET NOFAILOVER) and then placed back into dual-redundant mode (SET FAILOVER) to assure consistency

Explanation: Communication was lost in the middle of a SET FAILOVER command.

Follow the instructions included in the error message.

Error 6050: Communication failure with other controller while putting controllers into dual-redundant mode. Reissue SET FAILOVER command

Explanation: Communication was lost in the middle of a SET FAILOVER command.

Follow the instructions included in the error message.

Error 6070: Illegal command—this controller not configured for dual-redundancy

Explanation: A command was entered to a single controller configuration that requires two controllers to be in dual-redundant mode.

If two controllers are supposed to be in dual-redundant mode, enter a SET FAILOVER command. If not, do not enter the command that resulted in the error.

Error 6080: Illegal command—this controller not currently in dual-redundant mode

Explanation: A command was entered to a dual-redundant-configured controller, but the other controller was not available for communication.

Restart the other controller and wait until it is communicating with this controller. If this controller is no longer supposed to be in dual-redundant mode, enter a SET NOFAILOVER command.

Error 6090: In failover no device may be configured at target 6 <device type> <device name> is at PTL <port> <target> <lun>

Explanation: Target addresses 6 and 7 are used by the controllers when in a dual-redundant configuration. When in a single controller configuration, target 6 is available for use by devices. If devices are configured at target 6 and you attempt to install a dual-redundant configuration, this error is displayed for all devices that use target 6 and the controllers will not be placed in a dual-redundant configuration.

Reconfigure the drives both logically and physically so that target 6 is not used.

Error 6100: Allocation classes cannot be zero for a dual-redundant configuration. Set MSCP and TMSCP allocation classes to non-zero.

Explanation: If in a dual-redundant configuration, the allocation class must not be set to zero.

Error 6110: Controllers already configured for failover

Explanation: A SET FAILOVER cannot be issued on a controller already in failover.

Error 6130: RAID5 in use on this controller but not enabled on the other controller.

Explanation: When trying to SET FAILOVER, it was discovered that there were RAID5 configurations on this controller but the other controller did not have the RAID5 feature enabled.

If RAID5 is licensed on the other controller, enable it. If it is not licensed, either contact Digital Multivendor Customer Services for licensing information, or do not use the two controllers in dual-redundant mode, or do not use a RAID5 configuration.

Error 6140: Writeback cache in use on this controller but not enabled on the other controller.

Explanation: When trying to SET FAILOVER, it was discovered that there were write-back cache switches set on this controller but the other controller did not have the write-back cache feature enabled.

If write-back cache is licensed on the other controller, enable it. If it is not licensed, either contact Digital Multivendor Customer Services for licensing information, or do not use the two controllers in dual-redundant mode, or do not use the write-back cache switches.

Error 6150: RAID5 in use on other controller but not enabled on this controller

Explanation: When trying to SET FAILOVER, it was discovered that there were RAID5 configurations on the other controller but this controller did not have the RAID5 feature enabled.

If RAID5 is licensed on this controller, enable it. If it is not licensed, contact Digital Multivendor Customer Services for licensing information or do not use the two controllers in dual-redundant mode, or do not use a RAID5 configuration.

Error 6160: Writeback cache in use on other controller but not enabled on this controller.

Explanation: When trying to SET FAILOVER, it was discovered that there were write-back cache switches set on the other controller but this controller did not have the write-back cache feature enabled.

If write-back cache is licensed on this controller, enable it. If it is not licensed, either contact Digital Multivendor Customer Services for licensing information or do not use the two controllers in dual-redundant mode, or do not use the write-back cache switches.

Error 6170: An <controller type> and <controller type> cannot configured for failover

Explanation: Two different controllers (such as an HSJ and an HSZ) cannot be configured for failover.

Replace the other controller with the same model as this one and reissue the command.

Error 6180: MIRRORING in use on this controller but not enabled on the other controller

Explanation: When trying to SET FAILOVER, it was discovered that there were MIRRORsets on this controller but the other controller did not have the MIRROR feature enabled.

If MIRROR is licensed on the other controller, enable it. If it is not licensed, either contact Digital Multivendor Customer Services for licensing information, or do not use the two controllers in dual-redundant mode, or do not use a MIRRORset configuration.

Error 6190: MIRRORING in use on the other controller but not enabled on this controller

Explanation: When trying to SET FAILOVER, it was discovered that there were MIRRORsets on the other controller but this controller did not have the MIRROR feature enabled.

If MIRROR is licensed on this controller, enable it. If it is not licensed, contact Digital Multivendor Customer Services for licensing information or do not use the two controllers in dual-redundant mode, or do not use a MIRRORset configuration.

Error 7000: Can only clear LOST_DATA cache errors on a unit.

Explanation: you specified something other than a unit for clearing the LOST_DATA cache error.

Error 7010: Can only clear UNWRITEABLE_DATA cache errors on a unit.

Explanation: You specified something other than a unit for clearing the UNWRITEABLE_DATA cache error.

Error 7020: Can only retry UNWRITEABLE_DATA cache errors on a unit

Explanation: You specified something other than a unit for retrying a write on a UNWRITEABLE_DATA cache error.

Error 7030: Unable to force write of unwriteable data

Explanation: A RETRY UNWRITEABLE_DATA command could not write the UNWRITEABLE_DATA.

Error 7040: Unable to rundown unit before clearing error

Explanation: To clear UNWRITEABLE_DATA and LOST_DATA errors, the unit must be rundown before the error is cleared. If the unit could not be rundown, the above error results. If this error persists, call Digital Multivendor Customer Services.

Error 7050: Unable to runup unit after clearing error. This controller must be restarted

Explanation: To clear UNWRITEABLE_DATA and LOST_DATA errors, the unit must be rundown before the error is cleared. If the unit was rundown and the error was cleared and then the unit was unable to be run back up, the unit will remain unavailable until the controller is restarted.

Error 7060: Cannot clear LOST_DATA on a unit without LOST_DATA

Explanation: If a unit does not have a LOST_DATA error, a CLEAR LOST_DATA <unit number> is an illegal command.

Check to assure the unit that you wished to CLEAR LOST_DATA on does exhibit a LOST_DATA error.

Error 7070: Cannot clear UNWRITEABLE_DATA on a unit without UNWRITEABLE_DATA

Explanation: If a unit does not have a UNWRITEABLE_DATA error, a CLEAR UNWRITEABLE_DATA <unit number> is an illegal command.

Check to assure the unit that you wished to CLEAR UNWRITEABLE_DATA on does exhibit an UNWRITEABLE_DATA error.

Error 7080: Cannot retry UNWRITEABLE_DATA on a unit without UNWRITEABLE_DATA

Explanation: If a unit does not have a UNWRITEABLE_DATA error, a RETRY UNWRITEABLE_DATA <unit number> is an illegal command.

Check to assure the unit that you wished to RETRY UNWRITEABLE_DATA on does exhibit a UNWRITEABLE_DATA error.

Error 9000: Cannot rename a unit

Explanation: Only devices and storagesets may be renamed. If you attempt to rename a unit, the above message results.

Error 9010: <name> is an illegal name, it must be from 1 to 9 characters.

Explanation: This error results from an ADD command with an illegal name given.

Error 9020: <name> is an illegal name, it must start with A-Z

Explanation: This error results from an ADD command with an illegal name given.

Error 9030: <name> is an illegal name, characters may consist only of A-Z, 0-9, ., - or _

Explanation: This error results from an ADD command with an illegal name given.

Error 9040: <name> conflicts with keyword <keyword>

Explanation: The name given in an ADD command conflicts with a CLI keyword.

Specify another name.

Error 9050: Configuration area full

Explanation: The total number of units, devices, and storagesets that can be configured is 195 in any combination. This error results when you exceed that number of nodes.

Delete some units or devices in order to recover some configuration nodes.

Error 9060: <name> does not exist

Explanation: Some operation (SET, DELETE, INITIALIZE, and so forth) specified a name that does not exist.

Check the name and retry the command.

Error 9070: <name> is part of a configuration

Explanation: Devices may not be deleted if they are still in use by storagesets or units. Storagesets may not be deleted if they are still used by units.

Delete configurations from the top down; delete units, then stripesets, and RAIDsets (if any), and then finally devices.

Error 9080: <name> is already used

Explanation: An ADD command specified a name that is already in use.

Specify another name.

Note

This error is commonly the result of failing to name a storageset. For example, when trying to create a stripeset out of three disks the user may type:

```
ADD STRIPESET DISK100 DISK200 DISK300
```

This will result in a 9080 error since the controller attempted to create a stripeset named "DISK100" (since the user forgot to name the stripeset), which of course is a name already used by a disk drive.

Error 9090: A <device type> cannot be used in a <storageset type>

Explanation: The device specified cannot be used in the storageset specified, for example, tapes cannot be bound into a stripeset.

Reexamine the configuration and correct the incompatibility.

Error 9100: A <storageset type> must have from <minimum> to <maximum> entities

Explanation: The wrong number of devices was specified for this storageset. Different storagesets require different numbers of devices.

Reexamine the configuration, then correct the number of devices.

Error 9130: Cannot delete ONLINE unit

Explanation: Unit specified in a DELETE command is online to a host.

Dismount the unit at the host then retry the command. Or add the OVERRIDE_ONLINE qualifier to the DELETE command.

Error 9140: Cannot delete exclusive access unit

Explanation: Unit specified in a DELETE command is set up for exclusive access.

Take the unit out of exclusive access mode and retry the command.

Error 9150: INITIALIZE is no longer supported at the unit level. You must INITIALIZE the container that makes up this unit

Explanation: You tried to initialize a unit. Units may no longer be initialized. The container that makes up the unit must be initialized before a unit is created out of the container.

Error 9160: Non-disk devices cannot be INITIALIZED

Explanation: Tapes and CDROMS may not be initialized.

Error 9170: <device type> <device name> at PTL <port> <target> <lun> No device installed

Explanation: When a unit is added or initialized, the configuration of the devices that makes up the unit is checked. If no device is found at the PTL specified, this error is displayed.

Check both the logical and physical configuration of the unit and correct any mismatches.

Error 9180: <device type> <device name> at PTL <port> <target> <lun> Incorrect device type installed

Explanation: When a unit is added or initialized, the configuration of the devices that make up the unit is checked. If a non disk device is found at the PTL specified, this error is displayed.

Check both the logical and physical configuration of the unit and correct any mismatches.

Error 9190: Unit <unum> is currently online

Explanation: When a SHUTDOWN, RESTART, or SELFTEST command is entered without the OVERRIDE_ONLINE qualifier and online devices are found, the command is aborted and the units currently online are listed.

Either retry the command with OVERRIDE_ONLINE qualifier or dismount all devices from the hosts.

Error 9200: <name> conflicts with unit names

Explanation: This error results from an ADD command. Names in the format of D*n* and T*n,* when *n* is a number from 0 to 4094, are reserved for units. Rename the storageset or device that is being added so it does not conflict with the unit names and retry the command.

Error 9210: Cannot check if drives are online to the other controller

Explanation: When trying to check for online drives on the other controller, there was a communication failure.

Retry the command.

Error 9220: You cannot specify NOREAD_CACHE while in WRITEBACK_ CACHE mode

Explanation: WRITEBACK_CACHE is specified for this unit. READ_ CACHE cannot be specified while WRITEBACK_CACAHE is set.

Reissue the SET command disabling both WRITEBACK_CACHE and READ_ CACHE.

Error 9230: Unable to modify switches requested

Explanation: This error results from a SET command. The system is currently busy.

Retry the SET command later.

Error 9240: Cannot delete unit in maintenance mode

Explanation: When trying to delete a unit, the unit was found to be in maintenance mode. This is typically the result of trying to delete a unit that is in use by DILX or TILX.

Ensure that DILX and TILX is not being run against the unit that is to be deleted, and retry the command.

Error 9250: Initialize of disk failed

Explanation: Unable to write metadata on disk.

Make sure the disk is not broken.

Error 9260: Cannot INITIALIZE a container that is still part of a configuration. Delete upper configuration first

Explanation: A container cannot be initialized that is part of another configuration or is being used by a unit.

Delete the upper configuration and reissue the INITIALIZE command.

Error 9270: Illegal command—this controller not configured for failover, but other controller present. Stop one controller or SET FAILOVER to put both in failover mode

Explanation: You may not change a non-dual-redundant controller's configuration if the other controller is running.

Stop the other controller (pop out the program card, for example) and retry the command.

Error 9280: Cannot rename the SPARESET or FAILEDSET

Explanation: The SPARESET and FAILEDSET cannot be renamed.

Error 9290: Communication failure with other controller, cannot check other controller's licensing

Explanation: Unable to communicate with the other controller to check licensing before creating a RAIDset or enabling write-back cache.

Check to make sure that both controllers are running. If one is broken, take this controller out of failover (SET NOFAILOVER) and reissue the command.

Warning 9300: Bad write cache or battery on <controller> controller

Explanation: When trying to set failover, it was discovered that one conrtoller's cache had failed. For this reason the ability to place the controller's in a dual redundant mode has been blocked.

Repair the cache and retry the command.

Error 9310: No metadata found on container, unit not created. <reason for failure>

Explanation: You attempted to create a unit from a container that did not have valid metadata.

INITIALIZE the metadata on the container, then create a unit out if it.

Error 9330: NV memory write collision. Please try again

Explanation: Two processes were trying to modify the controller's configuration at the same time.

Check the configuration you were trying to modify to make sure it's unchanged and retry the command.

Error 9340: Reduced raidsets cannot be INITIALIZED

Explanation: You cannot INITIALIZE a RAIDset that is running in reduced state.

Replace a member and try again.

Error 9360: A tape is not installed at the PTL <port> <target> <lun>. Cannot set tape switches unless a tape is installed

Explanation: A SET or ADD command specified a tape format, but there was no tape installed at the tape's PTL.

Install a tape and retry the command.

Error 9370: A <tape name> is an unsupported device. Tape switches cannot be set on unsupported devices

Explanation: The tape installed is not currently supported by the controller.

Replace the tape with a supported device and retry the command.

Error 9380: Unable to allocate unit for NORUN to RUN transition

Explanation: The unit could not be allocated so the controller could do a RUN/NORUN transition.

Retry the command. If this error persists, call Digital Multivendor Customer Services.

Error 9390: Cannot change default tape format while tape drive online to host

Explanation: The default tape format cannot be changed when the tape drive is online to a host.

Dismount the tape drive from the host and retry the command.

Error 9400: Cannot rundown or allocate unit in order to delete it

Explanation: Retry the command. If this error persists, call Digital Multivendor Customer Services.

Error 9410: Cannot delete unit—<type> error exists on unit that must be cleared first. To clear error type: <clear error string>

Explanation: Units cannot be deleted if cache errors exist. Any cache errors must be cleared before a unit can be deleted.

Issue the <clear error string> command and then delete the unit.

Error 9420: Unit <unit number> has unflushed data or a cache error and must be deleted on this controller

Explanation: When trying to set failover a unit with unflushed data or a cache error was detected on this controller.

Delete the unit as requested and then retry the SET FAILOVER command.

Error 9430: Cannot check if drives have unflushed data or cache errors on the other controller

Explanation: Communication error when trying to SET FAILOVER.

Retry the command. If this error persists, call Digital Multivendor Customer Services.

Error 9440: Unit <unit number> has unflushed data or a cache error and must be deleted on the other controller

Explanation: When trying to set failover a unit with unflushed data or a cache error was detected on the other controller.

Delete the unit as requested and then retry the SET FAILOVER command.

Error 9450: Cannot mirror <disk name>

Explanation: Error when attempting to mirror a disk drive.

Check the configuration to assure it's the same as before. If so, retry the command. If this error persists, call Digital Multivendor Customer Services.

B.2.3 Warning Conventions

A Warning *nnnn:* message means that the command completed, but there is a situation that you should be aware of. Typically, but not always, a warning will result in an unusable configuration; you will have to either logically reconfigure the cabinet using the CLI or physically reconfigure the cabinet by moving the disks around.

Multiple warning messages may result from one command.

Items in angle brackets (<>) are replaced at run time with names, numbers, and so on.

B.2.4 CLI Warning Messages

Warning 1000: It is recommended that you read the controller product documentation to understand the significance of enabling WRITEBACK_ CACHE particularly for RAID Arrays

Explanation: Using write-back cache introduces behaviors that you should completely understand before using. See the full documentation on write-back cache in the user guide.

Warning 3000: This storageset is configured with more than one disk per port. This causes a degradation in performance

Explanation: This warning results from an ADD *storageset-type* command. The storageset specified has more than one member per port. One method of increasing the controller's performance is through parallel transfers to members of a storageset. If multiple members of a storageset are on one port, transfers must be done in serial to those members.

Though multiple storageset members on one port will work, it is strongly recommended that the storageset be deleted and reconfigured with one member per port.

Warning 3020: <storageset name> is configured with different sized containers. This will result in a storageset of reduced size

Explanation: This warning results from an ADD *storageset-type* command. Storageset size is determined by the size of the smallest device, so the storageset configured will be of reduced size.

If a reduced size storageset is acceptable, nothing needs to be done in response to the above warning. To realize the maximum storageset size, the size of all devices that make up the storageset should be identical.

Warning 3030: Cannot determine state of disk <disk name>in mirrorset <mirrorset name>

Explanation: Before disk drives are removed from a MIRRORset, the MIRRORset is checked to assure that at least one NORMAL member will be left after the REMOVE or REDUCE. If the state of a disk cannot be determined, the above message is printed.

Warning 3040: <storageset name> will be disabled due to bad cache state on <controller> controller

Explanation: If the cache is in a state on this or the other controller such that the storageset cannot be used, it will be created but the above message will be printed so the user knows that the storageset wil be disabled.

Warning 4000: A restart of this controller is required before all the parameters modified will take effect

Explanation: This warning results from a SET THIS_CONTROLLER command. Some controller parameters require a restart before they can take effect. If any of those parameters are changed, this warning is displayed.

It is recommended that a restart via the ''RESTART THIS_CONTROLLER'' command be done as soon as possible.

Warning 4010: A restart of the other controller is required before all the parameters modified will take effect

Explanation: This warning results from a SET OTHER_CONTROLLER command. Some controller parameters require a restart before they can take effect. If any of those parameters are changed, this warning is displayed.

Restart the controller and retry the command.

Warning 4020: A restart of both this and the other controller is required before all the parameters modified will take effect

Explanation: This warning results from a SET THIS_CONTROLLER or a SET OTHER_CONTROLLER command. Some controller parameters require a restart of both controllers before they can take effect. If any of those parameters are changed, this warning is displayed. Restart both controllers and retry the command.

Warning 6000: Communication failure with the other controller while taking controllers out of dual-redundant mode. Issue a SET NOFAILOVER command on the other controller

Explanation: This warning results from a SET NOFAILOVER command. This controller was unable to communicate with the other controller to notify it that it is no longer in dual-redundant mode. Typically, this occurs when the other controller has already been removed prior to the SET NOFAILOVER command.

Enter a SET NOFAILOVER command on the other controller as soon as possible.

Warning 6010: Licensing different between the two controllers

Explanation: If the licensing is not identical on both controllers in a dual-redundant configuration, the above warning is displayed.

You should check the licensing on both controllers and make sure they are identical.

Warning 7000: Data written successfully before clearing unwriteable data error

Explanation: As a result of a CLEAR UNWRITEABLE_DATA, if the last-ditch attempt to write data before clearing the error was successful, the above warning is displayed.

Note

This means that no customer data was lost, so this warning is actually good.

Warning 7010: Unable to clear LOST_DATA on other controller

Explanation: When trying to clear LOST_DATA on the other controller, a communication error occurred.

Retry the command. If the failure persists, contact Digital Multivendor Customer Services.

Warning 7020: Unable to clear UNWRITEABLE_DATA on other controller

Explanation: When trying to clear UNWRITEABLE_DATA on the other controller, a communication error occurred.

Retry the command. If the failure persists, contact Digital Multivendor Customer Services.

Warning 9000: Drive has LOST_DATA

Explanation: During a check of the drive's metadata, it was detected that the drive had lost data.

Clear the lost data error on the drive.

Warning 9030: Cannot determine if the correct device type is at the PTL specified

Explanation: When a device is added, the location specified is checked to see if the correct device type is present. This warning results when no device responds from the location specified.

Check the physical configuration and the PTL that was specified.

Warning 9040: There is currently a <device type> at the PTL specified

Explanation: When a device is added, the location specified is checked to see if the correct device type is present. This warning results when a device different from the one specified is found at the location specified (for example, a tape is found where a disk was added).

Check the physical configuration and the PTL that was specified.

Warning 9050: <device type> <device name> at PTL <port> <target> <lun> No device installed

Explanation: When a unit is added, the configuration of the disks that make up the unit is checked. If no device is found at the PTL specified, this warning is displayed.

Check both the logical and physical configuration of the devices that make up the unit and correct any mismatches.

Warning 9060: <device type> <device name> at PTL <port> <target> <lun> Incorrect device type installed

Explanation: When a unit is added, the configuration of the disks that make up the unit is checked. If a non disk device is found at the PTL specified, this warning is displayed.

Check both the logical and physical configuration of the devices that make up the unit and correct any mismatches.

Warning 9080: <license> support is not licensed on <controller> controller. Any use of this feature requires licensing. Continued use does not comply with the terms and conditions of licensing for this product.

Explanation: You have a licensed feature enabled on this controller but it is not licensed. This is against the contractual agreement between Digital and your company. Please disable the licensed feature and contact Digital Multivendor Customer Services if you wish to purchase it.

Warning 9090: Metadata found on container. Are you sure this is a TRANSPORTABLE container?

Explanation: When a transportable disk was initialized, metadata was found.

Verify that this disk in fact should be marked transportable. No action is required to correct this warning.

Warning 9100: Bad or low battery or bad write cache on <controller> writeback cache will not be used

Explanation: The battery is low or bad on the specified controller. The unit specified will not use write-back cache until the battery is charged or repaired.

Warning 9110: Bad or low battery or bad write cache on <controller> this unit cannot be used by <controller>

Explanation: The battery is low or bad on the specified controller. The unit specified requires the use of write-back cache, so its use has been disabled until the battery is charged or repaired.

B.3 Device Configuration Examples

The following examples cover the majority of configurations and the method of defining those configurations.

Example B–1 Initial Single Controller Configuration of an HSD30 Controller

```
CLI> SET THIS_CONTROLLER ID=5 SCS_NODENAME="HSD03"
CLI> SET THIS_CONTROLLER MSCP_ALLOCATION_CLASS=4 TMSCP_ALLOCATION_CLASS=4
CLI> RESTART THIS_CONTROLLER
[this controller restarts at this point]
CLI> SET THIS_CONTROLLER PATH
```

Example B–2 Initial Dual-Redundant Controller Configuration of an HSJ Controller

```
CLI> SET THIS_CONTROLLER MAX_NODES=16
CLI> SET THIS_CONTROLLER ID=5 SCS_NODENAME="HSJ01"
CLI> SET THIS_CONTROLLER MSCP_ALLOCATION_CLASS=4 TMSCP_ALLOCATION_CLASS=4
CLI> SET FAILOVER COPY=THIS
CLI> SET OTHER_CONTROLLER MAX_NODES=16
CLI> SET OTHER_CONTROLLER ID=7 SCS_NODENAME="HSJ02"
CLI> RESTART OTHER_CONTROLLER
[other controller restarts at this point]
CLI> RESTART THIS_CONTROLLER
[this controller restarts at this point]
CLI> SET THIS_CONTROLLER PATH_A PATH_B
CLI> SET OTHER_CONTROLLER PATH_A PATH_B
```

Example B–3 Initial Single Controller Configuration of an HSZ Controller

```
CLI> SET THIS_CONTROLLER ID=5
CLI> RESTART THIS_CONTROLLER
[this controller restarts at this point]
```

Example B–4 Setting the Terminal Speed and Parity

```
CLI> SET THIS_CONTROLLER TERMINAL_SPEED=19200 NOTERMINAL_PARITY
```

Note

Garbage will appear on the terminal after setting the controller's terminal speed until you set the terminal's speed to match the controller's new terminal speed.

Example B–5 Creating a Unit from a Disk Device

```
CLI> ADD DISK DISK0 2 0 0
CLI> INITIALIZE DISK0
CLI> ADD UNIT D0 DISK0
```

Example B–6 Creating a Unit from a Tape Device

```
CLI> ADD TAPE TAPE0 3 0 0
CLI> ADD UNIT T0 TAPE0
```

Example B–7 Creating a Unit from a Four-Member Stripeset

```
CLI> ADD DISK DISK0 1 0 0
CLI> ADD DISK DISK1 2 0 0
CLI> ADD DISK DISK2 3 0 0
CLI> ADD DISK DISK3 1 1 0
CLI> ADD STRIPESET STRIPE0 DISK0 DISK1 DISK2 DISK3
Warning 3000: This storageset is configured with more than one disk per port.
              This causes a degradation in performance
CLI> INITIALIZE STRIPE0
CLI> ADD UNIT D0 STRIPE0
```

Example B–8 Creating a Unit from a Five-Member RAIDset

```
CLI> ADD DISK DISK0 1 0 0
CLI> ADD DISK DISK1 2 0 0
CLI> ADD DISK DISK2 3 0 0
CLI> ADD DISK DISK3 1 1 0
CLI> ADD DISK DISK4 2 1 0
CLI> ADD RAIDSET RAID9 DISK0 DISK1 DISK2 DISK3 DISK4
Warning 3000: This storageset is configured with more than one disk per port.
              This causes a degradation in performance
CLI> INITIALIZE RAID9
CLI> ADD UNIT D0 RAID9
```

Example B–9 Creating a Unit From a Disk Device and Setting the Write Protection

```
CLI> ADD DISK DISK0 2 0 0
CLI> INITIALIZE DISK0
CLI> ADD UNIT D0 DISK0 WRITE_PROTECT
```

Example B–10 Setting the Write Protection for an Existing Unit

```
CLI> ADD DISK DISK0 2 0 0
CLI> INITIALIZE DISK0
CLI> ADD UNIT D0 DISK0
CLI> SET D0 WRITE_PROTECT
```

Example B–11 Renumbering Disk Unit 0 to Disk Unit 100

```
CLI> ADD DISK DISK0 2 0 0
CLI> INITIALIZE DISK0
CLI> ADD UNIT D0 DISK0
CLI> DELETE D0
CLI> ADD UNIT D100 DISK0
```

Example B–12 Creating a Transportable Unit from a Disk Device

```
CLI> ADD DISK DISK0 2 0 0 TRANSPORTABLE
CLI> INITIALIZE DISK0
CLI> ADD UNIT D0 DISK0
```

```
[or]
```

```
CLI> ADD DISK DISK0 2 0 0
CLI> SET DISK0 TRANSPORTABLE
CLI> INITIALIZE DISK0
CLI> ADD UNIT D0 DISK0
```

Example B–13 Changing the Replacement Policy of a RAIDset

```
CLI> ADD DISK DISK0 1 0 0
CLI> ADD DISK DISK1 2 0 0
CLI> ADD DISK DISK2 3 0 0
CLI> ADD DISK DISK3 4 0 0
CLI> ADD DISK DISK4 5 0 0
CLI> ADD RAIDSET RAID9 DISK0 DISK1 DISK2 DISK3 DISK4
CLI> INITIALIZE RAID9
CLI> ADD UNIT D0 RAID9
CLI> SET RAID9 POLICY=BEST_FIT
```

Note

No INITIALIZE is required because DISK0 has already been initialized.

Note

The replacement policy can be changed at any time.

Example B–14 Deleting the Unit, Stripeset, and All Disks Associated with a Stripeset

```
CLI> DELETE D0
CLI> DELETE STRIPE0
CLI> DELETE DISK0
CLI> DELETE DISK1
CLI> DELETE DISK2
CLI> DELETE DISK3
```

C

HSJ-Series Error Logging

This appendix details errors the HSJ-series controller reports in its host event logs under the OpenVMS operating system, as well as how to extract the information from the logs.

Note

Host event log translations are correct as of the date of publication of this manual. However, log information may change with firmware updates. Refer to your firmware release notes for event log information updates.

You may see the word ''FIB'' in some error log output. FIB is a Digital-internal designation for the HS controllers, and can be safely ignored.

C.1 Reading an HSJ-Series Error Log (ERF)

To understand the error logs, use the following guidelines:

- Each error log contains an ''MSLG$B_FORMAT'' field (in the upper portion of the log), plus a controller dependent information area (in the lower portion of the log). controller dependent information will vary according to the ''MSLG$B_FORMAT'' field.

  Example C–1 shows an example of an ERF translated host error log (a Disk Transfer Event log). See Example C–1 to find ''MSLG$B_FORMAT'' and ''CONTROLLER DEPENDENT INFORMATION.''

- The key to interpreting error logs is a 32 bit instance code located in the ''CONTROLLER DEPENDENT INFORMATION'' area. The instance code uniquely identifies the following:
  - The error or condition
  - The component reporting the condition
  - The recommended repair action
  - The threshold when the repair action should be taken

Note

The instance code is the single, most important part of interpreting the error log.

Example C–1 Disk Transfer Error Event Log

```
V A X / V M S        SYSTEM ERROR REPORT         COMPILED 16-MAR-1993 11:05:04
                                                                  PAGE 146.

****************************** ENTRY      12. ******************************
ERROR SEQUENCE 2832.                              LOGGED ON:        SID 05903914
DATE/TIME 16-MAR-1993 10:27:58.95                                SYS_TYPE 00000000
SYSTEM UPTIME: 4 DAYS 02:11:34
SCS NODE: CNOTE                                                  VAX/VMS V5.5-2

ERL$LOGMESSAGE ENTRY  KA825  HW REV# B  PATCH REV# 28.  UCODE REV# 20.
                      BI NODE # 2.

I/O SUB-SYSTEM, UNIT _FRED$DUA115:

      MESSAGE TYPE        0001
                                        DISK MSCP MESSAGE

      MSLG$L_CMD_REF  9DB30013
      MSLG$W_UNIT         0073
                                        UNIT #115.

      MSLG$W_SEQ_NUM      0002
                                        SEQUENCE #2.

      MSLG$B_FORMAT         02
                                        DISK TRANSFER LOG

      MSLG$B_FLAGS          00
                                        UNRECOVERABLE ERROR

      MSLG$W_EVENT        000B
                                        DRIVE ERROR
                                        UNKNOWN SUBCODE #0000(X)

      MSLG$Q_CNT_ID   00134534
                      01280001
                                        UNIQUE IDENTIFIER, 000100134534(X)
                                        MASS STORAGE CONTROLLER
                                        MODEL = 40.

      MSLG$B_CNT_SVR        FF
                                        CONTROLLER SOFTWARE VERSION #255.

      MSLG$B_CNT_HVR        00
                                        CONTROLLER HARDWARE REVISION #0.

      MSLG$W_MULT_UNT     0005
      MSLG$Q_UNIT_ID  00000001
                      02FF0000
                                        UNIQUE IDENTIFIER, 000000000001(X)
                                        DISK CLASS DEVICE (166)
                                        MODEL = 255.

      MSLG$B_UNIT_SVR       0B
                                        UNIT SOFTWARE VERSION #11.

      MSLG$B_UNIT_HVR       0C
                                        UNIT HARDWARE REVISION #12.

      MSLG$B_LEVEL          01
      MSLG$B_RETRY          00
      MSLG$L_VOL_SER  00001492
                                        VOLUME SERIAL #5266.

      MSLG$L_HDR_CODE 000659B6
                                        LOGICAL BLOCK #416182.
                                        GOOD LOGICAL SECTOR
```

(continued on next page)

Example C–1 (Cont.) Disk Transfer Error Event Log

```
CONTROLLER DEPENDENT INFORMATION
      LONGWORD 1.     03094002
                                  /.@../
      LONGWORD 2.     00003C51
                                  /Q<../
      LONGWORD 3.     00000000
                                  /..../
      LONGWORD 4.     000016D4
                                  /Ô.../
      LONGWORD 5.     00000000
                                  /..../
      LONGWORD 6.     00030002
                                  /..../
      LONGWORD 7.     56415246
                                  /CNOT/
      LONGWORD 8.     20205355
                                  /E  /
      LONGWORD 9.     00000501
                                  /..../
      LONGWORD 10.    36325A52
                                  /RZ26/
      LONGWORD 11.    20202020
                                  /    /
      LONGWORD 12.    29432820
                                  / (C)/
      LONGWORD 13.    43454420
                                  / DEC/
      LONGWORD 14.    20202020
                                  /    /
      LONGWORD 15.    31202020
                                  /   1/
      LONGWORD 16.    i00F0002A
                                  /*.ð./
      LONGWORD 17.    59060004
                                  /...Y/
      LONGWORD 18.    000016B6
                                  /¶.../
      LONGWORD 19.    01030000
                                  /..../
      LONGWORD 20.    000A8001
                                  /..../
```

The 32-bit instance code always appears in ‘‘LONGWORD 1’’ of controller dependent information, with the following exceptions:

– When MSLG$B_FORMAT reads ‘‘09 BAD BLOCK REPLACEMENT ATTEMPT,’’ the instance code does not appear, because ERF does not provide controller dependent information.

– When MSLG$B_FORMAT reads ‘‘0A MEDIA LOADER LOG,’’ the instance code appears in ‘‘LONGWORD 2.’’

– When MSLG$B_FORMAT reads ‘‘00 CONTROLLER LOG,’’ the instance code appears in part of both ‘‘LONGWORD 1’’ and ‘‘LONGWORD 2.’’

  For this ‘‘MSLG$B_FORMAT,’’ the code is skewed and not directly readable as a longword. (The code’s low-order bytes appear in the two high-order bytes of ‘‘LONGWORD 1,’’ and the code’s high-order bytes appear in the two low-order bytes of ‘‘LONGWORD 2.’’) For example:

```
CONTROLLER DEPENDENT INFORMATION
     LONGWORD 1.     030A0000
                                    /..../
     LONGWORD 2.     24010102
                                    /...$/
```

  In this case, the instance code is 0102030A.

  An OpenVMS DCL command procedure is provided at the end of this appendix (see Section C.7) for deskewing this particular instance code. Running the command procedure will make the error log directly readable when used in conjunction with the other information supplied in this appendix.

• Once you locate and identify the instance code, see the following sections for further information:

  – Section C.4 contains the Event Log Code tables, Tables C–2 through C–52. These tables list specific code descriptions.

  – Section C.3 contains detailed error packet descriptions, based on template type.

  – Section C.5 contains error threshold values.

  – Section C.6 contains recommended repair actions.

• When you look up a specific instance code, you will notice that each error belongs to one of fifteen template types. Each template type has a one byte value identifying it, which also is located in the controller dependent information area longwords, as shown in Table C–1.

  You may be able to use Table C–1 to quickly identify the template type, after examining the longwords in the controller dependent information area. However, because the location of the value identifying the template varies, the safest way to determine the template is to use the instance code. The template type is always the very next byte after the instance code.

Table C–1 Template Types

Description	Template	Longword	Value	Deskewed Value
Last Failure Event Log	01†	2	24**01**xxxx	00002401
Failover Event Log	05†	2	00**05**xxxx	00000005
Host buffer Access Error Event Log	10	2	00000C**10**	
Nonvolatile Parameter Memory Component Event Log	11	2	0000081**1**	
Backup Battery Failure Event Log	12	2	0000001**2**	
Subsystem Built-In Self Test Failure Event Log	13†	2	24**13**xxxx	00002413
Cache Memory Failure Event Log	14	2	0000241**4**	
CI Port Event Log	31†	2	0C**31**xxxx	00000C31
CI Port/Port Driver Event Log	32†	2	10**32**xxxx	00001032
CI System Communication Services Event Log	33†	2	2C**33**xxxx	00002C33
Device Services Nontransfer Event Error Log	41†	2	04**41**xxxx	00000441
Disk Transfer Error Event Log	51	2	00003C**51**	
Disk Bad Block Replacement (BBR) Attempt Event Log	57	No Longwords		
Tape Transfer Error Event Log	61	2	00003C**61**	
Media Loader Error Event Log	71	3	00003C**71**	

†The MSLG$B_FORMAT field for these templates will read ‘‘00 CONTROLLER LOG,’’ so you may want to run the OpenVMS DCL command procedure provided at the end of this appendix (Section C.7) for deskewing the longwords.

- You should use the template type to learn even more from the error log. Information available in longwords, other than the instance code, includes the following:
  - Template type
  - Template information size
  - Event time
  - Drive sense data
  - Other information specific to the template

  Knowing the template type allows you to better use Section C.3 to obtain a complete description of each template and determine where information is located within the associated ‘‘CONTROLLER DEPENDENT INFORMATION.’’

C.2 Reading an HSJ-Series Error Log (DECevent)

DECevent-generated error reports, while containing basically the same information as ERF-generated reports, are far easier to interpret. This is true because more of the binary log is translated. Some of the information directly available from the ASCII report output includes the following:

- Instance code
- Recommended repair action
- Recovery threshold
- PTL of the faulty device
- ASC/ASCQ code values
- Template type
- MSCP event code
- Controller model

The following two examples illustrate the difference between event logs generated by ERF and DECevent. Example C–2 shows an ERF-generated disk transfer error log. Example C–2 shows the same error event translated by DECevent.

When using DECevent to translate event information, you should not need to refer as frequently to the information and tables included in the remaining sections of this appendix. However, familiarity with the ERF error log format, template types, and other elements of the event logs will help you understand the wide variety of events that might be reported, regardless of the translation utility you are using.

Example C–2 ERF-Generated Error Event Log

```
 V M S                SYSTEM ERROR REPORT         COMPILED  9-AUG-1994 13:41:37
                                                                    PAGE 758.

 ******************************* ENTRY    1122. *******************************
 ERROR SEQUENCE 5.                                LOGGED ON:  CPU_TYPE 00000002
 DATE/TIME 28-APR-1994 11:39:40.33                             SYS_TYPE 00000003
 SYSTEM UPTIME: 0 DAYS 00:01:41
 SCS NODE: MTX2                                              OpenVMS AXP X6.1-FT7

 HW_MODEL: 00000401 Hardware Model = 1025.

 ERL$LOGMESSAGE ENTRY DEC 7000 Model 610

 I/O SUB-SYSTEM, UNIT _MAT$DUA450:

       MESSAGE TYPE        0001
                                      DISK MSCP MESSAGE
       MSLG$L_CMD_REF  00000000
       MSLG$W_UNIT         01C2
                                      UNIT #450.
       MSLG$W_SEQ_NUM      0015
                                      SEQUENCE #21.
       MSLG$B_FORMAT         02
                                      DISK TRANSFER LOG
       MSLG$B_FLAGS          00
                                      UNRECOVERABLE ERROR
       MSLG$W_EVENT        014B
                                      DRIVE ERROR
                                      CNTRLR DETECTED PROTOCOL ERROR
       MSLG$Q_CNT_ID   01280009 40802576
                                      UNIQUE IDENTIFIER, 000940802576(X)
                                      MASS STORAGE CONTROLLER
                                      MODEL = 40.
       MSLG$B_CNT_SVR        14
                                      CONTROLLER SOFTWARE VERSION #20.
       MSLG$B_CNT_HVR        49
                                      CONTROLLER HARDWARE REVISION #73.
       MSLG$W_MULT_UNT     0035
       MSLG$Q_UNIT_ID  02FF0000 00000022
                                      UNIQUE IDENTIFIER, 000000000022(X)
                                      DISK CLASS DEVICE (166)
                                      HSXnn
       MSLG$B_UNIT_SVR       01
                                      UNIT SOFTWARE VERSION #1.
       MSLG$B_UNIT_HVR       43
                                      UNIT HARDWARE REVISION #67.
       MSLG$B_LEVEL          01
       MSLG$B_RETRY          00
       MSLG$L_VOL_SER  00000000
                                      VOLUME SERIAL #0.
       MSLG$L_HDR_CODE 00000000
                                      LOGICAL BLOCK #0.
                                      GOOD LOGICAL SECTOR

CONTROLLER DEPENDENT INFORMATION
```

(continued on next page)

Example C–2 (Cont.) ERF-Generated Error Event Log

```
LONGWORD 1.     030C4002
                                /.@../
LONGWORD 2.     00003C51
                                /Q<../
LONGWORD 3.     00000000
                                /..../
LONGWORD 4.     000B9331
                                /1.../
LONGWORD 5.     00000000
                                /..../
LONGWORD 6.     00000000
                                /..../
LONGWORD 7.     00000000
                                /..../
LONGWORD 8.     00000000
                                /..../
LONGWORD 9.     1F000504
                                /..../
LONGWORD 10.    36325A52
                                /RZ26/
LONGWORD 11.    20202020
                                /    /
LONGWORD 12.    29432820
                                / (C)/
LONGWORD 13.    43454420
                                / DEC/
LONGWORD 14.    34333533
                                /3534/
LONGWORD 15.    37313739
                                /9717/
LONGWORD 16.    00000000
                                /..../
LONGWORD 17.    00000004
                                /..../
LONGWORD 18.    00000000
                                /..../
LONGWORD 19.    853F0000
                                /..?./
LONGWORD 20.    00000000
```

Example C–3 DECevent-Generated Error Event Log

```
******************************** ENTRY 1122 ********************************

Logging OS                          3. OpenVMS AXP
OS version                             X6.1-FT7
Event sequence number               5.
Timestamp of occurrence                28-APR-1994 11:39:40
System uptime in seconds          101.
VMS error mask              x00000000
VMS flags                       x0001  Dynamic Device Recognition present
Host name                              MTX2

AXP HW model                           DEC 7000 Model 610
System type register        x00000003  DEC 7000
Unique CPU ID               x00000002
mpnum                       x000000FF
mperr                       x000000FF

Event validity                     -1. Unknown validity code
Event severity                     -1. Unknown severity code
Entry type                        100.
Major Event class                   3. IO Subsystem
AXP Device Type                     0.

IO Minor Class                      1. MSCP
IO Minor Sub Class                  5. Logged Message

---- Device Profile ----
Vendor
Product Name                           HSX00 MSCP basic disk
Unit Name                              MAT$DUA
Unit Number                       450.
Device Class                    x0001  Disk

---- IO SW Profile ----
VMS DC$_CLASS                       1.
VMS DT$_TYPE                      141.

---- MSCP Logged Msg ----


Command Reference number    x00000000
Unit Number                       450.
MSCP Sequence number               21.
Logged Message Format               2. Disk Transfer Error
MSCP Flags                        x00  No MSCP Flags indicated

MSCP Unique Controller-ID   x0000000940802576
MSCP Controller Model              40. HSJ40 HS Array Controller
MSCP Controller Class               1. Mass Storage Controller class
Controller SW version              20.
Controller HW version              73.

MSCP Unique Unit-ID         x0000000000000022
MSCP Unit Model                    -1. HSX0n MSCP basic/virtual disk
MSCP Unit Class                     2. Disk class - DEC Std 166 disk
Unit SW version                     1.
Unit HW version                    67.

MSCP Event Code                 x014B  Major Event =  Drive Error
                                       Sub-event =  Controller Detected Protocol
                                                    Error
```

(continued on next page)

Example C–3 (Cont.) DECevent-Generated Error Event Log

```
Multiunit code                x0035
Error recovery Level             1.
Retry count                      0.
Volume Serial Number             0.
Header code               x00000000  Flags=  Good LBN
                                     LBN  =   0.

------- HSAC Data -------
Instance Code             x030C4002  A Drive failed because a Test Unit Ready
                                     command or a Read Capacity command failed.

                                     Component ID =   Device Services.
                                     Event Number =   x0000000C
                                     Repair Action =   x00000040
                                     NR Threshold =   x00000002
Template Type                  x51  Disk Transfer Error.
Power On Time Value       x00000000000B9331

Completed Byte Count             0.
Starting LBN                     0.
Device Locator            x00000504  Port    =   4.
                                     Target  =   5.
                                     LUN     =   0.
SCSI Device Type                x1F  Device Type not decoded.
Drive Product Name                   RZ26     (C) DEC
Drive Serial Number                  35349717
Command Opcode                  x00  Test Unit Ready
Sense Data Qualifier            x00  Buf Mode =   The target shall not report
                                                  GOOD status on write commands
                                                  until the data blocks are
                                                  actually written on the
                                                  medium.
                                     UWEUO =   zero, not defined
                                     MSBD =   zero, not defined
                                     FBW =   zero, not defined
                                     DSSD =   Sense Data fields were generated
                                              by the HSAC controller on behalf
                                              of the target devices because the
                                              Sense Data could not be obtained
                                              from that device.
--- HSAC Sense Data ---

Error Code                      x00  Error Code no decoded
Segment #                       x00
Information Bytes         x00000000
CMD Specific Info         x00000000
Sense Key                       x04  Hardware Error

ASC & ASCQ                    x3F85  ASC  =   x003F
                                     ASCQ =   x0085
                                     Test Unit Ready or Read Capacity Command
                                     failed

FRU Code                        x00
Sense Key Specific Data   x00000000  Sense Key Data NOT Valid
                                     Byte 1 =   x00000000
                                     Byte 2 =   x00000000
                                     Byte 3 =   x00000000
```

C.3 Event Log Formats

Note

The numeric code values discussed in the figures and tables of this appendix are hexadecimal, unless otherwise stated.

The HSJ30/40 controller reports significant events that occur during normal controller operation using the following standard MSCP and TMSCP error log message formats:

- Controller errors
- Memory errors
- Disk transfer errors
- Bad block replacement attempts
- Tape errors
- Media loader errors
- Disk copy data correlation

To more fully use the remainder of this appendix, you should become familiar with MSCP and TMSCP protocols, especially in the area of error log message formats.

C.3.1 Implementation Dependent Information Area

With the exception of the disk copy data correlation error log message format, each of the error log message formats listed in Section C.3 provides an ''implementation dependent information'' area located at the end of the message. For HSJ30/40 controller specific event logs that area is formatted as shown in Figure C–1.

Note that the fields shown in Figure C–1 always begin on a longword boundary within HSJ30/40 controller specific event logs. If the ''implementation dependent information'' area of a particular MSCP error log message format does not begin on a longword boundary, a ''reserved'' field containing the appropriate number of bytes is appended to the format to provide the necessary alignment (such as see offset 16 in Figure C–15).

Implementation Dependent Information Fields:

instance code

A number that uniquely identifies the event being reported. The format of this field is shown in Figure C–2.

Figure C–1 Implementation Dependent Information Format

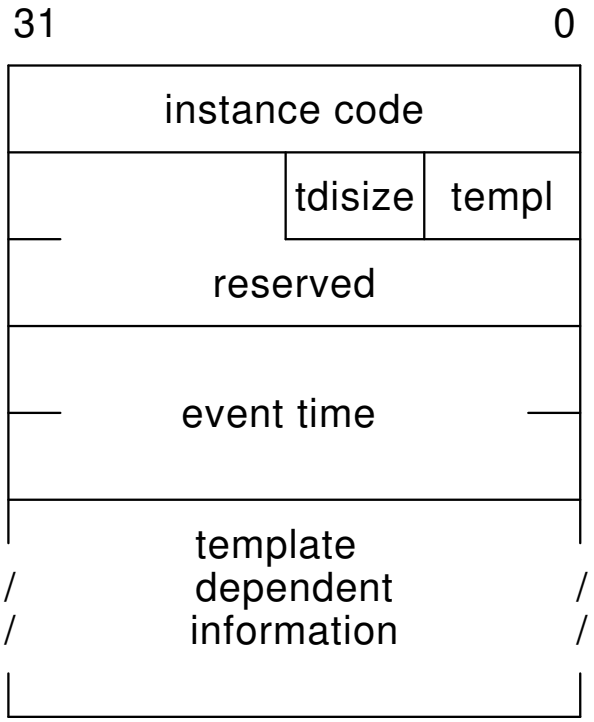
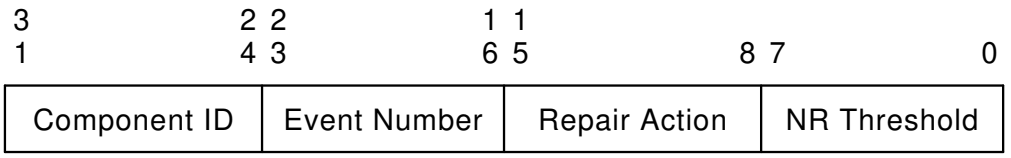


Figure C–2 Instance Code Format



Instance Code Specific Subfields:

NR Threshold

The notification/recovery threshold assigned to the event. This value is used during Symptom Directed Diagnosis procedures to determine when notification/recovery action should be taken. See Section C.5 for more detail.

Repair Action

The recommended repair action code assigned to the event. This value is used during Symptom Directed Diagnosis procedures to determine what notification/recovery action should be taken when the NR Threshold is reached. See Section C.6 for more detail.

Event Number

A number, when combined with the value contained in the Component ID subfield, uniquely identifies the event.

Component ID

A number that uniquely identifies the firmware component that detected the event as shown in Table C–2.

templ

A number that uniquely describes the format of the ‘‘template dependent information’’ field.

tdisize

The number of bytes contained in the ‘‘template dependent information’’ field.

reserved

Reserved for future use.

event time

The time the event occurred according to the power on time value maintained by the HSJ30/40 controller operational firmware.

The power on time value is a 64-bit unsigned integer that represents the total number of seconds HSJ30/40 controller operational firmware has executed on the HSJ30/40 controller board. Note that the time expended during controller restarts, power-on diagnostics, and system initialization is not accounted for by this value.

template dependent information

A variable length field containing information specific to the event being reported.

This field is divided into separate fields specific to the template identified in the ‘‘templ’’ field. The template specific fields common to multiple event logs are described in separate subsections of Section C.3.2 to avoid duplication of the field descriptions in Section C.3.3.

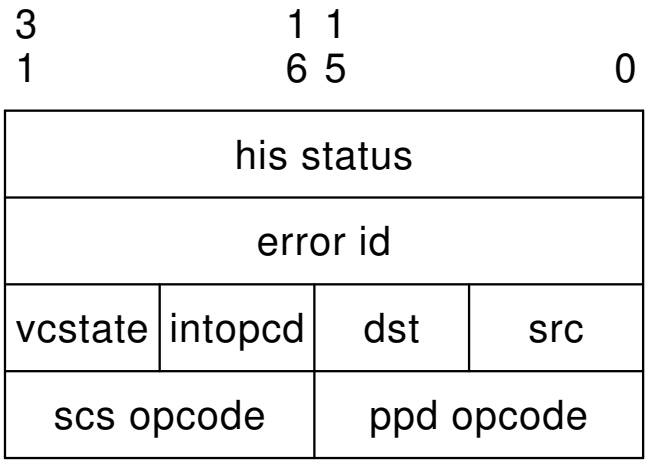
C.3.2 Common Event Log Fields

Common fields are generated across certain event logs. These common fields are described in Sections C.3.2.1 through C.3.2.5.

C.3.2.1 CI Host Interconnect Services Common Event Log Fields

The fields common to certain event logs generated by the CI Host Interconnect Services firmware component are shown in Figure C–3.

Figure C–3 CI Host Interconnect Services Common Event Log Fields



CI Host Interconnect Services Common Fields:

his status

The Host Interconnect Services status code as shown in Table C–3.

error id

The address of the Host Interconnect Services routine that detected the event.

src

The CI source node address.

dst

The CI destination node address.

intopcd

The CI message opcode as shown in Table C–4.

vcstate

The virtual circuit state code as shown in Table C–5.

NOTE

The setting of the high order bit (Bit 7) in this field indicates the state of ID polling for the virtual circuit.

If Bit 7 is set, ID polling is complete. Otherwise, ID polling is incomplete.

ppd opcode

The Port/Port Driver layer opcode as shown in Table C–6.

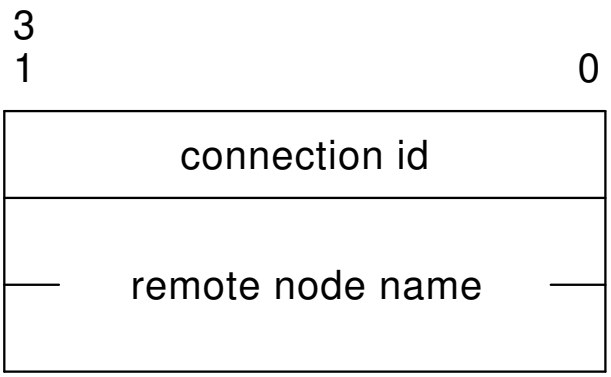
scs opcode

The System Communication Services layer opcode as shown in Table C–7.

C.3.2.2 Host/Server Connection Common Fields

The fields common to certain event logs generated by the Disk and Tape MSCP Server, CI Host Interconnect Services, Device Services, and Value Added firmware components are shown in Figure C–4.

Figure C–4 Host/Server Connection Common Fields



Host/Server Connection Common Fields:

connection id

Identifies the host/server connection associated with the event being reported. If this value is zero, the host/server connection information was invalidated before the event could be reported.

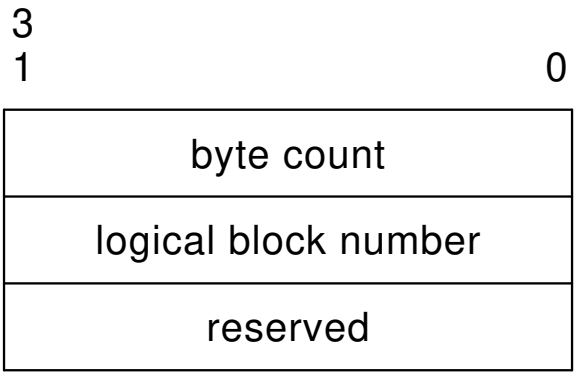
remote node name

An 8-byte ASCII string that represents the node name associated with the host/server connection identified in the ‘‘connection id’’ field. If the ‘‘connection id’’ field is zero, the content of this field is undefined.

C.3.2.3 Byte Count/Logical Block Number Common Fields

The fields common to certain event logs generated by the Device Services and Value Added firmware components are shown in Figure C–5.

Figure C–5 Byte Count/Logical Block Number Common Fields



Byte Count/Logical Block Number Common Fields:

byte count

Number of bytes of the HSJ30/40 controller firmware component initiated transfer successfully transferred.

logical block number

Starting logical block number of the HSJ30/40 controller firmware component initiated transfer.

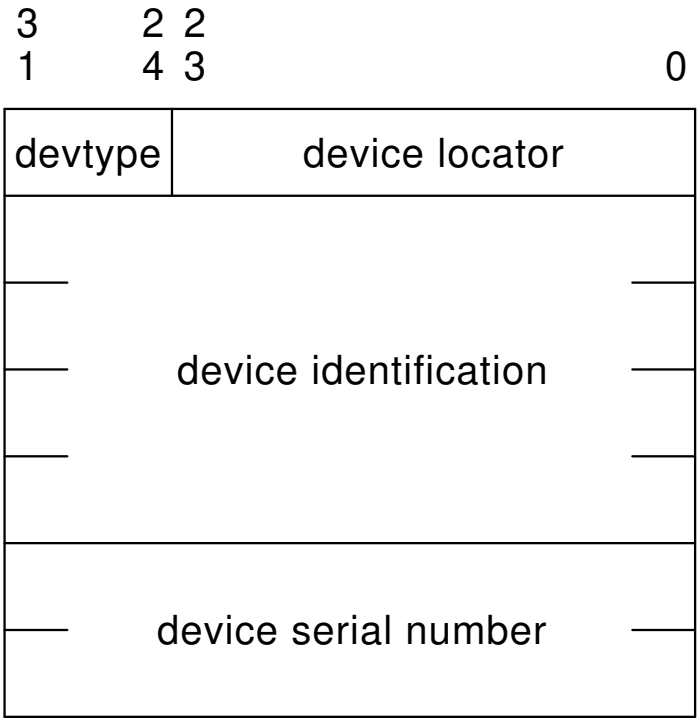
reserved

Reserved for future use, currently contains the value 0.

C.3.2.4 Device Location/Identification Common Fields

The fields common to certain event logs generated by the Device Services and Value Added firmware components are shown in Figure C–6.

Figure C–6 Device Location/Identification Common Fields

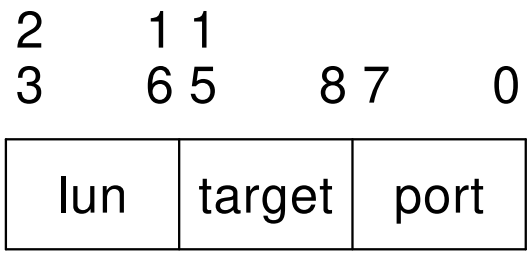


Device Location/Identification Common Fields:

device locator

The location within the HSJ30/40 controller's subsystem of the target device involved in the event being reported. This field is formatted as shown in Figure C–7.

Figure C–7 Device Locator Field Format



Device Locator Specific Subfields:

port

The SCSI bus number to which the target device is connected.

target

The SCSI target number on the ''port'' to which the target device is connected.

lun

The logical unit number on the ‘‘target’’ by which the target device is logically addressed.

devtype

The SCSI device type of the device. The various SCSI device types supported by the HSJ30/40 controller are shown in Table C–9.

device identification

Sixteen bytes of ASCII data as defined by the device vendor in the Product Identification field of the SCSI INQUIRY command data.

The most significant character of the product identification data will appear in the low order byte of the first longword of this field while the least significant character appears in the high order byte of the last long word.

device serial number

Eight bytes of ASCII data as defined by the device vendor in the Product Serial Number field of the SCSI Unit Serial Number Page data.

The most significant character of the serial number data will appear in the low order byte of the first longword of this field while the least significant character appears in the high order byte of the last longword.

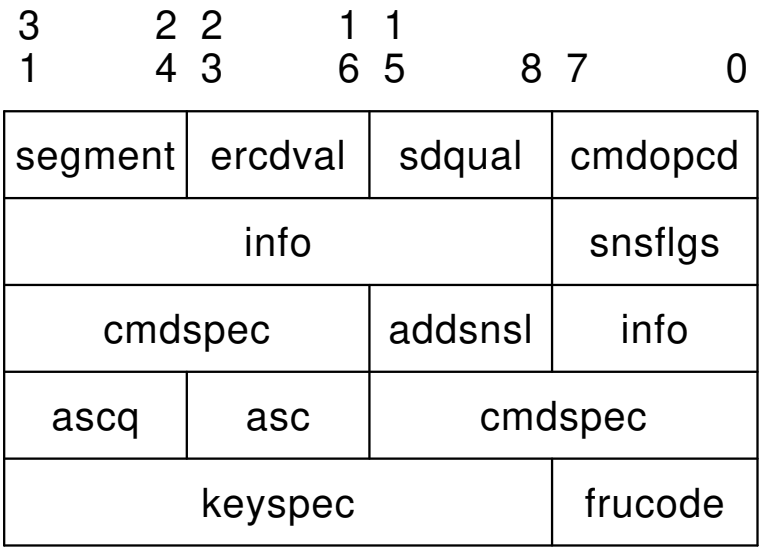
Note that the number of characters of serial number data supplied may vary from vendor to vendor as well as from device to device. If the serial number data supplied is less than eight characters, this field is ASCII space filled from the lowest order byte (relative to the low order byte of the first longword) containing a serial number character through the high order byte of the last longword. If the serial number data supplied is greater than eight characters, the serial number data is truncated at eight bytes (that is, the least significant characters of the serial number data is lost). If the serial number data is not available at all, this field is ASCII space filled.

C.3.2.5 SCSI Device Sense Data Common Fields

The fields common to certain event logs generated by the Device Services and Value Added firmware components are shown in Figure C–8.

The first two fields shown in Figure C–8, the ‘‘cmdopcd’’ and ‘‘sdqual’’ fields, are supplied by the HSJ30/40 controller to provide qualifying information required to interpret the other SCSI Sense Data Common fields. The other fields, ‘‘ercdval’’ through ‘‘keyspec,’’ contain standard Sense Data, returned in the response of a SCSI REQUEST SENSE command issued to the target device or generated by the HSJ30/40 controller on the target device’s behalf.

Figure C–8 SCSI Device Sense Data Common Fields



SCSI Device Sense Data Common Fields:

cmdopcd

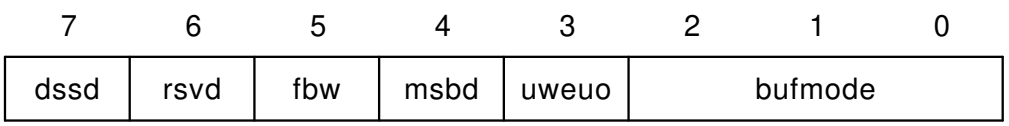
The operation code of the SCSI command issued to the target device. SCSI command operation codes vary according to device type (see Table C–10) so the content of this field depends on the content of the ‘‘devtype’’ field.

See the description of the ‘‘ercdval’’ field for information regarding the validity of this field.

sdqual

This field contains information necessary to determine whether the Sense Data contained in the ‘‘ercdval’’ through ‘‘keyspec’’ fields is supplied by an attached device or generated by the HSJ30/40 controller itself and to qualify the content of the ‘‘info’’ field. This field is formatted as shown in Figure C–9.

Figure C–9 Sense Data Qualifier Field Format



Sense Data Qualifier Specific Subfields:

bufmode

The SCSI buffered mode selected on the device. The various SCSI Buffered Modes are shown in Table C–11.

uweuo

This bit is set to one if and only if an unrecoverable write error was detected while unwritten objects (that is, data blocks, filemarks, or setmarks) remain in the buffer.

msbd

This bit is set to one if and only if the MODE SENSE block descriptor is nonzero.

fbw

This bit is set to one if and only if the Fixed bit of the WRITE command is set to one.

rsvd

Reserved for future use.

dssd

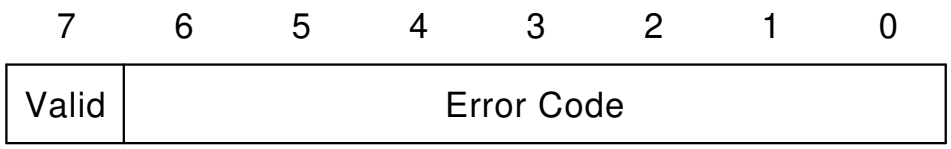
This bit is set to one if and only if the Sense Data contained in the ''ercdval'' through ''keyspec'' fields is supplied by the target device.

If this bit is zero, the Sense Data contained in the ''ercdval'' through ''keyspec'' fields is generated by the HSJ30/40 controller on behalf of the target device because the Sense Data could not be obtained from that device.

ercdval

This field contains byte 0 of the Sense Data returned in the response of a SCSI REQUEST SENSE command. This field is formatted as shown in Figure C–10.

Figure C–10 SCSI Sense Data Byte Zero (“ercdval”) Field Format



SCSI Sense Data Byte Zero (''ercdval'') Specific Subfields:

Error Code

An error code of 70 indicates that the event being reported occurred during the execution of the current command, identified in the ''cmdopcd'' field.

An error code of 71 indicates that the event being reported occurred during execution of a previous command for which GOOD status has already been returned. The ''cmdopcd'' field is undefined in this case.

For error codes 70 and 71 the remaining fields of the event log (such as segment, snsflgs, info, and so forth) will contain the standard SCSI Sense Data fields (bytes 1 through 17) returned in the response of a SCSI REQUEST SENSE command.

An error code of 7F indicates that the Sense Data fields are in a vendor-specific format so the content of the remaining event log fields can only be determined from documentation provided by the vendor of the target device.

The SCSI specification states that error code values 72 through 7E are currently reserved for future use and that error codes 00 through 6F are not defined. Should this field contain any of those codes the remaining event log fields are undefined.

Valid

If this bit is set to one, the content of the Sense Data Information field (bytes 3 through 6) is valid and its content is as defined by the SCSI specification (see the description of the ''info'' field for the SCSI definition of the Sense Data Information field). Otherwise, the Sense Data Information field is not as defined by the SCSI specification (refer to documentation provided by the device vendor for their definition of the field).

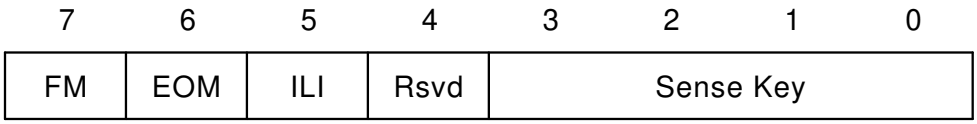
segment

This field contains byte 1 (Segment field) of the Sense Data returned in the response of a SCSI REQUEST SENSE command. If the ''cmdopcd'' is an 18 (COPY), 39 (COMPARE), or 3A (COPY AND VERIFY), this field contains the number of the current segment descriptor.

snsflgs

This field contains byte 2 of the Sense Data returned in the response of a SCSI REQUEST SENSE command. This field is formatted as shown in Figure C–11.

Figure C–11 SCSI Sense Data Byte Two (''snsflgs'') Field Format



SCSI Sense Data Byte Two (''snsflgs'') Specific Subfields:

Sense Key

The sense key provides generic categories in which events can be reported. The sense keys are described in Table C–12.

ILI

An incorrect length indicator (ILI) bit of one usually indicates that the requested logical block length did not match the logical block length of the data on the medium.

EOM

For sequential-access devices (that is, ‘‘devtype’’ is 1) an end-of-medium (EOM) bit set to one indicates that the unit is at or past the early-warning if the direction was forward or that the command could not be completed because beginning-of-partition was encountered if the direction was reverse.

FM

A filemark (FM) bit set to one indicates that the current command has read a filemark or setmark. The Additional Sense Code field (see ‘‘asc’’ field description) may be used to indicate whether a filemark or setmark was read. Note that the reporting of setmarks is optional.

info

This field contains bytes 3 through 6 (Information field) of the Sense Data returned in the response of a SCSI REQUEST SENSE command. The content of this field varies depending on the values contained in the ‘‘devtype’’ and ‘‘cmdopcd’’ fields and the ‘‘bufmode,’’ ‘‘uweuo,’’ ‘‘msbd,’’ and ‘‘fbw’’ subfields of the ‘‘sdqual’’ field as follows:

1. Regardless of the value of the ‘‘devtype’’ field and the ‘‘sdqual’’ subfields, if the ‘‘cmdopcd’’ is an 18 (COPY), 39 (COMPARE), or 3A (COPY AND VERIFY), this field contains the difference (residue) of the requested number of blocks minus the actual number of blocks copied or compared for the current segment descriptor.
2. Regardless of the value of the ‘‘sdqual’’ subfields, if ‘‘devtype’’ is 0 (Direct-Access Devices—such as magnetic disk) or 5 (CD-ROM Devices) and ‘‘cmdopcd’’ is not an 18 (COPY), 39 (COMPARE), or 3A (COPY AND VERIFY), this field contains the unsigned logical block address associated with the value contained in the Sense Key subfield of the ‘‘snsflgs’’ field (see Figure C–11).
3. Regardless of the value of ‘‘cmdopcd,’’ if ‘‘devtype’’ is 1 (Sequential-Access Devices—such as magnetic tape) and ‘‘uweuo’’ is 1 and ‘‘bufmode’’ is either 1 or 2, this field contains:
   a. the total number of objects in the buffer if ‘‘msbd’’ and ‘‘fbw’’ are both 1.
   b. the number of bytes in the buffer, including filemarks and setmarks, if ‘‘msbd’’ is 1 and ‘‘fbw’’ is 0.

addsnsl

This field contains byte 7 (Additional Sense Length field) of the Sense Data returned in the response of a SCSI REQUEST SENSE command. This field contains the number of additional Sense Data bytes to follow.

If this value is less than 10, the content of some or all of the remaining event log fields (that is, cmdspec, asc, ascq, frucode, and keyspec) may be undefined. The ''cmdspec'' field is undefined unless this value is 4 or greater. The ''asc'' and ''ascq'' fields are undefined unless this value is 6 or greater. The ''frucode'' field is undefined unless this value is 7 or greater. The ''keyspec'' field is undefined unless this value is 10 or greater.

If this value is greater than 10, the device supplied the Additional Sense Bytes field, which begins at byte 12 of the Sense Data. The content of the Additional Sense Bytes field is not included in the event log.

cmdspec

If the value contained in the ''addsnsl'' field is 4 or greater, this field contains bytes 8 through 0B (Command-Specific Information field) of the Sense Data returned in the response of a SCSI REQUEST SENSE command. The content of this field varies depending on the value contained in the ''cmdopcd'' field as follows:

1. If the ''cmdopcd'' is an 18 (COPY), 39 (COMPARE), or 3A (COPY AND VERIFY), the low order byte of this field contains the starting byte number of an area relative to Sense Data byte 0 that contains (unchanged) the source logical unit's status byte and sense data and the next higher order byte contains the starting byte number of an area relative to Sense Byte 0 that contains (unchanged) the destination logical unit's status byte and sense data. If the low order or next higher order byte of this field contains the value zero, no status byte or sense data was supplied for the corresponding (source or destination) logical unit. The content of the highest order two bytes of this field is undefined.
2. If the ''cmdopcd'' is a 7 (REASSIGN BLOCKS), this field contains the logical block address of the first defect descriptor not reassigned. If information about the first defect descriptor not reassigned is not available, or if all the defects have been reassigned, this field will contain the value FFFFFFFF.
3. If the ''cmdopcd'' is a 31 (SEARCH DATA EQUAL), 30 (SEARCH DATA HIGH), or 32 (SEARCH DATA LOW) and the Sense Key subfield of the ''snsflgs'' field (see Figure C–11) value is EQUAL, this field contains the record offset of the matching record.

asc
ascq

If the value contained in the ''addsnsl'' field is 6 or greater and the ''dssd'' subfield of the ''sdqual'' field is equal to 1, the ''asc'' and ''ascq'' fields contain the values supplied in the byte 0C (Additional Sense Code) and byte 0D (Additional Sense Code Qualifier) fields,

respectively, of the Sense Data returned in the response of a SCSI REQUEST SENSE command issued to the target device. The Additional Sense Code (ASC) field and the Additional Sense Code Qualifier (ASCQ) field together describe the event being reported. The standard SCSI ASC/ASCQ codes are ‘‘devtype’’ dependent as shown in Table C–13 through Table C–16. Note that the SCSI specification defines ASCs within the range 80 through FF in combination with ASCQs within the range 00 through FF and ASCQs within the range 80 through FF regardless of ASC value as being vendor specific. Refer to documentation provided by the vendor of the target device for a description of an ASC/ASCQ value that falls within the defined vendor specific ranges.

If the value contained in the ‘‘addsnsl’’ field is 6 or greater and the ‘‘dssd’’ subfield of the ‘‘sdqual’’ field is equal to 0, the ‘‘asc’’ and ‘‘ascq’’ fields contain HSJ30/40 controller vendor specific SCSI ASC/ASCQ codes generated by the HSJ30/40 on behalf of the target device. See Table C–17 for the descriptions of the HSJ30/40 controller vendor specific SCSI ASC/ASCQ codes.

frucode

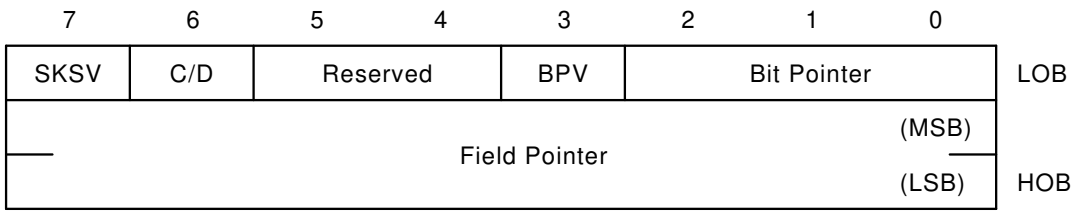
If the value contained in the ‘‘addsnsl’’ field is 7 or greater, this field contains byte 0E (Field Replaceable Unit field) of the Sense Data returned in the response of a SCSI REQUEST SENSE command. If this field is nonzero, the target device is identifying the ‘‘field replaceable unit’’ that has failed. See the service manual for the target device for complete details of the meaning of this value.

keyspec

If the value contained in the ‘‘addsnsl’’ field is 10 or greater, this field contains bytes 0F through 11 (Sense-Key Specific field) of the Sense Data returned in the response of a SCSI REQUEST SENSE command. The definition of this field is determined by the value of the Sense Key subfield of the ‘‘snsflgs’’ field. This field is reserved for Sense Key values other than ILLEGAL REQUEST, RECOVERED ERROR, HARDWARE ERROR, MEDIUM ERROR and NOT READY.

If the Sense Key value is ILLEGAL REQUEST, the format of this field is as shown in Figure C–12.

Figure C–12 SCSI Sense Data Byte 0F through 11 (“keyspec”) Field—Field Pointer Bytes Format



SCSI Sense Data Byte 0F through 11 (‘‘keyspec’’)—Field Pointer Bytes Specific Subfields:

Bit Pointer and BPV

A bit pointer valid (BPV) bit of zero indicates that the value in the Bit Pointer subfield is not valid. A BPV bit of one indicates that the Bit Pointer subfield specifies which bit of the byte designated by the Field Pointer field is in error. When a multiple-bit field is in error, the Bit Pointer subfield points to the most-significant (left-most) bit of the field.

C/D

A command data (C/D) bit of one indicates that the illegal parameter is in the command descriptor block. A C/D bit of zero indicates that the illegal parameter is in the data parameters sent by the initiator during the DATA OUT phase.

SKSV

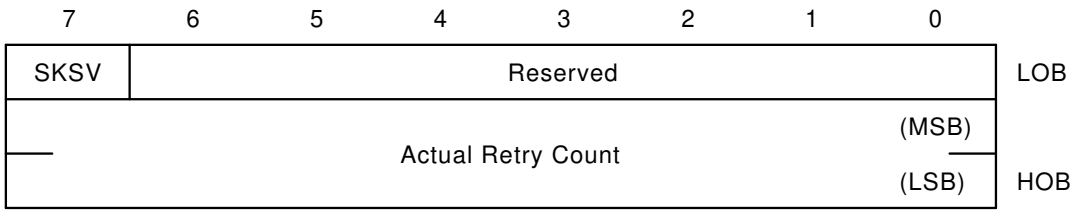
The content of the ‘‘keyspec’’ field is valid if and only if this bit is set to one.

Field Pointer

The Field Pointer subfield indicates which byte of the command descriptor block or of the parameter data was in error. When a multiple-byte field is in error, the pointer points to the most-significant (left-most) byte of the field.

If the Sense Key value is RECOVERED ERROR or HARDWARE ERROR or MEDIUM ERROR, the format of this field is as shown in Figure C–13.

Figure C–13 SCSI Sense Data Byte 0F through 11 (“keyspec”) Field—Actual Retry Count Bytes Format



SCSI Sense Data Byte 0F through 11 (‘‘keyspec’’)—Actual Retry Count Bytes Specific Subfields:

SKSV

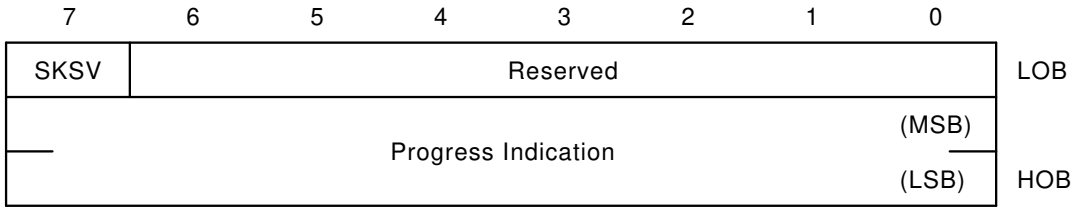
The content of the ‘‘keyspec’’ field is valid if and only if this bit is set to one.

Actual Retry Count

The actual retry count subfield contains the implementation-specific information on the actual number of retries of the recovery algorithm used in attempting to recover an error or exception condition.

If the Sense Key value is NOT READY and the last command issued to the device was a FORMAT UNIT, the format of this field is as shown in Figure C–14.

Figure C–14 SCSI Sense Data Byte 0F through 11 (“keyspec”) Field—Progress Indication Bytes Format



SCSI Sense Data Byte 0F through 11 (‘‘keyspec’’)—Progress Indication Bytes Specific Subfields:

SKSV

The content of the ‘‘keyspec’’ field is valid if and only if this bit is set to one.

Progress Indication

This subfield is a percent complete indication in which the returned value is the numerator that has 10000 as its denominator. The progress indication is based upon the total format operation including any certification or initialization operations.

C.3.3 Specific Event Log Formats

In addition to the common fields generated across certain event logs, there is specific information for each log, based on template type. The specific information is described in Sections C.3.3.1 through C.3.3.15.

C.3.3.1 Last Failure Event Log (Template 01)

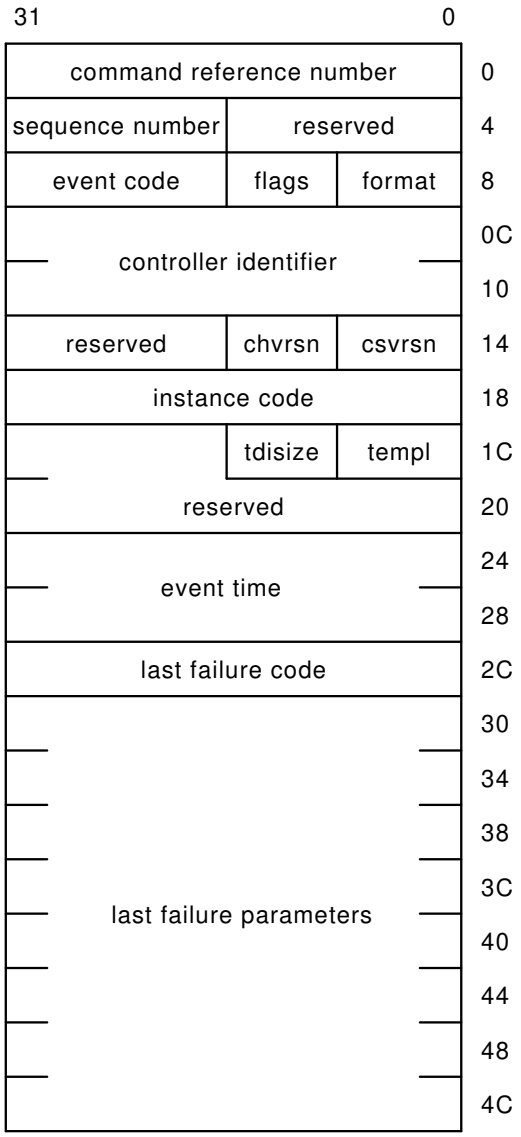
Unrecoverable conditions detected by either firmware or hardware and certain operator initiated conditions result in the termination of HSJ30/40 controller operation.

In most cases, following such a termination the controller will attempt to restart (that is, restart) with hardware components and firmware data structures initialized to the states necessary to perform normal operations.

If the restart is successful and communications are re-established with the host systems and ‘‘Miscellaneous’’ error logging is enabled by one or more host systems, the HSJ30/40 controller will send a Last Failure Event Log, which describes the condition that caused controller operation to terminate, to all host systems that have enabled ‘‘Miscellaneous’’ error logging on a connection or connections established with the HSJ30/40 controller’s Disk and/or Tape MSCP Server.

The Last Failure Event Log is reported via the T/MSCP Controller Errors error log message format. The format of this event log, including the HSJ30 /40 controller specific fields, is shown in Figure C–15.

Figure C–15 Last Failure Event Log (Template 01) Format



Last Failure Event Log Format Specific Fields:

format

This field contains the value 00 (that is, T/MSCP Controller Errors error log format code).

event code

The values that can be reported in this field for this event log are shown in Table C–18.

reserved (offset 16)

This field contains the value 0.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–18.

templ

See Section C.3.1 for the description of this field.

This field contains the value 01 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 24 for this event log.

reserved (offset 1E)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

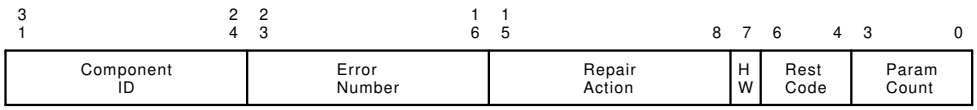
last failure code

A number that uniquely describes the unrecoverable condition being reported as shown in Table C–34 through Table C–50. The format of this field is shown in Figure C–16.

Note

Do not confuse this field with the ‘‘instance code’’ field. They are similar in format but convey different information.

Figure C–16 Last Failure Code Format



Last Failure Code Specific Subfields:

Parameter Count

The number of longwords of supplemental information provided in the ‘‘last failure parameters’’ field.

Restart Code

A number that describes the actions taken to restart the controller after the unrecoverable condition was detected as shown in Table C–52.

HW

Hardware/firmware flag. If this flag is equal to 1, the unrecoverable condition is due to a hardware detected fault. If this flag is equal to 0, the unrecoverable condition is due to a firmware detected inconsistency.

Repair Action

The recommended repair action code assigned to the condition. This value is used during Symptom Directed Diagnosis procedures to determine what notification /recovery action should be taken. See Section C.6 for more detail.

Error Number

A number, when combined with the value contained in the Component ID subfield, uniquely identifies the condition detected.

Component ID

A number that uniquely identifies the firmware component that reported the condition as shown in Table C–2.

last failure parameters

This field contains supplemental information specific to the failure being reported.

The content of the parameters supplied (if any) are described in the individual ‘‘last failure code’’ descriptions contained in Table C–34 through Table C–50.

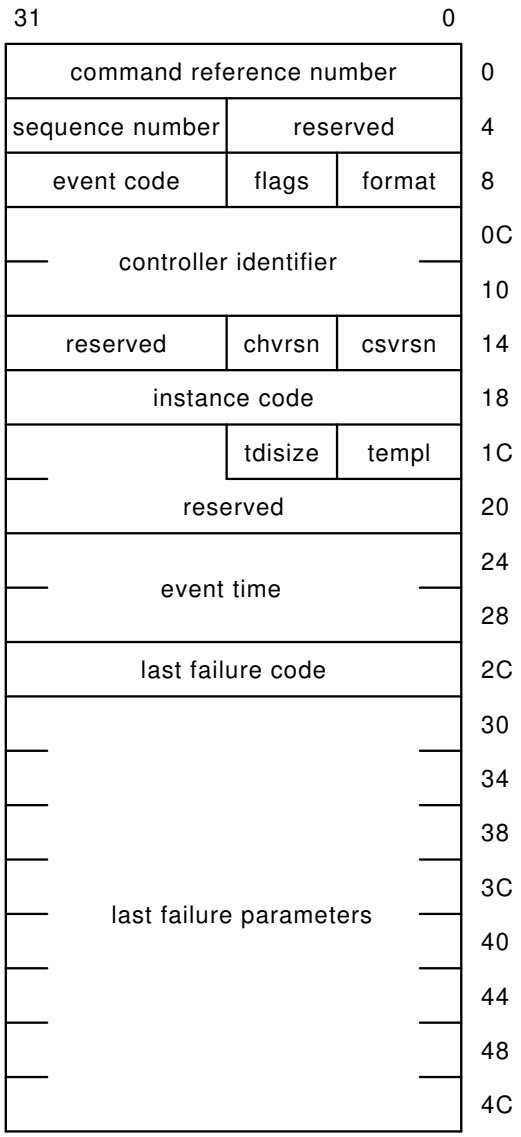
C.3.3.2 Failover Event Log (Template 05)

The HSJ30/40 controller Failover Control firmware component reports errors and other conditions encountered during redundant controller communications and failover operation via the Failover Event Log.

The Failover Event Log will be sent to all host systems that have enabled ''Miscellaneous'' error logging on a connection or connections established with the HSJ30/40 controller's Disk and/or Tape MSCP Server.

The Failover Event Log is reported via the T/MSCP Controller Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–17.

Figure C–17 Failover Event Log (Template 05) Format



Failover Event Log Format Specific Fields:

format

This field contains the value 00 (that is, T/MSCP Controller Errors error log format code).

event code

The values that can be reported in this field for this event log are shown in Table C–19.

reserved (offset 16)

This field contains the value 0.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–19.

templ

See Section C.3.1 for the description of this field.

This field contains the value 05 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 24 for this event log.

reserved (offset 1E)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

last failure code
last failure parameters

These fields contain the last failure information supplied in the last gasp message sent by the other HSJ30/40 controller in a dual-redundant configuration as a normal part of terminating controller operation.

See Section C.3.3.1 for the description of the format of these fields.

Note that the content of certain of the fields described above may be undefined depending on the value supplied in the ''instance code'' field. See Table C–19 for more detail.

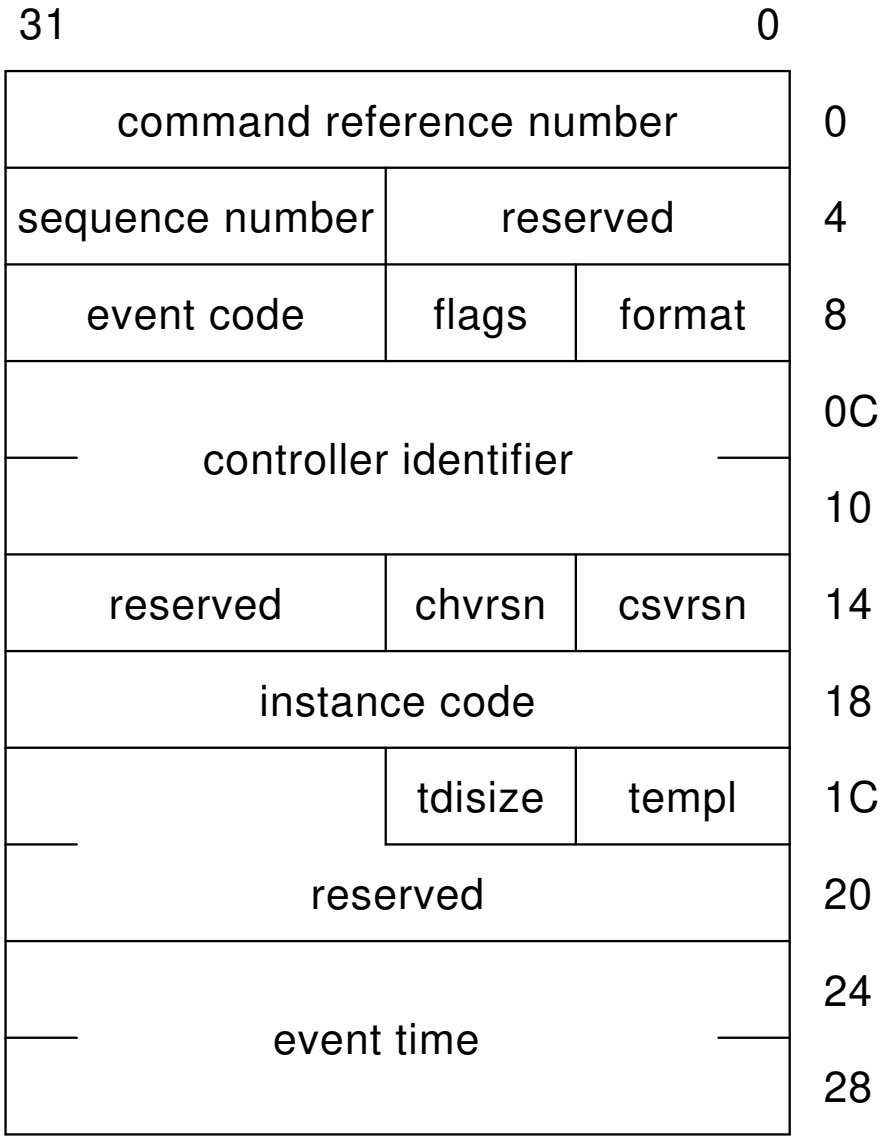
C.3.3.3 Firmware License Violation Event Log (Template 06)

The HSJ30/40 controller Value Added firmware component reports firmware license violations via the Firmware License Violation Event Log.

The Firmware License Violation Event Log will be sent to all host systems that have enabled ''Miscellaneous'' error logging on a connection or connections established with the HSJ30/40 controller's Disk and/or Tape MSCP Server.

The Firmware License Violation Event Log is reported via the T/MSCP Controller Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–18.

Figure C–18 Firmware License Violation Event Log (Template 06) Format



Firmware License Violation Event Log Format Specific Fields:

format

This field contains the value 00 (that is, T/MSCP Controller Errors error log format code).

event code

The values that can be reported in this field for this event log are shown in Table C–20.

reserved (offset 16)

This field contains the value 0.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–20.

templ

See Section C.3.1 for the description of this field.

This field contains the value 06 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 00 for this event log.

reserved (offset 1E)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

C.3.3.4 Nonvolatile Parameter Memory Component Event Log (Template 11)

The HSJ30/40 controller Executive firmware component reports errors detected while accessing a Nonvolatile Parameter Memory Component via the Nonvolatile Parameter Memory Component Event Log.

The Nonvolatile Parameter Memory Component Event Log will be sent to all host systems that have enabled ‘‘Miscellaneous’’ error logging on a connection or connections established with the HSJ30/40 controller’s Disk and/or Tape MSCP Server.

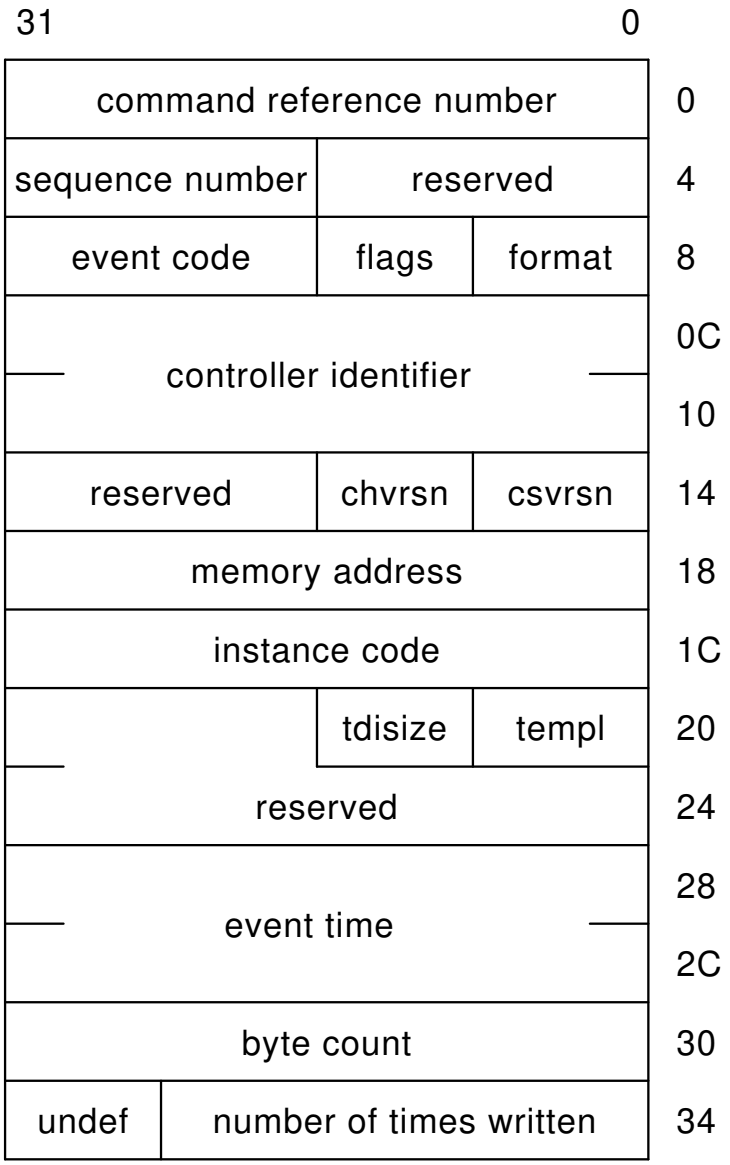
The Nonvolatile Parameter Memory Component Event Log is reported via the T/MSCP Memory Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–19.

Nonvolatile Parameter Memory Component Event Log Format Specific Fields:

format

This field contains the value 01 (that is, T/MSCP Memory Errors error log format code).

Figure C–19 Nonvolatile Parameter Memory Component Event Log (Template 11) Format



event code

The values that can be reported in this field for this event log are shown in Table C–21.

memory address

The physical address of the beginning of the affected Nonvolatile Parameter Memory component area.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–21.

templ

See Section C.3.1 for the description of this field.

This field contains the value 11 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 08 for this event log.

reserved (offset 22)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

byte count

The number of bytes contained in the affected Nonvolatile Parameter Memory component area (that is, the area bounded by: ‘‘memory address’’ through ‘‘memory address’’ + ‘‘byte count’’ - 1).

number of times written

The number of times the affected Nonvolatile Parameter Memory component area has been written.

undef

This field is only present to provide longword alignment, its content is undefined.

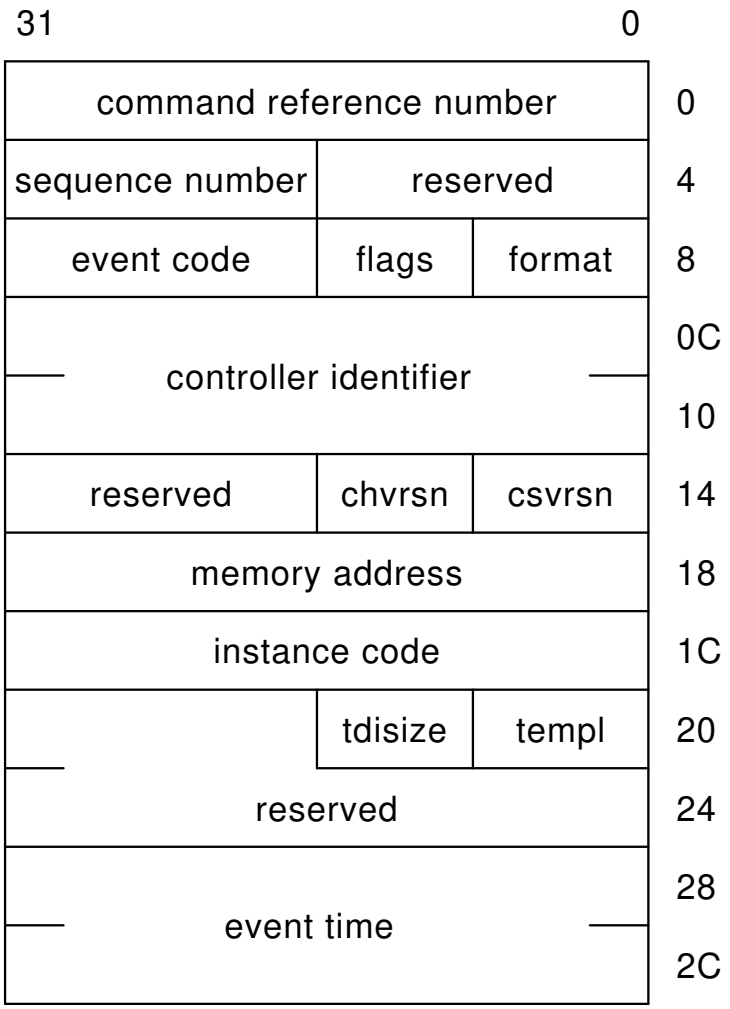
C.3.3.5 Backup Battery Failure Event Log (Template 12)

The HSJ30/40 controller Value Added Services firmware component reports backup battery failure conditions for the various hardware components that use a battery to maintain state during power-failures via the Backup Battery Failure Event Log.

The Backup Battery Failure Event Log will be sent to all host systems that have enabled ‘‘Miscellaneous’’ error logging on a connection or connections established with the HSJ30/40 controller’s Disk and/or Tape MSCP Server.

The Backup Battery Failure Event Log is reported via the T/MSCP Memory Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–20.

Figure C–20 Backup Battery Failure Event Log (Template 12) Format



Backup Battery Failure Event Log Format Specific Fields:

format

This field contains the value 01 (that is, T/MSCP Memory Errors error log format code).

event code

The values that can be reported in this field for this event log are shown in Table C–22.

memory address

The content of this field depends on the value supplied in the ‘‘instance code’’ field. See Table C–22 for more detail.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–22.

templ

See Section C.3.1 for the description of this field.

This field contains the value 12 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 00 for this event log.

reserved (offset 22)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

C.3.3.6 Subsystem Built-In Self Test Failure Event Log (Template 13)

The HSJ30/40 controller Subsystem Built-In Self Tests firmware component reports errors detected during test execution via the Subsystem Built-In Self Test Failure Event Log.

The Subsystem Built-In Self Test Failure Event Log will be sent to all host systems that have enabled ‘‘Miscellaneous’’ error logging on a connection or connections established with the HSJ30/40 controller’s Disk and/or Tape MSCP Server.

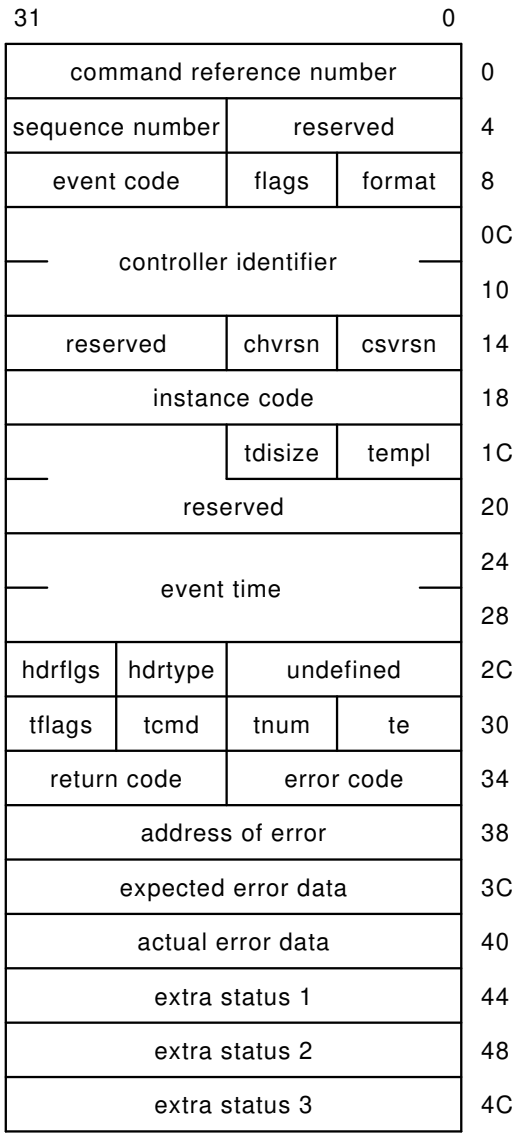
The Subsystem Built-In Self Test Failure Event Log is reported via the T /MSCP Controller Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–21.

Subsystem Built-In Self Test Failure Event Log Format Specific Fields:

format

This field contains the value 00 (that is, T/MSCP Controller Errors error log format code).

Figure C–21 Subsystem Built-In Self Test Failure Event Log (Template 13) Format



event code

The values that can be reported in this field for this event log are shown in Table C–23.

reserved (offset 16)

This field contains the value 0.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–23.

templ

See Section C.3.1 for the description of this field.

This field contains the value 13 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 24 for this event log.

reserved (offset 1E)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

undefined

This field is only present to provide longword alignment, its content is undefined.

hdrtype
hdrflgs
te
tnum
tcmd
tflags
error code
return code
address of error
expected error data
actual error data
extra status 1
extra status 2
extra status 3

The content of these fields varies depending on the HSJ30/40 controller Subsystem Built-in Self Test that detected the error condition and the error condition that was detected.

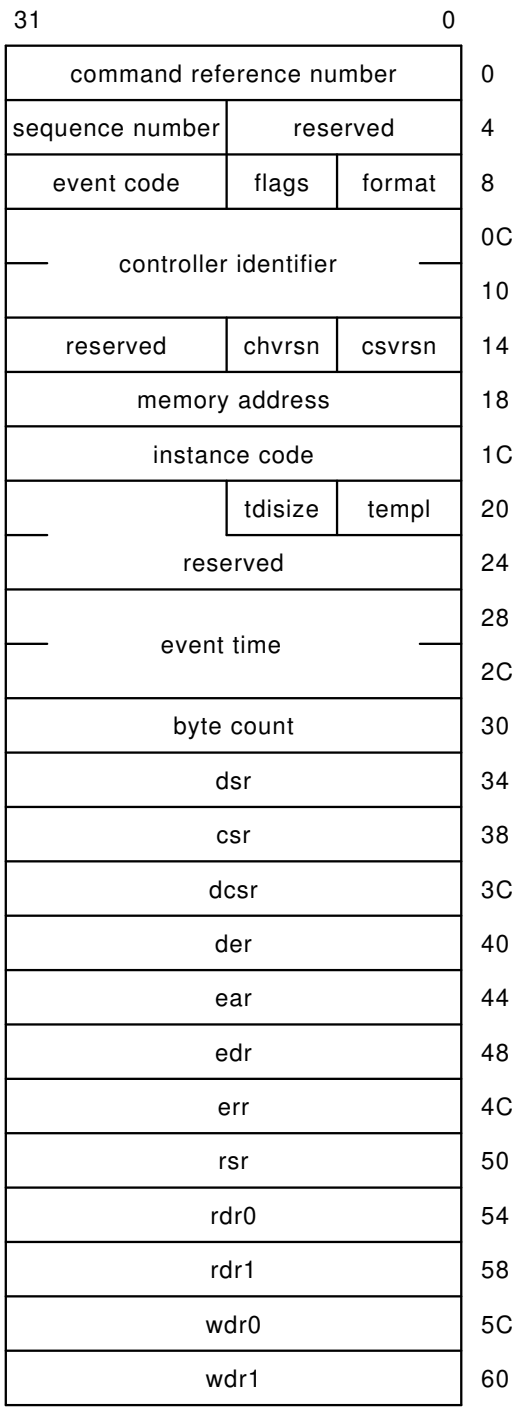
C.3.3.7 Memory System Failure Event Log (Template 14)

The HSJ30/40 controller Executive firmware component and the Cache Manager, part of the Value Added firmware component, report the occurrence of memory errors via the Memory System Failure Event Log.

The Memory System Failure Event Log will be sent to all host systems that have enabled ‘‘Miscellaneous’’ error logging on a connection or connections established with the HSJ30/40 controller’s Disk and/or Tape MSCP Server.

The Memory System Failure Event Log is reported via the T/MSCP Memory Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–22.

Figure C–22 Memory System Failure Event Log (Template 14) Format



Memory System Failure Event Log Format Specific Fields:

format

This field contains the value 01 (that is, T/MSCP Memory Errors error log format code).

event code

The values that can be reported in this field for this event log are shown in Table C–24.

memory address

The content of this field depends on the value supplied in the ‘‘instance code’’ field. See Table C–24 for more detail.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–24.

templ

See Section C.3.1 for the description of this field.

This field contains the value 14 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 34 for this event log.

reserved (offset 22)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

byte count

The number of bytes contained in the bad memory area (that is, the area bounded by: ‘‘memory address’’ through ‘‘memory address’’ + ‘‘byte count’’ - 1).

dsr
csr
dcsr
der
ear
edr

err
rsr

These fields contain the values contained in the registers of the DRAB that detected the memory failure.

rdr0
rdr1
wdr0
wdr1

These fields contain the values contained in the HSJ30/40 controller's Read and Write Diagnostic registers.

Note that the content of certain of the fields described above may be undefined depending on the value supplied in the ''instance code'' field. See Table C–24 for more detail.

C.3.3.8 CI Port Event Log (Template 31)

The HSJ30/40 controller Host Interconnect Services firmware component reports errors detected while performing work related to the CI Port communication layer via the CI Port Event Log.

The CI Port Event Log will be sent to all host systems that have enabled ''Miscellaneous'' error logging on a connection or connections established with the HSJ30/40 controller's Disk and/or Tape MSCP Server.

The CI Port Event Log is reported via the T/MSCP Controller Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–23.

CI Port Event Log Format Specific Fields:

format

This field contains the value 00 (that is, T/MSCP Controller Errors error log format code).

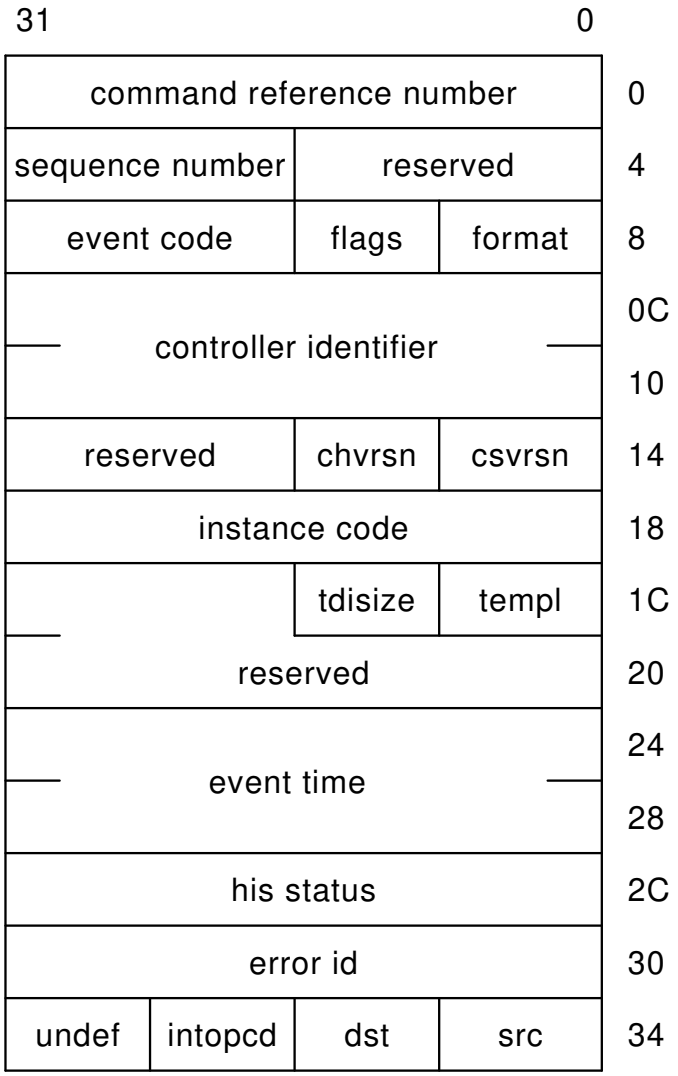
event code

The values that can be reported in this field for this event log are shown in Table C–25.

reserved (offset 16)

This field contains the value 0.

Figure C–23 CI Port Event Log (Template 31) Format



instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–25.

templ

See Section C.3.1 for the description of this field.

This field contains the value 31 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 0C for this event log.

reserved (offset 1E)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

his status
error id
src
dst
intopcd

See Section C.3.2.1 for the description of these fields.

undef

This field is only present to provide longword alignment, its content is undefined.

C.3.3.9 CI Port/Port Driver Event Log (Template 32)

The HSJ30/40 controller Host Interconnect Services firmware component reports errors detected while performing work related to the CI Port/Port Driver (PPD) communication layer via the CI Port/Port Driver Event Log.

The CI Port/Port Driver Event Log will be sent to all host systems that have enabled ''Miscellaneous'' error logging on a connection or connections established with the HSJ30/40 controller's Disk and/or Tape MSCP Server.

The CI Port/Port Driver Event Log is reported via the T/MSCP Controller Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–24.

CI Port/Port Driver Event Log Format Specific Fields:

format

This field contains the value 00 (that is, T/MSCP Controller Errors error log format code).

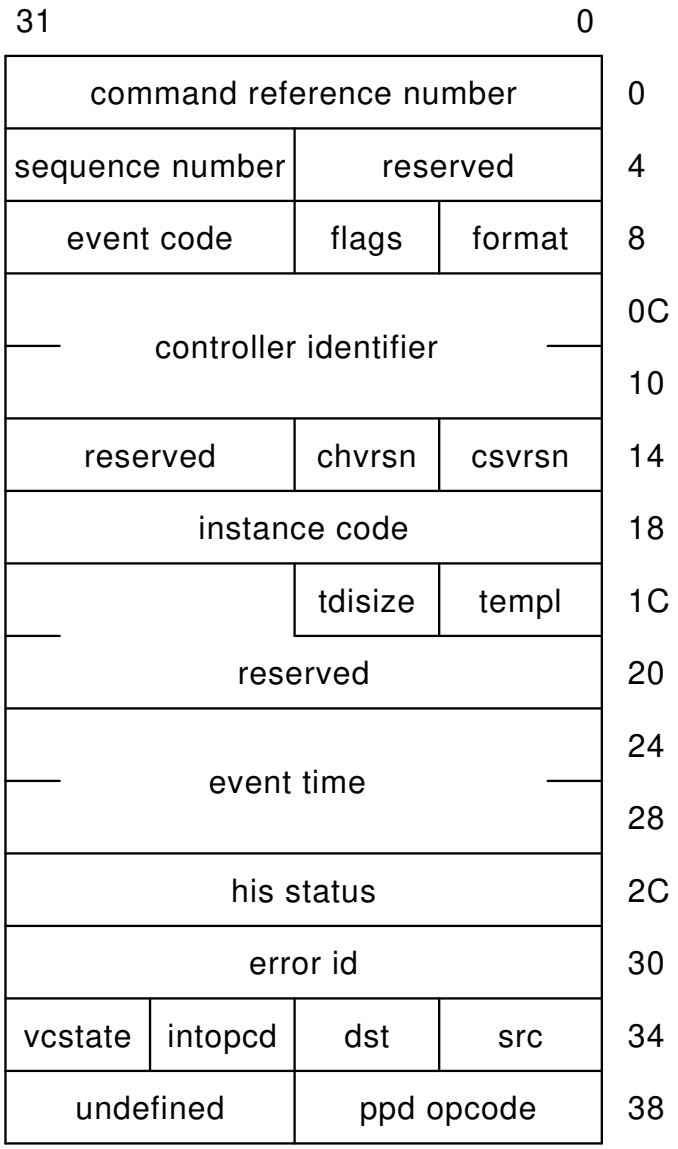
event code

The values that can be reported in this field for this event log are shown in Table C–26.

reserved (offset 16)

This field contains the value 0.

Figure C–24 CI Port/Port Driver Event Log (Template 32) Format



instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–26.

templ

See Section C.3.1 for the description of this field.

This field contains the value 32 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 10 for this event log.

reserved (offset 1E)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

his status
error id
src
dst
intopcd
vcstate
ppd opcode

See Section C.3.2.1 for the description of these fields.

undefined

This field is only present to provide longword alignment, its content is undefined.

Note that the content of certain of the fields described above may be undefined depending on the value supplied in the ''instance code'' field. See Table C–26 for more detail.

C.3.3.10 CI System Communication Services Event Log (Template 33)

The HSJ30/40 controller Host Interconnect Services firmware component reports errors detected while performing work related to the CI System Communication Services (SCS) communication layer via the CI System Communication Services Event Log.

The CI Communication Services Event Log will be sent to all host systems that have enabled ''Miscellaneous'' error logging on a connection or connections established with the HSJ30/40 controller's Disk and/or Tape MSCP Server.

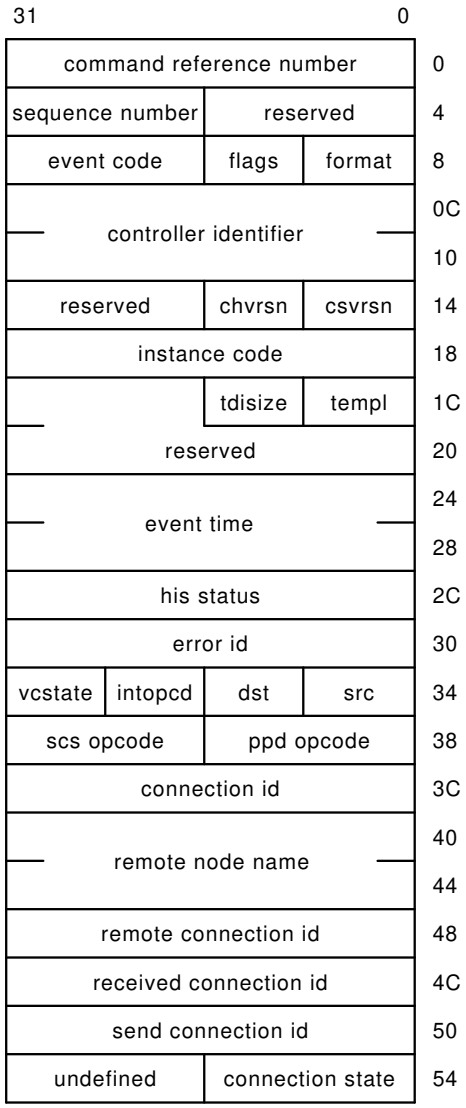
The CI System Communication Services Event Log is reported via the T/MSCP Controller Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–25.

CI System Communication Services Event Log Format Specific Fields:

format

This field contains the value 00 (that is, T/MSCP Controller Errors error log format code).

Figure C–25 CI System Communication Services Event Log (Template 33) Format



event code

The values that can be reported in this field for this event log are shown in Table C–27.

reserved (offset 16)

This field contains the value 0.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–27.

templ

See Section C.3.1 for the description of this field.

This field contains the value 33 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 2C for this event log.

reserved (offset 1E)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

his status
error id
src
dst
intopcd
vcstate
ppd opcode
scs opcode

See Section C.3.2.1 for the description of these fields.

connection id
remote node name

See Section C.3.2.2 for the description of these fields.

remote connection id

The remote connection identifier supplied by the host node.

received connection id

The connection identifier of the System Application (SYSAP) that is receiving the message contained in the Host Transaction Block.

send connection id

The connection identifier of the System Application (SYSAP) that is sending the message contained in the Host Transaction Block.

connection state

The connection state code as shown in Table C–8.

undefined

This field is only present to provide longword alignment, its content is undefined.

Note that the content of certain of the fields described above may be undefined depending on the value supplied in the ‘‘instance code’’ field. See Table C–27 for more detail.

C.3.3.11 Device Services Nontransfer Error Event Log (Template 41)

The HSJ30/40 controller Device Services firmware component reports errors detected while performing nontransfer work related to disk, tape, or media loader device operations via the Device Services Nontransfer Event Log.

If the error is associated with a command issued by a host system, the Device Services Nontransfer Error Event Log will be sent to the host system that issued the command on the same connection upon which the command was received if ‘‘This Host’’ error logging is enabled on that connection, and to all host systems that have enabled ‘‘Other Host’’ error logging on a connection or connections established with the HSJ30/40 controller’s Disk and/or Tape MSCP Server.

If the error is associated with a command issued by an HSJ30/40 controller firmware component, the Device Services Nontransfer Error Event Log will be sent to all host systems that have enabled ‘‘Miscellaneous’’ error logging on a connection established with the HSJ30/40 controller’s Disk and/or Tape MSCP Server.

The Device Services Nontransfer Error Event Log is reported via the T/MSCP Controller Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–26.

Device Services Nontransfer Error Event Log Format Specific Fields:

format

This field contains the value 00 (that is, T/MSCP Controller Errors error log format code).

event code

The values that can be reported in this field for this event log are shown in Table C–28.

reserved (offset 16)

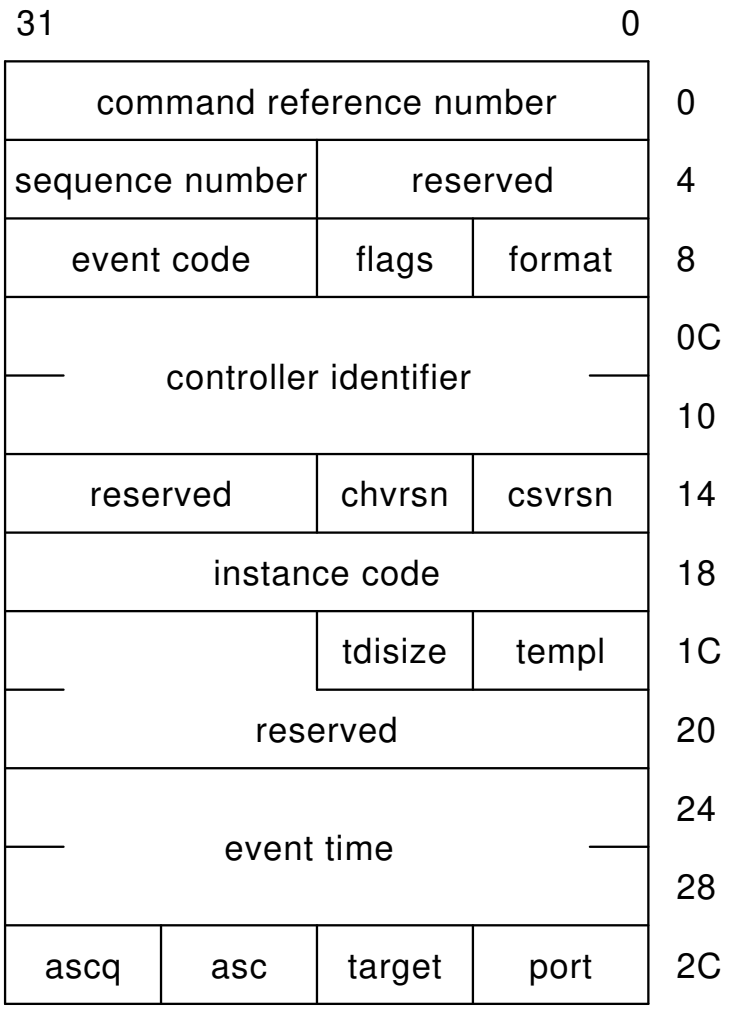
This field contains the value 0.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–28.

Figure C–26 Device Services Nontransfer Error Event Log (Template 41) Format



templ

See Section C.3.1 for the description of this field.

This field contains the value 41 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 04 for this event log.

reserved (offset 1E)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

port

The SCSI bus number affected by the error being reported.

target

The SCSI target number on the ‘‘port’’ affected by the error being reported.

asc
ascq

The ‘‘asc’’ and ‘‘ascq’’ fields contain the values supplied in byte 0C (Additional Sense Code) and byte 0D (Additional Sense Code Qualifier) fields, respectively, of the Sense Data returned in the response of a SCSI REQUEST SENSE command issued to the target device. The description of the value supplied in the ‘‘instance code’’ field (see Table C–28) describes the Sense Key value supplied in the Sense Data returned.

Note that the content of certain of the fields described above may be undefined depending on the value supplied in the ‘‘instance code’’ field. See Table C–28 for more detail.

C.3.3.12 Disk Transfer Error Event Log (Template 51)

The HSJ30/40 controller Device Services and Value Added Services firmware components report errors detected while performing work related to disk unit transfer operations via the Disk Transfer Error Event Log.

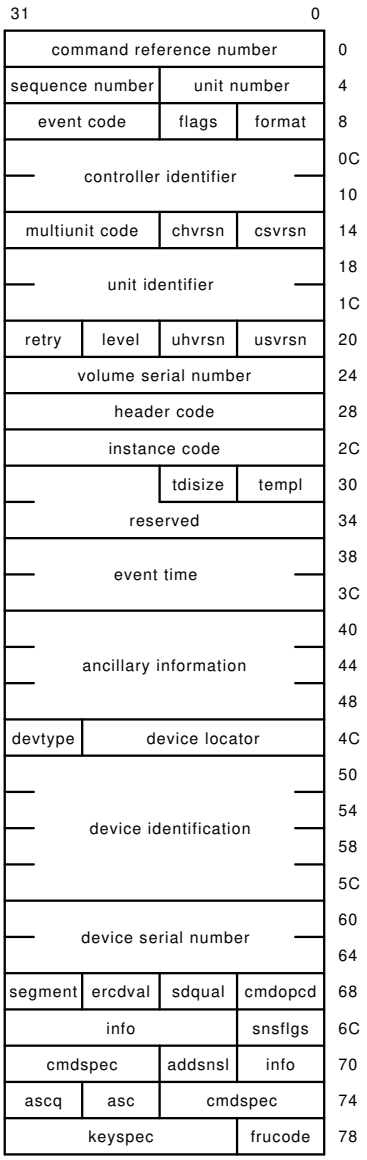
If the error is associated with a command issued by a host system, the Disk Transfer Error Event Log will be sent to the host system that issued the command on the same connection upon which the command was received if ‘‘This Host’’ error logging is enabled on that connection and to all host systems that have enabled ‘‘Other Host’’ error logging on a connection or connections established with the HSJ30/40 controller’s Disk and/or Tape MSCP Server.

If the error is associated with a command issued by a HSJ30/40 controller firmware component, the Disk Transfer Error Event Log will be sent to all host systems that have enabled ‘‘Miscellaneous’’ error logging on a connection established with the HSJ30/40 controller’s Disk MSCP Server.

The Disk Transfer Error Event Log is reported via the MSCP Disk Transfer Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–27.

Disk Transfer Error Event Log Format Specific Fields:

Figure C–27 Disk Transfer Error Event Log (Template 51) Format



format

This field contains the value 02 (that is, MSCP Disk Transfer Errors error log format code).

event code

The values that can be reported in this field for this event log are shown in Table C–29.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–29.

templ

See Section C.3.1 for the description of this field.

This field contains the value 51 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 3C for this event log.

reserved (offset 32)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

ancillary information

The format of this field varies depending on whether the event being reported is associated with a command issued by a host system or one issued by an HSJ30/40 controller firmware component.

If the event is associated with a command issued by a host system, this field is formatted as described in Section C.3.2.2.

If the event is associated with a command issued by an HSJ30/40 controller firmware component, this field is formatted as described in Section C.3.2.3.

device locator
devtype
device identification
device serial number

See Section C.3.2.4 for the description of these fields.

cmdopcd
infoq
ercdval
segment
snsflgs
info
addsnsl
cmdspec
asc
ascq
frucode
keyspec

See Section C.3.2.5 for the description of these fields.

Note that the content of certain of the fields described above may be undefined depending on the value supplied in the ‘‘instance code’’ field. See Table C–29 for more detail.

C.3.3.13 Disk Bad Block Replacement Attempt Event Log (Template 57)

The HSJ30/40 controller Value Added firmware component reports disk unit bad block replacement attempt results via the Disk Bad Block Replacement Attempt Event Log.

If the replacement is associated with a command issued by a host system, the Disk Bad Block Replacement Attempt Event Log will be sent to the host system that issued the command on the same connection upon which the command was received if ‘‘This Host’’ error logging is enabled on that connection, and to all host systems that have enabled ‘‘Other Host’’ error logging on a connection or connections established with the HSJ30/40 controller’s Disk and/or Tape MSCP Server.

If the replacement is associated with a command issued by an HSJ30/40 controller firmware component, the Disk Bad Block Replacement Attempt Error Event Log will be sent to all host systems that have enabled ‘‘Miscellaneous’’ error logging on a connection established with the HSJ30/40 controller’s Disk MSCP Server.

The Disk Bad Block Replacement Attempt Event Log is reported via the MSCP Bad Block Replacement Attempt error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–28.

Disk Bad Block Replacement Attempt Event Log Format Specific Fields:

format

This field contains the value 09 (that is, MSCP Bad Block Replacement Attempt error log format code).

event code

The values that can be reported in this field for this event log are shown in Table C–30.

reserved (offset 36)

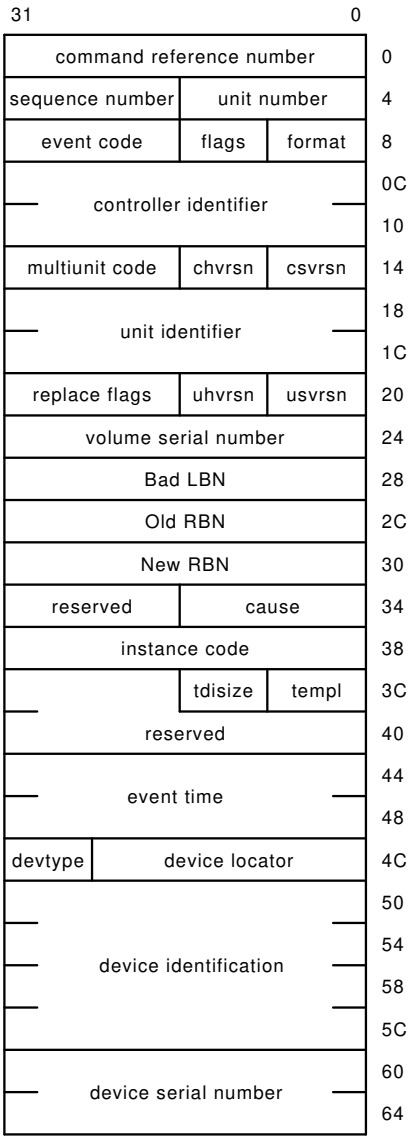
This field contains the value 0.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–30.

Figure C–28 Disk Bad Block Replacement Attempt Event Log (Template 57) Format



templ

See Section C.3.1 for the description of this field.

This field contains the value 57 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 1C for this event log.

reserved (offset 3E)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

device locator
devtype
device identification
device serial number

See Section C.3.2.4 for the description of these fields.

Note that the content of certain of the fields described above may be undefined depending on the value supplied in the ‘‘instance code’’ field. See Table C–30 for more detail.

C.3.3.14 Tape Transfer Error Event Log (Template 61)

The HSJ30/40 controller Device Services and Value Added Services firmware components report errors detected while performing work related to tape unit transfer operations via the Tape Transfer Error Event Log.

If the error is associated with a command issued by a host system, the Tape Transfer Error Event Log will be sent to the host system that issued the command on the same connection upon which the command was received if ‘‘This Host’’ error logging is enabled on that connection, and to all host systems that have enabled ‘‘Other Host’’ error logging on a connection or connections established with the HSJ30/40 controller’s Disk and/or Tape MSCP Server.

If the error is associated with a command issued by an HSJ30/40 controller firmware component, the Tape Transfer Error Event Log will be sent to all host systems that have enabled ‘‘Miscellaneous’’ error logging on a connection established with the HSJ30/40 controller’s Tape MSCP Server.

The Tape Transfer Error Event Log is reported via the TMSCP Tape Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–29.

Tape Transfer Error Event Log Format Specific Fields:

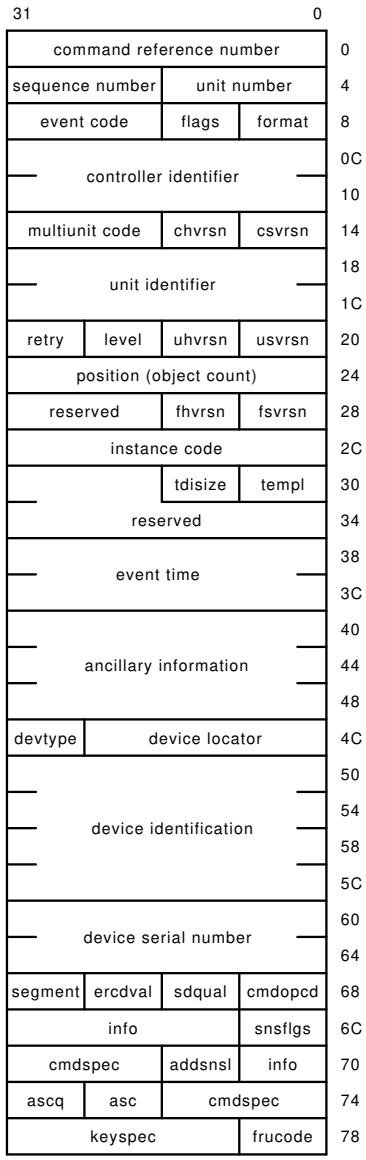
format

This field contains the value 05 (that is, TMSCP Tape Errors error log format code).

event code

The values that can be reported in this field for this event log are shown in Table C–31.

Figure C–29 Tape Transfer Error Event Log (Template 61) Format



instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–31.

templ

See Section C.3.1 for the description of this field.

This field contains the value 61 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 3C for this event log.

reserved (offset 32)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

ancillary information

The format of this field varies depending on whether the event being reported is associated with a command issued by a host system or one issued by an HSJ30/40 controller firmware component.

If the event is associated with a command issued by a host system, this field is formatted as described in Section C.3.2.2.

If the event is associated with a command issued by an HSJ30/40 controller firmware component, this field is considered ‘‘reserved’’ and contains the value 0.

device locator
devtype
device identification
device serial number

See Section C.3.2.4 for the description of these fields.

cmdopcd
infoq
ercdval
segment
snsflgs
info
addsnsl
cmdspec
asc
ascq
frucode
keyspec

See Section C.3.2.5 for the description of these fields.

Note that the content of certain of the fields described above may be undefined depending on the value supplied in the ‘‘instance code’’ field. See Table C–31 for more detail.

C.3.3.15 Media Loader Error Event Log (Template 71)

The HSJ30/40 controller Device Services firmware component reports errors detected while performing work related to media loader operations via the Media Loader Error Event Log.

If the error is associated with a command issued by a host system, the Media Loader Error Event Log will be sent to the host system that issued the command on the same connection upon which the command was received if ''This Host'' error logging is enabled on that connection, and to all host systems that have enabled ''Other Host'' error logging on a connection or connections established with the HSJ30/40 controller's Disk and/or Tape MSCP Server.

If the error is associated with a command issued by an HSJ30/40 controller firmware component, the Media Loader Error Event Log will be sent to all host systems that have enabled ''Miscellaneous'' error logging on a connection established with the HSJ30/40 controller's Tape MSCP Server.

The Media Loader Error Event Log is reported via the T/MSCP Media Loader Errors error log message format. The format of this event log, including the HSJ30/40 controller specific fields, is shown in Figure C–30.

Media Loader Error Event Log Format Specific Fields:

format

This field contains the value 0A (that is, T/MSCP Media Loader Errors error log format code).

event code

The values that can be reported in this field for this event log are shown in Table C–32.

instance code

See Section C.3.1 for the description of this field.

The values that can be reported in this field for this event log are shown in Table C–32.

templ

See Section C.3.1 for the description of this field.

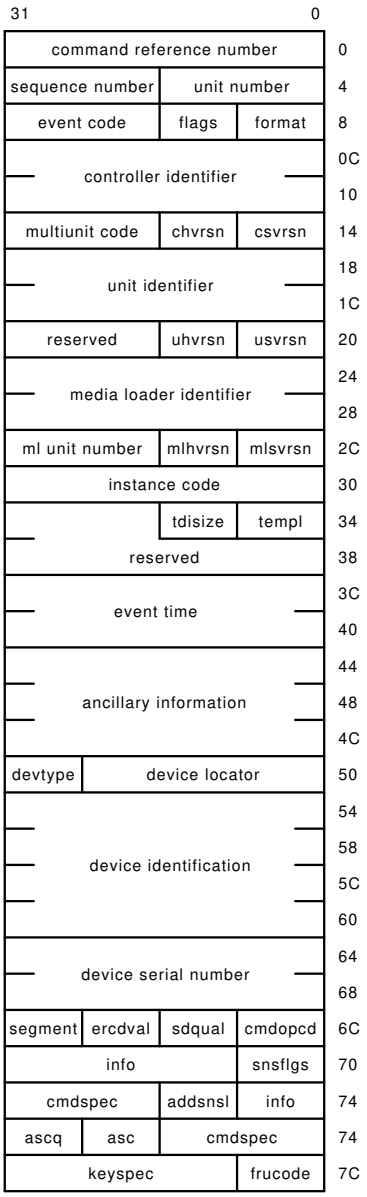
This field contains the value 71 for this event log.

tdisize

See Section C.3.1 for the description of this field.

This field contains the value 3C for this event log.

Figure C–30 Media Loader Error Event Log (Template 71) Format



reserved (offset 36)

This field contains the value 0.

event time

See Section C.3.1 for the description of this field.

ancillary information

The format of this field varies depending on whether the event being reported is associated with a command issued by a host system or one issued by an HSJ30/40 controller firmware component.

If the event is associated with a command issued by a host system, this field is formatted as described in Section C.3.2.2.

If the event is associated with a command issued by an HSJ30/40 controller firmware component, this field is considered ‘‘reserved’’ and contains the value 0.

device locator
devtype
device identification
device serial number

See Section C.3.2.4 for the description of these fields.

cmdopcd
infoq
ercdval
segment
snsflgs
info
addsnsl
cmdspec
asc
ascq
frucode
keyspec

See Section C.3.2.5 for the description of these fields.

C.3.3.16 Disk Copy Data Correlation Event Log

The HSJ30/40 controller disk MSCP server firmware component reports errors detected while performing disk copy data commands via the disk copy data correlation event log.

The format of the Disk Copy Data Correlation Event Log is identical to the format of the MSCP Disk Copy Data Correlation error log message.

If a Controller Error (subcode ‘‘Local Connection Request Failed, Insufficient Resources to Request Local Connection’’) or a Controller Error (subcode ‘‘Remote Connection Request Failed, Insufficient Resources to Request Remote Connection’’) condition is detected, the HSJ30/40 controller will store one of values shown in Table C–33 in the first longword of the event dependent information field of the MSCP Disk Copy Data Correlation error log message to identify the resource that is lacking.

C.4 Event Log Codes

Tables C–2 through C–52 list specific codes contained within the event log information.

Table C–2 Firmware Component Identifier Codes

Code	Description
01	Executive Services
02	Value Added Services
03	Device Services
04	Fault Manager
05	Common Library Routines
06	Dual Universal Asynchronous Receiver/Transmitter Services
07	Failover Control
08	Nonvolatile Parameter Memory Failover Control
20	Command Line Interpreter
40	Host Interconnect Services
42	Host Interconnect Port Services
60	Disk and Tape MSCP Server
61	Diagnostics and Utilities Protocol Server
62	System Communication Services Directory Service
80	Disk Inline Exerciser (DILX)
81	Tape Inline Exerciser (TILX)
82	Subsystem Built-In Self Tests (BIST)
83	Device Configuration Utilities (CONFIG/CFMENU)
84	Clone Utility(CLONE)

Table C–3 Host Interconnect Services Status Codes

Code	Description
00000000	Request succeeded.
00000001	The remote sent a message over a connection that has been invalidated.
00000002	The remote sent a message for which no receive credit is available.
00000003	Received a message from the remote while in an invalid or illegal connection state.
00000004	Pending work exists but connection state is invalid or illegal.
00000009	Request failed, no additional information available.
00000032	A PPD message was received from the remote but the Virtual Circuit is in an invalid or illegal state.
00000033	A PPD START was received from the remote but the Virtual Circuit state indicates that the Virtual Circuit is already OPEN.
00000034	A PPD NODE_STOP was received from the remote.

(continued on next page)

Table C–3 (Cont.) Host Interconnect Services Status Codes

Code	Description
00000035	The ‘‘PPD START send without receiving a PPD START in response’’ limit has been reached; the remote node is acknowledging the packets but not responding to them.
00000036	The ‘‘PPD STACK send without receiving a PPD ACK in response’’ limit has been reached; the remote node is acknowledging the packets but not responding to them.
00000064	The ‘‘CI IDREQ send without receiving a CI ID in response’’ limit has been reached on both Path A and Path B; the remote node is acknowledging the packets but not responding to them.
00000065	A CI ID or CI CNF packet (transmitted by the thread on behalf of Host Interconnect Services) could not be successfully transmitted.
00010009	VC closed due to CI ID request failure.
00020009	VC closed due to unexpected SCS state.
00030009	VC closed due to CI START failure.
00040009	VC closed due to CI STACK failure.
00050009	VC closed due to PPD ACK failure.
00060009	VC closed due to PPD NODE_STOP or PPD START message received.
00070009	VC closed due to NAK ADP retry CI ID transmit failure.
00080009	VC closed due to NAK ADP retry transmit failure.
00090009	VC closed due to NOR DDL retry transmit failure on Path A.
000A0009	VC closed due to NOR DDL retry transmit failure on Path B.
000B0009	VC closed due to NOR ADP retry CI ID transmit failure.
000C0009	VC closed due to NOR ADP retry transmit failure.
000D0009	VC closed due to NAK DDL retry transmit failure on Path A.
000E0009	VC closed due to NAK DDL retry transmit failure on Path B.
000F0009	VC closed due to arbitration timeout on Path A.
00100009	VC closed due to arbitration timeout on Path B.
00110009	VC closed due to Path A off.
00120009	VC closed due to Path B off.
00130009	VC closed due to dual receive.
00140009	VC closed due to invalid receive data structure state.
00150009	VC closed due to no path.
00160009	VC closed due to message transmit closed.
00170009	VC closed due to data transmit closed.
00180009	VC closed due to message scan.
00190009	VC closed due to data scan.
001A0009	VC closed due to data timeout.
001B0009	VC closed due to unrecognized packet.
001C0009	VC closed due to data transmit failure.
001D0009	VC closed due to CI ID complete failure.

(continued on next page)

Table C–3 (Cont.) Host Interconnect Services Status Codes

Code	Description
001E0009	VC closed due to lost command.
001F0009	Not implemented in CI environment.
00200009	VC closed due to sequence number mismatch.

Table C–4 CI Message Operation Codes

Code	Description
00	Reserved
01	DG
02	MSG
03	CNF
04	MCNF
05	IDREQ
06	RST
07	STRT
08	DATREQ0
09	DATREQ1
0A	DATREQ2
0B	ID
0C	PSREQ
0D	LB
0E	MDATREQ
0F	RETPS
10	SNTDAT
11	RETDAT
12	SNTMDAT
13	RETMDAT

Table C–5 CI Virtual Circuit State Codes

Code	Description
01	VC_CLOSED
02	START_SENT
03	START_REC
04	VC_OPEN
05	VC_CLOSING

Table C–6 Port/Port Driver Message Operation Codes

Code	Description
0000	START
0001	STACK
0002	ACK
0003	SCS_DG
0004	SCS_MSG
0005	ERROR_LOG
0006	NODE_STOP

Table C–7 System Communication Services Message Operation Codes

Code	Description
0000	CONNECT_REQ
0001	CONNECT_RSP
0002	ACCEPT_REQ
0003	ACCEPT_RSP
0004	REJECT_REQ
0005	REJECT_RSP
0006	DISCONNECT_REQ
0007	DISCONNECT_RSP
0008	CREDIT_REQ
0009	CREDIT_RSP
000A	APPL_MSG
000B	APPL_DG

Table C–8 CI Connection State Codes

Code	Description
0000	CLOSED
0001	LISTENING
0002	CONNECT_SENT
0003	CONNECT_ACK
0004	CONNECT_REC
0005	ACCEPT_SENT
0006	REJECT_SENT
0007	OPEN
0008	DISCONNECT_SENT
0009	DISCONNECT_REC
000A	DISCONNECT_ACK

(continued on next page)

Table C–8 (Cont.) CI Connection State Codes

Code	Description
000B	DISCONNECT_MATCH

Table C–9 Supported SCSI Device Type Codes

Code	Description
00	Direct-Access Devices (such as magnetic disk).
01	Sequential-Access Devices (such as magnetic tape).
05	CD-ROM Devices.
08	Medium Changer Devices (such as jukeboxes).

Table C–10 SCSI Command Operation Codes

Code	Supported Device Types (See Table C–9)	Description
00	00, 01, 05, 08	TEST UNIT READY
01	01	REWIND
01	00, 05, 08	REZERO UNIT
03	00, 01, 05, 08	REQUEST SENSE
04	00	FORMAT UNIT
05	01	READ BLOCK LIMITS
07	08	INITIALIZE ELEMENT STATUS
07	00	REASSIGN BLOCKS
08	00, 01, 05	READ (6 byte)
0A	00, 01	WRITE (6 byte)
0B	00, 05	SEEK (6 byte)
0F	01	READ REVERSE
10	01	WRITE FILEMARKS
11	01	SPACE
12	00, 01, 05, 08	INQUIRY
13	01	TAPE VERIFY
14	01	RECOVER BUFFERED DATA
15	00, 01, 05, 08	MODE SELECT (6 byte)
16	00, 01, 05, 08	RESERVE UNIT
17	00, 01, 05, 08	RELEASE UNIT
18	00, 01, 05	COPY
19	01	ERASE
1A	00, 01, 05, 08	MODE SENSE (6 byte)
1B	00, 05	START STOP UNIT
1B	01	LOAD UNLOAD

(continued on next page)

Table C–10 (Cont.) SCSI Command Operation Codes

Code	Supported Device Types (See Table C–9)	Description
1C	00, 01, 05, 08	RECEIVE DIAGNOSTIC RESULTS
1D	00, 01, 05, 08	SEND DIAGNOSTIC
1E	00, 01, 05, 08	PREVENT-ALLOW MEDIUM REMOVAL
25	00, 05	READ CAPACITY
28	00, 05	READ (10 byte)
2A	00	WRITE (10 byte)
2B	08	POSITION TO ELEMENT
2B	01	LOCATE
2B	00, 05	SEEK (10 byte)
2E	00	WRITE AND VERIFY (10 byte)
2F	00, 05	VERIFY (10 byte)
30	00, 05	SEARCH DATA HIGH (10 byte)
31	00, 05	SEARCH DATA EQUAL (10 byte)
32	00, 05	SEARCH DATA LOW (10 byte)
33	00, 05	SET LIMITS (10 byte)
34	01	READ POSITION
34	00, 05	PRE-FETCH
35	00, 05	SYNCHRONIZE CACHE
36	00, 05	LOCK-UNLOCK CACHE
37	00	READ DEFECT DATA (10 byte)
39	00, 01, 05	COMPARE
3A	00, 01, 05	COPY AND VERIFY
3B	00, 01, 05, 08	WRITE BUFFER
3C	00, 01, 05, 08	READ BUFFER
3E	00, 05	READ LONG
3F	00	WRITE LONG
40	00, 01, 05, 08	CHANGE DEFINITION
41	00	WRITE SAME
42	05	READ SUB-CHANNEL
43	05	READ TOC (table of contents)
44	05	READ HEADER
45	05	PLAY AUDIO (10 byte)
47	05	PLAY AUDIO MSF
48	05	PLAY AUDIO TRACK/INDEX
49	05	PLAY TRACK RELATIVE (10 byte)
4B	05	PAUSE/RESUME
4C	00, 01, 05, 08	LOG SELECT

(continued on next page)

Table C–10 (Cont.) SCSI Command Operation Codes

Code	Supported Device Types (See Table C–9)	Description
4D	00, 01, 05, 08	LOG SENSE
55	00, 01, 05, 08	MODE SELECT (10 byte)
5A	00, 01, 05, 08	MODE SENSE (10 byte)
A5	05	PLAY AUDIO (12 byte)
A5	08	MOVE MEDIUM
A6	08	EXCHANGE MEDIUM
A8	05	READ (12 byte)
A9	05	PLAY TRACK RELATIVE (12 byte)
AF	05	VERIFY (12 byte)
B0	05	SEARCH DATA HIGH (12 byte)
B1	05	SEARCH DATA EQUAL (12 byte)
B2	05	SEARCH DATA LOW (12 byte)
B3	05	SET LIMITS (12 byte)
B5	08	REQUEST VOLUME ELEMENT ADDRESS
B6	08	SEND VOLUME TAG
B8	08	READ ELEMENT STATUS

Table C–11 SCSI Buffered Modes Codes

Code	Description
0	The target shall not report GOOD status on write commands until the data blocks are actually written on the medium.
1	The target may report GOOD status on write commands as soon as as all the data specified in the write command has been transferred to the target's buffer. One or more blocks may be buffered prior to writing the blocks to the medium.
2	The target may report GOOD status on write commands as soon as: (1) All the data specified in the write command has been successfully transferred to the target's buffer, and (2) All buffered data from different initiators has been successfully written to the medium.
3	Reserved for future use.
4	Reserved for future use.
5	Reserved for future use.
6	Reserved for future use.
7	Reserved for future use.

Table C–12 SCSI Sense Key Codes

Code	Description
0	NO SENSE. Indicates that there is no specific sense key information to be reported for the designated logical unit. This would be the case for a successful command or a command that received CHECK CONDITION or COMMAND TERMINATED status because one of the FM, EOM, or ILI bits is set to one in the ‘‘snsflgs’’ field.
1	RECOVERED ERROR. Indicates that the last command completed successfully with some recovery action performed by the target. Details may be determinable by examining the ‘‘info’’ field.
2	NOT READY. Indicates that the logical unit addressed cannot be accessed. Operator intervention may be required to correct this condition.
3	MEDIUM ERROR. Indicates that the command terminated with a nonrecovered error condition that was probably caused by a flaw in the medium or an error in the recorded data. This sense key may also be returned if the target is unable to distinguish between a flaw in the medium and a specific hardware failure (sense key 4).
4	HARDWARE ERROR. Indicates that the target detected a nonrecoverable hardware failure (for example, controller failure, device failure, parity error, and so forth) while performing the command or during a self test.
5	ILLEGAL REQUEST. Indicates that there was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands (FORMAT UNIT, SEARCH DATA, and so forth). If the target detects an invalid parameter in the command descriptor block, then it shall terminate the command without altering the medium. If the target detects an invalid parameter in the additional parameters supplied as data, then the target may have already altered the medium. This sense key may also indicate that an invalid IDENTIFY message was received.
6	UNIT ATTENTION. Indicates that the removable medium may have been changed or the target has been reset.
7	DATA PROTECT. Indicates that a command that reads or writes the medium was attempted on a block that is protected from this operation. The read or write operation is not performed.
8	BLANK CHECK. Indicates that a write-once device or a sequential-access device encountered blank medium or format-defined end-of-data indication while reading or a write-once device encountered a nonblank medium while writing.
9	Vendor Specific. This sense key is available for reporting vendor specific conditions.
A	COPY ABORTED. Indicates a COPY, COMPARE, or COPY AND VERIFY command was aborted due to an error condition on the source device, the destination device, or both.
B	ABORTED COMMAND. Indicates that the target aborted the command. The initiator may be able to recover by trying the command again.
C	EQUAL. Indicates a SEARCH DATA command has satisfied an equal comparison.
D	VOLUME OVERFLOW. Indicates that a buffered peripheral device has reached the end-of-partition and data may remain in the buffer that has not been written to the medium. A RECOVER BUFFERED DATA commands may be issued to read the unwritten data from the buffer.
E	MISCOMPARE. Indicates that the source data did not match the data read from the medium.
F	RESERVED.

Table C–13 SCSI ASC/ASCQ Codes for Direct-Access Devices (Such as Magnetic Disk)

ASC Code	ASCQ Code	Description
00	00	No additional sense information.
00	06	I/O process terminated.
01	00	No index/sector signal.
02	00	No seek complete.
03	00	Peripheral device write fault.
04	00	Logical unit not ready, cause not reportable.
04	01	Logical unit is in process of becoming ready.
04	02	Logical unit not ready, initializing command required.
04	03	Logical unit not ready, manual intervention required.
04	04	Logical unit not ready, format in progress.
06	00	No reference position found.
07	00	Multiple peripheral devices selected.
08	00	Logical unit communication failure.
08	01	Logical unit communication time-out.
08	02	Logical unit communication parity error.
09	00	Track following error.
0A	00	Error log overflow.
0C	01	Write error recovered with auto reallocation.
0C	02	Write error - auto reallocation failed.
10	00	Id crc or ecc error.
11	00	Unrecovered read error.
11	01	Read retries exhausted.
11	02	Error too long to correct.
11	03	Multiple read errors.
11	04	Unrecovered read error - auto reallocate failed.
11	0A	Miscorrected error.
11	0B	Unrecovered read error - recommend reassignment.
11	0C	Unrecovered read error - recommend rewrite the data.
12	00	Address mark not found for id field.
13	00	Address mark not found for data field.
14	00	Recorded entity not found.
14	01	Record not found.
15	00	Random positioning error.
15	01	Mechanical positioning error.
15	02	Positioning error detected by read of medium.
16	00	Data synchronization mark error.
17	00	Recovered data with no error correction applied.

(continued on next page)

Table C–13 (Cont.) SCSI ASC/ASCQ Codes for Direct-Access Devices (Such as Magnetic Disk)

ASC Code	ASCQ Code	Description
17	01	Recovered data with retries.
17	02	Recovered data with positive head offset.
17	03	Recovered data with negative head offset.
17	05	Recovered data using previous sector id.
17	06	Recovered data without ecc - data auto-reallocated.
17	07	Recovered data without ecc - recommend reassignment.
17	08	Recovered data without ecc - recommend rewrite.
18	00	Recovered data with error correction applied.
18	01	Recovered data with error correction & retries applied.
18	02	Recovered data - data auto-reallocated.
18	05	Recovered data - recommend reassignment.
18	06	Recovered data - recommend rewrite.
19	00	Defect list error.
19	01	Defect list not available.
19	02	Defect list error in primary list.
19	03	Defect list error in grown list.
1A	00	Parameter list length error.
1B	00	Synchronous data transfer error.
1C	00	Defect list not found.
1C	01	Primary defect list not found.
1C	02	Grown defect list not found.
1D	00	Miscompare during verify operation.
1E	00	Recovered id with ecc correction.
20	00	Invalid command operation code.
21	00	Logical block address out of range.
22	00	Illegal function (should use 20 00, 24 00, or 26 00).
24	00	Invalid field in cdb.
25	00	Logical unit not supported.
26	00	Invalid field in parameter list.
26	01	Parameter not supported.
26	02	Parameter value invalid.
26	03	Threshold parameters not supported.
27	00	Write protected.
28	00	Not ready to ready transition, medium may have changed.
29	00	Power on, reset, or bus device reset occurred.
29	01	Power on occurred.

(continued on next page)

Table C–13 (Cont.) SCSI ASC/ASCQ Codes for Direct-Access Devices (Such as Magnetic Disk)

ASC Code	ASCQ Code	Description
29	02	SCSI bus reset occurred.
29	03	Bus device reset occurred.
2A	00	Parameters changed.
2A	01	Mode parameters changed.
2A	02	Log parameters changed.
2B	00	Copy cannot execute since host cannot disconnect.
2C	00	Command sequence error.
2F	00	Commands cleared by another initiator.
30	00	Incompatible medium installed.
30	01	Cannot read medium - unknown format.
30	02	Cannot read medium - incompatible format.
30	03	Cleaning cartridge installed.
31	00	Medium format corrupted.
31	01	Format command failed.
32	00	No defect spare location available.
32	01	Defect list update failure.
37	00	Rounded parameter.
39	00	Saving parameters not supported.
3A	00	Medium not present.
3D	00	Invalid bits in identify message.
3E	00	Logical unit has not self-configured yet.
3F	00	Target operating conditions have changed.
3F	01	Microcode has been changed.
3F	02	Changed operating definition.
3F	03	Inquiry data has changed.
40	*nn*	Diagnostic failure detected on component *nn*; where *nn* identifies a specific target device component (*nn* range 80 through FF). Refer to documentation provided by the vendor of the target device for a description of the component identified by *nn*.
40	00	Ram failure (should use 40 80 through 40 FF).
41	00	Data path failure (should use 40 80 through 40 FF).
42	00	Power-on or self-test failure (should use 40 80 through 40 FF).
43	00	Message error.
44	00	Internal target failure.
45	00	Select or reselect failure.
46	00	Unsuccessful soft reset.
47	00	SCSI parity error.

(continued on next page)

Table C–13 (Cont.) SCSI ASC/ASCQ Codes for Direct-Access Devices (Such as Magnetic Disk)

ASC Code	ASCQ Code	Description
48	00	Initiator detected error message received.
49	00	Invalid message error.
4A	00	Command phase error.
4B	00	Data phase error.
4C	00	Logical unit failed self-configuration.
4E	00	Overlapped commands attempted.
53	00	Media load or eject failed.
53	02	Medium removal prevented.
5A	00	Operator request or state change input (unspecified).
5A	01	Operator medium removal request.
5A	02	Operator selected write protect.
5A	03	Operator selected write permit.
5B	00	Log exception.
5B	01	Threshold condition met.
5B	02	Log counter at maximum.
5B	03	Log list codes exhausted.
5C	00	Rpl status change.
5C	01	Spindles synchronized.
5C	02	Spindles not synchronized.

Table C–14 SCSI ASC/ASCQ Codes for Sequential-Access Devices (Such as Magnetic Tape)

ASC Code	ASCQ Code	Description
00	00	No additional sense information.
00	01	Filemark detected.
00	02	End-of-partition/medium detected.
00	03	Setmark detected.
00	04	Beginning-of-partition/medium detected.
00	05	End-of-data detected.
00	06	I/O process terminated.
03	00	Peripheral device write fault.
03	01	No write current.
03	02	Excessive write errors.
04	00	Logical unit not ready, cause not reportable.
04	01	Logical unit is in process of becoming ready.

(continued on next page)

Table C–14 (Cont.) SCSI ASC/ASCQ Codes for Sequential-Access Devices (Such as Magnetic Tape)

ASC Code	ASCQ Code	Description
04	02	Logical unit not ready, initializing command required.
04	03	Logical unit not ready, manual intervention required.
04	04	Logical unit not ready, format in progress.
07	00	Multiple peripheral devices selected.
08	00	Logical unit communication failure.
08	01	Logical unit communication time-out.
08	02	Logical unit communication parity error.
09	00	Track following error.
0A	00	Error log overflow.
0C	00	Write error.
11	00	Unrecovered read error.
11	01	Read retries exhausted.
11	02	Error too long to correct.
11	03	Multiple read errors.
11	08	Incomplete block read.
11	09	No gap found.
11	0A	Miscorrected error.
14	00	Recorded entity not found.
14	01	Record not found.
14	02	Filemark or setmark not found.
14	03	End-of-data not found.
14	04	Block sequence error.
15	00	Random positioning error.
15	01	Mechanical positioning error.
15	02	Positioning error detected by read of medium.
17	00	Recovered data with no error correction applied.
17	01	Recovered data with retries.
17	02	Recovered data with positive head offset.
17	03	Recovered data with negative head offset.
18	00	Recovered data with error correction applied.
1A	00	Parameter list length error.
1B	00	Synchronous data transfer error.
20	00	Invalid command operation code.
21	00	Logical block address out of range.
24	00	Invalid field in cdb.
25	00	Logical unit not supported.

(continued on next page)

Table C–14 (Cont.) SCSI ASC/ASCQ Codes for Sequential-Access Devices (Such as Magnetic Tape)

ASC Code	ASCQ Code	Description
26	00	Invalid field in parameter list.
26	01	Parameter not supported.
26	02	Parameter value invalid.
26	03	Threshold parameters not supported.
27	00	Write protected.
28	00	Not ready to ready transition, medium may have changed.
29	00	Power on, reset, or bus device reset occurred.
29	01	Power on occurred.
29	02	SCSI bus reset occurred.
29	03	Bus device reset occurred.
2A	00	Parameters changed.
2A	01	Mode parameters changed.
2A	02	Log parameters changed.
2B	00	Copy cannot execute since host cannot disconnect.
2C	00	Command sequence error.
2D	00	Overwrite error on update in place.
2F	00	Commands cleared by another initiator.
30	00	Incompatible medium installed.
30	01	Cannot read medium - unknown format.
30	02	Cannot read medium - incompatible format.
30	03	Cleaning cartridge installed.
31	00	Medium format corrupted.
33	00	Tape length error.
37	00	Rounded parameter.
39	00	Saving parameters not supported.
3A	00	Medium not present.
3B	00	Sequential positioning error.
3B	01	Tape position error at beginning-of-medium.
3B	02	Tape position error at end-of-medium.
3B	08	Reposition error.
3D	00	Invalid bits in identify message.
3E	00	Logical unit has not self-configured yet.
3F	00	Target operating conditions have changed.
3F	01	Microcode has been changed.
3F	02	Changed operating definition.
3F	03	Inquiry data has changed.

(continued on next page)

Table C–14 (Cont.) SCSI ASC/ASCQ Codes for Sequential-Access Devices (Such as Magnetic Tape)

ASC Code	ASCQ Code	Description
40	*nn*	Diagnostic failure detected on component *nn*; where *nn* identifies a specific target device component (*nn* range 80 through FF). Refer to documentation provided by the vendor of the target device for a description of the component identified by *nn*.
43	00	Message error.
44	00	Internal target failure.
45	00	Select or reselect failure.
46	00	Unsuccessful soft reset.
47	00	SCSI parity error.
48	00	Initiator detected error message received.
49	00	Invalid message error.
4A	00	Command phase error.
4B	00	Data phase error.
4C	00	Logical unit failed self-configuration.
4E	00	Overlapped commands attempted.
50	00	Write append error.
50	01	Write append position error.
50	02	Position error related to timing.
51	00	Erase failure.
52	00	Cartridge fault.
53	00	Media load or eject failed.
53	01	Unload tape failure.
53	02	Medium removal prevented.
5A	00	Operator request or state change input (unspecified).
5A	01	Operator medium removal request.
5A	02	Operator selected write protect.
5A	03	Operator selected write permit.
5B	00	Log exception.
5B	01	Threshold condition met.
5B	02	Log counter at maximum.
5B	03	Log list codes exhausted.

Table C–15 SCSI ASC/ASCQ Codes for CD-ROM Devices

ASC Code	ASCQ Code	Description
00	00	No additional sense information.
00	06	I/O process terminated.

(continued on next page)

Table C–15 (Cont.) SCSI ASC/ASCQ Codes for CD-ROM Devices

ASC Code	ASCQ Code	Description
00	11	Audio play operation in progress.
00	12	Audio play operation paused.
00	13	Audio play operation successfully completed.
00	14	Audio play operation stopped due to error.
00	15	No current audio status to return.
02	00	No seek complete.
04	00	Logical unit not ready, cause not reportable.
04	01	Logical unit is in process of becoming ready.
04	02	Logical unit not ready, initializing command required.
04	03	Logical unit not ready, manual intervention required.
06	00	No reference position found.
07	00	Multiple peripheral devices selected.
08	00	Logical unit communication failure.
08	01	Logical unit communication time-out.
08	02	Logical unit communication parity error.
09	00	Track following error.
09	01	Tracking servo failure.
09	02	Focus servo failure.
09	03	Spindle servo failure.
0A	00	Error log overflow.
11	00	Unrecovered read error.
11	05	L-ec uncorrectable error.
11	06	Circ unrecovered error.
14	00	Recorded entity not found.
14	01	Record not found.
15	00	Random positioning error.
15	01	Mechanical positioning error.
15	02	Positioning error detected by read of medium.
17	00	Recovered data with no error correction applied.
17	01	Recovered data with retries.
17	02	Recovered data with positive head offset.
17	03	Recovered data with negative head offset.
17	04	Recovered data with retries and/or circ applied.
17	05	Recovered data using previous sector id.
18	00	Recovered data with error correction applied.
18	01	Recovered data with error correction & retries applied.
18	02	Recovered data - data auto-reallocated.

(continued on next page)

Table C–15 (Cont.) SCSI ASC/ASCQ Codes for CD-ROM Devices

ASC Code	ASCQ Code	Description
18	03	Recovered data with circ.
18	04	Recovered data with lec.
18	05	Recovered data - recommend reassignment.
18	06	Recovered data - recommend rewrite.
1A	00	Parameter list length error.
1B	00	Synchronous data transfer error.
20	00	Invalid command operation code.
21	00	Logical block address out of range.
24	00	Invalid field in cdb.
25	00	Logical unit not supported.
26	00	Invalid field in parameter list.
26	01	Parameter not supported.
26	02	Parameter value invalid.
26	03	Threshold parameters not supported.
28	00	Not ready to ready transition, medium may have changed.
29	00	Power on, reset, or bus device reset occurred.
29	01	Power on occurred.
29	02	SCSI bus reset occurred.
29	03	Bus device reset occurred.
2A	00	Parameters changed.
2A	01	Mode parameters changed.
2A	02	Log parameters changed.
2B	00	Copy cannot execute since host cannot disconnect.
2C	00	Command sequence error.
2F	00	Commands cleared by another initiator.
30	00	Incompatible medium installed.
30	01	Cannot read medium - unknown format.
30	02	Cannot read medium - incompatible format.
37	00	Rounded parameter.
39	00	Saving parameters not supported.
3A	00	Medium not present.
3D	00	Invalid bits in identify message.
3E	00	Logical unit has not self-configured yet.
3F	00	Target operating conditions have changed.
3F	01	Microcode has been changed.
3F	02	Changed operating definition.
3F	03	Inquiry data has changed.

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Table C–15 (Cont.) SCSI ASC/ASCQ Codes for CD-ROM Devices

ASC Code	ASCQ Code	Description
40	*nn*	Diagnostic failure detected on component *nn*; where *nn* identifies a specific target device component (*nn* range 80 through FF). Refer to documentation provided by the vendor of the target device for a description of the component identified by *nn*.
43	00	Message error.
44	00	Internal target failure.
45	00	Select or reselect failure.
46	00	Unsuccessful soft reset.
47	00	SCSI parity error.
48	00	Initiator detected error message received.
49	00	Invalid message error.
4A	00	Command phase error.
4B	00	Data phase error.
4C	00	Logical unit failed self-configuration.
4E	00	Overlapped commands attempted.
53	00	Media load or eject failed.
53	02	Medium removal prevented.
57	00	Unable to recover table-of-contents.
5A	00	Operator request or state change input (unspecified).
5A	01	Operator medium removal request.
5B	00	Log exception.
5B	01	Threshold condition met.
5B	02	Log counter at maximum.
5B	03	Log list codes exhausted.
63	00	End of user area encountered on this track.
64	00	Illegal mode for this track.

Table C–16 SCSI ASC/ASCQ Codes for Medium Changer Devices (Such as Jukeboxes)

ASC Code	ASCQ Code	Description
00	00	No additional sense information.
00	06	I/O process terminated.
02	00	No seek complete.
04	00	Logical unit not ready, cause not reportable.
04	01	Logical unit is in process of becoming ready.
04	02	Logical unit not ready, initializing command required.
04	03	Logical unit not ready, manual intervention required.

(continued on next page)

Table C–16 (Cont.) SCSI ASC/ASCQ Codes for Medium Changer Devices (Such as Jukeboxes)

ASC Code	ASCQ Code	Description
06	00	No reference position found.
07	00	Multiple peripheral devices selected.
08	00	Logical unit communication failure.
08	01	Logical unit communication time-out.
08	02	Logical unit communication parity error.
0A	00	Error log overflow.
15	00	Random positioning error.
15	01	Mechanical positioning error.
1A	00	Parameter list length error.
1B	00	Synchronous data transfer error.
20	00	Invalid command operation code.
21	00	Logical block address out of range.
21	01	Invalid element address.
24	00	Invalid field in cdb.
25	00	Logical unit not supported.
26	00	Invalid field in parameter list.
26	01	Parameter not supported.
26	02	Parameter value invalid.
26	03	Threshold parameters not supported.
28	00	Not ready to ready transition, medium may have changed.
28	01	Import or export element accessed.
29	00	Power on, reset, or bus device reset occurred.
29	01	Power on occurred.
29	02	SCSI bus reset occurred.
29	03	Bus device reset occurred.
2A	00	Parameters changed.
2A	01	Mode parameters changed.
2A	02	Log parameters changed.
2C	00	Command sequence error.
2F	00	Commands cleared by another initiator.
30	00	Incompatible medium installed.
37	00	Rounded parameter.
39	00	Saving parameters not supported.
3A	00	Medium not present.
3B	0D	Medium destination element full.
3B	0E	Medium source element empty.

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Table C–16 (Cont.) SCSI ASC/ASCQ Codes for Medium Changer Devices (Such as Jukeboxes)

ASC Code	ASCQ Code	Description
3D	00	Invalid bits in identify message.
3E	00	Logical unit has not self-configured yet.
3F	00	Target operating conditions have changed.
3F	01	Microcode has been changed.
3F	02	Changed operating definition.
3F	03	Inquiry data has changed.
40	*nn*	Diagnostic failure detected on component *nn*; where *nn* identifies a specific target device component (*nn* range 80 through FF). Refer to documentation provided by the vendor of the target device for a description of the component identified by *nn*.
43	00	Message error.
44	00	Internal target failure.
45	00	Select or reselect failure.
46	00	Unsuccessful soft reset.
47	00	SCSI parity error.
48	00	Initiator detected error message received.
49	00	Invalid message error.
4A	00	Command phase error.
4B	00	Data phase error.
4C	00	Logical unit failed self-configuration.
4E	00	Overlapped commands attempted.
53	00	Media load or eject failed.
53	02	Medium removal prevented.
5A	00	Operator request or state change input (unspecified).
5A	01	Operator medium removal request.
5B	00	Log exception.
5B	01	Threshold condition met.
5B	02	Log counter at maximum.
5B	03	Log list codes exhausted.

Table C–17 HSJ30/40 Controller Vendor Specific SCSI ASC/ASCQ Codes

ASC Code	ASCQ Code	Description
3F	85	Test Unit Ready or Read Capacity Command failed.
3F	87	Drive failed by a Host Mode Select command.
3F	88	Drive failed due to a deferred error reported by drive.
3F	90	Unrecovered Read/Write error.

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Table C–17 (Cont.) HSJ30/40 Controller Vendor Specific SCSI ASC/ASCQ Codes

ASC Code	ASCQ Code	Description
3F	C0	No response from one or more drives.
3F	C2	NV memory and drive metadata indicate conflicting drive configurations.
3F	D2	Synchronous Transfer Value differences between drives.
82	01	No command control structures available.
84	04	Command failed - SCSI ID verification failed.
85	05	Data returned from drive is invalid.
89	00	Request Sense command to drive failed.
8A	00	Illegal command for pass through mode.
8C	04	Data transfer request error.
8F	00	Premature completion of a drive command.
93	00	Drive returned vendor unique sense data.
A0	00	Last failure event report.
A0	01	Nonvolatile parameter memory component event report.
A0	02	Backup battery failure event report.
A0	03	Subsystem built-in self test failure event report.
A0	04	Memory system failure event report.
A0	05	Failover event report.
A0	06	Firmware license violation event report.
A0	07	RAID membership event report.
A1	00	Shelf OK is not properly asserted.
A1	01	Unable to clear SWAP interrupt, interrupt disabled.
A1	02	Swap interrupt re-enabled.
A1	03	Asynchronous SWAP detected.
A1	04	Controller shelf OK is not properly asserted.
B0	00	Command timeout.
B0	01	Watchdog timer timeout.
D0	01	Disconnect timeout.
D0	02	Chip command timeout.
D0	03	Byte transfer timeout.
D1	00	Bus errors.
D1	02	Unexpected bus phase.
D1	03	Disconnect expected.
D1	04	ID Message not sent.
D1	05	Synchronous negotiation error.
D1	07	Unexpected disconnect.
D1	08	Unexpected message.

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Table C–17 (Cont.) HSJ30/40 Controller Vendor Specific SCSI ASC/ASCQ Codes

ASC Code	ASCQ Code	Description
D1	09	Unexpected Tag message.
D1	0A	Channel busy.
D1	0B	Device initialization failure, device sense data available.
D2	00	Miscellaneous SCSI driver error.
D2	03	Device services had to reset the bus.
D3	00	Drive SCSI chip reported gross error.
D4	00	Non-SCSI bus parity error.
D5	02	Message Reject received on a valid message.
D7	00	Source driver programming error.
E0	03	Fault Manager detected an unknown error code.
E0	06	Maximum number of errors for this I/O exceeded.
E0	07	Drive reported recovered error without transferring all data.

Table C–18 Last Failure Event Log (Template 01) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
01010302	03EA	An unrecoverable hardware detected fault occurred.
0102030A	040A	An unrecoverable firmware inconsistency was detected.

Table C–19 Failover Event Log (Template 05) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
07030B0A	022A	Failover Control detected a receive packet sequence number mismatch. The controllers are out of synchronization with each other and are unable to communicate. Note that in this instance, the ''last failure code'' and ''last failure parameters'' fields are undefined.
07040B0A	022A	Failover Control detected a transmit packet sequence number mismatch. The controllers are out of synchronization with each other and are unable to communicate. Note that in this instance, the ''last failure code'' and ''last failure parameters'' fields are undefined.
07050064	022A	Failover Control received a Last Gasp message from the other controller. The other controller is expected to restart itself within a given time period. If it does not, it will be held reset with the ''Kill'' line.

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Table C–19 (Cont.) Failover Event Log (Template 05) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
07060C01	022A	Failover Control detected that both controllers are acting as SCSI ID 6. Because ids are determined by hardware, it is unknown which controller is the real SCSI ID 6. Note that in this instance, the ''last failure code'' and ''last failure parameters'' fields are undefined.
07070C01	022A	Failover Control detected that both controllers are acting as SCSI ID 7. Because ids are determined by hardware, it is unknown which controller is the real SCSI ID 7. Note that in this instance, the ''last failure code'' and ''last failure parameters'' fields are undefined.
07080B0A	022A	Failover Control was unable to send keep alive communication to the other controller. It is assumed that the other controller is hung or not started. Note that in this instance, the ''last failure code'' and ''last failure parameters'' fields are undefined.

Table C–20 Firmware License Violation Event Log (Template 06) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
0217000A	0016	RAID support is enabled but not licensed on this controller. Any use of this feature requires licensing. Continued use does not comply with the terms and conditions of licensing this product.
0218000A	0016	Write-Back Cache support is enabled but not licensed on this controller. Any use of this feature requires licensing. Continued use does not comply with the terms and conditions of licensing this product.
0227000A	0016	mirroring support is enabled but not licensed on this controller. Any use of this feature requires licensing. Continued use does not comply with the terms and conditions of licensing this product.

Table C–21 Nonvolatile Parameter Memory Component Event Log (Template 11) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
01032002	012A	Nonvolatile parameter memory component EDC check failed; content of the component reset to default settings.

Table C–22 Backup Battery Failure Event Log (Template 12) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
02032001	012A	Journal SRAM backup battery failure; detected during system restart. The ‘‘memory address’’ field contains the starting physical address of the Journal SRAM.
02042001	012A	Journal SRAM backup battery failure; detected during periodic check. The ‘‘memory address’’ field contains the starting physical address of the Journal SRAM.
02052301	012A	A processor interrupt was generated by the CACHE Dynamic Ram controller and Arbitration engine (DRAB) with an indication that the CACHE backup battery has failed or is low (needs charging). The ‘‘memory address’’ field contains the starting physical address of the CACHEA0 memory.
02062301	012A	The CACHE backup battery has failed testing performed by the Cache Diagnostics during system startup. The ‘‘memory address’’ field contains the starting physical address of the CACHEA0 memory.

Table C–23 Subsystem Built-In Self Test Failure Event Log (Template 13) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
82012002	020A	An unrecoverable error was detected during execution of the Device Port Subsystem Built-In Self Test. One or more of the device ports on the controller module has failed; some/all of the attached storage is no longer accessible via this controller.
82042002	020A	A spurious interrupt was detected during the execution of a Subsystem Built-In Self Test.
82052002	020A	An unrecoverable error was detected during execution of the HOST PORT Subsystem Test. The system will not be able to communicate with the host.
82062002	020A	An unrecoverable error was detected during execution of the UART/DUART Subsystem Test. This will cause the console to be unusable. This will cause failover communications to fail.
82072002	020A	An unrecoverable error was detected during execution of the FX Subsystem Test.
82082002	020A	An unrecoverable error was detected during execution of the nbuss init Test.

Table C–24 Memory System Failure Event Log (Template 14) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
0121370A	012A	Memory System Error Analysis is indicated in the information preserved during a previous last failure but no error conditions are indicated in the available DRAB registers. The Master DRAB registers content is supplied.
0122330A	012A	An error condition detected by one of the CACHE DRABs that requires supplemental information has been reported in another event report. This event report contains the Master DRAB and Diagnostic registers content associated with that initial event report.
01292602	012A	The Master DRAB detected a Cache Timeout condition during an access attempt to a CACHEA0, CACHEA1, CACHEB0, or CACHEB1 DRAB registers region or memory region, the addressed region failed to respond.
012A3702	012A	The CACHEA0 DRAB unexpectedly reported a Cache Timeout condition.
012B3702	012A	The CACHEA1 DRAB unexpectedly reported a Cache Timeout condition.
012C3702	012A	The CACHEB0 DRAB unexpectedly reported a Cache Timeout condition.
012D3702	012A	The CACHEB1 DRAB unexpectedly reported a Cache Timeout condition.
012E2702	012A	The Master DRAB detected an Nbus Transfer Error Acknowledge (TEA) condition—that is, the TEA signal was asserted by an Nbus device during an I960 to Nbus device transaction.
012F3702	012A	The Master DRAB unexpectedly reported an Nbus Transfer Error Acknowledge condition.
01303702	012A	The CACHEA0 DRAB unexpectedly reported an Nbus Transfer Error Acknowledge condition.
01313702	012A	The CACHEA1 DRAB unexpectedly reported an Nbus Transfer Error Acknowledge condition.
01323702	012A	The CACHEB0 DRAB unexpectedly reported an Nbus Transfer Error Acknowledge condition.
01333702	012A	The CACHEB1 DRAB unexpectedly reported an Nbus Transfer Error Acknowledge condition.
01342802	012A	A Multiple Bit ECC error was detected during a memory refresh attempt by the Master DRAB.
01352902	012A	A Multiple Bit ECC error was detected during a memory refresh attempt by the CACHEA0 DRAB.
01362902	012A	A Multiple Bit ECC error was detected during a memory refresh attempt by the CACHEA1 DRAB.
01372A02	012A	A Multiple Bit ECC error was detected during a memory refresh attempt by the CACHEB0 DRAB.
01382A02	012A	A Multiple Bit ECC error was detected during a memory refresh attempt by the CACHEB1 DRAB.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
01392802	012A	The Master DRAB detected a Multiple Bit ECC error during an FX attempt to read buffer memory.
013A2802	012A	The Master DRAB detected a Multiple Bit ECC error during a Host Port attempt to read buffer memory.
013B2802	012A	The Master DRAB detected a Multiple Bit ECC error during a Device Port attempt to read buffer memory.
013C2802	012A	The Master DRAB detected a Multiple Bit ECC error during an I960 attempt to read buffer memory.
013D2902	012A	The CACHEA0 DRAB detected a Multiple Bit ECC error during an FX attempt to read CACHEA0 memory.
013E2902	012A	The CACHEA0 DRAB detected a Multiple Bit ECC error during a Host Port attempt to read CACHEA0 memory.
013F2902	012A	The CACHEA0 DRAB detected a Multiple Bit ECC error during a Device Port attempt to read CACHEA0 memory.
01402902	012A	The CACHEA0 DRAB detected a Multiple Bit ECC error during an I960 attempt to read CACHEA0 memory.
01412902	012A	The CACHEA1 DRAB detected a Multiple Bit ECC error during an FX attempt to read CACHEA1 memory.
01422902	012A	The CACHEA1 DRAB detected a Multiple Bit ECC error during a Host Port attempt to read CACHEA1 memory.
01432902	012A	The CACHEA1 DRAB detected a Multiple Bit ECC error during a Device Port attempt to read CACHEA1 memory.
01442902	012A	The CACHEA1 DRAB detected a Multiple Bit ECC error during an I960 attempt to read CACHEA1 memory.
01452A02	012A	The CACHEB0 DRAB detected a Multiple Bit ECC error during an FX attempt to read CACHEB0 memory.
01462A02	012A	The CACHEB0 DRAB detected a Multiple Bit ECC error during a Host Port attempt to read CACHEB0 memory.
01472A02	012A	The CACHEB0 DRAB detected a Multiple Bit ECC error during a Device Port attempt to read CACHEB0 memory.
01482A02	012A	The CACHEB0 DRAB detected a Multiple Bit ECC error during an I960 attempt to read CACHEB0 memory.
01492A02	012A	The CACHEB1 DRAB detected a Multiple Bit ECC error during an FX attempt to read CACHEB1 memory.
014A2A02	012A	The CACHEB1 DRAB detected a Multiple Bit ECC error during a Host Port attempt to read CACHEB1 memory.
014B2A02	012A	The CACHEB1 DRAB detected a Multiple Bit ECC error during a Device Port attempt to read CACHEB1 memory.
014C2A02	012A	The CACHEB1 DRAB detected a Multiple Bit ECC error during an I960 attempt to read CACHEB1 memory.
014D3702	012A	The Master DRAB unexpectedly reported a Multiple Bit ECC error.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
014E3702	012A	The CACHEA0 DRAB unexpectedly reported a Multiple Bit ECC error.
014F3702	012A	The CACHEA1 DRAB unexpectedly reported a Multiple Bit ECC error.
01503702	012A	The CACHEB0 DRAB unexpectedly reported a Multiple Bit ECC error.
01513702	012A	The CACHEB1 DRAB unexpectedly reported a Multiple Bit ECC error.
01522B02	012A	The Master DRAB detected an Ibus to Nbus Timeout condition during an I960 to Nbus device transaction, the Nbus device failed to respond.
01533702	012A	The CACHEA0 DRAB unexpectedly reported an Ibus to Nbus Timeout condition.
01543702	012A	The CACHEA1 DRAB unexpectedly reported an Ibus to Nbus Timeout condition.
01553702	012A	The CACHEB0 DRAB unexpectedly reported an Ibus to Nbus Timeout condition.
01563702	012A	The CACHEB1 DRAB unexpectedly reported an Ibus to Nbus Timeout condition.
01572C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during an FX attempt to write buffer memory.
01582C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during an FX attempt to write a byte to buffer memory.
01592C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during an FX attempt to read buffer memory.
015A2C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to write buffer memory.
015B2C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to write a byte to buffer memory.
015C2C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to read buffer memory.
015D2C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to write buffer memory.
015E2C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to write a byte to buffer memory.
015F2C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to read buffer memory.
01602C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write buffer memory.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
01612C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write a byte to buffer memory.
01622C02	012A	The Master DRAB detected a Nonexistent Memory Error condition during an I960 attempt to read buffer memory.
01632D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write CACHEA0 memory.
01642D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write a byte to CACHEA0 memory.
01652D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during an FX attempt to read CACHEA0 memory.
01662D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to write CACHEA0 memory.
01672D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to write a byte to CACHEA0 memory.
01682D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to read CACHEA0 memory.
01692D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to write CACHEA0 memory.
016A2D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to write a byte to CACHEA0 memory.
016B2D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to read CACHEA0 memory.
016C2D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write CACHEA0 memory.
016D2D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write a byte to CACHEA0 memory.
016E2D02	012A	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to read CACHEA0 memory.
016F2D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write CACHEA1 memory.
01702D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write a byte to CACHEA1 memory.
01712D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to read CACHEA1 memory.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
01722D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to write CACHEA1 memory.
01732D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to write a byte to CACHEA1 memory.
01742D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to read CACHEA1 memory.
01752D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to write CACHEA1 memory.
01762D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to write a byte to CACHEA1 memory.
01772D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to read CACHEA1 memory.
01782D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write CACHEA1 memory.
01792D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write a byte to CACHEA1 memory.
017A2D02	012A	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to read CACHEA1 memory.
017B2E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write CACHEB0 memory.
017C2E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write a byte to CACHEB0 memory.
017D2E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an FX attempt to read CACHEB0 memory.
017E2E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to write CACHEB0 memory.
017F2E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to write a byte to CACHEB0 memory.
01802E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to read CACHEB0 memory.
01812E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to write CACHEB0 memory.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
01822E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to write a byte to CACHEB0 memory.
01832E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to read CACHEB0 memory.
01842E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write CACHEB0 memory.
01852E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write a byte to CACHEB0 memory.
01862E02	012A	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to read CACHEB0 memory.
01872E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write CACHEB1 memory.
01882E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write a byte to CACHEB1 memory.
01892E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to read CACHEB1 memory.
018A2E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to write CACHEB1 memory.
018B2E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to write a byte to CACHEB1 memory.
018C2E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Host Port attempt to read CACHEB1 memory.
018D2E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to write CACHEB1 memory.
018E2E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to write a byte to CACHEB1 memory.
018F2E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Device Port attempt to read CACHEB1 memory.
01902E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write CACHEB1 memory.
01912E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write a byte to CACHEB1 memory.
01922E02	012A	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to read CACHEB1 memory.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
01933702	012A	The Master DRAB unexpectedly reported a Nonexistent Memory Error condition.
01943702	012A	The CACHEA0 DRAB unexpectedly reported a Nonexistent Memory Error condition.
01953702	012A	The CACHEA1 DRAB unexpectedly reported a Nonexistent Memory Error condition.
01963702	012A	The CACHEB0 DRAB unexpectedly reported a Nonexistent Memory Error condition.
01973702	012A	The CACHEB1 DRAB unexpectedly reported a Nonexistent Memory Error condition.
01982F02	012A	An Address Parity error was detected during a memory refresh attempt by the Master DRAB.
01993002	012A	An Address Parity error was detected during a memory refresh attempt by the CACHEA0 DRAB.
019A3002	012A	An Address Parity error was detected during a memory refresh attempt by the CACHEA1 DRAB.
019B3102	012A	An Address Parity error was detected during a memory refresh attempt by the CACHEB0 DRAB.
019C3102	012A	An Address Parity error was detected during a memory refresh attempt by the CACHEB1 DRAB.
019D2F02	012A	The Master DRAB detected an Address Parity error during an FX attempt to read buffer memory.
019E2F02	012A	The Master DRAB detected an Address Parity error during a Host Port attempt to read buffer memory.
019F2F02	012A	The Master DRAB detected an Address Parity error during a Device Port attempt to read buffer memory.
01A02F02	012A	The Master DRAB detected an Address Parity error during an I960 attempt to read buffer memory.
01A13002	012A	The CACHEA0 DRAB detected an Address Parity error during an FX attempt to read CACHEA0 memory.
01A23002	012A	The CACHEA0 DRAB detected an Address Parity error during a Host Port attempt to read CACHEA0 memory.
01A33002	012A	The CACHEA0 DRAB detected an Address Parity error during a Device Port attempt to read CACHEA0 memory.
01A43002	012A	The CACHEA0 DRAB detected an Address Parity error during an I960 attempt to read CACHEA0 memory.
01A53002	012A	The CACHEA1 DRAB detected an Address Parity error during an FX attempt to read CACHEA1 memory.
01A63002	012A	The CACHEA1 DRAB detected an Address Parity error during a Host Port attempt to read CACHEA1 memory.
01A73002	012A	The CACHEA1 DRAB detected an Address Parity error during a Device Port attempt to read CACHEA1 memory.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
01A83002	012A	The CACHEA1 DRAB detected an Address Parity error during an I960 attempt to read CACHEA1 memory.
01A93102	012A	The CACHEB0 DRAB detected an Address Parity error during an FX attempt to read CACHEB0 memory.
01AA3102	012A	The CACHEB0 DRAB detected an Address Parity error during a Host Port attempt to read CACHEB0 memory.
01AB3102	012A	The CACHEB0 DRAB detected an Address Parity error during a Device Port attempt to read CACHEB0 memory.
01AC3102	012A	The CACHEB0 DRAB detected an Address Parity error during an I960 attempt to read CACHEB0 memory.
01AD3102	012A	The CACHEB1 DRAB detected an Address Parity error during an FX attempt to read CACHEB1 memory.
01AE3102	012A	The CACHEB1 DRAB detected an Address Parity error during a Host Port attempt to read CACHEB1 memory.
01AF3102	012A	The CACHEB1 DRAB detected an Address Parity error during a Device Port attempt to read CACHEB1 memory.
01B03102	012A	The CACHEB1 DRAB detected an Address Parity error during an I960 attempt to read CACHEB1 memory.
01B13702	012A	The Master DRAB unexpectedly reported an Address Parity error.
01B23702	012A	The CACHEA0 DRAB unexpectedly reported an Address Parity error.
01B33702	012A	The CACHEA1 DRAB unexpectedly reported an Address Parity error.
01B43702	012A	The CACHEB0 DRAB unexpectedly reported an Address Parity error.
01B53702	012A	The CACHEB1 DRAB unexpectedly reported an Address Parity error.
01B63202	012A	The Master DRAB detected an Ibus Parity Error during an I960 ID/Cache access attempt.
01B73202	012A	The Master DRAB detected an Ibus Parity Error during an I960 buffer memory access attempt.
01B83202	012A	The Master DRAB detected an Ibus Parity Error during an I960 buffer memory access attempt with a simultaneous but unrelated CACHExn memory access.
01B93202	012A	The Master DRAB detected an Ibus Parity Error during an I960 CACHEA memory access with a simultaneous but unrelated buffer memory access.
01BA3202	012A	The Master DRAB detected an Ibus Parity Error during an I960 CACHEB memory access with a simultaneous but unrelated buffer memory access.
01BB3202	012A	The Master DRAB detected an Ibus Parity Error during an I960 CACHEA Control and Status Register access with a simultaneous but unrelated buffer memory access.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
01BC3202	012A	The Master DRAB detected an Ibus Parity Error during an I960 CACHEB Control and Status Register access with a simultaneous but unrelated buffer memory access.
01BD3702	012A	The Master DRAB unexpectedly reported an Ibus Parity error.
01BE3702	012A	The CACHEA0 DRAB unexpectedly reported an Ibus Parity error.
01BF3702	012A	The CACHEA1 DRAB unexpectedly reported an Ibus Parity error.
01C03702	012A	The CACHEB0 DRAB unexpectedly reported an Ibus Parity error.
01C13702	012A	The CACHEB1 DRAB unexpectedly reported an Ibus Parity error.
01C22F02	012A	The Master DRAB detected a Write Data Parity error during an FX attempt to write buffer memory.
01C32F02	012A	The Master DRAB detected a Write Data Parity error during an FX attempt to write a byte to buffer memory.
01C42F02	012A	The Master DRAB detected a Write Data Parity error during a Host Port attempt to write buffer memory.
01C52F02	012A	The Master DRAB detected a Write Data Parity error during a Host Port attempt to write a byte to buffer memory.
01C62F02	012A	The Master DRAB detected a Write Data Parity error during a Device Port attempt to write buffer memory.
01C72F02	012A	The Master DRAB detected a Write Data Parity error during a Device Port attempt to write a byte to buffer memory.
01C82F02	012A	The Master DRAB detected a Write Data Parity error during an I960 attempt to write buffer memory.
01C92F02	012A	The Master DRAB detected a Write Data Parity error during an I960 attempt to write a byte to buffer memory.
01CA3002	012A	The CACHEA0 DRAB detected a Write Data Parity error during an FX attempt to write CACHEA0 memory.
01CB3002	012A	The CACHEA0 DRAB detected a Write Data Parity error during an FX attempt to write a byte to CACHEA0 memory.
01CC3002	012A	The CACHEA0 DRAB detected a Write Data Parity error during a Host Port attempt to write CACHEA0 memory.
01CD3002	012A	The CACHEA0 DRAB detected a Write Data Parity error during a Host Port attempt to write a byte to CACHEA0 memory.
01CE3002	012A	The CACHEA0 DRAB detected a Write Data Parity error during a Device Port attempt to write CACHEA0 memory.
01CF3002	012A	The CACHEA0 DRAB detected a Write Data Parity error during a Device Port attempt to write a byte to CACHEA0 memory.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
01D03002	012A	The CACHEA0 DRAB detected a Write Data Parity error during an I960 attempt to write CACHEA0 memory.
01D13002	012A	The CACHEA0 DRAB detected a Write Data Parity error during an I960 attempt to write a byte to CACHEA0 memory.
01D23002	012A	The CACHEA1 DRAB detected a Write Data Parity error during an FX attempt to write CACHEA1 memory.
01D33002	012A	The CACHEA1 DRAB detected a Write Data Parity error during an FX attempt to write a byte to CACHEA1 memory.
01D43002	012A	The CACHEA1 DRAB detected a Write Data Parity error during a Host Port attempt to write CACHEA1 memory.
01D53002	012A	The CACHEA1 DRAB detected a Write Data Parity error during a Host Port attempt to write a byte to CACHEA1 memory.
01D63002	012A	The CACHEA1 DRAB detected a Write Data Parity error during a Device Port attempt to write CACHEA1 memory.
01D73002	012A	The CACHEA1 DRAB detected a Write Data Parity error during a Device Port attempt to write a byte to CACHEA1 memory.
01D83002	012A	The CACHEA1 DRAB detected a Write Data Parity error during an I960 attempt to write CACHEA1 memory.
01D93002	012A	The CACHEA1 DRAB detected a Write Data Parity error during an I960 attempt to write a byte to CACHEA1 memory.
01DA3102	012A	The CACHEB0 DRAB detected a Write Data Parity error during an FX attempt to write CACHEB0 memory.
01DB3102	012A	The CACHEB0 DRAB detected a Write Data Parity error during an FX attempt to write a byte to CACHEB0 memory.
01DC3102	012A	The CACHEB0 DRAB detected a Write Data Parity error during a Host Port attempt to write CACHEB0 memory.
01DD3102	012A	The CACHEB0 DRAB detected a Write Data Parity error during a Host Port attempt to write a byte to CACHEB0 memory.
01DE3102	012A	The CACHEB0 DRAB detected a Write Data Parity error during a Device Port attempt to write CACHEB0 memory.
01DF3102	012A	The CACHEB0 DRAB detected a Write Data Parity error during a Device Port attempt to write a byte to CACHEB0 memory.
01E03102	012A	The CACHEB0 DRAB detected a Write Data Parity error during an I960 attempt to write CACHEB0 memory.
01E13102	012A	The CACHEB0 DRAB detected a Write Data Parity error during an I960 attempt to write a byte to CACHEB0 memory.
01E23102	012A	The CACHEB1 DRAB detected a Write Data Parity error during an FX attempt to write CACHEB1 memory.
01E33102	012A	The CACHEB1 DRAB detected a Write Data Parity error during an FX attempt to write a byte to CACHEB1 memory.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
01E43102	012A	The CACHEB1 DRAB detected a Write Data Parity error during a Host Port attempt to write CACHEB1 memory.
01E53102	012A	The CACHEB1 DRAB detected a Write Data Parity error during a Host Port attempt to write a byte to CACHEB1 memory.
01E63102	012A	The CACHEB1 DRAB detected a Write Data Parity error during a Device Port attempt to write CACHEB1 memory.
01E73102	012A	The CACHEB1 DRAB detected a Write Data Parity error during a Device Port attempt to write a byte to CACHEB1 memory.
01E83102	012A	The CACHEB1 DRAB detected a Write Data Parity error during an I960 attempt to write CACHEB1 memory.
01E93102	012A	The CACHEB1 DRAB detected a Write Data Parity error during an I960 attempt to write a byte to CACHEB1 memory.
01EA3702	012A	The Master DRAB unexpectedly reported a Write Data Parity error.
01EB3702	012A	The CACHEA0 DRAB unexpectedly reported a Write Data Parity error.
01EC3702	012A	The CACHEA1 DRAB unexpectedly reported a Write Data Parity error.
01ED3702	012A	The CACHEB0 DRAB unexpectedly reported a Write Data Parity error.
01EE3702	012A	The CACHEB1 DRAB unexpectedly reported a Write Data Parity error.
02072201	012A	The CACHE Dynamic Ram controller and Arbitration engine 0 (DRAB0) failed testing performed by the Cache Diagnostics. The ‘‘memory address’’ field contains the starting physical address of the CACHEA0 memory.
02082201	012A	The CACHE Dynamic Ram controller and Arbitration engine 1 (DRAB1) failed testing performed by the Cache Diagnostics. The ‘‘memory address’’ field contains the starting physical address of the CACHEA1 memory.
020B2201	012A	Failed read test of a write-back metadata page residing in cache. Dirty write-back cached data exists and cannot be flushed to media. The dirty data is lost. The ‘‘memory address’’ field contains the starting physical address of the CACHEA0 memory.
020C2201	012A	Cache Diagnostics have declared the cache bad during testing. The ‘‘memory address’’ field contains the starting physical address of the CACHEA0 memory.
020D2401	012A	The wrong write cache module is configured. The serial numbers do not match. Either the existing or the expected cache contains dirty write-back cached data. Note that in this instance the ‘‘memory address,’’ ‘‘byte count,’’ DRAB register, and Diagnostic register fields are undefined.

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Table C–24 (Cont.) Memory System Failure Event Log (Template 14) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
020E2401	012A	The write cache module is missing. A cache is expected to be configured and contains dirty write-back cached data. Note that in this instance the ''memory address,'' ''byte count,'' DRAB register, and Diagnostic register fields are undefined.
020F2401	012A	The write cache modules are not configured properly for a dual-redundant configuration. One of the write cache modules is not present to perform cache failover of dirty write-back cached data. Note that in this instance, the ''memory address,'' ''byte count,'' DRAB register, and Diagnostic register fields are undefined.
02102401	012A	The write cache modules are not configured properly for a dual-redundant configuration. One of the cache modules is not the same size to perform cache failover of dirty write-back cached data. Note that in this instance, the ''memory address,'' ''byte count,'' DRAB register, and Diagnostic register fields are undefined.
02192401	012A	The cache modules are not configured properly for a dual-redundant configuration. One of the cache modules is not the same type (that is, both write cache) to perform cache failover of dirty write-back cached data. Note that in this instance the ''memory address,'' ''byte count,'' DRAB register, and Diagnostic register fields are undefined.
021D0064	012A	Unable to lock the other controller's cache in a write-cache failover attempt. Either a latent error could not be cleared on the cache or the other controller did not release its cache. Note that in this instance, the ''memory address,'' ''byte count,'' DRAB register, and Diagnostic register fields are undefined.

Table C–25 CI Port Event Log (Template 31) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
40016001	006A	CI A/B transmit cables are crossed.
40026001	006A	CI A/B receive cables are crossed.
4009640A	006A	CI Port detected bad path A upon attempting to transmit a packet.
400A640A	006A	CI Port detected bad path B upon attempting to transmit a packet.
400D640A	006A	CI Port detected bad path A upon attempting to transmit a packet.
400E640A	006A	CI Port detected bad path B upon attempting to transmit a packet.

Table C–26 CI Port/Port Driver Event Log (Template 32) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
4003640A	006A	CI Port detected a Dual Receive condition that resulted in the closure of the Virtual Circuit. This error condition will be eliminated in a future CI interface chip.
4004020A	006A	Host Interconnect Services detected protocol error upon validating a received packet.
4007640A	006A	CI Port detected error upon attempting to transmit a packet. This resulted in the closure of the Virtual Circuit.
400F640A	006A	Host Interconnect Services detected packet sequence number mismatch.
403D020A	006A	Received packet with an unrecognized PPD opcode. Note that the content of the ''vcstate'' field is undefined in this instance.
40440064	006A	Received a PPD NODE_STOP and closed virtual circuit.

Table C–27 CI System Communication Services Event Log (Template 33) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
4015020A	006A	Remote SYSAP sent an SCS APPL_MSG but no receive credit was available.
4029010A	006A	Illegal connection state. Not in CONNECT_REC connection state when an SCS ACCEPT_REQ is pending.
402A010A	006A	Illegal connection state. Not in CONNECT_REC connection state when an SCS REJECT_REQ is pending.
402B010A	006A	Illegal connection state. Not in CLOSED connection state when an SCS CONNECT_REQ is pending.
402C010A	006A	Illegal connection state. Not in OPEN or DISCONNECT_REC connection state when an SCS DISCONNECT_REQ is pending.
4051020A	006A	Received SCS CONNECT_RSP when not in CONNECT_SENT connection state.
4052020A	006A	Received SCS CONNECT_RSP when the connection is no longer valid.
4053020A	006A	Received SCS ACCEPT_REQ when not in CONNECT_ACK connection state.
4054020A	006A	Received SCS ACCEPT_RSP when not in the ACCEPT_SENT connection state.
4055020A	006A	Received SCS REJECT_REQ when not in the CONNECT_ACK connection state.
4056020A	006A	Received SCS REJECT_RSP when not in the REJECT_SENT connection state.
4057020A	006A	Received SCS DISCONNECT_REQ when not in the OPEN, DISCONNECT_SENT or DISCONNECT_ACK connection state.

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Table C–27 (Cont.) CI System Communication Services Event Log (Template 33) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
4058020A	006A	Received SCS DISCONNECT_RSP when not in the DISCONNECT_SENT or DISCONNECT_MATCH connection state.
4059020A	006A	Received SCS CREDIT_REQ when in the DISCONNECT_REC or DISCONNECT_MATCH connection state.
405A020A	006A	Received SCS APPL_MSG when in the DISCONNECT_SENT or DISCONNECT_ACK connection state.
405B020A	006A	Received SCS ACCEPT_REQ on a connection that is no longer valid. Note that in this instance, if the ''connection id'' field is zero, the content of the ''vcstate,'' ''remote node name,'' ''remote connection id'' and ''connection state'' fields are undefined.
405C020A	006A	Received SCS ACCEPT_RSP on a connection that is no longer valid. Note that in this instance, if the ''connection id'' field is zero, the content of the ''vcstate,'' ''remote node name,'' ''remote connection id'' and ''connection state'' fields are undefined.
405D020A	006A	Received SCS REJECT_REQ on a connection that is no longer valid. Note that in this instance, if the ''connection id'' field is zero, the content of the ''vcstate,'' ''remote node name,'' ''remote connection id'' and ''connection state'' fields are undefined.
405E020A	006A	Received SCS REJECT_RSP on a connection that is no longer valid. Note that in this instance, if the ''connection id'' field is zero, the content of the ''vcstate,'' ''remote node name,'' ''remote connection id'' and ''connection state'' fields are undefined.
405F020A	006A	Received SCS DISCONNECT_REQ on a connection that is no longer valid. Note that in this instance, if the ''connection id'' field is zero, the content of the ''vcstate,'' ''remote node name,'' ''remote connection id'' and ''connection state'' fields are undefined.
4060020A	006A	Received SCS DISCONNECT_RSP on a connection that is no longer valid. Note that in this instance, if the ''connection id'' field is zero, the content of the ''vcstate,'' ''remote node name,'' ''remote connection id'' and ''connection state'' fields are undefined.
4061020A	006A	Received SCS CREDIT_REQ on a connection that is no longer valid. Note that in this instance, if the ''connection id'' field is zero, the content of the ''vcstate,'' ''remote node name,'' ''remote connection id'' and ''connection state'' fields are undefined.
4062020A	006A	Received SCS CREDIT_RSP on a connection that is no longer valid. Note that in this instance, if the ''connection id'' field is zero, the content of the ''vcstate,'' ''remote node name,'' ''remote connection id'' and ''connection state'' fields are undefined.
4063020A	006A	Received SCS APPL_MSG on a connection that is no longer valid. Note that in this instance, if the ''connection id'' field is zero, the content of the ''vcstate,'' ''remote node name,'' ''remote connection id'' and ''connection state'' fields are undefined.

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Table C–27 (Cont.) CI System Communication Services Event Log (Template 33) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
4064020A	006A	Received an unrecognized SCS message. Note that in this instance if the ''connection id'' field is zero, the content of the ''vcstate,'' ''remote node name,'' ''remote connection id'' and ''connection state'' fields are undefined.
4065020A	006A	Received SCS CONNECT_RSP with an unrecognized status. Connection is broken by Host Interconnect Services.
4066020A	006A	Received SCS REJECT_REQ with an invalid reason.
4067020A	006A	Received SCS APPL_MSG with no receive credit available.

Table C–28 Device Services Nontransfer Error Event Log (Template 41) Instance /MSCP Event Codes

Instance Code	MSCP Event Code	Description
021B0064	0014	Disk Bad Block Replacement attempt completed for a read of controller metadata from a location outside the user data area of the disk. Note that due to the way Bad Block Replacement is performed on SCSI disk drives, information on the actual replacement blocks is not available to the controller and is therefore not included in the event report.
021A0064	0014	Disk Bad Block Replacement attempt completed for a write of controller metadata to a location outside the user data area of the disk. Note that due to the way Bad Block Replacement is performed on SCSI disk drives, information on the actual replacement blocks is not available to the controller and is therefore not included in the event report.
03010101	006A	No command control structures available for disk operation. Note that in this instance, the ''asc'' and ''ascq'' fields are undefined.
03820101	006A	No command control structures available for tape operation. Note that in this instance, the ''asc'' and ''ascq'' fields are undefined.
03B40101	006A	No command control structures available for media loader operation. Note that in this instance, the ''asc'' and ''ascq'' fields are undefined.
03C80101	006A	No command control structures available for operation to a device that is unkown to the controller. Note that in this instance the ''asc'' and ''ascq'' fields are undefined.
03022002	002A	SCSI interface chip command timeout during disk operation. Note that in this instance the ''asc'' and ''ascq'' fields are undefined.
03832002	002A	SCSI interface chip command timeout during tape operation. Note that in this instance the ''asc'' and ''ascq'' fields are undefined.

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Table C–28 (Cont.) Device Services Nontransfer Error Event Log (Template 41) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
03B52002	002A	SCSI interface chip command timeout during media loader operation. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03C92002	002A	SCSI interface chip command timeout during operation to a device that is unknown to the controller. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03034002	016A	Byte transfer timeout during disk operation. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03844002	016A	Byte transfer timeout during tape operation. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03B64002	016A	Byte transfer timeout during media loader operation. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03CA4002	016A	Byte transfer timeout during operation to a device that is unknown to the controller. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03044402	01AA	SCSI bus errors during disk operation. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03854402	01AA	SCSI bus errors during tape operation. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03B74402	01AA	SCSI bus errors during media loader operation. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03D24402	01AA	SCSI bus errors during device operation. The device type is unknown to the controller. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03052002	002A	Device port SCSI chip reported gross error during disk operation. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03862002	002A	Device port SCSI chip reported gross error during tape operation. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03B82002	002A	Device port SCSI chip reported gross error during media loader operation. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03CD2002	002A	Device port SCSI chip reported gross error during operation to a device that is unknown to the controller. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03062002	008A	Non-SCSI bus parity error during disk operation. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03872002	008A	Non-SCSI bus parity error during tape operation. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03B92002	008A	Non-SCSI bus parity error during media loader operation. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03CE2002	008A	Non-SCSI bus parity error during operation to a device that is unknown to the controller. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.

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Table C–28 (Cont.) Device Services Nontransfer Error Event Log (Template 41) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
03070101	01CA	Source driver programming error encountered during disk operation. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03880101	01CA	Source driver programming error encountered during tape operation. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03BA0101	01CA	Source driver programming error encountered during media loader operation. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03CF0101	01CA	Source driver programming error encountered during operation to a device that is unknown to the controller. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03080101	01EA	Miscellaneous SCSI Port Driver coding error detected during disk operation. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03890101	01EA	Miscellaneous SCSI Port Driver coding error encountered during tape operation. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03BB0101	01EA	Miscellaneous SCSI Port Driver coding error detected during media loader operation. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03CB0101	01EA	Miscellaneous SCSI Port Driver coding error detected during operation to a device that is unkown to the controller. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03270101	01EA	A disk related error code was reported that was unknown to the Fault Management firmware. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
038A0101	01EA	A tape related error code was reported that was unknown to the Fault Management firmware. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03BC0101	01EA	A media loader related error code was reported that was unknown to the Fault Management firmware. Note that in this instance the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03CC0101	01EA	A error code was reported that was unknown to the Fault Management firmware. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03D04002	01AA	A failure occurred while attempting a SCSI Test Unit Ready or Read Capacity command to a device. The device type is unknown to the controller. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.
03D14002	006A	The identification of a device does not match the configuration information. The actual device type is unknown to the controller. Note that in this instance, the ‘‘asc’’ and ‘‘ascq’’ fields are undefined.

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Table C–28 (Cont.) Device Services Nontransfer Error Event Log (Template 41) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
03F40064	016A	Device services had to reset the port to clear a bad condition. Note that in this instance, the ‘‘target,’’ ‘‘asc,’’ and ‘‘ascq’’ fields are undefined.
03F00402	00EB	The shelf indicated by the ‘‘port’’ field is reporting a problem. This could mean one or both of the following: • If the shelf is using dual power supplies, one power supply has failed. • One of the shelf cooling fans has failed. Note that in this instance the ‘‘target,’’ ‘‘asc,’’ and ‘‘ascq’’ fields are undefined.
03F10502	00EB	The SWAP interrupt from the shelf indicated by the ‘‘port’’ field can not be cleared. All SWAP interrupts from all ports will be disabled until corrective action is taken. When SWAP interrupts are disabled, both controller front panel button presses and removal/insertion of devices are not detected by the controller. Note that in this instance, the ‘‘target,’’ ‘‘asc,’’ and ‘‘ascq’’ fields are undefined.
03F20064	00EB	The SWAP interrupts have been cleared and re-enabled for all shelves. Note that in this instance, the ‘‘port,’’ ‘‘target,’’ ‘‘asc,’’ and ‘‘ascq’’ fields are undefined.
03F30064	00EB	An asynchronous SWAP interrupt was detected by the controller for the shelf indicated by the ‘‘port’’ field. Possible reasons for this occurance include: • Device insertion/removal • Shelf power failure • SWAP interrupts re-enabled. Note that in this instance, the ‘‘target,’’ ‘‘asc,’’ and ‘‘ascq’’ fields are undefined.
03D3450A	00EB	During device initialization, the device reported the SCSI Sense Key NO SENSE. This indicates that there is no specific sense key information to be reported for the designated logical unit. This would be the case for a successful command or a command that received CHECK CONDITION or COMMAND TERMINATED status because one of the FM, EOM, or ILI bits is set to one in the sense data flags field.
03D4450A	00EB	During device initialization, the device reported the SCSI Sense Key RECOVERED ERROR. This indicates the last command completed successfully with some recovery action performed by the target.
03D5450A	00EB	During device initialization, the device reported the SCSI Sense Key NOT READY. This indicates that the logical unit addressed cannot be accessed. Operator intervention may be required to correct this condition.

(continued on next page)

Table C–28 (Cont.) Device Services Nontransfer Error Event Log (Template 41) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
03D6450A	00EB	During device initialization, the device reported the SCSI Sense Key MEDIUM ERROR. This indicates that the command terminated with a nonrecovered error condition that was probably caused by a flaw in the medium or an error in the recorded data. This sense key may also be returned if the target is unable to distinguish between a flaw in the medium and a specific hardware failure (HARDWARE ERROR sense key).
03D7450A	00EB	During device initialization, the device reported the SCSI Sense Key HARDWARE ERROR. This indicates that the target detected a nonrecoverable hardware failure (for example, controller failure, device failure, parity error, and so forth) while performing the command or during a self test.
03D8450A	00EB	During device initialization, the device reported the SCSI Sense Key ILLEGAL REQUEST. Indicates that there was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands (FORMAT UNIT, SEARCH DATA, and so forth). If the target detects an invalid parameter in the command descriptor block, then it shall terminate the command without altering the medium. If the target detects an invalid parameter in the additional parameters supplied as data, then the target may have already altered the medium. This sense key may also indicate that an invalid IDENTIFY message was received.
03D9450A	00EB	During device initialization, the device reported the SCSI Sense Key UNIT ATTENTION. This indicates that the removable medium may have been changed or the target has been reset.
03DA450A	00EB	During device initialization, the device reported the SCSI Sense Key DATA PROTECT. This indicates that a command that reads or writes the medium was attempted on a block that is protected from this operation. The read or write operation is not performed.
03DB450A	00EB	During device initialization, the device reported the SCSI Sense Key BLANK CHECK. This indicates that a write-once device or a sequential-access device encountered blank medium or format-defined end-of-data indication while reading or a write-once device encountered a medium that was not blank while writing.
03DC450A	00EB	During device initialization, the device reported a SCSI Vendor Specific Sense Key. This sense key is available for reporting vendor specific conditions.
03DD450A	00EB	During device initialization, the device reported the SCSI Sense Key COPY ABORTED. This indicates a COPY, COMPARE, or COPY AND VERIFY command was aborted due to an error condition on the source device, the destination device, or both.
03DE450A	00EB	During device initialization, the device reported the SCSI Sense Key ABORTED COMMAND. This indicates the target aborted the command. The initiator may be able to recover by trying the command again.

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Table C–28 (Cont.) Device Services Nontransfer Error Event Log (Template 41) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
03DF450A	00EB	During device initialization, the device reported the SCSI Sense Key EQUAL. This indicates a SEARCH DATA command has satisfied an equal comparison.
03E0450A	00EB	During device initialization, the device reported the SCSI Sense Key VOLUME OVERFLOW. This indicates a buffered peripheral device has reached the end-of-partition and data may remain in the buffer that has not been written to the medium. A RECOVER BUFFERED DATA commands may be issued to read the unwritten data from the buffer.
03E1450A	00EB	During device initialization, the device reported the SCSI Sense Key MISCOMPARE. This indicates the source data did not match the data read from the medium.
03E2450A	00EB	During device initialization, the device reported a reserved SCSI Sense Key.
03F50402	016A	The controller shelf is reporting a problem. This could mean one or both of the following: • If the shelf is using dual power supplies, one power supply has failed. • One of the shelf cooling fans has failed. Note that in this instance, the ‘‘target,’’ ‘‘asc,’’ and ‘‘ascq’’ fields are undefined.

Table C–29 Disk Transfer Error Event Log (Template 51) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
02090064	0007	A data compare error was detected during the execution of a compare modified READ or WRITE command. Note that in this instance the SCSI Device Sense Data fields, ‘‘cmdopcd’’ through ‘‘keyspec,’’ are undefined.
021E0064	0016	The device specified in the ‘‘device locator’’ field has been added to the RAIDset unit specified in the ‘‘unit identifier’’ field. The RAIDset is now in Reconstructing state. Note that in this instance the ‘‘header code,’’ ‘‘ancillary information,’’ and ‘‘cmdopcd’’ fields are undefined.
021F0064	0016	The device specified in the ‘‘device locator’’ field has been removed from the RAIDset unit specified in the ‘‘unit identifier’’ field. The removed device is now in the failedset. The RAIDset is now in Reduced state. Note that in this instance, the ‘‘header code,’’ ‘‘ancillary information,’’ and ‘‘cmdopcd’’ fields are undefined.

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Table C–29 (Cont.) Disk Transfer Error Event Log (Template 51) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
02200064	0016	The device specified in the ‘‘device locator’’ field failed to be added to the RAIDset unit specified in the ‘‘unit identifier’’ field. The device will remain in the spareset. Note that in this instance the ‘‘header code,’’ ‘‘ancillary information,’’ and ‘‘cmdopcd’’ fields are undefined.
02210064	0016	The device specified in the ‘‘device locator’’ field failed to be added to the RAIDset unit specified in the ‘‘unit identifier’’ field. The failed device has been moved to the failedset. Note that in this instance the ‘‘header code,’’ ‘‘ancillary information,’’ and ‘‘cmdopcd’’ fields are undefined.
02220064	0016	The RAIDset unit specified in the ‘‘unit identifier’’ field has transitioned from Reconstructing state to Normal state. Note that in this instance the ‘‘header code,’’ ‘‘ancillary information,’’ and ‘‘cmdopcd’’ fields are undefined. Note also that information supplied in the ‘‘device locator,’’ ‘‘devtype,’’ ‘‘device identification,’’ and ‘‘device serial number’’ fields is for the first device in the RAID set.
02280064	0016	The device specified in the "device locator" field has been added to the mirrorset unit specified in the "unit identifier" field. The new mirrorset member is now in Copying state. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined.
02230064	0016	The RAIDset unit specified in the ‘‘unit identifier’’ field has gone inoperative. Note that in this instance, the ‘‘header code,’’ ‘‘ancillary information,’’ and ‘‘cmdopcd’’ fields are undefined. Note also that information supplied in the ‘‘device locator,’’ ‘‘devtype,’’ ‘‘device identification,’’ and ‘‘device serial number’’ fields is for the first device in the RAID set.
02240064	0016	The RAIDset unit specified in the ‘‘unit identifier’’ field has transitioned from Normal state to Reconstructing state. Note that in this instance the ‘‘header code,’’ ‘‘ancillary information,’’ and ‘‘cmdopcd’’ fields are undefined. Note also that information supplied in the ‘‘device locator,’’ ‘‘devtype,’’ ‘‘device identification,’’ and ‘‘device serial number’’ fields is for the first device in the RAID set.
02280064	0016	The device specified in the ‘‘device locator’’ field has added the mirrorset unit specified in the ‘‘unit identifier’’ field. The new mirrorset member is now in Copying state. Note that in thie instance the ‘‘header code,’’ ‘‘ancillary information,’’ and ‘‘cmdopcd’’ fields are undefined.
02290064	0016	The device specified in the "device locator" field has been removed from the mirrorset unit specified in the "unit identifier" field. The removed device is now in the failedset. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined.

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Table C–29 (Cont.) Disk Transfer Error Event Log (Template 51) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
022A0064	0016	The device specified in the "device locator" field failed to be added to the mirrorset unit specified in the "unit identifier" field. The device will remain in the spareset. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined.
022B0064	0016	The device specified in the "device locator" field failed to be added to the mirrorset unit specified in the "unit identifier" field. The failed device has been moved to the failedset. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined.
022C0064	0016	The device specified in the "device locator" has transitioned from Copying or Normalizing state to Normal state. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined.
022D0064	0016	The mirrorset unit specified in the "unit identifier" field has gone inoperative. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined. Note also that information supplied in the "device locator," "devtype," "device identification," and "device serial number" fields is for the first device in the mirrorset.
022E0064	0016	The device specified in the "device locator" field has been converted to a mirrorset unit. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined.
022F0064	0016	The mirrored device specified in the "device locator" field has been converted to a single device unit Note that in this instance the "header code," "ancillary information," and "cmdopcd" fields are undefined.
02300064	0016	The device specified in the "device locator" field has been reduced from the mirrorset unit specified in the "unit identifier" field. The nominal number of members in the mirrorset has been decreased by one. The reduced device is now available for use. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined.
02310064	0016	The mirrorset unit specified in the "unit identifier" field has had its nominal membership changed. The new nominal number of members for the mirrorset is specified in the "port" field. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined. Note also that information supplied in the "device locator," "devtype," "device identification," and "device serial number" fields is for the first device in the mirrorset.
023B0064	0016	The device specified in the "device locator" field had a read error which has been repaired with data from another mirrorset member. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined.

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Table C–29 (Cont.) Disk Transfer Error Event Log (Template 51) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
023C0064	0016	The device specified in the "device locator" field had a read error. Attempts to repair the error with data from another mirrorset member failed due to lack of alternate error-free data source. Note that in this instance the "header code," "ancillary information," and "cmdopcd" fields are undefined.
023D0064	0016	The device specified in the "device locator" field had a read error. Attempts to repair the error with data from another mirrorset member failed due to a write error on the original device. The original device will be removed from the mirrorset. Note that in this instance, the "header code," "ancillary information," and "cmdopcd" fields are undefined.
03094002	000B	An unrecoverable disk drive error was encountered while performing work related to disk unit operations.
0328450A	000B	The disk device reported standard SCSI Sense Data.
030C4002	014B	A Drive failed because a Test Unit Ready command or a Read Capacity command failed.
030D000A	0103	Drive was failed by a Mode Select command received from the host.
030E4002	00EB	Drive failed due to a deferred error reported by drive.
030F4002	00E8	Unrecovered Read or Write error.
03104002	002B	No response from one or more drives.
0311430A	012B	Nonvolatile memory and drive metadata indicate conflicting drive configurations.
0312430A	012B	The Synchronous Transfer Value differs between drives in the same storageset.
03134002	012B	Maximum number of errors for this data transfer operation exceeded.
03144002	00CB	Drive reported recovered error without transferring all data.
03154002	00E8	Data returned from drive is invalid.
03164002	012B	Request Sense command to drive failed.
03170064	0016	Illegal command for pass through mode.
03180064	0016	Data transfer request error.
03194002	012B	Premature completion of a drive command.
031A4002	002B	Command timeout.
031B0101	002B	Watchdog timer timeout.
031C4002	002B	Disconnect timeout.
031D4002	012B	Unexpected bus phase.
031E4002	012B	Disconnect expected.
031F4002	012B	ID Message not sent by drive.
03204002	012B	Synchronous negotiation error.
03214002	012B	The drive unexpectedly disconnected from the SCSI bus.

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Table C–29 (Cont.) Disk Transfer Error Event Log (Template 51) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
03224002	012B	Unexpected message.
03234002	012B	Unexpected Tag message.
03244002	012B	Channel busy.
03254002	012B	Message Reject received on a valid message.
0326450A	00EB	The disk device reported Vendor Unique SCSI Sense Data.

Table C–30 Disk Bad Block Replacement Attempt Event Log (Template 57) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
02110064	0014	Disk Bad Block Replacement attempt completed for a read within the user data area of the disk. Note that due to the way Bad Block Replacement is performed on SCSI disk drives, information on the actual replacement blocks is not available to the controller and is therefore not included in the ''Old RBN'' and ''New RBN'' fields. The content of those fields is undefined.
02020064	0014	Disk Bad Block Replacement attempt completed for a write within the user data area of the disk. Note that due to the way Bad Block Replacement is performed on SCSI disk drives, information on the actual replacement blocks is not available to the controller and is therefore not included in the ''Old RBN'' and ''New RBN'' fields. The content of those fields is undefined.

Table C–31 Tape Transfer Error Event Log (Template 61) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
020A0064	0007	A data compare error was detected during the execution of a compare modified READ or WRITE command. Note that in this instance the SCSI Device Sense Data fields, ''cmdopcd'' through ''keyspec,'' are undefined.
03644002	000B	An unrecoverable tape drive error was encountered while performing work related to tape unit operations.
038B450A	000B	The tape device reported standard SCSI Sense Data.
03674002	014B	A Drive failed because a Test Unit Ready command or a Read Capacity command failed.
0368000A	0103	Drive was failed by a Mode Select command received from the host.
03694002	00EB	Drive failed due to a deferred error reported by drive.

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Table C–31 (Cont.) Tape Transfer Error Event Log (Template 61) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
036A4002	00E8	Unrecovered Read or Write error.
036B4002	002B	No response from one or more drives.
036C430A	012B	Nonvolatile memory and drive metadata indicate conflicting drive configurations.
036D430A	012B	The Synchronous Transfer Value differs between drives in the same storageset.
036E4002	012B	Maximum number of errors for this data transfer operation exceeded.
036F4002	00CB	Drive reported recovered error without transferring all data.
03704002	00E8	Data returned from drive is invalid.
03714002	012B	Request Sense command to drive failed.
03720064	0016	Illegal command for pass through mode.
03730064	0016	Data transfer request error.
03744002	012B	Premature completion of a drive command.
03754002	002B	Command timeout.
03760101	002B	Watchdog timer timeout.
03774002	002B	Disconnect timeout.
03784002	012B	Unexpected bus phase.
03794002	012B	Disconnect expected.
037A4002	012B	ID Message not sent by drive.
037B4002	012B	Synchronous negotiation error.
037C4002	012B	The drive unexpectedly disconnected from the SCSI bus.
037D4002	012B	Unexpected message.
037E4002	012B	Unexpected Tag message.
037F4002	012B	Channel busy.
03804002	012B	Message Reject received on a valid message.
0381450A	00EB	The tape device reported Vendor Unique SCSI Sense Data.

Table C–32 Media Loader Error Event Log (Template 71) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
03964002	0097	An unrecoverable media loader error was encountered while performing work related to media loader operations.
03BD450A	0097	The media changer device reported standard SCSI Sense Data.

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Table C–32 (Cont.) Media Loader Error Event Log (Template 71) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
03994002	0097	A Drive failed because a Test Unit Ready command or a Read Capacity command failed.
039A000A	0077	Drive was failed by a Mode Select command received from the host.
039B4002	0097	Drive failed due to a deferred error reported by drive.
039C4002	0097	Unrecovered Read or Write error.
039D4002	0037	No response from one or more drives.
039E430A	0097	Nonvolatile memory and drive metadata indicate conflicting drive configurations.
039F430A	0097	The Synchronous Transfer Value differs between drives in the same storageset.
03A04002	0097	Maximum number of errors for this data transfer operation exceeded.
03A14002	0097	Drive reported recovered error without transferring all data.
03A24002	0097	Data returned from drive is invalid.
03A34002	0097	Request Sense command to drive failed.
03A40064	0016	Illegal command for pass through mode.
03A50064	0016	Data transfer request error.
03A64002	0097	Premature completion of a drive command.
03A74002	0037	Command timeout.
03A80101	0037	Watchdog timer timeout.
03A94002	0037	Disconnect timeout.
03AA4002	0097	Unexpected bus phase.
03AB4002	0097	Disconnect expected.
03AC4002	0097	ID Message not sent by drive.
03AD4002	0097	Synchronous negotiation error.
03AE4002	0097	The drive unexpectedly disconnected from the SCSI bus.
03AF4002	0097	Unexpected message.
03B04002	0097	Unexpected Tag message.
03B14002	0097	Channel busy.
03B24002	0097	Message Reject received on a valid message.
03B3450A	0097	The media changer device reported Vendor Unique SCSI Sense Data.

Table C–33 Disk Copy Data Correlation Event Log "Event Dependent Information" Values

Value	Description
00000001	Unable to allocate a sufficient number of DCD Context Blocks to support this host.
00000002	Unable to find an inactive Unit Path Block.
00000003	Unable to find an inactive Source Unit Block.
00000004	Insufficient resources returned by HIS$CONNECT.

Table C–34 Executive Services Last Failure Codes

Code	Description
01000100	Memory allocation failure during executive initialization.
01010100	An interrupt without any handler was triggered.
01020100	Entry on timer que was not of type AQ or BQ.
01030100	Memory allocation for a facility lock failed.
01040100	Memory initialization called with invalid memory type.
01050104	The I960 reported a fault. • Last Failure Parameter[0] contains the PC value. • Last Failure Parameter[1] contains the AC value. • Last Failure Parameter[2] contains the fault type and subtype values. • Last Failure Parameter[3] contains the address of the faulting instruction.
01070100	Timer chip setup failed.
01082004	The core diagnostics reported a fault. • Last Failure Parameter[0] contains the error code value (same as blinking OCP LEDs error code). • Last Failure Parameter[1] contains the address of the fault. • Last Failure Parameter[2] contains the actual data value. • Last Failure Parameter[3] contains the expected data value.
01090105	An NMI occurred during EXEC$BUGCHECK processing. • Last Failure Parameter[0] contains the executive flags value. • Last Failure Parameter[1] contains the RIP from the NMI stack. • Last Failure Parameter[2] contains the read diagnostic register 0 value. • Last Failure Parameter[3] contains the Master DRAB CSR value. • Last Failure Parameter[4] contains the SIP last failure code value.

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Table C–34 (Cont.) Executive Services Last Failure Codes

Code	Description
010A2080	A single bit or a multi-single bit ECC error was detected. Due to a hardware bug, this could result in data corruption. If this event occurs frequently, the controller module should be replaced.
010B2380	A processor interrupt was generated by the CACHEA Dynamic Ram controller and Arbitration engine (DRAB) with an indication that the CACHE backup battery has failed or is low (needs charging).
010C2380	A processor interrupt was generated by the CACHEB Dynamic Ram controller and Arbitration engine (DRAB) with an indication that the CACHE backup battery has failed or is low (needs charging).
010D0110	The System Information structure within the System Information Page has been reset to default settings. The only known cause for this event is an I960 processor hang caused by an unimplemented memory region reference. When such a hang occurs, controller modules equipped with inactivity watchdog timer circuitry will spontaneously reboot after the watchdog timer expires (within seconds of the hang). Controller modules not so equipped will just hang as indicated by the green LED on the OCP remaining in a steady state.
010E0110	All structures contained in the System Information Page (SIP) and the Last Failure entries have been reset to their default settings. This is a normal occurance for the first boot following manufacture of the controller module and during the transition from one firmware version to another if and only if the format of the SIP is different between the two versions. If this event is reported at any other time, follow the recommended repair action associated with this Last Failure code.
010F0110	All structures contained in the System Information Page and the Last Failure entries have been reset to their default settings as the result of certain controller manufacturing configuration activities. If this event is reported at any other time, follow the recommended repair action associated with this Last Failure code.
018000A0	A powerfail interrupt occured.
018600A0	A processor interrupt was generated with an indication that the other controller in a dual controller configuration asserted the KILL line to disable this controller.
018700A0	A processor interrupt was generated with an indication that the (//) RESET button on the controller module was depressed.
018800A0	A processor interrupt was generated with an indication that the program card was removed.
018900A0	A processor interrupt was generated with an indication that the controller inactivity watch dog timer expired.
018B2580	A NMI interrupt was generated with an indication that a memory system problem occurred.
018C2580	A DRAB_INT interrupt was generated with an indication that a memory system problem occurred.

Table C–35 Value-Added Services Last Failure Codes

Code	Description
02000100	Initialization code was unable to allocate enough memory to set up the receive data descriptors.
02010100	Initialization code was unable to allocate enough memory to set up the send data descriptors.
02040100	Unable to allocate memory necessary for data buffers.
02050100	Unable to allocate memory for the Free Buffer Array.
02080100	A call to EXEC$ALLOCATE_MEM_ZEROED failed to return memory when populating the disk read DWD stack.
02090100	A call to EXEC$ALLOCATE_MEM_ZEROED failed to return memory when populating the disk write DWD stack.
020A0100	A call to EXEC$ALLOCATE_MEM_ZEROED failed to return memory when populating the tape read DWD stack.
020B0100	A call to EXEC$ALLOCATE_MEM_ZEROED failed to return memory when populating the tape write DWD stack.
020C0100	A call to EXEC$ALLOCATE_MEM_ZEROED failed to return memory when populating the miscellaneous DWD stack.
02100100	A call to EXEC$ALLOCATE_MEM_ZEROED failed to return memory when creating the device services state table.
02170100	Unable to allocate memory for the Free Node Array.
02180100	Unable to allocate memory for the Free Buffer Descriptor Array.
021D0100	Unable to allocate memory for the Free Buffer Array.
021E0100	Unable to allocate memory for the Free Strip Node Array.
021F0100	Unable to allocate memory for WARPs and RMDs.
02210100	Invalid parameters in CACHE$OFFER_META call.
02220100	No buffer found for CACHE$MARK_META_DIRTY call.
02270104	A callback from DS on a transfer request has returned a bad or illegal DWD status. • Last Failure Parameter[0] contains the DWD Status. • Last Failure Parameter[1] contains the DWD address. • Last Failure Parameter[2] contains the PUB Address. • Last Failure Parameter[3] contains the Device Port.
022E0102	An invalid mapping type was specified for a logical unit. • Last Failure Parameter[0] contains the USB address. • Last Failure Parameter[1] contains the Unit Mapping Type.
02360101	Unrecognized state supplied to FOC$SEND callback routine va_dap_ snd_cmd_complete. Last Failure Parameter[0] contains the unrecognized value.

(continued on next page)

Table C–35 (Cont.) Value-Added Services Last Failure Codes

Code	Description
02370102	Unsupported return from HIS$GET_CONN_INFO routine • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.
02392084	A processor interrupt was generated by the controller's XOR engine (FX), with no bits set in the CSR to indicate a reason for the interrupt. • Last Failure Parameter[0] contains the FX Control and Status Register (CSR). • Last Failure Parameter[1] contains the FX DMA Indirect List Pointer register (DILP). • Last Failure Parameter[2] contains the FX DMA Page Address register (DADDR). • Last Failure Parameter[3] contains the FX DMA Command and control register (DCMD).
023A2084	A processor interrupt was generated by the controller's XOR engine (FX), indicating an unrecoverable error condition. • Last Failure Parameter[0] contains the FX Control and Status Register (CSR). • Last Failure Parameter[1] contains the FX DMA Indirect List Pointer register (DILP). • Last Failure Parameter[2] contains the FX DMA Page Address register (DADDR). • Last Failure Parameter[3] contains the FX DMA Command and control register (DCMD).
02440100	The logical unit mapping type was detected invalid in va_set_disk_ geometry( )
02530102	An invalid status was returned from CACHE$LOOKUP_LOCK( ). • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.
02560102	An invalid status was returned from CACHE$LOOKUP_LOCK( ). • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.
02570102	An invalid status was returned from VA$XFER( ) during a operation. • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.

(continued on next page)

Table C–35 (Cont.) Value-Added Services Last Failure Codes

Code	Description
025A0102	An invalid status was returned from CACHE$LOOKUP_LOCK( ). • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.
025B0102	An invalid mapping type was specified for a logical unit. • Last Failure Parameter[0] contains the USB address. • Last Failure Parameter[1] contains the Unit Mapping Type.
025C0102	An invalid mapping type was specified for a logical unit. • Last Failure Parameter[0] contains the USB address. • Last Failure Parameter[1] contains the Unit Mapping Type.
02620102	An invalid status was returned from CACHE$LOOKUP_LOCK( ). • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.
02690102	An invalid status was returned from CACHE$OFFER_WRITE_DATA( ). • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.
02730100	A request was made to write a device metadata block with an invalid block type.
02790102	An invalid status was returned from VA$XFER( ) in a complex read operation. • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.
027B0102	An invalid status was returned from VA$XFER( ) in a complex ACCESS operation. • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.
027D0100	Unable to allocate memory for a Failover Control Block.
027E0100	Unable to allocate memory for a Failover Control Block.
027F0100	Unable to allocate memory for a Failover Control Block.
02800100	Unable to allocate memory for a Failover Control Block.
02820100	Unable to allocate memory for the Dirty Count Array.
02830100	Unable to allocate memory for the Cache Buffer Index Array.
02840100	Unable to allocate memory for the XNode Array.

(continued on next page)

Table C–35 (Cont.) Value-Added Services Last Failure Codes

Code	Description
02850100	Cache was declared bad by the Cache Diagnostics after first Meg was tested. Cannot recover and use local memory because cannot get those initial buffers back.
02860100	Unable to allocate memory for the Fault Management Event Information Packet used by the Cache Manager in generating error logs to the host.
02880100	Invalid FOC Message in cmfoc_snd_cmd.
02890100	Invalid FOC Message in cmfoc_rcv_cmd.
028A0100	Invalid return status from DIAG$CACHE_MEMORY_TEST.
028B0100	Invalid return status from DIAG$CACHE_MEMORY_TEST.
028C0100	Invalid error status given to cache_fail.
028E0100	Invalid DCA state detected in init_crashover.
028F0100	Invalid status returned from CACHE$CHECK_METADATA.
02900100	Unable to allocate memory for the First Cache Buffer Index Array.
02910100	Invalid metadata combination detected in build_raid_node.
02920100	Unable to handle that many bad dirty pages (exceeded MAX_BAD_ DIRTY). Cache memory is bad.
02930100	There was no free or freeable buffer to convert bad metadata or to borrow a buffer during failover of bad dirty.
02940100	A free Device Correlation Array entry could not be found during write-back cache failover.
02950100	Invalid DCA state detected in start_crashover.
02960100	Invalid DCA state detected in start_failover.
02970100	Invalid DCA state detected in init_failover.
02990100	A free RAID Correlation Array entry could not be found during write-back cache failover.
029A0100	Invalid cache buffer metadata detected while scanning the Buffer Metadata Array. Found a page containing dirty data but the corresponding Device Correlation Array entry does exist.
029D0100	Invalid metadata combination detected in build_bad_raid_node.
029F0100	The Cache Manager software has insufficient resources to handle a buffer request pending.
02A00100	VA change state is trying to change device affinity and the cache has data for this device.
02A10100	Pubs not one when transportable
02A20100	Pubs not one when transportable
02A30100	No available data buffers. If the cache module exists then this is true after testing the whole cache. Otherwise there were no buffers allocated from BUFFER memory on the controller module.
02A40100	A call to EXEC$ALLOCATE_MEM_ZEROED failed to return memory when allocating VAXDs.
02A50100	A call to EXEC$ALLOCATE_MEM_ZEROED failed to return memory when allocating DILPs.

(continued on next page)

Table C–35 (Cont.) Value-Added Services Last Failure Codes

Code	Description
02A60100	A call to EXEC$ALLOCATE_MEM_ZEROED failed to return memory when allocating Change State Work Items.
02A70100	A call to EXEC$ALLOCATE_MEM_ZEROED failed to return memory when allocating VA Request Items.
02A80000	Controller is being rebooted as a result of a CLI CLEAR INVALID_CACHE command being issued on the other controller.
02A90100	Too many pending FOC$SEND requests by the Cache Manager. Code is not designed to handle more than one FOC$SEND to be pending because there's no reason to expect more than one pending.
02AA0100	An invalid call was made to CACHE$DEALLOCATE_CLD. Either that device had dirty data or it was bound to a RAIDset.
02AB0100	An invalid call was made to CACHE$DEALLOCATE_SLD. A RAIDset member either had dirty data or write-back already turned on.
02AC0100	An invalid call was made to CACHE$DEALLOCATE_SLD. The RAIDset still has data (strip nodes).
02AD0180	The FX detected a compare error for data that was identical. This error has always previously occurred due to a hardware problem.
02AE0100	The mirrorset member count and individual member states are inconsistent. Discovered during a mirrorset write or erase.
02AF0102	An invalid status was returned from VA$XFER( ) in a write operation. • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.
02B00102	An invalid status was returned from VA$XFER( ) in an erase operation. • Last Failure Parameter[0] contains the DD address. • Last Failure Parameter[1] contains the invalid status.
02B10100	A mirrorset read operation was received and the round robin selection algorithm found no normal members in the mirrorset. Internal inconsistency.
02BC0100	A mirrorset read operation was received and the preferred member selection algorithm found no normal members in the mirrorset. Internal inconsistency.
02BD0100	A mirrorset metadata online operation found no normal members in the mirrorset. Internal inconsistency.

Table C–36 Device Services Last Failure Codes

Code	Description
03020101	Invalid SCSI direct-access device opcode in misc command DWD. Last Failure Parameter[0] contains the SCSI command opcode.
03030101	Invalid SCSI sequential-access device opcode in misc cmd DWD. Last Failure Parameter[0] contains the SCSI command opcode.

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Table C–36 (Cont.) Device Services Last Failure Codes

Code	Description
03040101	Invalid SCSI CD-ROM device opcode in misc command DWD. Last Failure Parameter[0] contains the SCSI command opcode.
03050101	Invalid SCSI medium changer device opcode in misc command DWD. Last Failure Parameter[0] contains the SCSI command opcode.
03060101	Invalid SCSI device type in PUB. Last Failure Parameter[0] contains the SCSI device type.
03070101	Invalid CDB Group Code detected during create of misc cmd DWD Last Failure Parameter[0] contains the SCSI command opcode.
03080101	Invalid SCSI OPTICAL MEMORY device opcode in misc command DWD. Last Failure Parameter[0] contains the SCSI command opcode.
030A0100	Error DWD not found in port in_proc_q.
030B0188	A dip error was detected when pcb_busy was set. • Last Failure Parameter[0] contains the PCB port_ptr value. • Last Failure Parameter[1] contains the new info NULL - SSTAT0 - DSTAT - ISTAT. • Last Failure Parameter[2] contains the PCB copy of the device port DBC register. • Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. • Last Failure Parameter[4] contains the PCB copy of the device portDSP register. • Last Failure Parameter[5] contains the PCB copy of the device portDSPS register. • Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. • Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.
03150100	More DBDs than allowded for in mask
031E0100	Cannot find in_error dwd on in-process queue
031F0100	either DWD_ptr is null or bad value in dsps
03280100	SCSI CDB contains an invalid group code for a transfer command
03290100	The required error information packet (EIP) or device work descriptor (DWD) were not supplied to the Device Services error logging code.
032A0100	HIS$GET_CONN_INFO( ) returned an unexpected completion code.
032B0100	A Device Work Discriptor (DWD) was supplied with a NULL Physical Unit Block (PUB) pointer.
03320101	An invalid code was passed to the error recovery thread in the error_stat field of the PCB. Last Failure Parameter[0] contains the PCB error_stat code.

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Table C–36 (Cont.) Device Services Last Failure Codes

Code	Description
03330188	A parity error was detected by a 710 while sending data out onto the SCSI bus. • Last Failure Parameter[0] contains the PCB reg710_ptr value. • Last Failure Parameter[1] contains the PCB copy of the 710 TEMP register. • Last Failure Parameter[2] contains the PCB copy of the 710 DBC register. • Last Failure Parameter[3] contains the PCB copy of the 710 DNAD register. • Last Failure Parameter[4] contains the PCB copy of the 710 DSP register. • Last Failure Parameter[5] contains the PCB copy of the 710 DSPS register. • Last Failure Parameter[6] contains the PCB copies of the 710 SSTAT2 /SSTAT1/SSTAT0/DSTAT registers. • Last Failure Parameter[7] contains the PCB copies of the 710 LCRC /RESERVED/ISTAT/DFIFO registers.
03350188	The TEA (bus fault) signal was asserted into a 710. • Last Failure Parameter[0] contains the PCB reg710_ptr value. • Last Failure Parameter[1] contains the PCB copy of the 710 TEMP register. • Last Failure Parameter[2] contains the PCB copy of the 710 DBC register. • Last Failure Parameter[3] contains the PCB copy of the 710 DNAD register. • Last Failure Parameter[4] contains the PCB copy of the 710 DSP register. • Last Failure Parameter[5] contains the PCB copy of the 710 DSPS register. • Last Failure Parameter[6] contains the PCB copies of the 710 SSTAT2 /SSTAT1/SSTAT0/DSTAT registers. • Last Failure Parameter[7] contains the PCB copies of the 710 LCRC /RESERVED/ISTAT/DFIFO registers.

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Table C–36 (Cont.) Device Services Last Failure Codes

Code	Description
03360188	A 710's host bus watchdog timer expired. • Last Failure Parameter[0] contains the PCB reg710_ptr value. • Last Failure Parameter[1] contains the PCB copy of the 710 TEMP register. • Last Failure Parameter[2] contains the PCB copy of the 710 DBC register. • Last Failure Parameter[3] contains the PCB copy of the 710 DNAD register. • Last Failure Parameter[4] contains the PCB copy of the 710 DSP register. • Last Failure Parameter[5] contains the PCB copy of the 710 DSPS register. • Last Failure Parameter[6] contains the PCB copies of the 710 SSTAT2 /SSTAT1/SSTAT0/DSTAT registers. • Last Failure Parameter[7] contains the PCB copies of the 710 LCRC /RESERVED/ISTAT/DFIFO registers.
03370108	A 710 detected an illegal script instruction. • Last Failure Parameter[0] contains the PCB reg710_ptr value. • Last Failure Parameter[1] contains the PCB copy of the 710 TEMP register. • Last Failure Parameter[2] contains the PCB copy of the 710 DBC register. • Last Failure Parameter[3] contains the PCB copy of the 710 DNAD register. • Last Failure Parameter[4] contains the PCB copy of the 710 DSP register. • Last Failure Parameter[5] contains the PCB copy of the 710 DSPS register. • Last Failure Parameter[6] contains the PCB copies of the 710 SSTAT2 /SSTAT1/SSTAT0/DSTAT registers. • Last Failure Parameter[7] contains the PCB copies of the 710 LCRC /RESERVED/ISTAT/DFIFO registers.

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Table C–36 (Cont.) Device Services Last Failure Codes

Code	Description
03380188	A 710's DSTAT register contains multiple asserted bits, or an invalidly asserted bit, or both. • Last Failure Parameter[0] contains the PCB reg710_ptr value. • Last Failure Parameter[1] contains the PCB copy of the 710 TEMP register. • Last Failure Parameter[2] contains the PCB copy of the 710 DBC register. • Last Failure Parameter[3] contains the PCB copy of the 710 DNAD register. • Last Failure Parameter[4] contains the PCB copy of the 710 DSP register. • Last Failure Parameter[5] contains the PCB copy of the 710 DSPS register. • Last Failure Parameter[6] contains the PCB copies of the 710 SSTAT2 /SSTAT1/SSTAT0/DSTAT registers. • Last Failure Parameter[7] contains the PCB copies of the 710 LCRC /RESERVED/ISTAT/DFIFO registers.
03390108	An unknown interrupt code was found in a 710's DSPS register. • Last Failure Parameter[0] contains the PCB reg710_ptr value. • Last Failure Parameter[1] contains the PCB copy of the 710 TEMP register. • Last Failure Parameter[2] contains the PCB copy of the 710 DBC register. • Last Failure Parameter[3] contains the PCB copy of the 710 DNAD register. • Last Failure Parameter[4] contains the PCB copy of the 710 DSP register. • Last Failure Parameter[5] contains the PCB copy of the 710 DSPS register. • Last Failure Parameter[6] contains the PCB copies of the 710 SSTAT2 /SSTAT1/SSTAT0/DSTAT registers. • Last Failure Parameter[7] contains the PCB copies of the 710 LCRC /RESERVED/ISTAT/DFIFO registers.
033C0101	An invalid code was seen by the error recovery thread in the er_funct_step field of the PCB. Last Failure Parameter[0] contains the PCB er_funct_ step code.

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Table C–36 (Cont.) Device Services Last Failure Codes

Code	Description
033E0108	An attempt was made to restart a 710 at the SDP DBD. • Last Failure Parameter[0] contains the PCB reg710_ptr value. • Last Failure Parameter[1] contains the PCB copy of the 710 TEMP register. • Last Failure Parameter[2] contains the PCB copy of the 710 DBC register. • Last Failure Parameter[3] contains the PCB copy of the 710 DNAD register. • Last Failure Parameter[4] contains the PCB copy of the 710 DSP register. • Last Failure Parameter[5] contains the PCB copy of the 710 DSPS register. • Last Failure Parameter[6] contains the PCB copies of the 710 SSTAT2 /SSTAT1/SSTAT0/DSTAT registers. • Last Failure Parameter[7] contains the PCB copies of the 710 LCRC /RESERVED/ISTAT/DFIFO registers.
033F0108	An EDC error was detected on a read of a soft-sectored device - path not yet implemented. • Last Failure Parameter[0] contains the PCB reg710_ptr value. • Last Failure Parameter[1] contains the PCB copy of the 710 TEMP register. • Last Failure Parameter[2] contains the PCB copy of the 710 DBC register. • Last Failure Parameter[3] contains the PCB copy of the 710 DNAD register. • Last Failure Parameter[4] contains the PCB copy of the 710 DSP register. • Last Failure Parameter[5] contains the PCB copy of the 710 DSPS register. • Last Failure Parameter[6] contains the PCB copies of the 710 SSTAT2 /SSTAT1/SSTAT0/DSTAT registers. • Last Failure Parameter[7] contains the PCB copies of the 710 LCRC /RESERVED/ISTAT/DFIFO registers.
03410101	Invalid SCSI device type in PUB. Last Failure Parameter[0] contains the PUB SCSI device type.

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Table C–36 (Cont.) Device Services Last Failure Codes

Code	Description
03420188	A UDC interrupt could not be associated with either a DWD or the noncallable scripts. • Last Failure Parameter[0] contains the PCB reg710_ptr value. • Last Failure Parameter[1] contains the PCB copy of the 710 TEMP register. • Last Failure Parameter[2] contains the PCB copy of the 710 DBC register. • Last Failure Parameter[3] contains the PCB copy of the 710 DNAD register. • Last Failure Parameter[4] contains the PCB copy of the 710 DSP register. • Last Failure Parameter[5] contains the PCB copy of the 710 DSPS register. • Last Failure Parameter[6] contains the PCB copies of the 710 SSTAT2 /SSTAT1/SSTAT0/DSTAT registers. • Last Failure Parameter[7] contains the PCB copies of the 710 LCRC /RESERVED/ISTAT/DFIFO registers.
03470100	Insufficient memory available for target block allocation.
03480100	Insufficient memory available for 710 info block allocation.
03490100	Insufficient memory available for autoconfig buffer allocation.
034A0100	Insufficient memory available for PUB allocation.
034B0100	Insufficient memory available for DS init buffer allocation.
034C0100	Insufficient memory available for static structure allocation.
034D0100	DS init DWDs exhausted.
034E2080	Diagnostics report all NCR710s are broken.
03500100	Insufficient memory available for command disk allocation.
03510100	Insufficient resourses available for command disk data region.
03520100	A failure resulted when an attempt was made to allocate a DWD for use by DS CDI.

Table C–37 Fault Manager Last Failure Codes

Code	Description
04010101	The requestor id component of the instance code passed to FM$REPORT_ EVENT is larger than the maximum allowed for this environment. Last Failure Parameter[0] contains the instance code value.

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Table C–37 (Cont.) Fault Manager Last Failure Codes

Code	Description
04020102	The requestor's error table index passed to FM$REPORT_EVENT is larger than the maximum allowed for this requestor. • Last Failure Parameter[0] contains the instance code value. • Last Failure Parameter[1] contains the requester error table index value.
04030102	The USB index supplied in the EIP is larger than the maximum number of USBs. • Last Failure Parameter[0] contains the instance code value. • Last Failure Parameter[1] contains the USB index value.
04040103	The event log format found in V_fm_template_table is not supported by the Fault Manager. The bad format was discovered while trying to fill in a supplied eip. • Last Failure Parameter[0] contains the instance code value. • Last Failure Parameter[1] contains the format code value. • Last Failure Parameter[2] contains the requester error table index value.
04050100	The Fault Manager could not allocate memory for his Event Information Packet (EIP) buffers.
04060100	The Fault Manager could not allocate a Datagram HTB in his initialization routine.
04070103	There is more EIP information than will fit into a datagram. The requestor specific size is probably too large. • Last Failure Parameter[0] contains the instance code value. • Last Failure Parameter[1] contains the format code value. • Last Failure Parameter[2] contains the requester error table index value.
04080102	The event log format found in the already built eip is not supported by the Fault Manager. The bad format was discovered while trying to copy the eip information into a datagram HTB. • Last Failure Parameter[0] contains the format code value. • Last Failure Parameter[1] contains the instance code value.
04090100	The caller of FM$CANCEL_EVENT_NOTIFICATION passed an address of an event notification routine which does not match the address of any routines for which event notification is enabled.
040D0100	FM$ENABLE_EVENT_NOTIFICATION was called to enable eip notification but the specified routine was already enabled to receive eip notification.

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Table C–37 (Cont.) Fault Manager Last Failure Codes

Code	Description
040F0102	The eip->generic.mscp1.flgs field of the EIP passed to FM$REPORT_ EVENT contains an invalid flag. • Last Failure Parameter[0] contains the instance code value. • Last Failure Parameter[1] contains the value supplied in the eip->generic.mscp1.flgs field.
04100101	Unexpected template type found during fmu_display_errlog processing. Last Failure Parameter[0] contains the unexpected template value.
04110101	Unexpected instance code found during fmu_memerr_report processing. Last Failure Parameter[0] contains the unexpected instance code value.
04120101	CLIB$SDD_FAO call failed. Last Failure Parameter[0] contains the failure status code value.

Table C–38 Common Library Routines Last Failure Codes

Code	Description
05010100	In recursive_noconflict could not get enough memory for scanning the keyword tables for configuration name conflicts.
05030100	In clib$scan_for_noconflict could not get enough memory for scanning the keyword tables for configuration name conflicts.

Table C–39 Dual Universal Asynchronous Receiver/Transmitter Services Last Failure Codes

Code	Description
06010100	The DUART was unable to allocate enough memory to establish a connection to the CLI.
06020100	A port other than terminal port A was referred to by a set terminal characteristics command. This is illegal.
06030100	A DUP question or default question message type was passed to the DUART driver, but the pointer to the input area to receive the response to the question was NULL.
06040100	Attempted to detach unattached maintenance terminal.
06050100	Attempted output to unattached maintenance terminal.
06060100	Attempted input from output only maintenance terminal service.

Table C–40 Failover Control Last Failure Codes

Code	Description
07010100	All available slots in the FOC notify table are filled
07020100	FOC$CANCEL_NOTIFY( ) was called to disable notification for a rtn that did not have notification enabled.
07030100	Unable to start the Failover Control Timer before main loop.

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Table C–40 (Cont.) Failover Control Last Failure Codes

Code	Description
07040100	Unable to restart the Failover Control Timer.
07050100	Unable to allocate flush buffer.
07060100	Unable to allocate active receive fcb.
07070100	The other controller killed this, but could not assert the kill line because nindy on or in debug. So it killed this now.

Table C–41 Nonvolatile Parameter Memory Failover Control Last Failure Codes

Code	Description
08010101	A remote state change was received from the FOC thread that NVFOC does not recognize. Last Failure Parameter[0] contains the unrecognized state value.
08020100	No memory could be allocated for a NVFOC information packet.
08030101	Work received on the S_nvfoc_bque did not have a NVFOC work id. Last Failure Parameter[0] contains the id type value that was received on the NVFOC work queue.
08040101	Unknown work value received by the S_nvfoc_bque. Last Failure Parameter[0] contains the unknown work value
08050100	An unlock was received and the controller was not locked by the other controller.
08060100	A really write command was received when the NV memory was not locked.
08070100	A write to NV memory was received while not locked.
08080000	The other controller requested this controller to restart.
08090010	The other controller requested this controller to shutdown.
080A0000	The other controller requested this controller to selftest.
080B0100	Could not get enough memory to build a FCB to send to the remote routines on the other controller.
080C0100	Could not get enough memory for FCBs to receive information from the other controller.
080D0100	Could not get enough memory to build a FCB to reply to a request from the other controller.
080E0101	An out-of-range receiver ID was received by the NVFOC communication utility (master send to slave send ACK). Last Failure Parameter[0] contains the bad id value.
080F0101	An out-of-range receiver ID was received by the NVFOC communication utility (received by master). Last Failure Parameter[0] contains the bad id value.
08100101	A call to NVFOC$TRANSACTION had a from field (id) that was out of range for the NVFOC communication utility. Last Failure Parameter[0] contains the bad id value.
08110101	NVFOC tried to defer more than one FOC send. Last Failure Parameter[0] contains the master ID of the connection that had the multiple delays.

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Table C–41 (Cont.) Nonvolatile Parameter Memory Failover Control Last Failure Codes

Code	Description
08120100	Unable to lock other controller's NVmemory despite the fact that the running and handshake_complete flags are set.
08130100	Could not allocate memory to build a callback context block on an unlock NVmemory call.
08140100	Could not allocate memory to build a workblock to queue to the NVFOC thread.
08150100	A lock was requested by the other controller but the memory is already locked by the other controller.
08160100	A request to clear the remote configuration was received but the memory was not locked.
08170100	A request to read the next configuration was received but the memory was not locked.
08180100	Could not get enough memory for FLS FCBs to receive information from the other controller.
08190100	An unlock command was received when the NV memory was not locked.
081A0100	Unable to allocate memory for remote work
081B0101	Bad remote work received on remote work queue Last Failure Parameter[0] contains the id type value that was received on the NVFOC remote work queue.
081C0101	Bad member management work received Last Failure Parameter[0] contains the bad member management value that was detected.

Table C–42 Command Line Interpreter Last Failure Codes

Code	Description
20010100	The action for work on the CLI queue should be CLI_CONNECT, CLI_ COMMAND_IN or CLI_PROMPT. If it is not one of these three, this bugcheck will result.
20020100	The FAO returned a nonsuccessful response. This will only happen if a bad format is detected or the formatted string overflows the output buffer.
20030100	The type of work received on the CLI work queue was not of type CLI.
20070100	A work item of an unknown type was placed on the CLI's DUP Virtual Terminal thread's work queue by the CLI.
20080000	This controller requested this controller to restart.
20090010	This controller requested this controller to shutdown.
200A0000	This controller requested this controller to selftest.
200B0100	Could not get enough memory for FCBs to receive information from the other controller.
200C0100	After a CLI command the NV memory was still locked. The CLI should *always* unlock NV memory when the command is complete (if it had an error or not).
200D0101	After many calls to DS$PORT_BLOCKED, we never got a FALSE status back (which signals that nothing is blocked). Last Failure Parameter[0] contains the port number (1 - n) that we were waiting on to be unblocked.

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Table C–42 (Cont.) Command Line Interpreter Last Failure Codes

Code	Description
200E0101	While traversing the structure of a unit, a config_info node was discovered with an unrecognized structure type. Last Failure Parameter[0] contains the structure type number that was unrecognized.
200F0101	A config_info node was discovered with an unrecognized structure type. Last Failure Parameter[0] contains the structure type number that was unrecognized.
20100101	A config_node of type VA_MA_DEVICE had an unrecognized SCSI device type. Last Failure Parameter[0] contains the SCSI device type number that was unrecognized.
20110100	An attempt to allocate memory so the CLI prompt messages could be deleted failed.
20120101	While traversing the structure of a unit, a config_info node was discovered with an unrecognized structure type. Last Failure Parameter[0] contains the structure type number that was unrecognized.
20130101	While traversing the structure of a unit, the device was of a unrecognized type. Last Failure Parameter[0] contains the SCSI device type that was unrecognized.

Table C–43 Host Interconnect Services Last Failure Codes

Code	Description
40000101	An unrecognized CI opcode was received by HIS. These packets are packets with CI opcodes recognized by the port but not by HIS. Last Failure Parameter[0] contains the CI opcode value.
40150100	LOCAL VC Timer in unexpected state.
40280100	Failed to allocate Buffer Name Table.
40290100	Failed to allocate ACB.
402A0100	Failed to allocate ID member template.
402B0100	Failed to allocate DG HTBs.
402C0100	Failed to allocate message HTBs.
402D0101	S_max_node greater than MAX_VC_ENTRIES. Last Failure Parameter[0] contains the S_ci_max_nodes value.
402E0101	S_max_node not set to valid value (8, 16, 32, 64, 128, 256). Last Failure Parameter[0] contains the S_ci_max_nodes value.
402F0100	Failure to allocate a HIS EIP structure
40300100	Failure in memory allocation
40510100	htb_id type not DG, when attempting to deallocate DG HTB.
40520100	htb_id type not RCV_SND, when attempting to dealloc recv queue HTB.
40530100	htb_id type not RCV_SND, when attempting to dealloc SCS queue HTB.
40560100	Failed to find a vc entry for ccb during his_close_connection routine.
407B0100	SCS command timeout unexpectedly inactive during SCS Accept Request.
407C0100	SCS command timeout unexpectedly inactive during SCS Reject Request.
408E0100	Message receive queue count disagrees with # HTBs on the queue.

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Table C–43 (Cont.) Host Interconnect Services Last Failure Codes

Code	Description
408F0100	Unrecognized HTB id type.
40900100	htb_id type not DG, when attempting to xmit DG HTB.
40930100	Message receive queue count disagrees with # HTBs on the queue.
40950100	Create xfer request with 0-byte count
40960100	Create xfer request with 0-byte count
40970100	Create xfer request with 0-byte count
40980100	Create xfer request with 0-byte count
409D0100	Illegal return value from HIS$MAP.
40B40101	Invalid value in max_nodes field of se_params structure. Last Failure Parameter[0] contains the max_nodes field value.

Table C–44 Host Interconnect Port Services Last Failure Codes

Code	Description
42000100	Cmpl_main routine found invalid port xmt status.
42020100	Cannot start timer.
42030100	Cannot restart work timer.
42060100	HP_INIT could not allocate initial buffers.
420B0100	HP_INIT could not allocate initial bufs for Path A dl_ctl table.
42120100	Host Port polling HTB failed to complete in time.
42332080	Receive_main found destination address in the rcv packet does not match node address.
42340100	HP could not allocate buffers for I/O rundown in VC Close.
42382080	Ci_isr found that the yaci hardware had invalid xmt status on Path A, no bits set.
42392080	Ci_isr found that the yaci hardware had invalid xmt status on Path B, no bits set.
423A2080	CI_ISR found the abort bit set with out any valid reason. Path A.
423B2080	CI_ISR found transmit parity error without abort bit set. Path A.
423C2080	CI_ISR found buffer underflow without abort bit set. Path A.
423D2080	CI_ISR found the abort bit set with out any valid reason. Path B.
423E2080	CI_ISR found transmit parity error without abort bit set. Path B.
423F2080	CI_ISR found buffer underflow without abort bit set. Path B.
42442080	Ci_isr found that yaci hardware had a parity error.
42452080	Ci_isr found that yaci hardware had a bus timeout error.
42472080	Ci_isr found Data parity on Transmit Path A.
42482080	Ci_isr found Data parity on Transmit Path B.
424B0001	Ci_isr found Host Reset on Path A. Last Failure Parameter[0] contains the node number of the resetting node.

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Table C–44 (Cont.) Host Interconnect Port Services Last Failure Codes

Code	Description
424C0001	Ci_isr found Host Reset on Path B. Last Failure Parameter[0] contains the node number of the resetting node.
424D2080	Ci_isr found Fetch parity on Transmit Path A.
424E2080	Ci_isr found Fetch parity on Transmit Path B.
424F0100	HP could not allocate buffers to repopulate dds when we close path.
42590001	Ci_isr found Host Reset on Path A. Last Failure Parameter[0] contains the node number of the resetting node.
425A0001	Ci_isr found Host Reset on Path B. Last Failure Parameter[0] contains the node number of the resetting node.
425B2080	CI_ISR found the abort bit set with out any valid reason. Path A.
425C2080	CI_ISR found transmit parity error without abort bit set. Path A.
425D2080	CI_ISR found buffer underflow without abort bit set. Path A.
425E2080	Ci_isr found that the yaci hardware had invalid xmt status on path a, no bits set.
425F2080	CI_ISR found the abort bit set with out any valid reason. Path B.
42602080	CI_ISR found transmit parity error without abort bit set. Path B.
42612080	CI_ISR found buffer underflow without abort bit set. Path B.
42622080	Ci_isr found that the yaci hardware had invalid xmt status on Path B, no bits set.
42632080	Receive_main found destination address in the rcv packet does not match node address.

Table C–45 Disk and Tape MSCP Server Last Failure Codes

Code	Description
60050100	Invalid return value from routine HIS$CONNECT, while DCD attempting to establish connection to a remote subsystem.
60070100	Invalid return value from routine HIS$MAP, while dmscp_dcd_allocate_bh attempting to map a buffer.
60090100	Invalid return value from routine HIS$DISCONNECT, while dmscp_dcd_ comm_path_event attempting to disconnect a remote source connection.
600C0100	Invalid return value from routine RESMGR$ALLOCATE_DATA_ SEGMENT.
600D0100	Opcode field in command being aborted is not valid.
60120100	Opcode of TMSCP command to be aborted is invalid.
60130100	tmscp_clear_sex_cdl_cmpl_rtn detected an unexpected opcode.
60140100	tmscp_clear_sex_cdl_cmpl_rtn detected an unexpected opcode.
60150100	VA$CHANGE_STATE failed to change the SW Write protect when requested to do so as part of the Disk Set Unit Characteristics command.
60160100	VA$CHANGE_STATE failed to change the SW Write protect when requested to do so as part of the Tape Set Unit Characteristics command.
60170100	Invalid type in entry of long interval work queue.

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Table C–45 (Cont.) Disk and Tape MSCP Server Last Failure Codes

Code	Description
60180100	mscp_short_interval found an Invalid type in entry of long interval work queue.
60190100	dmscp_dcd_send_cmd found that the SIWI Work Item code supplied is unrecognized or invalid in this context during DCD inhibited processing.
601B0100	Invalid EVENT_CODE parameter in call to dmscp_connection_event.
601C0100	Invalid EVENT_CODE parameter in call to tmscp_connection_event.
601D0100	Invalid EVENT_CODE parameter in call to dmscp_dcd_comm_path_event.
601E0100	Invalid EVENT_CODE parameter in call to dmscp_dcd_comm_path_event.
60250100	An attempt was about to be made to return a progress indicator to the host that was 0xFFFFFFFF, the only invalid value.
60260100	An WH_DAF command was requested to be performed by the wrong process.
60270100	A nonimmediate WHM operation was passed to the dmscp_exec_whm_ immediate routine.
60280100	This routine found an invalid xfer_state so cannot continue.
60290100	HIS did not allocate an HTB when there should have been one reserved for this connection as determined by mscp_rcv_listen.
602A0100	HIS did not allocate an HTB when there should have been one reserved for this connection as determined by dmscp_dcd_src_gcs_send.
602B0100	HIS did not allocate an HTB when there should have been one reserved for this connection as determined by dmscp_dcd_comm_path_event.
602C0100	When trying to put THE extra send-HTB on the connections send_htb_list there was already one on the queue.
602D0100	The VA$CHANGE_STATE service did not set the Software write protect as requested (for disk).
602E0100	The VA$CHANGE_STATE service did not set the Software write protect as requested (for tape).
603B0100	Initial HIS$LISTEN call for MSCP$DISK was unsuccessful.
603C0100	Initial HIS$LISTEN call for MSCP$TAPE was unsuccessful.
60400100	Unrecognized or invalid in this context return value from routine RESMGR$ALLOCATE_DATA_SEGMENT, while dmscp_dcd_allocate_ dseg attempting to allocate a data segment.
60410100	Unrecognized or invalid in this context return value from routine RESMGR$ALLOCATE_DATA_BUFFERS, while dmscp_dcd_allocate_ dbuf attempting to allocate a data buffer.
60420100	dmscp_dcd_rmte_end_msg was unable to find a command message that corresponds to end message it is currently processing.
60440100	dmscp_dcd_src_gcs_cmpl found the command being GCSed is no longer at the head of the remote connection's queue.
60450100	dmscp_dcd_errlog_rvc found that an error log is not associated with a command, internal miscellaneous error logs are assumed to not be associated with a connection and remote miscellaneous error logs generation was not requested.

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Table C–45 (Cont.) Disk and Tape MSCP Server Last Failure Codes

Code	Description
60460100	dmscp_dcd_elrt_scc_send was entered to issue a remote source connection SCC but was unable to find an available HTB on the connection's htb_list. With no active DCDs the connection should always have HTBs available.
60480100	tmscp_suc_avl_cmpl_rtn found the unit not in the available state.
60490100	tmscp_clear_sex_cdl_cmpl_rtn found the state change failed.
604A0100	tmscp_clear_sex_cdl_cmpl_rtn found the state change failed.
604B0100	Subroutine process_event returned a value to dmscp_dcd_comm_path_ event that indicates that an internal disconnect request occurred while processing an immediate communications event.
604D0100	Subroutine process_event returned a value to dmscp_dcd_comm_path_ event that indicates that a connection established event occurred while no DCD commands were active.
604F0100	tmscp_set_sex_cmpl_rtn found the state change failed.
60500100	dmscp_dcd_op_cmpl found an unrecognized P_STS value in a DCD HTB status field.
60550100	mscp_initialize unable to get LOCAL STATIC memory from exec for use as a local connection ITB.
60560100	mscp_initialize unable to get LOCAL STATIC memory from exec for use as an AVAILABLE ITB.
60570100	mscp_initialize unable to get LOCAL STATIC memory from exec for use as an AVAILABLE state change ITB.
60580100	mscp_initialize unable to get LOCAL STATIC memory from exec for use as a state change ITB.
605D0100	tmscp_onl_cleanup_rtn detected a failure in enabling variable speed mode suppression.
605E0100	tmscp_suc_cmpl_rtn detected a failure in enabling variable speed mode suppression.
605F0100	tmscp_suc_cmpl_rtn detected a failure in enabling variable speed mode suppression.
60610100	mscp_initialize unable to get BUFFER STATIC memory from exec for use as Write History Logs.
60620100	mscp_initialize unable to get LOCAL STATIC memory from exec for use as Write History Log Allocation Failure Lists.
60640100	Invalid condition when there exists no unused Write History Log Entries.
60650100	Attempting to block incoming requests for the tape/loader when it was unnexpectedly found already blocked.
60660100	Loader boundary block request to stall incoming requests to the tape /loader unit was not setup as expected.
60680100	VA$ENABLE_NOTIFICATION failed with insufficient resources at init time.
606B0100	mscp_foc_receive_cmd detected that the message sent from the other controller had an illegal usb index.
606C0100	mscp_foc_receive_cmd detected that the message sent from the other controller had an illegal exclusive access state.

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Table C–45 (Cont.) Disk and Tape MSCP Server Last Failure Codes

Code	Description
606D0100	FOC provided mscp_foc_send_cmpl_rtn with an invalid status for the FOC$SEND transmit command completion.
606E0100	FOC provided mscp_foc_send_rsp_done with an invalid transmit status for the FOC$SEND transmit response completion.

Table C–46 Diagnostics and Utilities Protocol Server Last Failure Codes

Code	Description
61010000	Controller crash was intentionally caused by the execution of the CRASH program. This bugcheck does not indicate the occurance of a controller failure.
61020100	HIS$LISTEN call failed with INSUFFICIENT_RESOURCES.
61090100	LISTEN_CONNECTION_ESTABLISHED event from HIS specified a connection ID for a connection we already know about.
610B0100	Code Load or Code Patch utility in CLCP local program forced controller restart to force new code or patch to take effect.
610C0100	HIS has reported a connection event that should not be possible.

Table C–47 System Communication Services Directory Service Last Failure Codes

Code	Description
62000100	HIS$LISTEN call failed with INSUFFICIENT_RESOURCES.
62020100	Failure to allocate associated timer queue.
62030100	Failure to allocate connection id timers.

Table C–48 Disk Inline Exerciser (DILX) Last Failure Codes

Code	Description
80010100	An HTB was not available to issue an IO when it should have been..
80020100	A unit could not be dropped from testing because an available cmd failed.
80030100	DILX tried to release a facility that was not reserved by DILX.
80040100	DILX tried to change the unit state from MAINTENANCE_MODE to NORMAL but was rejected because of insufficient resources.
80050100	DILX tried to change the usb unit state from MAINTENANCE_MODE to NORMAL but DILX never received notification of a successful state change.
80060100	DILX tried to switch the unit state from MAINTENANCE_MODE to NORMAL but was not successful.
80070100	DILX aborted all cmds via va$d_abort( ) but the htbs have not been returned.
80080100	While DILX was deallocating his eip buffers, at least one could not be found.

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Table C–48 (Cont.) Disk Inline Exerciser (DILX) Last Failure Codes

Code	Description
80090100	DILX received an end msg which corresponds to an op code not supported by DILX.
800A0100	DILX was was not able to restart his timer.
800B0100	DILX tried to issue an IO for an opcode not supported.
800C0100	DILX tried to issue a oneshot IO for an opcode not supported.
800D0100	A DILX device control block contains an unsupported unit_state.
800E0100	While trying to print an Event Information Packet, DILX discovered an unsupported MSCP error log format.
80100100	DILX could not compare buffers because no memory was available from EXEC$ALLOCATE_MEM_ZEROED.
80120100	DILX expected an eip to be on the receive eip q but no eips were there.
80130100	DILX was asked to fill a data buffer with an unsupported data pattern.
80140100	DILX could not process an unsupported answer in dx$reuse_params( ).

Table C–49 Tape Inline Exerciser (TILX) Last Failure Codes

Code	Description
81010100	An HTB was not available to issue an IO when it should have been
81020100	A unit could not be dropped from testing because an available cmd failed
81030100	TILX tried to release a facility that was not reserved by TILX
81040100	TILX tried to change the unit state from MAINTENANCE_MODE to NORMAL but was rejected because of insufficient resources
81050100	TILX tried to change the usb unit state from MAINTENANCE_MODE to NORMAL but TILX never received notification of a successful state change
81060100	TILX tried to switch the unit state from MAINTENANCE_MODE to NORMAL but was not successful
81070100	TILX aborted all cmds via va$d_abort( ) but the htbs have not been returned
81080100	While TILX was deallocating his eip buffers, at least one could not be found
81090100	TILX received an end msg which corresponds to an opcode not supported by TILX
810A0100	TILX was was not able to restart his timer
810B0100	TILX tried to issue an IO for an opcode not supported
810C0100	TILX tried to issue a oneshot IO for an opcode not supported
810D0100	A TILX device control block contains an unsupported unit_state
810E0100	TILX received an unsupported Value Added status in a Value added completion message
810F0100	TILX found an unsupported device control block substate while trying to build a cmd for the Basic Function test
81100100	TILX found an unsupported device control block substate while trying to build a cmd for the Read Only test

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Table C–49 (Cont.) Tape Inline Exerciser (TILX) Last Failure Codes

Code	Description
81110100	TILX found an unsupported device control block substate while trying to build a cmd for the User Defined test
81120100	TILX received an EOT encountered while in a substate where EOT encountered should not occur
81130100	TILX calculated an illegal position type value while trying to generate a cmd for the position intensive phase of the Basic Function test
81140100	While trying to print an Event Information Packet, TILX discovered an unsupported MSCP error log format
811A0100	TILX expected a deferred error to be on the receive deferred error q but no deferred errors were there.
811B0100	TILX was asked to fill a data buffer with an unsupported data pattern.
811C0100	TILX could not process an unsupported answer in tx$reuse_params( ).

Table C–50 Device Configuration Utilities (CONFIG/CFMENU) Last Failure Codes

Code	Description
83020100	An unsupported message type or terminal request was received by the CONFIG virtual terminal code from the CLI
83030100	Not all alter_device requests from the CONFIG utility completed within the timeout interval
83050100	An unsupported message type or terminal request was received by the CFMENU utility code from the CLI
83060100	Not all alter_device requests from the CFMENU utility completed within the timeout interval

Table C–51 Clone Unit Utility (CLONE) Last Failure Codes

Code	Description
84010100	An unsupported message type or terminal request was received by the CLONE virtual terminal code from the CLI

Table C–52 Controller Restart Codes

Code	Description
0	Full firmware restart
1	No restart
2	Automatic hardware restart

C.5 Event Notification/Recovery Threshold

An Event Notification/Recovery Threshold value is assigned to each significant event that can be reported by an HSJ30/40 controller. The Event Notification /Recovery Threshold values and their meanings are shown in Table C–53.

Table C–53 Event Notification/Recovery Threshold Classifications

Threshold Value	Classification	Description
01	IMMEDIATE	Failure or potential failure of a component critical to proper controller operation is indicated; immediate attention is required.
02	HARD	Failure of a component that affects controller performance or precludes access to a device connected to the controller is indicated.
0A	SOFT	An unexpected condition detected by a controller firmware component (such as protocol violations, host buffer access errors, internal inconsistencies, and so forth) is indicated.
64	INFORMATIONAL	An event having little or no effect on proper controller or device operation is indicated.

With the exception of events reported via the Disk Copy Data Correlation Event Log, the Event Notification/Recovery Threshold value assigned to a particular event is supplied in the NR Threshold subfield of the ''instance code'' field of the event log used to report the event. See Section C.3 for ''instance code'' field details.

Disk Copy Data Correlation Event Log Conditions

The Event Notification/Recovery Threshold Classification assigned to the following conditions reported via a Disk Copy Data Correlation Event Log is SOFT (see Table C–53):

- Subcommand Error (subcode ''Destination—Command Timed Out'')
- Subcommand Error (subcode ''Source—Command Timed Out'')
- Subcommand Error (subcode ''Destination—Inconsistent State''), cases A, B, C, D, E, and F
- Controller Error (subcode ''Local Connection Request Failed, Insufficient Resources to Request Local Connection'')
- Controller Error (subcode ''Remote Connection Request Failed, Insufficient Resources to Request Local Connection'')

All other conditions that can be reported via the Disk Copy Data Correlation Event Log are not assigned a specific Event Notification/Recovery Threshold Classification because they can be correlated with the associated condition specific event log.

C.6 Recommended Repair Action

A Recommended Repair Action code is assigned to each significant event that can be reported by an HSJ30/40 controller. The Recommended Repair Action codes and their meanings are shown in Table C–54.

Table C–54 Recommended Repair Action Codes

Code	Description
00	No action necessary.
01	An unrecoverable hardware detected fault occurred or an unrecoverable firmware inconsistency was detected, proceed with controller support avenues. Contact Digital Multivendor Customer Service.
02	Inconsistent/erroneous information received from the operating system, proceed with operating system software support avenues. Contact Digital Multivendor Customer Service.
03	Follow the recommended repair action contained in the ''last failure code'' field.
04	Two possible problem sources are indicated: • In the case of a shelf with dual power supplies, one of the power supplies has failed. Follow repair action 07 for the power supply with the Power LED out. • One of the shelf blowers has failed. Follow repair action 06.
05	Four possible problem sources are indicated: • Total power supply failure on a shelf. Follow repair action 09. • A device inserted into a shelf that has a broken internal SBB connector. Follow repair action 0A. • A standalone device is connected to the controller with an incorrect cable. Follow repair action 08. • A controller hardware failure. Follow repair action 20.
06	Determine which blower has failed and replace it. Refer to Chapter 7 for the blower removal procedure.
07	Replace power supply. Refer to Chapter 7 for the power supply removal procedure.
08	Replace the cable. Refer to the specific device documentation.
09	Determine power failure cause.
0A	Determine which SBB has a failed connector and replace it. Refer to Chapter 7.
0B	The other controller in a dual-redundant configuration has been reset with the ''Kill'' line by the controller that reported the event. To restart the ''Killed'' controller enter the CLI command RESTART OTHER on the ''Surviving'' controller and then depress the (//) RESET button on the ''Killed'' controller. If the other controller is repeatedly being ''Killed'' for the same or a similar reason, follow repair action 20.

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Table C–54 (Cont.) Recommended Repair Action Codes

Code	Description
0C	Both controllers in a dual-redundant configuration are attempting to use the same SCSI ID (either 6 or 7 as indicated in the event report). Note that the other controller of the dual-redundant pair has been reset with the ''Kill'' line by the controller that reported the event. Two possible problem sources are indicated: • A controller hardware failure • A controller backplane failure First, follow repair action 20 for the ''Killed'' controller. If the problem persists, then follow repair action 20 for the ''Surviving'' controller. If the problem still persists, then replace the controller backplane.
20	Replace the controller module. Refer to Chapter 7 for proper replacement procedure.
22	Replace the indicated cache module.
23	Replace the indicated write cache battery. CAUTION: BATTERY REPLACEMENT MAY CAUSE INJURY. Refer to Chapter 7 for proper replacement procedure.
24	Check for the following invalid write cache configurations: • If the wrong write cache module, replace with the matching module or clear the invalid cache error via the CLI (refer to Appendix B). • If the write cache module is missing, re-seat cache if it is actually present, or add the missing cache module or clear the invalid cache error via the CLI (refer to Appendix B). • If in a dual-redundant configuration and one of the write cache modules is missing, match write cache boards with both controllers. • If in a dual-redundant configuration and both caches are not of the same type (i.e, both write cache), replace a cache module to assure both are compatible. • If in a dual-redundant configuration and both write caches are not of the same size, replace a cache module to assure both are compatible.
25	An unrecoverable Memory System failure occurred. Upon restart the controller will generate one or more Memory System Failure Event Error Logs; follow the repair actions contained therein.
26	The Master DRAB detected a Cache Timeout condition. The cache regions in effect are identified in the Master DRAB RSR register: bits 8 through 11 identify the CACHEA memory region, bits 12 through 15 identify the CACHEB memory region, bits 20 through 23 the CACHEA DRAB registers region, and bits 24 through 27 identify the CACHEB DRAB registers region. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 36.
27	The Master DRAB detected an Nbus Transfer Error Acknowledge (TEA) condition. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 36.

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Table C–54 (Cont.) Recommended Repair Action Codes

Code	Description
28	A Multiple Bit ECC error was detected by the Master DRAB. The Master DRAB DER register bits 0 through 6 contain the syndrome value. The Master DRAB EAR register combined with Master DRAB ERR bits 0 through 3 (address region) yields the affected memory address. The Master DRAB EDR register contains the error data. If the failure involved a Device Port, the Master DRAB CSR register bits 10 through 12 identify that Device Port. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 34.
29	A Multiple Bit ECC error was detected by the CACHEA0 or CACHEA1 DRAB. The CACHEAn DRAB DER register bits 0 through 6 contain the syndrome value. The CACHEAn DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEA memory region) yields the affected memory address. The CACHEAn DRAB EDR register contains the error data. If the failure involved a Device Port, the Master DRAB CSR register bits 10 through 12 identify that Device Port. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 34.
2A	A Multiple Bit ECC error was detected by the CACHEB0 or CACHEB1 DRAB. The CACHEBn DRAB DER register bits 0 through 6 contain the syndrome value. The CACHEBn DRAB EAR register combined with the Master DRAB RSR register bits 12 through 15 (CACHEB memory region) yields the affected memory address. The CACHEBn DRAB EDR register contains the error data. If the failure involved a Device Port, the Master DRAB CSR register bits 10 through 12 identify that Device Port. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 34.
2B	The Master DRAB detected an Ibus to Nbus Timeout condition. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. If Master DRAB CSR register bits 10 through 12 contains the value 1 and ''wdr1'' register bit 26 is clear or Master DRAB CSR register bits 10 through 12 contains the value 2 and ''wdr1'' register bit 27 is clear or Master DRAB CSR register bits 10 through 12 contains the value 3 and ''wdr1'' register bit 28 is clear or Master DRAB CSR register bits 10 through 12 contains the value 4 and ''wdr1'' register bit 29 is clear or Master DRAB CSR register bits 10 through 12 contains the value 5 and ''wdr1'' register bit 30 is clear or Master DRAB CSR register bits 10 through 12 contains the value 6 and ''wdr1'' register bit 31 is clear, a firmware fault is indicated; follow repair action 01. Otherwise, follow repair action 36.
2C	The Master DRAB detected a Nonexistent Memory Error condition. The Master DRAB EAR register combined with Master DRAB ERR bits 0 through 3 (address region) yields the affected memory address. The Master DRAB EDR register contains the error data. If the failure involved a Device Port, the Master DRAB CSR register bits 10 through 12 identify that Device Port. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 36.

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Table C–54 (Cont.) Recommended Repair Action Codes

Code	Description
2D	The CACHEA0 or CACHEA1 DRAB detected a Nonexistent Memory Error condition. The CACHEAn DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEA memory region) yields the affected memory address. The CACHEAn DRAB EDR register contains the error data. If the failure involved a Device Port, the Master DRAB CSR register bits 10 through 12 identify that Device Port. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 36.
2E	The CACHEB0 or CACHEB1 DRAB detected a Nonexistent Memory Error condition. The CACHEBn DRAB EAR register combined with the Master DRAB RSR register bits 12 through 15 (CACHEB memory region) yields the affected memory address. The CACHEBn DRAB EDR register contains the error data. If the failure involved a Device Port, the Master DRAB CSR register bits 10 through 12 identify that Device Port. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 36.
2F	The Master DRAB detected an Address Parity Error or a Write Data Parity Error condition. The Master DRAB EAR register combined with Master DRAB ERR bits 0 through 3 (address region) yields the affected memory address. The Master DRAB EDR register contains the error data. If the failure involved a Device Port, the Master DRAB CSR register bits 10 through 12 identify that Device Port. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. For Write Data Parity Error conditions Bits 0 through 3 of the Master DRAB CSR register identify the byte in error. For Address Parity Error conditions follow repair action 34. For Write Data Parity Error conditions follow repair action 35.
30	The CACHEA0 or CACHEA1 DRAB detected an Address Parity Error or a Write Data Parity Error condition. If the failure occurred during a memory refresh attempt, the CACHEAn DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEA memory region) yields the affected memory address. If the failure occurred during a memory access attempt, the CACHEA0 DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEA memory region) or bits 20 through 23 (CACHEA DRAB register region) yields the affected memory address. Unfortunately, no other information is available to distinguish a memory region access from a DRAB register region access. The CACHEAn DRAB EDR register contains the error data. If the failure involved a Device Port, the Master DRAB CSR register bits 10 through 12 identify that Device Port. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is set, the failure was reported via the DRAB_INT. For Write Data Parity Error conditions bits 0 through 3 of the CACHEAn DRAB CSR register identify the byte in error. For Address Parity Error conditions follow repair action 34. For Write Data Parity Error conditions follow repair action 35.

(continued on next page)

Table C–54 (Cont.) Recommended Repair Action Codes

Code	Description
31	The CACHEB0 or CACHEB1 DRAB detected an Address Parity Error or a Write Data Parity Error condition. If the failure occurred during a memory refresh attempt, the CACHEBn DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEB memory region) yields the affected memory address. If the failure occurred during a memory access attempt, the CACHEB0 DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEB memory region) or bits 20 through 23 (CACHEB DRAB register region) yields the affected memory address. Unfortunately, no other information is available to distinguish a memory region access from a DRAB register region access. The CACHEBn DRAB EDR register contains the error data. If the failure involved a Device Port, the Master DRAB CSR register bits 10 through 12 identify that Device Port. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. For Write Data Parity Error conditions bits 0 through 3 of the CACHEBn DRAB CSR register identify the byte in error. For Address Parity Error conditions follow repair action 34. For Write Data Parity Error conditions follow repair action 35.
32	The Master DRAB detected an Ibus Parity Error condition. The Master DRAB EAR register combined with the Master DRAB ERR bits 4 through 7 (address region) yields the affected memory address. The Master DRAB EDR register contains the error data. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. If bits 20 through 23 of the Master DRAB DCSR register contain a nonzero value, a firmware fault is indicated; follow repair action 01. Otherwise, follow repair action 36.
33	This event report contains supplemental information related to a Memory System Failure event report delivered earlier. Use the instance code contained in the ''memory address'' field of this event report to correlate this event report with the other event report.
34	If Bit 31 of the DCSR register of the DRAB that detected the failure is set, a firmware fault is indicated; follow repair action 01. Otherwise, follow repair action 36.
35	If bits 20 through 23 of the ''wdr1'' register contain a nonzero value, a firmware fault is indicated; follow repair action 01. Otherwise, follow repair action 36.
36	Unfortunately, no other information is available to aid in diagnosing the cause of the failure. If the Master DRAB detected the failure, follow repair action 20. If the CACHEAn or CACHEBn DRAB detected the failure, follow repair action 22. If the problem persists, follow repair action 01.
37	The Memory System Failure translator could not determine the failure cause. Follow repair action 01.
40	If the Sense Data FRU field is non-zero, follow repair action 41. Otherwise, replace the appropriate FRU associated with the device's SCSI interface or the entire device.
41	Consult the device's maintenance manual for guidance on replacing the indicated device FRU.
43	Update the configuration data to correct the problem.
44	Replace the SCSI cable for the failing SCSI bus. If the problem persists, replace the controller backplane, drive backplane, or controller module.
45	Interpreting the device supplied Sense Data is beyond the scope of the controller's firmware. See the device's service manual to determine the appropriate repair action, if any.

(continued on next page)

Table C–54 (Cont.) Recommended Repair Action Codes

Code	Description
60	Swap the transmit and receive cables for the indicated path.
61	Check indicated path cables for proper installation.
63	Check the CI adapter on the host system identified in the ‘‘remote node name’’ field for proper operation.
64	Excessive VC closures are occuring. Perform repair action 61 on both sets of path cables. If the problem persists, perform repair action 63.

Recommended Repair Action codes apply to each reportable event (except those reported via the Disk Copy Data Correlation Event Log) as identified by the value contained in the Repair Action subfield of the ‘‘instance code’’ field of the event logs described in Section C.3.

For events reported via the Last Failure Event Log the Recommended Repair Action code is contained in the Repair Action subfield of the ‘‘last failure code’’ field of that event log.

Disk Copy Data Correlation Event Log Conditions

The Recommended Repair Action Code assigned to the following conditions reported via a Disk Copy Data Correlation Event Log is 01 (see Table C–54):

- Subcommand Error (subcode ‘‘Destination—Command Timed Out’’)
- Subcommand Error (subcode ‘‘Source—Command Timed Out’’)
- Subcommand Error (subcode ‘‘Destination—Inconsistent State’’), cases C, D, E, and F
- Controller Error (subcode ‘‘Local Connection Request Failed, Insufficient Resources to Request Local Connection’’)
- Controller Error (subcode ‘‘Remote Connection Request Failed, Insufficient Resources to Request Local Connection’’)

The Recommended Repair Action Code assigned to the following condition reported via a Disk Copy Data Correlation Event Log is 02 (see Table C–54):

- Subcommand Error (subcode ‘‘Source—Inconsistent State’’), cases A and B.

All other conditions that can be reported via the Disk Copy Data Correlation Event Log are not assigned a specific Recommended Repair Action Code because they can be correlated with the associated condition specific event log.

C.7 Deskew Command Procedure

Example C–4 presents a command procedure to deskew the ‘‘CONTROLLER DEPENDENT INFORMATION’’ for a ‘‘CONTROLLER LOG’’ type error log.

Example C–4 Deskew Command Procedure Example

```
$! P1 = Input file name
$! P2 = Output file name
$ on warning then $exit
$ inew_entry = " ****************************** ENTRY"
$ ctrl_entry = "                                        CONTROLLER LOG"
$ lw_entry = "       LONGWORD"
$ ctrl_inp = "FALSE"
$ lw_string = ""
$ open/read inf 'p1'
$ open/write ouf 'p2'
$in_loop:
$ read/end=in_done inf inr
$ inrlen = f$length(inr)
$ if f$locate(new_entry,inr) .ne. inrlen
$ then
$  write sys$output inr
$  if ctrl_inp
$  then
$   gosub convert_longs
$   ctrl_inp = "FALSE"
$  endif
$ else
$  if f$locate(ctrl_entry,inr) .ne. inrlen
$  then
$   write sys$output inr
$   ctrl_inp = "TRUE"
$   lw_string = ""
$  endif
$  if f$locate(lw_entry,inr) .ne. inrlen .and. ctrl_inp
$  then
$   lw = f$element(2," ",f$edit(inr,"TRIM,COMPRESS"))
$   if lw_string .eqs. ""
$   then
$    lw_string = f$extract(0,4,lw)
$   else
$    lw_string = lw + lw_string
$   endif
$  endif
$ endif
$ write ouf inr
$ goto in_loop
$in_done:
$ close inf
$  if ctrl_inp
$  then
$   gosub convert_longs
$  endif
$ close ouf
$ exit
$convert_longs:
$ index = 1
$ write ouf "<FF>"
$ write ouf ""
```

(continued on next page)

Example C–4 (Cont.) Deskew Command Procedure Example

```
$ write ouf ""
$ write ouf ""
$ write ouf "LONGWORD DESKEW:"
$ write ouf ""
$ write ouf ""
$convert_longs_loop:
$ len = f$length(lw_string)
$ if len .le. 4 then goto convert_longs_done
$ lw = f$extract(len - 8,8,lw_string)
$ write ouf "        LONGWORD[''index'] = ",lw
$ lw_string = f$extract(0,len - 8, lw_string)
$ index = index + 1
$ goto convert_longs_loop
$convert_longs_done:
$ write ouf "<FF>"
$ return
```

Example C–5 shows an ERF error log before running the command procedure.

Example C–5 ERF Error Log Before Command Procedure

```
V A X / V M S        SYSTEM ERROR REPORT         COMPILED 16-MAR-1993 12:30:07
                                                                  PAGE 144.

******************************* ENTRY      11. *******************************
ERROR SEQUENCE 2820.                          LOGGED ON:        SID 05903914
DATE/TIME 16-MAR-1993 11:35:45.39                            SYS_TYPE 00000000
SYSTEM UPTIME: 2 DAYS 22:48:03
SCS NODE: CNOTE                                               VAX/VMS V5.5-2

ERL$LOGMESSAGE ENTRY  KA825  HW REV# B  PATCH REV# 28.  UCODE REV# 20.
                      BI NODE # 2.

I/O SUB-SYSTEM, UNIT _HSJ402$DUA20:

      MESSAGE TYPE        0001
                                    DISK MSCP MESSAGE
      MSLG$L_CMD_REF  5B54001E
      MSLG$W_SEQ_NUM      0039
                                    SEQUENCE #57.
      MSLG$B_FORMAT         00
                                    CONTROLLER LOG
      MSLG$B_FLAGS          00
                                    UNRECOVERABLE ERROR
      MSLG$W_EVENT        01CA
                                    CONTROLLER ERROR
                                    POLICY PROCESS ERROR
      MSLG$Q_CNT_ID   00000021
                      01280001
                                    UNIQUE IDENTIFIER, 000100000021(X)
                                    MASS STORAGE CONTROLLER
                                    MODEL = 40.
      MSLG$B_CNT_SVR        FF
                                    CONTROLLER SOFTWARE VERSION #255.
      MSLG$B_CNT_HVR        00
                                    CONTROLLER HARDWARE REVISION #0.

CONTROLLER DEPENDENT INFORMATION

      LONGWORD 1.     01010000
                                    /..../
      LONGWORD 2.     044103CF
                                    /Ï.A./
      LONGWORD 3.     00000000
                                    /..../
      LONGWORD 4.     00470000
                                    /..G./
      LONGWORD 5.     00000000
                                    /..../
      LONGWORD 6.     00020000
                                    /..../
      LONGWORD 7.     00000000
                                    /..../
```

Example C–6 shows the same ERF error log after running the command procedure (notice the deskewed longwords).

Example C–6 ERF Error Log After Command Procedure

```
 V A X / V M S        SYSTEM ERROR REPORT         COMPILED 16-MAR-1993 12:30:07
                                                                   PAGE 144.

 ****************************** ENTRY     11. ******************************
 ERROR SEQUENCE 2820.                          LOGGED ON:        SID 05903914
 DATE/TIME 16-MAR-1993 11:35:45.39                            SYS_TYPE 00000000
 SYSTEM UPTIME: 2 DAYS 22:48:03
 SCS NODE: CNOTE                                             VAX/VMS V5.5-2

 ERL$LOGMESSAGE ENTRY  KA825  HW REV# B  PATCH REV# 28.  UCODE REV# 20.
                       BI NODE # 2.

 I/O SUB-SYSTEM, UNIT _HSJ402$DUA20:

       MESSAGE TYPE        0001
                                    DISK MSCP MESSAGE
       MSLG$L_CMD_REF  5B54001E
       MSLG$W_SEQ_NUM      0039
                                    SEQUENCE #57.
       MSLG$B_FORMAT         00
                                    CONTROLLER LOG
       MSLG$B_FLAGS          00
                                    UNRECOVERABLE ERROR
       MSLG$W_EVENT        01CA
                                    CONTROLLER ERROR
                                    POLICY PROCESS ERROR
       MSLG$Q_CNT_ID   00000021
                       01280001
                                    UNIQUE IDENTIFIER, 000100000021(X)
                                    MASS STORAGE CONTROLLER
                                    MODEL = 40.
       MSLG$B_CNT_SVR        FF
                                    CONTROLLER SOFTWARE VERSION #255.
       MSLG$B_CNT_HVR        00
                                    CONTROLLER HARDWARE REVISION #0.

 CONTROLLER DEPENDENT INFORMATION

       LONGWORD 1.     01010000
                                    /..../
       LONGWORD 2.     044103CF
                                    /Ï.A./
       LONGWORD 3.     00000000
                                    /..../
       LONGWORD 4.     00470000
                                    /..G./
       LONGWORD 5.     00000000
                                    /..../
       LONGWORD 6.     00020000
                                    /..../
       LONGWORD 7.     00000000
                                    /..../

LONGWORD DESKEW:
```

(continued on next page)

Example C–6 (Cont.) ERF Error Log After Command Procedure

```
LONGWORD[1] = 03CF0101
LONGWORD[2] = 00000441
LONGWORD[3] = 00000000
LONGWORD[4] = 00000047
LONGWORD[5] = 00000000
LONGWORD[6] = 00000002
```

D

HSD-Series Error Logging

This appendix details errors the HSD-series controller will report in its host error logs under the OpenVMS operating system, as well as how to extract the information from the logs.

Note

Host error log translations are correct as of the date of publication of this manual. However, log information may change with firmware updates. Refer to your firmware release notes for error log information updates.

D.1 Reading an HSD-series Error Log

You can interpret an HSD-series error log the same way as an HSJ-series error log (Appendix C), with the following exceptions:

- Template type 31 does not exist for HSD-series error logs.
- Template types 32 and 33 nomenclature has changed as shown in Table D–1.

Table D–1 Template Types

Description	Template	Longword	Value	Deskewed Value
DSSI Port/Port Driver Event Log	32†	2	10**32**xxxx	00001032
DSSI System Communication Services Event Log	33†	2	2C**33**xxxx	00002C**33**

†The MSLG$B_FORMAT field for these templates will read ‘‘00 CONTROLLER LOG,’’ so you may want to run the OpenVMS DCL command procedure provided at the end of Appendix C for deskewing the longwords.

D.2 Event Log Formats

In general, the event log formats for the HSD-series controller are identical to those for the HSJ-series. However, where the HSJ-series uses ‘‘CI’’ to describe the host interface, the HSD-series controller uses ‘‘DSSI.’’

For example, in the following table, the terms in the first column for HSJ-series controllers translate to the terms in the second column for HSD-series controllers. Be aware of this change in terminology as you use Appendix C to decode your error logs.

Table D–2 HSJ to HSD Message Tranlation

HSJ Message	HSD Message
CI Host Interconnect Services	DSSI Host Interconnect Services
CI source node address	DSSI source node address
CI destination node address	DSSI destination node address
CI Message Operation Codes	DSSI Message Operation Codes
CI Virtual Circuit State Codes	DSSI Virtual Circuit State Codes
CI Port/Port Driver Event Log (Template 32)	DSSI Port/Port Driver Event Log (Template 32)
CI System Communication Services Event Log (Template 33)	DSSI System Communication Services Event Log (Template 33)

D.3 Event Log Codes

Tables D–3 through D–6 show some important difference in reported codes between HSJ- and HSD-series controllers. Some entries may show identical numeric codes with different description text, while other entries are in fact different (HSD-series controller only) codes and descriptions.

Be aware of these differences when decoding HSD-series controller error logs using Appendix C.

Table D–3 Host Interconnect Services Status Codes

Code	Description
00000064	The ‘‘DSSI IDREQ send without receiving a DSSI ID in response’’ limit has been reached on Path A; the remote node is acknowledging the packets but not responding to them.
00000065	A DSSI ID or DSSI CNF packet (transmitted by the thread on behalf of Host Interconnect Services) could not be successfully transmitted.
00010009	VC closed due to DSSI ID request failure.
00030009	VC closed due to DSSI START failure.
00040009	VC closed due to DSSI STACK failure.
00070009	VC closed due to NAK ADP retry DSSI ID transmit failure.
000A0009	Not implemented in DSSI environment.
000B0009	VC closed due to NOR ADP retry DSSI ID transmit failure.

(continued on next page)

Table D–3 (Cont.) Host Interconnect Services Status Codes

Code	Description
000E0009	Not implemented in DSSI environment.
00100009	Not implemented in DSSI environment.
00120009	Not implemented in DSSI environment.
001D0009	VC closed due to DSSI ID complete failure.
001F0009	VC closed due to DSSI retry.

Table D–4 DSSI Port/Port Driver Event Log (Template 32) Instance/MSCP Event Codes

Instance Code	MSCP Event Code	Description
4007640A	006A	DSSI Port detected error upon attempting to transmit a packet. This resulted in the closure of the Virtual Circuit.

Table D–5 Host Interconnect Services Last Failure Codes

Code	Description
40000101	An unrecognized DSSI opcode was received by HIS. These packets are packets with DSSI opcodes recognized by the port but not by HIS. Last Failure Parameter[0] contains the DSSI opcode value.

Table D–6 Host Interconnect Port Services Last Failure Codes

Code	Description
42040100	Host port buffer allocation macro found an error allocating free buffers. The free buffer was NULLPTR. $DEBUG conditional
420C0100	HP_INIT could not allocate initial htb for Path A
420D0100	HP_INIT could not allocate HPHW structure
42130100	Host Port detected a inconstancy in the HW transmit status.
42350100	HP found a negative offset in a Host Data transfer operation.
42640100	Scan packet que found bad path select case for DSSI
42680102	Dssi_wait_isr routine found that 720 report unexpected interrupt status for target mode. • Last Failure Parameter[0] contains the 720 chip sist0 register value. • Last Failure Parameter[1] contains the 720 chip sist1 register value.
42690101	Dssi_wait_isr routine found that the 720 script reported an invalid rcv status. Last Failure Parameter[0] contains the receive interrupt status N720_dsps value.
426B0101	Dssi_wait_isr routine found that 720 interrupted without status Last Failure Parameter[0] contains the 720 chip istat register value.

(continued on next page)

Table D–6 (Cont.) Host Interconnect Port Services Last Failure Codes

Code	Description
42752002	Dssi_wait_isr routine found that 720 reported a bus error on the controller's internal bus. • Last Failure Parameter[0] contains the 720 chip dstat register value. • Last Failure Parameter[1] contains the 720 chip dcmd register value.
42760102	Dssi_err_isr routine found that 720 reported an unexpected status for initiator mode. • Last Failure Parameter[0] contains the 720 chip sist0 register value. • Last Failure Parameter[1] contains the 720 chip sist1 register value.
42770102	Dssi_err_isr routine found that 720 reported an unexpected status for initiator mode. • Last Failure Parameter[0] contains the 720 chip sist0 register value. • Last Failure Parameter[1] contains the 720 chip sist1 register value.
42790103	Dssi_wait_isr routine found that 720 reported an unexpected status in initiator mode causes stacked interrupters too many. • Last Failure Parameter[0] contains the 720 chip sist1 register value. • Last Failure Parameter[1] contains the 720 chip sist0 register value. • Last Failure Parameter[2] contains the 720 chip dstat register value.

D.4 Recommended Repair Action

Table D–7 shows a difference in description text for recommended repair actions on HSD-series controllers.

Be aware of the difference when decoding HSD-series controller error logs using Appendix C.

Table D–7 Recommended Repair Action Codes

Code	Description
63	Check the DSSI adapter on the host system identified in the ''remote node name'' field for proper operation.

E

HSZ-Series Error Logging

This appendix details errors the HSZ-series controller will report in its host event logs under the DEC OSF/1 operating system, as well as how to extract the information from the logs.

Note

Host event log translations are correct as of the date of publication of this manual. However, log information may change with firmware updates. Refer to your *StorageWorks Array Controllers HSZ40 Array Controller Operating Firmware Release Notes* for error log information updates.

E.1 Reading an HSZ-Series Error Log

Example E–1 shows an example of a uerf translated host error log. The uerf utility under the DEC OSF/1 operating system will show the target and LUN of the unit in question. Use your current configuration information to match the unit to the devices it is mapped to. Then, test and/or service the devices on a case-by-case basis.

You should also consider using the Fault Management Utility (FMU) described in Chapter 6 to increase your knowledge of some error events that may occur with your HSZ-series controller.

Note

Current versions of the DEC OSF/1 uerf utility do not translate all event codes reported by HS operating firmware, and documentation describing how to translate them is not yet available. Users requiring translation of HS operating firmware event codes should contact Digital Multivendor Customer Services.

Example E–1 was generated using the uerf -o full command on an HSZ40 controller with a KZTSA host adapter.

Example E–1 Error Event Log (uerf)

```
******************************** ENTRY    19. ********************************

----- EVENT INFORMATION -----

EVENT CLASS                              ERROR EVENT
OS EVENT TYPE                  199.      CAM SCSI
SEQUENCE NUMBER                 19.
OPERATING SYSTEM                         DEC OSF/1
OCCURRED/LOGGED ON                       Tue Mar 15 12:36:47 1994
OCCURRED ON SYSTEM                       dombek
SYSTEM ID                x0004000F       CPU TYPE: DEC
                                         CPU SUBTYPE: KN15AA

----- UNIT INFORMATION -----

CLASS                          x0000     DISK
SUBSYSTEM                      x0000     DISK
BUS #                          x000E
                               x0392     LUN x2
                                         TARGET x2

----- CAM STRING -----

ROUTINE NAME                             cdisk_check_sense

----- CAM STRING -----

ROUTINE NAME                             cdisk_check_sense

----- CAM STRING -----

                                          Hardware Error bad block number: 0

----- CAM STRING -----

ERROR TYPE                               Hard Error Detected

----- CAM STRING -----

DEVICE NAME                              DEC     HSZ40

----- CAM STRING -----

                                         Active CCB at time of error

----- CAM STRING -----

                                         CCB request completed with an error
ERROR - os_std, os_type = 11, std_type = 10

----- ENT_CCB_SCSIIO -----
```

(continued on next page)

Example E–1 (Cont.) Error Event Log (uerf)

```
*MY ADDR                  x8A960728
CCB LENGTH                    x00C0
FUNC CODE            x01
CAM_STATUS                    x0084     CAM_REQ_CMP_ERR
                                        AUTOSNS_VALID
PATH ID              14.
TARGET ID            2.
TARGET LUN           2.
CAM FLAGS                 x00000442
                                        CAM_QUEUE_ENABLE
                                        CAM_DIR_IN
                                        CAM_SIM_QFRZDIS
*PDRV_PTR                 x8A960428
*NEXT_CCB                 x00000000
*REQ_MAP                  x8A971E00
VOID (*CAM_CBFCNP)()      x003B5520
*DATA_PTR                 x40023230
DXFER_LEN                 x00000200
*SENSE_PTR                x8A960450
SENSE_LEN            xA0
CDB_LEN              x06
SGLIST_CNT                    x0000
CAM_SCSI_STATUS               x0002     SCSI_STAT_CHECK_CONDITION
SENSE_RESID          x00
RESID                     x00000000
CAM_CDB_IO           x0000000000000001DA681B08
CAM_TIMEOUT               x0000003C
MSGB_LEN                      x0000
VU_FLAGS                      x4000
TAG_ACTION           x20

----- CAM STRING -----

                                        Error, exception, or abnormal
                                         _condition

----- CAM STRING -----

                                        HARDWARE ERROR - Nonrecoverable
                                         _hardware error

----- ENT_SENSE_DATA -----
```

(continued on next page)

Example E–1 (Cont.) Error Event Log (uerf)

```
ERROR CODE                    x0070     CODE x70
SEGMENT             x00
SENSE KEY                     x0004     HARDWARE ERR
INFO BYTE 3         x00
INFO BYTE 2         x00
INFO BYTE 1         x00
INFO BYTE 0         x00
ADDITION LEN        x98
CMD SPECIFIC 3      x00
CMD SPECIFIC 2      x00
CMD SPECIFIC 1      x00
CMD SPECIFIC 0      x00
ASC                 x44
ASQ                 x00
FRU                 x00
SENSE SPECIFIC      x000000
ADDITIONAL SENSE
0000:   00030000  01080108  00000206  40020000        *...............@*
0010:   01510309  08002800  01DA681B  01000000        *..Q..(...h......*
0020:   00000700  20202020  58432020  33323130        *....      CX0123*
0030:   37363534  5A373845  00000000  36333400        *4567E87Z.....436*
0040:   325A5241  20202038  43282020  45442029        *ARZ28     (C) DE*
0050:   00000043  00000000  00000004  00000000        *C...............*
0060:   01080000  00000000  00000000  00000000        *................*
0070:   00000000  00000000  00000000  00000000        *................*
0080:   00000000  00000000  00000000  00000000        *................*
0090:   7E250000  00005E3C  00000000  00000000        *..%~<^.........*
```

Glossary

ac distribution

The method of controlling ac power in a cabinet.

adapter

A device that converts the protocol and hardware interface of one bus type into that of another without changing the functionality of the bus. *See* **SCSI bus signal converter**.

allocation class

A numerical value assigned to an HSJ or HSD30 controller to uniquely identify units across multiple, independent controllers. (Controllers in a dual-redundant configuration must have the same allocation class.)

array controller

A hardware/software device that facilitates communications between a host and one or more devices organized in an array. HS family controllers are examples of array controllers.

BA350–M*x* controller shelf

The StorageWorks controller shelf used for HS array controller modules, cache modules, and shelf power supplies.

BA350–S*x* SBB shelf

The common name for any StorageWorks shelf that contains only power units and storage SBBs.

BBR

bad block replacement. The procedure used to locate a replacement block, mark the bad block as replaced, and move the data from the bad block to the replacement block.

BBU

battery backup unit. A StorageWorks SBB option that extends power availability after the loss of primary ac power or a power supply to protect against the corruption or loss of data. This is not used for the HSJ controller shelves.

block

The smallest data unit addressable on a disk. Also called a sector. In DSSI integrated storage elements, a block contains 512 bytes of customer data, EDC, ECC, flags, and the block's address header.

CDU

Cable distribution unit. The power entry device for StorageWorks cabinets. The unit provides the connections necessary to distribute ac power to cabinet shelves and fans.

CI bus

Computer interconnect bus. Uses two serial paths, each with a transfer rate of 70 MB/s (8.75 MB/s).

CLI

Command line interpreter. Operator command line interface for the HS family controller firmware.

container

Any entity that is capable of storing data, whether it is a physical device or a group of physical devices. A disk, a stripeset, and a RAIDset are examples of a container.

controller shelf

A StorageWorks shelf designed to contain controller and cache memory modules.

CRC

An 8-character cyclic redundancy check string used in conjunction with the customer identification string for turning on licensed features such as RAID and write-back caching.

data center cabinet

A generic reference to the large cabinets, such as the SW800-series, in which StorageWorks components can be mounted.

DDL

dual data link. The ability to operate on the CI bus using both paths at the same time.

differential SCSI bus

A signal's level is determined by the potential difference between two wires. A differential bus is more robust and less subject to electrical noise than is a single-ended bus.

DILX

Disk Inline Exerciser. Diagnostic firmware used to test the data transfer capabilities of disk drives in a way that simulates a high level of user activity.

DSA

Digital Storage Architecture. A set of specifications and interfaces describing standards for designing mass storage products. DSA defines the functions performed by host computers, controllers, and disk drives. It also specifies how they interact to accomplish mass storage management.

DSSI

Digital Storage System Interconnect. A Digital-specific data bus with an 8-bit data transfer rate of 4 to 5 MB/s.

dual-redundant

Two controllers in one controller shelf providing the ability for one controller to take over the work of the other controller in the event of a failure of the other controller.

DUART

Dual universal asynchronous receiver transmitter. An integrated circuit containing two serial, asynchronous transceiver circuits.

DUP

Diagnostic and Utility Protocol. Host application software that allows a host operator terminal to connect to the controller's command line interpreter. *See also* **virtual terminal**.

ECC

error correction code. One or more cyclic redundancy check (CRC) words that allow detection of a mismatch between transmitted and received data in a communications system, or between stored and retrieved data in a storage system. The ECC allows for location and correction of an error in the received /retrieved data. All ECCs have limited correction power.

EDC

error detection code. One or more checksum words that allow detection of a mismatch between transmitted and received data in a communications system, or between stored and retrieved data in a storage system. The EDC has no data correction capability.

ESD

electrostatic discharge. The discharge of a potentially harmful static electric voltage as a result of improper grounding.

FAILEDSET

The FAILEDSET is a group of disk drives that have been removed from RAIDsets due to a failure or a manual removal. Disk drives in the FAILEDSET should be considered defective and should be tested, repaired, and then placed into the SPARESET.

failover

Failover is the software process that takes place when one controller in a dual-redundant configuration fails and the other controller takes over the devices of the failed controller and services them to the host until or if the failed controller comes back or is replaced.

flush

The act of writing data from the cache module to the media.

FRU

field replaceable unit. A hardware component that can be replaced.

FWD SCSI

fast, wide, differential SCSI. The differential SCSI bus with a 16-bit data transfer rate of up to 20 MB/s.

half-height device

A device that occupies half of a 5.25 inch SBB carrier. Two half-height devices can be mounted in a 5.25 inch SBB carrier. The first half-height device is normally mounted in the lower part of the carrier. The second device is normally mounted in the upper part of the carrier.

HBVS

Host-Based Volume Shadowing. Also known as Phase 2 Volume Shadowing.

HSOF

HSOF. An abbreviation for Hierarchical Storage Operating Firmware.

HIS

Host Interconnect Services. The firmware in the HS array controller that communicates with the host.

host

The primary or controlling computer to which a storage subsystem is attached.

HS Operating Firmware (HSOF)

Hierarchical Storage Operating Firmware or software contained on a program card used with HS array controllers.

initiator

A SCSI device that requests an I/O process to be performed by another SCSI device (a target). This is always the controller.

KB

The standard abbreviation for kilobyte, 1024 bytes.

KB/s

The standard abbreviation for kilobytes per second.

LED

The standard abbreviation for light emitting diode.

local terminal

A term used to describe a terminal plugged into the EIA–423 maintenance port on the front bezel of the HS array controller. Also called a maintenance terminal.

logical unit (host logical unit)

A physical device or a storageset seen by the host. Often these logical units are spread across more than one physical device, especially in RAID implementations. This is *not* a LUN.

logical unit number

See **LUN**.

LRU

Least recently used. This is cache terminology for the block replacement policy for the read cache.

LUN

A logical unit number is a physical or virtual peripheral device addressable through a target. LUNs use their target's bus connection to communicate on the SCSI bus.

maintenance terminal

Any EIA–423 compatible terminal to be plugged into the HS controller. This terminal is used to identify the controller, enable host paths, define the configuration, and check controller status. It is not required for normal operations. It is sometimes referred to as a local terminal.

MB

The standard abbreviation for megabyte, 1024 kilobytes.

MB/s

The standard abbreviation for megabytes per second.

metadata

Data written on the physical disk that is not visible to the host/customer that allows the HS array controller to maintain a high integrity of customer data.

mirrorsets

Two or more physical disks configured to present one highly reliable virtual unit to the host. NORMAL member, see NORMAL. NORMALIZING member, see NORMALIZING.

MSCP

Mass Storage Control Protocol. The protocol by which blocks of information are transferred between the host and the controller.

nonredundant

A single controller configuration. A controller configuration which does not include an second backup controller permitting failover in the event of a failure.

NORMAL

A mirrorset term for a mirrorset member whose entire contents is guaranteed to be the same as all other NORMAL members. All NORMAL members are exactly equivalent.

NORMALIZING

A mirrorset term for a mirrorset member whose contents is the same as all other NORMAL and NORMALIZING members for data that has been written since the mirrorset was created or lost cache data was cleared. Data that has never been written may differ among NORMALIZING members.

NV

Nonvolatile. A term used to describe memory, the contents of which survive loss of power.

port

The hardware and software used to connect a host controller to a communication bus, such as CI, DSSI, or SCSI bus. This term also is used to describe the connect between the controller and SCSI storage devices.

PTL

Port-Target-LUN device notation. Where **P** designates the port (1 through 6), **T** designates the target ID of the device (0 through 6 in a nonfailover configuration, or 0 through 5 if the controller is in a failover configuration), and **L** designates the LUN of the device (0 through 7).

qualified device

A device that has been fully tested in an approved StorageWorks configuration, (that is, shelf, cabinet, power supply, cabling, and so forth) and is in complete compliance with country-specific standards (for example, FCC, TUV, and so forth) and with all Digital standards.

quiesce

To make a bus inactive or dormant. The operator must quiesce SCSI bus operations, for example, during a device warm swap.

RAID

Redundant array of independent disks. The multiple storage access methods devised for performance (RAID 0, striping) and/or various cost levels of availability (RAID 1 through RAID 5).

RAIDset

Three or more physical disks that are configured to present an array of disks as a single virtual unit to the host.

read cache

The cache is used to accelerate read operations by retaining data which has been previously read, written, or erased, based on a prediction that it will be reread.

replacement policy

The firmware controller method by which a spare disk is selected to replace a disk that has failed in a RAIDset.

SBB

StorageWorks building block. A modular carrier plus the individual mechanical and electromechanical interface required to mount it into a standard shelf. Any device conforming to shelf mechanical and electrical standards is considered an SBB.

SBB shelf

StorageWorks building block shelf. A StorageWorks shelf, such as the BA350–Sx, designed to house plug-in SBB modules.

SCS

System Communication Services. A delivery protocol for packets of information (commands or data) to or from the host.

SCSI

Small Computer System Interface. An ANSI interface defining the physical and electrical parameters of a parallel I/O bus used to connect hosts to a maximum of seven devices. The StorageWorks device interface is implemented according to SCSI–2 standard, allowing the synchronous transfer of 8-bit data at rates of up to 10 MB/s.

SCSI device

A host computer adapter, a peripheral controller, or a storage element that can be attached to the SCSI bus.

SCSI device ID

The bit-significant representation of the SCSI addressing that refers to one of the signal lines numbered 0 through 7. Also referred to as a *target* ID.

SCSI–A cable

A 50-conductor (25 twisted pair) cable used for single-ended, SCSI bus connections.

SCSI–P cable

A 68-conductor (34 twisted pair) cable used for differential bus connections.

Small Computer System Interface

See **SCSI**.

spareset

A pool of disk drives used by the controller to replace failing members of a RAIDset.

SPD

Abbreviation for Software Product Description. A document that products a legal description of a product.

storageset

Any collection of containers, such as stripesets, RAIDsets, the SPARESET, and the FAILEDSET, that make up a container.

StorageWorks

Digital's family of modular data storage products that allows customers to design and configure their own storage subsystems. Components include power, packaging, cabling, devices, controllers, and software. Customers can integrate devices and array controllers in StorageWorks enclosure to form storage subsystems.

StorageWorks building block

See **SBB**.

stripesets

A virtual disk drive with its physical data spread across multiple physical disks. Stripeset configurations do not include a data recovery mechanism.

striped mirrorsets

Stripesets whose members have been mirrored.

tagged command queuing

A technique that allows a device to have multiple I/O requests outstanding to it at one time.

target

Is a SCSI device that performs an operation requested by an initiator. Target is determined by the device's address on its SCSI bus. For example, the HSJ controller can address targets 0 through 6 in a single configuration or targets 0 through 5 in a dual-redundant configuration.

TILX

Tape Inline Exerciser. Diagnostic firmware used to text the data transfer capabilities of tape drives in a way that simulates a high level of user activity.

TMSCP

Tape Mass Storage Control Protocol. The protocol by which blocks of information are transferred between the host and the controller.

unit

The host's view of a container on an HS array controller. A unit may be made up of simply a physical disk or tape drive, or a more complex container such as a RAIDset.

unwritten cached data

Data in the write-back cache which has not yet been written to the physical device, but the user has been notified that the data has been written.

value-added firmware

The firmware that provides logical block mapping, cache, RAID, and so on.

VCS

VAXcluster system console. This terminal allows access to the maintenance port on the controller from the host that connects to other hosts (by networks). Another method of accessing the controller. *See also* **DUP**.

virtual terminal

A software path from an operator terminal on the host to the controller's CLI. The path can be established via the host port on the controller (using DUP) or via the maintenance port through on intermediary host (VCS). A virtual terminal is also sometimes called a host console.

warm swap

A method used to add or swap devices while the system remains on line during device removal, replacement, or addition. All activity on the bus where the device is being swapped must be halted for the duration of the removal, replacement, or addition.

write-back

A cache write strategy that writes to the cache memory, the MAY flush the data to the primary media at some future time. The user sees the operation as complete when the data has reached the cache. The intent of this strategy is to avoid unnecessary accesses to the primary media.

write hole

Undetectable RAID level 1 or 5 data corruption. A write hole is caused by the successful writing of some, but not all, of the storageset members. Write holes occur under conditions such as power outages, where the writing of multiple members can be abruptly interrupted. A battery backed-up cache design eliminates the write hole, because data is preserved and writes can be retried.

write-through cache

A cache write strategy in which the destination of the write data is the primary storage media. This operation may update, invalidate, or delete data from the cache memory accordingly, to ensure that the cache does not contain obsolete data. The user sees the operation as complete only after the backup storage device has been updated.

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