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DIGITAL StorageWorks
HSD30 Array Controller Operating Software

HSOF Version 3.2
Release Notes

Order Number: EK–HSD30–RN. H01

This document summarizes features and characteristics of the HSD30 array controller operating software Version 3.2 that are not covered elsewhere in the documentation. These release notes also contain instructions for installing the software and should be retained for future reference.

Software Version: HSOF V3.2

Digital Equipment Corporation
Maynard, Massachusetts

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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Restrictions apply to the use of the local-connection port on this series of controllers; failure to observe these restrictions may result in harmful interference. Always disconnect this port as soon as possible after completing the setup operation. Any changes or modifications made to this equipment may void the user's authority to operate the equipment.

Warning!
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.

Achtung!
Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

Avertissement!
Cet appareil est un appareil de Classe A. Dans un environnement résidentiel cet appareil peut provoquer des brouillages radioélectriques. Dans ce cas, il peut être demandé à l' utilisateur de prendre les mesures appropriées.

Contents

Introduction

These release notes provide information for the HSD30 array controller operating software Version 3.2 not covered elsewhere in the documentation. This document should be used by individuals responsible for configuring, installing, and using HSD30 array controllers.

Read this entire document before installing or upgrading the software. The information in these release notes takes precedence over the information in the *HS Family of Array Controllers User's Guide.*

In this document and the documentation that accompanies it, the terms "switch" and "qualifier" are used interchangeably. A switch or qualifier is a portion of a command string that modifies a command verb or command parameter by selecting one of several options.

Topics Covered

These release notes cover the following topics:

- Hardware and software supported by software Version 3.2
- New features of Version 3.2—Describes the changes and enhancements included in Version 3.2
- Clarifications—Explanations of controller behavior in certain situations
- Operating constraints—Limitations placed on the operation of the controller by the nature of its design
- Avoiding problem situations—Information to help you avoid and recover from unusual controller behavior in certain situations, under specific conditions
- Additions and corrections to the documentation
- Items from previous releases—Modifications to operating parameters or functions that were introduced in software revisions prior to Version 3.2, but which were not covered in the user's guide.
- HSOF software installation/upgrade instructions
- Identification of the software revision level
- Replacing a controller or cache module using C_SWAP or an offline method
- Saving the subsystem's configuration (for nonredundant configurations)
- HSUTIL utility

Release Package Contents

The Version 3.2 release package consists of the following:

- A cover letter
- HSD30 Array Controller Operating Software Version 3.2 Release Notes
- HSD30 Array Controller Operating Software (HSOF), Version 3.2 Software Product Description
- The *HS Family of Array Controllers User's Guide*
- A PCMCIA program card containing HSOF software Version 3.2
- License keys to enable optional features: write-back cache, disk mirroring, and RAID (each to be purchased separately)

Intended Audience

This document has been prepared for DIGITAL customers who have purchased HSD30 array controllers and for DIGITAL Multivendor Customer Services personnel responsible for installing and maintaining systems that include HSD30 array controllers.

Hardware and Software Support

This section lists the hardware and software compatible with HSOF Software Version 3.2.

Hardware Support

HSOF Version 3.2 software supports the following revisions for the HSD-series controllers and associated hardware:

- HSD30 controller module, hardware revision A
- Cache module, hardware revision A or B
- BA350–MA controller shelf
- BA350–S*x* device shelf
- BA356–S*x* wide device shelf with 8-bit or 16-bit personality module (controller operates in 8-bit mode only)
- BA35*x*–HA power supply

Operating System Support

Software Version 3.2 on HSD30 controllers is supported by the following operating system versions, within the limitations described in the *HS Family of Array Controllers User's Guide.*

- OpenVMS Alpha™ Versions 6.1, 6.2, 7.0, 7.1
- OpenVMS VAX™ Versions 5.5–2, 6.1, 6.2, 7.0, 7.1

Host Adapter Support

The following adapters have been tested and are supported in this release.

- SHAC-based embedded/native adapters (for various VAX and DEC systems)
- Embedded/native adapter for DEC 4000™ systems
- KFMSA and KFMSB (for XMI-based systems)
- KFESA and KFESB (for AlphaServers 1000, 2000, and 2100)
- KFPSA (for AlphaServers 1000, 2000, 2100, 4100, 8400)

Device Support

HSOF Version 3.2 software supports the devices listed in Table 1 through Table 4 at the indicated hardware and microcode levels or higher.

Table 1: Supported Disk Drives

Device	Capacity in Gigabytes	Minimum Microcode Version	Minimum Hardware Version
RZ25-VA	0.43	0900	B01
RZ26-VA	1.05	T392	D02
RZ26L-VA/VW	1.05	440C	A01
RZ26N-VA/VW	1.05	446	A01
SWXD3-SF/WF	1.05	446	A01
DS-RZ26N-VZ	1.05	1003	A01
RZ28-VA/VW	2.10	435E	B01
RZ28B-VA	2.10	0003	A01
RZ28D-VA/VW	2.10	0008	A01
SWXD3-SG/WG	2.10	0008	A01
RZ28M-VA/VW	2.10	0466	A01
DS-RZ28M-VZ	2.10	1003	A01
SWXD3-SH/WH	2.10	0466	A01
RZ29B-VA/VW	4.3	0007	B01
SWXD3-SE/WE	4.3	0007	C02/A01
DS-RZ40-VA	9.1	LYGO	A01
DS-RZ1BB-VW	2.1	LYJO/0656	A01
DS-RZ1CB-VW	4.3	LYJO/0656	A01
DS-RZ1DB-VW	9.1	LYJO/0307	A01
RZ74-VA	3.57	T427B	B07

Table 2: Supported Tape Drives

Device	Capacity in Gigabytes	Minimum Microcode Version	Minimum Hardware Version	Notes
TKZ60-EC	.440	111	B01	1,6
TKZ61	4.4	0611	A01	1
TKZ62	24.0	0616	A01	1,3
TKZ63	2.4	0616	A01	1,3
2T-TKZ64	144	0616	A01	1,3
TL810	480/960	1.10 robot/v40 drive	A01	1,2,3
TL812	960/1920	1.2 robot/CC33 drive	A01	1,2,3,4
TL820, Rev A01	2640/5280	1d3M robot/v40	L1	1,2,3
TL822	5280/10560	1g4F robot/CC33 drive	A01	1,2,3,4
TL826	3520/7040	1g4F robot/ CC33 drive	A01	1,2,3,4
DS-TL893	9.24/18.48T	V2A/5A	A01	1,2,3,4
DS-TL894	1.69/3.36T	V1.24	A01	1,2,3,4
DS-TL896	6.16/12.32T	V2A/5A	A01	1,2,3,4
TLZ06-VA	4	0491	A04	3
TLZ07-VA	8	04Aq	AX01	3
TLZ09-VA	4/8	v165		5
TLZ6L-VA	16	0491	A01	3,6
TLZ7L-VA	8	4BQE	A02	3,6
TLZ9L-VA	32	A020	AX01	3,6
TSZ07-AA	0.140	0309	A01	1
TZ86-VA	6	430B	A02	5
TZ87-VA	10/20	930A	A01	3,5
TZ87N-VA	10/20	930A	A01	3,4,5
TZ87-TA	10/20	9514	B02	1,3,5
TZ87N-TA	10/20	930A	A01	1,3,5
TZ867-AE/AF	42	430B	A01	1,3,5
TZ875-NE	50/100	930A	A01	1,3,5
TZ875-NT	50/100	930A	A01	1,3,5
TZ875-AE/AF	50/100	930A	A01	1,3,5
TZ877-AE/AF	70/140	930A	A01	1,3,5
TZ877-NE	70/140	930A	A01	1,3,5
TZ88N-VA/TA	20/40	CC33	A01	3,4,5
TZ885-NT	100/200	CC33	A01	1,3,4,5
TZ887-NE/NT	140/280	CC33	A01	1,3,4,5
DS-TL890	560/1120	3.23 robot/V55 drive	A01	1,2,3,4,5
DS-TL891	350/700	3.23 robot/V55 drive	A02	1,2,3,4,5
DS-TL892	350/700	3.23 robot/V55 drive	A01	1,2,3,4,5
DS-TZ89N-VW	35/70	141F	A01	3,4,5

Device	Capacity in Gigabytes	Minimum Microcode Version	Minimum Hardware Version	Notes
DS-TZ89N-TA	35/70	141F	A01	1,3,4,5

Notes:

1. Requires 0.2 meter SCSI-1 to SCSI-2 transition cable, DIGITAL internal part number 17-03831-01 for DWZZA-AA and DIGITAL part number 17-04367-01 for SSB DWZZA-VA and DWZZB-VW.
2. Requires DWZZA/DWZZB single-ended to differential SCSI signal converter.
3. Capacity values represent compressed data. The compression factor is device dependent based on individual device algorithms.
4. Cannot read TK50, TK70 or TZ30 formatted tapes.
5. Tape device code load is supported using HSUTIL.
6. Loaders operate in sequential mode only.

Table 3: Supported Solid State Disk Drives

Device	Capacity in Gigabytes	Minimum Microcode Version	Minimum Hardware Version	Code Load Supported?
EZ31-VW	0.134	V064	A01	Yes, see note 2
EZ32-VW	0.268	V064	A01	Yes, see note 2
EZ51R-VA	0.10	V096	D01	Yes
EZ54R-VA	0.42	V096	A01	Yes
EZ58R-VA	0.85	V109	C01	No
EZ64-VA	0.475	V064	A01	Yes
EZ64-VW	0.475	V070	A01	Yes
EZ69-VA	0.950	V064	A01	Yes
EZ69-VW	0.950	V070	A01	Yes

Notes:

1. Do not warm-swap solid-state disk drives. Ensure power to the device shelf is turned off before removing or inserting this device. This applies to all solid state disk drives.
2. The EZ31 and EZ32 are supported as a devices in HSOF Version 3.1, but device code load to this drive with HSUTIL is not supported with an entry in the internal HSUTIL table. Code load to the EZ31 and EZ32 can be performed using the "unsupported device" feature of HSUTIL. The steps are as follows:

    a. answer the "unsupported device" path: yes

    b. total size: 1024

    c. single write buffer: no

    d. buffer size: 8

    e. download microcode and SAVE: yes

    f. bytes reversed: no

Table 4: Supported CD-ROM Drives

Device	Capacity in Gigabytes	Minimum Microcode Version	Minimum Hardware Version	Notes
RRD42-VB/VU	0.6	1.1a	A01	1
RRD43-VA	0.6	0064	A02	1
RRD44-VA	0.6	3493	A02	1
RRD45-VA/VU	0.6	1645	A01	1
RWZ52-VA	0.6 per side	3403	A01	1
RWZ53-VA	2.3/2.6	1.35	AX02	1
RW524	19	1.37 juke box /3404 drive	A01	2
RW525	19	2.17 juke box /3404 drive	A01	2
RW530	38	6.15 juke box /3404 drive	A01	2
RW531	38	0.35 juke box /3404 drive	A01	2
RW532	76	0.35 juke box /3404 drive	A01	2
RW534	104	5.20 juke box /3404 drive	A01	2
RW536	170	5.20 juke box 3404 drive	A01	2,3
RW546	36.8	1.36 juke box /1.35 drive	A01	2,3
RW551	64	1.36 juke box /1.35 drive	A01	2,3
RW552	147	1.36 juke box /1.35 drive	A01	2,3
RW555	294	1.36 juke box /1.35 drive	A01	2,3
RW557	547	1.36 juke box /1.35 drive	A01	2,3

Notes:

1. Do not warm-swap this device. Ensure that the device shelf power is off when inserting or removing this device.
2. Requires 0.2 meter SCSI-1 to SCSI-2 transition cable, DIGITAL internal part number 17-03831-01.
3. To add this device to your configuration, do the following:

   `SET` *`optical container-name`* `PTL TRANSFER_RATE_REQUESTED=ASYNC`

New Features of Version 3.2

Summary

HSOF Version 3.2 software incorporates patches to the Version 3.1 software. These patches fix problems and inconsistencies found in Version 3.1. This release improves internal battery test algorithms and resolves some anomalies in Version 3.1 battery testing.

The support of the CACHE_UPS option on the SET THIS_CONTROLLER has been added.

In addition, this release of software supports Fast Shadow Member Eviction, using the MD.SER flag.

The following new devices are supported in HSOF Version 3.2:

- DS-RZ1BB-VW
- DS-RZ1CB-VW
- DS-RZ1DB-VW
- DS-TL890
- DS-TL891
- DS-TL892

Fast Shadow Member Eviction

An MSCP flag is provided to enable rapid shadow member eviction when an device error is detected. OpenVMS sets this flag based on SYSGEN parameters in the field SHADOW_SYS_DISK. The MSCP flag is called MD.SER. When set, and an I/O encounters a device error, the I/O is returned as failed without further error recovery. OpenVMS can then evict a shadowset member, as appropriate.

Clarifications

This section presents clarifications on controller behavior in certain situations.

Battery Handling

Diagnostic testing is performed on the write-back cache batteries when the controller first initializes, and then periodically after it has become fully charged. This section clarifies battery-related topics.

Battery Handling and CACHE_UPS

If the CACHE_UPS qualifier is activated, the following behavior is true at all times:

- no battery checks are performed
- no battery condition is reported or messages sent
- no action is taken in the event of battery failure

Caution

> Use of this setting without a functional uninterruptible power supply (UPS) in place may result in data loss if power is interrupted and batteries have failed.

When the CACHE_UPS qualifier is enable, the controller ignores the condition of the write-back cache batteries because an UPS is assumed to be in use to maintain power to the write-back cache module in the event of a power failure. Note that HSOF software does not have the capability to monitor the remaining capacity of an UPD. There are many variables in an UPS configuration; some configurations may put data at risk if the UPS is exhausted. For example, if UPS power is lost to the entire host/storage without warning, write-back cache data is maintained by the cache batteries only. With CACHE_UPS set, the state of the batteries is unknown and data could be at risk.

Battery Handling and Cache Policy

The setting chosen for Cache Policy (A or B) affects access to RAIDsets and mirrorsets during the initial test only, and determines the cache mode the controller uses during initial test only.

Initial Test begins when the controller is turned on and continues until the battery charged, or up to ten hours. Initial testing includes a recharge of the battery after potential discharge during shutdown. Every four minutes, the software tests the battery. Full caching operations begins when the battery is fully charged.

Cache Policy A is the default setting. Cache Policy A and B apply only to a “low” battery from initialization until either:

1. the battery becomes fully charged or

2. 10 hours elapse without the battery becoming fully charged (in this case, failed battery action is taken, as described in “Failed Battery Action”, in this document).

Once a battery has become fully charged, Cache Policy A and B no longer applies, and regular periodic battery tests are performed.

The following table summarizes the effect of both cache policy settings on access to RAIDsets and mirrorsets when a battery is “low” during the initial test period.

	RAID/Mirror set access	Cache Mode
Cache Policy A	no access	write-through on individual disk units (also called JBOD)
Cache Policy B	access	write-through on RAID/mirrorsets and individual disk units

Note

Write-through cache mode is not a 100% guarantee of user data consistency within storagesets (RAID and mirrorsets). This is because in these storagesets, there is an inherent delay in the writing of data to the different members. If a power failure occurs between the writing of some members and others (an extremely narrow window), data on the various members is inconsistent. Therefore, Cache Policy A (which denies access to RAID/mirrorsets sets on controllers with low batteries) is the only 100% guarantee of user data consistency. That is why Cache Policy A enforces loss of storageset access in the event of a battery which does not pass the battery test.

HSOF software makes every attempt to notify the user that a battery problem (not good or open circuit) has occurred by printing a message to the console and posting an error to the host errorlog. However, not all operating systems present errorlogs reliably.

Failed Battery Action

If a battery passes the initial test, cache policy no longer applies, and periodic testing begins. During periodic testing, the battery is tested every 24 hours. When a failed battery is detected during either initial or periodic testing, the following failed battery action is taken:

Dual HSD30s (dual batteries on each cache module and partner is running and has good batteries):

- RAIDsets and mirrorsets migrate to partner under OpenVMS control without shutdown
- individual disk units accessed in write-through mode

Single HSD30:

- no shutdown
- no RAIDset or mirrorset access permitted
- individual disk units accessed in write-through mode

Using SAVE_CONFIGURATION to Save the Subsystem's Configuration

The SAVE_CONFIGURATION qualifier is intended to be used to provide a means to restore nonvolatile memory (NVRAM) contents when a controller in a single-controller module configuration is replaced. The SAVE_CONFIGURATION qualifier cannot cross hardware revisions or software versions. SAVE_CONFIGURATION is not available for upgrades of firmware or hardware, and will not perform inter-platform conversions. For example you cannot use SAVE_CONFIGURATION to upgrade from an HSD30 to an HSD50 array controller or from HSOF Version 3.1 to Version 3.2.

The controller stores the subsystem's configuration—the storagesets you configured, the qualifiers set for each, the HSOF patches you've installed, and so on—in its nonvolatile memory. This means that, if the controller fails in a nonredundant configuration, you would have to reconfigure the subsystem from scratch. (In a dual-redundant configuration, this information is stored by both controllers, which effectively eliminates the risk of losing it.)

Note

DIGITAL recommends that the SAVE_CONFIGURATION qualifier be used for nonredundant controller configurations only. To save the configuration information for dual-redundant configurations, use the SET FAILOVER COPY= command.

If you are operating a nonredundant configuration subsystem, DIGITAL recommends that you save the subsystem's configuration on at least one of the devices or storagesets with the following command:

`INITIALIZE` *`storageset_name`* `SAVE_CONFIGURATION`

DIGITAL does not recommend initializing all of your storagesets with the SAVE_CONFIGURATION qualifier. Every time you change the subsystem's configuration, the controller writes the new configuration to the storagesets that you initialized with this qualifier. Too many write operations can adversely affect performance.

When you initialize a device or storageset with the SAVE_CONFIGURATION qualifier , the controller copies the subsystem's configuration to the devices. If you use the qualifier for a multi-device storageset, such as a stripeset, the complete information is stored on each device in the storageset. The capacity of a device that is initialized with the SAVE_CONFIGURATION qualifier is reduced by 256KB. This capacity reduction applies to each member of a storageset.

After initializing a storageset with this qualifier, the controller keeps the copy up-to-date. For example, every time you add a new storageset, or patch to the HSOF software, the controller re-copies the new configuration to all storagesets that were initialized with the SAVE_CONFIGURATION qualifier.

If a controller fails in a nonredundant configuration, its replacement automatically searches the devices in the subsystem for a saved configuration. If it finds a saved configuration, it transparently loads it into nonvolatile memory and brings the subsystem online. It is unnecessary to issue an INITIALIZE command again after reconfiguring your devices with a new controller.

If you are upgrading from HSOF Version 3.1 to Version 3.2 in a single-controller configuration, you can refresh the SAVE_CONFIG data on your storagesets to include the new software revision by issuing the following command:

```
SET UNIT xxx WRITE_PROTECT
```

[where *xxx* is any existing unit on the controller]

```
SET UNIT xxx NOWRITE_PROTECT
```

These commands, which have no net effect, serve to change the contents of nonvolatile memory, causing the update SAVE_CONFIG information to be automatically written to the SAVE_CONFIG area of all units which have been initialized with this option.

Logical Device Event Reports

Under certain circumstances the Port, Target, and LUN fields contained in event reports associated with storageset logical devices, Event Log displays, as well as sense data responses, will be set to 255(decimal) instead of the Port, Target, and LUN of the first physical device in the storageset. In addition, when the Port, Target, LUN are set to 255, the Device Type is set to 0 (magnetic disk device), and the Device Product ID and Device Firmware Revision Level fields is ASCII space filled.

In a future release DIGITAL intends to properly identify the Port, Target, and LUN of the first physical device in the storageset in all possible cases. In cases where it is not possible to identify the first physical device in a storageset, the intention is to set the PTL values to 255 and provide the storageset specific information in the Device Product ID field to aid in identifying the logical device involved in the event.

SHOW on Both Controllers

Some devices, such as tape devices, might not show correctly on one controller if they are preferred to the other controller. If the expected information is not displayed from one controller, use the SHOW command again to view the information on the other controller.

Logical Block Address Does Not Match for MEDIUM ERROR

The Logical Block Address (LBA) is a number used to identify a block on a mass storage device. The LBA that appears in the Information field of an Event Log (%EVL) display when the Sense Key field is MEDIUM ERROR does not agree with the LBA number contained in the Information field of the extended sense data that is sent to the host system. It is one less than the number in the extended sense data.

Adding RAIDsets When Battery Condition is Low

You can use the ADD RAIDSET and ADD MIRRORSET commands, regardless of the write-back cache battery condition. However, if the CACHE_POLICY is set to A and the batteries are low, the controller does not allow access to any RAIDsets or mirrorsets. CACHE_POLICY A requires that the cache batteries be fully charged before you can use RAIDsets or mirrorsets. Refer to the *HS Family of Array Controllers User's Guide* for additional information about CACHE_POLICY A choices.

Drive-Level Event Reports

Under certain circumstances the "devtype" (device type) field contained in drive-level event reports %EVL displays, as well as error logs, contain the value 1F (hexadecimal). When "devtype" is 1F the content of the "device identification" and "device serial number" fields are undefined and should be ignored.

This is a permanent restriction.

Operating Constraints

This section describes the operating constraints for HSOF Version 3.2 software. An operating constraint is a limitation placed on the operation of the controller by the nature of its design. Other constraints of host adapters or other system components might also be described in this section. Keep these constraints in mind to avoid problems and to help you to get the maximum performance from your controller.

Maintenance Terminal Port Speeds

HSOF Version 3.2 software supports terminal port connections at 4800, 9600 and 19200 bits per second (bps). Connection speeds at 300, 1200, and 2400 bps are not supported.

Limits on the Total Number of Storagesets

The following limits apply to storagesets configured on a single controller or dual-redundant controller configurations:

- A mirrorset can have a maximum of 6 members.
- A stripeset or RAIDset can have a maximum of 14 members.
- There can be a maximum of 20 mirrorsets and/or RAIDsets.
- There can be a maximum of 30 storagesets (RAIDsets, mirrorsets, and/or stripesets).
- There can be no more than 32 physical device members total for a unit.
- Each storageset can store a maximum of 120 GB.

Restrictions on Moving Storagesets to Previous Software Versions

In HSOF Software Version 2.5, striped mirrorsets reported a different disk geometry than the same nonmirrored stripeset. This has been resolved in Versions 2.7, 3.1 and 3.2 such that striped mirrorsets initialized under these versions report a disk geometry identical to the same nonmirrored stripeset.

Due to this improvement, be aware of the following when moving stripesets to previous versions of software:

- Striped mirrorsets created under HSOF Software Versions 2.7, 3.1 or 3.2 cannot be used on previous versions; the metadata is incompatible.
- Any stripeset that is converted to a striped mirrorset using the MIRROR command under HSOF Software Versions 2.7, 3.1 or 3.2 cannot be used on previous versions. You must UNMIRROR each of the members to return the stripeset to an earlier version.
- Any stripeset clone that is created under Versions 2.7, 3.1 or 3.2 using the CLONE utility cannot be used with previous software versions.

- Containers initialized with the SAVE_CONFIGURAITON switch introduced in HSOF Version 2.7 cannot be used with versions prior to Version 2.7.

Striped mirrorsets created under previous software versions and used with Versions 2.7, 3.1 or 3.2 carry forward the same geometry they had under the previous version. If possible, back up the data and reinitialize the stripesets under Versions 2.7, 3.1 or 3.2 to take full advantage of geometry improvements.

Initialization Devices

Controller-attached devices can serve as initialization devices for VAX 7000 and VAX10000 systems, provided the VAX 7000/10000 console code is at version 4.0 or higher.

Only One Qualifier per CLI Command Recommended

Certain qualifiers to CLI commands are incompatible. To avoid problems in this area, only specify one qualifier per CLI command. For example, to set both WRITEBACK_CACHE and NORUN on unit D102, use the following two commands:

```
SET D102 WRITEBACK_CACHE
SET D102 NORUN
```

UNMIRROR and Device Capacity

The UNMIRROR command is valid only for devices that have a capacity equal to the capacity of the mirrorset. If a mirrorset is comprised of devices of different capacities, the mirrorset capacity is limited to the size of the smallest member; larger members will have unused capacity. If a member with unused capacity is the last remaining member of a mirrorset, you cannot use the UNMIRROR command to change the device back to a single-disk unit, because that change would cause a change in reported disk capacity, possibly confusing the operating system.

Unit Problems after Battery Low

An unusual combination of circumstances could cause a unit to unexpectedly become inoperative and report lost data after a write-back cache battery changes state from “low” to “good.” No data has been lost. Reset the controll er to correct the unit state or use the CLEAR_ERRORS LOST_DATA command.

CLEAR_ERRORS LOST_DATA command

When entering the CLEAR_ERRORS LOST_DATA command for a RAIDset-based unit, always enter the command through the preferred path on the controller that owns the unit . Entering the command from the companion controller in a dual-redundant configuration does not clear the lost data.

SET NOPATH Requires Controller Reset

Shut down the controller using the CLI SHUTDOWN THIS_CONTROLLER command to restart an HSD controller after disabling the host paths with the SET THIS_CONTROLLER NOPATH command. Failure to do so could result in subsequent unexpected conditions requiring controller reinitialization. The shutdown allows devices preferred to this controller to become visible on the other controller.

You do not need to reset an HSD controller after enabling paths.

RRD42 CD–ROM Reader

Mounting an RRD42 could put a message in the OpenVMS error log. In earlier versions of OpenVMS, the first four digits in Longword 19 of the controller-dependent information are 02D1. New versions of OpenVMS report ASC: 209.(D1) ASCQ: 2.(02). The message indicates "Unexpected bus phase," and can be ignored safely.

OVERRIDE_ONLINE Qualifier

Attempting to delete tape-based units using the OVERRIDE_ONLINE qualifier results in conditions requiring controller reinitialization. Do not enter the OVERRIDE_ONLINE qualifier when deleting tape-based units.

Unable to Access Tape Drives after Power Cycle

You might not be able to access a tape drive after the power for the drive is turned off and back on. Use the CLEAR_ERRORS UNKNOWN *device-name* command to place the device in a known state.

CFMENU Constraints

CFMENU can only delete one spareset member at a time. Delete sparesets one at a time by responding "Y" (yes) to one member, and "N" (no) to the remaining spareset's members. CFMENU deletes the spareset member.

You can also delete spareset members using the CLI command DELETE SPARESET *disk_name*. While you still have to delete each member individually with separate CLI commands for each one, this is a faster method for deleting multiple spareset members.

Avoiding Problem Situations

In certain situations, you could experience unusual controller behavior. This section presents information to help you avoid such situations and to recover from them if they occur.

Device Adds, Moves, and Changes

The controller maintains configuration maps of device types and locations and uses those maps for communicating with devices. If you add, move, or change devices while the controller is powered off and without changing the controller configuration first, the controller is not able to work with the changed devices when it returns to service.

Tape Drive Firmware Revision Upgrade

If you are not using HSUTIL to install your new tape firmware, do the following: Before installing a new version of tape drive firmware, delete the tape drive completely from the controller configuration. You can re-add the tape drive after the firmware installation is complete.

Running CONFIG or CFMENU Utilities During Backup Operations

Do not run the CONFIG or CFMENU utilities during a tape backup operation.

Changing Host Adapter Types

If you change the host adapter and maintain the same node number, restart the controller(s).

CLONE Utility

When running the CLONE utility in a dual-redundant controller configuration, do not issue any CLI commands to devices that are involved in the clone operation.

Moving Write-Back Cache Modules

When moving a write-back cache module to a new environment (that is, different controller, different devices), it is very important that you perform a clean shutdown of the controller and clear any data from the cache. Follow these steps to move a write-back cache module:

1. Shut down the controller and flush unwritten data from the cache module using the CLI command:

   ```
   SHUTDOWN THIS_CONTROLLER
   ```

   or

   ```
   SHUTDOWN OTHER_CONTROLLER
   ```

2. Wait for the SHUTDOWN command to complete and verify that the controller does not report any errors.
3. Remove the controller and cache module following the instructions in the *HS Family of Array Controllers User's Guide* or the *HS Family of Array Controllers Service Manual*.

The SHUTDOWN command flushes cache data to the devices, and you can install the module in another location without problems caused by uncleared cache data.

Set Tape Density When Adding Tape Drives and Changing Cartridge Types

The DEFAULT_FORMAT qualifier allows you to specify the tape format for use by the controller for write operations to a tape drive. Also use this qualifier to tell the controller to allow the host to set the tape format.

Not all tape devices support all formats. The easiest way to determine what formats are supported by a specific device is to enter the SET *tape-unit-number* DEFAULT_FORMAT=? command. The controller displays the valid options for the unit.

Notes

> Host system software must support the density selection for the affected device for this option to operate correctly. Using the host_selected qualifier for other devices may yield unpredictable results.
> DIGITAL recommends the use of the SET *tape-unit-number* DEFAULT_FORMAT=HOST_SELECTED command with only TSZ07 tape drives. Set the qualifier to HOST_SELECTED to allow the host to set the tape format.

When first adding a tape drive to the controller configuration, set the tape density with the SET *tape-unit-number* DEFAULT_FORMAT= command before using the OpenVMS INITIALIZE command. In dual-redundant controller configurations, set the tape density from **both** controllers in the pair before the tape drive is mounted. Not setting the tape density might cause the tape to be written at the wrong density, or the OpenVMS INITIALIZE command to fail with an invalid format error.

Removing DSSI Cables

Disable the DSSI paths and then restart the controller before removing the DSSI cables from HSD controllers, or the controller bug checks and restarts. To remove DSSI cables:

1. Disable DSSI paths on the controller.

   ```
   SET THIS_CONTROLLER NOPATH
   ```

2. Perform an orderly shutdown and restart of the controller.

   ```
   RESTART THIS_CONTROLLER
   ```

3. If the controller has a plastic mating guide installed on the DSSI connector, remove the DSSI cables. If the controller does not have a plastic mating guide on the DSSI connector, remove power from all devices on the bus before removing the cables.

Extending the Life of Your Write-Back Cache Batteries

Occasionally, circumstances require shutting down the controller and restarting it. If the correct steps for turning off the power to an HSD30 array controller configuration with write-back cache are not followed, there is a potential for data loss that might exist on any devices connected to them. In addition, turning off the power to the controller subsystem for any reason for longer than four days (such as a long holiday, system move, replacing a bad SCSI host cable, and so forth), turn off the write-back cache batteries to prevent them from discharging. To avoid problems when the controller restarts, always use the following process to shut it down:

Caution

> Allowing the write-back cache batteries to discharge completely, and leaving them in a discharged state for any length of time may result in permanent and irreversible degradation to the batteries.

Shutting Down a Controller

1. Use the proper procedures for shutting down the operating system if the host system is also going to be turned off.
2. 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 HSD30 array controllers.
3. If the controller configuration contains any devices or storagesets 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. If you have RAIDset or mirrorset units, or single devices with write-back caching turned on, Set NORUN on all units.
4. When the dismount and/or the operating system shutdown procedures are complete, invoke the controller SHUTDOWN commands on the controllers.

Caution

> Do not turn off the power to the controller subsystem until all shutdown procedures have successfully completed.

5. If you have a dual-redundant controller configuration, shutdown each controller one at a time, using the following commands:

   ```
   SHUTDOWN OTHER_CONTROLLER
   SHUTDOWN THIS_CONTROLLER
   ```

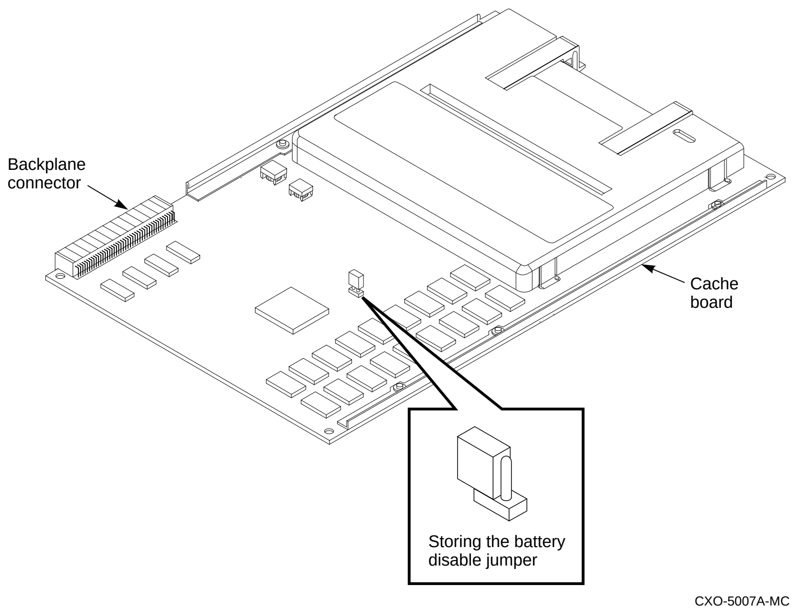
   If you have a non-redundant controller configuration, only the SHUTDOWN THIS_CONTROLLER command is necessary.

   The green reset LED light stops blinking when the SHUTDOWN command is complete.
6. Only when the controller SHUTDOWN command has successfully completed, turn off power to the controller subsystem (or just the controller shelf, if you are not shutting down the entire system, by unplugging the power supplies in the controller shelf).

Disabling the Controller and Write-Back Cache Module

Refer to Chapter 7 in *StorageWorks*™ *Array Controllers HS Family of Array Controllers Service Manual* for instructions on removing and replacing the controller module and write-back cache module.

Figure 1 Location of Write Back Cache Battery Disable Jumper



1. Remove the controller module.
2. Remove the write-back cache module.
3. Remove the battery disable jumper and replace it so that both pins are covered. The battery is no longer powering the cache.
4. Replace the write-back cache module.
5. Replace the controller module.

Restarting the Controller

1. Before restoring power to the subsystem, remove the controller module, and the write-back cache module. Remove the battery disable jumper and replace it so it is only covering **one** pin, then reassemble the unit again.
2. If you removed the PCMCIA card, hold down the reset button while inserting the PCMCIA card. When you release the reset button, the controller restarts.

   If you did not remove the PCMCIA card, press the reset button and the controller restarts.

Moving Drives from HSC Controller Subsystems

Software Version 3.2 contains an undocumented local program, CHVSN, for viewing and changing volume serial numbers that you can use to move drives from an HSC controller to an HSD30 controller. Use this program when moving drives because the HSC controller accepts volume serial numbers of zero and duplicate serial numbers, but HSD30 controllers do not.

Run CHVSN for drives in nontransportable mode that originated on an HSC controller. If the volume serial number is zero or a duplicate of another drive's volume serial number, answer "yes" to the "Update CHVSN" question. The controller then generates a new volume serial number:

```
CLI> RUN CHVSN
Device (port target lun) [EXIT] ? 4 1 0
CHVSN: Volume Serial Number is 00000000 00000000 Update
CHVSN (Y/N) [N] ? Y
CHVSN: Volume Serial Number is 00012010 00580010
Device (port target lun) [EXIT] ? Return
CHVSN - Normal Termination
```

If you attempt to run the subsystem with zero or duplicate volume serial numbers present, two symptoms appear:

1. The OpenVMS operating system reports "medium is offline."

```
$ MOUNT/FOR $3$DUA324 %MOUNT-F-MEDOFL, medium is
offline
$
```

2. The controller SHOW *unit* command reports "MEDIA FORMAT ERROR."

```
SHOW D324

MSCP unit                         Uses
--------------------------------------------------

  D324                            DISK240
        Switches:
          RUN
          NOWRITE_PROTECT
          READ_CACHE
          NOWRITEBACK_CACHE
          MAXIMUM_CACHED_TRANSFER_SIZE = 32
        State:
          MEDIA FORMAT ERROR
          NOPREFERRED_PATH
```

Documentation Additions and Corrections

This section describes additions and corrections to the:

- *HS Family of Array Controllers User's Guide*
- *HS Family of Array Controllers Service Manual*
- *HS Family of Array Controllers CLI Reference Manual*

CACHE_UPS

The following qualifiers have been added to the CLI commands SET THIS_CONTROLLER and SET OTHER_CONTROLLER.

```
CACHE_UPS
NOCACHE_UPS (Default)
```

Specifies whether the controller should perform regular battery condition checks, and whether it should ignore the CACHE_POLICY setting.

Specify CACHE_UPS if your storage subsystem receives power from an UPS. The controller does not check the condition of the cache batteries, and ignores the CACHE_POLICY setting, which means that RAIDsets and mirrorsets are always available, regardless of the condition of the cache batteries.

Specify NOCACHE_UPS to have the controller perform regular battery checks and follow the CACHE_POLICY setting for low batteries.

When the CACHE_UPS qualifier is enabled, the controller ignores the condition of the write-back cache batteries because an uninterruptible power supply (UPS) is assumed to be in use to maintain power to the write-back cache module in the event of a power failure. Note that HSOF software does not have the capability to monitor the remaining capacity of an UPS. There are many variables in an UPS configuration; some configurations may put data at risk if the UPS is exhausted. For example, if UPS power is lost to the entire host/storage system without warning, write-back cache data is maintained by the cache batteries only.

Warning

Use of this feature without a functional UPS could result in data loss if power is interrupted and batteries have failed.

Controller Warm Swap

The C_SWAP utility has been modified to better protect your data during controller replacements. Although the procedure looks much the same, there are subtle but important changes. Follow the instructions for running C_SWAP in "Replacing or Adding a Controller or Cache Module with C_SWAP" in these release notes. These instructions supersede those in the Version 2.5 Rev. D01 User's Guide and Service manuals.

Fault Management Utility (FMU) Codes

Add the following codes:

Executive Services Last Failure

01192390—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).

011A2390—A processor interrupt was generated by the VACHEB Dynamic Ram controller and ArBitration engine (DRAB) with an indication that the CAHCE backup battery has failed or is low (needs charging).

Host Interconnect Port Service Last Failure

42332080—Receive_main found destination address in the rcv packet does not match node address.

Last Failure Codes No Longer Used

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 CACHEEB Dynamic Ram controller and ArBitration engine (DRAB) with an indication that the CACHE backup battery has failed or is low (needs charging).

CLI Command Differences

This section describes changes to the CLI commands.

CLI Command Time Out

The time out duration for CLI commands has been extended from 10 minutes to 30 minutes. The time out is the length of time that one controller in a dual-redundant configuration will wait for the other controller to complete a command.

Cache and Battery Information

The following commands now display more accurate information about the cache and battery state, even when the cache is disabled:

```
SHOW THIS_CONTROLLER
SHOW THIS_CONTROLLER FULL
SHOW OTHER_CONTROLLER
SHOW OTHER_CONTROLLER FULL
```

NORECONSTRUCT Not Allowed

The NORECONSTRUCT option for RAIDsets is no longer allowed. The valid options are RECONSTRUCT=NORMAL and RECONSTRUCT=FAST.

New Qualifiers for CLEAR_ERRORS INVALID_CACHE

The CLEAR_ERRORS INVALID_CACHE command has new qualifiers to tell the controller whether to use the cache information in the controller module or the cache information in the cache module.

```
CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER NODESTROY_UNFLUSHED_DATA
CLEAR_ERRORS INVALID_CACHE OTHER_CONTROLLER
NODESTROY_UNFLUSHED_DATA
CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER DESTROY_UNFLUSHED_DATA
CLEAR_ERRORS INVALID_CACHE OTHER_CONTROLLER DESTROY_UNFLUSHED_DATA
```

Customer Data Not Lost

The documentation for the following commands includes warnings that customer data might be lost. Customer data is **not** lost when using these commands.

```
CLEAR_ERRORS LOST_DATA
DELETE UNIT OVERRIDE_ONLINE
RESTART OTHER_CONTROLLER OVERRIDE_ONLINE
RESTART THIS_CONTROLLER OVERRIDE_ONLINE
SELFTEST OTHER_CONTROLLER OVERRIDE_ONLINE
SELFTEST THIS_CONTROLLER OVERRIDE_ONLINE
SHUTDOWN OTHER_CONTROLLER OVERRIDE_ONLINE
SHUTDOWN THIS_CONTROLLER OVERRIDE_ONLINE
```

New Tape Formats

The values for DEFAULT_FORMAT used with the SET UNIT command have been expanded to include the following choices:

HOST_SELECTED	TZ88_COMPRESSION
1600BPI_9TRACK	TZ88_NOCOMPRESSION
6250BPI_9TRACK	3490E_COMPRESSION
TZ85	3490E_NOCOMPRESSION
TZ86	3480_COMPRESSION
TZ87_COMPRESSION	3480_NOCOMPRESSION
TZ87_NOCOMPRESSION	TZ89_COMPRESSION
DAT_DDS_COMPRESSION	TZ89_NOCOMPRESSION
DAT_DDS_NOCOMPRESSION	AIT_1_COMPRESSION
DAT_DDS2_COMPRESSION	AIT_1_NOCOMPRESSION
DAT_DDS2_NOCOMPRESSION	

Valid values depend upon the specific device and the media loaded. To list valid options for a given unit or media enter the following command:

SET *unit-number* DEFAULT_FORMAT=?

The SHOW ***unit-name*** FULL command now shows both the default and current tape format and whether the format was set from the host or from the controller CLI. There is a new entry at the end of the Switches section that reads:

DEFAULT_FORMAT= *XXX* (*ZZZ*)

where *xxx* is one of the formats listed above, and *zzz* is either CLI_SELECTED or HOST_SELECTED.

Optical Disks Always TRANSPORTABLE

Optical read/write disks are always treated as TRANSPORTABLE in Version 2.7 (no metadata is written on them) and cannot be set TRANSPORTABLE or NOTRANSPORTABLE. This has the following ramifications:

- The ADD OPTICAL and SET OPTICAL commands no longer accept the TRANSPORTABLE and NOTRANSPORTABLE switches.
- The INITIALIZE optical-device command is no longer allowed.
- A unit associated with an optical disk can no longer be set WRITEBACK or NOWRITEBACK.
- The following commands for optical devices no longer show the TRANSPORTABLE or NOTRANSPORTABLE states

```
SHOW DEVICE FULL
SHOW OPTICAL
SHOW OPTICAL-DEVICE
SHOW UNIT-ASSOCIATED-WITH-OPTICAL
```

Add Loader Correction

The example for creating a command disk on page 7-102 in the User's Guide and page 4-22 in the Service Manual incorrectly shows the loader being added as a unit rather than the passthrough container. The correct example is:

```
ADD TAPE TAPE320 3 2 0

ADD UNIT T322 TAPE320
ADD LOADER LDR321 3 2 1
ADD PASSTHROUGH PASS1 LDR321
ADD UNIT D332 PASS1
```

Items from Previous Releases

The following list briefly describes changes that were introduced in the code version previous to HSOF Version 3.2 that are not covered in other documentation.

CLI Type Ahead, Recall, And Editing

HSOF Version 3.1 software provides more flexibility when entering CLI commands. You no longer need to wait for the current command to complete before entering the next command. You can recall any of the last four commands entered, and then edit that command to save time when entering new commands.

Refer to *HS Family of Array Controllers User's Guide* for more information on entering CLI commands.

DILX Enhancement

The HSD30 controller with HSOF Version 3.1 software has a new version Disk In-Line Exerciser (DILX) that acts on disks configured as single-device, RAIDset, stripeset, mirrorset, stripe-mirrorset units. In addition, you can choose to perform either an auto half test or an auto full test.

Support for Larger Storagesets

HSOF Version 3.1 software allows you to use storagesets with capacities of up to 120GB. You can configure drives of any size into storagesets, such as RAIDsets or stripesets. The maximum size of a storageset is 120GB, regardless of the size of the member drives.

Faster Storageset Initialization

The INITIALIZE command has been optimized in Version 3.1, and runs significantly faster than on previous versions of HSOF software. It takes less than 30 seconds to initialize a large RAIDset.

Multiple Disk Drive Formatting

You can perform a low-level format on up to seven disk drives at once with HSOF Version 3.1 software. See the "Formatting a disk using HSUTIL" section in these release notes for instructions on how to format disk drives.

Configuration Saved on Disk

A new CLI option causes the controllers to save a copy of the controller configuration (nonredundant controllers only) on one or more disk drives in the subsystem. The saved information is updated whenever the configuration of the nonredundant controller is changed. Should a nonredundant controller be replaced by another controller with no configuration, the saved configuration is restored from one of the devices to the controller.

The information saved includes the controller settings, device, storageset and unit configurations, and software patches. The section "Using SAVE_CONFIGURATION to Save the Subsystem's Configuration" further describes this feature. Note that any container initialized with the SAVE_CONFIGURATION option cannot be used on previous HSD30 or HSD40 array controller HSOF software versions. See "Replacing or Adding an HSD Controller or Cache Module" in these release notes for instructions on how to replace a failed controller.

Ability to Install New Microcode on a Tape Drive and Solid State Disk Drives

HSOF Version 3.1 software allows you to use the controller's HSUTIL program to install new microcode to the TZ89 tape drive.

HSOF Version 3.1 software also allows you to use the controller's HSUTIL program to install new microcode to the following solid state disk drives:

- EZ51
- EZ54
- EZ64
- EZ69

Set SCSI Speed for Devices

HSOF Version 3.1 software makes it possible for the initiator and target to negotiate a faster data rate than is supported by the cable length. HSOF Version 3.1 software has a new CLI command to set a maximum data transfer rate between the controller and any device. Possible settings are 10MHz, 5MHz, or asynchronous mode.

To set the transfer speed, use the SET command as follows:

`SET` *`device-name`* `TRANSFER_RATE_REQUESTED=`*`rate`*

rate can be one of the following:

`ASYNCHRONOUS`

`10MHZ`

`5MHZ`

The default is 10MHZ.

Refer to *HS Family of Array Controllers User's Guide* for more information on setting the data transfer rate according to SCSI cable lengths.

Disk Code Load Capability

You can upload disk firmware to compatible disks in the subsystem using the HSUTIL utility. For more information, see Appendix B, "HSUTIL Utility" in these release notes.

Disk Formatting Capability

Format compatible disks in the subsystem using the HSUTIL utility. For more information, see Appendix B, "The HSUTIL Utility" in these release notes.

This section describes the features and user interface of the HSUTIL utility. HSUTIL provides two functions:

Device format—Enables you to perform a basic SCSI format operation on a disk device.

Device code load—Enables you to download device firmware into supported disk devices.

Default Chunksize and Maximum Chunksize

The algorithms for calculating the default and maximum chunksize for containers changed with Version 2.7. The default chunksize is determined by the following:

- If the number of members in a container is <= 9, the default chunksize is 256.
- If the number of members in a container is >9, the default chunksize is 128.
- If the controller cache size is less than 16 MB, the default chunksize is 64, regardless of number of members.

The maximum chunksize is figured as 2048 / (*n* – 1) where *n* is the number of devices in the container. You must specify the chunksize in accordance with the following table:

RAIDset Size	Maximum Chunksize	RAIDset Size	Maximum Chunksize
3 members	1024 blocks	9 members	256 blocks
4 members	682 blocks	10 members	227 blocks
5 members	512 blocks	11 members	204 blocks
6 members	409 blocks	12 members	186 blocks
7 members	341 blocks	13 members	170 blocks
8 members	292 blocks	14 members	157 blocks

Disk Geometry’s of Mirrorsets and Clones

In software Version 2.5 mirrored devices reported different geometry’s than unmirrored devices of the same type. This also affected the CLONE utility, such that a clone of a unit might have reported a different size to the operating system than the original unit. Software Version 2.7 resolved this issue. In Version 2.7, all mirrorsets and clones report the same disk geometry/capacity as their unmirrored equivalents.

New CLEAR_ERRORS INVALID_CACHE Functionality

A controller presents an INVALID CACHE error during initialization if it detects a mismatch between the cache information on the controller and the cache information on the cache module. The CLEAR_ERRORS INVALID_CACHE command has new qualifiers to tell the controller whether to use the information in the controller module or the information in the cache module.

The new syntax of the command is:

```
CLEAR_ERRORS INVALID_CACHE controller data_retention
```

- *controller* identifies the controller to clear the error on, either THIS_CONTROLLER or OTHER_CONTROLLER, and

- *data_retention* specifies whether to keep the cache data and overwrite the controller information (NODESTROY_UNFLUSHED_DATA) or keep the controller information and discard the cache data (DESTROY_UNFLUSHED_DATA).

  Use the NODESTROY_UNFLUSHED_DATA parameter in the following situations:

  – When you have replaced the controller module

  – The controller's nonvolatile memory (NVMEM) has lost its memory, possibly from an NVMEM battery failure

  – You removed the cache module while there was unflushed data

  In this case, specify the following:

  ```
  CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER
  NODESTROY_UNFLUSHED_DATA
  ```

  Use the DESTROY_UNFLUSHED_DATA parameter in the following situations:

  – When you have replaced the cache module

  – Any other reason not listed above.

  In this case, specify the following:

  ```
  CLEAR_ERRORS INVALID_CACHE OTHER_CONTROLLER
  DESTROY_UNFLUSHED_DATA
  ```

New Cache Battery Diagnostic

Software Versions 2.7, 3.1 and 3.2 check the condition of the write-back cache batteries every 24 hours. If a battery failure is detected, all RAIDsets and mirrorsets become inoperative on the controller with the failed batteries. In dual-redundant controller configurations, the RAIDsets and mirrorsets will fail over to the other controller.

Device Extended Status

HSD controllers with software Versions 2.7, 3.1 and 3.2 transfer additional device error log information to the host when the information is made available by the device.

SET FAILOVER Causes Target to Restart

The SET_FAILOVER COPY= command now causes the target controller to restart after the copy completes. For example, the command SET FAILOVER COPY=THIS_CONTROLLER causes the "other controller" to restart after the configuration information is copied from "this controller."

The SET_FAILOVER COPY= command now copies license information as well as the controller configuration.

Error Log Codes

Refer to revision D01 of the *HS Family of Array Controllers Service Manual* for lists of error log codes.

HSOF Software Installation/Upgrade

Use the procedures described in this section to install HSOF Version 3.2 software supplied in this kit. The procedure for upgrading your software to Version 3.2 requires that you shut down and then restart the controllers, and typically takes less than 5 minutes to accomplish.

CAUTION

If JBOD disks that were initialized using the SAVE_CONFIG option on an HSZ40 controller running HSOF Version 27Z have been moved onto your HSD30 controller, see Appendix A in these release notes **before** upgrading your HSD30 controller to HSOF V3.2.

DIGITAL recommends dismounting controller-attached devices before performing the upgrade procedure.

Note

HSOF Version 3.2 software waits up to one minute after controller restart before presenting a CLI prompt or accepting commands. This delay does not affect unit availability to the host. The delay provides time for controller internal configuration operations to finish before user commands change the configuration. After you insert the HSOF Version 3.2 program cards and press the reset button, allow 60 seconds for the CLI prompt to appear.

Nonredundant Configurations

Shut down and restart the controller during this upgrade. During this time units are unavailable to the host system. Before upgrading the controller software, prepare the host system for this situation, either by dismounting units or by shutting down the system.

Use the following procedure to upgrade the HSOF software in a nonredundant controller:

1. Establish a local terminal connection to the controller.
2. Stop all I/O to the units in your subsystem. Do this by taking all units offline to the controller:

   ```
   SET THIS_CONTROLLER NOPATH
   ```

3. Enter the SHUTDOWN command:

   ```
   SHUTDOWN THIS_CONTROLLER
   ```

CAUTION

Failure to shut down the controller in this step might result in problems with RAIDsets and cache when the controller is reset.

Wait for the command to complete. When the controller halts, the green Reset (//) LED stops flashing and stays lit.

4. Remove the ESD shield covering the PCMCIA program card.
5. Press and hold down the reset button while ejecting the program card.
6. Release the reset button.
7. Remove the program card.
8. While holding in the controller reset button, insert the V3.2 program card, pressing the card in until the eject button extends outward, then release the reset button.
9. Reinstall the ESD shield.

   The controller restarts, leading to normal operations with the host systems as described in the *HS Family of Array Controllers User's Guide, Revision D01*.

10. Allow devices to be brought online to the controller by issuing the following command:

```
SET THIS_CONTROLLER PATH
```

Dual-Redundant Configurations

The procedure below requires that you change your dual-redundant configuration into two single configurations for the HSOF V3.2 software upgrade. Shut down and restart both controllers during this upgrade. During this time units are unavailable to the host system. Before upgrading the controller software, prepare the host system for this situation, either by dismounting units or by shutting down the system.

CAUTION

DIGITAL does not recommend the use of the SAVE_CONFIGURATION option for dual-redundant configurations. The following procedure requires changing your dual-redundant configuration into two single configurations for the HSOF V3.2 software upgrade.

Use the following procedure to upgrade the HSOF software in a dual-redundant controller:

1. Establish a local terminal connection to one of the controllers.
2. Stop all I/O to the units in your subsystem. Do this by taking all units offline to the controller:

```
SET THIS_CONTROLLER NOPATH
```

3. Enter the SET NOFAILOVER command to take THIS_CONTROLLER and OTHER_CONTROLLER out of dual-redundant (failover) mode.

```
SET NOFAILOVER
SHUTDOWN THIS_CONTROLLER
```

CAUTION

Failure to shut down the controller in this step might result in problems with RAIDsets and cache when the controller is reset.

Wait for the command to complete. When the controller halts, the green Reset (//) LED stops flashing and stays lit.

5. Remove the ESD shield covering the PCMCIA program card.
6. Press and hold down the reset button while ejecting the program card.
7. Release the reset button.
8. Remove the program card.
9. While holding in the controller reset button, insert the V3.2 program card, pressing the card in until the eject button extends outward, then release the reset button.
10. Reinstall the ESD shield.

    The controller restarts, leading to normal operations with the host systems as described in the *HS Family of Array Controllers User's Guide.*

11. Repeat the previous steps for the second controller, starting with step 5.
12. After completing all of the above steps on both controllers, put the controllers back into dual-redundant (failover) mode, by entering the following command:

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

13. Allow devices to be brought online to the controller by issuing the following command:

```
SET THIS_CONTROLLER PATH
SET OTHER_CONTROLLER PATH
```

Identifying Your HSOF Software Revision Level

You can identify HSOF Version 3.2 software by entering the SHOW THIS_CONTROLLER command at the CLI prompt. The resulting display lists the software revision level as version "V32D–*x*" (where *x* represents the number of patches associated with this version of software).

Order Numbers

The following table contains order numbers for controller options and preconfigured options.

HSD30-BA/CA	StorageWorks HSD30 Array Controller with no cache module, 6 SCSI-2 device ports
HSD30-BD/CD	StorageWorks HSD30 Array Controller with a 16 MB read cache module, 6 SCSI-2 device ports
HSD30-BF/CF	StorageWorks HSD30 Array Controller with a 32 MB read cache module, 6 SCSI-2 device ports
HSD30-XD	16 MB read cache module
HSD30-XF	32 MB read cache module
HSD30-YX	Write-back cache option kit -- contains two onboard cache batteries, one battery bracket, one write-back cache license
QA-2YJAC-HS	HSOF Software and Documentation

Replacing or Adding an HSD Controller or Cache Module

There are two procedures for replacing a failed controller or cache module in a dual-redundant configuration: an online controller swap method (C_SWAP) in which the surviving controller continues to process I/O, and an offline method in which you must shut down both controllers.

Replacing a Controller or Cache Module with C_SWAP

The online (C_SWAP) method described in these release notes is valid for HSOF software Version 2.7 and higher.

To replace a controller or cache module using C_SWAP, two power supplies are required in the controller shelf in the SW500 and the SW800 cabinet.

The following sections guide you through the online method using the C_SWAP utility.

Required Parts and Tools

You must have the tools listed in Table 5 to replace a controller or cache module.

Table 5 Required Tools for Controller/Cache Replacement

TOOLS REQUIRED	PURPOSE
Maintenance terminal and cable	To shutdown controllers, restart controllers, and invoke C_SWAP
ESD wrist strap and ESD mat	To protect all equipment against electrostatic discharge
3/32-inch Allen wrench	To loosen the controller mounting screws; to reinstall the controller
5/32-inch Allen wrench	To unlock the SW800-series cabinet
Small flat-head screwdriver	To connect the CI cable to the controller

Caution

Before invoking the C_SWAP utility, terminate all other running utilities and disable all other terminals.

Preparing the Subsystem Configuration (Online C_SWAP Method)

Complete the following steps to prepare your subsystem for the replacement.

1. Have the replacement modules at hand. The modules should be factory-fresh, or should have been shut down cleanly (with the SHUTDOWN command) in their last application.

2. Connect a maintenance terminal to the controller that you are not replacing.
3. If the controller to be replaced is still functioning, use the SHUTDOWN command to take it out of service. When using this command, do not specify any command qualifiers.

```
SHUTDOWN OTHER_CONTROLLER
```

Caution

Failure to shut down the controller in this step could result in problems with RAIDsets and cache when the controller is reset.

When the controller halts, the green Reset (//) LED stops flashing and stays lit.

4. Take the operating controller out of dual-redundant (failover)mode.

```
SET NOFAILOVER
```

5. With a small flat-head screwdriver, loosen the captive screws that secure the trilink cable connector to the controller. Do not remove the connector (see Figure 2).
6. Loosen the four captive retaining screws on the controller’s front bezel. Do not remove the module yet.
7. Start the C_SWAP program.

```
RUN C_SWAP
```

Removing the Modules (Online C_SWAP Method)

Use the following steps to remove the modules.

1. When the controller prompts you, answer the question:

```
Do you wish to remove other HSD40?
```

2. Enter “YES”
3. Answer the question:

```
Will its cache module also be removed Y/N?
```

4. Enter “YES” if the cache module requires service or replacement.
5. Wait for the following text to be displayed at the console:

```
Port 1 quiesced
Port 2 quiesced
Port 3 quiesced
Port 4 quiesced
Port 5 quiesced
Port 6 quiesced
All ports quiesced
Remove the other controller (the one WITHOUT a blinking green
LED) within 5 minutes.
Time remaining 4 minutes 50 seconds.
```

Note

If the cache module is not being removed, the time allowed to remove the controller will be two minutes.

6. Obtain and place the ESD wrist strap around your wrist. Ensure that the strap fits snugly around your wrist.
7. Attach or clip the other end of the ESD wrist strap to the cabinet grounding stud or a convenient cabinet grounding point (nonpainted surface).
8. Unsnap and remove the program card ESD shield on the controller you are removing (see Figure 1).
9. Remove the program card by pushing the eject button next to the card. See Figure 2. Pull the card out and save it for use in the replacement controller module.
10. Remove the CI host cable from the controller to be replaced.
11. Slide the module out of the shelf (noting which rails the module was seated in) and place it on an ESD mat. See Figure 3.
12. Wait for the following text to be displayed at the operating controller's console:

```
Port 1 restarted
Port 2 restarted
Port 3 restarted
Port 4 restarted
Port 5 restarted
Port 6 restarted
```

Note

You can remove the cache module before or after port activity has restarted.

13. If necessary, remove the cache module.

Figure 2 Removing and Installing the PCMCIA Card

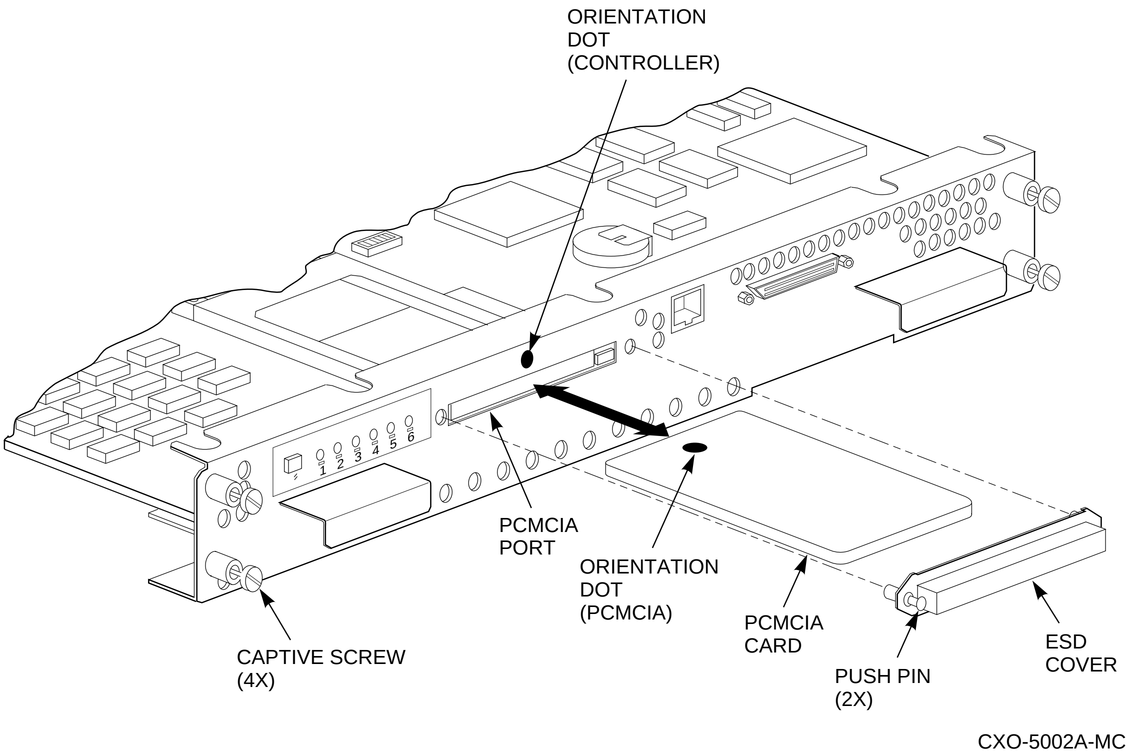
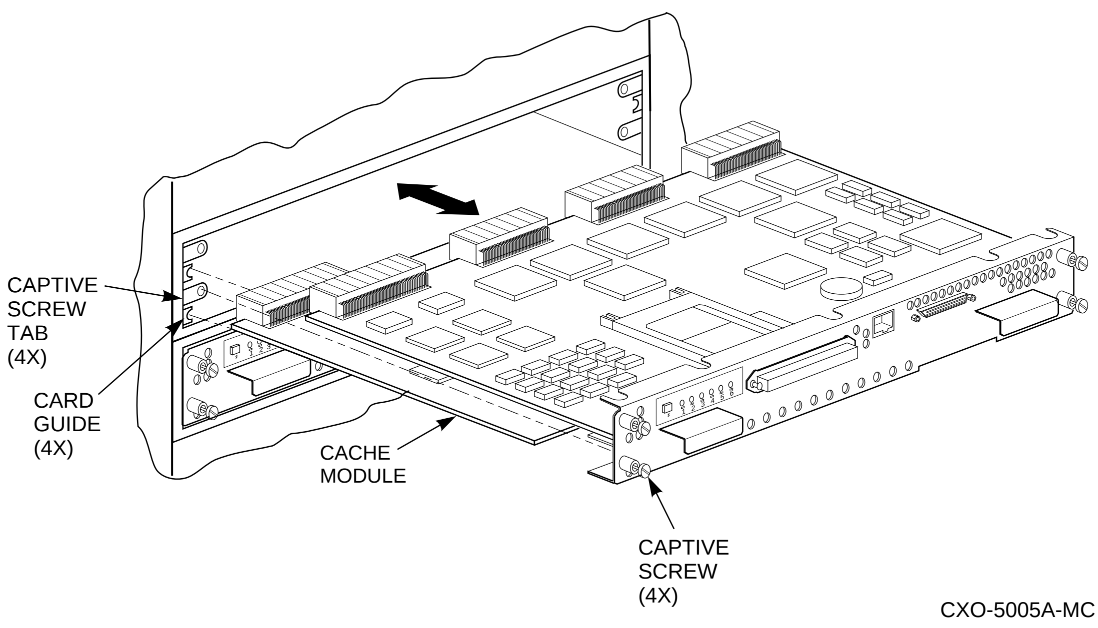


Figure 3 Removing and Installing the Controller



Installing the New Hardware (Online C_SWAP Method)

Use these steps to install the new hardware modules.

1. When the controller prompts you, answer the question:

```
Do you have a replacement controller available?
```

2. If you a replacement module ready, press "Y" for yes.
3. Answer the question:

```
***Sequence to INSERT the other HSD has begun.***
```

```
Do you wish to INSERT the other controller Y/N?
```

4. Press "Y" for yes.
5. Wait for the following text to appear on the operating controller's console:

```
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 other HSD WITHOUT its program card, and
press Return.
```

6. If necessary, install the cache module. Slide the module straight in along the rails and then push firmly to seat it in the backplane.
7. Install the controller module. Slide the module straight in along the rails and then push firmly to seat it in the backplane.

Caution

Do not overtighten the controller's front panel captive screws. Damage to the controller PC board or front panel may result.

8. Tighten the four front panel captive screws.
9. Press Return on the operating controller's console.
10. Wait for the following text to be displayed on the operating controller's console:

```
Port 1 restarted
Port 2 restarted
Port 3 restarted
Port 4 restarted
Port 5 restarted
Port 6 restarted
```

```
Controller Warm Swap terminated.
The configuration has two controllers
To restart the other HSD40
1) Enter the command RESTART OTHER_CONTROLLER
2) Press and hold in the Reset (//) button while
inserting the program card.
3) Release Reset (//); the controller will initialize.
4) Configure new controller by referring to
controller's user guide
```

Restarting the Subsystem (Online C_SWAP Method)

Use the following steps to restart the subsystem.

1. Set the original controller to enable the new controller:

```
RESTART OTHER_CONTROLLER
```

2. Connect the maintenance terminal to the newly installed controller.
3. Press and hold the Reset (//) button on the new controller while inserting the program card from the replaced controller.
4. Release the Reset button to initialize the controller. Wait for the CLI prompt to display at the terminal. Ignore the "Controllers misconfigured" message that displays.
5. If the new controller reports an invalid cache error, enter one of the following CLI commands to clear the error:

   If you have replaced the cache board, enter the following command:

   ```
   CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER
   DESTROY_UNFLUSHED_DATA
   ```

   Otherwise enter:

   ```
   CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER
   NODESTROY_UNFLUSHED_DATA
   ```

6. Ensure that the new controller is not in dual-redundant mode by entering the following command on the new controller.

   ```
   SET NOFAILOVER
   ```

   If the controller was already in nonredundant mode, a message is displayed indicating that.

7. Enter the following command from the new controller CLI to put the controllers into dual-redundant mode:

   ```
   SET FAILOVER COPY=OTHER_CONTROLLER
   ```

   The new controller restarts.

8. Verify that all host information is correct.

   ```
   SHOW THIS_CONTROLLER
   ```

   Modify any incorrect information.

9. If any information has been changed, restart the new controller.

   ```
   RESTART THIS_CONTROLLER
   ```

10. After the controller has initialized, reconnect the host cable to the new controller and tighten the captive screws.
11. Enable CI paths by entering the following CLI commands:

    ```
    SET THIS_CONTROLLER PATH_A
    SET THIS_CONTROLLER PATH_B
    ```

Replacing a Controller or Cache Module with the Offline Method

If you choose not to use the C-SWAP procedure to upgrade HSOF software, follow the steps in this section to replace an HSD30 controller that has write-back cache. C_SWAP can be used on Version 2.7 and higher.

Before beginning the procedure:

- Write down the following information:
  - *The name and ID number for the controller you are replacing*

- *The configurations of all RAID, stripe and/or mirrorsets*
- *Which devices are part of any RAID, stripe, or mirrorset, and all unit numbers, device names, and array names*

In the event that a problem occurs during this process, or a mistake is made in following these procedures, you will need this information for later manual restoration.

- You must shut down both controllers during part of this procedure, making the devices unavailable to the host operating system. Before starting this procedure, prepare your host system for all I/O associated with this controller to stop. OpenVMS shows the devices in mount verify state, and applications that use those devices stall until the controllers are back in service.

  DIGITAL recommends setting the mount verify time-out (MVTIMEOUT) to be at least 600 seconds (10 minutes) to allow time to complete this procedure.

  If the system uses host-based shadowsets that have members behind these controllers, increase the shadow member time-out (SHADOW_MBR_TM) to a value equal to the mount verify time-out (at least 600 seconds).

- If you do not have available a cache module which has already had its memory cleared, you will experience a five-minute delay in executing these procedures while you await the clearing of the memory on the installed cache module.

Required Parts and Tools

You must have the tools listed in Table 6 to replace a controller module.

Table 6 Required Tools for Adding a Second Controller

TOOLS REQUIRED	PURPOSE
Maintenance terminal and cable	To shutdown controllers, restart controllers, and invoke C_SWAP
ESD wrist strap and ESD mat	To protect all equipment against electrostatic discharge
3/32-inch Allen wrench	To loosen the controller mounting screws; to reinstall the controller
5/32-inch Allen wrench	To unlock the SW800-series cabinet
Small flat-head screwdriver	To connect the CI cable adapter to the controller

Preparing the Subsystem Configuration (Offline Method)

To replace a controller module follow these steps:

1. Have replacement HSD controller available. The replacement controller should be a unit direct from the factory or a unit that has been SHUTDOWN cleanly since its last application in accordance with the SHUTDOWN procedure identified in the *HS Family of Array Controllers User's Guide*, Revision D01, Appendix B, Page 125).

Note

Have all license keys for optional firmware available.

2. Connect a maintenance terminal to the controller you are not replacing.

3. Note which units are preferred to each controller, then prefer all units to the surviving controller.

   ```
   SET unit-number PREFERRED_PATH=THIS_CONTROLLER
   ```

   where *unit-number* is any unit preferred to the controller that is being replaced. Repeat the command for each unit that must be set to the surviving controller.

4. If the controller to be replaced is still functioning, use the SHUTDOWN command to take it out of service.

   ```
   SHUTDOWN OTHER_CONTROLLER
   ```

   When the controller halts, the green Reset (//) LED stops flashing and stays lit.

5. Take the operating controller out of dual-redundant (failover) mode.

   ```
   SET NOFAILOVER
   ```

6. Shut down the operating controller.

   ```
   SHUTDOWN THIS_CONTROLLER OVERRIDE_ONLINE
   ```

   The shutdown is normally fast, but it could take up to five minutes for the controller to flush all data from cache. When the controller halts, the green Reset (//) LED stops flashing and stays lit.

Removing the Modules (Offline Method)

To remove the modules complete these steps.

1. Place an ESD wrist strap around your wrist. Ensure that the strap fits snugly.
2. Attach or clip the end of the ESD wrist strap to the cabinet grounding stud or a convenient cabinet grounding point (non-painted surface).
3. Unsnap and remove the program card ESD cover on the controller you are removing.
4. Press and hold the reset button for the controller you are removing.
5. Remove the program card on the controller by pushing the eject button next to the card. Pull the card out and save it for use in the replacement controller module.
6. Disconnect the CI Bus cable from the front of the controller you are removing.
7. Loosen the four captive retaining screws on the front bezel of the controller you are removing.
8. Remove the controller module by pulling it straight out from the shelf backplane.
9. Slide the module out of the shelf (noting which rails the module was seated in) and place it on an ESD mat.
10. Remove the write-back cache module, if present.
11. If the cache module has not failed and you do not have another module that has had the memory cleared, you must clear (discharge) the memory on the current cache module. Locate the battery disable jumper on the cache module. It should be installed on one contact pin. Place the jumper on both pins and leave it there for five minutes. Put the jumper back on one pin to keep from losing it.

Installing the New Hardware (Offline Method)

Complete these steps to install the new hardware modules.

1. Install a new cache module or reinstall the original cache module in its original position. Slide the module straight in along the rails and then push firmly to seat it in the backplane.
2. Slide the replacement controller module into the shelf without the program card installed. Slide the module straight into the shelf and then push firmly to seat it in the backplane.

CAUTION

Do not overtighten the controller's front panel captive screws. Damage to the controller PC board or front panel could result.

3. Tighten the four front panel captive screws.

Restarting the Subsystem (Offline Method)

Restart the subsystem using the following steps.

1. Press the Reset (//) button on the original controller, and wait for the CLI prompt to appear.
2. Tell the original controller to enable the new controller with the command

   `RESTART OTHER_CONTROLLER`
3. Connect a maintenance terminal to the newly-installed controller.
4. Press and hold the Reset (//) button on the new controller while inserting the program card.
5. Release the Reset button to initialize the controller. Wait for the CLI prompt to appear at the terminal. Ignore the "Controllers misconfigured" message, that displays
6. Ensure that the new controller is not in dual-redundant mode by typing the following command:

   `SET NOFAILOVER`

   If the controller was already in non-redundant mode, a message is displayed indicating that.
7. Ensure the new controller cannot communicate with any host system yet by typing the following command:

   `SET THIS_CONTROLLER NOPATH_A`

   `SET THIS_CONTROLLER NOPATH_B`

   The new controller must not be able to communicate with any host system because its cluster parameters are undefined.
8. Reconnect the CI Bus cable to the new controller.
9. Configure the host interconnect parameters by typing the following commands:

   `SET THIS_CONTROLLER SCS_NODENAME = (`*`string enclosed in quotes`*`)`

   `SET THIS_CONTROLLER ID = (`*`decimal value`*`)`

10. Type the following command from the new controller CLI to put the controllers in dual-redundant mode.

    ```
    SET FAILOVER COPY=OTHER_CONTROLLER
    ```

11. Reinitialize the new controller by typing the command:

    ```
    RESTART THIS_CONTROLLER
    ```

12. Turn on the host interconnect path(s) by typing the following commands:

    ```
    SET THIS_CONTROLLER PATH_A
    SET THIS_CONTROLLER PATH_B
    ```

13. Restore the preferred paths for each unit to their original setting using the command

    SET *unit-number* PREFERRED_PATH=THIS CONTROLLER

    where *unit-number* is any unit to be serviced through the new controller. Repeat this command for each unit that you want to change.

Using C_SWAP to Add a Second HSD Controller

You can add a second controller to a single controller configuration to create a dual-redundant configuration. There are two procedures for adding a second controller: an online method using the C_SWAP utility in which the existing controller continues to process I/O, and an offline method in which you must shut down the existing controller. The online (C_SWAP) method described in these release notes is valid for HSOF software Version 2.7 and higher.

To add a controller module using the online (C_SWAP) method, your system must have two power supplies in the controller shelf of the SW500 and SW800 cabinet. If your controller shelf has only one power supply, you must shut down the operating controller to add a second controller. Refer to the *HS Family of Array Controllers User's Guide*, Rev. D01, Chapter 5, or the *HS Family of Array Controllers Service Manual*, Rev D01, Chapter 7 for this offline method of adding a second controller.

The following steps guide you through the online method using the C_SWAP utility.

Required Parts and Tools

You must have the tools listed in Table 7 to add a second controller module.

Table 7 Required Tools for Adding a Second Controller

Tools Required	Purpose
Maintenance terminal and cable	To shutdown controllers, restart controllers, and invoke C_SWAP
ESD wrist strap and ESD mat	To protect all equipment against electrostatic discharge
3/32-inch Allen wrench	To loosen the controller mounting screws; to reinstall the controller
5/32-inch Allen wrench	To unlock the SW800-series cabinet
Small flat-head screwdriver	To connect the CI cable adapter to the controller

Caution

Before starting the C_SWAP utility, terminate all other running utilities and disable all other terminals.

Preparing the Subsystem Configuration (Online C_SWAP Method)

Use these steps to prepare the subsystem for the second controller.

1. Have the new module at hand. The module should be factory-fresh or should have been shutdown cleanly (with the SHUTDOWN command) in its last application.
2. Connect a maintenance terminal to the existing controller.
3. Show the configuration of the existing controller:

   ```
   SHOW THIS_CONTROLLER
   ```

   The controller will display the following information:

   ```
   Controller:
       HSD40 (C) DEC CX20100000 Firmware V02.7,(1)
   Hardware F01
       Configured for dual-redundancy with ZG03231995
       In dual-redundant configuration
       SCSI address 7
       Time: 18 DEC-1995 16:32:54
   Host port:
       Node name: HSDA2, valid CI node 21, 32 max nodes
       System ID 42001015F525
       Path A is on
       Path B is on
       MSCP allocation class    3
       TMSCP allocation class   3
       CI_ARBITRATION = ASYNCHRONOUS
       MAXIMUM_HOSTS = 5
   Cache:
       32 megabyte writeback cache, version 2
       Cache is GOOD
       Battery is good
       No unflushed data in cache
       CACHE_FLUSH TIMER = 1 (seconds)
       CACHE_POLICY = B
       Host Functionality Mode = A
   ```

4. Record the size and type of the cache module (if any) that is installed with the first controller. Ensure that the cache module for the new controller is the same size and type.
5. Start the C_SWAP program:

   ```
   RUN C_SWAP
   ```

Installing the Second Controller and Cache Modules

Follow these steps to add the second controller and cache.

1. When the controller prompts you, answer the question:

   ```
   Do you have a replacement HSD readily available? [N] ?
   y
   ```

2. If you have a replacement module available, enter "YES."
3. Answer the question:

```
***Sequence to INSERT the other HSD has begun.***

Do you wish to INSERT the other HSD y/n?
```

4. Press “Y” for yes.
5. Wait for the following text to appear on the operating controller’s console:

```
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 other HSD WITHOUT its program card, and
press Return.
```

6. If you are installing a new cache module, slide it straight in along the rails and then push firmly to seat it in the backplane.
7. Check the new controller to ensure that the program card is not installed. If it is installed, take the card out by removing the ESD shield and then pressing the eject button next to the card.
8. Install the controller module. Slide the module straight in along the rails and then push firmly to seat it in the backplane.
9. Tighten the four front panel captive screws.

Caution

Do not overtighten the controller’s front panel captive screws. Damage to the controller PC board or front panel may result.

10. Press Return on the operating controller’s console.
11. Wait for the following text to be displayed on the operating controller’s console:

```
Port 1 restarted
Port 2 restarted
Port 3 restarted
Port 4 restarted
Port 5 restarted
Port 6 restarted Controller Warm Swap terminated.
The configuration has two controllers
To restart the other HSD40:
1) Enter the command RESTART OTHER_CONTROLLER
2) Press and hold in the Reset (//) button while
inserting the program card.
3) Release Reset (//); the controller will initialize.
4) Configure new controller by referring to
controller’s user guide
```

Restarting the Subsystem (Online C_SWAP Method)

Restart the subsystem using these steps.

1. Set the original controller to allow the new controller to start:

```
RESTART OTHER_CONTROLLER
```

2. Connect the maintenance terminal to the newly installed controller.

3. Press and hold the Reset (//) button on the new controller while inserting the program card from the new controller.

4. Release the Reset button to initialize the controller. Wait for the CLI prompt to appear at the terminal. Ignore the "Controllers misconfigured" message, that is displayed.

5. If the new controller reports an invalid cache error, enter the following CLI command to clear the error:

   ```
   CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER
   DESTROY_UNFLUSHED_DATA
   ```

6. Ensure that the new controller is not in dual-redundant mode by entering the following command on the new controller:

   ```
   SET NOFAILOVER
   ```

   If the controller was already in nonredundant mode, a message is displayed indicating that.

7. Enter the following command from the new controller CLI to put the controllers into dual-redundant mode:

   ```
   SET FAILOVER COPY=OTHER_CONTROLLER
   ```

   The new controller initializes.

8. Verify that all host settings are correct:

   ```
   SHOW THIS_CONTROLLER
   ```

   Modify any host information.

9. After the modifications have been made, restart the new controller:

   ```
   RESTART THIS_CONTROLLER
   ```

10. After the controller has initialized, connect the CI cable to the new controller and tighten the captive screws.

11. Enable CI paths by entering the following CLI commands:

    ```
    SET THIS_CONTROLLER PATH_A
    SET THIS_CONTROLLER PATH_B
    ```

Appendix A

Possible Problem with Disks Initialized with SAVE_CONFIG Under HSOF V2.7 on HSZ40/20/SWXRC

If you initialized a JBOD disk using the SAVE_CONFIGURATION switch on an HSZ40 controller which was running HSOF Version2.7, and then moved the disk to a HSD30 controller, read this appendix.

There is a remote possibility that some disks attached to HSZ40/20/SWXRC and the solution products containing them (RA410, SC4200/4600, etc.) might have a problem in the structure of the on-disk file system. Systems which might be affected are those which:

1. Use disks in JBOD configuration (that is, disks which are not members of controller-based storagesets such as RAIDsets and mirrorsets)
2. Initialized disks under HSOF V27Z using the SAVE_CONFIG command **and** reinitialized the controller BEFORE initializing the disk under the operating system.

Note that the problem does not occur if the file system was built on the disk before the controller was reinitialized. Also, the problem does not occur when disks are initialized using SAVE_CONFIG and the platform operating system under HSOF Versions 30Z, 31Z, 32Z, 50Z, 51Z or 52Z.

If a disk built as described above is moved to an HSD30 controller running HSOF Version 3.2, problems could occur.

When a disk being used in a JBOD configuration is initialized with SAVE_CONFIG, the last 500 blocks on the disk are allocated by the controller to store the configuration data. If the controller running HSOF Version 27Z is reinitialized before the disk is initialized by the platform operating system, the controller fails to remember the reduction in disk size and reports the unreduced disk capacity to the operating system. When the operating system subsequently builds the file system, the blocks which SAVE_CONFIG uses to update the configuration data are also included in the file system disk space, creating a potential for both the operating system and the controller to write to the last 500 blocks on disk.

If the file system subsequently overwrites configuration data, the controller recognizes that the data is invalid configuration data and ignores it. In this case, controller parameters must be manually re-entered when SAVE_CONFIG tries to restore the configuration (unless another drive contains valid configuration data).

Various configuration events cause the controller to write the configuration data to the SAVE_CONFIG area. If the controller overwrites file system data, the results vary depending on the platform operating system and the application.

If a disk having problem is moved to a controller running HSOF Version 3.2 before the differing file system and controller view of the disk capacity is resolved and the file system tries to access the SAVE_CONFIG area, the controller returns an error to the operating system. The action that the operating system takes upon receiving this error varies depending on the platform, but could include rendering the entire file system or database inaccessible.

How to Detect if You Have This Problem

OpenVMS platforms

The problem described in this appendix affects single-disks units in JBOD configuration with SAVE_CONFIG data stored on them. If you have not moved JBOD disk units with SAVE_CONFIG data saved on them to the HSD30 controller being upgraded to Version 3.2, do not proceed any further. Your system is **not** at risk.

If disks in your system are at risk of this problem, use the following procedure to check a disk in JBOD configuration to determine whether it is exposed:

a. At the controller prompt, type SHOW DISK *nnn* (where *nnn* is the JBOD disk in question).

b. Look for the "Configuration being backed up on this container" message.

c. Record the block size capacity displayed by the controller.

d. From the OpenVMS prompt on one of the hosts, mount the disk in question and type the command:

```
$ SHOW DEVICE/FULL DKA200:
```

e. Compare the total block size obtained from the "`SHOW DEVICE`" command with the block size capacity obtained in step 'c.'

f. If the reported sizes are different, this disk is at risk for the problem. See the "Solution" section below for the recovery procedure.

Solution

1. If you are using SAVE_CONFIG to initialize JBOD disks under HSOF Version 2.7Z, be sure to initialize the disk with the platform file system **before** reinitializing the controller.

2. If you have the risk factors for the problem as described in the "Detection" section in this appendix, use the steps below to resolve the discrepancy in controller/operating system views of the disk at the earliest opportunity.

DIGITAL recommends that the recovery process described below be performed before moving the disk to a controller running Version 3.2. Any files that might have been written in the SAVE_CONFIG area are accessible to the operating system after the restore process; however, these files are suspect and should be carefully examined to ensure that the data they contain is correct, or restored from a previous backup.

a. Back up the unit that contains SAVE_CONFIG information.

b. Unmount the file system(s) contained on that unit.

c. Delete the unit from the configuration in the controller.

d. Initialize the container from the controller without SAVE_CONFIG.

e. Add the unit back into the configuration.

f. Initialize and restore unit from backup.

Appendix B

The HSUTIL Utility

This section describes the features and user interface of the HSUTIL utility. HSUTIL provides two functions:

- Device format—Enables you to perform a basic SCSI format operation on a disk device.
- Device code load—Enables you to download device firmware into supported disk devices.

The Device Format Function

The device format function enables you to perform a SCSI format operation on a disk. Once started, the HSUTIL utility performs the operation without intervention.

Device Format Special Considerations

Be aware of the following special considerations when using the HSUTIL utility to format disks:

- HSUTIL formats a single target device per session.
- HSUTIL does not format devices configured as units, stripesets, mirrorsets, RAIDsets, sparesets, or failedsets. The destination device **must** be an unattached device.
- If a power failure or SCSI bus reset occurs during a format operation, the device may become unusable until a successful format operation is completed. To minimize the possibility of this problem, DIGITAL recommends that you prevent activity to all devices on the same port as the device being formatted.
- Use the Ctrl/C or Ctrl/Y keys to exit HSUTIL before the program begins issuing SCSI commands to perform a format. Once the program begins issuing SCSI commands, however, the exit key combinations are disabled.
- Medium formatting is accomplished with no initiator control over defect management. The destination device determines the degree of defect management to be performed.
- Special considerations for dual-redundant configurations:
  - While HSUTIL is active, do not invoke any CLI command or run any local program that might reference the target device from the other controller. Results are unpredictable.
  - Do not reinitialize either controller during a format operation. The resulting SCSI bus reset may render the target device unusable until after a successful format operation is completed.

Formatting a Disk Using HSUTIL

Example 1 demonstrates the use of the HSUTIL utility to format a disk. In the example, you are formatting target disk DISK150.

Example 1 Device Format Operation

1. Make a backup of any user data on the disk to be formatted.
2. If possible, prevent I/O operations to all other devices on the same device SCSI bus to reduce the possibility of a SCSI bus reset.
3. Invoke the HSUTIL utility and select the format operation by entering "1" at the prompt:

```
RUN HSUTIL
  *** Available functions are:
    0. EXIT
    1. FORMAT
    2. CODE_LOAD

Enter the number of the function you wish to perform
(0:2) [2] ?1
```

4. The program reports the unattached units available for formatting:

```
Unattached devices on this controller include:
 Device    SCSI Product ID    Current Device Rev
 DISK150   RZ26L    (C) DEC   T392
 DISK250   RZ28     (C) DEC   441C
```

5. Select DISK150 as the device to be formatted:

```
Enter the device to format ? DISK150
```

6. The program displays a number of informational messages and offers you the option of exiting before the format operation begins:

```
Do you want to continue(y/n)[n] ? Y
```

7. The format operation begins. The operation takes several minutes to complete.

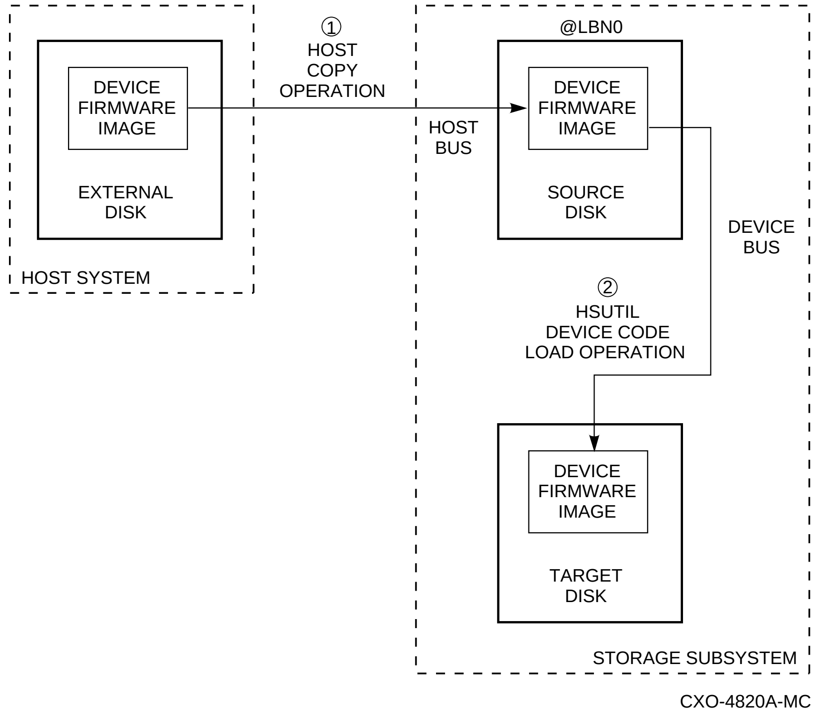
```
HSUTIL Started at: 13-JAN-1996 04:49:48
Format of DISK150 has successfully finished.
HSUTIL - Normal Termination at: 13-JAN-1996 05:22:33
```

   DISK150 is now formatted and usable.

The Device Code Load Function

The device code load function allows you to load new firmware into supported disk and tape devices. The new firmware image must be at a specific LBN on a source disk on the same controller. The source and target disks must be in the configuration on the controller from which HSUTIL is invoked. The source disk may be a raw disk device configured as a unit with no file system or label on it, or it may be a normal file system disk. The device code load process takes place in two steps.

Figure 4   The Device Code Load Process



Preparing the Source Disk

Copy the new device firmware image to a source disk in the storage subsystem. You cannot load the firmware image from a location external to the controller.

The device firmware image must be located in contiguous blocks at a known logical block number (LBN) on the source disk. Prepare for the code load operation by copying the device firmware image to the source disk at a known LBN location.

One way to prepare the firmware image for downloading is to copy it to a raw source disk containing no data, as illustrated in Figure 1. A raw source disk has no label and no formatted file structure on it. Using a raw disk as the source disk puts the firmware image in contiguous blocks at a specific LBN (usually LBN 0) on the source disk.

The details of copying the firmware image to the source disk from the host disk are specific to the host operating system. Refer to the sample Host Copy Scripts in this appendix for examples of copying a firmware image in OpenVMS.

Code Loading the Target Disk

Once the firmware image is located in contiguous blocks at a known LBN on the source disk, you can use HSUTIL to download it into the target disk.

Sample OpenVMS Host Copy Script

If you are installing new firmware on only one device type, such as RZ29B, and you want to be assured that you don’t select the wrong code for the code load, then load the code first onto a spare drive at LBN: 0.

Example 2 Copying Firmware for a Single Device Type

To copy firmware from a single device type, enter the following from an OpenVMS account:

```
$ MOUNT/FOREIGN $2$DUA300:

$ COPY/CONTIGUOUS NODE::LCA:[FIRMWARE.RZ2X]RZ29B_DEC_0014.LOD
-
TO $2$DUA300:

$ DISMOUNT/NOUNLOAD $2$DUA300:
```

Drive 2DUA300: must be installed but not mounted on a shelf visible to the controller you are going to connect to. You are now ready to update code in an RZ29B using the code starting at LBN: 0 on DUA300:.

Example 3 Copying Firmware for Multiple Device Types

If you are updating more than one type of supported device, copy the code for each device to a spare disk drive or any drive that can be moved to other controllers with little interference. In this example you can use any single mounted disk drive and would continue until you have all the software you need.

```
$ COPY/CONT NODE::LCA:[FIRMWARE.RZ2X]RZ29B_DEC_0014.LOD -
TO $2$DUA300:[000000]

$ COPY/CONT NODE::LCA:[FIRMWARE.RZ2X]RZ28P4_442C_DEC.FUP -
TO $2$DUA300:[000000]

$
```

Use the DUMP command to find the starting LBN of each firmware image:

```
$ DUMP/HEAD/BLOCK=COUNT=0 $2$DUA300:[000000]*.FUP

$ DUMP/HEAD/BLOCK=COUNT=0 $2$DUA300:[000000]*.LOD
```

The information below was edited to reduce the printout, but each line resulted from the above DUMP command.

```
$2$DUA300:[000000]RZ26L_442D_DEC.FUP LBN: 8

$2$DUA300:[000000]RZ26_T392A_DEC.FUP LBN: 520

$2$DUA300:[000000]RZ28P4_442C_DEC.FUP LBN: 1036

$2$DUA300:[000000]RZ28_442D_DEC2104.FUP LBN: 1548

$2$DUA300:[000000]RZ29B_DEC_0014.LOD LBN: 2060

$ DISMOUNT/NOUNLOAD $2$DUA300:
```

Drive 2DUA300: must be installed but not mounted on a shelf visible to the controller you are going to connect to. You are now ready to update code in different drives of choice with their code starting at LBN: * on DUA300: as printed out above.

Device Code Load Special Considerations

Be aware of the following special considerations when using the HSUTIL utility to download firmware to a disk device:

CAUTION

HSUTIL has been tested to perform the code load operation properly only with supported devices. Use HSUTIL to code load unsupported devices at your own risk.

- Device compatibility with firmware code loading using the SCSI Write Buffer command varies greatly from vendor to vendor. While HSUTIL does check to see if a target disk is an unsupported device, it does not prevent you from continuing the code load operation on the device. Understand that an unsupported device could be rendered unusable until it is factory-initialized, if the code load is unsuccessful.

CAUTION

Delete all non-disk devices from the controller configuration that are on the same shelf as the target disk, and prevent bus activity to all other disks on the same shelf before downloading firmware to the target disk.

- If a power failure or SCSI bus reset occurs during a code load operation, permanent damage to the device can result. To minimize the possibility of rendering a device unusable, DIGITAL recommends halting the activity on other devices on the same port during the code load process.
- HSUTIL processes a single target device per session.
- HSUTIL does not load code to devices configured as units, stripesets, mirrorsets, RAIDsets, sparesets, or failedsets. The destination device must be an unattached device.
- The source device must be configured as a single-device unit.
- The device firmware image must be located on the source disk in contiguous blocks at a known LBN location.
- Once HSUTIL has allocated the source disk for the code load operation, the source disk is not available to other subsystem operations.
- Some device firmware releases require a format operation after a code load operation to make the device usable. In this case, you must rerun HSUTIL to perform the format operation. See the release notes for your device firmware version to determine if you must format the device after code loading. If you do not have release notes, contact the device vendor to verify whether a format is required after a firmware update.
- You can use the Ctrl/C or Ctrl/Y keys to exit HSUTIL before the program begins issuing SCSI commands to perform a code load. Once the program begins issuing SCSI commands, however, the exit key combinations are disabled.
- In dual-redundant configurations, shut down the controller that you will not be using for the code load operation and eject the program card. Reinstall the program card to restart the controller after you have finished the code load.

Code Loading a Device Using HSUTIL

Example 4 demonstrates the use of the HSUTIL utility to download device firmware. In this case, your device's firmware release documentation specifies that it does not require a subsequent format. In the example, you are changing the firmware in device DISK150 from revision 0007 to 0014. The source disk is DISK250.

The details of copying the device firmware image from a location external to the controller to the source disk are specific to the host operating system. In this example, the firmware image is already at LBN 0 of DISK250.

Example 4 Device Code Load Operation

1. Backup all data on the target device using your operating system's backup procedures.

2. Use the SHOW DISK command to report the available devices and the firmware level of each. In the example below, DISK150 is the target device and DISK250 (Unit D200) is the source device. Note that the firmware level of DISK150 is reported as "0007" and that it is an unattached device:

```
SHOW DISK FULL
Name        Type     Port Targ  Lun                 Used by
------------------------------------------------------------
DISK150     disk        1    5    0
         RZ29B   (C) DEC          0007
DISK250     disk        2    5    0                    D200
         RZ28    (C) DEC          442D
      Switches:
        NOTRANSPORTABLE
      Size: 8356756 blocks
```

   If the target device is configured as part of a higher-level container, such as a unit, you must delete that part of the configuration. The target device must be an unattached disk drive.

3. Invoke the HSUTIL utility and select the code load function by entering option "2" at the prompt:

```
RUN HSUTIL
  *** Available functions are:
    0. EXIT
    1. FORMAT
    2. CODE_LOAD

Enter the number of the function you wish to perform (0:2) [2]
?2
```

4. The program displays the single-device units available as source disks for code loading:

```
Single device units on this controller include:
    Unit   Associated Device   SCSI Product ID
    200    DISK250             RZ28
```

5. Select Unit 200 (DISK250) as the source disk:

```
Which unit is the code to be loaded FROM ? 200
```

6. Because you have previously copied the firmware image to LBN 0 on the source disk, you can accept the default starting LBN of the device firmware image by pressing Return at the prompt:

```
What is the starting LBN of the code on the unit where the
code is to be loaded FROM [0] ? Return
```

7. Enter the disk model that is the target of the code load. Enter this information exactly as it was reported in the SHOW command, including any spaces or special characters: (You can, however, use only as many characters as are necessary to uniquely identify the device, as shown in the following example.)

```
What is the SCSI PRODUCT ID of the disk that you want code
load TO ? RZ29B
```

8. The program lists all unattached disk drives of the model specified. In this example, DISK150 as the only unattached device with the desired product ID:

```
Unattached devices on this controller include:
 Device    SCSI Product ID    Current Device Rev
 DISK150   RZ29B    (C) DEC   0007
```

9. Select the target device from the list:

```
Which device is the code to be loaded TO ? DISK150
```

10. The program displays a number of informational messages and offers you the option of exiting before the format operation begins:

```
Do you want to continue(y/n)[n] ? Y
```

11. The program begins the device code load operation, finishing within two minutes:

```
Device code has been successfully downloaded to DISK150
HSUTIL - Normal Termination at: 13-JAN-1996 05:53:03
```

12. Enter the SHOW DISK command for DISK150 to verify that the device code load operation was successful. Note that the program reports a new firmware revision level, “0014” in this example. The device is now available for use with its new firmware.

```
SHOW DISK150
Name        Type     Port Targ  Lun                 Used by
------------------------------------------------------------
DISK150     disk        1    5    0
         RZ29B   (C) DEC          0014
```

Code Loading a Device Using HSUTIL (Format Required)

Some devices and some revisions of device firmware require that you format the device after installing new firmware. The Code Load portion of HSUTIL will detect when a device format is required, and will display a message on the console indicating this. Follow the instructions for Formatting a Disk found earlier in this document. You cannot use the device until you format it.

Be sure to back up the data from the device before starting the code load.

Abort Codes

In the event that HSUTIL terminates before it successfully completes a format or code load operation, it reports one of the abort codes in Table 8.

Table 8 Abort Codes

Abort Code	Description
1	FAO returned either FAO_BAD_FORMAT or FAO_OVERFLOW
2	Bad return from TS$READ_TERMINAL_DATA
3	TS$READ_TERMINAL_DATA returned either an ABORTED or INVALID_BYTE_COUNT
4	User requested an abort via ^Y or ^C
5	An error occurred on a SCSI command
6	Can’t find the pub, device is probably missing