StorageWorks™ Array Controller

HSJ*xx* Array Controller Operating Software Version 2.7 Release Notes

Order Number: EK–HSFAM–RN. N01

This document summarizes features and characteristics of the HSJ*xx* array controller operating HSOF Software Version 2.7 that are not covered elsewhere in the documentation. These release notes also contain instructions for installing the software.

Note

This version of the HSOF Version 2.7 Release Notes includes information on the HSJ*xx*–C*x* controller modules.

These Release Notes contain instructions for C_SWAP and HSUTIL that supersede information in the product documentation. Keep these Release Notes near your StorageWorks subsystem.

Digital Equipment Corporation
Maynard, Massachusetts

March 1996

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

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

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

Restrictions apply to the use of the maintenance port on this series of array controllers. Failure to observe these restrictions may result in harmful interference. See *Disconnecting the Maintenance Terminal* on page 15 for details.

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 application information for the HSJ™ array controller operating HSOF Software Version 2.7[1] not covered elsewhere in the documentation. This document should be used by individuals responsible for configuring, installing, and using the HSJ*xx* controllers.

Read this entire document before installing or upgrading the software.

Topics Covered

These release notes cover the following topics:

- Hardware and software supported by HSOF Software Version 2.7
- New features—Modifications in the software that add significant functionality to the controller
- Changes from Version 2.5—Modifications to operating parameters or functions that do not necessarily add significant functionality to the controller
- 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
- Corrections and additions to the documentation
- Installation instructions
- Identification of the software revision level

Release Package Contents

The Version 2.7 release package consists of the following:

- These release notes
- A cover letter
- The *HS Family of Array Controllers User's Guide*
- A PCMCIA program card containing the HS operating software Version 2.7
- License keys to enable optional features: write-back cache, disk mirroring, and RAID (each to be purchased separately)

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[1] The OpenVMS™ SHOW CLUSTER command and the HSOF software SHOW THIS_CONTROLLER command display the version as "V27J".

Intended Audience

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

Hardware and Software Support

This section lists the hardware and software compatible with HSOF Software Version 2.7.

Hardware Support

HSOF Software Version 2.7 supports the following revisions or higher for the HSJ-series controllers and associated hardware:

- HSJ40 and HSJ40–C*x* controller modules
- HSJ30 and HSJ30–C*x* controller modules
- Version 1 read cache module, hardware revision F (HSJ40 only)
- Version 2 cache module, hardware revision A
- BA350–MA controller shelf
- BA350–S*x* device shelf
- BA356–S*x* wide device shelf with 8-bit I/O module
- BA35*x*–HA power supply

Operating System Support

HSOF Software Version 2.7 on HSJ-series 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™ Version 1.5 or higher
- OpenVMS VAX™ Version 5.5–2 or higher
- VAX VMS™ Version 5.5–1 or higher

Host Adapter Support

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

- CIXCD–AB
  CIXCD–AC (both for XMI-based systems)
- CIBCA–B*x* (for BI-based systems)[1]
- CI780 (for SBI-based systems)
- CIPCA (for PCI-based systems)

Device Support

HSOF Software Version 2.7 supports the devices listed in Table 1 through Table 4 at the indicated hardware and microcode levels or higher. New devices supported since Version 2.5 are listed in bold.

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[1] Supersedes CIBCA-A, which is no longer supported

Table 1: Supported Disk Devices

Device	Capacity in Gigabytes	Minimum Microcode Version	Minimum Hardware Version
RZ25-VA	0.426	0900	B01
RZ26-VA	1.05	T392	D02
RZ26L-VA, **VW**	1.05	440C	A01
RZ26N-VA, VW	1.05	446	A01
RZ28-VA, **VW**	2.1	435E	B01
RZ28B-VA	2.1	0003	A01
RZ28D-VA, VW	2.1	0008	A01
RZ28M-VA, VW	2.1	466	A01
RZ29B-VA, **VW**	4.3	0007	B01
RZ74-VA	3.57	T427B	B07

Note: VW models require BA356 wide device shelves and an 8-bit I/O module

Table 2: Supported Tape Devices

Device	Capacity in Gigabytes	Minimum Microcode Version	Minimum Hardware Version	Comments
TKZ60-EC	0.44	111	B01	Note 1
TL810	1000 (Compressed)	1.10	A01	Notes 1, 2
TL820 (Revision A01)	5200 (Compressed)	1d3M	L1	Notes 1, 2
TLZ06-VA	4 (Compressed)	0491	A04	
TLZ6L-VA	16 (Compressed)	0491	A01	Note 4
TLZ7L-VA	8 (Compressed)	4BQE	A02	Note 4
TLZ07-VA	8 (Compressed)	04AQ	AX01	
TSZ07-AA	0.14	0309	A01	Note 1
TZ86-VA	6	430B	A02	
TZ87-VA	20 (Compressed)	930A	A01	
TZ87N-VA	20 (Compressed)	930A	A01	Note 3
TZ87-TA	20 (Compressed)	9514	B02	Notes 1, 2
TZ867-AE, AF	42	430B	A01	Note 1
TZ875-NT	100 (Compressed)	930A	A01	Note 1
TZ875-TA	100 (Compressed)	930A	A01	Note 1
TZ877-AE, AF	140	930A	A01	Note 1
TZ88N-VA	20/40	CC33	A01	
TZ885-NT	100/200	CC33	A01	Note 1
TZ885-TA	100/200	CC33	A01	Note 1
TZ887-AE	140/280	CC33	A01	Note 1

Note 1: Requires 0.2 meter SCSI–1 to SCSI–2 transition cable (Digital internal part number 17–03831–01).

Note 2: Requires DWZZA–AA 8-bit single-ended to 16-bit differential SCSI signal converter.

Note 3: Cannot read TK50, TK70, or TZ30 format tapes.

Note 4: Loader operates in sequential mode only.

Table 3: Supported CDROM Readers and Optical Disk Drives

Device	Capacity in Gigabytes	Minimum Microcode Version	Minimum Hardware Version	Comments
RRD42-VB, VU	0.6	1.1a	A01	
RRD43-VA	0.6	0064	A02	
RRD44-VA	0.6	3493	A02	
RRD45-VA, VU	0.6	1645	A01	
RWZ52-VA	0.6 per side	3404	A01	Note 1, 2

Note 1: Device is a magneto-optical disk

Note 2: Do not warm swap this device. Make sure that the device shelf power is off when inserting or removing a magneto-optical disk device.

Table 4: Supported Solid State Disk Drives

Device	Capacity in Gigabytes	Minimum Microcode Version	Minimum Hardware Version
EZ31-VW	0.134	V064	A01
EZ32-VW	0.268	V064	A01
EZ51R-VA	0.1069	V096	D01
EZ54R-VA	0.4277	V096	A01
EZ58R-VA	0.8553	V109	C01
EZ64-VW	0.475	V064	A01
EZ69-VW	0.950	V064	A01

Do not warm swap solid state disk devices. Make sure that the device shelf power is off when inserting or removing a solid state disk device.

New Features

The following list briefly describes new features added since Version 2.5. A new feature is defined as a modification to the software that adds significant functionality to the controller.

Support for HSJ30–C*x* and HSJ40–C*x* Controller Modules

The HSJ*x*0–C*x* controller modules are fully supported with HSOF Version 2.7. The –C*x* modules are direct replacements for the previous modules, and can be used in dual-redundant configurations with them.

You can identify the different HSJ controller modules by looking at the label on the front bezel. The label on –C*x* modules shows either "HSJ30C" or "HSJ40C." You cannot identify the different modules using the SHOW THIS_CONTROLLER or SHOW OTHER_CONTROLLER commands.

Note

The HSJ*xx*–C*x* controller modules are not supported with any version of software prior to HSOF Version 2.7.

The order numbers for HSJ30/40–A*x* and HSJ30/40–C*x* controller options are listed in the Tables 5 through 8.

Table 5: HSJ30 Array Controller Options

Order Number	Description
HSJ30–CA	StorageWorks Array Cntrl 3-Channel (ports); 18 SCSI–2 Disk/Tape/Optical Device support; RAID 0, Base Firmware.
HSJ30–CD	StorageWorks Array Cntrl 3-Channel (ports); 18 SCSI–2 Disk/Tape/Optical Device support; 16 MB Read Cache; RAID 0, Base Firmware.
HSJ30-CF	StorageWorks Array Cntrl 3-Channel (ports); 18 SCSI–2 Disk/Tape/Optical Device support; 32 MB Read Cache; RAID 0, Base Firmware.
HSJ30–XE	HSJ30 array controller read cache replacement for the 16 MB read cache that comes with the HSJ30–CD option, a 32 MB read cache module; mandatory return of installed 16 MB read cache required.
HSJ30–XD	HSJ30 array controller 16 MB read cache module option for HSJ30–CA.
HSJ30–XF	HSJ30 array controller 32 MB read cache module option for HSJ30–CA.
HSJ30–YC	Two batteries, battery bracket, and write-cache option license.
QA–0W9AA–HS	SWKS HSJ MSC PCRM Media/DocKit.

Table 6: HSJ40 Array Controller Options

Order Number	Description
HSJ40–CD	StorageWorks Array Cntrl 6-Channel (ports); 36 SCSI–2 Disk/Tape/Optical Device support; 16 MB Read Cache; RAID 0, Base Firmware.
HSJ40–CF	StorageWorks Array Cntrl 6-Channel (ports); 36 SCSI–2 Disk/Tape/Optical Device support; 32 MB Read Cache; RAID 0, Base Firmware.
HSJ40–XE	HSJ40 array controller read cache replacement for the 16 MB read cache that comes with the HSJ40–CD option, a 32 MB read cache module; mandatory return of installed 16 MB read cache required.
HSJ40–YA	16 MB write-back cache module option.
HSJ40–YC	Two batteries, battery bracket, and write-cache option license.
QA–0W9AA–HS	SWKS HSJ MSC PCRM Media/Doc Kit.

Table 7: HSJ42 Array Controller Subsystem Options

Order Number	Description
HSJ42–CD	Two StorageWorks Array Cntrl 6-Channel (ports); 36 SCSI–2 Disk/Tape/SSD/Optical Device support; 32 MB total Read Cache; RAID 0, Base Firmware.
HSJ42–CF	Two StorageWorks Array Cntrl 6-Channel (ports); 36 SCSI–2 Disk/Tape/SSD/Optical Device support; 64 MB total Read Cache; RAID 0, Base Firmware.

Table 8: HSJ44 Array Controller Subsystem Options

Order Number	Description
HSJ44–CD	Four StorageWorks Array Cntrl 6-Channel (ports); 72 SCSI–2 Disk/Tape/SSD/Optical Device support; 64 MB total Read Cache; RAID 0, Base Firmware.
HSJ44–CF	Four StorageWorks Array Cntrl 6-Channel (ports); 72 SCSI–2 Disk/Tape/SSD/Optical Device support; 128 MB total Read Cache; RAID 0, Base Firmware.

Support for Wide Shelves and Devices

Controllers running HSOF software Version 2.7 support the BA356 wide device shelf using the 8-bit I/O module. The controller supports both wide and narrow devices installed in a BA356 shelf, provided that they conform to shelf loading rules. The following list is a brief summary of the 8-bit/16-bit device installation rules:

- All 16-bit devices must be used in 16-bit shelves. A 16-bit shelf that is connected to an 8-bit controller must have an 8-bit I/O module installed, and all devices on that shelf operate in 8-bit mode.
- All newer 8-bit devices can be used in 16-bit shelves, as long as the 8-bit I/O module is installed in the shelf. All 8-bit devices can be used in 8-bit shelves.
- Some "older" 8-bit devices cannot be mixed with 16-bit devices in 16-bit shelves. If you are unsure about some of your devices, see page 283 of the Digital Systems and Options Catalog – April 1995 supplement.

Host Tape Density Selection

You can now set the density for tape drive writes from the host operating system, as well as from the controller CLI.

Currently, the TSZ07 is the only tape drive for which you can set tape density from VMS through the HSJ controller using VMS INIT and VMS MOUNT. Do not use these commands to set tape density on other tape drives. You can set tape density on other tape drives through programs that issue QIOs, such as some customer applications.

You must tell the controller to allow the host to set tape density with the CLI command:

```
CLI> SET unit-name DEFAULT_FORMAT=HOST_SELECTED
```

When using dual-redundant controllers, tape format changes only appear on the controller that the device is mounted through. SHOW UNIT only shows the updated format on the controller which has the tape ONLINE.

Disk Code Load Capability

You can upload disk firmware to compatible disks in the subsystem using the HSUTIL utility. For more information, see *The HSUTIL Utility* at the end of these release notes.

Disk Formatting Capability

You can format compatible disks in the subsystem using the HSUTIL utility. For more information, see *The HSUTIL Utility* at the end of these release notes.

Changes from Version 2.5

The following list describes changes in the operation of the controller provided by the software. A change is a modification of some operating parameter or function that does not necessarily add significant functionality to the controller.

Replacing a Failed Controller

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. New instructions for running C_SWAP are at the end of these release notes. These instructions supersede those in the Version 2.5 documentation for some configurations. Follow the instructions in these release notes whenever you run C_SWAP.

Default Chunksize and Maximum Chunksize

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

- If the number of members in a container is less than or equal to 9, the default chunksize is 256.
- If the number of members in a container is greater than 9, the default chunksize is 128.
- If the 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. Thus you *must* specify the chunksize in accordance with the following table:

RAIDset Size	Maximum Chunksize
3 members	1024 blocks
4 members	682 blocks
5 members	512 blocks
6 members	409 blocks
7 members	341 blocks
8 members	292 blocks

RAIDset Size	Maximum Chunksize
9 members	256 blocks
10 members	227 blocks
11 members	204 blocks
12 members	186 blocks
13 members	170 blocks
14 members	157 blocks

Disk Geometries of Mirrorsets and Clones

In HSOF Software Version 2.5, the MIRROR and ADD MIRRORSET commands caused the mirrored devices to report different geometries than unmirrored devices of the same type. This also affected the CLONE utility, such that a clone of a unit may have reported a different size to the operating system than the original unit. This problem was the reason behind TD# 1905, *Inability to Mount Shadow Set Members/Entire Shadow*.

HSOF Software Version 2.7 resolves 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
```

where

- *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:

- You have replaced the controller module
- The controller's non-volatile memory (NVMEM) has lost its memory, possibly from an NVMEM battery failure
- You removed the cache module while there was unflushed data

For example:

```
CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER NODESTROY_UNFLUSHED_DATA
```

Use the DESTROY_UNFLUSHED_DATA parameter in the following situations:

- You have replaced the cache module
- Any other reason not listed above.

For example:

```
CLEAR_ERRORS INVALID_CACHE OTHER_CONTROLLER DESTROY_UNFLUSHED_DATA
```

New Cache Battery Diagnostic

Software version 2.7 checks 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.

Static CI Credit Management

A new CLI option, MAXIMUM_HOSTS, allows HSJ controllers to calculate CI credits based on number of *host* nodes, rather than on the total number of nodes. Use the following CLI command to enable this feature:

```
CLI> SET THIS_CONTROLLER MAXIMUM_HOSTS = n
```

where *n* is equal to or greater than the number of host (CPU) connections to the cluster. Note that if a single CPU has two or more adapters, you must count each adapter. This number must be smaller than the MAX_NODES number, because some cluster members (such as the HSJ controller) are not CPUs.

Caution

> Do not add more hosts to the CI cluster without *first* changing the MAXIMUM_HOSTS parameter for *all* HSJ controllers on the cluster. HSJ controllers will shut down if they detect more hosts on the cluster than expected.

Device Extended Status

HSJ controllers with HSOF Software Version 2.7 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

```
CLI> 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 for Version 2.5. Additional information on error log changes is at the end of this document.

Clarifications

This section presents clarifications on controller behavior in certain situations.

SHOW on Both Controllers

Some devices, such as tape devices, may not SHOW correctly on one controller if they are preferred to the other controller. If you do not see the information that you expected from one controller, use the SHOW command again to view the information on the other controller.

LBA Does Not Match for MEDIUM ERROR

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 actually one less than the number in the extended sense data.

This problem will be fixed in a future release.

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.

Set Tape Density When Adding Tape Drive

When first adding a tape drive to the controller configuration, be sure to set the tape density with the SET *unit-number* DEFAULT_FORMAT= command before using the VMS INITIALIZE command. If you do not set the tape density, the tape may be written at the wrong density, or the VMS INITIALIZE command may fail with an invalid format error.

Drive-Level Event Reports

Under certain circumstances, the Device Type field contained in %EVL drive-level event reports displays, as well as sense data responses, will contain the value 1F(hexadecimal). When the Device Type is 1F, the content of the Device Firmware Revision Level and Device Product ID fields are undefined and should be ignored.

This is a permanent condition.

Operating Constraints

This section describes the operating constraints for HSOF Software Version 2.7. An operating constraint is a limitation placed on the operation of the controller by the nature of its design. Keep these constraints in mind to avoid problems and to help you to get the maximum performance from your controller.

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.
- 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.

Only One Qualifier per CLI Command

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:

```
CLI> SET D102 WRITEBACK_CACHE
CLI> 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.

Restrictions on Moving Storagesets to Previous HSOF 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 Version 2.7, such that striped mirrorsets initialized under Version 2.7 report a disk geometry identical to the same nonmirrored stripeset.

Due to this improvement in Version 2.7, you should be aware of the following when moving stripesets to previous versions of software:

- Striped mirrorsets created under HSOF Software Version 2.7 cannot be used on previous versions; the metadata is incompatible.
- Any stripeset that is converted to a striped mirrorset using the MIRROR command under Version 2.7 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 Version 2.7 (using the CLONE utility) cannot be used with previous software versions.
- Any container initialized with the SAVE_CONFIGURATION option cannot be used with previous software versions.

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

Unit Problems after Battery Low

An unusual combination of circumstances may cause a unit to unexpectedly become inoperative or report lost data after a write-back cache battery changes state from “low” to “good.” No data has been lost. Reset the controller to correct the unit state.

CLEAR_ERRORS LOST_DATA Command

When entering the CLEAR_ERRORS LOST_DATA command for a RAIDset-based unit, always enter the command on the controller that owns the unit (through the preferred path). Entering the command from the companion controller in a dual-redundant configuration will not clear the lost data. Digital expects to lift this restriction in a future software release.

RRD42 CD–ROM Reader

Mounting an RRD42 may put a message in the VMS error log. In older versions of VMS, the first four digits in Longword 19 of the controller dependent information will be 02D1. New versions of VMS 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. Digital expects to lift this restriction in a future software release.

Unable to Access Tape Drives after Power Cycle

You may 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.

Initialization Devices

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

Avoiding Problem Situations

In certain situations, you may experience unusual controller behavior. This section presents information to help you to 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

Before installing a new version of tape drive firmware, remove the tape drive completely from the controller configuration. You can re-add the tape drive after the firmware installation is complete.

CLONE

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. Shutdown the controller and flush unwritten data from the cache module using the appropriate CLI command:

   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

   or

   ```
   CLI> 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.

Moving Drives from HSC Controllers

HSOF Software Version 2.7 contains an undocumented local program for viewing and changing volume serial numbers that you can use to move drives from an HSC controller to an HSJ*xx* controller. You must use this program when moving drives because the HSC controller accepts volume serial numbers of zero and duplicate serial numbers, but HSJ*xx* 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 will report “medium is offline.”

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

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

```
CLI> 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

Following are additions and corrections to the *HS Family of Array Controllers User's Guide* and *HS Family of Array Controllers Service Manual*:

Note

Both the *HS Family of Array Controllers User's Guide* and the *HS Family of Array Controllers Service Manual* were revised for the Version 2.5 software release. Much of the information contained in prior versions of these release notes, as well as new information, has been included in these revised manuals. Digital strongly recommends referring to the new revisions of these manuals for updated information.

Disconnecting the Maintenance Terminal

The maintenance terminal port on the front bezel of the controller is meant to be used only for initial configuration and required maintenance functions. Operation of this port may cause harmful radio frequency interference. Always disconnect the terminal and cable when you have finished working with the controller.

CLI Command Differences

CLI Command Timeout

The timeout duration for CLI commands has been extended from 10 minutes to 30 minutes. The timeout 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.

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. New instructions for running C_SWAP are at the end of these release notes. These instructions supersede those in the Version 2.5 documentation for some configurations. Follow the instructions in these release notes whenever you run C_SWAP.

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 may 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. Valid values depend upon the specific device and the media loaded.

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 options.
- 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
```

CI Credit Management

There are new options to set the static CI credit management feature.

```
SET THIS_CONTROLLER MAXIMUM_HOSTS = n
SET OTHER_CONTROLLER MAXIMUM_HOSTS = n
```

where n is a value between 1 and 31.

The SHOW THIS_CONTROLLER and SHOW OTHER_CONTROLLER commands now show the MAXIMUM_HOSTS setting at the end of the Host port section:

```
MAXIMUM_HOSTS = n
```

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 should be:

```
CLI> ADD TAPE TAPE320 3 2 0
CLI> ADD UNIT T322 TAPE320
CLI> ADD LOADER LOADER321 3 2 1
CLI> ADD PASSTHROUGH PASS1 LOADER321
CLI> ADD UNIT D332 PASS1
```

Installation

Use the procedures described in this section to install HSOF Software Version 2.7 supplied in this kit. The procedure for upgrading your software to Version 2.7 typically takes less than 5 minutes to accomplish.

CAUTION

HSOF Software Version 2.7 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 Version 2.7 program cards and press the reset button, allow 60 seconds for the CLI prompt to appear.

Nonredundant Configurations

The software upgrade to Version 2.7 causes a brief interruption in service to attached devices. The operating system should automatically recover from this outage within a few seconds after the new software becomes operational and restores service.

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

1. Remove the ESD shield covering the PCMCIA program card.
2. Press the program card eject button to eject the program card from the controller.
3. Remove the program card.
4. While holding in the controller reset button, insert the new program card, pressing the card in until the eject button extends outward, then release the reset button.
5. 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*.

Dual-Redundant Configurations

In dual-redundant configurations, you must upgrade the software in both controllers simultaneously.

The software upgrade to Version 2.7 requires that both controllers be momentarily halted at the same time, causing a brief (30 to 45 second) interruption in service to attached drives. The operating system should automatically recover from this outage within a few seconds after the new software becomes operational and restores service.

Release notes for previous versions of HS operating software described a method of upgrading sequentially in a dual-redundant configuration. That method is inappropriate for upgrades to Version 2.7.

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

1. Remove the ESD shields covering the PCMCIA program cards.
2. Press the program card eject buttons on both controllers simultaneously and remove both program cards.
3. Press and hold the controller reset buttons on both controllers while inserting new program cards. Be sure the eject buttons extend outward.
4. Release the reset buttons.
5. Reinstall the ESD shields.

Both controllers restart, leading to normal operations with the host systems as described in the *HS Family of Array Controllers User's Guide*.

The two controllers reinitialize concurrently and synchronize with each other. The timing of this procedure is not critical, except that you should insert and remove the program cards at approximately the same time (within an interval of a few seconds).

After installation, use the controller preferred path command (CLI> SET *unit* PREFERRED_PATH) to restore the desired load balance among devices attached to the two controllers, if any load changes occurred.

Identifying Your HSOF Software Revision Level

You can identify HSOF Software Version 2.7 by entering the SHOW THIS_CONTROLLER command at the CLI prompt. The resulting display lists the software revision level as version "V27J."

The HSUTIL Utility

This section describes the features and user interface of the HSUTIL utility.

Introduction to HSUTIL

The HSUTIL utility 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 not be a part of any higher-level container.
- 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.
- You can 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 commands or run any local programs that might reference the target device from the other controller. Results are unpredictable.
  - Do not boot 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:

```
CLI> 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 disk drives 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, finishing a number of minutes later:

```
HSUTIL Started at: 13-JAN-1946 04:49:48
Format of DISK150 has successfully finished.
HSUTIL - Normal Termination at: 13-JAN-1946 05:22:33
```

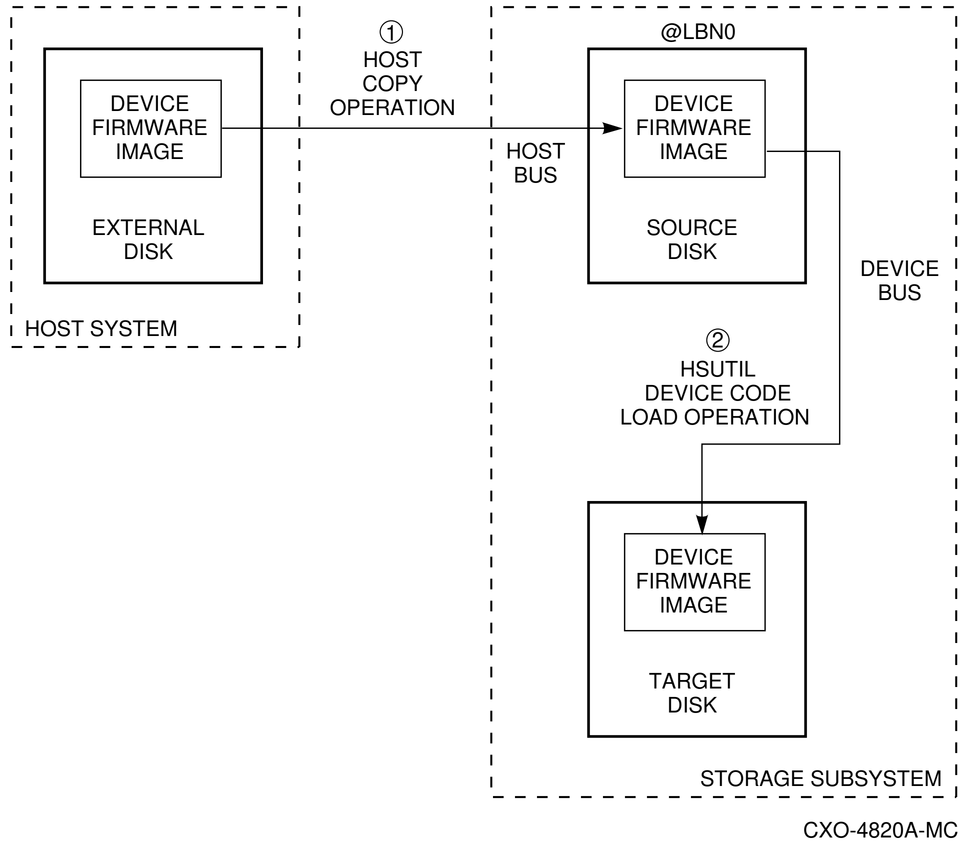
8. DISK150 is now formatted and usable.

The Device Code Load Function

The device code load function allows you to load new firmware into supported devices. The new firmware image must be at a specific logical block number (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 and is illustrated in Figure 1.

Figure 1: The Device Code Load Process



Preparing the Source Disk—You must 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 LBN on the source disk. You must 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 below 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

From an OpenVMS account:

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

$ COPY/CONTIGUOUS BABAGI::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, you can 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.

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

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

$
```

Continue until you have all the software you need.

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 is 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. You should understand that an unsupported device may 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 that you halt 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:

```
CLI> 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:

```
CLI> 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 may, 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-1946 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, such as “0014.” The device is now available for use with its new firmware.

```
CLI> 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 1.

Table 9: 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

Replace a Failed HSJ Controller and/or Cache Module (Dual-Redundant Configuration)

There are two procedures for replacing a failed controller or cache module - 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.

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

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 10 to replace a controller and/or cache module.

Table 10: 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 doors
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.

Prepare the Subsystem Configuration

1. Have the replacement modules at hand. The modules should be factory-fresh, or should have been shutdown cleanly (with the SHUTDOWN command) in their last application.
2. Connect a maintenance terminal to the controller that you are *not* replacing.
3. Prefer all units to the controller that you are not replacing.

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

   Repeat the command for each unit that is preferred to the controller that you are replacing.

4. Disable the CI paths by issuing the following CLI commands:

```
CLI> SET OTHER_CONTROLLER NOPATH_A
CLI> SET OTHER_CONTROLLER NOPATH_B
```

5. 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.

```
CLI> SHUTDOWN OTHER_CONTROLLER
```

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

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

```
CLI> SET NOFAILOVER
```

7. With a small flat-head screwdriver, loosen the captive screws that secure the CI cable connector to the controller. Do not remove the connector.
8. Loosen the four captive retaining screws on the controller's front bezel. Do not remove the module yet.
9. Start the C_SWAP program.

```
CLI> RUN C_SWAP
```

Remove the Modules

9. Indicate that you are going to remove the controller module.

```
Do you wish to remove other HSJ40? Y
```

10. Indicate if you are also going to remove the cache module.

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

11. 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.
```

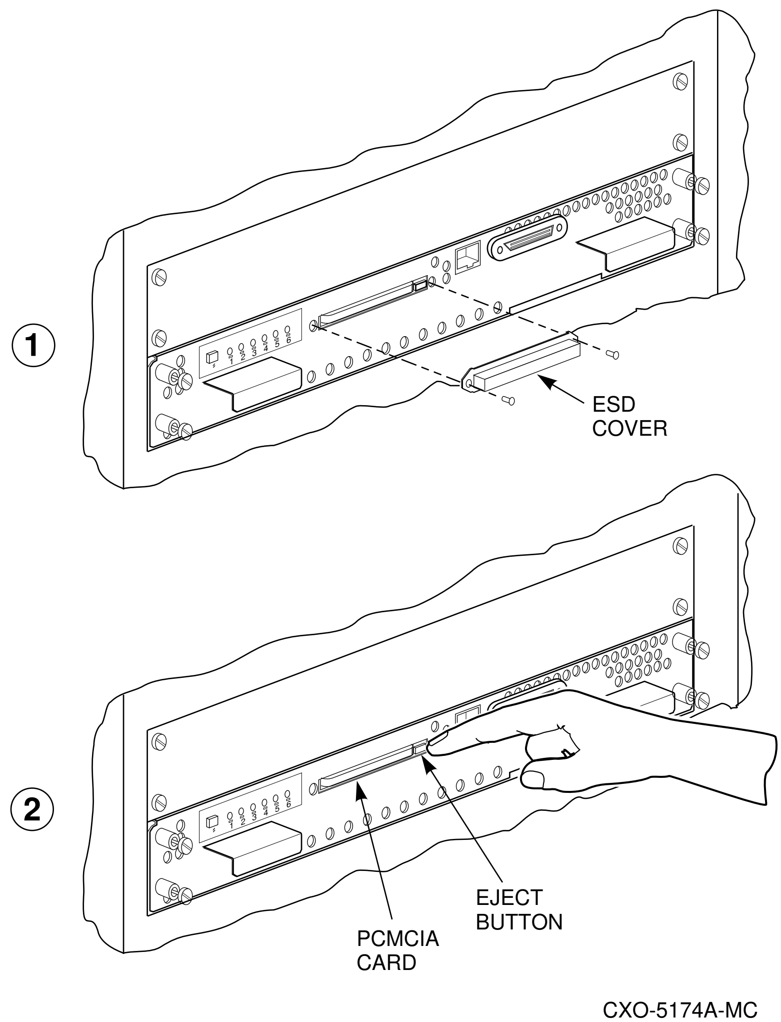
Note

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

14. Obtain and place the ESD wrist strap around your wrist. Ensure that the strap fits snugly around your wrist.
15. Attach or clip the other end of the ESD wrist strap to the cabinet grounding stud or a convenient cabinet grounding point (nonpainted surface).

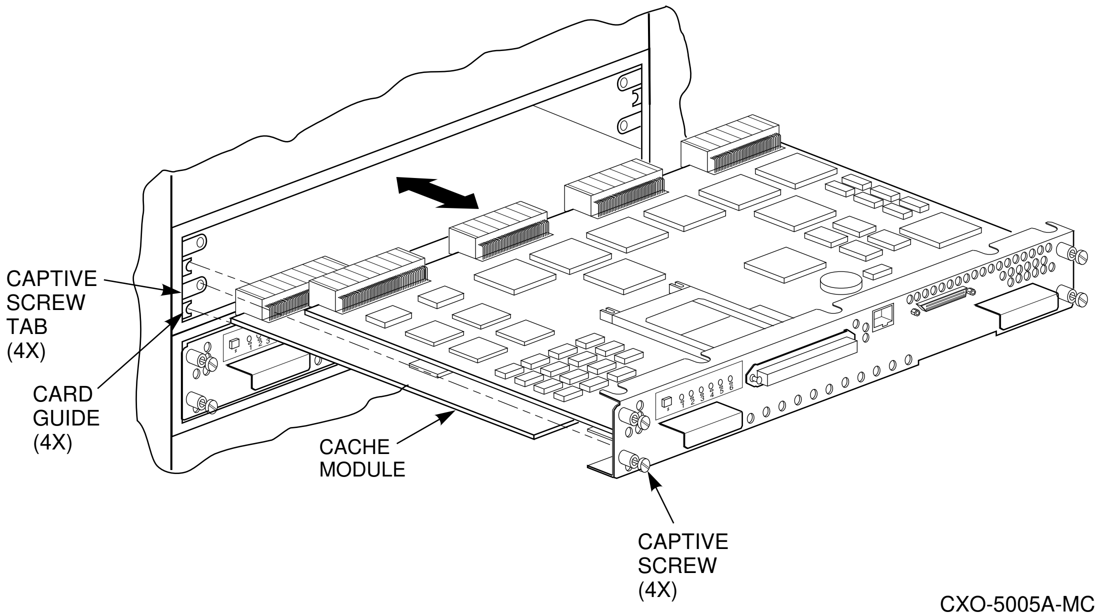
16. Unsnap and remove the program card ESD shield on the controller you are removing (see Figure 2).
17. Remove the program card by pushing the eject button next to the card (see Figure 2). Pull the card out and save it for use in the replacement controller module.

Figure 2: Removing the PCMCIA Card



18. Remove the CI host cable from the controller to be replaced.
19. 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).

Figure 3: Removing and Installing the Controller



20. 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 may remove the cache module before or after port activity has restarted.

21. If necessary remove the cache module.

Install the New Hardware

22. Answer the next two questions to tell the controller that you are ready to install the new hardware.

```
Do you have a replacement controller available? Y
***Sequence to INSERT the other HSJ has begun.***
Do you wish to INSERT the other controller Y/N? Y
```

23. 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 HSJ WITHOUT its program card, and press
Return.
```

24. If necessary, install the cache module. Slide the module straight in along the rails and then push firmly to seat it in the backplane.
25. 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.

29. Tighten the four front panel captive screws.
30. Press **Return** on the operating controller's console.
31. 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 HSJ40
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
```

Restart the Subsystem

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

```
CLI> RESTART OTHER_CONTROLLER
```

33. Connect the maintenance terminal to the newly installed controller.
34. Press and hold the Reset (//) button on the new controller while inserting the program card from the replaced controller.

35. Release the Reset button to initialize the controller. Wait for the CLI prompt to appear at the terminal. You will see a “Controllers misconfigured” message, which you can ignore.
36. 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:

    ```
    CLI> CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER
    DESTROY_UNFLUSHED_DATA
    ```

    Otherwise enter:

    ```
    CLI> CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER
    NODESTROY_UNFLUSHED_DATA
    ```

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

    ```
    CLI> SET NOFAILOVER
    ```

    If the controller was already in nonredundant mode, you will see a message indicating that.

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

    ```
    CLI> SET FAILOVER COPY=OTHER_CONTROLLER
    ```

    The new controller will restart.

39. Verify that all host information is correct.

    ```
    CLI> SHOW THIS_CONTROLLER
    ```

    Modify any incorrect information.

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

    ```
    CLI> RESTART THIS_CONTROLLER
    ```

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

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

43. Balance I/O load between the controllers by setting the preferred path for units.

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

    Repeat the command for each unit that you want accessed through the new controller.

Add a Second HSJ 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.

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.

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 11 to add a second controller module.

Table 11: 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 doors
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.

Prepare the Subsystem Configuration

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:

```
CLI> SHOW THIS_CONTROLLER
```

The controller will display the following information:

```
Controller:
    HSJ40 (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: HSJA2, 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. Make sure that the cache module for the new controller is the same size and type.
5. Start the C_SWAP program:

   CLI> **RUN C_SWAP**

6. Answer the two questions to tell the controller that you are ready to install new hardware.

   Do you have a replacement HSJ readily available? [N] ? **Y**

   Sequence to INSERT the other HSJ has begun.

   Do you wish to INSERT the other HSJ y/n? **Y**

7. 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 HSJ WITHOUT its program card, and press
Return.
```

8. 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.
9. Check the new controller to make sure 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.
10. Install the controller module. Slide the module straight in along the rails and then push firmly to seat it in the backplane.

11. 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.

15. Press **Return** on the operating controller's console.

16. 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 HSJ40
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
```

Restart the Subsystem

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

    CLI> **RESTART OTHER_CONTROLLER**

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

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

20. Release the Reset button to initialize the controller. Wait for the CLI prompt to appear at the terminal. You will see a "Controllers misconfigured" message, which you can ignore.

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

    CLI> **CLEAR_ERRORS INVALID_CACHE THIS_CONTROLLER DESTROY_UNFLUSHED_DATA**

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

    CLI> **SET NOFAILOVER**

    If the controller was already in nonredundant mode, you will see a message indicating that.

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

    CLI> **SET FAILOVER COPY=OTHER_CONTROLLER**

    The new controller will initialize.

24. Verify that all host settings are correct:

    CLI> **SHOW THIS_CONTROLLER**

    Modify any host information.

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

    CLI> **RESTART THIS_CONTROLLER**

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

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

    CLI> **SET THIS_CONTROLLER PATH_A**
    CLI> **SET THIS_CONTROLLER PATH_B**