Servicing your StorageWorks subsystem

HSZ50 Array Controllers

HSOF Version 5.0

StorageWorks

Part Number: EK–HSZ50–SV. B01
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Related documents

The following table lists documents that contain information related to this product.

Document name	Order number
StorageWorks HSZ40 Array Controller Utility for Digital UNIX, System Manager's Guide for HSZterm	AA–QC39B–TE
DECevent Analysis and Notification Utility for OpenVMS User and Reference Guide	AA–Q73LA–TE
DECevent Installation Guide	AA–Q73JA–TE
DECevent Translation and Reporting Utility for OpenVMS User and Reference Guide	AA–Q73KA–TE
StorageWorks BA350–MA Controller Shelf User's Guide	EK–350MA–UG
StorageWorks Configuration Manager for DEC OSF/1 Installation Guide	AA–QC38A–TE
StorageWorks Configuration Manager for DEC OSF/1 System Manager's Guide for HSZterm	AA–QC39A–TE
StorageWorks Family StorageWorks Building Blocks User's Guide	EK–SBB35–UG
StorageWorks Solutions Configuration Guide	EK–BA350–CG
StorageWorks Solutions Shelf and SBB User's Guide	EK–BA350–UG
StorageWorks Solutions SW300-Series RAID Enclosure Installation and User's Guide	EK–SW300–UG
StorageWorks SW500-Series Cabinet Installation and User's Guide	EK–SW500–IG
StorageWorks SW500-Series Cabinet Cable Distribution Unit Installation Guide	EK–SW5CU–IG
StorageWorks SW800-Series Data Center Cabinet Cable Distribution Unit Installation Sheet	EK–SWCDU–IS
StorageWorks SW800-Series Data Center Cabinet Installation and User's Guide	EK–SW800–IG

1 Troubleshooting

Interpreting controller LED codes

Troubleshooting controllers

Using FMU to describe event log codes

Testing disk drives

Monitoring subsystem performance

Introduction

This chapter is designed to help you quickly isolate the source of any problems you might encounter when you service the StorageWorks HSZ50 controllers, and take the necessary steps to correct the problems.

Interpreting controller LED codes

This section provides information on how to interpret controller LED codes.. The operator control panel (OCP) on each HSZ controller contains a green reset LED and six device bus LEDs. These LEDs light in patterns to display codes when there is a problem with a device configuration, a device, or a controller.

- During normal operation, the green reset LED on each controller flashes once per second, and the device bus LEDs are not lit.
- The amber LED for a device bus lights continuously when the installed devices do not match the controller configuration, or when a device fault occurs.
- The green reset LED lights continuously and the amber LEDs display a code when a controller problem occurs. Solid LED codes indicate a fault detected by internal diagnostic and initialization routines. Flashing LED codes indicate a fault that occurred during core diagnostics.

Look up the LED code that is showing on your controller in Table 1 or Table 2 to determine its meaning and find the corrective action.

Table 1
Solid controller LED codes

Code	Description of Error	Corrective Action
●●●●●●●	DAEMON hard error	Replace controller module.
●●●●●●❍	Repeated firmware bugcheck	Replace controller module.
●●●●●❍●	NVMEM version mismatch	Replace program card with later version of firmware.
●●●●●❍❍	NVMEM write error	Replace controller module.
●●●●❍●●	NVMEM read error	Replace controller module.
●●●●❍●❍	NMI error within firmware bugcheck	Reset the controller.
●●●●❍❍●	Inconsistent NVMEM structures repaired	Reset the controller.

Code	Description of Error	Corrective Action
●●●●❍❍❍	Bugcheck with no restart	Reset the controller.
●●●❍●●●	Firmware induced restart following bugcheck failed to occur	Replace controller module.
●●●❍●●❍	Hardware induced restart following bugcheck failed to occur	Replace controller module.
●●●❍●❍●	Bugcheck within bugcheck controller	Reset controller module.
●●●❍❍●●	NVMEM version is too low	Verify the card is the latest revision. If the problem still exists, replace the module.
●●●❍❍●❍	Program card write fail	Replace the card.
●●●❍❍❍●	ILF, INIT unable to allocate memory	Reset the controller.
●●●❍❍❍❍	Bugcheck before subsystem initialization completed	Reset the controller.
●❍❍❍❍❍❍	No program card seen	Try the card in another module. If the problem follows the card, replace the card. Otherwise, replace the controller.

Table 2
Flashing controller LED codes

Code	Description of Error	Corrective Action
●❍❍❍❍❍☼	Program card EDC error	Replace program card.
●❍❍❍☼❍❍	Timer zero in the timer chip will run when disabled	Replace controller module.
●❍❍❍☼❍☼	Timer zero in the timer chip decrements incorrectly	Replace controller module.
●❍❍❍☼☼❍	Timer zero in the timer chip did not interrupt the processor when requested	Replace controller module.
●❍❍❍☼☼☼	Timer one in the timer chip decrements incorrectly	Replace controller module.
●❍❍☼❍❍❍	Timer one in the timer chip did not interrupt the processor when requested	Replace controller module.

Code	Description of Error	Corrective Action
● ❍ ❍ ✲ ❍ ❍ ✲	Timer two in the timer chip decrements incorrectly	Replace controller module.
● ❍ ❍ ✲ ❍ ✲ ❍	Timer two in the timer chip did not interrupt the processor when requested	Replace controller module.
● ❍ ❍ ✲ ❍ ✲ ✲	Memory failure in the I/D cache	Replace controller module.
● ❍ ❍ ✲ ✲ ❍ ❍	No hit or miss to the I/D cache when expected	Replace controller module.
● ❍ ❍ ✲ ✲ ❍ ✲	One or more bits in the diagnostic registers did not match the expected reset value	Replace controller module.
● ❍ ❍ ✲ ✲ ✲ ❍	Memory error in the nonvolatile journal SRAM	Replace controller module.
● ❍ ❍ ✲ ✲ ✲ ✲	Wrong image seen on program card	Replace program card.
● ❍ ✲ ❍ ❍ ❍ ❍	At least one register in the controller DRAB does not read as written	Replace controller module.
● ❍ ✲ ❍ ❍ ❍ ✲	Main memory is fragmented into too many sections for the number of entries in the good memory list	Replace controller module.
● ❍ ✲ ❍ ❍ ✲ ❍	The controller DRAB or DRAC chip does not arbitrate correctly	Replace controller module.
● ❍ ✲ ❍ ❍ ✲ ✲	The controller DRAB or DRAC chip failed to detect forced parity, or detected parity when not forced	Replace controller module.
● ❍ ✲ ❍ ✲ ❍ ❍	The controller DRAB or DRAC chip failed to verify the EDC correctly	Replace controller module.
● ❍ ✲ ❍ ✲ ❍ ✲	The controller DRAB or DRAC chip failed to report forced ECC	Replace controller module.
● ❍ ✲ ❍ ✲ ✲ ❍	The controller DRAB or DRAC chip failed some operation in the reporting, validating, and testing of the multibit ECC memory error	Replace controller module.
● ❍ ✲ ❍ ✲ ✲ ✲	The controller DRAB or DRAC chip failed some operation in the reporting, validating, and testing of the multiple single-bit ECC memory error	Replace controller module.
● ❍ ✲ ✲ ❍ ❍ ❍	The controller main memory did not write correctly in one or more sized memory transfers	Replace controller module.
● ❍ ✲ ✲ ❍ ❍ ✲	The controller did not cause an I-to-N bus	Replace controller module.

Code	Description of Error	Corrective Action
	timeout when accessing a "reset" host port chip	
● ❍ ✻ ✻ ❍ ✻ ❍	The controller DRAB or DRAC chip did not report an I-to-N bus timeout when accessing a "reset" host port chip.	Replace controller module.
● ❍ ✻ ✻ ❍ ✻ ✻	The controller DRAB or DRAC chip did not interrupt the controller processor when expected	Replace controller module.
● ❍ ✻ ✻ ✻ ❍ ❍	The controller DRAB or DRAC chip did not report an NXM error when nonexistent memory was accessed	Replace controller module.
● ❍ ✻ ✻ ✻ ❍ ✻	The controller DRAB or DRAC chip did not report an address parity error when one was forced	Replace controller module.
● ❍ ✻ ✻ ✻ ✻ ❍	There was an unexpected nonmaskable interrupt from the controller DRAB or DRAC chip during the DRAB memory test.	Replace controller module.
● ❍ ✻ ✻ ✻ ✻ ✻	Diagnostic register indicates there is no cache module, but an interrupt exists from the non-existent cache module	Replace controller module.
● ✻ ❍ ❍ ❍ ❍ ❍	The required amount of memory available for the code image to be loaded from the program card is insufficient	Replace controller module.
● ✻ ❍ ❍ ❍ ❍ ✻	The required amount of memory available in the pool area is insufficient for the controller to run	Replace controller module.
● ✻ ❍ ❍ ❍ ✻ ✻	The required amount of memory available in the buffer area is insufficient for the controller to run	Replace controller module.
● ✻ ❍ ❍ ✻ ❍ ❍	The code image was not the same as the image on the card after the contents were copied to memory	Replace controller module.
● ✻ ❍ ❍ ✻ ❍ ✻	Diagnostic register indicates that the cache module does not exist, but access to that cache module caused an error	Replace controller shelf backplane.
● ✻ ❍ ❍ ✻ ✻ ❍	Diagnostic register indicates that the cache module does not exist, but access to that	Replace controller shelf backplane.

Code	Description of Error	Corrective Action
	cache module did not cause an error	
● ✵ ✵ ❍ ❍ ❍ ❍	The journal SRAM battery is bad	Replace controller module.
● ✵ ✵ ✵ ❍ ✵ ❍	There was an unexpected interrupt from a read cache or the present and lock bits are not working correctly	Replace controller module.
● ✵ ✵ ✵ ❍ ✵ ✵	There is an interrupt pending on the controller's policy processor when there should be none	Replace controller module.
● ✵ ✵ ✵ ✵ ❍ ❍	There was an unexpected fault during initialization	Replace controller module.
● ✵ ✵ ✵ ✵ ❍ ✵	There was an unexpected maskable interrupt received during initialization	Replace controller module.
● ✵ ✵ ✵ ✵ ✵ ❍	There was an unexpected nonmaskable interrupt received during initialization	Replace controller module.
● ✵ ✵ ✵ ✵ ✵ ✵	An illegal process was activated during initialization	Replace controller module.

Troubleshooting Digital HSZ controllers

This section covers the following topics:

- Troubleshooting when you cannot access HSZ units.
- Troubleshooting on Digital UNIX
- VMS host troubleshooting
- Troubleshooting application errors

Troubleshooting when you cannot access host units

If the error that occurred prevents you from accessing units for the host, determine if any HSZ units can be accessed. If no HSZ units can be accessed, run the VTDPY display and ensure that the host established communications with all HSZ target IDs. Refer to the section later in this chapter on "Monitoring System Performance Using the VTDPY Utility" for more information about running VTDPY. If the host has not established communications, one of the following might be true:

- The host adapter is bad.
- The host SCSI bus is bad or misconfigured.
- The HSZ controller is bad.

To find more information about this error, use the following procedure from the HSZ console. (If this is a dual controller configuration, the command must be executed on both controllers.)

1. To determine if the unit is online to a controller:

   ```
   HSZ50> SHOW UNITS FULL
   ```

2. Check the following:

   – Is the unit online or available to this or the other controller?

   - From the HSZ controller to which the unit is online, does the SHOW UNITS command also show the size in blocks?

3. If the answer to both of the questions in step 2 is no, there is a problem with the HSZ controller. Look for any type of errors in the SHOW UNITS output, such as Lost Data or Media Format.

4. Run the VTDPY display.

5. Look at the unit status in the VTDPY display. Use the information in a later section in this chapter, "Monitoring System Performance with the VTDPY Utility" to interpret the VTDPY display.

6. If the unit is not online or if errors are present in the SHOW UNITS display, take appropriate action to clear the errors or rebuild the unit.

   Be careful with user's data. If this is a RAIDset, try to save the user's data. Do not initialize the storage unit unless there is no other alternative.

If you determine that units are online and everything seems to be in order on the HSZ side, proceed to check the host side using the file utility procedure.

Troubleshooting on a Digital UNIX system

To troubleshoot on a Digital UNIX system, use the file utility to access the device. The error message from the file utility might explain where the problem lies.

Using the Digital UNIX file utility

You can use the Digital UNIX file utility to determine if an HSZ unit can be accessed from the Digital UNIX host system. In the following procedure, an HSZ controller has a unit named D101, which will be used by the file utility.

1. Enter the following command from the HSZ CLI:

   ```
   HSZ50>SHOW D101
   ```

2. Disable the writeback_cache and read_cache on this unit, if they are both enabled, using the following command:

   ```
   HSZ50>SET D101 nowriteback_cache
   ```

   ```
   HSZ50>SET D101 noread_cache
   ```

   or disable just the read_cache if it is enabled on the unit with the following command:.

   ```
   HSZ50>SET D101 noread_cache
   ```

   Disabling the read_cache causes information to be accessed from the unit rather than from the cache, if the information is in cache. This gives a visual indication that the unit is being accessed.

3. Issue the file command to start the file utility. (Assume that the character special file has been created for rrzb17a.)

   ```
   /usr/bin/file /dev/rrzb17a
   ```

   The device activity indicator on the device, the green light, should light up. If the unit is a multidevice storage unit only one of the devices that is part of that storage unit lights.

   The host system should display the following output after the file command is issued (the output displays on one line):

   ```
   /dev/rrzb17a character special (8/mmmm) SCSI # n HSZ50
   disk #xxx (SCSI ID #t)
   ```

   The output values have the following meanings:

   - 8 - major number
   - mmmm - minor number

- n - SCSI host side bus number
- t - target ID as used in the HSZ50 unit DTZL where the "T". In the DTZL HSZ50 unit matches the "t" from the file command.
- xxx - the disk number

4. If an error occurs, use the information in the following table to evaluate errors or output:

Error or Output	Meaning and action
file: Cannot get file status on /dev/mmmm /dev/mmmm: Cannot open for reading	Indicates the special file in the /dev directory that matches mmmm does not exist.
Only the major and minor number is returned from the file command	The device is not answering or the device special file does not have the correct minor number. Check the minor number to be sure that it matches the correct SCSI host side bus number and the correct HSZ50 Target ID and LUN from the HSZ50 unit designator.

5. If the unit had write-back cache enabled, remember to enable the cache again using the following HSZ CLI command that enables both the write-back and read cache:

```
HSZ50> SET D101 WRITEBACK_CACHE
```

6. If the unit had only the read cache enabled, enable the read cache with this HSZ50 CLI command:

```
HSZ50> SET D101 READ_CACHE
```

7. Run VTDPY to ensure the host established communication with all HSZ target IDs.

VMS host troubleshooting

If you cannot access the host on a VMS system, use the following procedure to troubleshoot:

1. On the VMS system,enter the following command.

   ```
   ,  SHOW DEVICE DK*
   ```

   Device names will display in the following format:

   DKA101

   The A in the device name represents a SCSI controller designation and the 101 represents a unit number on an HSZ or other SCSI controller. If there was an HSZ unit named D101 on the HSZ whose letter designation was A, that would be the VMS device DKA101.

   If there are multiple SCSI controllers, there would be a different controller letter designation, for example DKA, DKB, and so forth.

   The SHOW DEVICE FULL command also would give the controller type. If the device was configured on an HSZ controller, HSZ would appear in the device information.

2. The SHOW DEVICE DK* command should display the HSZ unit. If the unit is not displayed, follow the procedures in the previous section to determine if the unit is online.

3. If the unit is online to the HSZ, run the SYSMAN utility on the VMS system to ensure the device is configured.

   ```
   , MC SYSMAN

   SYSMAN> IO AUTOCONFIGURE

   SYSMAN> EXIT
   ```

4. If you still cannot see the unit, check the error logs for SCSI errors. The problem could be due to a bad host adapter, SCSI bus problem, or the HSZ.

5. Use the VTDPY display to ensure the host adapter established connectivity to all HSZ target IDs. The host

port portion of the VTDPY display should show all HSZ target IDs, and the rate should be 10MZ.

Troubleshooting application errors

Application errors can be categorized into three different types: device errors, controller errors, and host adapter errors. For each of these error types, you should check the log entries for key pieces of information. The important information for each error example is described in the following sections.

Locating a device error

This section contains an example of a DECevent error log for a device event or error. You should be able to locate the following important details in the DECevent error log when a device event occurs. Note that if the controller ASC and ASCQ are zero, the device generated the error. Also note the Generic String message, BBR disabled bad block number: 230262. This message is always generated and is a generic message for a device software error. Check the device ASC and ASCQ.

The following important information is highlighted in the example:

- Unit Information, Port-Target-LUN
- Generic String message. This message is always generated and is a generic message for a device software error. You should check the ASC and ASCQ.
- CAM Status
- SCSI Status
- Command Information
- Most Recent ASC and ASCQ
- Device Information, Port-Target-LUN

- Controller ASC and ASCQ
- LBN
- Device ASC and ASCQ

The command "-i ios" qualifier used in the following DECevent log indicates that I/O subsystem log entries should be included: these entries include CAM events. The command issued is the following:

```
#dia -i ios -t s:03-oct-1995, 10:47 e:03-oct-1995, 10:48
```

Example

```
******************************** ENTRY    4********************************


Logging OS                          2. Digital UNIX
System Architecture                 2. Alpha
Event sequence number               1.
Timestamp of occurrence                03-OCT-1995 10:47:59
Host name                              testsys

System type register      x00000004  DEC 3000
Number of CPUs (mpnum)    x00000001
CPU logging event (mperr) x00000000

Event validity                      1. O/S claims event is valid
Event severity                      5. Low Priority
Entry type                        199. CAM SCSI Event Type


------- Unit Info -------
Bus Number                          2.
Unit Number                    x0090  Target =   2.
                                      LUN =   0.
------- CAM Data -------
Class                             x00  Disk
Subsystem                         x00  Disk
Number of Packets                  10.

------ Packet Type ------        258. Module Name String

Routine Name                           cdisk_bbr_done
```

```
------ Packet Type ------       256. Generic String

                                     cdisk_bbr: BBR disabled bad block number:
                                     230262

------ Packet Type ------       261. Soft Error String

Error Type                           Soft Error Detected (recovered)

------ Packet Type ------       257. Device Name String

Device Name                          DEC     HSZ4

------ Packet Type ------       256. Generic String

                                     Active CCB at time of error

------ Packet Type ------       256. Generic String

                                     CCB request completed with an error

------ Packet Type ------         1. SCSI I/O Request CCB(CCB_SCSIIO)
Packet Revision                  37.

CCB Address                xFFFFFC0007F9BB28
CCB Length                     x00C0
XPT Function Code                x01  Execute requested SCSI I/O
Cam Status                       x84  CCB Request Completed WITH Error
                                      Autosense Data Valid for Target
Path ID                            2.
Target ID                          2.
Target LUN                         0.
Cam Flags                  x00000482  SIM Queue Actions are Enabled
                                      Data Direction (10: DATA OUT)
                                      Disable the SIM Queue Frozen State
*pdrv_ptr                  xFFFFFC0007F9B828
*next_ccb                  x0000000000000000
*req_map                   xFFFFFC0007F8C200
void (*cam_cbfcnp)()       xFFFFFC00004AC8A0
*data_ptr                  x000000014000A1A0
Data Transfer Length            8192.
*sense_ptr                 xFFFFFC0007F9B850
Auotsense Byte Length            160.
CDB Length                         6.
Scatter/Gather Entry Cnt           0.
SCSI Status                      x02  Check Condition
```

```
Autosense Residue Length        x00
Transfer Residue Length   x00000000
(CDB) Command & Data Buf

          15--<-12  11--<-08  07--<-04  03--<-00   :Byte Order
 0000:              00000000  00000010  7083030A   *    ...p........*

Timeout Value             x0000003C
*msg_ptr                  x0000000000000000
Message Length                   0.
Vendor Unique Flags           x4000
Tag Queue Actions               x20  Tag for Simple Queue

------ Packet Type ------       256. Generic String

                                     Error, exception, or abnormal condition

------ Packet Type ------       256. Generic String

                                     RECOVERED ERROR - Recovery action
                                     performed

------ Packet Type ------       768. SCSI Sense Data
Packet Revision                  0.

------- HSZ Data -------
Instance, Code             x0328450A  The disk device reported standard SCSI
                                     Sense Data.

                                     Component ID =   Device Services.
                                     Event Number =   x00000028
                                     Repair Action =   x00000045
                                     NR Threshold =   x0000000A
Template Type                   x51  Disk Transfer Error.
Template Flags                  x01  HCE =   1, Event occurred during Host
                                            Command Execution.
Ctrl Serial #                              ZG41800293
Ctrl Software Revision              V20Z
RAIDSET State                   x00  NORMAL. All members present and
                                     reconstructed, IF LUN is configured as a
                                     RAIDSET.

Error Count                       1.
Retry Count                       0.
Most Recent ASC                 x09
Most Recent ASCQ                x00
Next Most Recent ASC            x00
```

```
Next Most Recent ASCQ           x00
Device Locator               x000105  Port    =   5.
                                      Target  =   1.
                                      LUN     =   0.
Command Opcode                  x2A  Write (10 byte)
Original CDB

          15--<-12  11--<-08  07--<-04  03--<-00   :Byte Order
 0000:              00070010  00000010  7083030A   *    ...p.......B*

SCSI Host ID                      7.
Drive Software Revision              T370
Drive Product Name                   RZ26     (C) DEC
Device Type                     x00  Direct Access Device.
Sense Data Qualifier            x80  Buf Mode =   0, The target shall not
                                          report GOOD Status on write
                                          commands until the data
                                          blocks are actually written
                                          on the medium.
                                     UWEUO =   0, not defined.
                                     MSBD =   0, not defined.
                                     FBW =   0, not defined.
                                     IDSD =   0, Valid Device Sense Data
                                              fields.
                                     DSSD =   1, Device Sense Data fields
                                              supplied by Physical Device.
-- Standard Sense Data --

Error Code                      xF0  Current Error
                                     Information Bytes are Valid
Segment #                       x00
Information Byte 3              x00
            Byte 2              x03
            Byte 1              x83
            Byte 0              x76
Sense Key                       x01  Recovered Error
Additional Sense Length         x98
CMD Specific Info Byte 3        x00
                  Byte 2        x00
                  Byte 1        x0C
                  Byte 0        x00
ASC & ASCQ                   x0000  ASC  =   x0000
                                    ASCQ =   x0000
                                    No Additional Sense Information
FRU Code                        x02
Sense Key Specific Byte 0       x00  Sense Key Data NOT Valid
                  Byte 1        x00
```

```
                    Byte 2       x00

-- Device Sense Data --

Error Code                       xF0  Current Error
                                      Information Bytes are Valid
Segment #                        x00
Information Byte 3               x00
            Byte 2               x03
            Byte 1               x83
            Byte 0               x76
Sense Key                        x01  Recovered Error
Additional Sense Length          x0A
CMD Specific Info Byte 3         x00
                  Byte 2         x00
                  Byte 1         x0C
                  Byte 0         x00
ASC & ASCQ                     x0900  ASC  =   x0009
                                      ASCQ =   x0000
                                      Track Following Error
FRU Code                         x02
Sense Key Specific Byte 0        x00  Sense Key Data NOT Valid
                   Byte 1        x00
                   Byte 2        x00
```

Controller generated event

This section contains an example of a DECevent error log for a forced error that is a controller generated event. This does not indicate a controller problem, but might have been caused by a previous device event. Note that if the controllers ASC and ASCQ are not zero, the controller generated the error, but it might have been caused by a previous device event. No device ASC or ASCQ information displays for this type of error.

The following important information is highlighted in the example:

- Unit Information, Port-Target-LUN
- CAM Status
- SCSI Status

- Command Information
- Actual Error
- Instance, Code - If the Instance, Code contains a value of Can't Describe, use the procedure defined in a later section in this chapter, Using FMU to Describe Event Log Codes for locating the instance, code.
- Most Recent ASC and ASCQ

Example

```
******************************** ENTRY 1598 ********************************


Logging OS                          2. Digital UNIX
System Architecture                 2. Alpha
Event sequence number              11.
Timestamp of occurrence                24-JAN-1996 17:11:56
Host name                              tgonzo

System type register      x00000004  DEC 3000
Number of CPUs (mpnum)    x00000001
CPU logging event (mperr) x00000000

Event validity                      1. O/S claims event is valid
Event severity                      3. High Priority
Entry type                        199. CAM SCSI Event Type


------- Unit Info -------
Bus Number                          2.
Unit Number                     x0080  Target =   0.
                                       LUN =   0.
------- CAM Data -------
Class                             x00  Disk
Subsystem                         x00  Disk
Number of Packets                  10.

------ Packet Type ------        258. Module Name String

Routine Name                           cdisk_check_sense

------ Packet Type ------        256. Generic String
```

```
                                        Medium Error bad block number: 0

------ Packet Type ------       260. Hardware Error String

Error Type                            Hard Error Detected

------ Packet Type ------       257. Device Name String

Device Name                           DEC     HSZ4

------ Packet Type ------       256. Generic String

                                      Active CCB at time of error

------ Packet Type ------       256. Generic String

                                      CCB request completed with an error

------ Packet Type ------         1. SCSI I/O Request CCB(CCB_SCSIIO)
Packet Revision                  37.

CCB Address                xFFFFFC00071D2328
CCB Length                     x00C0
XPT Function Code                x01  Execute requested SCSI I/O
Cam Status                       x84  CCB Request Completed WITH Error
                                      Autosense Data Valid for Target
Path ID                            2.
Target ID                          0.
Target LUN                         0.
Cam Flags                  x00000442  SIM Queue Actions are Enabled
                                      Data Direction (01: DATA IN)
                                      Disable the SIM Queue Frozen State
*pdrv_ptr                  xFFFFFC00071D2028
*next_ccb                  x0000000000000000
*req_map                   xFFFFFC00006378F8
void (*cam_cbfcnp)()       xFFFFFC00004AC8A0
*data_ptr                  xFFFFFFFF88AB4000
Data Transfer Length             512.
*sense_ptr                 xFFFFFC00071D2050
Auotsense Byte Length            160.
CDB Length                         6.
Scatter/Gather Entry Cnt           0.
SCSI Status                      x02  Check Condition
Autosense Residue Length         x00
Transfer Residue Length    x00000000
(CDB) Command & Data Buf
```

```
          15--<-12  11--<-08  07--<-04  03--<-00   :Byte Order
 0000:              00000000  00000001  00000008   *    ............*

Timeout Value             x0000003C
*msg_ptr                  x0000000000000000
Message Length                   0.
Vendor Unique Flags           x4000
Tag Queue Actions               x20  Tag for Simple Queue

------ Packet Type ------       256. Generic String

                                     Error, exception, or abnormal condition

------ Packet Type ------       256. Generic String

                                     MEDIUM ERROR - Nonrecoverable medium error

------ Packet Type ------       768. SCSI Sense Data
Packet Revision                  0.

------- HSZ Data -------
Instance, Code            x0252000A  The last block of data returned contains a
                                     forced error. A forced error occurs when a
                                     disk block is successfully  reassigned,
                                     but the data in that block is lost.
                                     Re-writing the disk block will clear the
                                     forced error condition. The Device Sense
                                     Data Information Bytes contain the block
                                     number of the first block in error.

                                     Component ID =   Value Added Services.
                                     Event Number =   x00000052
                                     Repair Action =   x00000000
                                     NR Threshold =   x0000000A
Template Type                   x51  Disk Transfer Error.
Template Flags                  x01  HCE =   1, Event occurred during Host
                                          Command Execution.
Ctrl Serial #                              ZG41800293
Ctrl Software Revision                W15Z
RAIDSET State                   x00  NORMAL. All members present and
                                     reconstructed, IF LUN is configured as a
                                     RAIDSET.

Error Count                      1.
Retry Count                      0.
Most Recent ASC                 x80
```

```
Most Recent ASCQ                x00
Next Most Recent ASC            x00
Next Most Recent ASCQ           x00
Device Locator              x000403  Port    =   3.
                                     Target  =   4.
                                     LUN     =   0.
Command Opcode                  x08  Read (6 byte)
Original CDB

          15--<-12  11--<-08  07--<-04  03--<-00   :Byte Order
 0000:              00070000  00000001  00000008   *    ...........B*

SCSI Host ID                      7.
Drive Software Revision              427H
Drive Product Name                   RZ74     (C) DEC
Device Type                     x00  Direct Access Device.
Sense Data Qualifier            x40  Buf Mode =   0, The target shall not
                                                   report GOOD Status on write
                                                   commands until the data
                                                   blocks are actually written
                                                   on the medium.
                                     UWEUO =   0, not defined.
                                     MSBD =   0, not defined.
                                     FBW =   0, not defined.
                                     IDSD =   1, Ignore Device Sense Data
                                              fields, copied to Standard Sense
                                              Data fields.
                                     DSSD =   0, Device Sense Data fields
                                              supplied by the controller.
-- Standard Sense Data --

Error Code                      xF0  Current Error
                                     Information Bytes are Valid
Segment #                       x00
Information Byte 3              x00
            Byte 2              x00
            Byte 1              x00
            Byte 0              x00
Sense Key                       x03  Medium Error
Additional Sense Length         x98
CMD Specific Info Byte 3        x00
                  Byte 2        x00
                  Byte 1        x00
                  Byte 0        x00
ASC & ASCQ                    x8000  ASC  =   x0080
                                     ASCQ =   x0000
                                     Forced error on read.
```

```
FRU Code                        x00
Sense Key Specific Byte 0       x00    Sense Key Data NOTE Valid
                   Byte 1        x00
                   Byte 2        x00
```

Locating a host bus error

This section contains two examples of host bus errors: command timeout and select timeout. A host bus error could be a host adapter error, SCSI bus error, or an HSZ error that is not device specific.

Command Timeout (Host system timeout)

In this first example, the routine exceeded its retry count or timeout value. In such a case, check the CAM status and determine if there is any sense data. The following important information is highlighted in the example:

- Generic String message. In this example, the message is Retries Exhausted which indicates that the retry count was exceeded or timed out.
- CAM Status
- No Sense Data available

Example

```
******************************** ENTRY  390 ********************************


Logging OS                          2. Digital UNIX
System Architecture                 2. Alpha
Event sequence number             118.
Timestamp of occurrence                29-MAY-1996 20:02:09
Host name                              tgonzo

System type register      x0000000C  AlphaServer 8x00
Number of CPUs (mpnum)    x00000002
CPU logging event (mperr) x00000001

Event validity                      1. O/S claims event is valid
Event severity                      3. High Priority
```

```
Entry type                      199. CAM SCSI Event Type


------- Unit Info -------
Bus Number                        4.
Unit Number                   x010A  Target =   1.
                                     LUN =   2.
------- CAM Data -------
Class                           x00  Disk
Subsystem                       x00  Disk
Number of Packets                 7.

------ Packet Type ------       258. Module Name String

Routine Name                         cdisk_complete

------ Packet Type ------       256. Generic String

                                     Retries Exhausted


------ Packet Type ------       260. Hardware Error String

Error Type                           Hard Error Detected

------ Packet Type ------       257. Device Name String

Device Name                          DEC     HSZ4

------ Packet Type ------       256. Generic String

                                     Active CCB at time of error

------ Packet Type ------       256. Generic String

                                     Command timed out

------ Packet Type ------         1. SCSI I/O Request CCB(CCB_SCSIIO)
Packet Revision                  37.

CCB Address               xFFFFFC002B420F28
CCB Length                    x00C0
XPT Function Code               x01  Execute requested SCSI I/O
Cam Status                      x0B  Command Timeout
Path ID                           4.
Target ID                         1.
Target LUN                        2.
```

```
Cam Flags                 x00000482  SIM Queue Actions are Enabled
                                     Data Direction (10: DATA OUT)
                                     Disable the SIM Queue Frozen State
*pdrv_ptr                 xFFFFFC002B420C28
*next_ccb                 x0000000000000000
*req_map                  xFFFFFC0019337D00
void (*cam_cbfcnp)()      xFFFFFC00004B4C90
*data_ptr                 xFFFFFC003FC06000
Data Transfer Length           8192.
*sense_ptr                xFFFFFC002B420C50
Auotsense Byte Length           160.
CDB Length                       10.
Scatter/Gather Entry Cnt          0.
SCSI Status                     x00  Good Condition
Autosense Residue Length        x00
Transfer Residue Length   x00000000
(CDB) Command & Data Buf

          15--<-12  11--<-08  07--<-04  03--<-00   :Byte Order
 0000:              00000000  0000F05A  F200002A   *    *...Z.......*

Timeout Value             x0000003C
*msg_ptr                  x0000000000000000
Message Length                   0.
Vendor Unique Flags            x4000
Tag Queue Actions                x20  Tag for Simple Queue
```

Select timeout (SCSI protocol timeout)

A select timeout is a SCSI protocol timeout. Locate the following information:

- CAM Status
- No Sense Data available

Example

```
******************************** ENTRY 1605 ********************************


Logging OS                          2. Digital UNIX
System Architecture                 2. Alpha
Event sequence number              18.
Timestamp of occurrence                26-JAN-1996 11:11:37
Host name                              tgonzo

System type register      x00000004  DEC 3000
Number of CPUs (mpnum)    x00000001
CPU logging event (mperr) x00000000

Event validity                      1. O/S claims event is valid
Event severity                      3. High Priority
Entry type                        199. CAM SCSI Event Type


------- Unit Info -------
Bus Number                          2.
Unit Number                     x0088  Target =   1.
                                       LUN =   0.
------- CAM Data -------
Class                             x00  Disk
Subsystem                         x00  Disk
Number of Packets                   7.

------ Packet Type ------         258. Module Name String

Routine Name                           cdisk_complete

------ Packet Type ------         256. Generic String

                                       Retries Exhausted
```

```
------ Packet Type ------       260. Hardware Error String

Error Type                          Hard Error Detected

------ Packet Type ------       257. Device Name String

Device Name                         DEC     HSZ4

------ Packet Type ------       256. Generic String

                                    Active CCB at time of error

------ Packet Type ------       256. Generic String

                                    Target selection timeout

------ Packet Type ------         1. SCSI I/O Request CCB(CCB_SCSIIO)
Packet Revision                  37.

CCB Address                xFFFFFC0005997F28
CCB Length                     x00C0
XPT Function Code                x01  Execute requested SCSI I/O
Cam Status                       x0A  Target Selection Timeout
Path ID                            2.
Target ID                          1.
Target LUN                         0.
Cam Flags                  x00000482  SIM Queue Actions are Enabled
                                      Data Direction (10: DATA OUT)
                                      Disable the SIM Queue Frozen State
*pdrv_ptr                  xFFFFFC0005997C28
*next_ccb                  x0000000000000000
*req_map                   xFFFFFC0002BD2100
void (*cam_cbfcnp)()       xFFFFFC00004AC8A0
*data_ptr                  xFFFFFC00040FC000
Data Transfer Length            8192.
*sense_ptr                 xFFFFFC0005997C50
Auotsense Byte Length            160.
CDB Length                         6.
Scatter/Gather Entry Cnt           0.
SCSI Status                      x00  Good Condition
Autosense Residue Length         x00
Transfer Residue Length    x00000000
(CDB) Command & Data Buf

          15--<-12  11--<-08  07--<-04  03--<-00   :Byte Order
 0000:              00000000  00000010  00D4010A   *    ............*
```

```
Timeout Value             x0000003C
*msg_ptr                  x0000000000000000
Message Length                   0.
Vendor Unique Flags           x0000
Tag Queue Actions               x20  Tag for Simple Queue
```

Identifying unit attention errors

This section contains two examples (one Digital UNIX and one VMS) of DECevent error logs for unit attention errors. If an event occurs that causes a unit attention and it is not associated with a device that is online to a host, all units online to that host receive a unit attention log entry.

OpenVMS unit attention

When a unit attention error occurs on an OpenVMS system, check the Port-Target-LUN information in the log entry to determine which event and device caused the entry. Locate the following important information highlighted in the example:

- Command Data
- SCSI Status
- HSZ ASC and ASCQ
- Port-Tartget-LUN

Example

```
******************************** ENTRY    1 ********************************


Logging OS                         1. OpenVMS
System Architecture                2. Alpha
OS version                            V6.2-1H2
Event sequence number           639.
Timestamp of occurrence               03-APR-1996 16:50:17
Time since reboot                     0 Day(s) 0:53:17
Host name                             TGONZO

System Model                          DEC 3000 Model 500

Entry type                         1. Device Error


---- Device Profile ----
Unit                                  TGONZO, DKA201
```

```
Product Name                          HSZ50  SCSI to SCSI Ctrl

-- Driver Supplied Info -
Device Firmware Revision              V27Z
VMS SCSI Error Type                5. Extended Sense Data from Device

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
This is unit 201 at port 5 target 1

SCSI ID                          x02
SCSI LUN                         x00
SCSI SUBLUN                      x01


Port Status                 x00000001  Success
Command Opcode                   x0A  Write (6 byte)
Command Data
                                 x19
                                 xE0
                                 x60
                                 x10
                                 x00

SCSI Status                      x02  Check Condition
Remaining Byte Length            160.

------- HSZ Data -------
Instance, Code               x03D04002  A failure occurred while attempting a SCSI
                                        Test Unit Ready or Read Capacity command
                                        to a device. The device type is unknown to
                                        the controller. Note that in this instance,
                                        the Associated ASC and Associated ASCQ
                                        fields are undefined.

                                        Component ID =   Device Services.
                                        Event Number =   x000000D0
                                        Repair Action =   x00000040
                                        NR Threshold =   x00000002
Template Type                    x41  Device Services Non-Transfer Error.
Template Flags                   x00  HCE =   0, Event did not occur during Host
                                              Command Execution.
Ctrl Serial #                               ZG43300068
Ctrl Software Revision                  V27Z
RAIDSET State                    x00  NORMAL. All members present and
                                      reconstructed, IF LUN is configured as a
                                      RAIDSET.
```

```
Error Code                      x70  Current Error
Sense Key                       x06  Unit Attention
ASC & ASCQ                    x3F85  ASC  =   x003F
                                     ASCQ =   x0085
                                     Test Unit Ready or Read Capacity Command
                                     failed.
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

NOtice port 3 target 2

!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Associated Port                 x03
Associated Target               x02
Associated ASC                  x00
Associated ASCQ                 x00

----- Software Info -----
UCB, x_ERTCNT                     16. Retries Remaining
UCB, x_ERTMAX                     16. Retries Allowable
IRP, Q_IOSB               x0000000000000000
UCB, x_STS                x08021810  Online
                                     Software Valid
                                     Unload At Dismount
                                     Volume is Valid on the local node
                                     Unit supports the Extended Function bit
IRP, L_PID                x00010018  Requestor "PID"
IRP, x_BOFF                     512. Byte Page Offset
IRP, x_BCNT                    8192. Transfer Size In Byte(s)
UCB, x_ERRCNT                     4. Errors This Unit
UCB, L_OPCNT                 337624. QIO's This Unit
ORB, L_OWNER              x00010004  Owners UIC
UCB, L_DEVCHAR1           x1C4D4008  Directory Structured
                                     File Oriented
                                     Sharable
                                     Available
                                     Mounted
                                     Error Logging
                                     Capable of Input
                                     Capable of Output
                                     Random Access
```

Digital UNIX unit attention

When a unit attention error occurs on a Digital UNIX system, check the Port-Target-LUN information in the log entry to determine which event and device caused the entry. The following important information is highlighted in the example:

- Unit Attention
- Controller ASC and ASCQ
- Port-Target-LUN

Example

```
******************************** ENTRY 1604 ********************************


Logging OS                          2. Digital UNIX
System Architecture                 2. Alpha
Event sequence number              17.
Timestamp of occurrence                24-JAN-1996 17:19:01
Host name                              tgonzo

System type register      x00000004  DEC 3000
Number of CPUs (mpnum)    x00000001
CPU logging event (mperr) x00000000

Event validity                      1. O/S claims event is valid
Event severity                      5. Low Priority
Entry type                        199. CAM SCSI Event Type


------- Unit Info -------
Bus Number                          2.
Unit Number                     x0090  Target =   2.
                                       LUN =   0.
------- CAM Data -------
Class                             x00  Disk
Subsystem                         x00  Disk
Number of Packets                  10.

------ Packet Type ------        258. Module Name String
```

```
Routine Name                          cdisk_check_sense

------ Packet Type ------       256. Generic String

                                     Event - Unit Attention

------ Packet Type ------       261. Soft Error String

Error Type                           Soft Error Detected (recovered)

------ Packet Type ------       257. Device Name String

Device Name                          DEC     HSZ4

------ Packet Type ------       256. Generic String

                                     Active CCB at time of error

------ Packet Type ------       256. Generic String

                                     CCB request completed with an error

------ Packet Type ------         1. SCSI I/O Request CCB(CCB_SCSIIO)
Packet Revision                  37.

CCB Address               xFFFFFC0004F83B28
CCB Length                    x00C0
XPT Function Code               x01  Execute requested SCSI I/O
Cam Status                      x84  CCB Request Completed WITH Error
                                     Autosense Data Valid for Target
Path ID                           2.
Target ID                         2.
Target LUN                        0.
Cam Flags                 x00000442  SIM Queue Actions are Enabled
                                     Data Direction (01: DATA IN)
                                     Disable the SIM Queue Frozen State
*pdrv_ptr                 xFFFFFC0004F83828
*next_ccb                 x0000000000000000
*req_map                  xFFFFFC0007F8C200
void (*cam_cbfcnp)()      xFFFFFC00004AC8A0
*data_ptr                 x00000000000F0008
Data Transfer Length          65536.
*sense_ptr                xFFFFFC0004F83850
Auotsense Byte Length           160.
CDB Length                        6.
Scatter/Gather Entry Cnt          0.
SCSI Status                     x02  Check Condition
```

```
Autosense Residue Length        x00
Transfer Residue Length   x00010000
(CDB) Command & Data Buf

          15--<-12  11--<-08  07--<-04  03--<-00   :Byte Order
 0000:              00000000  00000080  80160508   *    ............*

Timeout Value             x0000003C
*msg_ptr                  x0000000000000000
Message Length                   0.
Vendor Unique Flags           x4000
Tag Queue Actions               x20  Tag for Simple Queue

------ Packet Type ------       256. Generic String

                                     Error, exception, or abnormal condition

------ Packet Type ------       256. Generic String

                                     UNIT ATTENTION - Medium changed or target
                                     reset

------ Packet Type ------       768. SCSI Sense Data
Packet Revision                  0.

------- HSZ Data -------
Instance, Code             x03F40064  Device services had to reset the port to
                                      clear a bad condition. Note that in this
                                      instance, the Associated Target, Associated
                                      ASC, and Associated ASCQ fields are
                                      undefined.

                                     Component ID =   Device Services.
                                     Event Number =   x000000F4
                                     Repair Action =   x00000000
                                     NR Threshold =   x00000064
Template Type                   x41  Device Services Non-Transfer Error.
Template Flags                  x00  HCE =   0, Event did not occur during Host
                                             Command Execution.
Ctrl Serial #                              ZG41800293
Ctrl Software Revision               W15Z
RAIDSET State                   x00  NORMAL. All members present and
                                     reconstructed, IF LUN is configured as a
                                     RAIDSET.

Error Code                      x70  Current Error
Sense Key                       x06  Unit Attention
```

ASC & ASCQ	**xD203**	**ASC = x00D2** **ASCQ = x0003** **Device services had to reset the bus.**
Associated Port	**x03**	
Associated Target	**x03**	
Associated ASC	x00	
Associated ASCQ	x00	

Using FMU to describe event log codes

FMU has a DESCRIBE function you can use to interpret event codes produced by the controller. Use this function to understand events that have occurred in the subsystem (instance, codes) and to find the recommended repair action (repair action codes), as well as to interpret other codes.

The types of codes FMU can describe are:

- INSTANCE,_CODE
- REPAIR_ACTION_CODE
- LAST_FAILURE_CODE
- ASC_ASCQ_CODE
- COMPONENT_CODE
- CONTROLLER_UNIQUE_ASC_ASCQ_CODE
- DEVICE_TYPE_CODE
- EVENT_THRESHOLD_CODE
- RESTART_TYPE
- SCSI_COMMAND_OPERATION_CODE
- SENSE_DATA_QUALIFIERS
- SENSE_KEY_CODE
- TEMPLATE_CODE

To translate a code:

1. Start FMU from the CLI:

   ```
   CLI> RUN FMU
   ```

2. Use the correct DESCRIBE command and give it the code number you want translated.

```
FMU> DESCRIBE code-type code-number [additional
numbers]
```

Following is an example of how to use the describe command and a sample display:

```
CLI> RUN FMU

Fault Management Utility

FMU> DESCRIBE INSTANCE,_CODE 030C4002

Instance, Code: 030C4002 Description:

A Drive failed because a Test Unit Ready command or a
Read Capacity command failed.

Reporting Component: 3.(03) Description:

Device Services

Reporting component's event number: 12.(0C)

Event Threshold: 2.(02) Classification:

HARD. Failure of a component that affects controller
performance or precludes access to a device connected
to the controller is indicated.

FMU> DESCRIBE REPAIR_ACTION_CODE 22

Recommended Repair Action Code: 34.(22) Description:

Replace the indicated cache module.
```

If you are not sure what value to enter with the DESCRIBE command, enter a question mark (?) in place of a parameter to see the value and range required. For those code types that require multiple values, you must supply values for the earlier parameters before entering a question mark for the later values.

Example

```
FMU> DESCRIBE ASC_ASCQ_CODE ?
Your options are:
   ASC value (range: 0 through FF hexadecimal)
FMU> DESCRIBE ASC_ASCQ_CODE 0 ?
Your options are:
   ASCQ value (range: 0 through FF hexadecimal)
FMU> DESCRIBE ASC_ASCQ_CODE 0 0 ?
Your options are:
   SCSI Device Type value (range: 0 through FF
```

```
hexadecimal)
FMU>
```

Using FMU to Describe Recent Last Fail or Memory System Failure Codes

HSZ controllers store the four most recent last failure codes and memory system failure codes. You can use the FMU utility to retrieve these codes and their descriptions.

Use the following procedure to view a last failure or memory system failure code:

1. Start FMU from the CLI:

   ```
   CLI> RUN FMU
   ```

2. To see all of the stored last failure or memory system failure events:

   ```
   FMU> DESCRIBE LAST_FAILURE ALL
   ```

   or

   ```
   FMU> DESCRIBE MEMORY_SYSTEM_FAILURE ALL
   ```

3. To see the most recent last failure or memory system failure events:

   ```
   FMU> DESCRIBE LAST_FAILURE MOST_RECENT
   ```

   or

   ```
   FMU> DESCRIBE MEMORY_SYSTEM_FAILURE MOST_RECENT
   ```

4. To see one of the four stored last failure or memory system failure events:

   ```
   FMU> DESCRIBE LAST_FAILURE n
   ```

   or

   ```
   FMU> DESCRIBE MEMORY_SYSTEM_FAILURE n
   ```

   where *n* is the stored event number from 1-4.

Example

```
CLI> RUN FMU

Fault Management Utility

FMU> SHOW LAST_FAILURE MOST_RECENT

Last Failure Entry: 1. Flags: 000FF301
 Template: 1.(01) Description: Last Failure Event
 Occurred on 07-DEC-1995 at 09:21:44
 Controller Model: HSZ50
 Serial Number: ZG51909900 Hardware Version: 0000(00)
 Controller Identifier:
 Unique Device Number: 01519090 Model: 40.(28) Class: 1.(01)
 Firmware Version: W18J(FF)
 Node Name: "HSZA3" CI Node Number: 12.(0C)
 Informational Report
 Instance, Code: 01010302 Description:
  An unrecoverable hardware detected fault occurred.
 Reporting Component: 1.(01) Description:
  Executive Services
 Reporting component's event number: 1.(01)
 Event Threshold: 2.(02) Classification:
  HARD. Failure of a component that affects controller
  performance or precludes access to a device connected to
  the controller is indicated.
 Last Failure Code: 018800A0 (No Last Failure Parameters)
 Last Failure Code: 018800A0 Description:
  A processor interrupt was generated with an indication
  that the program card was removed.
 Reporting Component: 1.(01) Description:
  Executive Services
 Reporting component's event number: 136.(88)
 Restart Type: 2.(02) Description: Automatic hardware
restart
```

Testing disks (DILX)

HSZ-series controllers have a Disk In-line Exerciser (DILX) that you can use to test suspect disks. When you run DILX, you can specify many parameters for the test, such as starting and ending block numbers, the duration of the test, and whether the test should be read-only or read/write.

Note

DILX places a heavy load on the controllers. You should stop normal I/O operations before running DILX, or run DILX during periods of low activity.

DILX can test several disks at the same time. Before starting DILX, you must configure the disks you want to test as single-disk units. In other words, the disks cannot be part of any storageset, and they must have a unit number assigned.

There are four tests you can run with DILX: a quick disk test, an initial test on all disks, a basic function test, and an advanced user-defined test.

Running a quick disk test

This section provides instructions on how to run a quick DILX test on one or more disks. This is a 10-minute read-only test that uses the default DILX settings.

1. Start DILX from the CLI prompt:

   ```
   CLI> RUN DILX
   ```

2. Skip the auto-configure option so you can specify which disk drives to test:

   ```
   Do you wish to perform an Auto-configure (y/n) ? n
   ```

3. Accept the default settings:

   ```
   Use all defaults and run in read only mode (y/n)? y
   ```

4. The system displays a list of all single-disk units (by unit number) you can choose for DILX testing. Select the first disk that you want to test. Do not include the letter "D" in the unit number:

   ```
   Enter unit number to be tested? 350
   ```

5. DILX indicates whether it has been able to allocate the disk. If you want to test more disks, enter the unit numbers when prompted. Otherwise, enter n to start the test:

   ```
   Select another unit (y/n) [n] n

   DILX testing started at <date> <time>
   Test will run for 10 minutes
   ```

6. DILX will run for 10 minutes and then display the results of the testing. If you want to interrupt the test early:

   - Enter ^G (CTRL G) to get a performance summary without stopping the test (^T if you are running DILX through VCS).
   - Enter ^C (CTRL C) to terminate the current DILX test.
   - Enter ^Y (CTRL Y) to terminate the current test and exit DILX.

Running an initial test on all disks

Caution

The initial test performs write operations. Make sure that the disks that you use do not contain customer data.

This section provides instructions on how to run a DILX test on all single-disk units in the subsystem. This is a read/write basic function test that uses the default DILX settings. The test performs an initial write pass, followed by a repeating 10-minute cycle consisting of 8 minutes of random I/O and 2 minutes of data-intensive transfers. You can set the duration of the test.

1. Start DILX from the CLI prompt:

```
CLI> RUN DILX
```

2. Choose the auto-configure option to test all single-disk units:

```
Do you wish to perform an Auto-configure (y/n) [n]?
y
```

3. Choose option 1 (test all disks) if you have a single-controller system; choose option 2 (test half of the disks) if you have a dual-redundant controller system:

```
Enter auto-configure option (1:3) [3]? 1
```

4. DILX displays a warning indicating that data on the disks will be destroyed. Either exit the test, or enter y to continue.

```
All data on the Auto-Configured disks will be
destroyed.
You *MUST* be sure of yourself.
Are you sure you want to continue (y/n) [n]? y
```

5. Enter the amount of time that you want the test to run. A single complete pass takes 10 minutes (after the initial write pass).

```
Enter execution time limit in minutes (1:65535)
[60] ? 25
```

6. If you want to see performance summaries while DILX is running, specify how often DILX should display the summaries:

```
Enter performance summary interval in minutes
(1:65535) [60] ? 5
```

7. The usual DILX summary simply indicates whether it detected any errors on each unit. Additionally, you can choose to see statistics on how many read and write operations were performed during the test.

```
Include performance statistics in performance
summary (y/n) [n] y
```

8. DILX displays a list of the units that it is able to test and begins the initial write pass and test.

```
DILX testing started at <date> <time>
Test will run for <nn> minutes
```

9. DILX will run for the amount of time that you selected and then display the results of the testing. If you want to interrupt the test early:
   - Enter ^G (CTRL G) to get a current performance summary without stopping the test (^T if you are running DILX through VCS).
   - Enter ^C (CTRL C) to terminate the current DILX test.
   - Enter ^Y (CTRL Y) to terminate the current test and exit DILX.

Running a disk basic function test

This section provides instructions on how to run a DILX basic function test on one or more disks. The test performs an optional initial write pass, followed by a repeating 10-minute cycle consisting of 8 minutes of random I/O and 2 minutes of data-intensive transfers. You can set the percentage of the test that will be read operations, the data pattern to use for write command, and other parameters.

1. Start DILX from the CLI prompt:

```
CLI> RUN DILX
```

2. Skip the auto-configure option to get to the basic function test:

```
Do you wish to perform an Auto-configure (y/n) ? n
```

3. Do not accept the default settings:

```
Use all defaults and run in read only mode (y/n)? n
```

4. Enter the amount of time that you want the test to run. A single complete pass takes 10 minutes (after the initial write pass).

```
Enter execution time limit in minutes (1:65535)
[60] ? 25
```

5. If you want to see performance summaries while DILX is running, specify how often DILX should display the summaries.

```
Enter performance summary interval in minutes
(1:65535) [60] ? 5
```

6. The usual DILX summary simply indicates whether it detected any errors on each unit. Additionally, you can choose to see statistics on how many read and write operations were performed during the test.

```
Include performance statistics in performance
summary (y/n) [n] y
```

7. DILX asks if you want hard and soft errors (sense data and deferred errors) displayed. If you do, answer **y** and respond to the rest of the questions. If you do not want to see the errors displayed, answer **n** and proceed to the next step:

```
Display hard/soft errors? y

Display hex dump of Error Information Packet
Requester Specific information (y/n) [n] ? y

When the hard error limit is reached, the unit will
be dropped from testing.  Enter hard error limit
(1:65535) [65535] ? 100

When the soft error limit is reached, soft errors
will no longer be displayed but testing will
```

```
continue for the unit.  Enter soft error limit
(1:65535) [32] ? 32
```

8. Set the maximum number of outstanding I/Os for each unit:

```
Set the I/O queue depth (1:12) [4] ? 9
```

9. Select to run the basic function test:

```
*** Available tests are:
    1. Basic Function
    2. User Defined

Use the Basic Function test 99.9% of the time. The
User Defined test is for special problems only.

Enter test number (1:2) [1] ? 1
```

Caution

If you choose to write-enable disks during the test, make sure that the disks do not contain customer data.

10. Set the test as read-only or read/write:

```
Write enable disk unit(s) to be tested (y/n) [n]? y
```

11. Set the percentage of requests that will be read requests during the random I/O phase. The remaining requests will be write requests.

```
Enter read percentage for Random IO and Data
Intensive phase (0:100) [67] ? 80
```

12. If you set the test to allow write operations, specify the data pattern to be used for the writes. Unless you have some specific requirement, select 0 to use all patterns. See Table 3 for a listing of available patterns.

```
Enter data pattern number 0=ALL, 19=USER_DEFINED,
(0:19) [0] ? 0
```

13. If you set the test to allow write operations and you want to test data integrity, enable or disable the initial write pass. The initial write pass writes the selected data patterns to the entire specified data space. This allows

the data to be verified later, but it may take a long time to complete the write operation.

```
Perform initial write (y/n) [n] ? y
```

14. During the data intensive phase, DILX only executes access and erase commands. Set the percentage of commands that will be access commands; the remaining commands will be erase commands.

```
The erase percentage will be set automatically.
Enter access percentage for Seek Intensive phase
(0:100) [90] ?
```

15. If you enabled the initial write pass and want to test data integrity, set the percentage of read and write commands that will have a data compare operation performed.

```
Perform data compare (y/n) [n] ? y
Enter compare percentage (1:100) [5] ? 10
```

16. The system displays a list of all single-disk units (by unit number) you can choose for DILX testing. Select the first disk that you want to test. Do not include the letter "D" in the unit number.

```
Enter unit number to be tested? 350
```

17. DILX indicates whether it has been able to allocate the disk. If you enabled the read/write test, DILX gives you a final warning that the data on the disk will be destroyed.

```
Unit 350 will be write enabled.
Do you still wish to add this unit (y/n) [n] ? y
```

18. If you want to test more disks, enter the unit numbers when prompted. Otherwise, enter **n** to start the test.

```
Select another unit (y/n) [n] n
```

```
DILX testing started at <date> <time>
Test will run for <nn> minutes
```

19. DILX will run for the amount of time you selected and then display the results of the testing. If you want to interrupt the test early:
    - Enter ^G (CTRL G) to get a performance summary without stopping the test (^T if you are running DILX through VCS).
    - Enter ^C (CTRL C)to terminate the current DILX test.
    - Enter ^Y (CTRL Y)to terminate the current test and exit DILX.

Running an advanced disk test

This section provides instructions on how to run an advanced DILX test in which you define the commands that make up the test (read, write, access, and so on). Only select this test if you are very knowledgeable about disk testing. You should use the basic function test in almost all situations.

1. Start DILX from the CLI prompt:

   ```
   CLI> RUN DILX
   ```

2. Skip the auto-configure option to get to the user-defined test:

   ```
   Do you wish to perform an Auto-configure (y/n) ? n
   ```

3. Do not accept the default settings:

   ```
   Use all defaults and run in read only mode (y/n)? n
   ```

4. Enter the amount of time that you want the test to run. A single complete pass takes 10 minutes (after the initial write pass).

```
Enter execution time limit in minutes (1:65535)
[60] ? 25
```

5. If you want to see performance summaries while DILX is running, specify how often DILX should display the summaries:

```
Enter performance summary interval in minutes
(1:65535) [60] ? 5
```

6. The usual DILX summary simply indicates whether it detected any errors on each unit. Additionally, you can choose to see statistics on how many read and write operations were performed during the test.

```
Include performance statistics in performance
summary (y/n) [n] y
```

7. DILX asks if you want hard and soft errors (sense data and deferred errors) displayed. If you do, answer **y** and respond to the rest of the questions. If you do not want to see the errors displayed, answer **n** and proceed to the next step.

```
Display hard/soft errors? y

Display hex dump of Error Information Packet
Requester Specific information (y/n) [n] ? y

When the hard error limit is reached, the unit will
be dropped from testing.  Enter hard error limit
(1:65535) [65535] ? 100

When the soft error limit is reached, soft errors
will no longer be displayed but testing will
continue for the unit.  Enter soft error limit
(1:65535) [32] ? 32
```

8. Set the maximum number of outstanding I/Os for each unit:

```
Set the I/O queue depth (1:12) [4] ? 9
```

9. Select to run the user-defined test:

```
*** Available tests are:
    1. Basic Function
    2. User Defined

Use the Basic Function test 99.9% of the time. The
User Defined test is for special problems only.

Enter test number (1:2) [1] ? 2
```

Caution

If you define write or erase commands, user data will be destroyed.

10. Define the test sequence by entering command number 1 and its associated parameters. You may define up to 20 commands, and they will be executed in the order in which you enter them.

```
Enter command number 1 (read, write, access, erase,
quit) [] ? read
Enter starting lbn for this command ? 0
Enter the IO size in 512 byte blocks for this
command (1:128) [] ? 20
Enter in HEX, the MSCP Command Modifiers[0] ? 0
```

11. Repeat Step 10 until you have defined the entire command sequence (up to 20). When you have finished enter **QUIT**.

12. The system displays a list of all single-disk units (by unit number) that you can choose for DILX testing. Select the first disk that you want to test. Do not include the letter "D" in the unit number:

```
Enter unit number to be tested? 350
```

13. DILX indicates whether it has been able to allocate the disk. If you enabled the read/write test, DILX gives you a final warning that the data on the disk will be destroyed.

```
Unit 350 will be write enabled.
Do you still wish to add this unit (y/n) [n] ? y
```

14. If you want to test more disks, enter the unit numbers when prompted. Otherwise, enter n to start the test:

```
Select another unit (y/n) [n] n

DILX testing started at <date> <time>
Test will run for <nn> minutes
```

15. DILX will run for the amount of time that you selected and then display the results of the testing. If you want to interrupt the test early:

    - Enter ^G (CTRL G) to get a performance summary without stopping the test (^T if you are running DILX through VCS).
    - Enter ^C (CTRL C) to terminate the current DILX test.
    - Enter ^Y (CTRL Y) to terminate the current test and exit DILX.

DILX error codes

If DILX detects an error, the performance display for the unit includes:

- The controller instance, code (IC)
- The device PTL location (PTL)
- The SCSI sense key (Key)
- The ASC and ASCQ codes (ASC/Q)
- The number of hard and soft errors (HC/SC)

In addition, you will see the following message:

```
DILX detected error, code x.
```

where x is 1, 2, 3, or 4. The meanings of the codes are:

Message:
```
CODE 1: Illegal Data Pattern Number found in data pattern
header.  Unit x
```

Explanation:
DILX read data from the disk and found the data was not in a pattern that DILX previously wrote to the disk.

Message:
```
CODE 2: No write buffers correspond to data pattern Unit x.
```

Explanation:
DILX read a legal data pattern from the disk at a place where DILX wrote to the disk, but DILX does not have any write buffers that correspond to the data pattern. Thus, the data has been corrupted.

Message:
```
CODE 3: Read data do not match what DILX thought was
written to the  media.  Unit x.
```

Explanation:
DILX writes data to the disk and then reads it and compares it against what was written to the disk. This indicates a compare failure. More information is displayed to indicate where in the data buffer the compare operation failed and what the data was and should have been.

Message:
```
CODE 4: Compare Host Data should have reported a compare
error but did not.  Unit x
```

Explanation:
A compare host data compare was issued in a way that DILX expected to receive a compare error but no error was received.

DILX data patterns

Table 3 defines the data patterns used with the DILX Basic Function or User-Defined tests. There are 18 unique data patterns. These data patterns were selected as worst case, or the ones most likely to produce errors on disks connected to the controller.

Table 3
DILX data patterns

Pattern Number	Pattern in Hexadecimal Numbers
1	0000
2	8B8B
3	3333
4	3091
5, shifting 1s	0001, 0003, 0007, 000F, 001F, 003F, 007F, 00FF, 01FF, 03FF, 07FF, 0FFF, 1FFF, 3FFF, 7FFF
6, shifting 0s	FIE, FFFC, FFFC, FFFC, FFE0, FFE0, FFE0, FFE0, FE00, FC00, F800, F000, F000, C000, 8000, 0000
7, alternating 1s, 0s	0000, 0000, 0000, FFFF, FFFF, FFFF, 0000, 0000, FFFF, FFFF, 0000, FFFF, 0000, FFFF, 0000, FFFF
8	B6D9
9	5555, 5555, 5555, AAAA, AAAA, AAAA, 5555, 5555, AAAA, AAAA, 5555, AAAA, 5555, AAAA, 5555, AAAA, 5555
10	DB6C
11	2D2D, 2D2D, 2D2D, D2D2, D2D2, D2D2, 2D2D, 2D2D, D2D2, D2D2, 2D2D, D2D2, 2D2D, D2D2, 2D2D, D2D2
12	6DB6
13, ripple 1	0001, 0002, 0004, 0008, 0010, 0020, 0040, 0080, 0100, 0200, 0400, 0800, 1000, 2000, 4000, 8000
14, ripple 0	FIE, FFFD, FFFB, FFF7, FFEF, FFDF, FFBF, FF7F, FEFF, FDFF, FBFF, F7FF, EFFF, BFFF, DFFF, 7FFF
15	DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D, B6DB, 6DB6, DB6D
16	3333, 3333, 3333, 1999, 9999, 9999, B6D9, B6D9, B6D9, B6D9, FFFF, FFFF, 0000, 0000, DB6C, DB6C
17	9999, 1999, 699C, E99C, 9921, 9921, 1921, 699C, 699C, 0747, 0747, 0747, 699C, E99C, 9999, 9999
18	FFFF
Default—Use all of the above patterns in a random method	

Monitoring system performance with the VTDPY utility

The VTDPY utility gathers and displays system state and performance information for the HS family of modular storage controllers. The information displayed includes processor utilization, host port activity and status, device state, logical unit state, and cache and I/O performance.

The VTDPY utility requires a video terminal that supports **ANSI** control sequences, such as a VT220, VT320, or VT420 terminal. A graphics display that provides emulation of an ANSI-compatible video terminal also can be used. For DSSI and CI based HS controllers, VTDPY can be run on terminals either directly connected to the HS controller or on terminals connected through a host-based DUP connection. For SCSI based HS controllers, VTDPY can be run only on terminals connected to the HS controller maintenance terminal port. Note that VCS can be used only from a terminal attached to the terminal port on the front bezel of the HS array controller.

The following sections show how to use the VTDPY utility.

How to Run VTDPY

You can run only one VTDPY session on each controller at one time. Prior to running VTDPY, set the terminal to NOWRAP mode to prevent the top line of the display from scrolling off of the screen.

To initiate VTDPY from a maintenance terminal at the CLI> prompt, enter the following command:

```
CLI> RUN VTDPY
```

Using the VTDPY Control Keys

Use the following control key sequences with the VTDPY display:

Table 4
VTDPY control keys

Control Key Sequence	Function
Ctrl/C	Prompts for commands.
Ctrl/G	Updates the screen (same as Ctrl/Z).
Ctrl/O	Pauses or resumes screen updates.
Ctrl/R	Refreshes current screen display (same as Ctrl/W).
Ctrl/W	Refreshes current screen display (same as Ctrl/R).
Ctrl/Y	Terminates VTDPY and resets screen characteristics.
Ctrl/Z	Updates the screen (same as Ctrl/G).

While VTDPY and a maintenance terminal interface support passing all of the listed control characters, some host-based terminal interfaces restrict passing some of the characters. All of the listed characters have equivalent text string commands, defined in Table 5.

Using the VTDPY Command Line

VTDPY contains a command line interpreter that you can invoke by entering Ctrl/C any time after starting the program. The command line interpreter is used to modify the characteristics of the VTDPY display. The following table lists the VTDPY commands.

Table 5
VTDPY commands

Command String	Function
DISPLAY CACHE	Use 132 column unit caching statistics display.
DISPLAY DEFAULT	Use default 132 column system performance display.
DISPLAY DEVICE	Use 132 column device performance display.
DISPLAY STATUS	Use 80 column controller status display.
EXIT	Terminates program (same as QUIT).
INTERVAL <seconds>	Changes update interval.
HELP	Displays help message text.

Command String	Function
REFRESH	Refreshes the current display.
QUIT	Terminates program (same as EXIT).
UPDATE	Updates screen display.

The keywords in the command strings can be abbreviated to the minimum number of characters necessary to uniquely identify the keyword. Entering a question mark (?) after a keyword causes the parser to provide a list of keywords or values that can follow the supplied keyword. The command line interpreter is not case sensitive, so keywords can be entered in uppercase, lowercase, or mixed case.

Upon successful execution of a command other than HELP, the command line interpreter is exited and the display is resumed. Entering a carriage return without a command also exits the command line interpreter and resumes the display. If an error occurs in the command, the user prompts for command expansion help, or the HELP command is entered, the command line interpreter prompts for an additional command instead of returning to the display.

How to Interpret the VTDPY Display Fields

This section contains descriptions of the major fields in a VTDPY display.

SCSI Host port Characteristics

```
Xfer Rate
T❶W❷I❸Mhz❹
1 W 7 10.00
2 W Async❺
```

Description

This subdisplay shows the current host port SCSI target identification, any initiator that has negotiated synchronous transfers, and the negotiated transfer method currently in use between the controller and the initiators. This subdisplay is available only for SCSI based HS controllers.

1. ❶SCSI host port target ID.
2. ❷Transfer width. **W** indicates 16 bit or wide transfers are being used. A space indicates 8 bit transfers are being used.
3. ❸The initiator with which synchronous communication has been negotiated.
4. ❹A numeric value indicates the synchronous data rate which has been negotiated with the initiator at the specified SCSI ID. The value is listed in megahertz (Mhz). In this example, the negotiated synchronous transfer rate is approximately 3.57 Mhz. To convert this number to the nanosecond period, invert and multiply by 1000. The period for this is approximately 280 nanoseconds.

   If the field is still Async, this might indicate a failure to establish communication between host adapter and HSZ. The problem could be one of the following:

   - Host port
   - SCSI bus configuration
   - SCSI termination
   - SCSI cables

– HSZ

5. ❺**Async** indicates communication between this target and all initiators is being done in asynchronous mode. This is the default communication mode and is used unless the initiator successfully negotiates for synchronous communications. If there is no communication with a given target ID, the communication mode is listed as asynchronous.

Device SCSI Status

```
Target
  01234567 ❶
P1 DDDDFhH ❷
o2TTT T hH
r3DDD   hH
t4DDDDDDhH
 5DDDD  hH
 6      hH❸
```

Description

This display shows what devices the controller has been able to identify on the device busses.

The controller does not look for devices that have not been configured into the nonvolatile memory using the CLI ADD command.

1. ❶The column headings indicate the SCSI target numbers for the devices. SCSI targets are in the range 0 through 7. Target 7 is always used by a controller. In a dual controller configuration, target 6 is used by the second controller.

2. ❷The device grid contains a letter signifying the device type in each port/target location where a device has been found:

   - **D** indicates a disk device or CD-ROM device.
   - **F** indicates a device type not listed above.
   - **H** indicates bus position of this controller.
   - **h** indicates bus position of the other controller.
   - **P** indicates pass-through device support (i.e., tape or media loader).
   - **A** period (.) indicates the device type is unknown.
   - A space indicates there is no device configured at this location.

3. ❸This subdisplay contains a row for each SCSI device port supported by the controller. The subdisplay for a controller that has six SCSI device ports is shown.

Unit Status (abbreviated)

```
Unit❶ ASWC❷ KB/S❸ Rd%❹ Wr%❺ Cm%❻ HT%❼
D0000  a^ r      0     0     0     0     0
D0002  a^ r      0     0     0     0     0
D0004  o^ r    236   100     0     0   100
P0220  av        0     0     0     0     0
```

Description

This subdisplay shows the status of the logical units that are known to the controller firmware. It also indicates performance information for the units. Up to 42 units can be displayed in this subdisplay.

1. ❶The **Unit** column contains a letter indicating the type of unit followed by the unit number of the logical unit. The list is sorted by unit number. There may be duplication of unit numbers between devices of different types. If this happens, the order of these devices is arbitrary. The following device type letters may appear:
   - **D** indicates a disk device or a CD-ROM device.
   - **F** indicates a device type not listed above.
   - **U** indicates the device type is unknown.
2. ❷The **ASWC** columns indicate respectively the availability, spindle state, write protect state, and cache state of the logical unit.

   For HSZ controllers, online in this column means that the unit is online to the HSZ controller only. It does not indicate that the unit is mounted by the host.

   The availability state is indicated using the following letters:

   - **a**—Available. The available state indicates a problem. HSZ units will show online if a problem does not exist.

- **d**—Offline, Disabled by Digital Multivendor Customer Services. The unit has been disabled for service.
- **e**—Online, Exclusive Access. Unit has been reserved by the host.
- **f**—Offline, Media Format Error. The unit cannot be brought available due to a media format inconsistency.
- **i**—Offline, Inoperative. The unit is inoperative and cannot be brought available by the controller.
- **m**—Offline, Maintenance. The unit has been placed in maintenance mode for diagnostic or other purposes.
- **o**—Online. Mounted by at least one of the host systems. For HSZ controllers, online in this column means that the unit is online to the HSZ controller only. It does not indicate that the unit is mounted by the host.
- **r**—Offline, Rundown. The CLI SET NORUN command has been issued for this unit.
- **v**—Offline, No Volume Mounted. The device does not contain media.
- **x**—Online to other controller. Not available for use by this controller.
- A space in this column indicates the availability is unknown.

The spindle state is indicated using the following characters:

- **^**—For disks, this symbol indicates the device is at speed. For tapes, it indicates the tape is loaded.
- **>**—For disks, this symbol indicates the device is spinning up. For tapes, it indicates the tape is loading.

- **<**—For disks, this symbol indicates the device is spinning down. For tapes, it indicates the tape is unloading.
- **v**—For disks, this symbol indicates the device is stopped. For tapes, it indicates the tape is unloaded.
- For other types of devices, this column is left blank.

For disks and tapes, a **w** in the write protect column indicates the unit is write protected. This column is left blank for other device types.

The data caching state is indicated using the following letters:

- **b**—Both Read caching and Write-Back caching are enabled.
- **r**—Read caching is enabled.
- **w**—Write-Back caching is enabled.
- A space in this column indicates caching is disabled.

3. **❸KB/S**—This column indicates the average amount of kilobytes of data transferred to and from the unit in the previous screen update interval. This data is available only for disk and tape units.
4. **❹Rd%**—This column indicates what percentage of data transferred between the host and the unit were read from the unit. This data is contained only in the **DEFAULT** display for disk and tape device types.
5. **❺Wr%**—This column indicates what percentage of data transferred between the host and the unit were written to the unit. This data is contained only in the **DEFAULT** display for disk and tape device types.
6. **❻Cm%**—This column indicates what percentage of data transferred between the host and the unit were compared. A compare operation can be accompanied by

either a read or a write operation, so this column is not cumulative with read percentage and write percentage columns. This data is contained only in the **DEFAULT** display for disk and tape device types.

7. ❼**HT%**—This column indicates the cache hit percentage for data transferred between the host and the unit.

Unit Status (full)

Unit❶	ASWC❷	KB/S❸	Rd%❹	Wr%❺	Cm%❻	HT%❼	PH%❽	MS%❾	Purge❿	BlChd⓫	BlHit⓬	
D0000	o^ r	382	0	100	0	0	0	0	0	6880		0
D0002	o^ r	382	100	0	0	0	0	100	0	6880		0
D0003	o^ r	284	100	0	0	0	0	100	0	5120		0
D0005	a^ r	0	0	0	0	0	0	0	0	0		0
D0201	o^ r	497	44	55	0	0	0	100	0	9011		0
D0202	a^ r	0	0	0	0	0	0	0	0	0		0
D0300	a^ r	0	0	0	0	0	0	0	0	0		0
D0301	a^ r	0	0	0	0	0	0	0	0	0		0

Description

This subdisplay shows the status of the logical units that are known to the controller firmware. It also shows I/O performance information and caching statistics for the units. Up to 42 units can be displayed in this subdisplay.

1. ❶The **Unit** column contains a letter indicating the type of unit followed by the unit number of the logical unit. The list is sorted by unit number. There may be duplication of unit numbers between devices of different types. If this happens, the order of these devices is arbitrary. The following device type letters may appear:
   - **D** indicates a disk device or CD-ROM device.
   - **F** indicates a device type not listed above.
   - **P** indicates passthrough device support (i.e., tape or medial loader).
   - **U** indicates the device type is unknown.
2. ❷The **ASWC** columns indicate the availability, spindle state, write protect state, and cache state respectively of the logical unit.

   For HSZ controllers, online in this column means that the unit is online to the HSZ controller only. It does not indicate that the unit is mounted by the host.

The availability state is indicated using the following letters:

- **a**—Available. Available to be mounted by a host system.
- **d**—Offline, Disabled by Digital Multivendor Customer Services. The unit has been disabled for service.
- **e**—Online, Exclusive Access. Unit has been mounted for exclusive access by a user.
- **f**—Offline, Media Format Error. The unit cannot be brought available due to a media format inconsistency.
- **i**—Offline, Inoperative. The unit is inoperative and cannot be brought available by the controller.
- **m**—Offline, Maintenance. The unit has been placed in maintenance mode for diagnostic or other purposes.
- **o**—Online. Mounted by at least one of the host systems. For

  HSZ controllers, online in this column means that the unit is online to the HSZ controller only. It does not indicate that the unit is mounted by the host.
- **r**—Offline, Rundown. The CLI SET NORUN command has been issued for this unit.
- **v**—Offline, No Volume Mounted. The device does not contain media.
- **x**—Online to other controller. Not available for use by this controller.
- A space in this column indicates the availability is unknown.

The spindle state is indicated using the following characters:

- **^**—For disks, this symbol indicates the device is at speed. For tapes, it indicates the tape is loaded.
- **>**—For disks, this symbol indicates the device is spinning up. For tapes, it indicates the tape is loading.
- **<**—For disks, this symbol indicates the device is spinning down. For tapes, it indicates the tape is unloading.
- **v**—For disks, this symbol indicates the device is stopped. For tapes, it indicates the tape is unloaded.

For other types of devices, this column is left blank.

For disks and tapes, a **w** in the write protect column indicates the unit is write protected. This column is left blank for other device types.

The data caching state is indicated using the following letters:

- **b**—Both Read caching and Write Back caching are enabled.
- **r**—Read caching is enabled.
- **w**—Write Back caching is enabled.
- A space in this column indicates caching is disabled.

3. **❸KB/S**—This column indicates the average amount of kilobytes of data transferred to and from the unit in the previous screen update interval. This data is only available for disk and tape units.
4. **❹Rd%**—This column indicates what percentage of data transferred between the host and the unit were read from the unit. This data is only contained in the **DEFAULT** display for disk and tape device types.
5. **❺Wr%**—This column indicates what percentage of data transferred between the host and the unit were written

to the unit. This data is only contained in the **DEFAULT** display for disk and tape device types.

6. ❻**Cm%**—This column indicates what percentage of data transferred between the host and the unit were compared. A compare operation may be accompanied by either a read or a write operation, so this column is not cumulative with read percentage and write percentage columns. This data is only contained in the **DEFAULT** display for disk and tape device types.

7. ❼**HT%**—This column indicates the cache hit percentage for data transferred between the host and the unit.

8. ❽**PH%**—This column indicates the partial cache hit percentage for data transferred between the host and the unit.

9. ❾**MS%**—This column indicates the cache miss percentage for data transferred between the host and the unit.

10. ❿**Purge**—This column shows the number of blocks purged from the write back cache in the last update interval.

11. ➂**BlChd**—This column shows the number of blocks added to the cache in the last update interval.

12. ➇**BlHit**—This column shows the number of cached data blocks “hit” in the last update interval.

Device Status

PTL❶	ASWF❷	Rq/S❸	RdKB/S❹	WrKB/S❺	Que❻	Tg❼	CR❽	BR❾	TR❿
D100	A^	0	0	0	11	0	0	0	0
D120	A^	0	0	0	0	0	0	0	0
D140	A^	0	0	0	0	0	0	0	0
D210	A^	11	93	0	1	1	0	0	0
D230	A^	0	0	0	0	0	0	0	0
D300	A^	11	93	0	2	1	0	0	0
D310	A^	0	0	0	0	0	0	0	0
D320	A^	36	247	0	12	10	0	0	0
D400	A^	11	93	0	2	1	0	0	0
D410	A^	0	0	0	0	0	0	0	0
D420	A^	36	247	0	10	8	0	0	0
D430	A^	0	0	0	0	0	0	0	0
D440	A^	0	0	0	0	0	0	0	0
D450	A^	0	0	0	0	0	0	0	0
D500	A^	11	93	0	1	1	0	0	0
D510	A^	0	0	0	0	0	0	0	0
D520	A^	0	0	0	0	0	0	0	0
D530	A^	47	0	375	6	5	0	0	0

Description

This subdisplay shows the status of the physical storage devices that are known to the controller firmware. It also shows I/O performance information and bus statistics for these devices. Up to 42 devices can be displayed in this subdisplay.

1. ❶The **PTL** column contains a letter indicating the type of device followed by the SCSI Port, Target, and LUN of the device. The list is sorted by port, target, and LUN. The following device type letters may appear:
   - **D** indicates a disk device or CD-ROM device.
   - **P** indicates passthrough device support (i.e., tape or media loader).
   - **F** indicates a device type not listed above.
   - **U** indicates the device type is unknown.

2. ❷The **ASWF** columns indicate the allocation, spindle state, write protect state, and fault state respectively of the device.

   The availability state is indicated using the following letters:

   - **A**—Allocated to this controller.
   - **a**—Allocated to the other controller.
   - **U**—Unallocated, but owned by this controller.
   - **u**—Unallocated, but owned by the other controller.
   - A space in this column indicates the allocation is unknown.

   The spindle state is indicated using the following characters:

   - **^**—For disks, this symbol indicates the device is at speed. For tapes, it indicates the tape is loaded.
   - **>**—For disks, this symbol indicates the device is spinning up. For tapes, it indicates the tape is loading.
   - **<**—For disks, this symbol indicates the device is spinning down. For tapes, it indicates the tape is unloading.
   - **v**—For disks, this symbol indicates the device is stopped. For tapes, it indicates the tape is unloaded.
   - For other types of devices, this column is left blank.

   For disks and tapes, a **W** in the write protect column indicates the device is hardware write protected. This column is left blank for other device types.

   An **F** in the fault column indicates an unrecoverable device fault. If this field is set, the device fault indicator also is illuminated.

3. ❸**Rq/S**—This column shows the average I/O request rate for the device during the last update interval. These requests are up to eight kilobytes long and are either generated by host requests or cache flush activity.
4. ❹**RdKB/S**—This column shows the average data transfer rate from the device in kilobytes during the previous screen update interval.
5. ❺**WrKB/S**—This column shows the average data transfer rate to the device in kilobytes during the previous screen update interval.
6. ❻**Que**—This column shows the maximum number of transfer requests waiting to be transferred to the device during the last screen update interval.
7. ❼**Tg**—This column shows the maximum number of transfer requests queued to the device during the last screen update interval. If a device does not support tagged queuing, the maximum value is 1.
8. ❽**CR**—This column indicates the number of SCSI command resets that occurred since VTDPY was started.
9. ❾**BR**—This column indicates the number of SCSI bus resets that occurred since VTDPY was started.
10. ❿**TR**—This column indicates the number of SCSI target resets that occurred since VTDPY was started.

Device SCSI Port Performance

Port❶	Rq/S❷	RdKB/S❸	WrKB/S❹	CR❺	BR❻	TR❼
1	0	0	0	0	0	0
2	11	93	0	0	0	0
3	48	341	0	0	0	0
4	48	340	0	0	0	0
5	58	93	375	0	0	0
6	0	0	0	0	0	0

Description

This subdisplay shows the accumulated I/O performance values and bus statistics for the SCSI device ports. The subdisplay for a controller that has six SCSI device ports is shown.

1. ❶The **Port** column indicates the number of the SCSI device port.
2. ❷**Rq/S**—This column shows the average I/O request rate for the port during the last update interval. These requests are up to eight kilobytes long and are either generated by host requests or cache flush activity.
3. ❸**RdKB/S**—This column shows the average data transfer rate from all devices on the SCSI bus in kilobytes during the previous screen update interval.
4. ❹**WrKB/S**—This column shows the average data transfer rate to all devices on the SCSI bus in kilobytes during the previous screen update interval.
5. ❺**CR**—This column indicates the number of SCSI command resets that occurred since VTDPY was started.
6. ❻**BR**—This column indicates the number of SCSI bus resets that occurred since VTDPY was started.
7. ❼**TR**—This column indicates the number of SCSI target resets that occurred since VTDPY was started.

Help Example

```
VTDPY> HELP

Available VTDPY commands:

^C - Prompt for commands
^G or ^Z - Update screen
^O - Pause/Resume screen updates
^Y - Terminate program
^R or ^W - Refresh screen
DISPLAY CACHE - Use 132 column unit caching statistics
display
DISPLAY DEFAULT - Use default 132 column system performance
display
DISPLAY DEVICE - Use 132 column device performance display
DISPLAY STATUS - Use 80 column controller status display
EXIT - Terminate program (same as QUIT)
INTERVAL <seconds> - Change update interval
HELP - Display this help message
REFRESH - Refresh the current display
QUIT - Terminate program (same as EXIT)
UPDATE - Update screen display

VTDPY>
```

Description

This is the sample output from executing the HELP command.

2 Replacing field-replaceable units

Introduction and precautions

Replacing controllers and cache modules using C_Swap

Replacing a single controller and cache module

Replacing dual-redundant controllers and cache modules using the offline method

Replacing the SBB battery module

Replacing power supplies

Replacing disk drives

Replacing tape drives

Replacing solid state disks and CD-ROM drives

Replacing host and device cables

Introduction and precautions

This chapter describes the procedures for replacing HSZ50 field replaceable units.

The following sections provide important information to prevent damage to system components you must handle during replacement procedures, and to ensure you have the tools you need to replace system components.

You will need to refer to these sections for installation and removal procedures described later in this document.

Electrostatic Discharge

Electrostatic discharge (ESD) can damage system components. When handling system components, use the following precautions:

1. Obtain and place an ESD wrist strap around your wrist. Make sure the strap fits snugly around your wrist.
2. Attach or clip the other end of the ESD wrist strap to the cabinet grounding stud or a convenient cabinet grounding point (nonpainted surface).
3. Obtain and use an approved antistatic bag and/or grounding antistatic mat for temporarily storing system components during replacement procedures.

Handling controllers or cache modules

After removing a controller or cache module from the shelf, place the module into an approved antistatic bag or onto a grounding mat.

Handling the program card

Use the following precautions when you remove or replace the program card:

- Cover the program card with the snap-on ESD cover when the card is installed in the controller.
- Keep the program card in its original carrying case when not in use.
- Do not twist or bend the program card.
- Do not touch the program card contacts.

Handling controller host-port cables:

Use the following procedures when you remove or install host port cables:

- When installing host port cables, use care not to touch the connector's pins.
- Use care not to bend any connector pins when plugging the host cables into the trilink connector.

Required tools

You will need the tools listed in Table 6 for the removal and replacement procedures described in the remainder of this document.

Table 6
Required tools

Required tools	Purpose
Maintenance terminal	To shut down controllers, restart controllers, add and delete devices
ESD wrist strap	To protect all equipment against ESD
Small flat head screwdriver	To loosen and tighten captive screws on controllers and cache modules
5/32-inch Allen wrench	To unlock the SW800-series cabinet

Replacing controllers and cache modules using C_SWAP

This section describes the replacement procedures for the HSZ50 controllers and cache modules using the C_SWAP (warm swap) procedure.

Caution

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

Use the C_SWAP procedure when you cannot shut down the system and only in dual-redundant configurations. When you use C_SWAP to replace a controller in an SW500 and SW800 cabinet, you must have two power supplies; in an SW300 cabinet, you must have five power supplies.

When you use C_SWAP to replace a controller or any other component, always begin with Step 1 of this procedure. You will be directed to the appropriate step in the procedure to replace the controller and/or component.

Preparing the subsystem

Use the following procedure to restart the failed controller, capture last failure information, and ensure a clean recovery:

1. Connect a maintenance terminal to the controller that does NOT require service (see Figure 1).

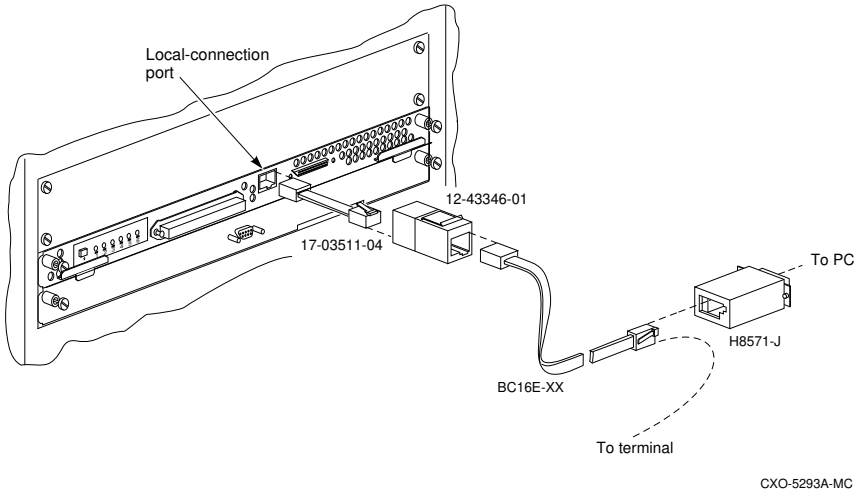


Figure 1 Connecting a maintenance terminal

2. Enter the following command at the CLI:

   ```
   CLI> SHOW_THIS CONTROLLER
   ```

3. Record the preferred IDs and the host port SCSI target IDs to use later in this procedure.

4. Prefer all target IDs to this controller by entering the following command:

   ```
   CLI> SET THIS_CONTROLLER PREFERRED_ID=(n,n,n,n)
   ```

   where *n,n,n, n* are equal to all host port SCSI target IDs noted in Step 3.

5. Enter the following command at the CLI:

   ```
   CLI> RESTART OTHER_CONTROLLER
   ```

   This command does not restart the controller at this point. It enables the controller requiring service to be restarted later in this procedure.

   Ignore any error messages that may display on the terminal.

6. Try to reboot the controller that requires service by pressing the reset button on that controller.

7. If the controller starts, connect a maintenance terminal to the controller that requires service.

8. If the controller requiring service does not start, proceed to Step 12.

9. Run the FMU (Fault Management Utility) to identify last failure codes. Enter the following command at the CLI:

   ```
   CLI> RUN FMU
   ```

10. Enter the following command at the FMU prompt:

    ```
    FMU> SHOW LAST_FAILURE ALL
    ```

    Record all instance, and last failure codes.

11. Enter the following command at the CLI:

    ```
    CLI> SHUTDOWN OTHER_CONTROLLER
    ```

    When the controller requiring service halts, the green Reset (//) LED stops flashing and stays lit. Do not proceed until the controller has halted.

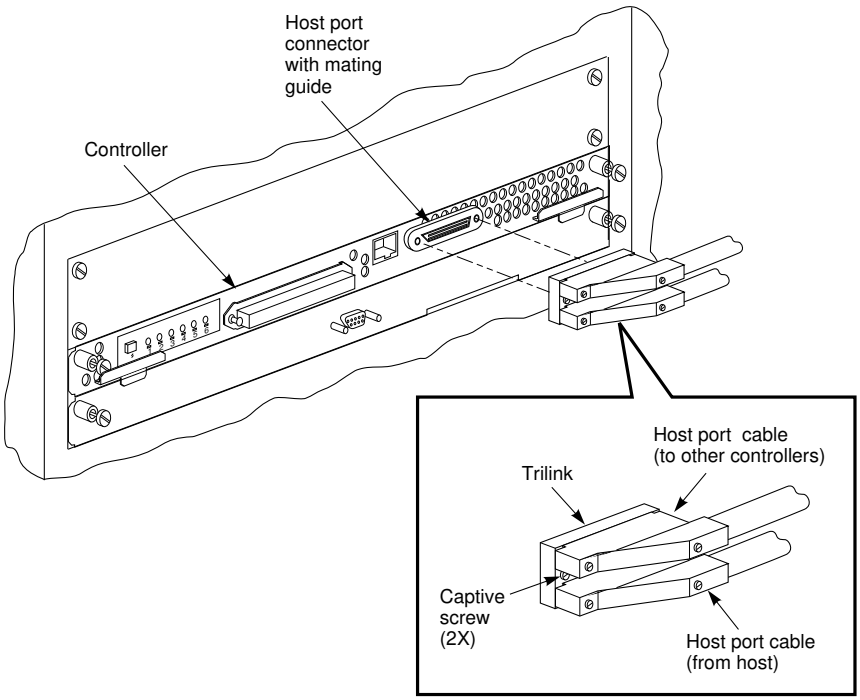
12. Take the controller that does NOT require service out of dual-redundant (failover) mode:

    ```
    CLI> SET NOFAILOVER
    ```

    You may see a Warning 6000 message on the terminal: you can safely ignore this warning.

13. Loosen the captive screws that secure the trilink connector to the controller requiring service. Do not remove the connector (see Figure 2).

Figure 2 Disconnecting the trilink connector



14. Loosen the captive retaining screws on the controller's front bezel. Do not remove the module yet.

15. If you are removing the cache module, loosen the captive retaining screws on the cache module's front bezel.

16. Start the C_SWAP program by entering the following command:

```
CLI> RUN C_SWAP
```

Removing the controller and cache modules

Use the following procedure to remove the controller and cache modules:

1. When the controller prompts you with the following question:

   ```
   Do you wish to remove the other HSZ50 Y/N [N] ?
   ```

   Enter "**Y**" for YES and press **Return.**

   Do not remove the controller module yet.

2. The following question displays:

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

   Enter "**Y**" for YES if the cache module requires service or replacement. Press **Return**.

   Do not remove the cache module yet.

3. Wait for the following text to display at the console:

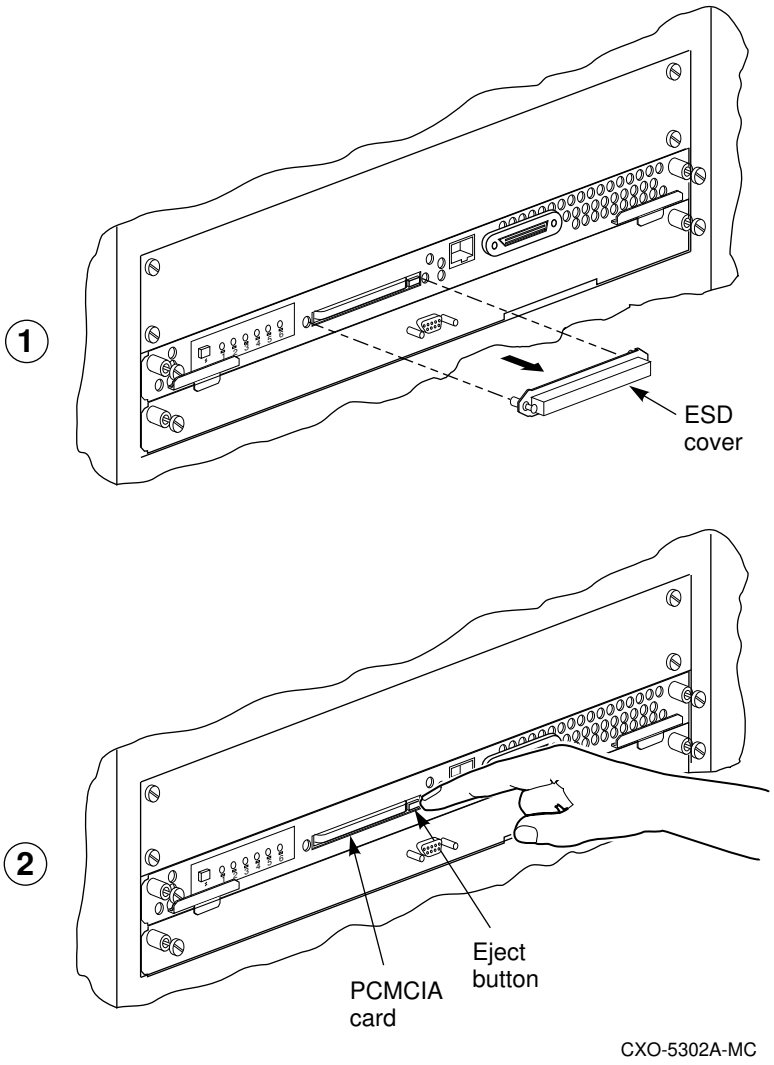
```
Port 1 quiesced.
Port 2 quiesced.
Port 3 quiesced.
Port 4 quiesced.
Port 5 quiesced.
Port 6 quiesced.
All ports quiesced.
```

Note

You have 5 minutes in which to remove the controller. If you are removing the cache module, the time allowed is 2 minutes.

4. Unsnap and remove the program card ESD shield on the controller you are removing.
5. Eject the program card. If you are not replacing the controller module, leave the program card in the ejected position.
6. Remove the program card if you are replacing the controller. Save it for use in the replacement controller. (see Figure 3).

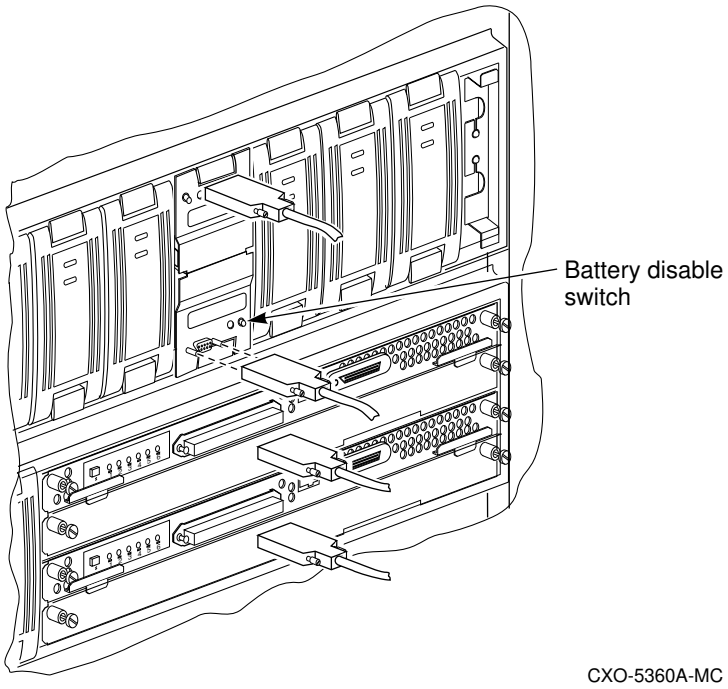
Figure 3 Removing the program card



7. Remove the trilink connector from the controller. Do not disconnect the host cables from the trilink.
8. Loosen the screws on the external cache battery cable and disconnect the ECB from the cache module.

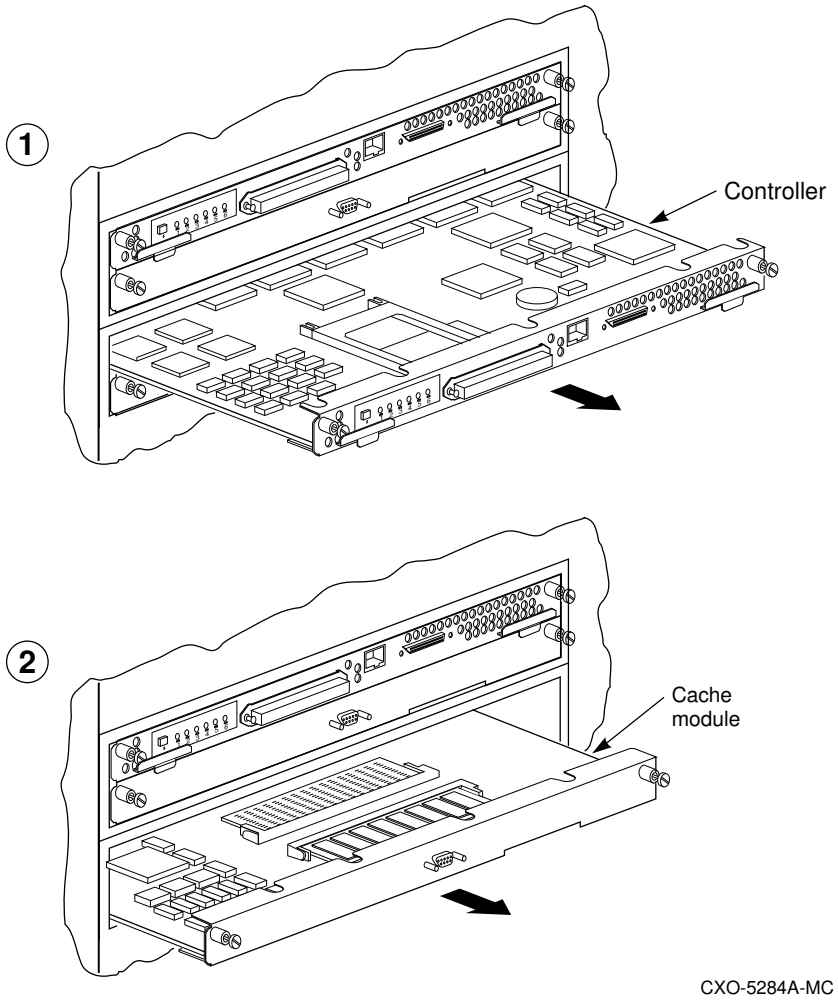
   If you are removing the cache module, disconnect the battery from the cache side only.
9. Hold the battery cable in one hand and disable the ECB by pressing the battery disable switch (see Figure 4).

Figure 4 Disconnecting the battery cable and disabling the ECB



10. Slide the defective controller out of the shelf and note the location (see Figure 5).

Figure 5 Removing controllers and cache modules



11. Wait for the following message to display on the maintenance terminal:

```
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.

Do not proceed with the procedures for reinstalling the controller and cache modules until you see this message.

12. If you are replacing the cache module, remove it now.

Renstalling the controller subsystem components

Make sure you have all the replacement components ready to be installed. Use the following procedure to install the new controller and cache modules:

1. When the controller prompts you with the following question:

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

Enter **Y** for "YES" if all replacement procedures are completed and all functioning modules are available (both replacement and existing modules).

Press **Return**.

2. The following question displays:

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

Do you wish to INSERT the other HSZ [N] ?
```

Enter "**Y**" for YES.

3. Wait for the following text to appear on the terminal:

```
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 HSZ WITHOUT its program card, and
press Return.
```

3. Do not press **Return** until you have installed the cache and controller modules as described in Steps 4-6 of this procedure.

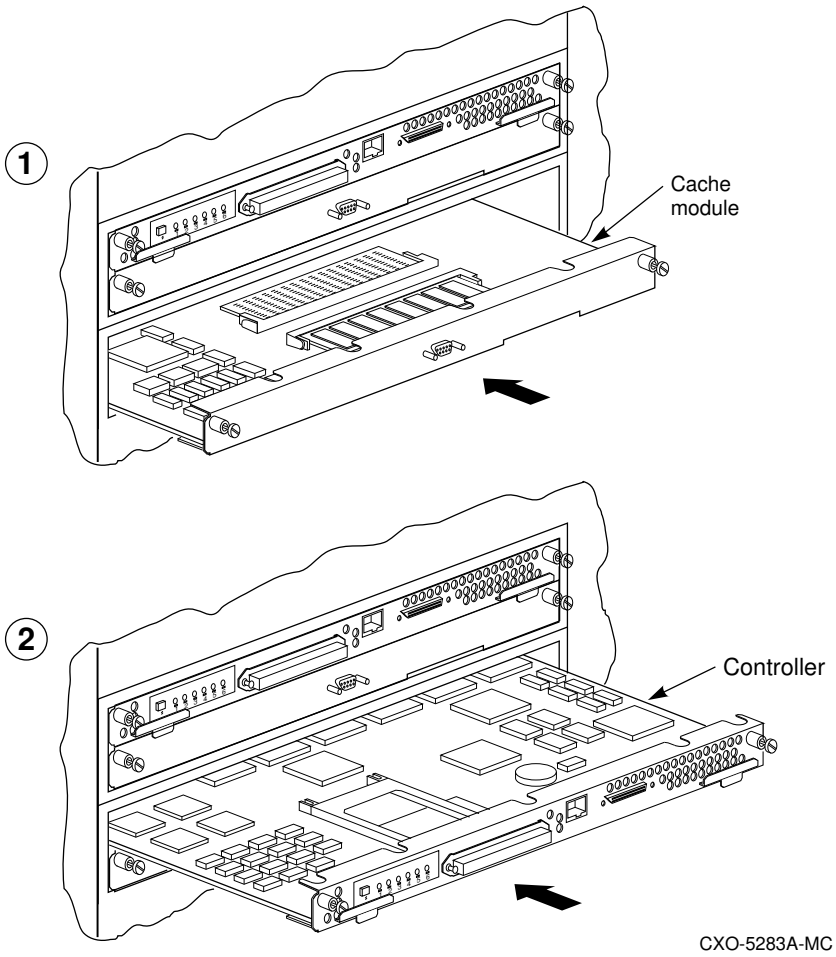
Note

Make sure you install the cache module into the correct slot.

4. Insert the cache module by sliding it straight in along the rails and then push firmly to seat it in the backplane (see Figure 6).

5. Insert the controller module by sliding it straight in along the rails and then push firmly to seat it in the backplane (see Figure 6).

Figure 6 Installing controllers and cache modules



Caution

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

6. Tighten the captive screws on the controller's front bezel. If you replaced the cache module, tighten the captive screws on the cache module's front bezel.
7. Reconnect the ECB cable to the cache module and tighten the screws on the cable.
8. Press **Return** on the operator console.
9. Wait for the following text to be displayed on the operator 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 HSZ50.
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 the
controller's Configuring manual.
```

NOTE

Follow the procedures in this manual NOT the instructions shown on the terminal .

10. On the controller that does NOT require service, enter the following command at the CLI:

    ```
    CLI> RESTART OTHER_CONTROLLER
    ```

    Ignore any error messages displayed on the terminal.

Restarting the subsystem

1. Connect the maintenance terminal to the newly installed controller.
2. Press and hold the Reset (//) button on the new controller while inserting the program card from the replaced controller.
3. 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.
4. Enter the following command at the CLI:

    ```
    CLI> SHOW THIS_CONTROLLER
    ```

5. If the new controller reports an invalid cache error, enter one of the following CLI commands from the new controller to clear the error.

    If you have replaced ONLY the cache module enter the following command:

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

If you have replaced ONLY the controller module, enter the following command:

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

6. Do not proceed until all invalid cache errors are cleared. To ensure they are cleared enter the following command:

   ```
   CLI> SHOW THIS_CONTROLLER
   ```

7. Ensure the newly installed controller is not in dual-redundant mode by entering the following command from the maintenance terminal of the newly installed controller:

   ```
   CLI> SET NOFAILOVER
   ```

   If the controller was already in nonredundant mode, a message displays indicating so. Ignore any “Controller misconfigured” messages on the terminal.

8. Reconnect the trilink connector to the new controller and tighten the captive screws. Make sure the trilink connector is competely installed before proceeding.

9. Make sure the terminal is connected to the newly installed controller and enter the following command to place the controllers into dual-redundant mode:

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

   The newly installed controller will initialize. This process takes about 20 seconds. Wait for a message to display on the terminal indicating the controller has rebooted.

10. On the ECB front panel, check the LED status indicator for the appropriate indication as shown in Table 7 below:

Table 7
ECB status indicators

LED Status	Battery Status
LED is on continuously	System power is on and the ECB is fully charged.
LED blinks rapidly	System power is on and the ECB is charging.
LED blinks slowly	System power is off and the ECB is supplying power to the cache.
LED is off	System power is off and the ECB is not supplying power to the cache.

If the battery status is low, you may want to set the cache policy. Refer to the procedure documented in the *HSZ50 Array Controllers CLI Reference Manual*.

11. Verify that all host settings are correct by entering the following commands:

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

The information on both controllers should match except for preferred IDs and serial numbers. The output should indicate the controllers are in dual-redundant mode.

12. If any information is not correct, the failover procedure failed. Check for any error messages at Step 4.

When all errors are cleared, go back to Step 6 and try to restart the newly installed controller again.

13. If this procedure fails, the replacement controller and/or cache module may be bad. Obtain new modules and repeat the C_SWAP procedure from the beginning.

14. If all the information matches, enter the following command:

```
CLI> SHOW THIS_CONTROLLER
```

15. If you wish to balance the I/O load, as it was before the controller replacement, enter the following command:

    ```
    CLI> SET OTHER_CONTROLLER  PREFERRED_ID =(n,n)
    ```

    Where n =preferred IDs that were shown on the controller that did NOT require service.

    Refer to the target configuration you recorded in Step 4 of the procedure “Preparing the Subsystem”.

Replacing a controller and cache module in a single controller configuration

This section describes the procedure for replacing a controller and controller components in a nonredundant configuration. Device service is interrupted for the duration of the service cycle. Stop all host activity and dismount all device units from the host system if possible.

Removing the controller and cache modules

1. If the controller is fully or partially functioning, connect a maintenance terminal to the controller (see Figure 1). If the controller is not functioning, try to restart the controller. If it reboots, proceed with Step 2. If it does not reboot, go to Step 6.
2. Run FMU by entering the following command at the CLI:

   ```
   CLI>RUN FMU
   ```

3. At the FMU prompt, enter the following command:

   ```
   FMU>SHOW LAST_FAILURE ALL
   ```

4. Record all instance, and failure codes and remember the order. Exit the FMU utility.
5. Take the controller out of service.

   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

   To ensure that the controller has shut down cleanly, check for the following indications on the controller's operator control panel (OCP):

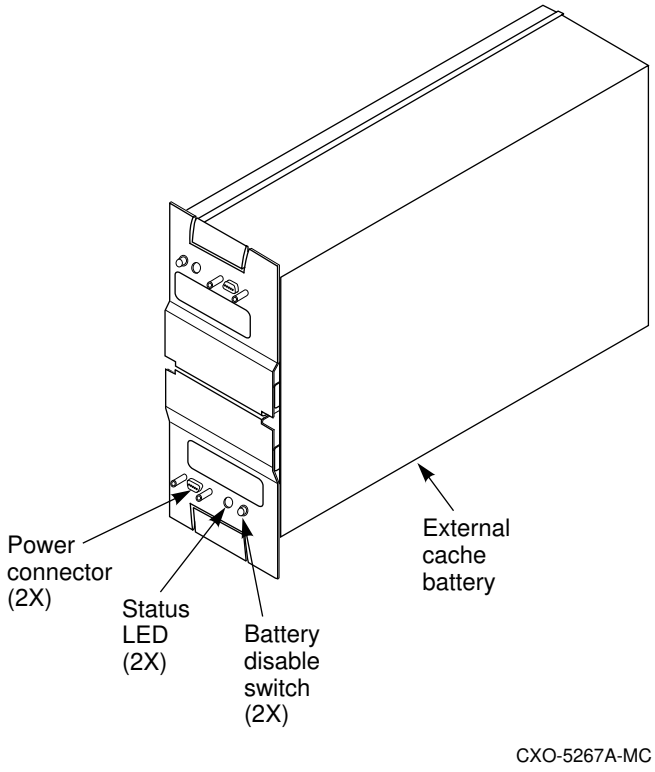
   - The Reset (//) light is lit continuously.
   - Port lights 1, 2, and 3, are also lit continuously.

6. Remove the power cords from the controller power supplies.

7. Loosen the screws on the ECB cable and disconnect the battery cable from the cache module ONLY if you are replacing the cache module (see Figure 4).

8. Disable the ECB by pressing the battery disable switch on the battery module front panel (see Figure 7).

Figure 7 Disabling the ECB



9. Unsnap and remove the program card ESD shield (see Figure 3).

10. Eject and remove the program card. Save it for the replacement controller (see Figure 3).

11. Loosen the captive screws on the trilink connector and remove the trilink (see Figure 2).

12. Loosen the captive retaining screws on the controller's front bezel.

13. Loosen the controller from the shelf backplane with a gently rocking motion. Slide the controller module out of the shelf, noting in which rails it was seated (see Figure 5).
14. If you are replacing the cache module, loosen the screws on the cache module's front bezel.
15. Loosen the cache module from the shelf backplane with a gentle rocking motion and slide the module out of the shelf (see Figure 5).

Reinstalling controller subsystem components

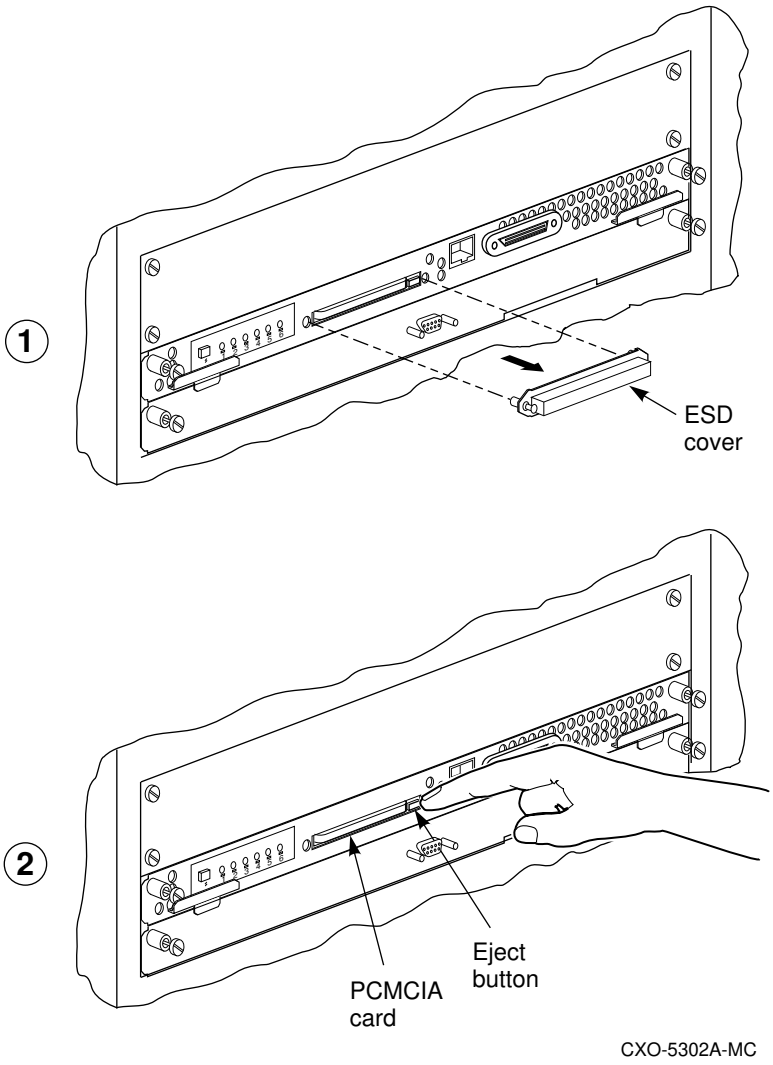
1. If you removed the cache module in the previous procedure, slide the new cache module into the shelf making sure you are using the correct slot.
2. Slide the new controller module into the shelf using the same rails from which you removed the module (see Figure 6).

Caution

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

3. Tighten the captive screws on the front bezel of both the controller and cache modules.
4. Reconnect the ECB cable to the cache module and tighten the mounting screws on the cable.
5. Reconnect the power cords to the controller power supplies.
6. Attach a maintenance terminal to the new controller.
7. Press and hold the controller's green reset (//) button, while inserting the program card. The program card eject button will extend when the card is fully inserted.

Figure 8 Installing the program card



8. Release the reset button to initialize the controller.
9. Enter the following command at the CLI:

   ```
   CLI>SHOW THIS_CONTROLLER
   ```

   Look for invalid cache errors. To clear the errors, first use the following command:

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

If there are still invalid cache errors, use the following command to clear the errors:

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

10. Reattach the trilink connector.
11. At the CLI prompt type:

```
CLI> SHOW THIS_CONTROLLER
```

The controller displays the following information (this is a sample only):

```
Controller:
   HSZ50-AX ZG34901786 Firmware V50Z Hardware AX11
        Not configured for dual-redundancy
SCSI address 7
   Time: 04 JUN-1996 16:32:54
Host port:
   SCSI target(s) (0, 1, 2), Preferred target(s) (0, 1,
2)
Cache:
   32 megabyte  write cache, version 3
   Cache is GOOD
   Battery is good
   No unflushed data in cache
   CACHE_FLUSH TIMER = DEFAULT (10 seconds)
   CACHE_POLICY =  B
   Host Functionality Mode = A
   No CACHE_UPS
```

12. If save_config was not previously enabled, set the following controller parameters:

- SCSI IDs
- prompt
- time
- cache policy
- host functionality mode

13. You may now resume host activity.

Replacing dual-redundant controllers and cache modules

Follow the procedure described in this section when you replace controllers and/or cache modules in a dual-redundant configuration using the offline method. Stop all host activity and dismount all device units from the host system if possible. Device service is interrupted for the duration of the service cycle.

Removing the controller and cache

1. In dual-redundant mode, when one controller fails, connect a maintenance terminal to the surviving controller.
2. Enter the following command at the CLI:

   ```
   CLI> SHOW_THIS CONTROLLER
   ```

3. Record the preferred IDs and the host port SCSI target IDs to use later in this procedure.
4. Prefer all target IDs to this controller by entering the following command:

   ```
   CLI> SET THIS_CONTROLLER PREFERRED_ID=(n,n,n,n)
   ```

   where *n,n,n, n* are equal to all host port SCSI target IDs noted in Step 3.

5. Loosen the captive screws on the trilink connector and remove the trilink.
6. Loosen the screws on the ECB cable and disconnect the battery cable from the cache module ONLY if you are replacing the cache module.
7. Disable the ECB by pressing the battery disable switch on the battery module front panel (see Figure 7).
8. Unsnap and remove the program card ESD shield (see Figure 3).

9. Eject and remove the program card. Save it for the replacement controller (see Figure 3).

10. Loosen the controller from the shelf backplane with a gently rocking motion. Slide the controller module out of the shelf, noting in which rails it was seated (see Figure 5).

11. If you are replacing the cache module, loosen the screws on the cache module's front bezel.

12. Loosen the cache module from the shelf backplane with a gentle rocking motion and slide the module out of the shelf (see Figure 5).

ReInstalling subsystem components

1. If you removed the cache module in the previous procedure, slide the new cache module into the shelf. Make sure you use the correct slot.

2. Slide the new controller module into the shelf using the same rails from which you removed the module (see Figure 6).

Caution

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

3. Tighten the captive screws on the front bezel of both the controller and cache modules.

4. Reconnect the ECB cable to the cache module and tighten the screws on the cable.

5. Enter the following command from the CLI:

```
CLI>RESTART_OTHER
```

6. Attach a maintenance terminal to the new controller.

7. Press and hold the controller's green reset (//) button, while inserting the program card. The program card eject button will extend when the card is fully inserted.

8. Release the reset button to initialize the controller.

9. Enter the following command at the CLI:

   ```
   CLI>SHOW THIS_CONTROLLER
   ```

   Look for invalid cache errors. To clear the errors, first use the following command:

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

   If there are still invalid cache errors, use the following command to clear the errors:

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

10. Reattach the trilink connector.

11. Ensure the newly installed controller is not in dual-redundant mode by entering the following command from the maintenance terminal of the newly installed controller:

    ```
    CLI>SET NOFAILOVER
    ```

12. Make sure the terminal is connected to the newly installed controller and enter the following command to place the controllers into dual-redundant mode:

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

    The newly installed controller will initialize. This process takes about 20 seconds. Wait for a message to display on the terminal indicating the controller has rebooted.

13. On the ECB front panel, check the LED status indicator for the appropriate indication as shown in Table 7 below:

Table 8
ECB status indicators

LED Status	Battery Status
LED is on continuously	System power is on and the ECB is fully charged.
LED blinks rapidly	System power is on and the ECB is charging.
LED blinks slowly	System power is off and the ECB is supplying power to the cache.
LED is off	System power is off and the ECB is not supplying power to the cache.

If the battery status is low, you may want to set cache policy. Refer to the procedure documented in the *HSZ50 Array Controller CLI Reference Manual*.

14. Verify that all host settings are correct by entering the following commands:

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

The information on both controllers should match except for preferred IDs and serial numbers. The output should indicate the controllers are in dual-redundant mode.

15. If any information is not correct, the failover procedure failed. Check for any error messages at Step 8.

When all errors are cleared, go back to Step 4 and try to restart the newly installed controller again.

16. If this procedure fails, the replacement controller and/or cache module may be bad. Obtain new modules and repeat this procedure from the beginning.

17. If all the information matches, enter the following command:

```
CLI> SHOW THIS_CONTROLLER
```

18. If you wish to balance the I/O load, as it was before the controller replacement, enter the following command:

    ```
    CLI> SET OTHER_CONTROLLER  PREFERRED_ID =(n,n)
    ```

    Where n =preferred IDs that were shown on the controller that did NOT require service.

    Refer to the target configuration you recorded in Step 4 of the procedure “Preparing the Subsystem”.

Replacing the SBB battery module (external cache batteries)

The batteries are installed in a 3 1/2-inch SBB (storage building block) module. Digital does not recommend replacing individual ECBs. Therefore, when one ECB needs to be replaced, replace the entire SBB.

There are two ways to replace the battery SBB:

1. An online method (C_SWAP) in which one controller continues to process I/O.
2. An offline method in which both controllers are taken out of service.

Replacing ECBs using the online method

Use the following procedure to replace an ECB in a dual-redundant controller configuration using C_SWAP.

Preparing the subsystem

1. For the purpose of this procedure, mark one controller A and the other controller B.
2. Connect a maintenance terminal to controller B.
3. Loosen the captive screws of controller A trilink and the front bezel of controller A and cache module A.
4. Shutdown controller A:

   ```
   CLI> 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:

   ```
   CLI> SET NOFAILOVER
   ```

You may see a Warning 6000 at the terminal: you can safely ignore this warning.

6. Start the C_SWAP program:

```
CLI> RUN C_SWAP
```

Removing the ECB

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

```
Do you wish to remove the other HSZ50 y/n [n] ?
```

2. Enter "**Y**" for YES.

3. Answer the question:

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

4. Enter "**Y**" for YES.

5. Wait for the following text to be displayed at the console:

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

6. Unsnap and remove the program card ESD shield on the controller you are removing.

7. Remove the program card by pushing the eject button next to the card.

8. Remove the trilink from controller A. Do not disconnect the host cables from the trilink.

9. Slide the controller module out of the shelf, noting the location. Do not remove the trilink connector.

10. Wait for the following text to be displayed on the terminal.

```
Restarting all ports
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.

11. Pull the cache module partly out of the shelf.
12. Disconnect the battery cable at the ECB and connect it to the new ECB (see Figure 4).

Reinstalling the modules

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

```
Do you have a replacement HSZ50 readily available? [N]
? y
```

2. Answer the question:

```
***Sequence to INSERT the other HSZ50 has begun.***

Do you wish to INSERT the other HSZ50 [N] ?
```

3. Enter **Y** for YES.
4. 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 HSZ WITHOUT its program card, and
press Return.
```

5. Slide the cache module along the rails and then push firmly to seat it in the backplane.

6. Install the controller module. Slide the controller module along the rails and then push firmly to seat it in the backplane.

Caution

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

7. Reinstall the trilink on controller A and tighten the captive screws.
8. Press **Return** on the operating controller's console.
9. 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 HSZ50:
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

1. Start the new controller by entering the following CLI command:

```
CLI> RESTART OTHER_CONTROLLER
```

2. Connect the maintenance terminal to controller A.
3. Press and hold the Reset (//) button on controller B while inserting the program card from the replaced controller.
4. 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.

5. Enter the following command:

   ```
   CLI> SET NOFAILOVER
   ```

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

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

   Controller A will restart.

7. Tighten the front bezel captive screws on the cache and controller module.

Servicing the second cache module

1. Loosen the captive screws of controller B trilink and the front bezel of controller B and cache module B.
2. At controller A, shutdown controller B:

   ```
   CLI> SHUTDOWN OTHER_CONTROLLER
   ```

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

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

   ```
   CLI> SET NOFAILOVER
   ```

4. Start the C_SWAP program:

   ```
   CLI> RUN C_SWAP
   ```

Removing the ECB

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

   ```
   Do you wish to remove the other HSZ50 y/n [n] ?
   ```

2. Enter "**Y**" for YES.
3. Answer the question:

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

4. Enter "**Y**" for YES.

5. Wait for the following text to be displayed at the console:

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

1. Unsnap and remove the program card ESD shield on the controller you are removing.

2. Remove the program card by pushing the eject button next to the card.

3. Slide the controller module out of the shelf noting in which rails the module was seated.

4. Wait for the following text to be displayed at the operating controller's console:

```
Restarting all ports
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.

5. Pull the cache module partly out of the shelf.

6. Disconnect the battery cable at the ECB and connect it to the new ECB.

Reinstalling the modules

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

```
Do you have a replacement HSZ50 readily available? [N]
? y
```

2. If you have a replacement module available, enter "YES"

3. Answer the question:

```
***Sequence to INSERT the other HSZ50 has begun.***

Do you wish to INSERT the other HSZ50 [N] ?
```

4. Enter "**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 HSZ50 WITHOUT its program card, and
press Return.
```

6. Slide the cache module along the rails and then push firmly to seat it in the backplane.

7. Install the controller module. Slide the controller module along the rails and then push firmly to seat it in the backplane.

Caution

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

8. Tighten the front bezel captive screws on the cache module and the controller module.

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 HSZ50.
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

1. Start the controller by entering the following CLI command:

   ```
   CLI> RESTART OTHER_CONTROLLER
   ```

2. Connect the maintenance terminal to controller B.
3. Press and hold the Reset (//) button on the controller while inserting the program card.
4. 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.
5. Entering the following command:

   ```
   CLI> SET NOFAILOVER
   ```

6. Place the controllers into dual-redundant mode:

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

   Controller A will restart.

7. Ensure that the ECB cable connections are secure.
8. Remove the old SBB battery module from the device shelf and replace it with the new operating SBB.

Replacing ECBs using the offline method

Use the following procedure to replace an ECB in a dual-redundant controller configuration using the offline method:

1. Attach a maintenance terminal to one of the controllers.
2. Enter the following commands from the CLI:

   ```
   CLI>SHUTDOWN OTHER_CONTROLLER
   CLI>SHUTDOWN THIS_CONTROLLER
   ```

   To ensure the controllers have shut down cleanly, check for the following indications on the controllers' OCP:

   - The Reset (\\)light is lit continuously.
   - Port lights 1, 2, and 3 are also lit continuously.

   Wait until the controller halts before proceeding.
3. Loosen the screws on both ECB cables and remove both cables from both cache modules.
4. Connect the new ECB cables to the new ECB modules and tighten the screws.
5. Connect the new ECB cables to the cache modules and tighten the screws.
6. Press and hold the reset buttons on both controllers to reinitialize the controllers.

7. On the ECB front panel, check the LED status indicator for the appropriate indication as shown in Table 7 below:

Table 9
ECB status indicators

LED Status	Battery Status
LED is on continuously	System power is on and the ECB is fully charged.
LED blinks rapidly	System power is on and the ECB is charging.
LED blinks slowly	System power is off and the ECB is supplying power to the cache.
LED is off	System power is off and the ECB is not supplying power to the cache.

If the battery status is low, you may want to set the cache policy. Refer to the procedure documented in the *HSZ50 Array Controller CLI Reference Manual*.

Replacing power supplies

There are two methods for replacing shelf and controller power supplies: cold swap and asynchronous swap.

Cold-swap

Use the cold-swap method when there are no redundant power supplies in the shelf. When you use the cold swap method, service to the subsystem is interrupted for the duration of the service cycle.

Removing the power supply

1. Connect a maintenance terminal to the controllers.

2. Since you are in dual-redundant mode, enter the following command from the CLI of one controller:

   ```
   CLI> SHUTDOWN OTHER_CONTROLLER
   ```

3. From the CLI on the same controller, enter:

   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

   To ensure the controller has shut down cleanly, check for the following indications on the controller's operator control panel (OCP):

   - The Reset (\\) light is lit continuously.
   - Port lights 1, 2, and 3 are also lit continuously.

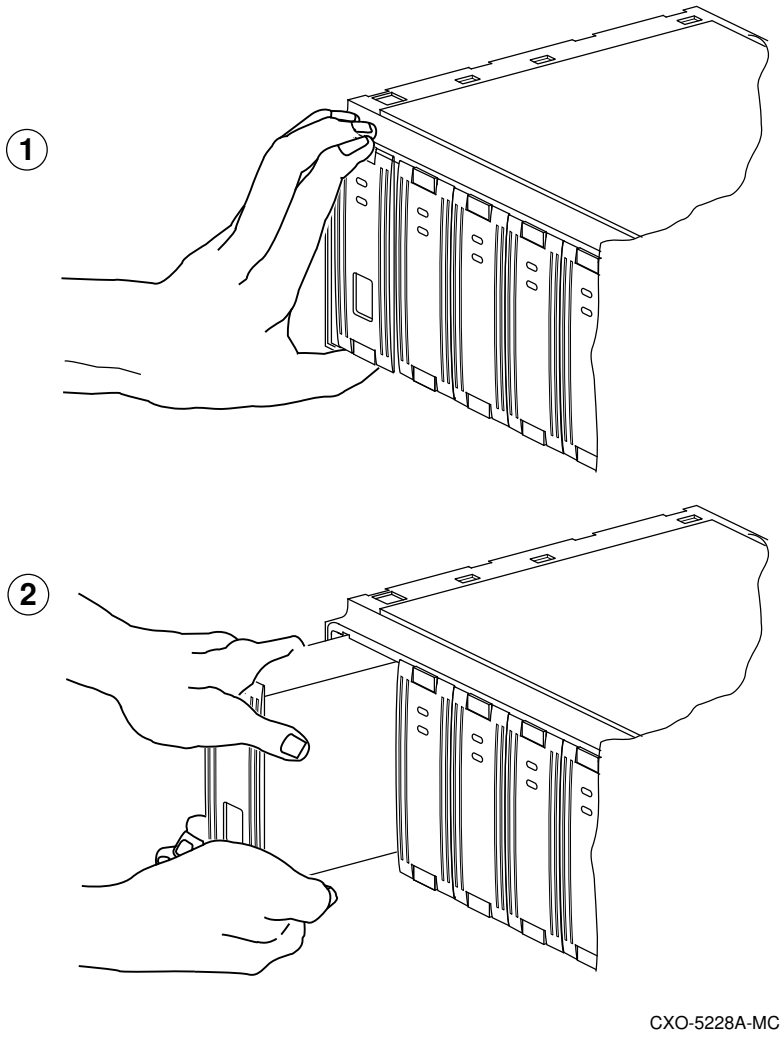
   Wait until the controller halts before proceeding.

4. Disconnect the power cords from the power supply.

5. Press the two mounting tabs together to release the power supply from the shelf and partially pull it out of the shelf (see Figure 9).

6. Use both hands to pull the power supply out of the shelf (see Figure 9).

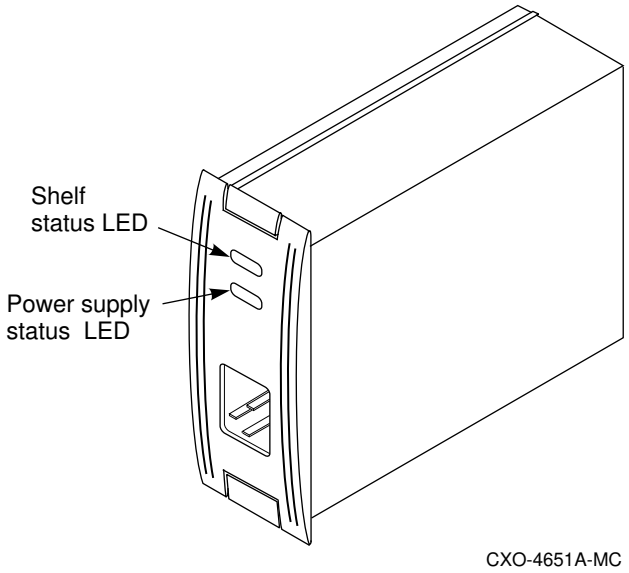
Figure 9 Removing the power supply



Installing the new power supply

1. Firmly push the power supply into the shelf until the mounting tabs snap into place.
2. Reconnect the power cord to the power supply.
3. Observe the power and shelf fault indicators to make sure they are on (see Figure 10). If the fault indicators are not on, refer to Tables 18 and 19 in the Appendix of this manual.

Figure 10 Power supply fault indicators



Asynchronous swap method

The asynchronous swap allows you to remove a defective power supply while the other power supply provides power to the shelf or the controller. Use the asynchronous swap method to replace a power supply only when there is a redundant power supply in the shelf and if one of the supplies is still operating.

1. Remove the failed power supply using steps 4 and 5 of of cold-swap method.
2. Replace a new power supply using the same procedure you used for replacing the power supply with the cold-swap method.

Replacing storage devices

There are three methods for replacing storage devices:

- The asynchronous swap method can be used to replace disk drives.
- The warm-swap method can be used to replace tape drives.
- The cold-swap method must be used to replace solid-state disks.

Asynchronous disk drive swap

Software version V3.0 supports asynchronous disk drive replacement, device removal, and device insertion without first quiescing the device bus. You can remove or insert disk drives using the asynchronous method with the following restrictions:

- Do not remove or insert devices during failover.
- Do not remove or insert devices during failback.
- Do not remove or insert devices before the CLI prompt appears during controller initialization.
- Do not remove or insert devices while the controller is still recognizing a device removal (indicated by flashing LEDs on the controller).
- Do not remove or insert devices while the controller is running a local program such as DILX, VTDPY or HSUTIL.
- Wait 50 seconds after inserting one disk drive before inserting a second disk drive.

Disk drive replacement procedure (3.5, 5.25-inch drives)

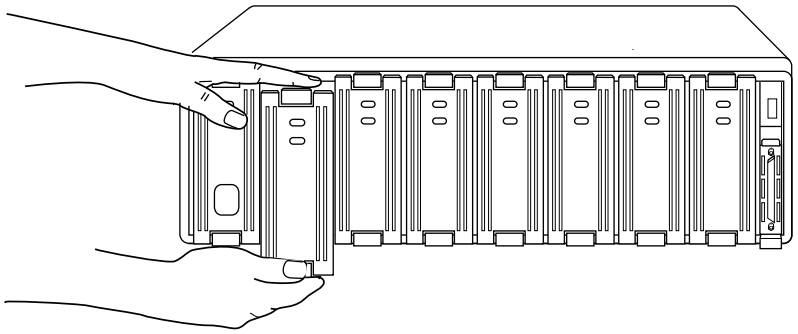
Before replacing any devices, note the following precautions:

1. Make sure the device is not an active device in any storageset.
2. Do not remove any device unless a knowledgeable person approves of the removal.
3. Determine the disk name (DISK100, DISK200, and so forth).
4. Enter the following command:

   ```
   CLI>SHOW DISK_NAME
   ```

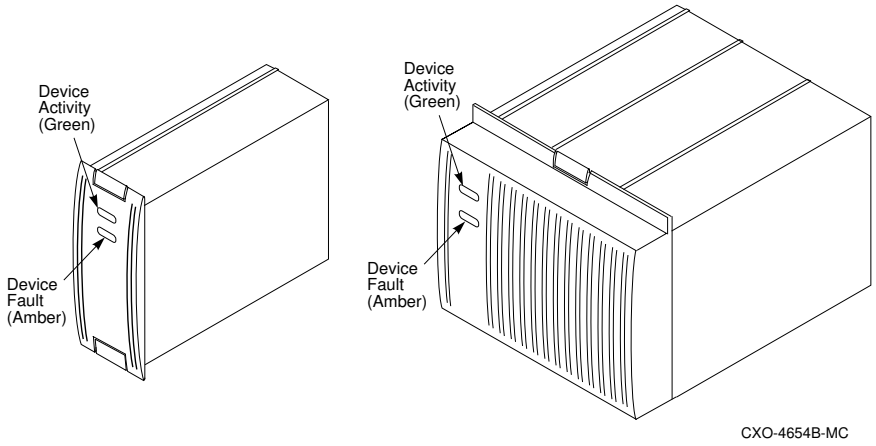
5. If the failed device is part of a failedset, delete it from the failedset. If the failed device is part of a spareset, delete it from the spareset.
6. If the device is part of a storageset or unit, follow the procedure described in the *SBB User's Guide* to remove the device from a storageset.
7. Once the device is no longer part of a storageset or unit, delete the disk name you determined in Step 3.
8. Determine which disk drive has failed using the procedures in Chapter 1, "Troubleshooting", of this manual.
9. Press the two mounting tabs together to release the disk drive from the shelf and partially pull it out of the shelf (see Figure 11).

Figure 11
Removing a disk drive



10. Using both hands, pull the disk drive out of the shelf.
11. Align the replacement disk drive with the shelf rails.
12. Push the disk drive all the way into the shelf until the locking tabs snap into place.
13. Observe the status LED for the following indications (see Figure 12).
    - The device activity (green) LED is either on, flashing, or off.
    - The device fault (amber) LED is off.

Figure 12
Default indicators for 3.5- and 5.25-inch SBBs



7. If you replaced a single disk drive or a disk from a stripeset, follow the procedure described in the *StorageWorks Array Controllers HS Family of Array Controllers User's Guide* to initialize the device.

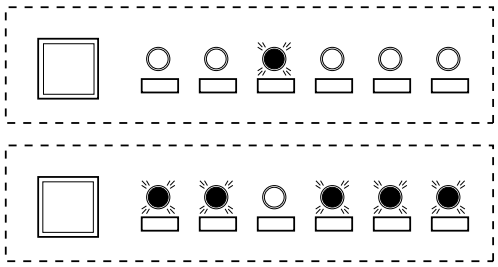
Replacing tape drives

Use the warm-swap method to replace tape drives. When you use this method the OCP (operator control panel) buttons are used to quiesce the bus that corresponds to the replacement device.

Tape drive replacement procedure

1. Determine the failed device using the procedures in Chapter 1, “Troubleshooting”, of this manual.
2. Quiesce the port by pressing the OCP button for that port. When the OCP LED flashes the port is quiesced.
3. When the OCP LEDs flash in an alternating pattern the device port is quiesced. For example, when you quiesce device port three and I/O has halted, the OCP LEDs are flashing in an alternating pattern as shown in Figure 13.

Figure 13 OCP LED patterns



4. At the replacement tape drive, press the two mounting tabs together to release the device from the shelf and partially pull it out of the shelf.
5. Use both hands to pull the device out of the shelf.
6. Quiesce the port again. Look for the OCP indicators depicted in the diagram in Step 3 of this procedure.

7. Align the replacement device with the shelf rails and insert the new device.
8. When the controller recognizes the device, the port light will be turned off and the system will return to normal operation.

Replacing solid-state disk and CD-ROM drives

Use the cold-swap method to replace a solid-state or CD-ROM drive. When you use this method, you must shut down the controllers and remove power from the shelf.

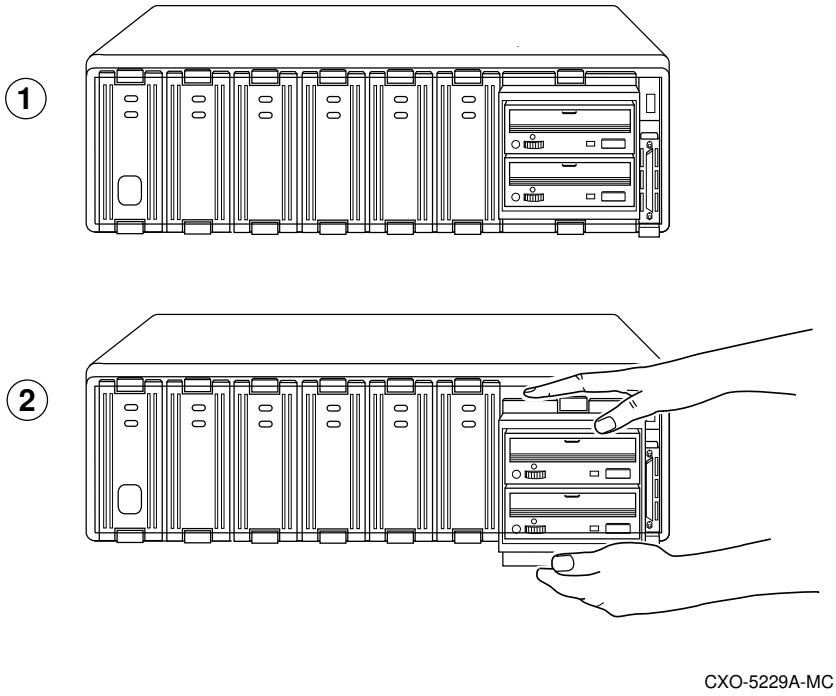
Solid-state disk and CD-ROM drive replacement procedure

1. Halt all host I/O activity using the appropriate procedures for your operating system.
2. Connect a maintenance terminal to one of the controllers.
3. At the CLI prompt, enter:

   ```
   CLI> SHUTDOWN OTHER_CONTROLLER
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

4. Remove the power cords from the shelf that contains the failed solid-state disk drive. If the device is in an SW300 cabinet, you must power down the whole cabinet.
5. Press the two mounting tabs together to remove the SBB from the shelf (see Figure 14).

Figure 14 Removing the CD-ROM drive



6. Align the replacement solid-state disk drive with the shelf rails.
7. Push the device all the way into the shelf until the locking tabs snap into place.
8. Reconnect the power cords to the shelf power supply or power up the SW300 cabinet.
9. Observe the status LED for the following indication:
   - The device fault (amber) LED is off.

Replacing SCSI host cables

Servicing the SCSI host cables will cause some system downtime, because the host path will be disconnected from at least one controller for the duration of the procedure.

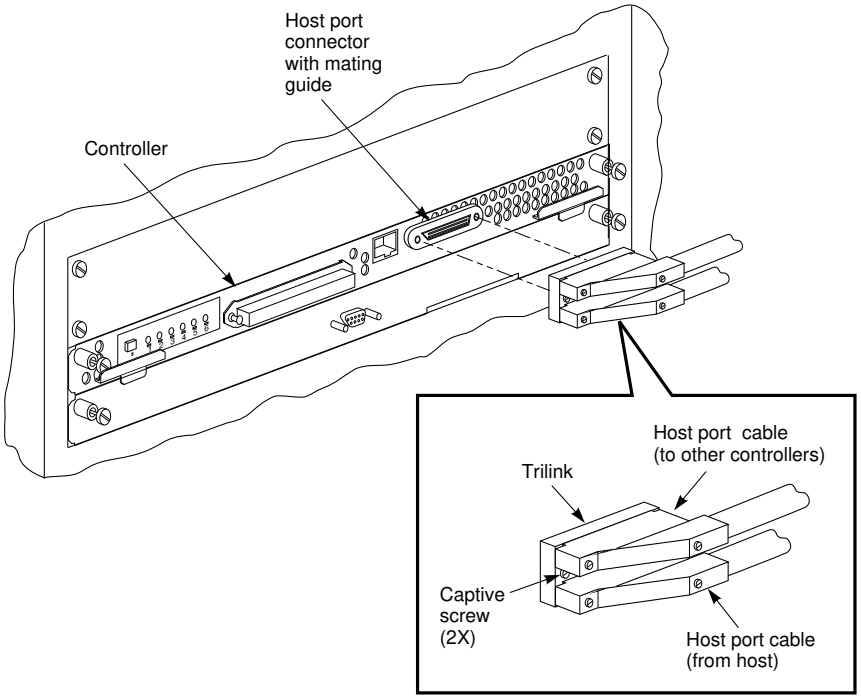
Replacing the SCSI host cables

Caution

Never leave the active SCSI host buses unterminated during the service cycle.

1. Halt all I/O activity using the appropriate procedures for your operating system.
2. Dismount all units using the procedures for your operating system.
3. Disconnect the failed SCSI host cable from the host or other device.
4. Shut down the controller/controllers.
5. Loosen the captive screws on the trilink connector at the controller's front bezel. Disconnect the cable from the trilink connector (see Figure 15).

Figure 15 Disconnecting the SCSI host cable



6. Remove the failed SCSI host cable from the cabinet, cutting the tie wraps as necessary.
7. Position and route the new SCSI host cable within the cabinet.
8. Install new tie wraps as necessary to hold the SCSI host cable in place.
9. Connect the new SCSI host cable and terminator to the trilink connector on the controller's front bezel. Tighten the captive screws on the SCSI host cable connector.
10. Connect the other end of the host cable to the appropriate device on the bus.
11. Restart the controller/controllers.

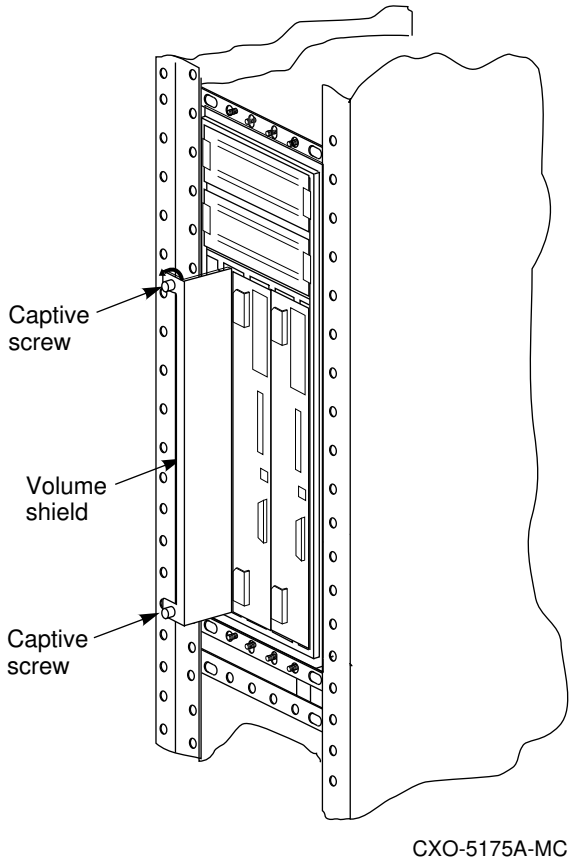
Replacing SCSI device port cables

Servicing SCSI device port cables will require some downtime because you must remove devices to access SCSI connectors in the controller shelf and the device shelf.

Replacing the device port cables

1. Make sure the controller/controllers have been properly shut down.
2. Remove each controller and cache module using the procedure described in "Replacing a Controller and Cache Module in a Single Controller Configuration."
3. Loosen the two captive screws on each side of the volume shield and remove the shield (see Figure 16).

Figure 16 Removing the volume shield



4. Remove the failed cable from the controller shelf backplane by pinching the cable connector side clips and disconnecting the cable.

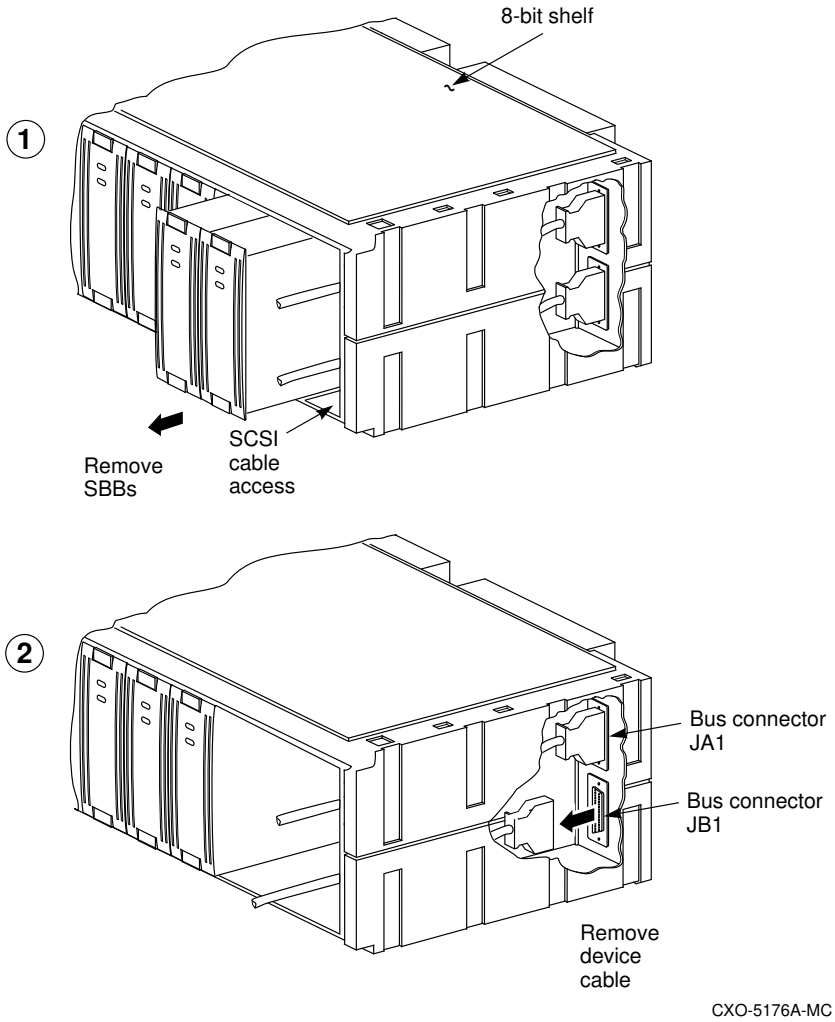
Caution

Digital recommends that you label all devices before you remove them from the device shelf. Note the PTL for each device.

5. Before removing the disk drives from the device shelf, let the drive spin down for at least 30 seconds. Gyroscopic motion from a spinning disk may cause you to drop and damage the disk.

6. Remove any SBBs necessary to gain access the SCSI cable (see Figure 17).

Figure 17 Access to the SCSI cables



6. Remove the failed cable from the device shelf backplane by pinching the cable connector side clips and disconnect the cable.
7. To install a new SCSI device port cable, at the device gently slide the cable's connector in from one side to the other, and rock the connector to help seat it. Listen for the connector to snap into place. Take care not to bend any connector pins.
8. To install the cable at the controller shelf, gently slide the cable connector on from one side to the other, and rock the connector to help seat it. Listen for the connector to snap into place.
9. Reinstall the SBBs into the device shelf. Make sure you install devices into the same slot from which you removed them.
10. Replace the volume shield in the controller shelf and lightly tighten the captive screws using a flat-head screwdriver.
11. Replace the cache modules and the controller modules following the same procedure you used to replace these modules in a single controller configuration.

3 Installing and upgrading

Upgrading Array Controller software

Upgrading controller software using CLCP utility

Patching controller software

Formatting disk drives

Installing new firmware on a device

Enabling a licensed option (FLS Utility)

Installing a controller and cache module (single controller configuration)

Installing a second controller and cache module

Installing a cache module

Adding cache memory

Installing power supplies

Installing storage building blocks

Introduction

This chapter describes various installation and upgrade procedures you will perform while servicing the HSZ50 subsystem.

As you perform these procedures, refer to Chapter 2, “Replacing Field Replaceable Units”, for important precaution information and required tools.

Upgrading Array Controller software

This section describes how to upgrade controller software using the program card in both the single and dual-redundant controller configurations. An HS operating software upgrade causes a brief interruption in service to attached devices.

Program card upgrade (single controller configuration)

Use the following procedure to upgrade controller software in a single controller configuration.

1. Halt all I/O activity to the controller using the appropriate procedures for your operating system.
2. Connect a maintenance terminal to the controller.
3. Take the controller out of service:

   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

   To ensure the controller has shutdown cleanly, check for the following indications on the controller's OCP:

   - The Reset (\\) light is lit continuously.
   - Port lights 1, 2, and 3 are also lit continuously.
4. Unsnap and remove the program card ESD cover.
5. Eject and remove the program card.
6. While pushing and holding down the OCP (operator control pane) Reset (//) button on the controller, insert the new program card.
7. Release the Reset (//) button to initialize the controller.

   After restart, the controller will not allow you to enter any CLI commands for approximately 60 seconds. This delay does not affect unit availability to the host. The delay provides time for the controller internal operations

to complete before user commands can change configuration.

When the controller initializes correctly, the green reset indicator will flash once every second.

8. Replace the ESD cover over the program card by pushing the two plastic push pins on each side of the shield.
9. Resume I/O activity to the controller.

Program card upgrade (dual-redundant configuration)

In a dual-redundant configuration, the software in both controllers must be upgraded simultaneously. Use the following procedure to upgrade controller software in a dual-redundant configuration:

1. Make sure all host activity has completed. This procedure will cause all devices to appear unavailable until host activity is completed.
2. Make sure both controllers have been properly shutdown.
3. Follow steps 1-8 of the upgrade procedure in a single controller configuration.
4. Release the reset buttons to initialize the controllers.

   The two controllers will reinitialize concurrently and will synchronize with each other. The timing of this procedure is not critical, however the program cards should be removed and inserted at approximately the same time (within a few seconds).

   After restart, the controllers will not allow you to enter any CLI commands for approximately 60 seconds. This delay does not affect unit availability to the host. The delay provides time for the controller internal operations

to complete before user commands can change configuration.

When the controllers initialize correctly, the green Reset (//) LED will flash once every second.

5. Replace the ESD covers over both program cards.

Upgrading controller software using the CLCP utility

The (CLCP) Code Load/Code Patch utility provides two controller software maintenance functions:

- Code loading—You can replace the software in your controller's program card via the controller maintenance port and PC terminal emulation program or host interface. This function enables you to upgrade your controller's software without physically replacing the program card.
- Code patching—You can alter your controller's software with patches stored in the controller's nonvolatile memory. Using program patches supplied by Digital, you can update your controller's software without completely replacing it.

Invoking the CLCP utility

To invoke the CLCP utility enter the following command at the CLI:

```
CLI> RUN CLCP
```

The CLCP utility menu is displayed:

```
Select an option from the following list:

 Code Load & Code Patch local program Main Menu
 0: Exit
 1: Enter Code LOAD local program
 2: Enter Code PATCH local program
  Enter option number  (0..2) [0] ?
```

When you select the desired option number, the appropriate function of the utility executes, prompting for further inputs.

Code load methods

There are three software upgrade methods using code load:

Single Controller Upgrade—This upgrade method is used in single-controller configurations and is used for upgrading any software revision level to any other. With single-controller configurations, you always experience some interruption of subsystem operation while the code load process takes place.

Dual-Redundant Sequential Upgrade—This upgrade method is required for major software upgrades. Major upgrades are defined as those in which you are changing whole version numbers, such as Version 2.7 to Version 3.0. With this process, subsystem operation must be interrupted for a short amount of time. I/O activity should be halted during this type of code load operation.

Dual-Redundant Concurrent Upgrade—This upgrade method is usually used for minor software upgrades. Minor upgrades are defined as those in which you are changing among versions within the same whole version number, such as from Version 2.5 to Version 2.7.

Each of these methods can be performed from either the host console, or controller maintenance terminal ports.

Single controller upgrade method

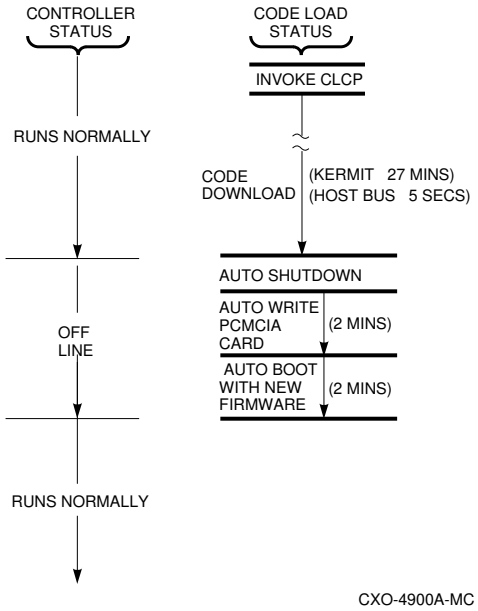
This section describes how to use the CLCP utility to perform code load from either the host console or controller maintenance terminal port in single controller configurations.

Figure 18 shows a flow diagram of the single controller code load method.

After the CLCP utility is invoked, the controller continues to run normally while the code is downloaded from host console or PC terminal program. This process may take from several seconds (for a host bus download) to 35 to 45 minutes (for a download performed via the maintenance

terminal port). The only time the code load process interrupts device service is for a period of about 4 minutes, while the program card is written and the controller initializes with the new software.

Figure 18
Single controller code load method



Host port upgrade

Caution

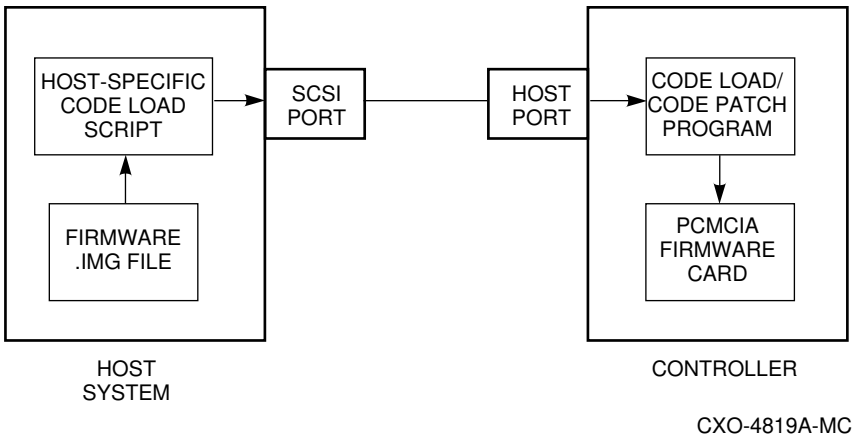
Device activity on your controller should be minimized during the code load operation.

The CLCP utility enables the user to upgrade the controller's software by downloading code through the host port. Host port code loading is much faster than using the maintenance terminal. The entire operation takes about 2 minutes to complete.

As shown in Figure 19, the user employs a download script running in the host to communicate with CLCP utility.

The user invokes the CLCP utility via the CLI, and when prompted, instructs the host to download the binary software image to the controller using the download script. The controller rewrites the software in its program card using the downloaded software image.

Figure 19
Host port code load operation



Host download script requirements

The host download script must meet the following requirements, for compatibility with the CLCP utility:

- The script must use the SCSI Write Buffer command in Mode 5 (Controller Download and Save) to transfer the software image.
- Data Length must be a multiple of 512 blocks.
- The Data Address must be a multiple of 512 blocks.
- Reserved command data block (CDB) fields must be zero.
- Data Address plus Data Length must not exceed 2 MB.

Note

Upgrade instructions for your system may vary, depending upon the platform, operating system, and application environment of your external processor. The instructions presented in this document are provided as a general guide.

Preparing the software image

Prepare the software image using the following procedure:

1. Obtain a copy of the software you wish to download. The file you receive is supplied in compressed, self-extracting, DOS.EXE format.
2. In an external PC or host DOS session, execute the file to extract the software image. The file has an .IMG

extension and is extracted into the same directory as the .EXE file.

Setting up the host

1. Copy the software .IMG file into an appropriate host directory.
2. Make sure that the download script is available to be run.

   There are two styles of program cards used in the controllers: one with a write protect switch and the other without a write protect switch.
3. Check the program card in your controller and see if it has a write protect switch.
4. If the program card in your controller has a write protect switch, perform the program card write enable procedure. This procedure may be done while the program card is installed in the controller. If you have a program card without a write protect switch, skip to the Run CLCP procedure.

Write enable the program card in the controller

Caution

The program card write enable switch is very fragile. Use care when sliding it to the proper position.

1. Locate the program card on the controller module.
2. Locate the write-protect switch on the outer edge of the card.
3. With a small pointed object, carefully slide the switch lever away from the eject button (see Figure 20).

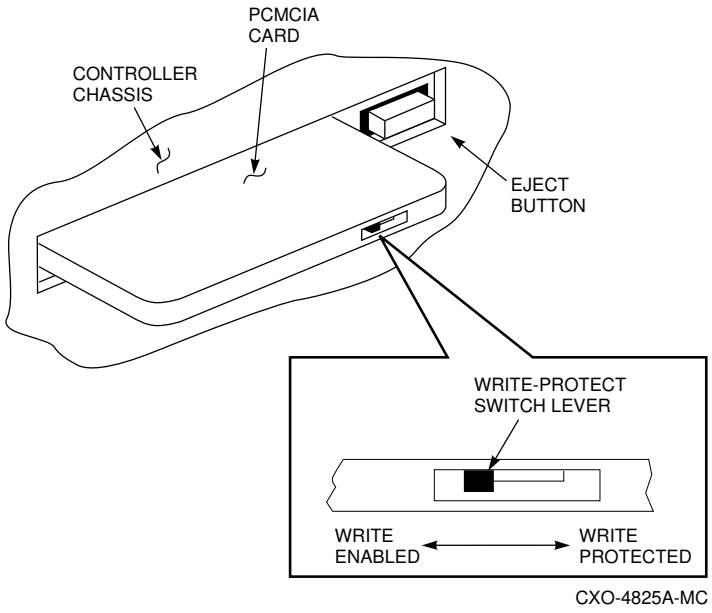


Figure 20
Write enable the program card

Running the CLCP utility

1. Invoke the CLCP utility:

```
CLI> RUN CLCP

 Select an option from the following list:

 Code Load & Code Patch local program Main Menu
0: Exit
1: Enter Code LOAD local program
2: Enter Code PATCH local program
Enter option number (0..2) [0] ? 1
-------------------------------------------------
```

2. Enter "1" to select the code load option.

3. The program displays a description of the code download options:

```
You have selected the Code Load local program. This
program is used to load a new firmware image on the
program card currently inserted in the controller.

Type ^Y or ^C (then RETURN) at any time to abort code
load.

The code image may be loaded using SCSI Write Buffer
commands through the SCSI host port, or using KERMIT
through the Maintenance Terminal port.
```

```
0: Exit
1: Use the SCSI Host port
2: Use the Maintenance Terminal Port

Enter option number  (0..2) [0] ?
```

4. Enter **1** to select the SCSI host port.

5. The program prompts with the following warning and the option to cancel the code load operation:

   ```
   WARNING: proceeding with Code Load will overwrite the
   current content of your program card with a new image.
   Enter Y (then RETURN) to continue [N]:
   ```

   Enter "**Y**" to continue:

   The program prompts with an indication that it is ready to accept the software image via the host port:

   ```
   Start code download now...
   ```

6. Invoke the host code load script (this is a host-specific process).

   After several seconds, the CLCP program displays a completion message and starts to write the newly loaded software to the program card:

   ```
   Code download finished.
   Program card is being re-programmed with new file
   ***  DO NOT INTERRUPT THIS STEP  ***
   ```

   After approximately 2 minutes, the controller starts automatically using the new software that was written to the program card. No user action is required. Ignore the "Last fail code" reported. The failcode is the indication the controller has restarted because of a successful code load operation.

   ```
   Copyright Digital Equipment Corporation 1993, 1995. All
   rights reserved.
   HSZ50 Firmware version V5.0, Hardware version AXYY
   Last fail code: 86000020
   Press " ?" at any time for help.
   The CLI will take 60 seconds to initialize.
   ```

7. After the code load operation is complete, and the program card is rewritten, verify the new software is installed. At the CLI prompt, enter:

```
CLI> SHOW THIS_CONTROLLER
```

The controller displays the following information (this is a sample only):

```
Controller:
   HSZ50-AX ZG34901786 Firmware V50Z, Hardware AX11
      Configured for dual-redundancy with ZG51301100
          In dual-redundant configuration
SCSI address 7
   Time: 05 JUN-1996 16:32:54
Host port:
   SCSI target(s) (0, 1, 2), Preferred target(s) (0, 1,
2)
Cache:
   32 megabyte  write cache, version 3
   Cache is GOOD
   Battery is good
   No unflushed data in cache
   CACHE_FLUSH TIMER = DEFAULT (10 seconds)
   CACHE_POLICY = B
   Host Functionality Mode = A
    No CACHE_UPS
```

Note, the software (firmware) version is displayed. Ensure that the software version is correct.

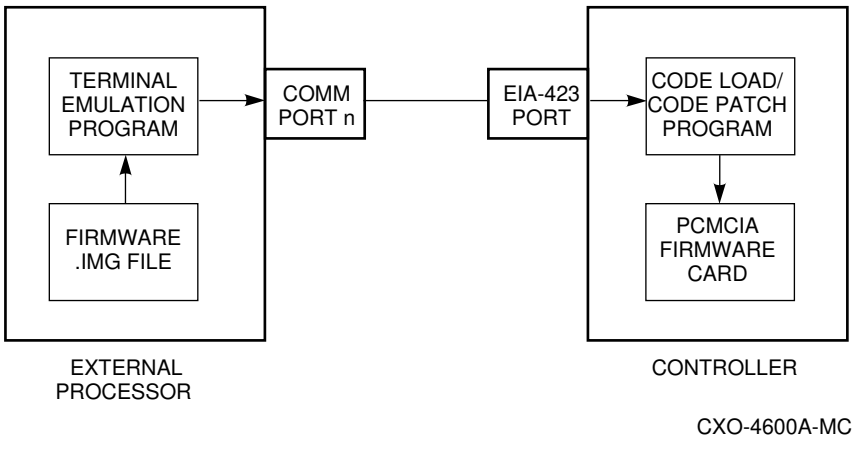
Maintenance terminal port upgrade

CLCP's code load option enables the user to upgrade the controller's software by downloading it through the controller's maintenance terminal port. This section describes how to use the CLCP utility to perform the maintenance port download code load operation.

As shown in Figure 21, an external processor containing a binary image of the controller software is connected to the controller's maintenance port. The external processor is typically a personal computer (PC). The user employs a terminal emulation program running in the external processor to communicate with the CLI in the controller. The user invokes the CLCP utility via the CLI.

When prompted by the CLCP utility, the user instructs the terminal emulator program to download the binary software image to the controller using the KERMIT line protocol. The controller rewrites the software in its program card using the downloaded software image.

Figure 21
Terminal port code load operation



System setup

Upgrade instructions for your system may vary, depending upon the platform, operating system, and application environment of your external processor. The instructions presented here apply to a system using the Microsoft Windows ™ operating environment and terminal emulator.

To set up your system for the code load operation, perform the following procedure:

1. Connect a serial communications port on your external processor and to the maintenance port on the controller, using the appropriate cable.

Caution

Failure to disable TSR programs may result in interruption of the code loading process and corruption of the controller's program card.

2. Disable any screen saver or other terminate-and-stay-resident (TSR) programs that may be activated within the external processor during the code load process.

3. Obtain a copy of the controller software image and load it into the external processor. The file is supplied in compressed, self-extracting, DOS .EXE format.

4. Extract the software binary image from the compressed, self-extracting file. In the Windows File Manager, double-click the file icon to run the file and extract the software image. The image file has an .IMG extension, and is extracted into the same directory as the .EXE file.

5. Open the Windows Accessories group in the Program Manager. Double-click the terminal icon to invoke the terminal emulator.

6. Open the Communications menu on the menu bar and configure the terminal emulator as shown below. Set the baud rate to the same speed that you set in your controller with the SET THIS_CONTROLLER command. Set the connector location to the serial communications port you are using on your external processor. When the terminal emulator is configured, close the menu window.

7. Configure your terminal as follows:
   - Baud Rate19200
   - Data Bits8
   - Stop Bits1
   - Parity None
   - Flow ControlXon/Xoff
8. Press the Enter key to obtain a CLI prompt. The controller should respond with a prompt such as “HSZ50”. If it does not respond, check your communications connection and terminal emulator configuration. Make sure the emulator and CLI communications settings match.
9. Open the Settings menu on the terminal emulator menu bar and select the Binary Transfers option. The binary transfers protocol selection menu is displayed.

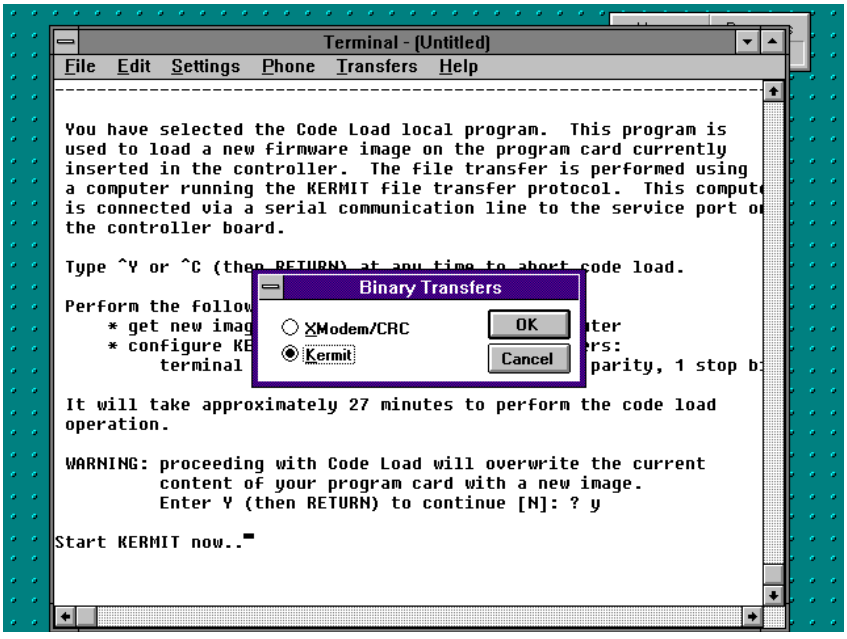


Figure 22
Binary transfer protocol selection

10. Select the KERMIT transfer protocol and click on the OK button (see Figure 22).

11. Your external processor and the serial link to the controller are now ready to download the new software image to the controller.
12. Remove the program card ESD cover.
13. Check the program card in your controller and see if it has a write protect switch.

    There are two styles of program cards used in the controllers: one with a write protect switch and the other without a write protect switch.
14. If the program card in your controller has a write protect switch, perform the program card write enable procedure. This procedure may performed while the program card is installed in the controller. If you have a program card without a write protect switch, skip to the procedure for running CLCP.

Write enable the program card in the controller

Caution

The program card write enable switch is very fragile. Use care when sliding it to the proper position.

1. Locate the program card on the controller module.
2. Locate the write-protect switch on the outer edge of the card.
3. With a small pointed object, carefully slide the switch lever away from the eject button.

Running the CLCP utility

1. Invoke the CLCP utility

```
CLI> RUN CLCP
```

The CLCP main menu is displayed:

```
Select an option from the following list:

 Code Load & Code Patch local program Main Menu
0: Exit
1: Enter Code LOAD local program
2: Enter Code PATCH local program

Enter option number (0..2) [0] ? 1
--------------------------------------------------
```

2. Enter "**1**" to select the code load option.
3. The program displays a description of the code download options.

```
You have selected the Code Load local program. This
program is used to load a new firmware image on the
program card currently inserted in the controller.

Type ^Y or ^C (then RETURN) at any time to abort code
load.

The code image may be loaded using SCSI Write Buffer
commands through the SCSI Host port, or using KERMIT
through the Maintenance Terminal Port

0: Exit
1: Use the SCSI Host port
2: Use the Maintenance Terminal Port

Enter option number (0..2) [0] ?
```

4. Enter 2 to select the maintenance terminal port.

   The program will prompt you with the following instructions and warning:

```
Perform the following steps before continuing:

* get new image file on serial line host computer
* configure KERMIT with the following parameters:
  terminal speed 19200 baud, eight bit, noparity, 1
stop bit

It will take approximately 35 to 45 minutes to perform
the code load operation.

WARNING: proceeding with Code Load will overwrite the
current content of your program card with a new image.
Enter Y (then RETURN) to continue [N]:?
```

5. Enter "**Y**" and press the **Return** key to continue with the code load operation. The program prompts you with "Start KERMIT now..".

6. Open the Transfers menu on the terminal emulator menu bar and select the Send Binary File option. The Send Binary File menu is displayed.

Caution

Do not abort the code load operation during the following two steps. If the code load operation is interrupted while data is being transferred or while the program card is begin rewritten, the card may be rendered unusable until it is reinitialized offline.

7. Select the disk drive and directory in which the software binary .IMG file resides. Double-click the .IMG file to select it. The terminal emulator program begins the binary file transfer to the controller.

   After 35 to 45 minutes (at a baud rate of 19, 200), the program displays the status of the code load operation and begins writing the software image from its shared memory into the program card.

   The controller automatically restarts using the newly-installed software after the program card is successfully rewritten. When the green RESET button begins flashing about once each second, the card rewrite operation is complete. No user interaction is required to restart the controller with the newly-installed software.

The dual-redundant, sequential upgrade method

The sequential upgrade code load method for dual-redundant configurations is illustrated in Figure 23. This method is *required* for major software upgrades.

The sequential upgrade method forces an interruption to device service. To avoid a situation in which the two controllers are running different software versions, each is shut down, while the other is code loaded. As shown in Figure 23, there are two periods of time when both controllers are off line. During these periods, devices are not serviced, and the subsystem is off line. I/O activity also should be halted during the code load operation.

Caution

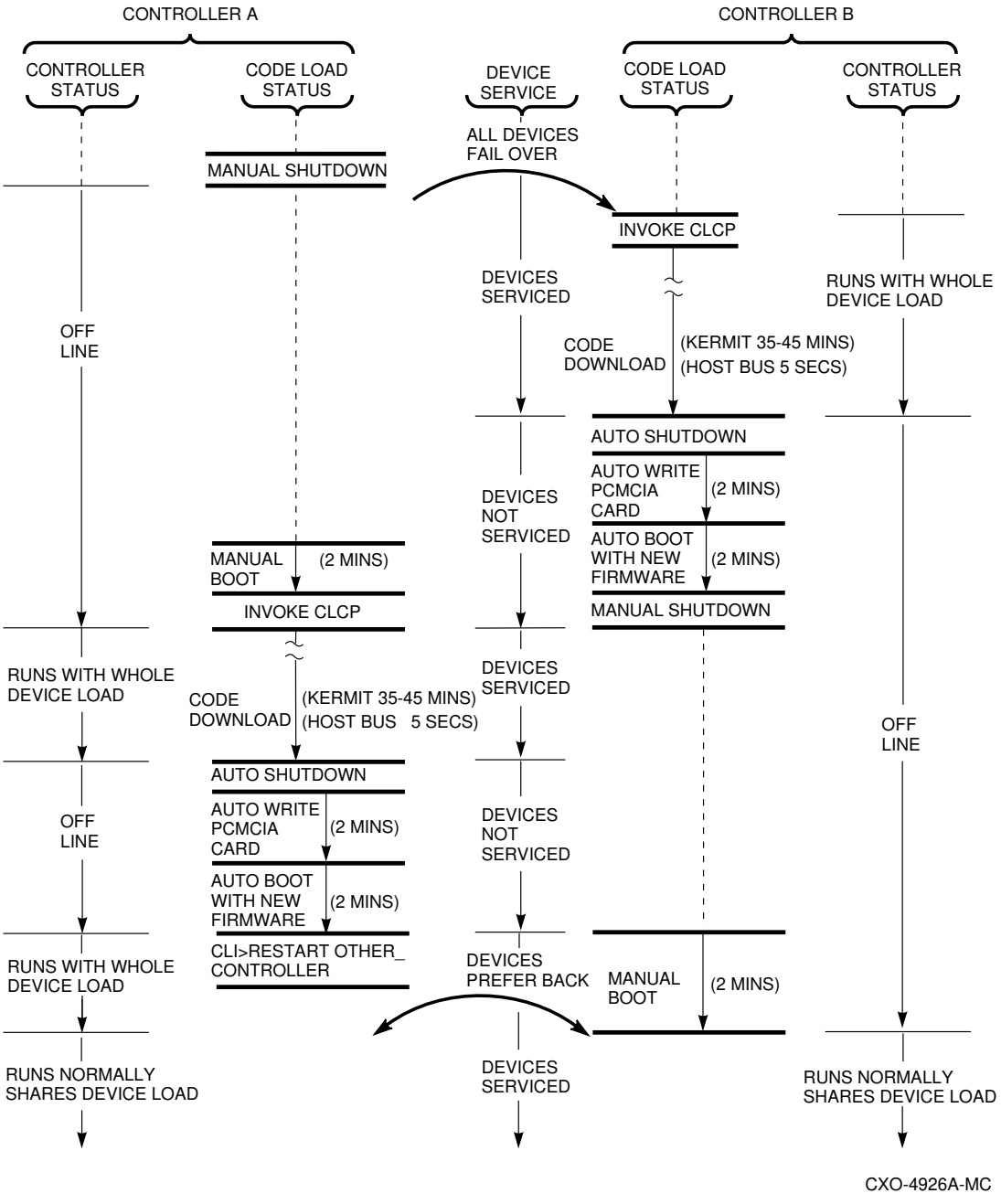
Always upgrade both of your controllers when you perform a software upgrade. Do not run your controllers at different version levels: the results may be unpredictable.

Special considerations for the sequential code load upgrade method

Be aware of the following special considerations when using the sequential upgrade method to upgrade your software:

- You must invoke CLCP separately for each controller in a dual-redundant configuration. CLCP does not automatically load both controllers.
- To avoid extended downtime, always upgrade both controllers when you perform a software upgrade.

Figure 23
The sequential upgrade method



Sequential upgrade procedure

1. For the purpose of this procedure, mark one controller "A" and one controller "B." This step will help you keep track of which controller is shut down and which controller is being loaded with new software.
2. Halt all I/O activity using the applicable procedures to your platform and operating system.
3. Connect a maintenance terminal to controller A.
4. At the CLI prompt, enter:

   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

5. Move the maintenance terminal to controller B.
6. If you wish to use the host port to load your software, perform the single controller host port upgrade procedure.

   If you wish to use the maintenance terminal port on the controller to upgrade your software, use the single controller maintenance port upgrade procedure.
7. After the code load process is completed, controller B will initialize.
8. At the CLI prompt, enter:

   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

9. Move the maintenance terminal back to controller A.
10. Manually initialize controller A by pressing the Reset (//) button for a few seconds.
11. After controller A has initialized, perform either host port upgrade procedure or the maintenance terminal port upgrade procedure.

12. At the CLI prompt, enter:

```
CLI> RESTART OTHER_CONTROLLER
```

The dual-redundant concurrent code load upgrade method

The concurrent upgrade code load method proceeds without any interruption to device service (see Figure 24). The shut down that occurs just after the code download causes a failover of all devices to the other controller. During the period when the program card is being written and the controller initializes, the other controller maintains control over the subsystem. While there might be a slight degradation in performance, the subsystem continues to operate during the controller code load operation.

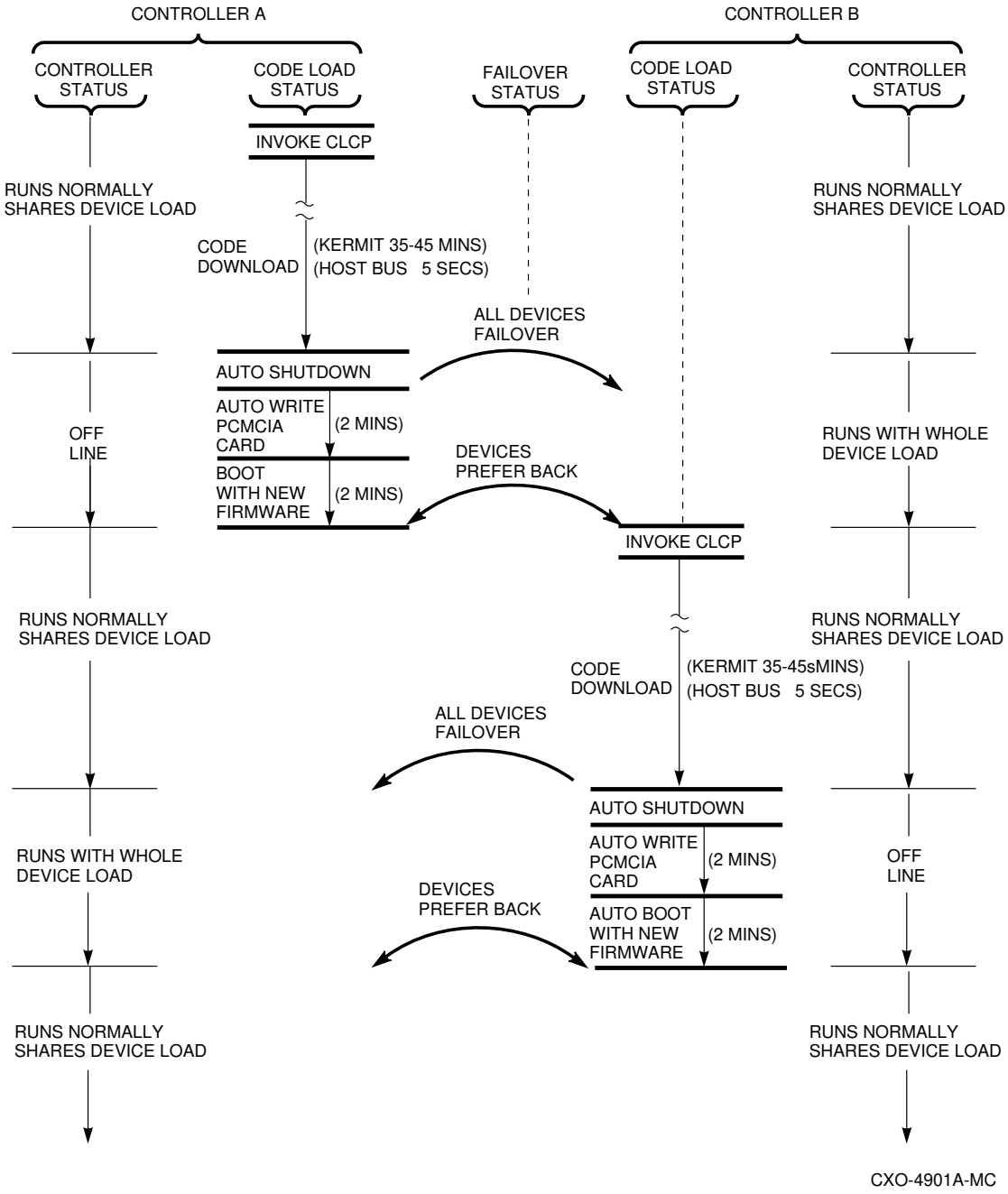
Considerations for the concurrent code load upgrade method

Be aware of the following special considerations when using the concurrent upgrade method to upgrade your software:

- You must invoke CLCP separately for each controller in a dual-redundant configuration. CLCP does not automatically load both controllers.
- Perform an upgrade each time a minor software version is released. If you skip releases and later upgrade one controller while the other is using an older revision, you may experience unpredictable results in the upgrade process. You may then have to use the sequential upgrade method to bring both controllers to the same software version level. Subsystem downtime will result.

- Code load controllers in a dual-redundant configuration in a serial fashion. If the controllers are code loaded in parallel, there is a chance that their program card write/reboot operations may overlap, causing both controllers to be off line at the same time. Subsystem downtime may result.
- Always upgrade both of your controllers when you do a software upgrade. Do not run your controllers at different revision levels, except for the short amount of time this may happen during the upgrade process.

Figure 24
The concurrent upgrade method



Concurrent code load upgrade procedure

1. For the purpose of this procedure, mark one controller "A" and the other controller "B."
2. If you wish to use the maintenance terminal to upgrade the software, use the Single Controller Maintenance Port Upgrade procedure.
3. After you have upgraded software in one controller repeat the same procedure for the other controller.
4. If you wish to use the host port to upgrade the software,proceed with Step 5 of this procedure.
5. Connect a maintenance terminal to controller A.
6. At the CLI prompt, enter:

```
CLI> SHOW THIS_CONTROLLER
```

7. The controller displays the following information (this is a sample only):

```
Controller:
   HSZ50 ZG34901786 Firmware V03.0-0, Hardware F01
      Configured for dual-redundancy with ZG51301100
          In dual-redundant configuration
SCSI address 7
   Time: 05 JUN-1996 16:32:54
Host port:
   SCSI target(s) (0, 1, 2), Preferred target(s) (0, 1,
2)
Cache:
   32 megabyte  write cache, version 3
   Cache is GOOD
   Battery is good
   No unflushed data in cache
   CACHE_FLUSH TIMER = DEFAULT (10 seconds)
   CACHE_POLICY = B
   Host Functionality Mode = A
```

8. Check to see if there are preferred targets on this controller. Note in the previous example, all SCSI targets are preferred to controller A. No targets are preferred to controller B.

9. In order to upgrade the software in both controllers from the host port, at least one target must be preferred to each controller. At the CLI prompt, enter:

   ```
   CLI> SET OTHER_CONTROLLER PREFERRED_ID=0
   ```

10. Both controllers are now configured for software upgrade using the host port method.

11. To upgrade controller A software, follow the single controller host port upgrade procedure.

12. When code load is completed, controller A will initialize.

13. Connect the maintenance terminal to controller B.

14. To upgrade controller B software, follow the same instructions as controller A.

15. Reconfigure both controllers to their original state by entering the following command:

    ```
    CLI>SET THIS_CONTROLLER PREFERRED
    ```

Patching controller software

The Code Patch function of the CLCP utility allows you to enter small changes to the controller's software. The patches that you enter are placed directly into the controller's NVMEM (nonvolatile memory), and become active after the next controller initialization. If any storage devices have been initialized with the SAVE_CONFIGURATION switch of the INITILIZE command, the patches that you enter will be stored on those disks.

The code patching utility allows more than one patch to be entered for a given software version. Each patch is associated with only one software version, and the code patch utility verifies the patch against the currently installed software version. Some patches require the installation of previous patches, *called dependent patches*, before they can be installed. Each patch has a unique patch number to identify it.

The Code Patch function also allows you to list patches already installed. You may want to list patches before you install a patch to see what has previously been loaded and to see how much free space is available.

You can run the Code Patch function of the CLCP utility from either a maintenance terminal or a virtual host terminal.

Code patch considerations

Be aware of the following when using the Code Patch function of the CLCP utility:

- The controller reserves enough nonvolatile memory for approximately 10 patches. However, this number varies according to the size of the patches you install.
- Each patch is associated with only one software version, and the Code Patch program verifies the patch against the currently installed software version.
- Patches are hierarchical. In other words, patch number one must be entered before you enter patch number two, and so on. Furthermore, there are no "zero" patches. Patches are always numbered sequentially beginning with the number one.
- Because of the hierarchical patch structure, removing any patch also removes all higher numbered patches. For example, deleting patch number two also removes patches three, four, and so on.
- Controllers in dual-redundant configurations must have the same patches applied. You must enter patches into each controller separately.

Listing patches

The List Patches option allows you to display a listing of controller software versions, and the currently installed patches that apply to them.

Following is an example of the List Patches option:

1. Connect a maintenance terminal to the controller.
2. Invoke the CLCP utility:

```
CLI> RUN CLCP
```

The CLCP main menu is displayed:

```
Select an option from the following list:

Code Load & Code Patch local program Main Menu

0: Exit
1: Enter Code LOAD local program
2: Enter Code PATCH local program
Enter option number  (0..2) [0] ?
```

3. Enter option "**2**" to enter the patch program:

```
You have selected the Code Patch local program. This
program is used to manage firmware code patches. Select
an option from the following list:

Type ^Y or ^C (then RETURN) at any time to abort Code
Patch.

Code Patch Main Menu

0: Exit
1: Enter a Patch
2: Delete Patches
3: List Patches

Enter option number (0..3) [0] ? 3
```

4. Enter option "**3**" to list patches.

```
The following patches are currently stored in the patch
area:

Firmware Version  -  Patch number(s)
     _______          _________

      V27Z  -            2, 1
      V30Z  -          3, 2, 1

Currently, 91% of the patch area is free.
```

   The SHOW THIS_CONTROLLER command also provides patch information in the form of a "dash number" following the software version. In the following example, software Version 3.0 has had up to three patches applied to the current software.

5. At the CLI prompt, enter:

```
CLI> SHOW THIS_CONTROLLER

Controller:
HSZ50 ZG33400026 ❶Firmware V30Z-3, Hardware 0000
.
.
.
```

   Note at ❶, the bold number 3 shows that three patches have been installed for software version 3.0

Installing a patch

This option allows you to enter a software program patch directly into the controller's NVMEM. You are prompted to enter the software version number to which the patch applies, the patch length, the patch type, the patch number, the count, the RAM address, the new contents of that address, and a patch verification number.

The code patch utility verifies that the patch you are entering is appropriate for the software version in the controller, and that there are no required dependent patches. It allows you to enter only one patch at a time.

Note

The patch data in these examples is provided only for the purpose of illustrating the code patch operation. Obtain actual code patch data for your controller's software version from your Digital representative.

The utility prompts with error messages if you attempt to perform an illegal patch entry. Following is an example of the use of the patch entry option:

1. Obtain the appropriate patch data for your controller's software version from your Digital Equipment Corporation representative.
2. Connect a maintenance terminal to the controller.
3. At the CLI prompt, enter:

```
CLI> RUN CLCP
```

   The CLCP main menu is displayed:

```
Select an option from the following list:

Code Load & Code Patch local program Main Menu

0: Exit
1: Enter Code LOAD local program
2: Enter Code PATCH local program

Enter option number  (0..2)?
```

4. Enter option "**2**" for the code patch menu:

```
You have selected the Code Patch program. This program
is used to manage firmware code patches. Select an
option from the following list:

Type ^Y or ^C (then RETURN) at any time to abort Code
Patch.

Code Patch Main Menu

0: Exit
1: Enter a Patch
2: Delete Patches
3: List Patches

Enter option number (0..3)?
```

5. Select option "**1**" to enter a patch and press Return.

```
This is the Enter a Patch option. The program prompts
you
for the patch information, one line at time. Be careful
to enter the information exactly as it appears on the
patch release.
Patches may be installed for any version of firmware;
however, patches entered for firmware versions other
than V30Z are not applied until the matching version of
firmware is installed.

To enter any patch, you must first install all patches
with lower patch numbers, beginning with patch number
1, for the specific firmware version.
If you incorrectly enter the patch information, you are
given the option to review the patch one line at a
time.

Type ^Y or ^C (then RETURN) at any time to abort Code
Patch.

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

6. Enter "**Y**" to continue.

7. Enter the required information as shown:

```
Version:      ? V30Z
Length:       ? 10
Patch Type:   ? 0
Patch Number: ? 1

Count:        ? 1
Address:      ? 10
Value[  0]    ? 0
Count:        ? 0

Verification: ? 18FG2118
The patch you just entered is not applied until
the controller is restarted.

Code Patch Main Menu

       0: Exit
       1: Enter a Patch
       2: Delete Patches
       3: List Patches

Enter option number (0..3) [0] ?

CLCP - Normal Termination
Restart of the controller required to apply new patch

CLI>
```

8. If you are using a dual-redundant controller configuration, repeat the Installing a Patch procedure for the second controller.

Code patch messages

The Code Patch utility does not allow you to incorrectly enter or delete patch information. The program provides messages to assist you with understanding any problems that you may encounter and suggests corrective actions.

Message:

```
Firmware Version x does not have any patches to delete.
```

Explanation: You cannot delete a patch because the software (firmware) version entered does not have any patches entered.

Message:

```
Firmware Version x does not have patch number x to delete.
```

Explanation: You cannot delete this patch because the software (firmware) version entered does not have the specified patch entered.

Message:

```
The patch you entered is already installed on this
controller.
```

Explanation: The specified patch is already present in the patch area of controller memory. If you wish to reenter this patch, first use the Delete Patch option.

Message:

```
The patch you are entering requires other patches to be
entered.
```

Explanation: You have attempted to enter a patch without first entering the lower numbered patches in the hierarchy. Enter all patches for this software (firmware) version that have lower numbers than the current patch. Then enter the current patch.

Message:

```
WARNING  The patch you are entering is not for the current
firmware version x.
```

Explanation: The patch you are entering applies to a software version other than the one currently installed in the controller. Code Patch will allow you to enter the patch; however, the patch will not be applied until its correct software version is installed.

Message:

```
You incorrectly entered the patch information.
```

Explanation: The patch information was not entered exactly. The program prompts you for each line of the patch entry, with the default from your previous response. Verify that each entry is exactly the same as the patch release. If you choose not to continue, or if you abort during this review procedure, the patch information you entered is lost and you must enter the entire patch again. You may enter Ctrl/Z followed by Return at any prompt to choose the default for the remaining entries.

Message:

```
The patch you have just entered is not applied until the
controller firmware is changed to Version x.
```

Explanation: The patch entered applies to a software version (firmware) other than the one currently installed in the controller. Code Patch will not apply the patch until its correct software version is installed.

Message:

```
You have requested deletion of a patch number that another
patch requires.
```

Explanation: You are attempting to delete a patch in the hierarchy that has higher numbered patches entered. Code Patch will allow you to proceed; however, the program will delete all the higher numbered patches in the hierarchy (for this software version) along with the specified patch.

Formatting disk drives

Use HSUTIL's FORMAT_DISK option to format simultaneously up to seven disk drives attached to a single controller or up to six disk drives attached to a dual-redundant pair of controllers.

Caution

Suspend all I/O to the buses that service the target disk drives.

To format one or more disk drives:

1. Start HSUTIL.

   ```
   CLI> RUN HSUTIL
   ```

2. Enter 1 to select the FORMAT function.

   HSUTIL finds and displays all of the unformatted disk drives attached to the controller.

3. Enter the name of each disk drive you want to format:

   ```
   Enter a device to format ? disk_name
   ```

4. Enter "Y" to enter another disk drive name or "N" to begin the formatting operation:

   ```
   Select another device (y/n) [n] ? N
   ```

5. Read the cautionary information that HSUTIL displays, then confirm or cancel the formatting operation:

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

Considerations for formatting disk drives

Keep the following points in mind for formatting disk drives with HSUTIL:

- HSUTIL cannot format disk drives that have been configured as single disk drive units or as members of a storageset, spareset, or failedset. If you want to format a disk drive that was previously been configured as such, you will have to delete the unit number and storageset name associated with it.

- If the power fails or the bus is reset while HSUTIL is formatting a disk drive, the drive may become unusable until a successful format is completed. To minimize this possibility, Digital recommends you secure a reliable power source and suspend all non-HSUTIL activity to the bus that services the target disk drive.
- HSUTIL cannot control or affect the defect management for a disk drive. The drive's microcode controls the defect management during formatting.
- Do not invoke any CLI command or run any local program that might reference the target disk drive while HSUTIL is active. Also, do not reinitialize either controller in the dual-redundant configuration.

Example

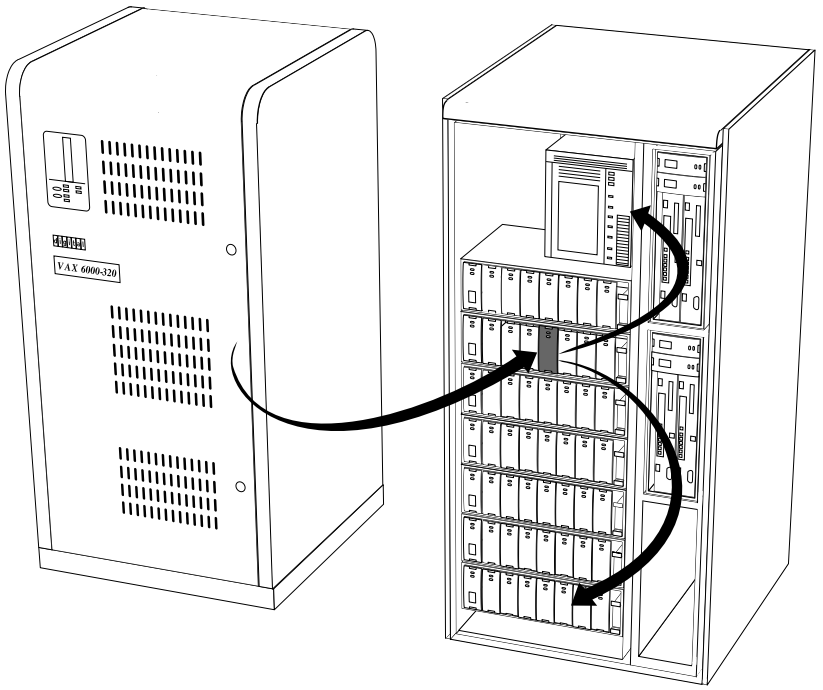
```
CLI> RUN HSUTIL

*** Available functions are:
0. EXIT
1. FORMAT
2. DEVICE_CODE_LOAD_DISK
3. DEVICE_CODE_LOAD_TAPE
Enter function number (0:3) [0] ? 1

Unattached devices on this controller include:
Device        SCSI Product ID    Current Device Rev
DISK100       RZ26   (C) DEC     T386
DISK200       RZ26   (C) DEC     T386
DISK210       RZ29B  (C) DEC     0006
DISK310       RZ25   (C) DEC     0900
DISK320       RZ26L  (C) DEC     X442

Enter a device to format ? DISK100
Format DISK100 may take up to 40 minutes to format
Select another device (y/n) [n] Y

Enter a device to format ? DISK200
Format DISK200 may take up to 35 minutes to format
Select another device (y/n) [n] Y

Enter a device to format ? DISK210
Format DISK210 may take up to 15 minutes to format
Select another device (y/n) [n] N

^Y and ^C will be disabled while the format operation is in
progress.

CAUTION:
   When you format a device, it will destroy the data on
```

```
   the device. A backup of the device should have been
   done if the data is important.

NOTE:
   In order to minimize the possibility of a SCSI bus
   reset, it is recommended that you prevent non-HSUTIL IO
   operations to all other devices on the same port as the
   destination device(s). If a SCSI bus reset occurs, the
   format may be incomplete and you may have to re-invoke
   HSUTIL.

After you answer the next question, the format will start.
Do you want to continue (y/n) [n] ? Y

HSUTIL started at: 14-AUG-1996 15:00:31
Format of DISK100 finished at 14-JUN-1996 16:40:12
Format of DISK200 finished at 14-JUN-1996 17:15:31
Format of DISK210 finished at 14-JUN-1996 16:30:43

HSUTIL - Normal Termination at 14-JUN-1996 16:31:09
```

Installing new firmware on a device

Installing new firmware on a disk or tape drive is a two-step process as shown in Figure 25. First, copy the new firmware from your host to a disk drive in your subsystem, then use HSUTIL to distribute the *firmware* devices in your subsystem.

Figure 25
Installing new firmware on a disk or tape drive



Considerations for installing new device *firmware*

Keep the following points in mind while using HSUTIL to install new *firmware* on a device:

- Installing new *firmware* with HSUTIL has been thoroughly tested with the qualified devices listed in the release notes. HSUTIL does not prevent you from attempting to install new *firmware* on unsupported devices but, if the installation fails, the device may be rendered unusable and require the manufacturer's attention.
- If the power fails or the bus is reset while HSUTIL is installing the new *firmware*, the device may become unusable. To minimize this possibility, Digital recommends that you secure a reliable power source and suspend all non-HSUTIL activity to the bus that services the target device.
- HSUTIL cannot install *firmware* on devices that have been configured as single disk drive units or as members of a storageset, spareset, or failedset. If you want to install *firmware* on a device that is previously been configured as such, you will have to delete the unit number and storageset name associated with it.
- The source disk drive that contains the new *firmware* to be downloaded must be configured as a single disk drive unit within your subsystem.
- During the installation, the source disk drive is not available for other subsystem operations.
- Some *firmware* releases require that you format the device after installing the new *firmware*. Refer to the documentation that accompanied the *firmware* to determine if you need to reformat the device after installing new *firmware*.

- Some devices may not reflect the new *firmware* version number, and so forth,. when viewed from another controller (in dual-redundant configurations). If you experience this, simply reinitialize the device from either controller.

HSUTIL abort codes

If HSUTIL terminates before it formats a disk drive or installs new firmware, it reports one of the abort codes in Table 10.

Table 10
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

HSUTIL messages

HSUTIL may produce one or more of the following messages while you are formatting disk drives or installing new firmware. Many HSUTIL messages have been omitted from this section because they are self-explanatory.

Message:

```
Insufficient resources
```

Explanation: HSUTIL cannot find or perform the operation because internal controller resources are not available.

Message:

```
Unable to change operation mode to maintenance for unit
unit_number
```

Explanation: HSUTIL was unable to put the source single disk drive unit into maintenance mode to enable formatting or code load.

Message:

```
Unit unit_number successfully allocated
```

Explanation: HSUTIL has allocated the single disk drive unit for code load operation. At this point, the unit and its associated device are not available for other subsystem operations.

Message:

```
Unable to allocate unit
```

Explanation: HSUTIL could not allocate the single disk drive unit. An accompanying message explains the reason.

Message:

```
Unit is owned by another sysap
```

Explanation: Device cannot be allocated because it is being used by another subsystem function or local program.

Message:

```
Unit unit_number is in maintenance mode
```

Explanation: Device cannot be formatted or code loaded because it is being used by another subsystem function or local program.

Message:

Unit *unit_number* is allocated to other controller, please re-invoke HSUTIL from the other controller or make the unit allocated to this controller by one of the following commands:

```
SET THIS PREFERRED ID=(unit's target ID).
SET OTHER NOPREFERRED_ID.
```

Explanation: The device shown is still under the control of the companion controller. Follow the recommended steps to run HSUTIL.

Message:

```
CAUTION:
In order to minimize the possibility of a SCSI bus reset,
which could disable the destination device, it is
recommended that you prevent IO operations to all other
devices on the same port as the destination device.
```

Explanation: (Displayed in code load only.) A SCSI bus reset can occur if the controller is manually rebooted or if it detects an error during normal subsystem operation. The more active devices there are on the same port as the target device, the greater the chance that an error causing a SCSI bus reset may occur. By minimizing the level of activity on the device port being used for code loading, the user minimizes the chances of a SCSI bus reset that could render a target device unusable.

Message:

Exclusive access is declared for unit *unit_number*

Explanation: Another subsystem function has reserved the unit shown.

Message:

The other controller has exclusive access declared for unit *unit_number*

Explanation: The companion controller has locked out this controller from accessing the unit shown.

Message:

The RUNSTOP_SWITCH is set to RUN_DISABLED for unit *unit_number*

Explanation: The RUN\NORUN unit indicator for the unit shown is set to NORUN. The disk is not spun up.

Message:

```
No available unattached devices.
```

Explanation: The program could find no unattached devices to list.

Message:

```
What BUFFER SIZE, (KB) 1024, does the drive require (2, 4,
8, 16, 32) [8] ?
```

Explanation: This message is displayed if HSUTIL detects that an unsupported device has been selected as the target device and if you're downloading the firmware image using more than one SCSI Write Buffer command. You must specify the number of bytes to be sent in each Write Buffer command. The default buffer size is 8192 bytes. A firmware image of 256 KB, for example, can be code loaded in 32 Write Buffer commands, each transferring 8192 bytes. In this example, the correct entry for the buffer size would be "8."

Message:

```
What is the TOTAL SIZE of the code image in 512 byte blocks
[MAX 512] ?
```

Explanation: This message is displayed if HSUTIL detects that an unsupported device has been selected as the target device. You must enter the total number of 512-byte blocks of data to be sent in the code load operation. For example, a firmware image that is 262, 144 bytes long would require 512, 512-byte blocks.

Message:

```
Does the target device support only the download microcode
and SAVE (y/n) [y] ?
```

Explanation: This message is displayed if HSUTIL detects that an unsupported device has been selected as the target device. You must specify whether the device supports the SCSI Write Buffer command's download and save function.

Message:

```
Should the code be downloaded with a single write buffer
command (y/n) [y] ?
```

Explanation: This message is displayed if HSUTIL detects that an unsupported device has been selected as the target device. You must indicate whether to download the firmware image to the device in one or more contiguous blocks, each corresponding to one SCSI Write Buffer command.

Enabling a licensed option (FLS Utility)

The firmware licensing system (FLS) enables or disables the licensed value-added firmware features: RAID, mirroring, write-back cache. You can use the FLS utility to perform the following tasks:

- Enable or disable optional functions for your controller
- Try an optional feature before purchasing the license to use it
- Enter your license key for a licensed feature

After starting the FLS utility, the display shows the current status of the value-added options for your controller and contains menu choices for each function of the utility.

Enabling options

You can turn on any option at any time using FLS, but if you enable an option for which you are not licensed, an error message appears on your CLI console and an error is logged in the host error log. These error indications are repeated once each hour while the unlicensed option remains enabled. Licensed value-added software features may have their license keys preloaded at the factory.

License key

After you have installed a license key for a software option, you must run the FLS utility again to enable any licensed keys you have entered for your controller.

Also, you must run the FLS utility separately for each controller in a dual-redundant configuration. The FLS utility does not automatically load both controllers.

FLS operations

Table 11 shows all of the FLS operations. Enabling a software option and entering a licensed key are explained in this section. For disabling and clearing a licensed key, refer to Chapter 5, "Removing" of this manual.

Table 11
FLS operations

Action	Submenu choices	Result
Enable an option	List each option and its status	Option enabled
Disable an option	List each option and its status	Option disabled
Enter a license key	Prompt for new license key	Key becomes valid
Clear a license key	Prompt for license key to clear	Key becomes invalid

The FLS utility menu

The following example shows the FLS main menu:

1. Connect a maintenance terminal to a controller.
2. At the CLI prompt, enter:

```
CLI> RUN FLS
```

The FLS menu displays:

```
Firmware Licensing System (FLS) on node MASS
Option❶   State❷       License❸       Key❹
-------------------------------------------------
RAID      DISABLED      INVALID        *none*
WBCA      DISABLED      INVALID        *none*
MIRR      DISABLED      INVALID        *none*

               RAID = RAID Option❺
               WBCA = Writeback Cache Option
               MIRR = Disk Mirroring Option
-------------------------------------------------
    1   Enable a firmware option
    2.  Disable a firmware option
    3.  Enter a license key for a firmware option
    4.  Clear a license key for a firmware option
    0.  Exit FLS
Enter selection (0:4) [0] ?
```

- ❶**Option**–The RAID, write-back cache (WBCA), mirror (MIRR).
- ❷**State**–All three of the available options (RAID, WBCA, MIRR) are disabled. You may enable any option available, regardless of whether you have a valid license key.
- ❸**License**–None of the available license options are enabled.
- ❹**Key**–The company name that holds the valid license key (in this example no companies are listed).
- ❺**Description of Option**–A short description of each option is given.

To perform an operation, enter the choice number and any information requested by the submenu or prompts.

The write-back cache example

The following example demonstrates how to enter a license key. The example shows how to enable the WBCA (write-back cache) key.

1. Connect a maintenance terminal to the controller.
2. Start the FLS utility:

```
CLI> RUN FLS
```

The FLS menu displays.

```
-------------------------------------------------
Firmware Licensing System (FLS) on node MASS
Option      State        License        Key
-------------------------------------------------
RAID      DISABLED      INVALID        *none*
WBCA      DISABLED      INVALID        *none*
MIRR      DISABLED      INVALID        *none*
              RAID = RAID Option
              WBCA = Writeback Cache Option
              MIRR = Disk Mirroring Option
-------------------------------------------------

1.  Enable a firmware option
2.  Disable a firmware option
3.  Enter a license key for a firmware option
4.  Clear a license key for a firmware option
0.  Exit FLS
Enter selection (0:4) [0] ?
```

3. Enter option "**3**" to enter a license key:

The available options are displayed.

```
1. Enter new license key for RAID (current key is
invalid)
2. Enter new license key for WBCA (current key is
invalid)
3. Enter new license key for MIRR (current key is
invalid)
0. Return to main menu
Enter selection (0:3) [0] ?
```

4. Select option "**2**" to enter license key for WBCA:

```
Enter new WBCA key, or enter 0  to return to main menu:
```

5. Enter the license key for WBCA:

ACME_WIDGET_CORP2Z813AE7

6. Enter "**0**" to return to the FLS main menu.

   If the correct key has been entered, the controller reports the following:

```
*** License key verified ***
```

   The FLS main menu now displays:

```
------------------------------------------------
Firmware Licensing System (FLS) on node MASS
Option      State        License        Key
------------------------------------------------
RAID      DISABLED      INVALID        *none*
WBCA      DISABLED       VALID     ACME WIDGET_CORP
MIRR      DISABLED      INVALID        *none*

              RAID = RAID Option
              WBCA = Writeback Cache Option
              MIRR = Disk Mirroring Option
------------------------------------------------

1. Enable a firmware option
2. Disable a firmware option
3. Enter a license key for a firmware option
4. Clear a license key for a firmware option
0. Exit FLS
Enter selection (0:4) [0] ?
```

7. Enter option "**1**" to enable the licensed option.

   The FLS main menu shows the following license information:

```
------------------------------------------------
Firmware Licensing System (FLS) on node MASS
Option      State        License        Key
------------------------------------------------
RAID      DISABLED      INVALID        *none*
WBCA      ENABLED       VALID     ACME WIDGET CORP
MIRR      DISABLED      INVALID        *none*
               RAID = RAID Option
               WBCA = Writeback Cache Option
               MIRR = Disk Mirroring Option
------------------------------------------------
```

Enabling a firmware option without a valid license key

You can turn on any firmware option at any time using the FLS utility. However, if you enable an option for which you

are not licensed, an error message appears on your CLI console and an error is logged in the host error log. These host error indicators are repeated every hour while the unlicensed option remains enabled.

1. At the CLI prompt, enter:

   ```
   CLI> RUN FLS
   ```

   The FLS main menu displays:

   ```
   ------------------------------------------------
   Firmware Licensing System (FLS) on node MASS
   Option      State         License        Key
   ------------------------------------------------
   RAID      DISABLED      INVALID        *none*
   WBCA      DISABLED      INVALID        *none*
   MIRR      DISABLED      INVALID        *none*

               RAID = RAID Option
               WBCA = Writeback Cache Option
               MIRR = Disk Mirroring Option
   ------------------------------------------------

   1. Enable a firmware option
   2. Disable a firmware option
   3. Enter a license key for a firmware option
   4. Clear a license key for a firmware option
   0. Exit FLS
   Enter selection (0:4) [0] ?
   ```

2. Select option "**1**" to enable a firmware option.

3. Select the option you wish to enable (that is, RAID = RAID Option, WBCA = Write Back Cache Option, MIRR = Disk Mirroring Option.

   The controller reports that the option has been enabled.

4. Select "**0**" from the main menu to exit the FLS utility.

FLS messages

This section lists the messages you may see when you use the FLS utility:

Message:

option has been turned on without a valid license

Explanation: You have activated the option named by *option* without entering a valid license key. You can evaluate this option for a time to determine its value, and you receive a valid license key when you purchase the license for the option.

Message:

```
Error nnnn: option support is not enabled on this
controller
```

Explanation: The *option* you are attempting to use is not enabled in FLS. For example, if you try to turn on write-back caching, you receive this error if write-back caching is not enabled by FLS.

Message:

```
***WARNING:  This is an invalid license Key***
```

Explanation: The license key you entered is not between 6 and 32 characters, or the customer license key is not valid. Verify that the key is correct and reenter.

Message:

```
Error: Disabling option is not possible at this time,
option is in use
```

Explanation: You have attempted to disable the option named by *option* while it is in use.

Message:

```
License different between the two controllers
```

Explanation: You have installed your license key in only one of your dual-redundant controllers. Connect a maintenance terminal to the other controller, run FLS and enter the license key.

Installing a controller and cache module in a single controller configuration

Use the following procedure to install a controller, cache module and power supplies into an empty controller shelf for the first time:

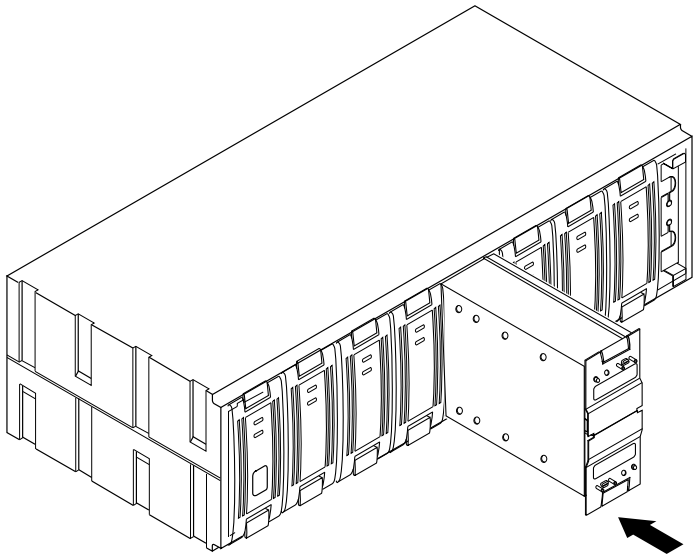
1. Using Table 12 as a guide, determine the SCSI ID and the slot into which the controller is to be installed. Note that the first controller should be installed in the slot that corresponds to SCSI ID 7.

Table 12
SCSI ID Slots

Controller	SW800 Front View	SW800 Rear View	SW500 Front	SW300
First Controller	Right Side SCSI ID 7	Left Side SCSI ID 7	Top Slot SCSI ID 7	Bottom Slot SCSI ID 7
Second Controller	Left Side SCSI ID 6	Right Side SCSI ID 6	Bottom Slot SCSI ID 6	Top Slot SCSI ID 6

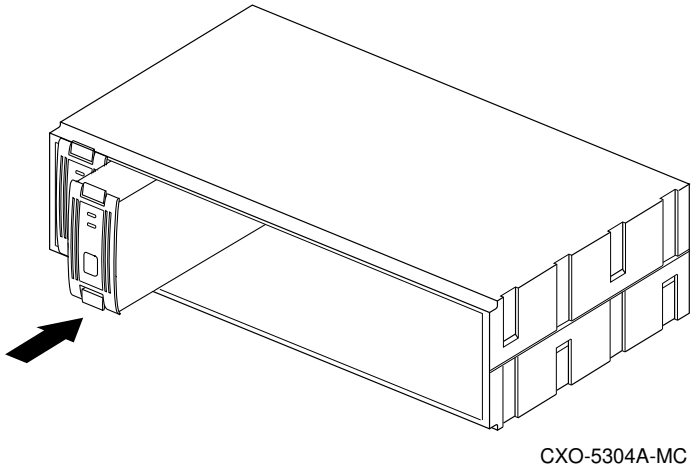
2. Connect a maintenance terminal to the controller.
3. Install an SBB battery module into a convenient device slot (see Figure 26).

Figure 26 Installing an SBB battery module



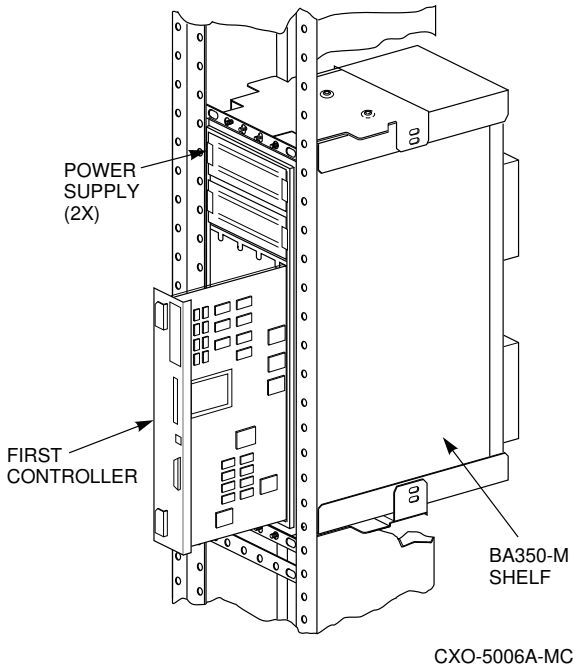
4. Install the controller power supplies into the controller shelf (see Figure 27).

Figure 27 Installing controller power supplies



5. Slide the cache module into the controller shelf with a gentle rocking motion to help seat the module.
6. Install the controller module into the shelf slot that corresponds to SCSI ID 7 (see Figure 28).

Figure 28
Installing a single controller (SW800 cabinet)



7. Connect the ECB cable to the cache module and then to the ECB.
8. Tighten the screws on each end of the ECB cable.
9. Remove the program card from the controller.
10. Connect the power cords to the controller power supplies.
11. Press and hold the Reset button (//) while inserting the program card. The controller initializes and performs all internal self tests.

    When the Reset (//) LED flashes at a rate of once every second, the initialization process is complete.
12. Snap the ESD cover into place over the program card. Push the pins inward to lock the cover into place.
13. Connect the trilink connector with host cable and terminator to the controller host port.

14. Check the ECB status indicator for the appropriate indication (see Table 13).

15. On the ECB front panel, check the LED status indicator for the appropriate indication as shown in Table 13:

Table 13
ECB status indicators

LED Status	Battery Status
LED is on continuously	System power is on and the ECB is fully charged.
LED blinks rapidly	System power is on and the ECB is charging.
LED blinks slowly	System power is off and the ECB is supplying power to the cache.
LED is off	System power is off and the ECB is not supplying power to the cache.

If the battery status is low, you may want to set the cache policy. Refer to the procedure documented in the *HSZ50 Array Controllers CLI Reference Manual*.

16. Enable your valid license for the write-back cache. Refer to the section "Enabling a License Option (FLS utility)".

17. Enable the write-back cache from the CLI:

```
CLI> SET unit name WRITEBACK_CACHE
```

Installing a second controller and cache module

Use this procedure to install a second controller and cache module for redundancy. Service to the subsystem is halted during this procedure.

To add the second controller and cache module:

1. Connect a maintenance terminal to the existing controller.
2. At the existing controller's terminal, enter:

   ```
   CLI> SHOW THIS_CONTROLLER
   ```

   The controller displays the following information (this is a sample only):

   ```
   Controller:
     HSZ50-AX ZG34901786 Firmware V50Z, Hardware AX11
           Not configured for dual-redundancy
   SCSI address 7
      Time: 04 JUN-1996 16:32:54
   Host port:
      SCSI target(s) (0, 1, 2), Preferred target(s) (0, 1,
   2)
   Cache:
      64 megabyte  write cache, version 2
      Cache is GOOD
      Battery is good
      No unflushed data in cache
      CACHE_FLUSH TIMER = DEFAULT (10 seconds)
      CACHE_POLICY = B
      Host Functionality Mode = A
      No CACHE_UPS
   ```

3. Note the type, memory size, and version of cache that is installed with the first controller.
4. If a cache module is present with the first controller, prepare another one of the same type and memory size.
5. Set the preferred ID by entering the following command:

   ```
   CLI> SET THIS_CONTROLLER PREFERRED_ID=(n,n)
   ```

   where nn=SCSI target IDs.

6. Use the procedures appropriate to your host operating system to halt *host* activity on your subsystem.
7. At the CLI prompt, enter:

   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

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

   Wait until the controller halts before proceeding.
8. Disconnect power cords from controller power supplies. If you do not already have a second power supply installed, this may be the time to install the second supply.
9. Using Table 12 as a guide, find the slot and the SCSI ID into which the controller is to be installed. Note that the second controller should be installed in the slot that corresponds to SCSI ID 6.
10. Install an ECB into one of the SBB slots.
11. Slide the cache module into the appropriate slot in the controller shelf and push it firmly into the slot until it is seated.
12. Slide the controller module into the appropriate slot and push the module firmly into the slot until it is seated.
13. Eject the program card.
14. Tighten the four captive screws on the controller's front bezel.
15. Connect the ECB battery cables to the cache module and then to the ECB. Tighten the screws on the cable.

16. Reconnect power cords to the controller power supplies.
17. Press and hold the Reset button (//) on the existing controller while inserting the program card. Then release the button and the controller will intialize.
18. When the Reset (//) LED flashes at a rate of once every second, the initialization process is complete.
19. Press and hold the Reset (\\) button on the new controller while inserting the program card. The new controller will initialize and perform all internal self tests.
20. Snap the ESD covers in place over the program cards of both controllers.
21. Connect a maintenance terminal to the new controller and enter the following command to verify the new controller is functioning:

    ```
    CLI> SHOW THIS_CONTROLLER
    ```

22. If there are any invalid cache errors, enter the following command to clear the errors:

    ```
    CLI> CLEAR INVALID_CACHE THIS_CONTROLLER
    NODESTROY_UNFLUSHED_DATA
    ```

23. Set the new controller to nofailover with the following command:

    ```
    CLI> SET NOFAILOVER
    ```

24. Remove the SCSI host interconnect cable and terminator on the existing controller.
25. Connect the SCSI host interconnect cable to the trilink on each controller.
26. Reconnect the SCSI host interconnect cable to the trilink on the new controller and install the terminator on the trilink of the new controller.

27. From the CLI of the existing controller, enter the following command:

    ```
    CLI> SET NOFAILOVER
    ```

28. Restart the new controller by entering the following command:

    ```
    CLI> RESTART OTHER_CONTROLLER
    ```

29. Connect a maintenance terminal to the new controller and verify it is functioning with the following command:

    ```
    CLI> SHOW THIS_CONTROLLER
    ```

30. At the maintenance terminal, enter the following command:

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

    The two controllers are now configured in a dual-redundant configuration.

    The new controller will restart itself. This process takes about 60 seconds.

31. Connect the trilink with the host cable and terminator to the controller.

32. On the ECB front panel, check the LED status indicator for the appropriate indication as shown in Table 13.

Installing a cache module

The following sections describe how to install a write-back cache module in a single controller configuration.

Removing the controller

Use the following procedure to remove the controller:

1. Connect a maintenance terminal to the controller.
2. Halt all host I/O activity using the appropriate procedure for your operating system.
3. Take the controller out of service:

   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

   To ensure the controller has shutdown cleanly, check for the following indications on the controller's OCP:

   - The Reset (\\) light is lit continuously.
   - Port lights 1, 2, and 3 are also lit continuously.
4. Remove the power cords from the controller power supplies.
5. Loosen the capitive screws on the trilink connector of the controller and remove the trilink.
6. Loosen the captive retaining screws on the controller's front bezel.
7. Loosen the controller from the shelf backplane with a gentle rocking motion. Slide the controller module out of the shelf, noting in which rails it was seated.

Note

If you are installing cache modules into a dual-redundant configuration, ensure that both cache modules are of the same memory capacity.

Installing the write-back cache module

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

1. Install the SBB battery module into a convenient slot in a device shelf.
2. Slide the write-back cache module into the appropriate slot. Push the module firmly into the slot until it is seated.
3. Reinstall the controller module into its original slot. Push the module firmly into the slot until it is seated.

Caution

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

4. Tighten the front panel captive screws on the controller and cache modules. Do not over tighten.
5. Connect the ECB battery cable to the ECB and then to the cache module. Tighten the screws on the ECB cable.
6. Remove the program card from the controller.
7. Reconnect power cords to the controller power supplies.
8. Press and hold the Reset button (//) on the controller while pushing in the program card.
9. The controller will initialize.
10. When the Reset (//) LED on the controller flashes at a rate of once every second, the initialization process is complete.
11. Snap the ESD covers into place over the program card. Push the pins inward to lock the covers in place.
12. At the maintenance terminal that is still connected to the controller, invoke the FLS utility and install the new valid license keys for write-back cache.

13. To see if the controller recognizes the new write-back cache module, attach a maintenance terminal to the controller. At the CLI prompt, enter:

```
CLI> SHOW THIS_CONTROLLER
```

If you are in a dual-redundant configuration, the controller reports the following information:

```
Controller:
   HSZ50-AX ZG34901786 Firmware V50Z, Hardware AX11
      Configured for dual-redundancy with ZG51301100
          In dual-redundant configuration
SCSI address 7
   Time: 05 JUN-1996 16:32:54
Host port:
   SCSI target(s) (0,1,2), Preferred target(s) (0,1,2)
Cache:
   32 megabyte  write cache, version 3
   Cache is GOOD
   Battery is good
   No unflushed data in cache
   CACHE_FLUSH TIMER = DEFAULT (10 seconds)
   CACHE_POLICY = B
   Host Functionality Mode = A
   No CACHE_UPS
```

Notice that the new write-back cache module is reported on THIS_CONTROLLER.

14. Enable the new write-back cache on specific units by issuing the following command.

```
CLI >SET unit name WRITEBACK_CACHE
```

Adding Cache Memory

Use the following procedure to increase cache memory. You can increase cache memory up to a maximum of 128 MB in 32MB SIMM increments.

Service to the devices is interrupted during this upgrade procedure.

Installing SIMM Cards

The following procedure shows how to install SIMM cards to increase write-back cache capacity in single and dual-redundant controller configuration:

1. Connect a maintenance terminal to the controller.
2. Take the single controller out of service:

   ```
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

3. If you are working with a dual redundant configuration, take both controllers out of service:

   ```
   CLI> SHUTDOWN OTHER_CONTROLLER
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

   To ensure the controllers have shutdown cleanly, check for the following indications on the controllers' OCPs:

   - The Reset (//) light is continuously lit.
   - Port lights 1, 2, and 3 are also continuously lit.

4. After the controllers have shut down, remove the maintenance terminal cable and remove the power cords from the controller power supplies.
5. Disable the ECB by pressing the battery disable switch on the front panel of the battery module.
6. Loosen the captive screws on the trilink connector of each controller and remove the trilink connectors. Do not remove the host cables from the trilink connector.

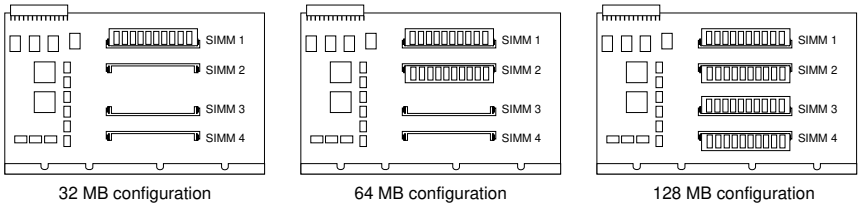
7. Loosen the captive screws on the controller's front bezel.
8. Loosen the controller modules from the shelf using a gentle rocking motion and slide the controller modules out of the shelf.
9. Loosen the captive screws on front bezel of both cache modules.
10. Loosen the cache modules from the shelf using a gentle rocking motion and slide the cache modules from the controller shelf.
11. Refer to Table 14 and Figure 29 and install as many SIMM cards into each cache modules as required.

Table 14
Adding cache memory capacity

Cache size	SIMM slot # occupied
32Mb	SIMM 1
64Mb	SIMM 1+2
128Mb	SIMM 1+2+3+4

Note: The cache board is marked by SIMM slot numbers as shown in Table 14.

Figure 29
Cache configurations for cache Version 3



12. Reinstall the cache modules into the controller shelf.
13. Reinstall the controller modules into their original slots. Use a gentle rocking motion to help seat the module. If

you are using a single controller configuration, use the slot that is designated SCSI ID 7.

14. Reconnect the ECB cable to the cache module.
15. Tighten the ECB cable mounting screws.

Caution

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

16. Tighten the captive screws on the cache module and the controller module.
17. Remove the program cards from each controller.
18. Reconnect the power cords to the controller power supplies.
19. Press and hold the Reset button (//) on each controller while pushing in the program card.
20. The controllers will initialize.

    When the Reset (//) LED on each controller flashes at a rate of once every second, the initialization process is complete.

21. Snap the ESD covers into place over each program card. Push the pins inward to lock the covers in place.
22. To check cache capacity of the modules, attach a maintenance terminal to one of the controllers. At the CLI prompt type:

```
CLI> SHOW THIS_CONTROLLER
```

The controller will report the following information:

```
Controller:
   HSZ50-AX ZG34901786 Firmware V50Z, Hardware AX11
      Configured for dual-redundancy with ZG51301100
          In dual-redundant configuration
SCSI address 7
   Time: 05 JUN-1996 16:32:54
Host port:
   SCSI target(s) (0,1,2), Preferred target(s) (0,1,2)
Cache:
   32 megabyte  write cache, version 3
   Cache is GOOD
   Battery is good
   No unflushed data in cache
   CACHE_FLUSH TIMER = DEFAULT (10 seconds)
   CACHE_POLICY = B
   Host Functionality Mode = A
   No CACHE_UPS
```

23. Use the SHOW OTHER_COMMAND to check the capacity of the second cache module:

```
CLI>SHOW OTHER_CONTROLLER
```

The OTHER_CONTROLLER will report the same information.

24. Enable the new write-back cache on specific units by issuing the following command.

CLI> SET *unit name* WRITEBACK_CACHE

Installing power supplies

This section described how to install a power supply into a SBB shelf or into a controller shelf.

Power supply and shelf LED status indicators.

Each power supply has two LED status indicators that display the power supply status. The upper LED is the common power supply status. The lower LED is the power supply status indicator.

Table 15 shows the possible fault indications for an SW300 cabinet.

Table 15
Power supply status indicators -- SW300 cabinet

When the LED Display is ...	The RAID Shelf Power Status is ...
■ ■	All the power supplies on the associated power bus are functioning.
■ □	This power supply is operating properly however, One power supply on the associated bus has failed..
□ □	Either there is no AC power to this supply or this power supply should be replaced.

LED on = ■

LED off = □

Table 16 shows all possible status indications for the SW500 and the SW800 cabinet in a single power supply configuration.

Table 16
Shelf and single power supply status indicators -- SW500, SW800 cabinets

Status Indicator	State	Indication
Shelf LED Power supply LED		System is operating normally.
Shelf LED Power supply LED		There is a shelf fault; there is no power supply fault. Replace shelf blower.
Shelf LED Power supply LED		Shelf and power supply fault. Replace power supply. Described in the Replace Section.

LED on =

LED off =

Table 17 shows all possible status indications for the SW500 and the SW800 cabinets for a dual power supply configuration.

Table 17
Shelf and dual power supply status indicators -- SW500, SW800 cabinets

Status Indicator	PS 1	PS 2	Indication
Shelf LED Power supply LED	■ ■	■ ■	Normal. System is operating normally.
Shelf LED power supply LED	□ ■	□ ■	There is a shelf fault; there is no power supply failure. Replace shelf blower.
Shelf LED Power supply LED	□ ■	□ □	PS 1 is operational. Replace PS 2.
Shelf LED Power supply LED	□ □	□ ■	PS 2 is operational. Replace PS 1.
Shelf LED Power supply LED	□ □	□ □	Possible PS 1 and PS 2 fault or input power problem.

LED on = ■

LED off = □

Note

The status indicators will operate ONLY if the power supplies and the shelf blowers are present. The failure must be an electrical or mechanical failure.

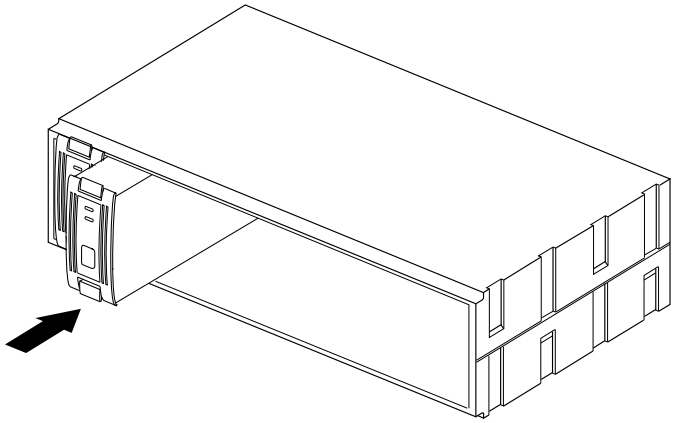
Power supply installation procedure

Use the following procedure to install a power supply. For a single power supply configuration, use slot 7 in the SBB shelf.

Repeat this procedure to install a second power supply for redundancy and use slot 6 in the SBB shelf.

1. Orient the power supply so that the status indicators are at the top. Firmly push the power supply into the shelf until the mounting tabs snap into place (see Figure 30).

Figure 30
Installing a power supply



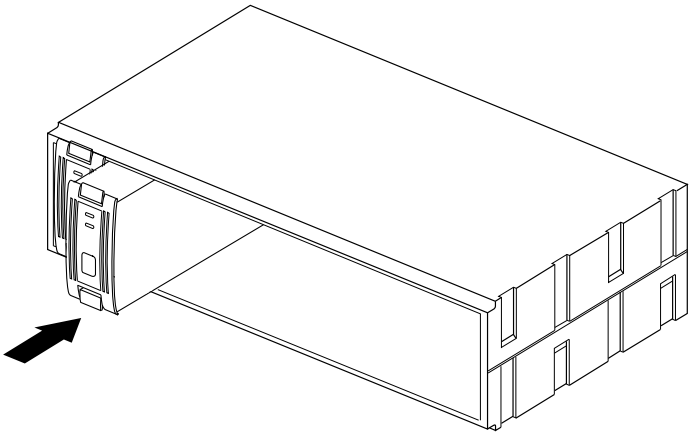
2. Plug the power cord into the supply.
3. Observe the power and shelf status indicators and ensure they are both on. If the status indicators are not on,refer to the Status indicator tables and take appropriate service action.
4. Repeat the above steps to add a second power supply for redundancy. After connecting the power cord, observe the status indicators and ensure that they are both on.

Installing storage building blocks

The storage device building blocks (SBBs) are 3 1/2 inch or 5 1/4 inch form factors. The HSZ50 controller supports the following devices:

- 3.5-inch and 5.25-inch disk drives

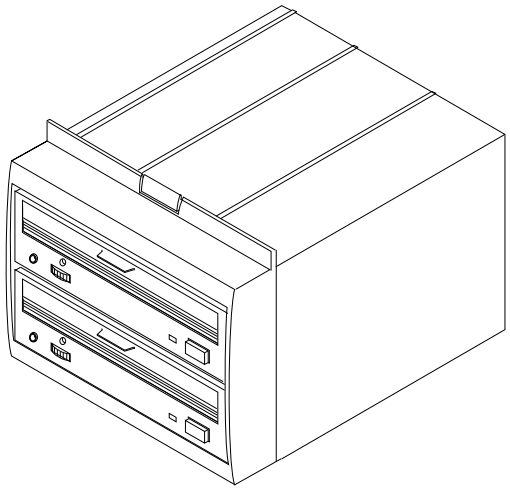
Figure 31 Typical 3.5-inch and 5.25-inch disk drive SBBs



CXO-5304A-MC

- CD ROM drives in 5 1/4 inch StorageWorks building blocks

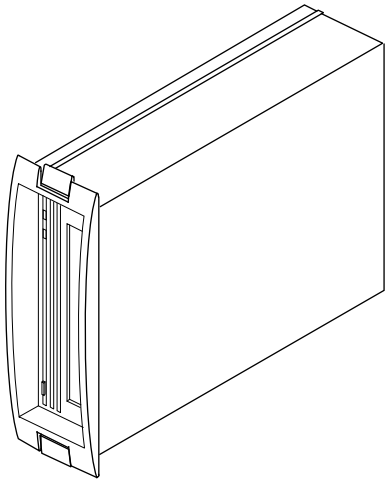
Figure 32 Typical 5.25-inch CD-ROM SBB



CXO-5167A-MC

- Solid state disks and tape drives

Figure 33 Typical 3.5-inch tape drive SBB



CXO-5168A-MC

Caution

Do not install solid state disk when power is applied to the shelf.

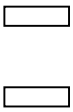
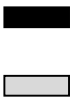
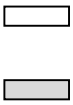
SBB activity and fault indicators

Each storage device has two LEDs that display SBB status. These LEDs have three states: on, off, and flashing.

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

The lower LED (amber) is the device fault indicator and indicates an error condition or a configuration problem when it is on or flashing (see Table 18).

Table 18
Storage SBB Status Indicators

LED	Status	Indication
Device activity Device fault		SBB is operating normally.
Device activity Device fault		SBB is operating normally.
Device activity Device fault		SBB is operating normally. The SBB is inactive, and there is no fault.
Device activity Device fault		Fault status SBB is probably not responding to control signals. Replace the SBB.
Device activity Device fault		Fault status SBB is inactive and spun down. Replace the SBB.
Device activity Device fault		Fault status SBB is active and is spinning down because of a fault.
Device activity Device fault		Fault status SBB has been identified by the controller as failed. Replace the SBB.

LED on =

LED off =

LED flashing =

When using the LOCATE command, the lower LED also may be used to locate or identify units, storagesets, and devices in a cabinet.

For example, to locate or identify device DISK100 enter:

```
CLI> LOCATE DISK100
```

The lower LED (amber) of DISK100 will flash a rate of once every second. To turn off the lower LED, use the LOCATE CANCEL command.

Note

If a device has been placed into a failedset, the lower LED will flash at a rapid rate. In this case, the LOCATE command cannot identify the device.

The lower LED of each configured device can be tested using the LOCATE command with the ALL qualifier.

For example, to test the fault LED, of each configured device, enter:

```
CLI> LOCATE ALL
```

The lower LED of each configured device will flash at rate of once every second. To turn off the lower LED use the LOCATE CANCEL command.

Refer to the *HSZ50 Array Controllers CLI Reference Manual* for further details of the LOCATE command.

Installing SBBs

Use the following procedure to install SBBs:

1. Insert the SBB into the shelf guide slots and push it in until it is fully seated and the mounting tabs engage the shelf.
2. Observe the activity indicator (upper LED) and the fault indicator (lower LED). The activity indicator is either on, flashing, or off. The fault indicator is off.

Installing a solid state disk and CD-ROM

Use the following procedure to install a solid state disk. To install a solid state disk, power must be removed from the shelf.

1. Halt all I/O activity using the appropriate procedures for your operating system.
2. Connect a maintenance terminal to one of the controllers.
3. At the CLI prompt, enter:

   ```
   CLI> SHUTDOWN OTHER_CONTROLLER
   CLI> SHUTDOWN THIS_CONTROLLER
   ```

   To ensure that the controller has shut down cleanly, check for the following indications on the controller's operator control panel (OCP):

   - The Reset (//) light is lit continuously.
   - Port lights 1, 2, and 3 are also lit continuously.
4. Remove the power cords from the shelf power supplies in which you are installing the solid state drive.
5. Insert the solid state disk into the shelf.
6. Reconnect the power cord to the shelf power supply.
7. Reinitialize the controllers by pressing the Reset button (//) on both controllers.
8. Observe the status indicators for the following conditions:

   - The green device activity LED is either on, flashing, or off.
   - The amber device fault LED is off.

4 Moving storagesets and devices

Moving storagesets

Moving storageset members

Moving single disk-drive units

Moving devices

Precautions

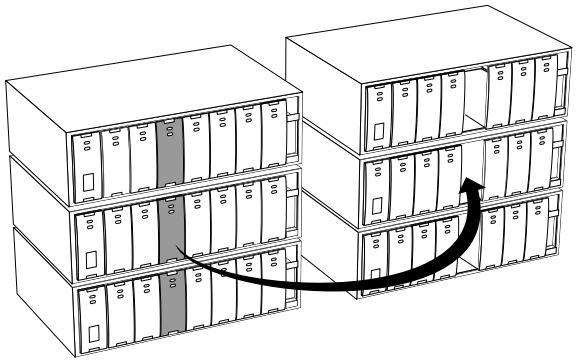
If you are moving a storageset or device that contains data you want to keep:

- Make sure the controller is functioning properly—the green LED should be flashing on and off about once per second.
- Exit any local programs you may be running, such as CSWAP, CFMENU, or CHVSN.
- Wait until the CLI prompt appears on your local or remote terminal before inserting or removing any device.
- Wait about one minute after inserting each device before you insert another.
- Do not insert or remove a device during failover or failback.

Moving storagesets

You can move a storageset from one subsystem to another without destroying its data. You also can follow these steps to move a storageset to a new location within the same subsystem.

Figure 34 Moving a storageset from one subsystem to another



Note

Never initialize any container or this procedure will not guarantee data.

Use the following procedure to move a storageset while maintaining the data it contains:

1. Show the details for the storageset you want to move:

   CLI> **SHOW *storageset-name***

2. Label each member with its name and PTL location. (If you do not have a storageset map for your subsystem, you can LOCATE each member to find its PTL location.):

   CLI> **LOCATE *disk-name***

   To cancel the locate command:

   CLI> **LOCATE CANCEL**

3. Delete the unit-number shown in the "Used by" column of the SHOW *storageset-name* command:

   CLI> **DELETE *unit-number***

4. Delete the storageset shown in the "Name" column of the SHOW *storageset-name* command.

```
CLI> DELETE storageset-name
```

5. Delete each disk drive—one at a time—that was contained by the storageset.

```
CLI> DELETE disk-name
CLI> DELETE disk-name
CLI> DELETE disk-name
```

6. Remove the disk drives and move them to their new PTL locations.

7. Add again each disk drive to the controller's list of valid devices.

```
CLI> ADD DISK disk-name PTL-location
CLI> ADD DISK disk-name PTL-location
CLI> ADD DISK disk-name PTL-location
```

8. Recreate the storageset by adding its name to the controller's list of valid storagesets and specifying the disk drives it contains. (Although you have to recreate the storageset from its original disks, you do not have to add them in their original order.)

```
CLI> ADD STORAGESET storageset-name disk-name disk-name
disk-name
```

9. Represent the storageset to the host by giving it a unit number the host can recognize. You can use the original unit number or create a new one.

```
CLI> ADD UNIT unit-number storageset-name
```

Example

The following example moves unit D100 to another cabinet. D100 is the RAIDset "RAID99" that comprises members 200, 300, and 400.

```
CLI> SHOW Raid99

Name     Storageset        Uses        Used by
-------------------------------------------------
RAID99    raidset          disk100     D100
                           disk200
                           disk300
CLI> DELETE D100
```

```
CLI> DELETE RAID99
CLI> DELETE DISK200 DISK300 DISK400
```

(...move the disk drives to their new location...)

```
CLI> ADD DISK DISK200 2 0 0
CLI> ADD DISK DISK300 3 0 0
CLI> ADD DISK DISK400 4 0 0
CLI> ADD RAIDSET RAID99 DISK200 DISK300 DISK400
CLI> ADD UNIT D100 RAID99
```

Example

The following example moves the reduced RAIDset, "R3, " to another cabinet. (R3 used to contain DISK200, which failed before the RAIDset was moved. At the beginning of this example, it contains DISK100, DISK300, and DISK400.)

```
CLI> DELETE D100
CLI> DELETE R3
CLI> DELETE DISK100 DISK300 DISK400
```

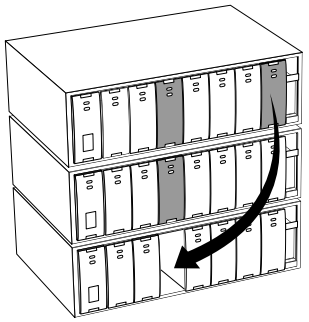
(...move disk drives to their new location...)

```
CLI> ADD DISK DISK100 1 0 0
CLI> ADD DISK DISK300 3 0 0
CLI> ADD DISK DISK400 4 0 0
CLI> ADD RAIDSET R3 DISK100 DISK300 DISK400 REDUCED
CLI> ADD UNIT D100 R3
```

Moving storageset members

You may want to move a storageset member and its data from one PTL location to another to maintain the symmetry in your subsystem. For example, if a RAIDset member fails and is replaced by a disk drive in the spareset, you could move the replacement member into the column that contains the RAIDset.

Figure 35 Moving storageset members



To move a storageset member while maintaining the data it contains:

1. Delete the unit-number of the storageset that contains the disk drive you want to move:

   ```
   CLI> DELETE unit-number
   ```

2. Delete the storagesets that contains the disk drive you want to move:

   ```
   CLI> DELETE storageset-name
   ```

3. Delete each disk drive—one at a time—that was contained by the storageset:

   ```
   CLI> DELETE disk-name_1
   CLI> DELETE disk-name_2
   CLI> DELETE disk-name_n
   ```

4. Move the desired disk drive to its new PTL location:

5. Add again each member to the controller's list of valid devices:

```
CLI> ADD DISK disk-name PTL-location
CLI> ADD DISK disk-name PTL-location
CLI> ADD DISK disk-name PTL-location
```

6. Recreate the storageset by adding it's name to the controller's list of valid storagesets and specifying the disk drives it contains. (Although you have to recreate the storageset from its original members, you do not have to add them in their original order.)

```
CLI> ADD STORAGESET storageset-name disk_1 disk_n
```

7. Represent the storageset to the host by giving it a unit number the host can recognize. You can use the original unit number or create a new one.

```
CLI> ADD UNIT unit-number storageset-name
```

Example

The following example moves DISK210 to PTL location 300. (Its new name will be DISK300 to correspond to its new PTL location.) DISK210 was a spare that was pulled into unit D100 when its DISK300 failed. (D100 is the RAIDset "RAID99" that comprises members 200, 210, and 400.)

```
CLI> DELETE D100
CLI> DELETE RAID99
CLI> DELETE DISK210
```

(...move disk210 to PTL location 300...)

```
CLI> ADD DISK DISK300 3 0 0
CLI> ADD RAIDSET RAID99 DISK200 DISK300 DISK400
CLI> ADD UNIT D100 RAID99
```

Moving a single disk-drive unit

You can move a single disk-drive unit from one subsystem to another without destroying its data. You can also use the following procedure to move a unit to a new location within the same subsystem.

To move a single disk-drive unit while maintaining the data it contains:

1. Show the details for the unit you want to move:

   ```
   CLI> SHOW unit-number
   ```

2. Delete the unit-number shown in the "Used by" column of the SHOW *unit-number* command:

   ```
   CLI> DELETE unit-number
   ```

3. Delete the disk drive:

   ```
   CLI> DELETE disk-name
   ```

4. Remove the disk drive and move it to its new PTL location:

5. Add again the disk drive to the controller's list of valid devices:

   ```
   CLI> ADD DISK disk-name PTL-location
   ```

6. Represent the disk drive to the host by giving it a unit number the host can recognize. You can use the original unit number or create a new one.

   ```
   CLI> ADD UNIT unit-number disk-name
   ```

Example

The following example moves DISK507 to PTL location 100. (Its new name will be DISK100 to correspond to its new PTL location.)

```
CLI> Show D507
CLI> Delete D507
CLI> Delete Disk100
CLI> Add Disk100 1 0 0
CLI> Add D507 Disk100
```

Moving devices

Follow these steps to move a device, such as a disk drive, tape drive, CDROM drive, or tape loader:

1. Quiesce the bus that services the device you want to move.
2. Show the details for the device you want to move. (If you are moving a tape loader, show the details for the passthrough device that is associated with it.)

   ```
   CLI> SHOW device-name
   ```

3. If the device has a unit number associated with it, delete the unit-number that's shown in the "Used by" column:

   ```
   CLI> DELETE unit-number
   ```

4. Delete the device name shown in the "Name" column:

   ```
   CLI> DELETE device-name
   ```

5. Remove the device and move it to its new PTL location:
6. Add again the device to the controller's list of valid devices.:

   ```
   CLI> ADD DEVICE device-name PTL-location
   ```

7. If you are moving a tape loader, recreate the passthrough device that represents the loader:

   ```
   CLI> ADD PASSTHROUGH passthrough_name PTL-location
   ```

8. Represent the device to the host by giving it a unit number the host can recognize. You can use the original unit number or create a new one.

   ```
   CLI> ADD UNIT unit-number device-name
   ```

9. You might have to reconfigure the host-based software that controls the loader. Refer to the documentation that accompanied the loader and its software.

Example

The following example moves TAPE100 (unit T108) from PTL 1 0 0 to PTL 6 0 0.

```
CLI> SHOW tape100

NAME TypePort TargLunUsed by
-------------------------------------------------
TAPE100tape100T108

CLI> DELETE T108
CLI> DELETE TAPE100
```

(...move tape100 to its new location...)

```
CLI> ADD TAPE TAPE600 6 0 0
CLI> ADD UNIT T600 TAPE600
```

The following example moves tape LOADER120 from p3 to p1:

```
CLI> SHOW PASSTHROUGH LOADER

NAME       Type                Port   TargLunUsed by
-------------------------------------------------
LOADER120  passthrough loader     4      2  0  P3
TAPE430    passthrough tape       4      3  0  P0


CLI> DELETE P3
CLI> DELETE P0
CLI> DELETE TAPE430

(...move passthrough loader120 to new location)

CLI> ADD PASSTHROUGH LOADER120 1 2 0
CLI> ADD UNIT P0 TAPE430
CLI> ADD UNIT P3 LOADER LOADER 120
```

5 Removing

Removing a patch

Disabling a licensed option

Removing a license key

Removing a controller and cache module

Removing storage devices

Removing a patch

Use the delete patch program to free memory space for patches that need to be added to the current software version. When patches are removed from controller memory, they will also be removed from storagesets that have been initialized with the INITIALIZE *container name* SAVE CONFIGURATION command.

The version numbers and patch numbers in this procedure are only examples. The Patch Code program will not allow you to enter any of these numbers used in these examples.

To remove a patch:

1. Connect a maintenance terminal to one of the controllers.
2. Start the CLCP utility:

   ```
   CLI> RUN CLCP
   ```

   The CLCP main menu is displayed.

   ```
   Select an option from the following list:

   Code Load & Code Patch Utility Main Menu

   0: Exit
   1: Enter Code LOAD utility
   2: Enter Code PATCH utility
   Enter option number  (0..2) [0] ?
   ```

3. Enter **2** to select the code patch program:

   The code patch menu is displayed:

   ```
   You have selected the Code Patch local program. This
   program is used to manage firmware code patches. Select
   an option from the following list:

   Type ^Y or ^C (then RETURN) at any time to abort Code
   Patch.
   Code Patch Main Menu

   0: Exit
   1: Enter a Patch
   2: Delete Patches
   3: List Patches
   ```

```
Enter option number (0..3) [0] ?
```

4. Select option **2** to delete a patch:

```
This is the Delete Patches option. The program prompts
you for the firmware version and patch number you wish
to delete. If you select a patch for deletion that is
required for an other patch, all dependent patches are
also selected for deletion. The program lists your
deletion selections and asks if you wish to continue.

Type ^Y or ^C (then RETURN) at any time to abort Code
Patch.

The following patches are currently stored in the patch
area:

Firmware Version - Patch number(s)

     V123               1, 2

     V456               1

Currently 90% of the patch area is free.

Firmware Version of patch to delete?
```

5. Enter the firmware version V456.

```
Patch Number to delete?
```

6. Enter **1** to select patch 1:

```
The following patches have been selected for deletion:

Firmware Version - Patch number(s)

    V456                1

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

7. Enter **Y** to continue.

```
The patch you have just deleted is currently applied,
but will not be applied when the controller is
restarted.

Code Patch Main Men

0: Exit
1: Enter a Patch
2: Delete Patches
3: List Patches

Enter option number (0..3) [0]  ?

The following patches are currently stored in the patch
area:

Firmware Version - Patch number(s)

    V123               1, 2

Currently, 95% of the patch area is free.
```

Disabling a licensed option

Once you have tested a licensed option and have decided not to purchase a valid license key, you need to disable this option. You cannot disable an option if that option is currently in use. Table 19 lists the conditions under which you can disable an FLS option.

Table 19
Disabling FLS options

Option	Condition required to disable
RAID	No RAIDsets configured
WBCA	Write-back caching not in use on any unit
MIRR	No mirrorsets configured

To disable a licensed option:

Use the following procedure to disable a licensed option. In the following example, the MIRR (disk mirroring option) option is disabled.

1. Connect a maintenance terminal to the controller.
2. Start the FLS utility:

```
CLI> RUN FLS
```

The FLS Main menu and all licensable options are displayed:

```
Firmware Licensing System (FLS) on node MASS
Option      State       License         Key
-----------------------------------------------------
RAID      DISABLED      INVALID        *none*
WBCA      DISABLED      INVALID        *none*
MIRR      ENABLED       INVALID        *none*

               RAID = RAID Option
               WBCA = Writeback Cache Option
               MIRR = Disk Mirroring Option
-----------------------------------------------------
1. Enable a firmware option
2. Disable a firmware option
3. Enter a license key for a firmware option
4. Clear a license key for a firmware option
0. Exit FLS
Enter selection (0:4) [0] ?
```

3. Enter **2** to select the disable firmware option. All of the licensed options are displayed:

```
1. Disable RAID  (already disabled)
2. Disable WBCA  (already disabled)
3. Disable MIRR
0. Return to main menu

Enter selection (0:4)  {0}  ?
```

4. Enter **3** to disable the MIRR firmware option:

Note

The warning at the top of the FLS main menu is displayed only if there is a dual-redundant controller in the subsystem with the same license enabled.

```
***Warning: other controller's MIRR option is enabled
at this time.***

-------------------------------------------------------
Firmware Licensing System (FLS) on node MASS
Option      State        License        Key
-------------------------------------------------------
RAID      DISABLED        INVALID    *  none *
WBCA      DISABLED        INVALID    *  none *
MIRR      DISABLED        INVALID    *  none *

              RAID = RAID Option
              WBCA = Writeback Cache Option
              MIRR = Disk Mirroring Option
-------------------------------------------------------

    1.  Enable a firmware option
    2.  Disable a firmware option
    3.  Enter a license key for a firmware option
    4.  Clear a license key for a firmware option
    0.  Exit FLS
Enter selection (0:4) [0] ?
```

Notice that the MIRR option is disabled.

Enter **0** to exit the FLS utility:

Removing a license key

You may wish to move a specific license key to a different controller.

Use the following procedure to remove a license key.(In this example the license key for MIRR option is removed):

1. Connect a maintenance terminal to controller that has the valid license key installed.
2. Start the FLS utility:

```
CLI> RUN FLS
```

The FLS main menu and all valid licenses are displayed:

```
-------------------------------------------------
Firmware Licensing System (FLS) on node MASS
Option      State        License        Key
-------------------------------------------------
RAID      ENABLED        VALID    * ACME WIDGIT CO
WBCA      ENABLED        VALID    * ACME WIDGIT CO
MIRR      ENABLED        VALID    * ACME WIDGIT CO

              RAID = RAID Option
              WBCA = Writeback Cache Option
              MIRR = Disk Mirroring Option
-------------------------------------------------

1. Enable a firmware option
2. Disable a firmware option
3. Enter a license key for a firmware option
4. Clear a license key for a firmware option
0. Exit FLS
Enter selection (0:4) [0] ?
```

3. Enter **4** to select the clear a license key option:

The program shows all valid license keys that may be cleared.

```
1. Clear license key for RAID (current key is valid)
2. Clear license key for WBCA (current key is valid)
3. Cleat license key for MIRR (current key is valid)
0 Return to main menu

Enter selection (0..3)  [0]  ?
*CAUTION*  You are about to erase a valid license key
Continue (y/n {n} ?
```

4. Enter **3** to clear the license key for the MIRR option.

The FLS utility main menu is displayed.

```
-----------------------------------------------------
Firmware Licensing System (FLS) on node MASS
Option      State        License        Key
-----------------------------------------------------
RAID      ENABLED        VALID    * ACME WIDGIT CO *
WBCA      ENABLED        VALID    * ACME WIDGIT CO *
MIRR      DISABLED      INVALID        *none*

              RAID = RAID Option
              WBCA = Writeback Cache Option
              MIRR = Disk Mirroring Option
-----------------------------------------------------

    1.  Enable a firmware option
    2.  Disable a firmware option
    3.  Enter a license key for a firmware option
    4.  Clear a license key for a firmware option
    0.  Exit FLS
Enter selection (0:4) [0] ?
```

Notice that the license key for the MIRR license is cleared.

Removing a controller and cache module

You can remove a controller and cache module if you want to use them in another subsystem. This procedure describes the cold swap method for removal for dual-redundant configurations.

You can use the warm swap (C_SWAP) method to remove the controller and cache module. Refer to Chapter 2 for this procedure.

To remove a controller and its cache module:

1. Connect a maintenance terminal to the controller.
2. Take the controller to be removed out of service by entering the following command:

   ```
   CLI>SHUTDOWN THIS_CONTROLLER
   ```

   Ensure the controller to be removed has shutdown cleanly. Check for the following indications on the controller's OCP (operator control panel:

   - The Reset (//) light is continuously lit.
   - Port lights 1, 2, 3 are continuously lit.
3. Remove the trilink connector. Do not disconnect the host cables from the trilink.
4. Loosen the screws on the ECB cables and disconnect the cables.
5. Loosen the captive screws on the controller's front bezel and slide the controller out of the shelf.
6. If you are removing the cache module, loosen the captive screws on the cache module's front bezel and slide the cache module out of the shelf.
7. Remove the ECB and store it with the cache module.

Removing storage devices

Remove storage devices so they can be used in other subsystems.

Removing disk drives

Disk drives may be removed without having to quiesce the device bus or remove power from the shelf with the following restrictions:

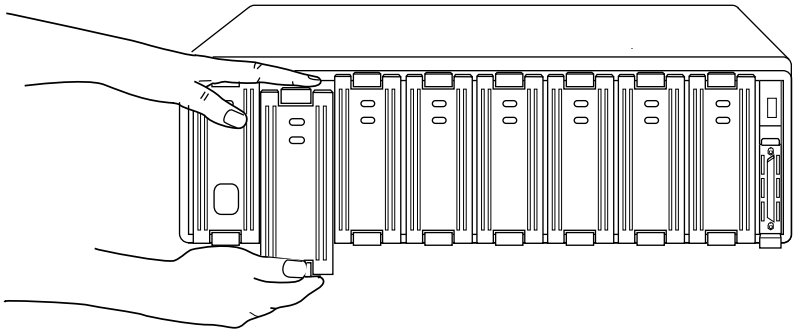
- Do not remove devices during failover.
- Do not remove devices during failback.
- Do not remove devices before the CLI prompt appears during controller initialization.
- Do not remove devices while the controller is running a local program such as DILX or VTDPY.

To remove storage devices:

Use the following procedure to remove 3 1/2 - inch and 5 1/4 - inch disk drives

1. Determine the disk drive you wish to remove.
2. Press the two mounting tabs together to release the disk drive from the shelf and partially pull the disk drive out of the shelf. Allow the disk drive to spin down.

Figure 36
Removing a 3.5-inch disk drive



3. Using both hands, slide the disk drive out of the shelf and place it on flat surface (see Figure 36).

Removing solid state disks and CD-ROM drives

When removing solid state disk drives and CD-ROM drives, you must shut down the controller and remove power from the device shelf.

1. Connect a maintenance terminal to the controller.
2. Halt all host I/O activity using the appropriate procedures for your operating system.
3. Take the controller out of service:

```
CLI> SHUTDOWN THIS_CONTROLLER
```

4. If you are working in a dual-redundant configuration take both controllers out of service:

```
CLI> SHUTDOWN OTHER_CONTROLLER
CLI> SHUTDOWN THIS_CONTROLLER
```

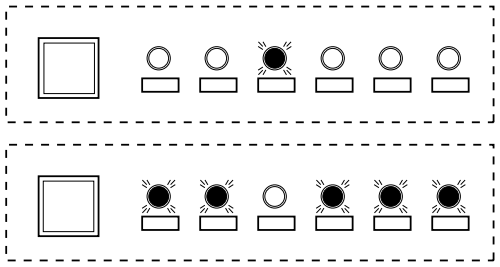
5. Remove the power cords from the shelf power supplies.
6. Remove the device by pressing the two mounting tabs together to release it from the shelf. Using both hands, remove the device from the shelf.
7. Restart the system.

Removing tape drives

To remove tape drives:

1. Halt all I/O activity to the tape drive using the appropriate procedures for your operating system.
2. Quiesce the appropriate device port by pushing the device port button on the controller's OCP (operator control panel).
3. When the OCP LEDs flash in an alternating pattern the device port is quiesced. For example when you quiesce device port 3 and I/O has halted, the OCP LEDs are flashing in an alternating pattern as shown in the Figure below:

Figure 37 OCP LED patterns



4. When the port has quiesced, remove the tape drive by pressing the two mounting tabs together to release it from the shelf.
5. Using both hands, pull the tape drive out of the device shelf.
6. Using both hands, pull the tape drive out of the device shelf.

Appendix

Instance, codes

Last failure codes

Repair action codes

Instance, codes and definitions

The following table contains instance, codes and their definitions. Use these tables to identify instance, code definitions and the suggested repair action. ***Repair action codes*** on page 303 contains the repair action codes and actions.

Table 20
Instance, codes

Instance, Code	Explanation	Repair Action Code
01010302	An unrecoverable hardware detected fault occurred.	03
0102030A	An unrecoverable firmware inconsistency was detected or an intentional restart or shutdown of controller operation was requested.	03
01032002	Nonvolatile parameter memory component EDC check failed. The content of the component was reset to default settings.	20
0121370A	Memory System Error Analysis is indicated in the information preserved during a previous last failure but no error conditions are indicated in the available DRAB registers. The Master DRAB registers' content is supplied.	37
0122330A	An error condition detected by one of the CACHE DRABs that requires supplemental information has been reported in another event report. This event report contains the Master DRAB and Diagnostic registers content associated with that initial event report.	33
01292602	The Master DRAB detected a Cache Time-out condition during an access attempt to a CACHEA0, CACHEA1, CACHEB0, or CACHEB1 DRAB registers region or memory region. The addressed region failed to respond.	26
012A3702	The CACHEA0 DRAB unexpectedly reported a Cache Time-out condition.	37
012B3702	The CACHEA1 DRAB unexpectedly reported a Cache Time-out condition.	37
012C3702	The CACHEB0 DRAB unexpectedly reported a Cache Time-out condition.	37
012D3702	The CACHEB1 DRAB unexpectedly reported a Cache Time-out condition.	37
012E2702	The Master DRAB detected an Nbus Transfer Error Acknowledge (TEA) condition. This means the TEA signal was asserted by an Nbus device during an I960-to-Nbus device transaction.	37
012F3702	The Master DRAB unexpectedly reported an Nbus Transfer Error Acknowledge condition.	37
01303702	The CACHEA0 DRAB unexpectedly reported an Nbus Transfer Error Acknowledge condition.	37

Instance, Code	Explanation	Repair Action Code
01313702	The CACHEA1 DRAB unexpectedly reported an Nbus Transfer Error Acknowledge condition.	37
01323702	The CACHEB0 DRAB unexpectedly reported an Nbus Transfer Error Acknowledge condition.	37
01333702	The CACHEB1 DRAB unexpectedly reported an Nbus Transfer Error Acknowledge condition.	37
01342802	A Multiple Bit ECC error was detected during a memory refresh attempt by the Master DRAB.	28
01352902	A Multiple Bit ECC error was detected during a memory refresh attempt by the CACHEA0 DRAB.	29
01362902	A Multiple Bit ECC error was detected during a memory refresh attempt by the CACHEA1 DRAB.	29
01372A02	A Multiple Bit ECC error was detected during a memory refresh attempt by the CACHEB0 DRAB.	2A
01382A02	A Multiple Bit ECC error was detected during a memory refresh attempt by the CACHEB1 DRAB.	2A
01392802	The Master DRAB detected a Multiple Bit ECC error during an FX attempt to read buffer memory.	28
013A2802	The Master DRAB detected a Multiple Bit ECC error during a host port attempt to read buffer memory.	28
013B2802	The Master DRAB detected a Multiple Bit ECC error during a Device port attempt to read buffer memory.	28
013C2802	The Master DRAB detected a Multiple Bit ECC error during an I960 attempt to read buffer memory.	28
013D2902	The CACHEA0 DRAB detected a Multiple Bit ECC error during an FX attempt to read CACHEA0 memory.	29
013E2902	The CACHEA0 DRAB detected a Multiple Bit ECC error during a host port attempt to read CACHEA0 memory.	29
013F2902	The CACHEA0 DRAB detected a Multiple Bit ECC error during a Device port attempt to read CACHEA0 memory.	29
01402902	The CACHEA0 DRAB detected a Multiple Bit ECC error during an I960 attempt to read CACHEA0 memory.	29
01412902	The CACHEA1 DRAB detected a Multiple Bit ECC error during an FX attempt to read CACHEA1 memory.	29
01422902	The CACHEA1 DRAB detected a Multiple Bit ECC error during a host port attempt to read CACHEA1 memory.	29
01432902	The CACHEA1 DRAB detected a Multiple Bit ECC error during a device port attempt to read CACHEA1 memory.	29
01442902	The CACHEA1 DRAB detected a Multiple Bit ECC error during an I960 attempt to read CACHEA1 memory.	29
01452A02	The CACHEB0 DRAB detected a Multiple Bit ECC error during an FX attempt to read CACHEB0 memory.	2A

Instance, Code	Explanation	Repair Action Code
01462A02	The CACHEB0 DRAB detected a Multiple Bit ECC error during a host port attempt to read CACHEB0 memory.	2A
01472A02	The CACHEB0 DRAB detected a Multiple Bit ECC error during a device port attempt to read CACHEB0 memory.	2A
01482A02	The CACHEB0 DRAB detected a Multiple Bit ECC error during an I960 attempt to read CACHEB0 memory.	2A
01492A02	The CACHEB1 DRAB detected a Multiple Bit ECC error during an FX attempt to read CACHEB1 memory.	2A
014A2A02	The CACHEB1 DRAB detected a Multiple Bit ECC error during a host port attempt to read CACHEB1 memory.	2A
014B2A02	The CACHEB1 DRAB detected a Multiple Bit ECC error during a device port attempt to read CACHEB1 memory.	2A
014C2A02	The CACHEB1 DRAB detected a Multiple Bit ECC error during an I960 attempt to read CACHEB1 memory.	2A
014D3702	The Master DRAB unexpectedly reported a Multiple Bit ECC error.	37
014E3702	The CACHEA0 DRAB unexpectedly reported a Multiple Bit ECC error.	37
014F3702	The CACHEA1 DRAB unexpectedly reported a Multiple Bit ECC error.	37
01503702	The CACHEB0 DRAB unexpectedly reported a Multiple Bit ECC error.	37
01513702	The CACHEB1 DRAB unexpectedly reported a Multiple Bit ECC error.	37
01522B02	The Master DRAB detected an Ibus-to-Nbus Time-out condition during an I960 to Nbus device transaction. The Nbus device failed to respond.	2B
01533702	The CACHEA0 DRAB unexpectedly reported an Ibus-to-Nbus Time-out condition.	37
01543702	The CACHEA1 DRAB unexpectedly reported an Ibus-to-Nbus Time-out condition.	37
01553702	The CACHEB0 DRAB unexpectedly reported an Ibus-to-Nbus Time-out condition.	37
01563702	The CACHEB1 DRAB unexpectedly reported an Ibus-to-Nbus Time-out condition.	37
01572C02	The Master DRAB detected a Nonexistent Memory Error condition during an FX attempt to write buffer memory.	2C
01582C02	The Master DRAB detected a Nonexistent Memory Error condition during an FX attempt to write a byte to buffer memory.	2C
01592C02	The Master DRAB detected a Nonexistent Memory Error condition during an FX attempt to read buffer memory.	2C

Instance, Code	Explanation	Repair Action Code
015A2C02	The Master DRAB detected a Nonexistent Memory Error condition during a host port attempt to write buffer memory.	2C
015B2C02	The Master DRAB detected a Nonexistent Memory Error condition during a Host port attempt to write a byte to buffer memoryh	2C
015C2C02	The Master DRAB detected a Nonexistent Memory Error condition during a host port attempt to read buffer memory.	2C
015D2C02	The Master DRAB detected a Nonexistent Memory Error condition during a Device port attempt to write buffer memory.	2C
015E2C02	The Master DRAB detected a Nonexistent Memory Error condition during a Device port attempt to write a byte to buffer memory.	2C
015F2C02	The Master DRAB detected a Nonexistent Memory Error condition during a Device port attempt to read buffer memory.	2C
01602C02	The Master DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write buffer memory.	2C
01612C02	The Master DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write a byte to buffer memory.	2C
01622C02	The Master DRAB detected a Nonexistent Memory Error condition during an I960 attempt to read buffer memory.	2C
01632D02	The CACHEAO DRAB detected a Nonexistent Memory Error condition during an FX attempt to write CACHEAO memory.	2D
01642D02	The CACHEAO DRAB detected a Nonexistent Memory Error condition during an FX attempt to write a byte to CACHEAO memory.	2D
01652D02	The CACHEAO DRAB detected a Nonexistent Memory Error condition during an FX attempt to read CACHEAO memory.	2D
01662D02	The CACHEAO DRAB detected a Nonexistent Memory Error condition during a host port attempt to write CACHEAO memory.	2D
01672D02	The CACHEAO DRAB detected a Nonexistent Memory Error condition during a host port attempt to write a byte to CACHEAO memory.	2D
01682D02	The CACHEAO DRAB detected a Nonexistent Memory Error condition during a host port attempt to read CACHEAO memory.	2D
01692D02	The CACHEAO DRAB detected a Nonexistent Memory Error condition during a Device port attempt to write CACHEAO memory.	2D

Instance, Code	Explanation	Repair Action Code
016A2D02	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during a Device port attempt to write a byte to CACHEA0 memory.	2D
016B2D02	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during a Device port attempt to read CACHEA0 memory.	2D
016C2D02	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write CACHEA0 memory.	2D
016D2D02	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write a byte to CACHEA0 memory.	2D
016E2D02	The CACHEA0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to read CACHEA0 memory.	2D
016F2D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write CACHEA1 memory.	2D
01702D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write a byte to CACHEA1 memory.	2D
01712D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to read CACHEA1 memory.	2D
01722D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a host port attempt to write CACHEA1 memory.	2D
01732D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a host port attempt to write a byte to CACHEA1 memory.	2D
01742D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a host port attempt to read CACHEA1 memory.	2D
01752D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a Device port attempt to write CACHEA1 memory.	2D
01762D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a Device port attempt to write a byte to CACHEA1 memory.	2D
01772D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during a Device port attempt to read CACHEA1 memory.	2D
01782D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write CACHEA1 memory.	2D

Instance, Code	Explanation	Repair Action Code
01792D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write a byte to CACHEA1 memory.	2D
017A2D02	The CACHEA1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to read CACHEA1 memory.	2D
017B2E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write CACHEB0 memory.	2E
017C2E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write a byte to CACHEB0 memory.	2E
017D2E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an FX attempt to read CACHEB0 memory.	2E
017E2E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a host port attempt to write CACHEB0 memory.	2E
017F2E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a host port attempt to write a byte to CACHEB0 memory.	2E
01802E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a host port attempt to read CACHEB0 memory.	2E
01812E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a device port attempt to write CACHEB0 memory.	2E
01822E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a device port attempt to write a byte to CACHEB0 memory.	2E
01832E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during a Device port attempt to read CACHEB0 memory.	2E
01842E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write CACHEB0 memory.	2E
01852E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write a byte to CACHEB0 memory.	2E
01862E02	The CACHEB0 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to read CACHEB0 memory.	2E
01872E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write CACHEB1 memory.	2E

Instance, Code	Explanation	Repair Action Code
01882E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to write a byte to CACHEB1 memory.	2E
01892E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an FX attempt to read CACHEB1 memory.	2E
018A2E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Host port attempt to write CACHEB1 memory.	2E
018B2E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Host port attempt to write a byte to CACHEB1 memory.	2E
018C2E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Host port attempt to read CACHEB1 memory.	2E
018D2E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Device port attempt to write CACHEB1 memory.	2E
018E2E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Device port attempt to write a byte to CACHEB1 memory.	2E
018F2E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during a Device port attempt to read CACHEB1 memory.	2E
01902E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write CACHEB1 memory.	2E
01912E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to write a byte to CACHEB1 memory.	2E
01922E02	The CACHEB1 DRAB detected a Nonexistent Memory Error condition during an I960 attempt to read CACHEB1 memory.	2E
01933702	The Master DRAB unexpectedly reported a Nonexistent Memory Error condition.	37
01943702	The CACHEA0 DRAB unexpectedly reported a Nonexistent Memory Error condition.	37
01953702	The CACHEA1 DRAB unexpectedly reported a Nonexistent Memory Error condition.	37
01963702	The CACHEB0 DRAB unexpectedly reported a Nonexistent Memory Error condition.	37
01973702	The CACHEB1 DRAB unexpectedly reported a Nonexistent Memory Error condition.	37
01982F02	An Address Parity error was detected during a memory refresh attempt by the Master DRAB.	2F

Instance, Code	Explanation	Repair Action Code
01993002	An Address Parity error was detected during a memory refresh attempt by the CACHEA0 DRAB.	30
019A3002	An Address Parity error was detected during a memory refresh attempt by the CACHEA1 DRAB.	30
019B3102	An Address Parity error was detected during a memory refresh attempt by the CACHEB0 DRAB.	31
019C3102	An Address Parity error was detected during a memory refresh attempt by the CACHEB1 DRAB.	31
019D2F02	The Master DRAB detected an Address Parity error during an FX attempt to read buffer memory.	2F
019E2F02	The Master DRAB detected an Address Parity error during a Host port attempt to read buffer memory.	2F
019F2F02	The Master DRAB detected an Address Parity error during a Device port attempt to read buffer memory.	2F
01A02F02	The Master DRAB detected an Address Parity error during an I960 attempt to read buffer memory.	2F
01A13002	The CACHEA0 DRAB detected an Address Parity error during an FX attempt to read CACHEA0 memory.	30
01A23002	The CACHEA0 DRAB detected an Address Parity error during a Host port attempt to read CACHEA0 memory.	30
01A33002	The CACHEA0 DRAB detected an Address Parity error during a Device port attempt to read CACHEA0 memory.	30
01A43002	The CACHEA0 DRAB detected an Address Parity error during an I960 attempt to read CACHEA0 memory.	30
01A53002	The CACHEA1 DRAB detected an Address Parity error during an FX attempt to read CACHEA1 memory.	30
01A63002	The CACHEA1 DRAB detected an Address Parity error during a Host port attempt to read CACHEA1 memory.	30
01A73002	The CACHEA1 DRAB detected an Address Parity error during a Device port attempt to read CACHEA1 memory.	30
01A83002	The CACHEA1 DRAB detected an Address Parity error during an I960 attempt to read CACHEA1 memory.	30
01A93102	The CACHEB0 DRAB detected an Address Parity error during an FX attempt to read CACHEB0 memory.	31
01AA3102	The CACHEB0 DRAB detected an Address Parity error during a Host port attempt to read CACHEB0 memory.	31
01AB3102	The CACHEB0 DRAB detected an Address Parity error during a Device port attempt to read CACHEB0 memory.	31
01AC3102	The CACHEB0 DRAB detected an Address Parity error during an I960 attempt to read CACHEB0 memory.	31
01AD3102	The CACHEB1 DRAB detected an Address Parity error during an FX attempt to read CACHEB1 memory.	31

Instance, Code	Explanation	Repair Action Code
01AE3102	The CACHEB1 DRAB detected an Address Parity error during a Host port attempt to read CACHEB1 memory.	31
01AF3102	The CACHEB1 DRAB detected an Address Parity error during a Device port attempt to read CACHEB1 memory.	31
01B03102	The CACHEB1 DRAB detected an Address Parity error during an I960 attempt to read CACHEB1 memory.	31
01B13702	The Master DRAB unexpectedly reported an Address Parity error.	37
01B23702	The CACHEA0 DRAB unexpectedly reported an Address Parity error.	37
01B33702	The CACHEA1 DRAB unexpectedly reported an Address Parity error.	37
01B43702	The CACHEB0 DRAB unexpectedly reported an Address Parity error.	37
01B53702	The CACHEB1 DRAB unexpectedly reported an Address Parity error.	37
01B63202	The Master DRAB detected an Ibus Parity Error during an I960 ID/Cache access attempt.	32
01B73202	The Master DRAB detected an Ibus Parity Error during an I960 buffer memory access attempt.	32
01B83202	The Master DRAB detected an Ibus Parity Error during an I960 buffer memory access attempt with a simultaneous, but unrelated, CACHE*xn* memory access.	32
01B93202	The Master DRAB detected an Ibus Parity Error during an I960 CACHEA memory access with a simultaneous, but unrelated, buffer memory access.	32
01BA3202	The Master DRAB detected an Ibus Parity Error during an I960 CACHEB memory access with a simultaneous, but unrelated, buffer memory access.	32
01BB3202	The Master DRAB detected an Ibus Parity Error during an I960 CACHEA Control and Status Register access with a simultaneous, but unrelated, buffer memory access.	32
01BC3202	The Master DRAB detected an Ibus Parity Error during an I960 CACHEB Control and Status Register access with a simultaneous, but unrelated, buffer memory access.	32
01BD3702	The Master DRAB unexpectedly reported an Ibus Parity error.	37
01BE3702	The CACHEA0 DRAB unexpectedly reported an Ibus Parity error.	37
01BF3702	The CACHEA1 DRAB unexpectedly reported an Ibus Parity error.	37
01C03702	The CACHEB0 DRAB unexpectedly reported an Ibus Parity error.	37

Instance, Code	Explanation	Repair Action Code
01C13702	The CACHEB1 DRAB unexpectedly reported an Ibus Parity error.	37
01C22F02	The Master DRAB detected a Write Data Parity error during an FX attempt to write buffer memory.	2F
01C32F02	The Master DRAB detected a Write Data Parity error during an FX attempt to write a byte to buffer memory.	2F
01C42F02	The Master DRAB detected a Write Data Parity error during a Host port attempt to write buffer memory.	2F
01C52F02	The Master DRAB detected a Write Data Parity error during a Host port attempt to write a byte to buffer memory.	2F
01C62F02	The Master DRAB detected a Write Data Parity error during a Device port attempt to write buffer memory.	2F
01C72F02	The Master DRAB detected a Write Data Parity error during a Device port attempt to write a byte to buffer memory.	2F
01C82F02	The Master DRAB detected a Write Data Parity error during an I960 attempt to write buffer memory.	2F
01C92F02	The Master DRAB detected a Write Data Parity error during an I960 attempt to write a byte to buffer memory.	2F
01CA3002	The CACHEA0 DRAB detected a Write Data Parity error during an FX attempt to write CACHEA0 memory.	30
01CB3002	The CACHEA0 DRAB detected a Write Data Parity error during an FX attempt to write a byte to CACHEA0 memory.	30
01CC3002	The CACHEA0 DRAB detected a Write Data Parity error during a Host port attempt to write CACHEA0 memory.	30
01CD3002	The CACHEA0 DRAB detected a Write Data Parity error during a Host port attempt to write a byte to CACHEA0 memory.	30
01CE3002	The CACHEA0 DRAB detected a Write Data Parity error during a Device port attempt to write CACHEA0 memory.	30
01CF3002	The CACHEA0 DRAB detected a Write Data Parity error during a Device port attempt to write a byte to CACHEA0 memory.	30
01D03002	The CACHEA0 DRAB detected a Write Data Parity error during an I960 attempt to write CACHEA0 memory.	30
01D13002	The CACHEA0 DRAB detected a Write Data Parity error during an I960 attempt to write a byte to CACHEA0 memory.	30
01D23002	The CACHEA1 DRAB detected a Write Data Parity error during an FX attempt to write CACHEA1 memory.	30
01D33002	The CACHEA1 DRAB detected a Write Data Parity error during an FX attempt to write a byte to CACHEA1 memory.	30

Instance, Code	Explanation	Repair Action Code
01D43002	The CACHEA1 DRAB detected a Write Data Parity error during a Host port attempt to write CACHEA1 memory.	30
01D53002	The CACHEA1 DRAB detected a Write Data Parity error during a Host port attempt to write a byte to CACHEA1 memory.	30
01D63002	The CACHEA1 DRAB detected a Write Data Parity error during a Device port attempt to write CACHEA1 memory.	30
01D73002	The CACHEA1 DRAB detected a Write Data Parity error during a Device port attempt to write a byte to CACHEA1 memory.	30
01D83002	The CACHEA1 DRAB detected a Write Data Parity error during an I960 attempt to write CACHEA1 memory.	30
01D93002	The CACHEA1 DRAB detected a Write Data Parity error during an I960 attempt to write a byte to CACHEA1 memory.	30
01DA3102	The CACHEB0 DRAB detected a Write Data Parity error during an FX attempt to write CACHEB0 memory.	31
01DB3102	The CACHEB0 DRAB detected a Write Data Parity error during an FX attempt to write a byte to CACHEB0 memory.	31
01DC3102	The CACHEB0 DRAB detected a Write Data Parity error during a Host port attempt to write CACHEB0 memory.	31
01DD3102	The CACHEB0 DRAB detected a Write Data Parity error during a Host port attempt to write a byte to CACHEB0 memory.	31
01DE3102	The CACHEB0 DRAB detected a Write Data Parity error during a Device port attempt to write CACHEB0 memory.	31
01DF3102	The CACHEB0 DRAB detected a Write Data Parity error during a Device port attempt to write a byte to CACHEB0 memory.	31
01E03102	The CACHEB0 DRAB detected a Write Data Parity error during an I960 attempt to write CACHEB0 memory.	31
01E13102	The CACHEB0 DRAB detected a Write Data Parity error during an I960 attempt to write a byte to CACHEB0 memory.	31
01E23102	The CACHEB1 DRAB detected a Write Data Parity error during an FX attempt to write CACHEB1 memory.	31
01E33102	The CACHEB1 DRAB detected a Write Data Parity error during an FX attempt to write a byte to CACHEB1 memory.	31
01E43102	The CACHEB1 DRAB detected a Write Data Parity error during a Host port attempt to write CACHEB1 memory.	31
01E53102	The CACHEB1 DRAB detected a Write Data Parity error during a Host port attempt to write a byte to CACHEB1 memory.	31

Instance, Code	Explanation	Repair Action Code
01E63102	The CACHEB1 DRAB detected a Write Data Parity error during a Device port attempt to write CACHEB1 memory.	31
01E73102	The CACHEB1 DRAB detected a Write Data Parity error during a Device port attempt to write a byte to CACHEB1 memory.	31
01E83102	The CACHEB1 DRAB detected a Write Data Parity error during an I960 attempt to write CACHEB1 memory.	31
01E93102	The CACHEB1 DRAB detected a Write Data Parity error during an I960 attempt to write a byte to CACHEB1 memory.	31
01EA3702	The Master DRAB unexpectedly reported a Write Data Parity error.	37
01EB3702	The CACHEA0 DRAB unexpectedly reported a Write Data Parity error.	37
01EC3702	The CACHEA1 DRAB unexpectedly reported a Write Data Parity error.	37
01ED3702	The CACHEB0 DRAB unexpectedly reported a Write Data Parity error.	37
01EE3702	The CACHEB1 DRAB unexpectedly reported a Write Data Parity error.	37
02020064	Disk Bad Block Replacement attempt completed for a write within the user data area of the disk. Note that due to the way Bad Block Replacement is performed on SCSI disk drives, information on the actual replacement blocks is not available to the controller and is therefore not included in the event report.	00
02032001	Journal SRAM backup battery failure; detected during system restart. The Memory Address field contains the starting physical address of the Journal SRAM.	20
02042001	Journal SRAM backup battery failure; detected during periodic check. The Memory Address field contains the starting physical address of the Journal SRAM.	20
02052301	A processor interrupt was generated by the CACHE Dynamic Ram controller and ArBitration engine (DRAB) with an indication that the CACHE backup battery has failed or is low (needs charging). The Memory Address field contains the starting physical address of the CACHE A0 memory.	23
02062301	The CACHE backup battery has been declared bad. Either it failed testing performed by the cache diagnostics during system startup or it was too low (insufficiently charged) for the expected duration. The Memory Address field contains the starting physical address of the CACHE A0 memory.	23

Instance, Code	Explanation	Repair Action Code
02072201	The CACHE Dynamic Ram controller and ArBitration engine 0 (DRAB0) failed testing performed by the cache diagnostics. The Memory Address field contains the starting physical address of the CACHEA0 memory.	22
02082201	The CACHE Dynamic Ram controller and ArBitration engine 1 (DRAB1) failed testing performed by the cache diagnostics. The Memory Address field contains the starting physical address of the CACHEA1 memory.	22
02090064	A data compare error was detected during the execution of a compare modified READ or WRITE command.	00
020A0064	A data compare error was detected during the execution of a compare modified READ or WRITE command. Note that in this instance, the SCSI Device Sense Data fields, cmdopcd through keyspec, are undefined.	00
020B2201	A failed read test of a write-back metadata page residing in cache occurred. Dirty write-back cached data exists and cannot be flushed to media. The dirty data is lost. The Memory Address field contains the starting physical address of the CACHEA0 memory.	22
020C2201	cache diagnostics have declared the cache bad during testing. The Memory Address field contains the starting physical address of the CACHEA0 memory.	22
020D2401	The wrong write cache module is configured. The serial numbers do not match. Either the existing or the expected cache contains dirty write-back cached data. Note that in this instance, the Memory Address, Byte Count, DRAB register, and Diagnostic register fields are undefined.	24
020E2401	The write cache module is missing. A cache is expected to be configured and contains dirty write-back cached data. Note that in this instance, the Memory Address, Byte Count, DRAB register, and Diagnostic register fields are undefined.	24
020F2401	The write cache modules are not configured properly for a dual-redundant configuration. One of the write cache modules is not present to perform cache failover of dirty write-back cached data. Note that in this instance, the Memory Address, Byte Count, DRAB register, and Diagnostic register fields are undefined.	24
02102401	The write cache modules are not configured properly for a dual-redundant configuration. One of the cache modules is not the same size to perform cache failover of dirty write-back cached data. Note that in this instance, the Memory Address, Byte Count, DRAB register, and Diagnostic register fields are undefined.	24
02110064	Disk Bad Block Replacement attempt completed for a read within the user data area of the disk. Note that due to the way Bad Block Replacement is performed on SCSI disk drives, information on the actual replacement blocks is not available to the controller and is therefore not included in the event report.	00

Instance, Code	Explanation	Repair Action Code
02120064	There are insufficient resources to complete operation in a SCSI environment. Insufficient resources returned from HIS, CREATE_RECEIVE_DATA.	00
02130064	The tape device does not contain any medium.	00
02140064	The unit has been marked inoperative or UNKNOWN. In either case, the unit is not available.	00
02150064	The Unit State Block unit status, associated with this I/O has changed to the UNKNOWN state. Therefore, the I/O was aborted.	00
02160064	A request was received to abort this command.	00
0217000A	Raid support is enabled but not licensed on this controller. Any use of this feature requires licensing. Continued use does not comply with the terms and conditions of licensing for this product.	00
0218000A	Write-back cache support is enabled but not licensed on this controller. Any use of this feature requires licensing. Continued use does not comply with the terms and conditions of licensing for this product.	00
02192401	The cache modules are not configured properly for a dual-redundant configuration. One of the cache modules is not the same type (both write -back cache) which is necessary to perform cache failover of dirty write-back cached data. Note that in this instance, the Memory Address, Byte Count, DRAB register, and Diagnostic register fields are undefined.	24
021A0064	Disk Bad Block Replacement attempt completed for a write of controller metadata to a location outside the user data area of the disk. Note that due to the way Bad Block Replacement is performed on SCSI disk drives, information on the actual replacement blocks is not available to the controller and is therefore not included in the event report.	00
021B0064	Disk Bad Block Replacement attempt completed for a read of controller metadata from a location outside the user data area of the disk. Note that due to the way Bad Block Replacement is performed on SCSI disk drives, information on the actual replacement blocks is not available to the controller and is therefore not included in the event report.	00
021D0064	Unable to lock the other controller's cache in a write-cache failover attempt. Either a latent error could not be cleared on the cache or the other controller did not release its cache. Note that in this instance, the Memory Address, Byte Count, DRAB register, and Diagnostic register fields are undefined.	00
021E0064	The device specified in the Device Locator field has been added to the RAIDset associated with the logical unit. The RAIDset is now in Reconstructing state.	00

Instance, Code	Explanation	Repair Action Code
021F0064	The device specified in the Device Locator field has been removed from the RAIDset associated with the logical unit. The removed device is now in the Failedset. The RAIDset is now in Reduced state.	00
02200064	The device specified in the Device Locator field failed to be added to the RAIDset associated with the logical unit. The device will remain in the spareset.	00
02210064	The device specified in the Device Locator field failed to be added to the RAIDset associated with the logical unit. The failed device has been moved to the Failedset.	00
02220064	The RAID set associated with the logical unit has transitioned from Reconstructing state to Normal state. Note that in this instance, information supplied in the Device Locator, Device Firmware Revision Level, Device Product ID, and Device Type fields is for the first device in the RAID set.	00
02230064	The RAIDset associated with the logical unit has gone inoperative. Note that in this instance, information supplied in the Device Locator, Device Firmware Revision Level, Device Product ID, and Device Type fields is for the first device in the RAIDset.	00
02240064	The RAIDset associated with the logical unit has transitioned from Normal state to Reconstructing state. Note that in this instance, information supplied in the Device Locator, Device Firmware Revision Level, Device Product ID, and Device Type fields is for the first device in the RAIDset.	00
0227000A	Mirroring support is enabled but not licensed on this controller. Any use of this feature requires licensing. Continued use does not comply with the terms and conditions of licensing for this product.	00
02280064	The device specified in the Device Locator field has been added to the mirrorset associated with the logical unit. The new mirrorset member is now in the Copying state.	00
02290064	The device specified in the Device Locator field has been removed from the mirrorset associated with the logical unit. The removed device is now in the Failedset.	00
022A0064	The device specified in the Device Locator field failed to be added to the mirrorset associated with the logical unit. The device will remain in the Spareset.	00
022B0064	The device specified in the Device Locator field failed to be added to the mirrorset associated with the logical unit. The failed device has been moved to the Failedset.	00
022C0064	The device specified in the Device Locator has transitioned from Copying or Normalizing state to Normal state.	00

Instance, Code	Explanation	Repair Action Code
022D0064	The mirrorset associated with the logical unit has gone inoperative. Note that in this instance, information supplied in the Device Locator, Device Firmware Revision Level Device Product ID, and Device Type fields is for the first device in the mirrorset .	00
022E0064	The device specified in the Device Locator field has been converted to a mirrorset unit.	00
022F0064	The mirrored device specified in the Device Locator field has been converted to a single device associated with the logical unit.	00
02300064	The device specified in the Device Locator field has been reduced from its associated mirrorset. The nominal number of members in the mirrorset has been decreased by one. The reduced device is now available for use.	00
02310064	The mirrorset associated with the logical unit has had its nominal membership changed. The new nominal number of members for the mirrorset is specified in the Associated Port field. Note that in this instance, information supplied in the Device Locator, Device Firmware Revision Level, Device Product ID, and Device Type fields is for the first device in the mirrorset . This Instance, code has been removed from the HSOF Version 2.7 release.	00
023B0064	The device specified in the Device Locator field had a read error that has been repaired with data from another mirrorset member.	00
023C0064	The device specified in the Device Locator field had a read error. Attempts to repair the error with data from another mirrorset member failed bacause of a lack of alternate error-free data source.	00
023D0064	The device specified in the Device Locator field had a read error. Attempts to repair the error with data from another mirrorset member failed because of a write error on the original device. The original device will be removed from the mirrorset.	00
02422464	Cache failover attempt failed because the other cache was illegally configured with SIMMs. Note that in this instance, the memory address, byte count, DRAB register, and Diagnostic register fields are undefined.	24
02432201	The CACHE Dynamic Ram controller and ArBitration engine 0 (DRAB0) failed cache diagnostics testing performed on Cache B (other cache) during a cache failover attempt. The memory address field contains the starting physical address of the CACHEB0 memory.	22
02442201	The CACHE Dynamic Ram controller and ArBitration engine 1 (DRAB1) failed cache diagnostics testing performed on Cache B (other cache) during a cache failover attempt. The memory address field contains the starting physical address of the CACHEB1 memory.	22

Instance, Code	Explanation	Repair Action Code
02452201	The CACHE Dynamic Ram controller and ArBitration engine 0 and 1 (DRAB0 and DRAB1) failed cache diagnostics testing performed on Cache B (other cache) during a cache failover attempt. The memory address field contains the starting physical address of the CACHEB1 memory.	22
02460064	The A Write Append Position Error occurred during a tape write but no recovery was attempted because the attempted transfer did not meet the parameters for a recoverable Write Append Position Error.	00
02470064	When attempting to recover a Write Append Position Error on a tape unit, the recovery failed to start because resources required for the recovery were not available.	00
02480064	When attempting to recover a Write Append Position Error on a tape unit, an error occurred during the recovery.	00
024B2401	The Write-back caching has been disabled either due to a cache or battery related problem. The exact nature of the problem is reported by other instance, codes. Note that in this instance, the memory address, byte count, DRAB register, and Diagnostic register fields are undefined.	24
024F2401	This cache module is populated with SIMMs incorrectly. Cache metadata resident in the cache module indicates that unflushed write cache data exists for a cache size different than what is found present. Note that in this instance, the memory address, byte count, DRAB register and Diagnostic register fields are undefined.	24
02502401	The cache module has memory SIMMs populated in an unsupported configuration. Note that in this instance, the memory address, byte count, DRAB register, and Diagnostic register fields are undefined.	24
0251000A	The command failed because the target unit is not online to the controller. The Information field of the Device Sense Data contains the block number of the first block in error.	00
0252000A	The last block of data returned contains a forced error. A forced error occurs when a disk block is successfully reassigned, but the data in that block is lost. Rewriting the disk block will clear the forced error condition. The Information field of the Device Sense Data contains the block number of the first block in error.	00
0253000A	The data supplied from the host for a data compare operation differs from the data on the disk in the specified block. The Information field of the Device Sense Data contains the block number of the first block in error.	00
0254000A	The command failed due to a host data transfer failure. The Information field of the Device Sense Data contains the block number of the first block in error.	00
0255000A	The controller was unable to successfully transfer data to target unit.	00

Instance, Code	Explanation	Repair Action Code
0256000A	The write operation failed because the unit is data safety write protected.	00
0257000A	An attempt to reassign a bad disk block failed. The contents of the disk block is lost. The Information field of the Device Sense Data contains the block number of the first block in error.	00
0258000A	The command was aborted prior to completion. The Information field of the Device Sense Data contains the block number of the first block in error.	00
0259000A	The write operation failed because the unit is hardware write protected. The Information field of the Device Sense Data contains the block number of the first block in error.	00
025A000A	The command failed because the unit became inoperative prior to command completion. The Information field of the Device Sense Data contains the block number of the first block in error.	00
025B000A	The command failed because the unit became unknown to the controller prior to command completion. The Information field of the Device Sense Data contains the block number of the first block in error.	00
025C000A	The command failed because of a unit media format error. The Information field of the Device Sense Data contains the block number of the first block in error.	00
025D000A	The command failed for an unknown reason. The Information field of the Device Sense Data contains the block number of the first block in error.	00
025E0064	The mirrorset unit associated with the logical unit has had its nominal membership changed. The information provided in the device locator, device type , device identification, and the device serial number fields is for the first device in the mirrorset.	00
03010101	No command control structures available for disk operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03022002	A SCSI interface chip command time-out occurred during disk operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03034002	Byte transfer time-out during disk operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	40
03044402	SCSI bus errors during disk operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	44

Instance, Code	Explanation	Repair Action Code
03052002	Device port SCSI chip reported gross error during disk operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03062002	Non-SCSI bus parity error during disk operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03070101	Source driver programming error encountered during disk operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03080101	Miscellaneous SCSI Port Driver coding error detected during disk operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03094002	An unrecoverable disk drive error was encountered while performing work related to disk unit operations.	40
030C4002	A Drive failed because a Test Unit Ready command or a Read Capacity command failed.	40
030D000A	Drive was failed by a Mode Select command received from the host.	00
030E4002	Drive failed due to a deferred error reported by drive.	40
030F4002	Unrecovered Read or Write error.	40
03104002	No response from one or more drives.	40
0311430A	Nonvolatile memory and drive metadata indicate conflicting drive configurations.	43
0312430A	The Synchronous Transfer Value differs between drives in the same storageset.	43
03134002	Maximum number of errors for this data transfer operation exceeded.	40
03144002	Drive reported recovered error without transferring all data.	40
03154002	Data returned from drive is invalid.	40
03164002	Request Sense command to drive failed.	40
03170064	Illegal command for pass through mode.	00
03180064	Data transfer request error.	00
03194002	Premature completion of a drive command.	40
031A4002	Command time-out.	40
031B0101	Watchdog timer time-out.	01
031C4002	Disconnect time-out.	40

Instance, Code	Explanation	Repair Action Code
031D4002	Unexpected bus phase.	40
031E4002	Disconnect expected.	40
031F4002	ID message not sent by drive.	40
03204002	Synchronous negotiation error.	40
03214002	The drive unexpectedly disconnected from the SCSI bus.	40
03224002	Unexpected message.	40
03234002	Unexpected Tag message.	40
03244002	Channel busy.	40
03254002	Message Reject received on a valid message.	40
0326450A	The disk device reported Vendor Unique SCSI Sense Data.	45
03270101	A disk related error code was reported that was unknown to the Fault Management firmware. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
0328450A	The disk device reported standard SCSI Sense Data.	45
03324002	SCSI bus selection time-out.	40
03330002	Device power on reset.	00
03344002	Target assertion of REQ after WAIT DISCONNECT.	40
03354002	During device initialization a Test Unit Ready command or a Read Capacity command to the drive failed.	40
03364002	During device initialization the device reported a deferred error.	40
03374002	During device initialization the maximum number of errors for a data transfer operation was exceeded.	40
03384002	Request Sense command to the device failed.	40
03394002	Command time-out.	40
033A4002	Disconnect time-out.	40
033B4002	Unexpected bus phase.	40
033C4002	The device unexpectedly disconnected from the SCSI bus.	40
033D4002	Unexpected message	40
033E4002	Message Reject received on a valid message.	40
033F0101	No command control structures available for pass-through device operation.	01
03402002	Device port SCSI chip reported gross error.	20
03410101	Miscellaneous SCSI Port Driver coding error.	01

Instance, Code	Explanation	Repair Action Code
03420101	A pass-through device related internal error code was reported that is not recognized by the Fault Management firmware of the HSZ controller.	01
03434002	During device initialization, the device reported unexpected standard SCSI Sense Data.	40
03644002	An unrecoverable tape drive error was encountered while performing work related to tape unit operations.	01
03674002	A Drive failed because a Test Unit Ready command or a Read Capacity command failed.	40
0368000A	Drive was failed by a Mode Select command received from the host.	00
03694002	Drive failed due to a deferred error reported by drive.	40
036A4002	Unrecovered Read or Write error.	40
036B4002	No response from one or more drives.	40
036C430A	Nonvolatile memory and drive metadata indicate conflicting drive configurations.	43
036D430A	The Synchronous Transfer Value differs between drives in the same storageset.	43
036E4002	Maximum number of errors for this data transfer operation exceeded.	40
036F4002	Drive reported recovered error without transferring all data.	40
03704002	Data returned from drive is invalid.	40
03714002	Request Sense command to drive failed.	40
03720064	Illegal command for pass through mode.	00
03730064	Data transfer request error.	00
03744002	Premature completion of a drive command.	40
03754002	Command time-out.	40
03760101	Watchdog timer time-out.	01
03774002	Disconnect time-out.	40
03784002	Unexpected bus phase.	40
03794002	Disconnect expected.	40
037A4002	Message not sent by drive.	40
037B4002	Synchronous negotiation error.	40
037C4002	The drive unexpectedly disconnected from the SCSI bus.	40
037D4002	Unexpected message.	40
037E4002	Unexpected Tag message.	40

Instance, Code	Explanation	Repair Action Code
037F4002	Channel busy.	40
03804002	Message Reject received on a valid message.	40
0381450A	The tape device reported Vendor Unique SCSI Sense Data.	45
03820101	No command control structures available for tape operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03832002	A SCSI interface chip command time-out occurred during tape operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03844002	Byte transfer time-out during tape operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	40
03854402	SCSI bus errors occurred during tape operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	44
03862002	Device port SCSI chip reported gross error during tape operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03872002	A non-SCSI bus parity error occurred during tape operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03880101	A source driver programming error was encountered during tape operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03890101	A miscellaneous SCSI Port Driver coding error was encountered during tape operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
038A0101	A tape-related error code was reported that was unknown to the Fault Management firmware. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
038B450A	The tape device reported standard SCSI Sense Data.	45
03964002	An unrecoverable media loader error was encountered while performing work related to media loader operations.	40
03994002	A Drive failed because a Test Unit Ready command or a Read Capacity command failed.	40

Instance, Code	Explanation	Repair Action Code
039A000A	The drive was failed by a Mode Select command received from the host.	00
039B4002	The drive failed due to a deferred error reported by drive.	40
039C4002	Unrecovered Read or Write error.	40
039D4002	No response from one or more drives.	40
039E430A	Nonvolatile memory and drive metadata indicate conflicting drive configurations.	43
039F430A	The Synchronous Transfer Value differs between drives in the same storageset.	43
03A04002	Maximum number of errors for this data transfer operation exceeded.	40
03A14002	The drive reported recovered error without transferring all data.	40
03A24002	Data returned from drive is invalid.	40
03A34002	Request Sense command to drive failed.	40
03A40064	Illegal command for pass through mode.	00
03A50064	Data transfer request error.	00
03A64002	Premature completion of a drive command.	40
03A74002	Command time-out.	40
03A80101	Watchdog timer time-out.	01
03A94002	Disconnect time-out.	40
03AA4002	Unexpected bus phase.	40
03AB4002	Disconnect expected.	40
03AC4002	ID message not sent by drive.	40
03AD4002	Synchronous negotiation error.	40
03AE4002	The drive unexpectedly disconnected from the SCSI bus.	40
03AF4002	Unexpected message..	40
03B04002	Unexpected Tag message.	40
03B14002	Channel busy.	40
03B24002	Message Reject received on a valid message.	40
03B3450A	SCSI Sense Data.	44
03B40101	No command control structures available for media loader operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01

Instance, Code	Explanation	Repair Action Code
03B52002	SCSI interface chip command time-out during media loader operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03B64002	Byte transfer time-out during media loader operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	40
03B74402	SCSI bus errors during media loader operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	44
03B82002	Device port SCSI chip reported gross error during media loader operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03B92002	Non-SCSI bus parity error during media loader operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03BA0101	Source driver programming error encountered during media loader operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03BB0101	Miscellaneous SCSI Port Driver coding error detected during media loader operation. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03BC0101	A media loader related error code was reported that was unknown to the Fault Management firmware. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03BD450A	The media changer device reported standard SCSI Sense Data.	45
03C80101	No command control structures available for operation to a device which is unknown to the controller. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03C92002	SCSI interface chip command time-out during operation to a device which is unknown to the controller. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03CA4002	Byte transfer time-out during operation to a device which is unknown to the controller. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	40

Instance, Code	Explanation	Repair Action Code
03CB0101	Miscellaneous SCSI Port Driver coding error detected during operation to a device which is unknown to the controller. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03CC0101	An error code was reported that was unknown to the Fault Management firmware. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03CD2002	Device port SCSI chip reported gross error during operation to a device which is unknown to the controller. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	??
03CE2002	Non-SCSI bus parity error during operation to a device which is unknown to the controller. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	20
03CF0101	Source driver programming error encountered during operation to a device which is unknown to the controller. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	01
03D04002	A failure occurred while attempting a SCSI Test Unit Ready or Read Capacity command to a device. The device type is unknown to the controller. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	40
03D24402	SCSI bus errors during device operation. The device type is unknown to the controller. Note that in this instance, the Associated Additional Sense Code and Associated Additional Sense Code Qualifier fields are undefined.	44
03D3450A	During device initialization, the device reported the SCSI Sense Key NO SENSE. This indicates that there is no specific sense key information to be reported for the designated logical unit. This would be the case for a successful command or a command that received CHECK CONDITION or COMMAND TERMINATED status because one of the FM, EOM, or ILI bits is set to one in the sense data flags field.	45
03D4450A	During device initialization, the device reported the SCSI Sense Key RECOVERED ERROR. This indicates the last command completed successfully with some recovery action performed by the target.	45
03D5450A	During device initialization, the device reported the SCSI Sense Key NOT READY. This indicates that the logical unit addressed cannot be accessed. Operator intervention may be required to correct this condition.	45

Instance, Code	Explanation	Repair Action Code
03D6450A	During device initialization, the device reported the SCSI Sense Key MEDIUM ERROR. This indicates that the command terminated with a non-recovered error condition that was probably caused by a flaw in the medium or an error in the recorded data. This sense key also may be returned if the target is unable to distinguish between a flaw in the medium and a specific hardware failure (HARDWARE ERROR sense key).	45
03D7450A	During device initialization, the device reported the SCSI Sense Key HARDWARE ERROR. This indicates that the target detected a non-recoverable hardware failure (for example, controller failure, device failure, parity error, etc.) while performing the command or during a self test.	45
03D8450A	During device initialization, the device reported the SCSI Sense Key ILLEGAL REQUEST. This indicates that there was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands (FORMAT UNIT, SEARCH DATA, etc.). If the target detects an invalid parameter in the command descriptor block, then it will terminate the command without altering the medium. If the target detects an invalid parameter in the additional parameters supplied as data, then the target may have already altered the medium. This sense key also may indicate that an invalid IDENTIFY message was received.	45
03D9450A	During device initialization, the device reported the SCSI Sense Key UNIT ATTENTION. This indicates that the removable medium may have been changed or the target has been reset.	45
03DA450A	During device initialization, the device reported the SCSI Sense Key DATA PROTECT. This indicates that a command that reads or writes the medium was attempted on a block that is protected from this operation. The read or write operation is not performed.	45
03DB450A	During device initialization, the device reported the SCSI Sense Key BLANK CHECK. This indicates that a write-once device encountered blank medium or format-defined end-of-data indication while reading or a write-once device encountered a nonblank medium while writing.	45
03DC450A	During device initialization, the device reported a SCSI Vendor Specific Sense Key. This sense key is available for reporting vendor specific conditions.	45
03DD450A	During device initialization, the device reported the SCSI Sense Key COPY ABORTED. This indicates a COPY, COMPARE, or COPY AND VERIFY command was aborted due to an error condition on the source device, the destination device, or both.	45

Instance, Code	Explanation	Repair Action Code
03DE450A	During device initialization, the device reported the SCSI Sense Key ABORTED COMMAND. This indicates the target aborted the command. The initiator may be able to recover by trying the command again.	45
03DF450A	During device initialization, the device reported the SCSI Sense Key EQUAL. This indicates a SEARCH DATA command has satisfied an equal comparison.	45
03E0450A	During device initialization, the device reported the SCSI Sense Key VOLUME OVERFLOW. This indicates a buffered peripheral device has reached the end-of-partition and data may remain in the buffer that has not been written to the medium. A RECOVER BUFFERED DATA command(s) may be issued to read the unwritten data from the buffer.	45
03E1450A	During device initialization, the device reported the SCSI Sense Key MISCOMPARE. This indicates the source data did not match the data read from the medium.	45
03E2450A	During device initialization, the device reported a reserved SCSI Sense Key.	45
03E60702	The EMU has detected one or more bad power supplies. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	07
03E70602	The EMU has detected one or more bad fans. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	06
03E80D02	The EMU has detected an elevated temperature condition. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	0D
03E90E02	The EMU has detected an external air sense fault Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	0E
03EA0F02	The EMU-detected power supply fault is now fixed. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	0F
03EB0F02	The EMU-detected bad fan fault is now fixed. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	0F
03EC0F02	The EMU-detected elevated temperature fault is now fixed. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	0F

Instance, Code	Explanation	Repair Action Code
03ED0F02	The EMU-detected external air sense fault is now fixed. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	0F
03F00402	The shelf indicated by the port field is reporting a problem. This could mean one or both of the following: ☐ If the shelf is using dual power supplies, one power supply has failed. ☐ One of the shelf cooling fans has failed. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	04
03F10502	The SWAP interrupt from the shelf indicated by the port field can not be cleared. All SWAP interrupts from all ports will be disabled until corrective action is taken. When SWAP interrupts are disabled, neither controller front panel button presses nor removal/insertion of devices are detected by the controller. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	05
03F20064	The SWAP interrupts have been cleared and re-enabled for all shelves. Note that in this instance, the Associated Port, Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	00
03F30064	An asynchronous SWAP interrupt was detected by the controller for the shelf indicated by the port field. Possible reasons for this occurrence include ☐ device insertion/removal ☐ shelf power failure ☐ SWAP interrupts re-enabled Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	00
03F40064	Device services had to reset the port to clear a bad condition. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	00

Instance, Code	Explanation	Repair Action Code
03F50402	The controller shelf is reporting a problem. This could mean one or both of the following: ☐ If the shelf is using dual power supplies, one power supply has failed. ☐ One of the shelf cooling fans has failed. Note that in this instance, the Associated Target, Associated Additional Sense Code, and Associated Additional Sense Code Qualifier fields are undefined.	04
07030B0A	Failover Control detected a receive packet sequence number mismatch. The controllers are out of synchronization with each other and are unable to communicate. Note that in this instance, the Last Failure Code and Last Failure Parameters fields are undefined.	0B
07040B0A	Failover Control detected a transmit packet sequence number mismatch. The controllers are out of synchronization with each other and are unable to communicate. Note that in this instance, the Last Failure Code and Last Failure Parameters fields are undefined.	0B
07050064	Failover Control received a Last Gasp message from the other controller. The other controller is expected to restart itself within a given time period. If it does not, it will be held reset with the Kill line.	40
07060C01	Failover Control detected that both controllers are acting as SCSI ID 6. Since IDs are determined by hardware, it is unknown which controller is the real SCSI ID 6. Note that in this instance, the Last Failure Code and Last Failure Parameters fields are undefined.	0C
07070C01	Failover Control detected that both controllers are acting as SCSI ID 7. Since IDs are determined by hardware, it is unknown which controller is the real SCSI ID 7. Note that in this instance, the Last Failure Code and Last Failure Parameters fields are undefined.	0C
07080B0A	Failover Control was unable to send keep alive communication to the other controller. It is assumed that the other controller is hung or not started. Note that in this instance, the Last Failure Code and Last Failure Parameters fields are undefined.	0B
40016001	CI A/B transmit cables are crossed.	60
40026001	CI A/B receive cables are crossed.	60
4003640A	CI Port detected a Dual Receive condition that resulted in the closure of the Virtual Circuit. This error condition will be eliminated in a future CI interface chip.	64
4004020A	Host Interconnect Services detected protocol error upon validating a received packet.	02
4007640A	CI Port detected error upon attempting to transmit a packet. This resulted in the closure of the Virtual Circuit.	64

Instance, Code	Explanation	Repair Action Code
4009640A	CI Port detected bad path A upon attempting to transmit a packet.	64
400A640A	CI Port detected bad path B upon attempting to transmit a packet.	64
400D640A	CI Port detected bad path A upon attempting to transmit a packet.	64
400E640A	CI Port detected bad path B upon attempting to transmit a packet.	64
400F640A	Host Interconnect Services detected packet sequence number mismatch.	64
4015020A	Remote SYSAP sent an SCS APPL_MSG but no receive credit was available.	02
4029010A	Illegal connection state. Not in CONNECT_REC connection state when an SCS ACCEPT_REQ is pending.	01
402A010A	Illegal connection state. Not in CONNECT_REC connection state when an SCS REJECT_REQ is pending.	01
402B010A	Illegal connection state. Not in CLOSED connection state when an SCS CONNECT_REQ is pending.	01
402C010A	Illegal connection state. Not in OPEN or DISCONNECT_REC connection state when an SCS DISCONNECT_REQ is pending.	01
403D020A	Received packet with an unrecognized PPD opcode. Note that the content of the vcstate field is undefined in this instance,.	02
40440064	Received a PPD NODE_STOP and closed virtual circuit.	00
4051020A	Received SCS CONNECT_RSP when not in CONNECT_SENT connection state.	02
4052020A	Received SCS CONNECT_RSP when the connection is no longer valid.	02
4053020A	Received SCS ACCEPT_REQ when not in CONNECT_ACK connection state.	02
4054020A	Received SCS ACCEPT_RSP when not in the ACCEPT_SENT connection state.	02
4055020A	Received SCS REJECT_REQ when not in the CONNECT_ACK connection state.	02
4056020A	Received SCS REJECT_RSP when not in the REJECT_SENT connection state.	02
4057020A	Received SCS DISCONNECT_REQ when not in the OPEN, DISCONNECT_SENT or DISCONNECT_ACK connection state.	02
4058020A	Received SCS DISCONNECT_RSP when not in the DISCONNECT_SENT or DISCONNECT_MATCH connection state.	02

Instance, Code	Explanation	Repair Action Code
4059020A	Received SCS CREDIT_REQ when in the DISCONNECT_REC or DISCONNECT_MATCH connection state.	02
405A020A	Received SCS APPL_MSG when in the DISCONNECT_SENT or DISCONNECT_ACK connection state.	02
405B020A	Received SCS ACCEPT_REQ on a connection that is no longer valid. Note that in this instance, if the connection id field is zero, the content of the "vcstate," "remote node name," "remote connection id" and "connection state" fields are undefined.	02
405C020A	Received SCS ACCEPT_RSP on a connection that is no longer valid. Note that in this instance, if the connection id field is zero, the content of the vcstate, remote node name, remote connection id and connection state fields are undefined.	02
405D020A	Received SCS REJECT_REQ on a connection that is no longer valid. Note that in this instance, if the connection id field is zero, the content of the vcstate, remote node name, remote connection id and connection state fields are undefined.	02
405E020A	Received SCS REJECT_RSP on a connection that is no longer valid. Note that in this instance, if the connection id field is zero, the content of the vcstate, remote node name, remote connection id and connection state fields are undefined.	02
405F020A	Received SCS DISCONNECT_REQ on a connection that is no longer valid. Note that in this instance, if the connection id field is zero, the content of the vcstate, remote node name, remote connection id and connection state fields are undefined.	02
4060020A	Received SCS DISCONNECT_RSP on a connection that is no longer valid. Note that in this instance, if the connection id field is zero, the content of the vcstate, remote node name, remote connection id and connection state fields are undefined.	02
4061020A	Received SCS CREDIT_REQ on a connection that is no longer valid. Note that in this instance, if the connection id field is zero, the content of the vcstate, remote node name, remote connection id and connection state fields are undefined.	02
4062020A	Received SCS CREDIT_RSP on a connection that is no longer valid. Note that in this instance, if the connection id field is zero, the content of the vcstate, remote node name, remote connection id and connection state fields are undefined.	02
4063020A	Received SCS APPL_MSG on a connection that is no longer valid. Note that in this instance, if the connection id field is zero, the content of the vcstate, remote node name, remote connection id and connection state fields are undefined.	02

Instance, Code	Explanation	Repair Action Code
4064020A	Received an unrecognized SCS message. Note that in this instance, if the connection id field is zero, the content of the vcstate, remote node name, remote connection id and connection state fields are undefined.	02
4065020A	Received SCS CONNECT_RSP with an unrecognized status. Connection is broken by Host Interconnect Services.	02
4066020A	Received SCS REJECT_REQ with an invalid reason.	02
4067020A	Received SCS APPL_MSG with no receive credit available.	02
41010064	SCSI Host Interconnect Services has detected that the other controller, identified in the Failed Controller Target Number and Other Controller Board Serial Number sense data fields, has failed and that the controller reporting the event has assumed control of the units identified in the Affected LUNs sense data field.	00
41020064	SCSI Host Interconnect Services has detected that the other controller, identified in the Failed Controller Target Number and Other Controller Board Serial Number sense data fields, is again operational and that the controller reporting the event is willing to relinquish control of the units identified in the affected LUNs sense data field.	00
82012002	An unrecoverable error was detected during execution of the Device port Subsystem Built-In Self Test. One or more of the device ports on the controller module has failed; some/all of the attached storage is no longer accessible via this controller.	20
82042002	A spurious interrupt was detected during the execution of a Subsystem Built-In Self Test.	20
82052002	An unrecoverable error was detected during execution of the HOST PORT Subsystem Test. The system will not be able to communicate with the host.	20
82062002	An unrecoverable error was detected during execution of the UART/DUART Subsystem Test. This will cause the console to be unusable. This will cause failover communications to fail.	20
82072002	An unrecoverable error was detected during execution of the FX Subsystem Test.	20
82082002	An unrecoverable error was detected during execution of the nbuss init Test.	20

Last fail codes

The following tables contain last fail codes and their definitions. Use these tables if your subsystem or controller is out of service due to some type of failure and you cannot use FMU to translate the last fail code.

These codes are presented in tables according to the software component that was the source of the error. However, they are also sorted numerically, so you can scan down the list until you find the code you're looking for.

Table 21
Executive services last failure codes

Last Fail Code	Explanation	Repair Action Code
01000100	Memory allocation failure during executive initialization.	01
01010100	An interrupt without any handler was triggered.	01
01020100	Entry on timer queue was not of type AQ or BQ.	01
01030100	Memory allocation for a facility lock failed.	01
01040100	Memory initialization called with invalid memory type.	01
01050104	The I960 reported a fault. ☐ Last Failure Parameter[0] contains the PC value. ☐ Last Failure Parameter[1] contains the AC value. ☐ Last Failure Parameter[2] contains the fault type and subtype values. ☐ Last Failure Parameter[3] contains the address of the faulting instruction.	01
01070100	Timer chip setup failed.	01
01082004	The core diagnostics reported a fault. ☐ Last Failure Parameter[0] contains the error code value (same as blinking OCP LEDs error code). ☐ Last Failure Parameter[1] contains the address of the fault. ☐ Last Failure Parameter[2] contains the actual data value. ☐ Last Failure Parameter[3] contains the expected data value.	20

Last Fail Code	Explanation	Repair Action Code
01090105	An NMI occurred during EXEC, BUGCHECK processing. ☐ Last Failure Parameter[0] contains the executive flags value. ☐ Last Failure Parameter[1] contains the RIP from the NMI stack. ☐ Last Failure Parameter[2] contains the read diagnostic register 0 value. ☐ Last Failure Parameter[3] contains the Master DRAB CSR value. ☐ Last Failure Parameter[4] contains the SIP last failure code value.	01
010A2080	A single bit or a multi-single bit ECC error was detected. To prevent data corruption, the controller was reset. If this event occurs frequently, the controller module should be replaced.	20
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).	23
010C2380	A processor interrupt was generated by the CACHEB Dynamic Ram controller and ArBitration engine (DRAB) with an indication that the CACHE backup battery has failed or is low (needs charging).	23
010D0110	The System Information structure within the System Information Page has been reset to default settings. The only known cause for this event is an I960 processor hang caused by an unimplemented memory region reference. When such a hang occurs, controller modules equipped with inactivity watchdog timer circuitry will spontaneously reboot after the watchdog timer expires (within seconds of the hang). Controller modules not so equipped will just hang as indicated by the green LED on the OCP remaining in a steady state.	01
010E0110	All structures contained in the System Information Page (SIP) and the Last Failure entries have been reset to their default settings. This is a normal occurrence in the following situations: ☐ For the first boot following manufacture of the controller module ☐ During the transition from one firmware version to another if the format of the SIP is different between the two versions. If this event is reported at any other time, follow the recommended repair action associated with this Last Failure code.	01

Last Fail Code	Explanation	Repair Action Code
010F0110	All structures contained in the System Information Page and the Last Failure entries have been reset to their default settings as the result of certain controller manufacturing configuration activities. If this event is reported at any other time, follow the recommended repair action associated with this Last Failure code.	01
01100100	Non-maskable interrupt entered but no Non-maskable interrupt pending. This is typically caused by an indirect call to address 0.	01
01110106	A bugcheck occurred during EXEC, BUGCHECK processing. ☐ Last Failure Parameter [0] contains the executive flags value. ☐ Last Failure Parameter [1] contains the RIP from the bugcheck call stack. ☐ Last Failure Parameter [2] contains the first SIP last failure parameter value. ☐ Last Failure Parameter [3] contains the second SIP last failure parameter value. ☐ Last Failure Parameter [4] contains the SIP last failure code value ☐ Last Failure Parameter [5] contains the EXEC, BUGCHECK call last failure code value.	01
01126880	A processor interrupt was generated by the CACHA Dynamic Ram controller and ArBitration engine (DRAB) with an indication that the CACHE backup battery has been disconnected.	68
01136880	A processor interrupt was generated by the CACHB Dynamic Ram controller and ArBitration engine (DRAB) with an indication that the CACHE backup battery has been disconnected.	68

Last Fail Code	Explanation	Repair Action Code
01150106	A bugcheck occurred before subsystem initialization completed. ☐ Last Failure Parameter [0] contains the executive flags value. ☐ Last Failure Parameter [1] contains the RIP from the bugcheck call stack. ☐ Last Failure Parameter [2] contains the first SIP last failure parameter value. ☐ Last Failure Parameter [3] contains the second SIP last failure parameter value. ☐ Last Failure Parameter [4] contains the SIP last failure code value ☐ Last Failure Parameter [5] contains the EXEC, BUGCHECK call last failure code value.	01
018000A0	A powerfail interrupt occurred.	00
018600A0	A processor interrupt was generated with an indication that the other controller in a dual controller configuration asserted the KILL line to disable this controller.	00
018700A0	A processor interrupt was generated with an indication that the (//) RESET button on the controller module was depressed.	00
018800A0	A processor interrupt was generated with an indication that the program card was removed.	00
018900A0	A processor interrupt was generated with an indication that the controller inactivity watchdog timer expired.	00
018B2580	A NMI interrupt was generated with an indication that a memory system problem occurred.	25
018C2580	A DRAB_INT interrupt was generated with an indication that a memory system problem occurred.	25
018D2580	The memory address range for which buffer SYSCOM was linked is not available.	25

Table 22
Value-added services last failure codes

Last Fail Code	Explanation	Repair Action Code
02000100	Initialization code was unable to allocate enough memory to setup the receive data descriptors.	01
02010100	Initialization code was unable to allocate enough memory to setup the send data descriptors.	01
02040100	Unable to allocate memory necessary for data buffers.	01
02050100	Unable to allocate memory for the Free Buffer Array.	01

Last Fail Code	Explanation	Repair Action Code
02080100	A call to EXEC, ALLOCATE_MEM_ZEROED failed to return memory when populating the disk read DWD stack.	01
02090100	A call to EXEC, ALLOCATE_MEM_ZEROED failed to return memory when populating the disk write DWD stack.	01
020A0100	A call to EXEC, ALLOCATE_MEM_ZEROED failed to return memory when populating the tape read DWD stack.	01
020B0100	A call to EXEC, ALLOCATE_MEM_ZEROED failed to return memory when populating the tape write DWD stack.	01
020C0100	A call to EXEC, ALLOCATE_MEM_ZEROED failed to return memory when populating the miscellaneous DWD stack.	01
02100100	A call to EXEC, ALLOCATE_MEM_ZEROED failed to return memory when creating the device services state table.	01
02170100	Unable to allocate memory for the Free Node Array.	01
02180100	Unable to allocate memory for the Free Buffer Descriptor Array.	01
021D0100	Unable to allocate memory for the Free Buffer Array.	01
021E0100	Unable to allocate memory for the Free Strip Node Array.	01
021F0100	Unable to allocate memory for WARPs and RMDs.	01
02210100	Invalid parameters in CACHE, OFFER_META call.	01
02220100	No buffer found for CACHE, MARK_META_DIRTY call.	01
02270104	A callback from DS on a transfer request has returned a bad or illegal DWD status. ☐ Last Failure Parameter[0] contains the DWD Status. ☐ Last Failure Parameter[1] contains the DWD address. ☐ Last Failure Parameter[2] contains the PUB Address. ☐ Last Failure Parameter[3] contains the Device port.	01
022C0100	A READ_LONG operation was requested for a Local Buffer Transfer. READ_LONG is not supported for Local Buffer Transfers.	01
022D0100	A WRITE_LONG operation was requested for a Local Buffer Transfer. WRTE_LONG is not supported for Local Buffer Transfers.	01
022E0102	An invalid mapping type was specified for a logical unit. ☐ Last Failure Parameter[0] contains the USB address. ☐ Last Failure Parameter[1] contains the Unit Mapping Type.	01

Last Fail Code	Explanation	Repair Action Code
02360101	Unrecognized state supplied to FOC, SEND callback routine va_dap_snd_cmd_complete. Last Failure Parameter[0] contains the unrecognized value.	01
02370102	Unsupported return from HIS, GET_CONN_INFO routine ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
02392084	A processor interrupt was generated by the controller's XOR engine (FX), with no bits set in the CSR to indicate a reason for the interrupt. ☐ Last Failure Parameter[0] contains the FX Control and Status Register (CSR). ☐ Last Failure Parameter[1] contains the FX DMA Indirect List Pointer register (DILP). ☐ Last Failure Parameter[2] contains the FX DMA Page Address register (DADDR). ☐ Last Failure Parameter[3] contains the FX DMA Command and control register (DCMD).	20
023A2084	A processor interrupt was generated by the controller's XOR engine (FX), indicating an unrecoverable error condition. ☐ Last Failure Parameter[0] contains the FX Control and Status Register (CSR). ☐ Last Failure Parameter[1] contains the FX DMA Indirect List Pointer register (DILP). ☐ Last Failure Parameter[2] contains the FX DMA Page Address register (DADDR). ☐ Last Failure Parameter[3] contains the FX DMA Command and control register (DCMD).	20
02440100	The logical unit mapping type was detected invalid in va_set_disk_geometry()	01
02530102	An invalid status was returned from CACHE, LOOKUP_LOCK(). ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
02560102	An invalid status was returned from CACHE, LOOKUP_LOCK(). ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01

Last Fail Code	Explanation	Repair Action Code
02570102	An invalid status was returned from VA_XFER() during a operation. ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
025A0102	An invalid status was returned from CACHE, LOOKUP_LOCK(). ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
025B0102	An invalid mapping type was specified for a logical unit. ☐ Last Failure Parameter[0] contains the USB address. ☐ Last Failure Parameter[1] contains the Unit Mapping Type.	01
025C0102	An invalid mapping type was specified for a logical unit. ☐ Last Failure Parameter[0] contains the USB address. ☐ Last Failure Parameter[1] contains the Unit Mapping Type.	01
02620102	An invalid status was returned from CACHE, LOOKUP_LOCK(). ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
02690102	An invalid status was returned from CACHE, OFFER_WRITE_DATA(). ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
02730100	A request was made to write a device metadata block with an invalid block type.	01
02790102	An invalid status was returned from VA_XFER() in a complex read operation. ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
027B0102	An invalid status was returned from VA_XFER() in a complex ACCESS operation. ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
027D0100	Unable to allocate memory for a Failover Control Block.	01
027E0100	Unable to allocate memory for a Failover Control Block.	01
027F0100	Unable to allocate memory for a Failover Control Block.	01

Last Fail Code	Explanation	Repair Action Code
02800100	Unable to allocate memory for a Failover Control Block.	01
02820100	Unable to allocate memory for the Dirty Count Array.	01
02830100	Unable to allocate memory for the Cache Buffer Index Array.	01
02840100	Unable to allocate memory for the XNode Array.	01
02850100	Cache was declared bad by the cache diagnostics after first Meg was tested. Can't recover and use local memory because cannot get those initial buffers back.	01
02860100	Unable to allocate memory for the Fault Management Event Information Packet used by the Cache Manager in generating error logs to the host.	01
02880100	Invalid FOC Message in cmfoc_snd_cmd.	01
02890100	Invalid FOC Message in cmfoc_rcv_cmd.	01
028A0100	Invalid return status from DIAG, CACHE_MEMORY_TEST.	01
028B0100	Invalid return status from DIAG, CACHE_MEMORY_TEST.	01
028C0100	Invalid error status given to cache_fail.	01
028E0100	Invalid DCA state detected in init_crashover.	01
028F0100	Invalid status returned from CACHE, CHECK_METADATA.	01
02900100	Unable to allocate memory for the First Cache Buffer Index Array.	01
02910100	Invalid metadata combination detected in build_raid_node.	01
02920100	Unable to handle that many bad dirty pages (exceeded MAX_BAD_DIRTY). Cache memory is bad.	01
02930100	There was no free or freeable buffer to convert bad metadata or to borrow a buffer during failover of bad dirty.	01
02940100	A free Device Correlation Array entry could not be found during write-back cache failover.	01
02950100	Invalid DCA state detected in start_crashover.	01
02960100	Invalid DCA state detected in start_failover.	01
02970100	Invalid DCA state detected in init_failover.	01
02980100	This bugcheck was created for testing purposes only, specifically testing write-back cache failover. It should not be seen in the field.	01
02990100	A free RAID Correlation Array entry could not be found during write-back cache failover.	01

Last Fail Code	Explanation	Repair Action Code
029A0100	Invalid cache buffer metadata detected while scanning the Buffer Metadata Array. Found a page containing dirty data but the corresponding Device Correlation Array entry does exist.	01
029D0100	Invalid metadata combination detected in build_bad_raid_node.	01
029E0100	Distinguished member is not null_pub. This last_fail code was removed from HSOF firmware at Version 2.5.	01
029F0100	The Cache Manager software has insufficient resources to handle a buffer request pending.	01
02A00100	VA change state is trying to change device affinity and the cache has data for this device.	01
02A10100	Pubs not one when transportable.	01
02A20100	Pubs not one when transportable.	01
02A30100	No available data buffers. If the cache module exists then this is true after testing the whole cache. Otherwise, there were no buffers allocated from BUFFER memory on the controller module.	01
02A40100	A call to EXEC, ALLOCATE_MEM_ZEROED failed to return memory when allocating VAXDs.	01
02A50100	A call to EXEC, ALLOCATE_MEM_ZEROED failed to return memory when allocating DILPs.	01
02A60100	A call to EXEC, ALLOCATE_MEM_ZEROED failed to return memory when allocating Change State Work Items.	01
02A70100	A call to EXEC, ALLOCATE_MEM_ZEROED failed to return memory when allocating VA Request Items.	01
02A80000	Controller is being rebooted as a result of a CLI CLEAR INVALID_CACHE command being issued on the other controller.	00
02A90100	Too many pending FOC, SEND requests by the Cache Manager. Code is not designed to handle more than one FOC, SEND to be pending because there's no reason to expect more than one pending.	01
02AA0100	An invalid call was made to CACHE, DEALLOCATE_CLD. Either that device had dirty data or it was bound to a RAIDset.	01
02AB0100	An invalid call was made to CACHE, DEALLOCATE_SLD. A RAIDset member either had dirty data or write-back already turned on.	01
02AC0100	An invalid call was made to CACHE, DEALLOCATE_SLD. The RAIDset still has data (strip nodes).	01
02AD0180	The FX detected a compare error for data that was identical. This error has always previously occurred due to a hardware problem.	01

Last Fail Code	Explanation	Repair Action Code
02AE0100	The mirrorset member count and individual member states are inconsistent. Discovered during a mirrorset write or erase.	01
02AF0102	An invalid status was returned from VA, XFER() in a write operation. ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
02B00102	An invalid status was returned from VA, XFER() in an erase operation. ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
02B10100	A mirrorset read operation was received and the round robin selection algorithm found no normal members in the mirrorset. Internal inconsistency.	01
02B20102	An invalid status was returned from CACHE, LOCK_READ during a mirror copy operation ☐ Last Failure Parameter[0] contains the DD address. ☐ Last Failure Parameter[1] contains the invalid status.	01
02B80100	Invalid Cache Policy parameter to CACHE, POLICY_CHANGE.	01
02B90100	Invalid code loop counter attempting to find the Cache ID Blocks.	01
02BC0100	A mirrorset read operation was received and the preferred member selection algorithm found no normal members in the mirrorset. Internal inconsistency.	01
02BD0100	A mirrorset metadata online operation found no normal members in the mirrorset. Internal inconsistency.	01
02BF0100	Report_error routine encountered an unexpected failure status returned from DIAG, LOCK_AND_TEST_CACHE_B.	01
02C00100	Copy_buff_on_this routine expected the given page to be marked bad and it wasn't.	01
02C10100	Copy_buff_on_other routine expected the given page to be marked bad and it wasn't.	01
02C60100	Mirroring transfer found CLD with writeback state OFF.	01
02C70100	Bad BBR offsets for active shadowset, detected on write.	01
02C80100	Bad BBR offsets for active shadowset, detected on read.	01
02C90100	Illegal call made to CACHE, PURGE_META when the storageset was not quiesced.	01

Last Fail Code	Explanation	Repair Action Code
02CA0100	Illegal call made to VA, RAID5_META_READ when another read (of metadata) is already in progress on the same strip.	01
02CB0000	A restore of the configuration has been done. This cleans up and restarts with the new configuration	00
02CC0100	On an attempt, which is not allowed to fail, to allocate a cache node, no freeable cache node was found.	01
02CD0100	On an attempt, which is not allowed to fail, to allocate a strip node, no freeable strip node was found.	01
02CE1010	Serial number mismatch was detected during an attempt to restore saved configuration information.	10
02CF0100	An unsupported message type or terminal request was received by the VA_SAVE_Config virtual terminal code from the CLI.	01
02D00100	Not all alter_device requests from VA_SAVE_CONFIG completed within the time-out interval.	01
02D10102	Failed to read or write metadata while UNMIRRORING a mirrorset to a disk unit.	01
02D30100	The controller has insufficient memory to allocate enough data structures used to manage metadata operations.	01
02D50100	No resources are available to handle a new metadata work request.	01
02D60100	An invalid storage set type was specified for metadata initialization.	01
02D72390	Forced failover of devices due to a cache battery failure. This was initiated because the dual partner was operational with a good battery and there is no host failover assistance.	23
02D80100	Unable to allocate memory for Fast Buffers. Code bug suspected rather than low buffer memory, because the code just checked for sufficient buffer memory.	01

Table 23
Device services last failure codes

Last Fail Code	Explanation	Repair Action Code
03010100	Failed request for port-specific scripts memory allocation.	01
03020101	Invalid SCSI direct-access device opcode in misc command DWD. Last Failure Parameter[0] contains the SCSI command opcode.	01

Last Fail Code	Explanation	Repair Action Code
03030101	Invalid SCSI sequential-access device opcode in misc cmd DWD. Last Failure Parameter[0] contains the SCSI command opcode.	01
03040101	Invalid SCSI CDROM device opcode in misc command DWD. Last Failure Parameter[0] contains the SCSI command opcode.	01
03050101	Invalid SCSI medium changer device opcode in misc command DWD. Last Failure Parameter[0] contains the SCSI command opcode.	01
03060101	Invalid SCSI device type in PUB. Last Failure Parameter[0] contains the SCSI device type.	01
03070101	Invalid CDB Group Code detected during create of misc cmd DWD Last Failure Parameter[0] contains the SCSI command opcode.	01
03080101	Invalid SCSI OPTICAL MEMORY device opcode in misc command DWD. Last Failure Parameter[0] contains the SCSI command opcode.	01
030A0100	Error DWD not found in port in_proc_q.	01
030B0188	A dip error was detected when pcb_busy was set. ☐ Last Failure Parameter[0] contains the PCB port_ptr value. ☐ Last Failure Parameter[1] contains the new info NULL - SSTAT0 - DSTAT - ISTAT. ☐ Last Failure Parameter[2] contains the PCB copy of the device port DBC register. ☐ Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. ☐ Last Failure Parameter[4] contains the PCB copy of the device port DSP register. ☐ Last Failure Parameter[5] contains the PCB copy of the device port DSPS register. ☐ Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. ☐ Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.	01

Last Fail Code	Explanation	Repair Action Code
03150100	More DBDs than allowed for in mask	01
031E0100	Can't find in_error dwd on in-process queue	01
031F0100	Either DWD_ptr is null or bad value in dsps	01
03280100	SCSI CDB contains an invalid group code for a transfer command	01
03290100	The required error information packet (EIP) or device work descriptor (DWD) were not supplied to the Device Services error logging code.	01
032A0100	HIS, GET_CONN_INFO() returned an unexpected completion code.	01
032B0100	A Device Work Descriptor (DWD) was supplied with a NULL Physical Unit Block (PUB) pointer	01
03320101	An invalid code was passed to the error recovery thread in the error_stat field of the PCB. Last Failure Parameter[0] contains the PCB error_stat code.	01
03330188	A parity error was detected by a device port while sending data out onto the SCSI bus. ☐ Last Failure Parameter[0] contains the PCB port_ptr value. ☐ Last Failure Parameter[1] contains the PCB copy of the device port TEMP register. ☐ Last Failure Parameter[2] contains the PCB copy of the device port DBC register. ☐ Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. ☐ Last Failure Parameter[4] contains the PCB copy of the device port DSP register. ☐ Last Failure Parameter[5] contains the PCB copy of the device port DSPS register. ☐ Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. ☐ Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.	01

Last Fail Code	Explanation	Repair Action Code
03350188	The TEA (bus fault) signal was asserted into a device port. ☐ Last Failure Parameter[0] contains the PCB port_ptr value. ☐ Last Failure Parameter[1] contains the PCB copy of the device port TEMP register. ☐ Last Failure Parameter[2] contains the PCB copy of the device port BC register. ☐ Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. ☐ Last Failure Parameter[4] contains the PCB copy of the device port DSP register. ☐ Last Failure Parameter[5] contains the PCB copy of the device port DSPS register. ☐ Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. ☐ Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.	01
03360188	A device port's host bus watchdog timer expired. ☐ Last Failure Parameter[0] contains the PCB port_ptr value. ☐ Last Failure Parameter[1] contains the PCB copy of the device port TEMP register. ☐ Last Failure Parameter[2] contains the PCB copy of the device port DBC register. ☐ Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. ☐ Last Failure Parameter[4] contains the PCB copy of the device port DSP register. ☐ Last Failure Parameter[5] contains the PCB copy of the device port DSPS register. ☐ Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. ☐ Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.	01

Last Fail Code	Explanation	Repair Action Code
03370108	A device port detected an illegal script instruction. ☐ Last Failure Parameter[0] contains the PCB port_ptr value. ☐ Last Failure Parameter[1] contains the PCB copy of the device port TEMP register. ☐ Last Failure Parameter[2] contains the PCB copy of the device port DBC register. ☐ Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. ☐ Last Failure Parameter[4] contains the PCB copy of the device port DSP register. ☐ Last Failure Parameter[5] contains the PCB copy of the device port DSPS register. ☐ Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. ☐ Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.	01
03380188	A device port's DSTAT register contains multiple asserted bits, or an invalidity asserted bit, or both. ☐ Last Failure Parameter[0] contains the PCB port_ptr value. ☐ Last Failure Parameter[1] contains the PCB copy of the device port TEMP register. ☐ Last Failure Parameter[2] contains the PCB copy of the device port DBC register. ☐ Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. ☐ Last Failure Parameter[4] contains the PCB copy of the device port DSP register. ☐ Last Failure Parameter[5] contains the PCB copy of the device port DSPS register. ☐ Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. ☐ Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.	01

Last Fail Code	Explanation	Repair Action Code
03390108	An unknown interrupt code was found in a device port's DSPS register. ☐ Last Failure Parameter[0] contains the PCB port_ptr value. ☐ Last Failure Parameter[1] contains the PCB copy of the device port TEMP register. ☐ Last Failure Parameter[2] contains the PCB copy of the device port DBC register. ☐ Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. ☐ Last Failure Parameter[4] contains the PCB copy of the device port DSP register. ☐ Last Failure Parameter[5] contains the PCB copy of the device port DSPS register. ☐ Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. ☐ Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.	01
033C0101	An invalid code was seen by the error recovery thread in the er_funct_step field of the PCB. Last Failure Parameter[0] contains the PCB er_funct_step code.	01

Last Fail Code	Explanation	Repair Action Code
033E0108	An attempt was made to restart a device port at the SDP DBD. ☐ Last Failure Parameter[0] contains the PCB port_ptr value. ☐ Last Failure Parameter[1] contains the PCB copy of the device port TEMP register. ☐ Last Failure Parameter[2] contains the PCB copy of the device port DBC register. ☐ Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. ☐ Last Failure Parameter[4] contains the PCB copy of the device port DSP register. ☐ Last Failure Parameter[5] contains the PCB copy of the device port DSPS register. ☐ Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. ☐ Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.	01
033F0108	An EDC error was detected on a read of a soft-sectored device-path not yet implemented. ☐ Last Failure Parameter[0] contains the PCB port_ptr value. ☐ Last Failure Parameter[1] contains the PCB copy of the device port TEMP register. ☐ Last Failure Parameter[2] contains the PCB copy of the device port DBC register. ☐ Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. ☐ Last Failure Parameter[4] contains the PCB copy of the device port DSP register. ☐ Last Failure Parameter[5] contains the PCB copy of the device port DSPS register. ☐ Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. ☐ Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.	01

Last Fail Code	Explanation	Repair Action Code
03410101	Invalid SCSI device type in PUB. Last Failure Parameter[0] contains the PUB SCSI device type.	01
03420188	A UDC interrupt could not be associated with either a DWD or the non-callable scripts. Last Failure Parameter[0] contains the PCB port_ptr value. ☐ Last Failure Parameter[1] contains the PCB copy of the device port TEMP register. ☐ Last Failure Parameter[2] contains the PCB copy of the device port DBC register. ☐ Last Failure Parameter[3] contains the PCB copy of the device port DNAD register. ☐ Last Failure Parameter[4] contains the PCB copy of the device port DSP register. ☐ Last Failure Parameter[5] contains the PCB copy of the device port DSPS register. ☐ Last Failure Parameter[6] contains the PCB copies of the device port SSTAT2/SSTAT1/SSTAT0/DSTAT registers. ☐ Last Failure Parameter[7] contains the PCB copies of the device port LCRC/RESERVED/ISTAT/DFIFO registers.	01
03470100	Insufficient memory available for target block allocation.	01
03480100	Insufficient memory available for device port info block allocation.	01
03490100	Insufficient memory available for autoconfig buffer allocation.	01
034A0100	Insufficient memory available for PUB allocation.	01
034B0100	Insufficient memory available for DS init buffer allocation.	01
034C0100	Insufficient memory available for static structure allocation.	01
034D0100	DS init DWDs exhausted.	01
034E2080	Diagnostics report all device ports are broken.	20
03500100	Insufficient memory available for command disk allocation.	01
03510100	Insufficient resources available for command disk data region.	01
03520100	A failure resulted when an attempt was made to allocate a DWD for use by DS CDI.	01
035A0100	Invalid SCSI message byte passed to DS.	01

Last Fail Code	Explanation	Repair Action Code
035B0100	Insufficient DWD resources available for SCSI message pass-through.	01
03640100	Processing run_switch disabled for LOGDISK associated with the other controller.	01
03650100	Processing pub unblock for LOGDISK associated with the other controller	01
03660100	No memory available to allocate pub to tell the other controller of reset to one if its LUNs.	01
03670100	No memory available to allocate pub to tell the other controller of a bdr to one if its LUNs.	01

Table 24
Fault manager last failure codes

Last Fail Code	Explanation	Repair Action Code
04010101	The requester id component of the instance, code passed to FM, REPORT_EVENT is larger than the maximum allowed for this environment. Last Failure Parameter[0] contains the instance, code value.	01
04020102	The requester's error table index passed to FM, REPORT_EVENT is larger than the maximum allowed for this requester. ☐ Last Failure Parameter[0] contains the instance, code value. ☐ Last Failure Parameter[1] contains the requester error table index value.	01
04030102	The USB index supplied in the EIP is larger than the maximum number of USBs. ☐ Last Failure Parameter[0] contains the instance, code value. ☐ Last Failure Parameter[1] contains the USB index value.	01
04040103	The event log format found in V_fm_template_table is not supported by the Fault Manager. The bad format was discovered while trying to fill in a supplied eip. ☐ Last Failure Parameter[0] contains the instance, code value. ☐ Last Failure Parameter[1] contains the format code value. ☐ Last Failure Parameter[2] contains the requester error table index value.	01

Last Fail Code	Explanation	Repair Action Code
04050100	The Fault Manager could not allocate memory for his Event Information Packet (EIP) buffers.	01
04060100	The Fault Manager could not allocate a Datagram HTB in his initialization routine.	01
04070103	There is more EIP information than will fit into a datagram. The requester specific size is probably too large. ☐ Last Failure Parameter[0] contains the instance, code value. ☐ Last Failure Parameter[1] contains the format code value. ☐ Last Failure Parameter[2] contains the requester error table index value.	01
04080102	The event log format found in the already built eip is not supported by the Fault Manager. The bad format was discovered while trying to copy the eip information into a datagram HTB. ☐ Last Failure Parameter[0] contains the format code value. ☐ Last Failure Parameter[1] contains the instance, code value.	01
04090100	The caller of FM, CANCEL_EVENT_NOTIFICATION passed an address of an event notification routine which does not match the address of any routines for which event notification is enabled.	01
040A0100	The caller of FM, CANCEL_SCSI_DE_NOTIFICATION passed an address of a deferred error notification routine which doesn't match the address of any routines for which deferred error notification is enabled.	01
040B0100	An error which is not related to an I/O request(htb_ptr) has an unsupported template type.	01
040D0100	FM, ENABLE_EVENT_NOTIFICATION was called to enable eip notification but the specified routine was already enabled to receive eip notification.	01
040E0100	FM, ENABLE_DE_NOTIFICATION was called to enable deferred error notification but the specified routine was already enabled to receive deferred error notification.	01
040F0102	The eip->generic.mscp1.flgs field of the EIP passed to FM, REPORT_EVENT contains an invalid flag. ☐ Last Failure Parameter[0] contains the instance, code value. ☐ Last Failure Parameter[1] contains the value supplied in the eip->generic.mscp1.flgs field.	01

Last Fail Code	Explanation	Repair Action Code
04100101	Unexpected template type found during fmu_display_errlog processing. Last Failure Parameter[0] contains the unexpected template value.	01
04110101	Unexpected instance, code found during fmu_memerr_report processing. Last Failure Parameter[0] contains the unexpected instance, code value.	01
04120101	CLIB, SDD_FAO call failed. Last Failure Parameter[0] contains the failure status code value.	01
04130103	The event log format found in the eip is not supported by the Fault Manager. The bad format was discovered while trying to fill in the DLI of the supplied eip. ☐ Last Failure Parameters[0] contains the instance, code value ☐ Last Failure Parameters[1] contains the format code value. ☐ Last Failure Parameters[2] contains the requester error table index value.	01
04140103	The template value found in the eip is not supported by the Fault Manager. The bad template value was discovered while trying to build an esd. ☐ Last Failure Parameters[0] contains the instance, code value ☐ Last Failure Parameters[1] contains the template code value. ☐ Last Failure Parameters[2] contains the requester error table index value.	01

Table 25
Common library last failure codes

Last Fail Code	Explanation	Repair Action Code
05010100	In recursive_nonconflict could not get enough memory for scanning the keyword tables for configuration name conflicts.	01
05030100	In clib, scan_for_nonconflict could not get enough memory for scanning the keyword tables for configuration name conflicts.	01

Table 26
DUART services last failure codes

Last Fail Code	Explanation	Repair Action Code
06010100	The DUART was unable to allocate enough memory to establish a connection to the CLI.	01
06020100	A port other than terminal port A was referred to by a set terminal characteristics command. This is illegal.	01
06030100	A DUP question or default question message type was passed to the DUART driver, but the pointer to the input area to receive the response to the question was NULL.	01
06040100	Attempted to detach unattached maintenance terminal.	01
06050100	Attempted output to unattached maintenance terminal.	01
06060100	Attempted input from output only maintenance terminal service.	01
06070100	The DUART was unable to allocate enough memory for its input buffers.	01
06080000	Controller was forced to restart due to entry of a CONTROL-K character on the maintenance terminal.	00

Table 27
Failover control last failure codes

Last Fail Code	Explanation	Repair Action Code
07010100	All available slots in the FOC notify table are filled	01
07020100	FOC, CANCEL_NOTIFY() was called to disable notification for a rtn that did not have notification enabled	01
07030100	Unable to start the Failover Control Timer before main loop	01
07040100	Unable to restart the Failover Control Timer	01
07050100	Unable to allocate flush buffer	01
07060100	Unable to allocate active receive fcb	01
07070100	The other controller killed this controller, but could not assert the kill line because nindy was on or in debug. It killed this controller now.	01
07080000	The other controller crashed, so this one must crash too.	00

Table 28
Nonvolatile parameter memory failover control last failure codes

Last Fail Code	Explanation	Repair Action Code
08010101	A remote state change was received from the FOC thread that NVFOC does not recognize. Last Failure Parameter[0] contains the unrecognized state value.	01
08020100	No memory could be allocated for a NVFOC information packet.	01
08030101	Work received on the S_nvfoc_bque did not have a NVFOC work id. Last Failure Parameter[0] contains the id type value that was received on the NVFOC work queue.	01
08040101	Unknown work value received by the S_nvfoc_bque. Last Failure Parameter[0] contains the unknown work value.	01
08050100	An unlock was received and the controller was not locked by the other controller. This last_failure code was removed from HSOF firmware at Version 2.7.	01
08060100	A really write command was received when the NV memory was not locked.	01
08070100	A write to NV memory was received while not locked.	01
08080000	The other controller requested this controller to restart.	00
08090010	The other controller requested this controller to shutdown.	00
080A0000	The other controller requested this controller to selftest.	00
080B0100	Could not get enough memory to build a FCB to send to the remote routines on the other controller.	01
080C0100	Could not get enough memory for FCBs to receive information from the other controller.	01
080D0100	Could not get enough memory to build a FCB to reply to a request from the other controller.	01
080E0101	An out-of-range receiver ID was received by the NVFOC communication utility (master send to slave send ACK). Last Failure Parameter[0] contains the bad id value.	01
080F0101	An out-of-range receiver ID was received by the NVFOC communication utility (received by master). Last Failure Parameter[0] contains the bad id value.	01
08100101	A call to NVFOC, TRANSACTION had a from field (id) that was out of range for the NVFOC communication utility. Last Failure Parameter[0] contains the bad id value.	01

08110101	NVFOC tried to defer more than one FOC send. Last Failure Parameter[0] contains the master ID of the connection that had the multiple delays.	01
08120100	Unable to lock other controller's NVmemory despite the fact that the running and handshake_complete flags are set.	01
08130100	Could not allocate memory to build a callback context block on an unlock NVmemory call.	01
08140100	Could not allocate memory to build a workblock to queue to the NVFOC thread.	01
08150100	A lock was requested by the other controller but the memory is already locked by the other controller.	01
08160100	A request to clear the remote configuration was received but the memory was not locked.	01
08170100	A request to read the next configuration was received but the memory was not locked.	01
08180100	Could not get enough memory for FLS FCBs to receive information from the other controller.	01
08190100	An unlock command was received when the NV memory was not locked. Removed from HSOF firmware at Version 2.7.	01
081A0100	Unable to allocate memory for remote work.	01
081B0101	Bad remote work received on remote work queue. Last Failure Parameter[0] contains the id type value that was received on the NVFOC remote work queue.	01
081C0101	Bad member management work received. Last Failure Parameter[0] contains the bad member management value that was detected.	01
081F0000	An FLM, INSUFFICIENT_RESOURCES error was returned from a FLM lock or unlock call.	01
08200000	Expected restart so the write_instance, may recover from a configuration mismatch.	01
08210100	Unable to allocate memory to setup NVFOC lock/unlock notification routines.	01

Table 29
Facility lock manager last failure codes

Last Fail Code	Explanation	Repair Action Code
09010100	Unable to acquire memory to initialize the FLM structures.	01
09640101	Work that was not FLM work was found on the FLM queue. Bad format is detected or the formatted string overflows the output buffer. Last Failure Parameter[0] contains the work found.	01
09650101	Work that was not FLM work was found on the FLM queue. Last Failure Parameter[0] contains the structure found.	01

Last Fail Code	Explanation	Repair Action Code
09670101	Local FLM detected an invalid facility to act upon. Last Failure Parameter[0] contains the facility found.	01
09680101	Remote FLM detected an error and requested the local controller to restart. Last Failure Parameter[0] contains the reason for the request.	01
09C80101	Remote FLM detected an invalid facility to act upon. Last Failure Parameter[0] contains the facility found.	01
09C90101	Remote FLM detected an invalid work type. Last Failure Parameter[0] contains the work type found.	01
09CA0101	Remote FLM detected an invalid work type. Last Failure Parameter[0] contains the work type found.	01
09CB0012	Remote FLM detected that the other controller has a facility lock manager at an incompatible revision level with this controller. Last Failure Parameter[0] contains this controller's FLM revision. Last Failure Parameter[1] contains the other controller's FLM revision.	01

Table 30
Integrated logging facility last failure codes

Last Fail Code	Explanation	Repair Action Code
0A010100	CACHE, FIND_LOG_BUFFERS returned continuation handle >0.	01
0A020100	ILF, CACHE_READY unable to allocate necessary DWDs.	01
0A030100	ILF, CACHE_READY buffers_obtained > non-zero stack entry count.	01
0A040100	ILF, CACHE_READY DWD overrun.	01
0A050100	IFL, CACHE_READY DWD underrun.	01

Table 31
CLI last failure codes

Last Fail Code	Explanation	Repair Action Code
20010100	The action for work on the CLI queue should be CLI_CONNECT, CLI_COMMAND_IN or CLI_PROMPT. If it isn't one of these three, this bugcheck will result.	01
20020100	The FAO returned a non-successful response. This will only happen if a bad format is detected or the formatted string overflows the output buffer.	01
20030100	The type of work received on the CLI work queue wasn't of type CLI.	01
20060100	A work item of an unknown type was placed on the CLI's SCSI Virtual Terminal thread's work queue by the CLI.	01

Last Fail Code	Explanation	Repair Action Code
20070100	A work item of an unknown type was placed on the CLI's DUP Virtual Terminal thread's work queue by the CLI.	01
20080000	This controller requested this controller to restart.	00
20090010	This controller requested this controller to shutdown.	00
200A0000	This controller requested this controller to selftest.	00
200B0100	Could not get enough memory for FCBs to receive information from the other controller.	01
200C0100	After a CLI command the NV memory was still locked. The CLI should always unlock NV memory when the command is complete (if it had an error or not). Removed from HSOF firmware at Version 2.7.	01
200D0101	After many calls to DS, PORT_BLOCKED, we never got a FALSE status back (which signals that nothing is blocked). Last Failure Parameter[0] contains the port number (1 - n) that we were waiting on to be unblocked.	01
200E0101	While traversing the structure of a unit, a config_info node was discovered with an unrecognized structure type. Last Failure Parameter[0] contains the structure type number that was unrecognized.	01
200F0101	A config_info node was discovered with an unrecognized structure type. Last Failure Parameter[0] contains the structure type number that was unrecognized.	01
20100101	A config_node of type VA_MA_DEVICE had an unrecognized SCSI device type. Last Failure Parameter[0] contains the SCSI device type number that was unrecognized.	01
20110100	An attempt to allocate memory so the CLI prompt messages could be deleted failed.	01
20120101	While traversing the structure of a unit, a config_info node was discovered with an unrecognized structure type. Last Failure Parameter[0] contains the structure type number that was unrecognized.	01
20130101	While traversing the structure of a unit, the device was of a unrecognized type. Last Failure Parameter[0] contains the SCSI device type that was unrecognized.	01
20150100	On SCSI failover, both controllers must be restarted for failover to take effect. This is how this controller is restarted in COPY=OTHER.	01

Last Fail Code	Explanation	Repair Action Code
20160100	Unable to allocate resources needed for the CLI local program.	01
20180010	User requested this controller's parameters to be set to initial configuration state.	00
20190010	A cache state of a unit remains WRITE_CACHE_UNWRITTEN_DATA. The unit is not ONLINE, thus this state would only be valid for a very short period of time.	00
201A0100	An attempt to allocate memory so a CLI prompt message could be reformatted has failed.	01
201B0100	Insufficient resources to get memory to lock CLI.	01
201C0100	Insufficient resources to get memory to unlock CLI.	01
20640000	Nindy was turned on.	00
20650000	Nindy was turned off.	00
20692010	To enter dual-redundant mode both controllers must be of the same type.	20
206A0000	Controller restart forced by DEBUG CRASH REBOOT command.	01
206B0010	Controller restart forced by DEBUG CRASH NOREBOOT command.	01

Table 32
Host interconnect services last failure codes

Last Fail Code	Explanation	Repair Action Code
40000101	HSJ3x/4x: An unrecognized DSSI opcode was received by HIS. These packets are packets with CI opcodes recognized by the port but not by HIS. Last Failure Parameter[0] contains the CI opcode value. HSD3x/4x/HS1CP: An unrecognized DSSI opcode was received by HIS. These packets are packets with DSSI opcodes recognized by the port but not by HIS. Last Failure Parameter[0] contains the DSSI opcode value.	01
4007640A	HSD3x/4x/HS1CP: DSSI Port detected error upon attempting to transmit a packet. This resulted in the closure of the Virtual Circuit.	64
40150100	LOCAL VC Timer in unexpected state.	01
40280100	Failed to allocate Buffer Name Table.	01
40290100	Failed to allocate ACB.	01
402A0100	Failed to allocate ID member template.	01
402B0100	Failed to allocate DG HTBs.	01
402C0100	Failed to allocate message HTBs.	01

Last Fail Code	Explanation	Repair Action Code
402D0101	S_max_node greater than MAX_VC_ENTRIES. Last Failure Parameter[0] contains the S_ci_max_nodes value.	01
402E0101	S_max_node not set to valid value (8, 16, 32, 64, 128, 256). Last Failure Parameter[0] contains the S_ci_max_nodes value.	01
402F0100	Failure to allocate a HIS EIP structure.	01
40300100	Failure in memory allocation.	01
40510100	htb_id type not DG, when attempting to deallocate DG HTB.	01
40520100	htb_id type not RCV_SND, when attempting to dealloc recv queue HTB.	01
40530100	htb_id type not RCV_SND, when attempting to dealloc SCS queue HTB.	01
40560100	Failed to find a vc entry for ccb during his_close_connection routine.	01
407B0100	SCS command timeout unexpectedly inactive during SCS Accept Request.	01
407C0100	SCS command timeout unexpectedly inactive during SCS Reject Request.	01
408E0100	Message receive queue count disagrees with # HTBs on the queue.	01
408F0100	Unrecognized HTB id type.	01
40900100	htb_id type not DG, when attempting to xmit DG HTB.	01
40930100	Message receive queue count disagrees with # HTBs on the queue.	01
40950100	Create xfer request with 0-byte count	01
40960100	Create xfer request with 0-byte count	01
40970100	Create xfer request with 0-byte count	01
40980100	Create xfer request with 0-byte count	01
409D0100	Illegal return value from HIS, MAP.	01
40B40101	Invalid value in max_nodes field of se_params structure. Last Failure Parameter[0] contains the max_nodes field value.	01

Table 33
SCSI host interconnect services last failure codes

Last Failure Code	Explanation	Repair Action Code
41000100	Encountered an unexpected structure type on S_shis_ctl.scsi_q.	01
41020100	Unable to allocate the necessary number of HTBS in shis_init().	01
41030100	Unable to allocate the necessary number of large Sense Data buckets in shis_init().	01
41060100	Unable to locate the IDENTIFY msg in HTB.	01
41070100	Encountered an unknown MESSAGE OUT message.	01
41080100	Encountered an unknown MESSAGE OUT message.	01
41090100	Encountered an unknown structure on the host port queue. During SCSI ABORT message.	01
410A0100	Encountered an unknown structure on the host port queue. During SCSI ABORT TAG message.	01
410B0100	Encountered an unknown structure on the host port queue. During SCSI CLEAR QUEUE message.	01
410E0100	Encountered an unrecognized queue tag message.	01
41100100	Encountered a NULL completion routine pointer in a DD.	01
41130100	Could not allocate a large sense bucket.	01
41160100	A sense data bucket of unknown type (neither LARGE or SMALL) was passed to deallocate_SDB().	01
41170100	Call to VA, ENABLE_NOTIFICATION() failed due to INSUFFICIENT_RESOURCES.	01
41180100	Encountered a NULL completion routine pointer in a Work q entry.	01

Table 34
Host interconnect port services last failure codes

Last Fail Code	Explanation	Repair Action Code
42000100	Cmpl_main routine found invalid port xmt status.	01
42020100	Cannot start timer.	01
42030100	Cannot restart work timer.	01
42040100	Host port buffer allocation macro found an error allocating free buffers. The free buffer was NULLPTR. , DEBUG conditional.	01
42060100	HP_INIT could not allocate initial buffers.	01
420B0100	HP_INIT could not allocate initial buffs for Path A dl_ctl table.	01
420C0100	HP_INIT could not allocate initial htb for Path A.	01

Last Fail Code	Explanation	Repair Action Code
420D0100	HP_INIT could not allocate HPHW structure.	01
42120100	Host port polling HTB failed to complete in time. This last_failure code was removed from HSOF firmware at Version 2.7.	01
42126500	Host port polling HTB failed to complete in time.	65
42130100	Host port detected a inconsistency in the HW transmit status.	01
42316601	Host port found that the controller has exceeded the maximum number of user specified host VCS. Last Failure Parameter[0] is a 32-bit MASK of OPEN VCS the controller sees to host nodes.	66
42332080	Receive_main found destination address in the rcv packet does not match node address.	20
42340100	HP could not allocate buffers for I/O rundown in VC Close.	01
42350100	HP found a negative offset in a Host Data transfer Operation.	01
42382080	Ci_isr found that the yaci hardware had invalid xmt status on Path A, no bits set.	20
42392080	Ci_isr found that the yaci hardware had invalid xmt status on Path B, no bits set.	20
423A2080	CI_ISR found the abort bit set with out any valid reason. Path A.	20
423B2080	CI_ISR found transmit parity error without abort bit set. Path A.	20
423C2080	CI_ISR found buffer underflow without abort bit set. Path A.	20
423D2080	CI_ISR found the abort bit set with out any valid reason. Path B.	20
423E2080	CI_ISR found transmit parity error without abort bit set. Path B.	20
423F2080	CI_ISR found buffer underflow without abort bit set. Path B.	20
42442080	Ci_isr found that yaci hardware had a parity error.	20
42452080	Ci_isr found that yaci hardware had a bus timeout error.	20
42472080	Ci_isr found Data parity on Transmit Path A.	20
42482080	Ci_isr found Data parity on Transmit Path B.	20
424B0001	Ci_isr found Host Reset on Path A. Last Failure Parameter[0] contains the node number of the resetting node.	00

Last Fail Code	Explanation	Repair Action Code
424C0001	Ci_isr found Host Reset on Path B. Last Failure Parameter[0] contains the node number of the resetting node.	00
424D2080	Ci_isr found Fetch parity on Transmit Path A.	20
424E2080	Ci_isr found Fetch parity on Transmit Path B.	20
424F0100	HP could not allocate buffers to repopulate dds when we close path.	01
42506700	CI Host port detected an arbitration timeout on path A. Persistent Hardware faults generating an arbitration timeout will cause the controller to repeatedly reboot.	67
42516700	CI Host port detected an arbitration timeout on path b. Persistent Hardware faults generating an arbitration timeout will cause the controller to repeatedly reboot.	67
42590001	Ci_isr found Host Reset on Path A. Last Failure Parameter[0] contains the node number of the resetting node.	00
425A0001	Ci_isr found Host Reset on Path B. Last Failure Parameter[0] contains the node number of the resetting node.	00
425B2080	CI_ISR found the abort bit set with out any valid reason. Path A.	20
425C2080	CI_ISR found transmit parity error without abort bit set. Path A.	20
425D2080	CI_ISR found buffer underflow without abort bit set. Path A.	20
425E2080	Ci_isr found that the yaci hardware had invalid xmt status on path a, no bits set.	20
425F2080	CI_ISR found the abort bit set with out any valid reason. Path B.	20
42602080	CI_ISR found transmit parity error without abort bit set. Path B.	20
42612080	CI_ISR found buffer underflow without abort bit set. Path B.	20
42622080	Ci_isr found that the yaci hardware had invalid xmt status on Path B, no bits set.	20
42632080	Receive_main found destination address in the rcv packet does not match node address.	20
42640100	Scan packet que found bad path select case for DSSI	01

Last Fail Code	Explanation	Repair Action Code
42680102	Dssi_wait_isr routine found that 720 report unexpected interrupt status for target mode. ☐ Last Fail Parameter[0] contains the 720 chip sist0 register value. ☐ Last Failure Parameter[1] contains the 720 chip sist1 register value.	01
42690101	Dssi_wait_isr routine found that the 720 script reported an invalid rcv status. Last Failure Parameter[0] contains the receive interrupt status N720)_dsps value.	01
426B0101	Dssi_wait_isr routine found that 720 interrupted without status. Last Failure Parameter[0] contains the 720 chip istat register value.	01
42752002	Dssi_wait_isr routine found that 720 reported a bus error on the controller's internal bus. ☐ Last Failure Parameter[0] contains the 720 chip dstat register value. ☐ Last Failure Parameter[1] contains the 720 chip dcmd register value.	20
42760102	Dssi_wait_isr routine found that 720 reported an unexpected status for initiator mode. ☐ Last Failure Parameter[0] contains the 720 chip dstat register value. ☐ Last Failure Parameter[1] contains the 720 chip dcmd register value.	01
42770102	Dssi_wait_isr routine found that 720 reported an unexpected status for initiator mode. ☐ Last Failure Parameter[0] contains the 720 chip dstat register value. ☐ Last Failure Parameter[1] contains the 720 chip dcmd register value.	01
42790103	Dssi_wait_isr routine found that 720 reported an unexpected status in initiator mode causes stacked interrupters too many. ☐ Last Failure Parameter[0] contains the 720 chip dstat register value. ☐ Last Failure Parameter[1] contains the 720 chip dcmd register value.	01

Last Fail Code	Explanation	Repair Action Code
427A6601	Host port found that the controller has exceeded the maximum number of user specified host VCs Last Failure Parameter[0] is a 32-bit MASK of OPEN VCs the controller sees to host nodes.	66

Table 35
Disk and tape MSCP server last failure codes

Last Fail Code	Explanation	Repair Action Code
60030100	Unable to fine free DCD_CMDCORL_BLOCK.	01
60050100	Invalid return value from routine HIS, CONNECT, while DCD attempting to establish connection to a remote subsystem.	01
60070100	Invalid return value from routine HIS, MAP, while dmscp_dcd_allocate_bh attempting to map a buffer.	01
60090100	Invalid return value from routine HIS, DISCONNECT, while dmscp_dcd_comm_path_event attempting to disconnect a remote source connection.	01
600C0100	Invalid return value from routine RESMGR, ALLOCATE_DATA_SEGMENT.	01
600D0100	Opcode field in command being aborted is not valid.	01
60120100	Opcode of TMSCP command to be aborted is invalid.	01
60130100	tmscp_clear_sex_cdl_cmpl_rtn detected an unexpected opcode.	01
60140100	tmscp_clear_sex_cdl_cmpl_rtn detected an unexpected opcode.	01
60150100	VA, CHANGE_STATE failed to change the SW Write protect when requested to do so as part of the Disk Set Unit Characteristics command.	01
60160100	VA, CHANGE_STATE failed to change the SW Write protect when requested to do so as part of the Tape Set Unit Characteristics command.	01
60170100	Invalid type in entry of long interval work queue.	01
60180100	mscp_short_interval found an invalid type in entry of long interval work queue.	01
60190100	dmscp_dcd_send_cmd found that the SIWI Work Item code supplied is unrecognized or invalid in this context during DCD inhibited processing.	01
601B0100	Invalid EVENT_CODE parameter in call to dmscp_connection_event.	01
601C0100	Invalid EVENT_CODE parameter in call to tmscp_connection_event.	01

Last Fail Code	Explanation	Repair Action Code
601D0100	Invalid EVENT_CODE parameter in call to dmscp_dcd_comm_path_event.	01
601E0100	Invalid EVENT_CODE parameter in call to dmscp_dcd_comm_path_event.	01
60250100	An attempt was about to be made to return a progress indicator to the host that was 0xFFFFFFFF, the only invalid value.	01
60260100	An WH_DAF command was requested to be performed by the wrong process.	01
60270100	A nonimmediate WHM operation was passed to the dmscp_exec_whm_immediate routine.	01
60280100	This routine found an invalid xfer_state so cannot continue.	01
60290100	HIS did not allocate an HTB when there should have been one reserved for this connection as determined by mscp_rcv_listen.	01
602A0100	HIS did not allocate an HTB when there should have been one reserved for this connection as determined by dmscp_dcd_src_gcs_send.	01
602B0100	HIS did not allocate an HTB when there should have been one reserved for this connection as determined by dmscp_dcd_comm_path_event.	01
602C0100	When trying to put THE extra send-HTB on the connections send_htb_list there was already one on the queue.	01
602D0100	The VA, CHANGE_STATE service did not set the Software write protect as requested (for disk).	01
602E0100	The VA, CHANGE_STATE service did not set the Software write protect as requested (for tape).	01
603B0100	Initial HIS, LISTEN call for MSCP, DISK was unsuccessful.	01
603C0100	Initial HIS, LISTEN call for MSCP, TAPE was unsuccessful.	01
60400100	Unrecognized or invalid in this context return value from routine RESMGR, ALLOCATE_DATA_SEGMENT, while dmscp_dcd_allocate_dseg attempting to allocate a data segment.	01
60410100	Unrecognized or invalid in this context return value from routine RESMGR, ALLOCATE_DATA_BUFFERS, while dmscp_dcd_allocate_dbuf attempting to allocate a data buffer.	01
60420100	dmscp_dcd_rmte_end_msg was unable to find a command message that corresponds to end message it is currently processing.	01

Last Fail Code	Explanation	Repair Action Code
60440100	dmscp_dcd_src_gcs_cmpl found the command being GCSed is no longer at the head of the remote connection's queue.	01
60450100	dmscp_dcd_errlog_rvc found that an error log is not associated with a command, internal miscellaneous error logs are assumed to not be associated with a connection and remote miscellaneous error logs generation was not requested.	01
60460100	dmscp_dcd_elrt_scc_send was entered to issue a remote source connection SCC but was unable to find an available HTB on the connection's htb_list. With no active DCDs the connection should always have HTBs available.	01
60480100	tmscp_suc_avl_cmpl_rtn found the unit not in the available state.	01
60490100	tmscp_clear_sex_cdl_cmpl_rtn found the state change failed.	01
604A0100	tmscp_clear_sex_cdl_cmpl_rtn found the state change failed.	01
604B0100	Subroutine process_event returned a value to dmscp_dcd_comm_path_event that indicates that an internal disconnect request occurred while processing an immediate communications event.	01
604D0100	Subroutine process_event returned a value to dmscp_dcd_comm_path_event that indicates that a connection established event occurred while no DCD commands were active.	01
604F0100	tmscp_set_sex_cmpl_rtn found the state change failed.	01
60500100	dmscp_dcd_op_cmpl found an unrecognized P_STS value in a DCD HTB status field.	01
60550100	mscp_initialize unable to get LOCAL STATIC memory from exec for use as a local connection ITB.	01
60560100	mscp_initialize unable to get LOCAL STATIC memory from exec for use as an AVAILABLE ITB.	01
60570100	mscp_initialize unable to get LOCAL STATIC memory from exec for use as an AVAILABLE state change ITB.	01
60580100	mscp_initialize unable to get LOCAL STATIC memory from exec for use as a state change ITB.	01
605D0100	tmscp_onl_cleanup_rtn detected a failure in enabling variable speed mode suppression.	01
605E0100	tmscp_suc_cmpl_rtn detected a failure in enabling variable speed mode suppression.	01
605F0100	tmscp_suc_cmpl_rtn detected a failure in enabling variable speed mode suppression.	01

Last Fail Code	Explanation	Repair Action Code
60610100	mscp_initialize unable to get BUFFER STATIC memory from exec for use as Write History Logs.	01
60620100	mscp_initialize unable to get LOCAL STATIC memory from exec for use as Write History Log Allocation Failure Lists.	01
60640100	Invalid condition when there exists no unused Write History Log Entries.	01
60650100	Attempting to block incoming requests for the tape/loader when it was unexpectedly found already blocked.	01
60660100	Loader boundary block request to stall incoming requests to the tape/loader unit was not setup as expected.	01
60670100	The controller has insufficient memory available for allocating context blocks needed for Disk_Copy_Data commands.	01
60680100	VA, ENABLE_NOTIFICATION failed with insufficient resources at init time.	01
606B0100	mscp_foc_receive_cmd detected that the message sent from the other controller had an illegal usb index.	01
606C0100	mscp_foc_receive_cmd detected that the message sent from the other controller had an illegal exclusive access state.	01
606D0100	FOC provided mscp_foc_send_cmpl_rtn with an invalid status for the FOC, SEND transmit command completion.	01
606E0100	FOC provided mscp_foc_send_rsp_done with an invalid transmit status for the FOC, SEND transmit response completion.	01

Table 36
Diagnostics and utilities protocol server last failure codes

Last Fail Code	Explanation	Repair Action Code
61010000	Controller crash was intentionally caused by the execution of the CRASH program. This bugcheck does not indicate the occurrence of a controller failure. Removed from HSOF firmware at Version 2.7	00
61020100	HIS, LISTEN call failed with INSUFFICIENT_RESOURCES.	01
61090100	LISTEN_CONNECTION_ESTABLISHED event from HIS specified a connection ID for a connection we already know about.	01
610B0100	Code Load or Code Patch utility in CLCP local program forced controller restart to force new code or patch to take effect. This last_failure code was removed from HSOF firmware at Version 2.7	01
610C0100	HIS has reported a connection event that should not be possible.	01

Table 37

System communication services directory last failure code

Last Fail Code	Explanation	Repair Action Code
62000100	HIS, LISTEN call failed with INSUFFICIENT_RESOURCES.	01
62020100	Failure to allocate associated timer queue.	01
62030100	Failure to allocate connection id timers.	01

Table 38

SCSI host value-added services last failure codes

Last Fail Code	Explanation	Repair Action Code
64000100	Insufficient buffer memory to allocate data structures needed to propagate SCSI Mode Select changes to other controller.	01
64010100	During initialization of LUN specific mode pages, an unexpected device type was encountered.	01

Table 39
Disk inline exerciser (DILX) last failure codes

Last Fail Code	Explanation	Repair Action Code
80010100	An HTB was not available to issue an I/O when it should have been	01
80020100	A unit could not be dropped from testing because an available cmd failed.	01
80030100	DILX tried to release a facility that wasn't reserved by DILX	01
80040100	DILX tried to change the unit state from MAINTENANCE_MODE to NORMAL but was rejected because of insufficient resources	01
80050100	DILX tried to change the usb unit state from MAINTENANCE_MODE to NORMAL but DILX never received notification of a successful state change	01
80060100	DILX tried to switch the unit state from MAINTENANCE_MODE to NORMAL but was not successful	01
80070100	DILX aborted all cmds via va_d_abort() but the HTBS haven't been returned	01
80080100	While DILX was deallocating his eip buffers, at least one could not be found.	01
80090100	DILX received an end msg which corresponds to an op code not supported by DILX	01
800A0100	DILX was not able to restart his timer	01
800B0100	DILX tried to issue an I/O for an opcode not supported	01

Last Fail Code	Explanation	Repair Action Code
800C0100	DILX tried to issue a oneshot I/O for an opcode not supported	01
800D0100	A DILX device control block contains an unsupported unit_state	01
800E0100	While trying to print an Event Information Packet, DILX discovered an unsupported MSCP error log format.	01
800F0100	A DILX cmd completed with a sense key that DILX does not support	01
80100100	DILX could not compare buffers because no memory was available from EXEC, ALLOCATE_MEM_ZEROED	01
80110100	While DILX was deallocating his deferred error buffers, at least one could not be found	01
80120100	DILX expected an eip to be on the receive eip q but no eips were there.	01
80130100	DILX was asked to fill a data buffer with an unsupported data pattern.	01
80140100	DILX could not process an unsupported answer in dx, reuse_params().	01
80150100	A deferred error was received with an unsupported template.	01

Table 40
Tape inline exerciser (TILX) last failure codes

Last Fail Code	Explanation	Repair Action Code
81010100	An HTB was not available to issue an I/O when it should have been	01
81020100	A unit could not be dropped from testing because an available cmd failed	01
81030100	TILX tried to release a facility that wasn't reserved by TILX	01
81040100	TILX tried to change the unit state from MAINTENANCE_MODE to NORMAL but was rejected because of insufficient resources	01
81050100	TILX tried to change the usb unit state from MAINTENANCE_MODE to NORMAL but TILX never received notification of a successful state change	01
81060100	TILX tried to switch the unit state from MAINTENANCE_MODE to NORMAL but was not successful	01
81070100	TILX aborted all cmds via va, d_abort() but the htbs haven't been returned	01
81080100	While TILX was deallocating his eip buffers, at least one could not be found	01

Last Fail Code	Explanation	Repair Action Code
81090100	TILX received an end msg which corresponds to an opcode not supported by TILX	01
810A0100	TILX was not able to restart his timer	01
810B0100	TILX tried to issue an I/O for an opcode not supported	01
810D0100	A TILX device control block contains an unsupported unit_state	01
810E0100	TILX received an unsupported Value Added status in a Value added completion message.	01
810F0100	TILX found an unsupported device control block substate while trying to build a cmd for the Basic Function test	01
81100100	TILX found an unsupported device control block substate while trying to build a cmd for the Read Only test	01
81110100	TILX found an unsupported device control block substate while trying to build a cmd for the User Defined test	01
81120100	TILX received an EOT encountered while in a substate where EOT encountered should not occur	01
81130100	TILX calculated an illegal position type value while trying to generate a cmd for the position intensive phase of the Basic Function test	01
81140100	While trying to print an Event Information Packet, TILX discovered an unsupported MSCP error log format	01
81150100	A cmd which TILX issued was terminated with a sense key of SCSI_SENSEKEY_ILLEGAL_REQUEST	01
81160100	A cmd which TILX issued was terminated with a sense key of SCSI_SENSEKEY_VOLUME_OVERFLOW but the End of Medium bit is not set	01
81170100	A TILX cmd completed with a sense key that TILX does not support	01
81180100	TILX found an unsupported device control block substate while trying to build a SCSI cmd for the Basic Function test	01
81190100	While TILX was deallocating his deferred error buffers, at least one could not be found	01
811A0100	TILX expected a deferred error to be on the receive deferred error q but no deferred errors were there.	01
811B0100	TILX was asked to fill a data buffer with an unsupported data pattern.	01
811C0100	TILX could not process an unsupported answer in tx, reuse_params().	01
811D0100	TILX received a SCSI deferred error with a template which is not supported	01

Table 41
Device configuration utilities (CONFIG/CFMENU) last failure codes

Last Fail Code	Explanation	Repair Action Code
83020100	An unsupported message type or terminal request was received by the CONFIG virtual terminal code from the CLI	01
83030100	Not all alter_device requests from the CONFIG utility completed within the timeout interval	01
83050100	An unsupported message type or terminal request was received by the CFMENU utility code from the CLI	01
83060100	Not all alter_device requests from the CFMENU utility completed within the timeout interval	01

Table 42
Clone unit utility (CLONE) last failure codes

Last Fail Code	Explanation	Repair Action Code
84010100	An unsupported message type or terminal request was received by the CLONE virtual terminal code from the CLI	01
84020100	VA, GET_MEMBER_INFO returned a bad status for a member 10 times in a row.	01
84030100	VA, GET_MEMBER_INFO returned a bad status for a container 10 times in a row.	01

Table 43
Format and device code load utility (HSUTIL) last failure codes

Last Fail Code	Explanation	Repair Action Code
85010100	HSUTIL tried to release a facility that wasn't reserved by HSUTIL.	01
85020100	HSUTIL tried to change the unit state from MAINTENANCE_MODE to NORMAL but was rejected because of insufficient resources.	01
85030100	HSUTIL tried to change the usb unit state from MAINTENANCE_MODE to NORMAL but HSUTIL never received notification of a successful state change	01
85040100	HSUTIL tried to switch the unit state from MAINTENANCE_MODE to NORMAL but was not successful.	01

Table 44
Code load/code patch utility (CLCP) last failure codes

Last Fail Code	Explanation	Repair Action Code
86000020	Controller was forced to restart in order for new code load or patch to take effect.	00

Last Fail Code	Explanation	Repair Action Code
86010010	The controller code load function is about to update the program card. This requires controller activity to cease. This code is used to inform the other controller this controller will stop responding to inter-controller communications during card update. An automatic restart of the controller at the end of the program card update will cause normal controller activity to resume.	00

Table 45
Induce controller crash utility (CRASH) last failure codes

Last Fail Code	Explanation	Repair Action Code
88000000	Controller was forced to restart due to the execution of the CRASH utility.	00

Repair action codes

This section contains the repair action codes you will reference from Instance, Codes and Last Fail codes.

Table 46
Repair action codes

Repair Action Code	Action to take
00	No action necessary
01	An unrecoverable hardware detected fault occurred or an unrecoverable firmware inconsistency was detected, proceed with controller support avenues.
02	Inconsistent or erroneous information was received from the operating system. Proceed with operating system software support avenues.
03	Follow the recommended repair action contained in the Last Failure Code.
04	There are two possible problem sources: 1. In the case of a shelf with dual power supplies, one of the power supplies has failed. Follow repair action 07 for the power supply with the power LED out. 2. One of the shelf blowers has failed. Follow repair action 06.
05	There are four possible problem sources: 1. Total power supply failure on a shelf. Follow repair action 09. 2. A device inserted into a shelf that has a broken internal SBB connector. Follow repair action 0A. 3. A standalone device is connected to the controller with an incorrect cable. Follow repair action 08. 4. A controller hardware failure. Follow repair action 20.
06	Determine which blower failed and replace it.
07	Replace the power supply.
08	Replace the cable. Refer to the specific device documentation.
09	Determine power failure cause.
10	Restore on-disk configuration information to original state.
0A	Determine which SBB has a failed connector and replace it.
0B	The other controller in a dual-redundant configuration has been reset with the Kill line by the controller that reported the event. To restart the Killed controller enter the CLI command RESTART OTHER on the Surviving controller and then depress the (//) RESET button on the Killed controller. If the other controller is repeatedly being Killed for the same or a similar reason, follow repair action 20.

Repair Action Code	Action to take
0C	Both controllers in a dual-redundant configuration are attempting to use the same SCSI ID (either 6 or 7, as indicated in the event report). Note: The other controller of the dual-redundant pair has been reset with the Kill line by the controller that reported the event. Two possible problem sources are indicated: 1. A controller hardware failure. 2. A controller backplane failure. First, follow repair action 20 for the Killed controller. If the problem persists, then follow repair action 20 for the Surviving controller. If the problem still persists, then replace the controller backplane.
0D	The Environmental Monitor Unit (EMU) has detected an elevated temperature condition. Check the shelf and its components for the cause of the fault.
0E	The Environmental Monitor Unit (EMU) has detected an external air-sense fault. Check components outside of the shelf for the cause of the fault.
0F	An environmental fault previously detected by the EMU is now fixed. The EIP is used to notify that the repair was successful.
20	Replace the controller module.
22	Replace the indicated cache module, or the appropriate memory SIMMs located on the indicated cache module.
23	Replace the indicated write cache battery. Caution: BATTERY REPLACEMENT MAY CAUSE INJURY.
24	Check for the following invalid write cache configurations: ☐ If it is the wrong write cache module, replace with the matching module or clear the invalid cache error via the CLI. See the *CLI Reference Manual* for details. ☐ If the write cache module is missing, re-seat cache if it is actually present, or add the missing cache module or clear the invalid cache error via the CLI. See the *CLI Reference Manual* for details. ☐ If this is a dual-redundant configuration and one of the write cache modules is missing, match write cache boards with both controllers. ☐ If this is a dual-redundant configuration and both caches are not of the same type, for example both write -back cache, replace a cache module to assure both are compatible. ☐ If this is a dual-redundant configuration and both write caches are not of the same size, replace a cache module to assure both are compatible. ☐ If the cache module is populated with memory SIMMs in an illegal configuration, reconfigure according to guidelines.

Repair Action Code	Action to take
25	An unrecoverable Memory System failure occurred. Upon restart the controller will generate one or more Memory System Failure Event Sense Data Responses. Follow the repair actions contained in the respwhichwhichonses.
26	The Master DRAB detected a Cache Time-out condition. The cache regions in effect are identified in the Master DRAB RSR register as follows. ☐ Bits 8 through 11 identify the CACHEA memory region ☐ Bits 12 through 15 identify the CACHEB memory region ☐ Bits 20 through 23 the CACHE A DRAB registers region ☐ Bits 24 through 27 identify the CACHEB DRAB registers region ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. ☐ If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 36.
27	The Master DRAB detected an Nbus Transfer Error Acknowledge (TEA) condition. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. ☐ If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 36.
28	A Multiple Bit ECC error was detected by the Master DRAB. Use the following register information to locate additional details. ☐ The Master DRAB DER register bits 0 through 6 contain the syndrome value. ☐ The Master DRAB EAR register combined with Master DRAB ERR bits 0 through 3 (address region) yields the affected memory address. ☐ The Master DRAB EDR register contains the error data. If the failure involved a Device port, the Master DRAB CSR register bits 10 through 12 identify that Device port. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. ☐ If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 34.

Repair Action Code	Action to take
29	A Multiple Bit ECC error was detected by the CACHEA0 or CACHEA1 DRAB. Use the following register information to locate additional details. ☐ The CACHEAn DRAB DER register bits 0 through 6 contain the syndrome value. ☐ The CACHEAn DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEA memory region) yields the affected memory address. ☐ The CACHEAn DRAB EDR register contains the error data. ☐ If the failure involved a Device port, the Master DRAB CSR register bits 10 through 12 identify that Device port. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. ☐ If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 34.
2A	A Multiple Bit ECC error was detected by the CACHEB0 or CACHEB1 DRAB. Use the following register information to locate additional details. ☐ The CACHEBn DRAB DER register bits 0 through 6 contain the syndrome value. ☐ The CACHEBn DRAB EAR register combined with the Master DRAB RSR register bits 12 through 15 (CACHEB memory region) yields the affected memory address. ☐ The CACHEBn DRAB EDR register contains the error data. ☐ If the failure involved a Device port, the Master DRAB CSR register bits 10 through 12 identify that Device port. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. ☐ If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 34.

Repair Action Code	Action to take
2B	The Master DRAB detected an Ibus-to-Nbus Time-out condition. If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. If any of the following is true, a firmware fault is indicated; follow repair action 01. ☐ Master DRAB CSR register bits 10 through 12 contains the value 1 and WDR1 register bit 26 is clear. ☐ Master DRAB CSR register bits 10 through 12 contains the value 2 and WDR1 register bit 27 is clear. ☐ Master DRAB CSR register bits 10 through 12 contains the value 3 and WDR1 register bit 28 is clear. ☐ Master DRAB CSR register bits 10 through 12 contains the value 4 and WDR1 register bit 29 is clear. ☐ Master DRAB CSR register bits 10 through 12 contains the value 5 and WDR1 register bit 30 is clear. ☐ Master DRAB CSR register bits 10 through 12 contains the value 6 and WDR1 register bit 31 is clear. If none of the above conditions were true, follow repair action 36.
2C	The Master DRAB detected a Nonexistent Memory Error condition. Use the following register information to locate additional details. ☐ The Master DRAB EAR register combined with Master DRAB ERR bits 0 through 3 (address region) yields the affected memory address. ☐ The Master DRAB EDR register contains the error data. ☐ If the failure involved a Device port, the Master DRAB CSR register bits 10 through 12 identify that Device port. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. ☐ If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 36.

Repair Action Code	Action to take
2D	The CACHEA0 or CACHEA1 DRAB detected a Nonexistent Memory Error condition. ☐ The CACHEAn DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEA memory region) yields the affected memory address. ☐ The CACHEAn DRAB EDR register contains the error data. ☐ If the failure involved a Device port, the Master DRAB CSR register bits 10 through 12 identify that Device port. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. ☐ If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 36.
2E	The CACHEB0 or CACHEB1 DRAB detected a Nonexistent Memory Error condition. Use the following register information to locate additional details. ☐ The CACHEBn DRAB EAR register combined with the Master DRAB RSR register bits 12 through 15 (CACHEB memory region) yields the affected memory address. ☐ The CACHEBn DRAB EDR register contains the error data. ☐ If the failure involved a Device port, the Master DRAB CSR register bits 10 through 12 identify that Device port. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. Follow repair action 36.

Repair Action Code	Action to take
2F	The Master DRAB detected an Address Parity Error or a Write Data Parity Error condition. Use the following register information to locate additional details. ☐ The Master DRAB EAR register combined with Master DRAB ERR bits 0 through 3 (address region) yields the affected memory address. ☐ The Master DRAB EDR register contains the error data. ☐ If the failure involved a Device port, the Master DRAB CSR register bits 10 through 12 identify that Device port. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. ☐ If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. ☐ For Write Data Parity Error conditions Bits 0 through 3 of the Master DRAB CSR register identify the byte in error. For Address Parity Error conditions follow repair action 34. For Write Data Parity Error conditions follow repair action 35.
30	The CACHEA0 or CACHEA1 DRAB detected an Address Parity Error or a Write Data Parity Error condition. Use the following register informtion to locate additional details about the error. ☐ If the failure occurred during a memory refresh attempt, the CACHEAn DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEA memory region) yields the affected memory address. ☐ If the failure occurred during a memory access attempt, the CACHEA0 DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEA memory region) or bits 20 through 23 (CACHEA DRAB register region) yields the affected memory address. Unfortunately, no other information is available to distinguish a memory region access from a DRAB register region access. ☐ The CACHEAn DRAB EDR register contains the error data. ☐ If the failure involved a Device port, the Master DRAB CSR register bits 10 through 12 identify that Device port. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. ☐ For Write Data Parity Error conditions bits 0 through 3 of the CACHEAn DRAB CSR register identify the byte in error. For Address Parity Error conditions follow repair action 34. For Write Data Parity Error conditions follow repair action 35.

Repair Action Code	Action to take
31	The CACHEB0 or CACHEB1 DRAB detected an Address Parity Error or a Write Data Parity Error condition. Use the following register information to location additional details about the error. ☐ If the failure occurred during a memory refresh attempt, the CACHEBn DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEB memory region) yields the affected memory address. ☐ If the failure occurred during a memory access attempt, the CACHEB0 DRAB EAR register combined with the Master DRAB RSR register bits 8 through 11 (CACHEB memory region) or bits 20 through 23 (CACHEB DRAB register region) yields the affected memory address. Unfortunately, no other information is available to distinguish a memory region access from a DRAB register region access. ☐ The CACHEBn DRAB EDR register contains the error data. ☐ If the failure involved a Device port, the Master DRAB CSR register bits 10 through 12 identify that Device port. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. ☐ For Write Data Parity Error conditions bits 0 through 3 of the CACHEBn DRAB CSR register identify the byte in error. For Address Parity Error conditions follow repair action 34. For Write Data Parity Error conditions follow repair action 35.
32	The Master DRAB detected an Ibus Parity Error condition. Use the following register information to locate additional details about the error. ☐ The Master DRAB EAR register combined with the Master DRAB ERR bits 4 through 7 (address region) yields the affected memory address. ☐ The Master DRAB EDR register contains the error data. ☐ If Master DRAB DSR register bit 14 is set, the failure was reported via the NMI. If Master DRAB DSR register bit 14 is clear, the failure was reported via the DRAB_INT. If bits 20 through 23 of the Master DRAB DCSR register contain a non-zero value, a firmware fault is indicated; follow repair action 01, otherwise, follow repair action 36.
33	This event report contains supplemental information related to a Memory System Failure event report delivered earlier. Use the instance, code contained in the memory address field of this event report to correlate this event report with the other event report.
34	If bit 31 of the DCSR register of the DRAB that detected the failure is set, it indicate a firmware fault; follow repair action 01. If bit 31 is not set, follow repair action 36.
35	If bits 20 through 23 of the WDR1 register contain a non-zero value, it indicates a firmware fault; follow repair action 01. If bits 20 through 23 contain zero, follow repair action 36.

Repair Action Code	Action to take
36	No other information is available to aid in diagnosing the cause of the failure. If the Master DRAB detected the failure, follow repair action 20. If the CACHE An or CACHEBn DRAM detected the failure, follow repair action 22. If the problem persists, follow repair action 01.
37	The Memory System Failure translator could not determine the failure cause. Follow repair action 01.
40	If the Sense Data FRU field is non-zero, follow repair action 41. If the Sense Data FRU field is zero, replace the appropriate FRU associated with the device's SCSI interface or the entire device.
41	Consult the device's maintenance manual for guidance on replacing the indicated device FRU.
43	Update the configuration data to correct the problem.
44	Replace the SCSI cable for the failing SCSI bus. If the problem persists, replace the controller backplane, drive backplane, or controller module.
45	Interpreting the device supplied Sense Data is beyond the scope of the controller's firmware. See the device's service manual to determine the appropriate repair action, if any.
60	Swap the transmit and receive cables for the indicated path.
61	Check the indicated path cables for proper installation.
63	For HSHJ3x/4x: Check the CI adapter on the host system identified in the Remote Node Name field for proper operation. For HSD3x/HS1CP: Check the DSSI adapter on the host system identified in the Remote Node Name field for proper operation.
64	Excessive VC closures are occurring. Perform repair action 61 on both sets of path cables. If the problem persists, perform repair action 63.
65	Polling failed to complete in a timely manner. Perform repair action 61 on all path cables.
66	The number of hosts forming virtual circuits with the controller exceeds the current user specified maximum. Increase the maximum number of hosts allowed value.
67	Perform repair action 61. If the problem persists, perform repair action 20.
68	The external cache battery cable might have been disconnected.

Glossary

adapter
A device that converts the protocol and hardware interface of one bus type into that of another without changing the functionality of the bus.

allocation class
A numerical value assigned to a controller to identify units across multiple, independent controllers. (Controllers in a dual-redundant configuration must have the same allocation class.)

array controller
A hardware/software device that facilitates communications between a host and one or more devices organized in an array. HS family controllers are examples of array controllers.

BBR
Bad block replacement. The procedure used to locate a replacement block, mark the bad block as replaced, and move the data from the bad block to the replacement block.

BBU
Battery backup unit. A StorageWorks SBB option that extends power availability after the loss of primary ac power or a power supply to protect against the corruption or loss of data.

block
The smallest data unit addressable on a disk. Also called a sector. In integrated storage elements, a block contains 512 bytes of data, EDC, ECC, flags, and the block's address header.

CDU
Cable distribution unit. The power entry device for StorageWorks cabinets. The unit provides the connections necessary to distribute ac power to cabinet shelves and fans.

CLI
Command line interpreter. Operator command line interface for the HS family controller firmware.

controller shelf
A StorageWorks shelf designed to contain controller and cache memory modules.

CRC
Cyclic redundancy check. An 8-character cyclic redundancy check string used in conjunction with the customer identification

string for turning on licensed features such as write-back caching.

data center cabinet
A generic reference to the large cabinets, such as the SW800-series, in which StorageWorks components can be mounted.

DDL
Dual data link. The ability to operate on the CI bus using both paths simultaneously to the same remote node.

differential SCSI bus
A signal's level is determined by the potential difference between two wires. A differential bus is more robust and less subject to electrical noise than is a single-ended bus.

DILX
Disk inline exerciser. Diagnostic firmware used to test the data transfer capabilities of disk drives in a way that simulates a high level of user activity.

DSA
Digital storage architecture. A set of specifications and interfaces describing standards for designing mass storage products. DSA defines the functions performed by host computers, controllers, and disk drives. It also specifies how they interact to accomplish mass storage management.

DSSI
Digital storage system interconnect. A Digital-specific data bus with an 8-bit data transfer rate of 4 MB/s.

dual-redundant configuration
Two controllers in one controller shelf providing the ability for one controller to take over the work of the other controller in the event of a failure of the other controller.

DUART
Dual universal asynchronous receiver/transmitter. An integrated circuit containing two serial, asynchronous transceiver circuits.

DUP
Diagnostic and utility protocol. Host application software that allows a host terminal to be connected to the controller's command line interpreter.

DWZZA
The StorageWorks compatible SCSI bus signal converter.

ECB
External cache battery.

ECC
Error correction code. One or more cyclic redundancy check (CRC) words that allow detection of a mismatch between transmitted and received data in a communications system, or between stored and retrieved data in a storage system. The ECC allows for location and correction of an error in the received/retrieved data. All ECCs have limited correction power.

EDC
Error detection code. One or more checksum words that allow detection of a mismatch between transmitted and received data in a communications system, or between stored and retrieved data in a storage system. The EDC has no data correction capability.

ESD
Electrostatic discharge. The discharge of a potentially harmful static electric voltage as a result of improper grounding.

failedset
A group of disk drives that have been removed from RAIDsets due to a failure or a manual removal. Disk drives in the failedset should be considered defective and should be tested, repaired, and then placed into the spareset.

failover
The process that takes place when one controller in a dual-redundant configuration assumes the workload of a failed controller.

flush
The act of writing data from the cache module to the media.

FRU
Field replaceable unit. A hardware component that can be replaced.

FWD SCSI
Fast, wide, differential SCSI. The differential SCSI bus with a 16-bit parallel data path that yields a transfer rate of up to 20 MB/s.

half-height device
A device that occupies half of a 5.25 inch SBB carrier. Two half-height devices can be mounted in a 5.25 inch SBB carrier. The

first half-height device is normally mounted in the lower part of the carrier. The second device is normally mounted in the upper part of the carrier.

HBVS
Host-based volume shadowing. Also known as Phase 2 volume shadowing.

HSOF
Hierarchical storage operating firmware. Software contained on a program card that provides the logic for the HS array controllers.

HIS
Host interconnect services. The firmware in the HS array controller that communicates with the host.

host
Any computer to which a storage subsystem can be attached.

hot swap
A method of replacing a device whereby the system that contains the device remains online and active during replacement. The device being replaced is the only device that cannot perform operations during a hot swap.

initiator
A SCSI device that requests an I/O process to be performed by another SCSI device (a target). This is always the controller.

local terminal
A terminal plugged into the EIA-423 maintenance port on the front bezel of the HS array controller. Also called a maintenance terminal.

logical unit
The physical device or storage unit seen by the host. Often these logical units are spread across more than one physical device, especially in RAID implementations. This is *not* a LUN.

Logical Unit Number
See LUN.

LRU
Least recently used. This is cache terminology for the block replacement policy for the read cache.

LUN
A logical unit number is a physical or virtual peripheral device addressable through a target. LUNs use their target's bus connection to communicate on the SCSI bus.

maintenance terminal
Any EIA-423 compatible terminal to be plugged into the HS controller. This terminal is used to identify the controller, enable host paths, define the configuration, and check controller status. It is not required for normal operations. It is sometimes referred to as a local terminal.

metadata
Data written on the physical disk that is not visible to the host/customer that allows the HS array controller to maintain a high integrity of customer data.

mirrorset
Two or more physical disks configured to present one highly reliable virtual unit to the host.

MSCP
Mass storage control protocol. The protocol by which blocks of information are transferred between the host and the controller.

non-redundant configuration
A single controller configuration. A controller configuration that does not include an second backup controller permitting failover in the event of a failure.

normal member
A mirrorset member whose entire contents is guaranteed to be the same as all other NORMAL members. All NORMAL members are exactly equivalent.

normalizing member
A mirrorset member whose contents is the same as all other NORMAL and NORMALIZING members for data that has been written since the mirrorset was created or lost cache data was cleared. Data that has never been written may differ among NORMALIZING members.

NV
Nonvolatile. A term used to describe memory that can retain data during a power loss to the controller.

partition
A percentage of a storageset or single-disk unit that may be presented to the host as a storage unit.

port
The hardware and software used to connect a host controller to a communication bus, such as CI, DSSI, or SCSI bus. This term also is used to describe the connection between the controller and its SCSI storage devices.

PTL
Port-target-LUN. A method of device notation where **P** designates the controller's device port (1-6), **T** designates the target ID of the device (0-6), and **L** designates the LUN of the device (0-7).

qualified device
A device that has been fully tested in an approved StorageWorks configuration, (that is, shelf, cabinet, power supply, cabling, and so forth) and is in complete compliance with country-specific standards (for example, FCC, TUV, and so forth) and with all Digital standards.

quiesce
To make a bus inactive or dormant. The operator must quiesce SCSI bus operations, for example, during a device warm swap.

RAID
Redundant array of independent disks. The multiple storage access methods devised for performance (RAID 0, striping) and/or various cost levels of availability (RAID 1 through RAID 5).

RAIDset
Three or more physical disks that are configured to present an array of disks as a single virtual unit to the host.

read cache
The cache used to accelerate read operations by retaining data that has been previously read, written, or erased, based on a prediction that it will be reread.

replacement policy
The method by which a spare disk is selected to replace a disk that has failed in a RAIDset.

SBB
StorageWorks building block. A modular carrier plus the individual mechanical and electromechanical interface required to

mount it into a standard StorageWorks shelf. Any device conforming to shelf mechanical and electrical standards is considered an SBB.

SBB shelf
StorageWorks building block shelf. A StorageWorks shelf, such as the BA350-Sx, designed to house plug-in SBB modules.

SCS
System communication services. A delivery protocol for packets of information (commands or data) to or from the host.

SCSI
Small computer system interface. An ANSI interface defining the physical and electrical parameters of a parallel I/O bus used to connect initiators to a maximum of seven devices. The StorageWorks device interface is implemented according to SCSI-2 standard, allowing the synchronous transfer of 8-bit data at rates of up to 10 MB/s.

SCSI device
A host computer adapter, a peripheral controller, or a storage element that can be attached to the SCSI bus.

SCSI device ID
The bit-significant representation of the SCSI addressing that refers to one of the signal lines numbered 0 through 7. Also referred to as a *target* ID.

SCSI-A cable
A 50-conductor 25 twisted pair cable used for single-ended, SCSI bus connections.

SCSI-P cable
A 68-conductor 34 twisted pair cable used for differential bus connections.

Small Computer System Interface
See SCSI.

Spareset
A pool of disk drives used by the controller to replace failed members of a RAIDset.

SPD
Software product description. A document that contains the legal description of a product.

storageset
Any collection of containers, such as stripesets, RAIDsets, the spareset, and the failedset, that make up a container.

storage unit
The general term that refers to storagesets, single disk units, and all other storage devices that can be installed in your subsystem and accessed by a host. A storage unit can be any entity that is capable of storing data, whether it is a physical device or a group of physical devices.

StorageWorks
Digital's family of modular data storage products that allows customers to design and configure their own storage subsystems. Components include power, packaging, cabling, devices, controllers, and software. Customers can integrate devices and array controllers in StorageWorks enclosure to form storage subsystems.

StorageWorks building block
See SBB.

stripeset
A virtual disk drive with its physical data spread across multiple physical disks. Stripeset configurations do not include a data recovery mechanism.

striped mirrorset
Stripesets whose members have been mirrored.

tagged command queuing
A SCSI feature that allows a device to have multiple I/O requests outstanding to it at one time.

target
A SCSI device that performs an operation requested by an initiator. The target number is determined by the device's address on its SCSI bus.

TMSCP
Tape mass storage control protocol. The protocol by which blocks of information are transferred between the host and the controller.

unit
The host's view of a container on an HS array controller. A unit may be made up of simply a physical disk or tape drive, or a more complex container such as a RAIDset.

unwritten cached data
Data in the write-back cache that has not yet been written to the physical device, but the user has been notified that the data has been written.

VCS
VAXcluster console system.

virtual terminal
A software path from an operator terminal on the host to the controller's CLI. The path can be established via the host port on the controller (using DUP) or via the maintenance port through on intermediary host (VCS). A virtual terminal is also sometimes called a host console.

warm swap
A method for adding or replacing a device whereby the system remains online, but all activity on the device's bus must be halted for the duration of the swap.

write-back caching
A caching strategy that writes data to the cache memory, then flushes the data to the intended device at some future time. From the user's perspective, the write operation is complete when the data is stored in the cache memory. This strategy avoids unnecessary access of the devices.

write hole
Undetectable RAID level 1 or 5 data corruption. A write hole is caused by the successful writing of some, but not all, of the storageset members. Write holes occur under conditions such as power outages, in which the writing of multiple members can be abruptly interrupted. A battery backed-up cache design eliminates the write hole, because data is preserved and writes can be retried.

write-through cache
A cache write strategy in which the destination of the write data is the primary storage media. This operation may update, invalidate, or delete data from the cache memory accordingly, to ensure that the cache does not contain obsolete data. The user

sees the operation as complete only after the backup storage device has been updated.

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