digital™

Software Product Description

PRODUCT NAME: HSZ50 Array Controller Operating Software (HSOF), Version 5.0 **SPD 61.36.01**

DESCRIPTION

The HSZ50 Array Controller Operating Software (HSOF) is the software component of the HSZ50 array controller. This array controller is an intelligent mass storage controller that interfaces between host computer systems and SCSI-attached mass storage devices using a SCSI–2 bus. HSOF executes in the HSZ50 array controller; it processes SCSI I/O requests from hosts, performing the device-level operations required to satisfy the requests.

HSOF SOFTWARE FUNCTIONS

HSOF software performs the following functions including:

- Testing and diagnosis of the HSZ50 array controller
- Host interconnect and protocol services
- SCSI device control
- Subsystem management services
- Local program support
- Disk partitioning functions

The following sections describe these functions.

Testing and Diagnosis of the HSZ50 Array Controller

HSOF software internal diagnostics execute automatically when controller power is turned on or when the array controller is reset.

LEDs on the controller's front bezel provide diagnostic information upon controller failure.

A maintenance asynchronous I/O port is provided for configuration and diagnosis.

Cache Battery Diagnostic

HSOF software Version 5.0 checks the condition of the External Cache Batteries (ECB) every 24 hours. If a low capacity or failure is detected, write-back cache data is flushed from cache and depending on the pre-defined cache policy, selected RAIDsets and disk mirrorsets may become inoperative. In dual redundant configurations, failover to the redundant controller may occur based upon the cache policy selected.

Host Interconnect and Protocol Services

The HSZ50 array controller attaches to host computer systems using a fast, wide, differential (FWD) SCSI–2 bus. Up to four SCSI target addresses can be set for either a single or a dual-redundant controller configuration. This allows support for up to 32 SCSI logical units (LUNs) per controller shelf.

SCSI Device Control

HSOF software converts host I/O requests into device-specific SCSI commands. It supports concurrent commands and data transfers on multiple SCSI device buses to the maximum extent possible for each supported device type.

HSOF software device control functions include the following:

Error Detection and Recovery

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HSOF software recovers from device errors including bad block replacement for supported disk drives that do not perform this function for themselves.

For errors on the SCSI host interface, HSZ50 array controller hardware and HSOF software cooperate to provide the following:

- Automatic retransmission of data detected as being in error
- Automatic detection of internal data path errors
- Automatic failover of attached devices between identically configured HSZ50 controllers installed in the same controller shelf (refer to product specific documentation for any configuration restrictions).

Device Integrity Testing

HSOF software executes Device Integrity Test programs on system manager command. These tests perform the following:

- Verify correct operation of individual disk devices
- Place the HSZ50 array controller under load to verify correct subsystem operation

Error Logging

HSOF software uses SCSI protocol messages to report faulty or failing devices and controller faults to all connected hosts that have error logging enabled.

Save Configuration on Disk

Saves device, controller configuration information and HSOF software patches on a disk. This improves availability, for single controller implementations, in the event of a software upgrade or controller replacement.

Save Software Patches on Disk

Saves any installed patches on disk initialized with the SAVE_CONFIGURATION option.

Set SCSI Speed for Host and Devices

In configurations that must use a long SCSI cable between the HSZ50 controller and the host system it is possible for the initiator and target to negotiate a faster data rate than is supported by the cable length.

Set SCSI Speed for Devices allows the controller to force a slower data rate when negotiating with the target device. This allows for a longer cable length than that supported by the speed that the controller and target device would normally negotiate. This CLI command can set the maximum data transfer rate between the controller and any device to 10MHz, 5MHz.

SCSI Multibus Failover

Allows the connection of dual-redundant pairs to separate host SCSI buses and separate host adapters. This configuration provides redundant paths from the host to the controllers and devices for high availability. SCSI Multibus Failover requires host operating system hardware and software support. Check the operating systems SPD and Release Notes to verify support for this functionality.

Asynchronous Disk Swap

HSOF Software Version 5.0 supports asynchronous disk swaps—disk removal and insertion without first quiescing the device bus. Disk can be removed or inserted at any time with some restrictions.

Simultaneous Multiple Operating System Support

HSOF Software V5.0 provides support for a different host function mode for each controller target ID, thus allowing the controllers to work with different host operating systems on the same SCSI bus. HSOF V5.0 Software supports any two of the four host modes at one time.

Subsystem Management Services

HSOF software provides the following subsystem management service:

Alteration of Subsystem Parameters

HSOF software includes a command language interpreter (CLI) utility that allows a system manager to display and manipulate controller parameters and device configuration information as needed.

The CLI utility provides type ahead, recall and editing features. Any of the last four commands entered may be recalled and edited.

Dynamic Status Display

The HSOF VTDPY utility allows a system manager to view the HSZ50-based subsystem's state dynamically. This utility can use VT200-, VT300-, and VT400-series video terminals.

Terminal port connections are supported at 4800, 9600, and 19200BPS only.

HSUTIL

The HSUTIL utility provides two functions: device format and device code load. Device format enables the system manager to perform a basic format operation on a disk device. Device code load provides the functionality to download device firmware onto supported disk drives via the controller.

Environmental Monitor Unit (EMU)

HSOF Version Software 5.0 supports EMU functionality in SW300-series cabinets for HSZ50 products only.

Local Program Support

HSOF software supports the following local utilities and commands:

- AUTOSPARE as an option to aid in the replacement of failed disk drives
- CFMENU for configuring controller-attached storage devices
- CHVSN supports the ability to change volume serial numbers for disk drive devices
- CLONE utility for obtaining snapshot copies of data in concert with Disk Mirroring software
- Code Load/Code Patch (CLCP) for controller software changes
- CONFIG for automatically adding new devices to the configuration
- C_SWAP for controller and/or cache module warm swap (for dual-redundant configurations)
- DILX disk inline exerciser
- FLS for re-enabling licensed features
- FMU for displaying controller last failure and memory system failure information as well as control of spontaneous event logging and last failure logging displays
- VTDPY presents a user display of current controller state and performance data for attached disk drive devices

Note: NOTE:

CFMENU cannot be used to partition striped-mirrorsets. The CLI commands may be used to manually partition striped mirrorsets. The Clone Utility cannot be used with partitioned units.

Write-Back Cache Capability

The write-back cache capability provides the following functions:

- Stores data to be written temporarily in the controller's write-back cache and informs the host that the write request is complete. This allows the host to continue working without waiting for data to be written to disk media
- Writes the data stored in cache to the disk media based on a least-recently-used cache flushing policy or when a device has been inactive for a defined time
- Consolidates contiguously located data blocks from multiple host write requests into a single device request to reduce average latency
- On recovery from a controller failure (for example, a power outage), detects that unwritten data still exists in cache and writes it to disk media before enabling normal controller operations

Disk Striping (RAID 0)

HSOF software treats sets of disk drives as stripesets (2 to 14 members) for improved I/O performance through load balancing. A stripeset appears to the operating system as a single disk drive.

RAID Capability (RAID3/5)

The RAID capability provides the following functions:

- Manages up to 14 sets of between 3 and 14 disks as RAIDsets (limited by controller configuration restrictions). A RAIDset is viewed by the host as a single disk. RAIDsets can tolerate the failure of a single member disk without loss of ability to deliver data to hosts.
- Dynamically adjusts between RAID Level 3 and RAID Level 5-like data protection algorithms depending on instantaneous workload.
- Maintains consistency of data and parity across all member disks in a RAIDset. This includes recovery from media errors.
- Detects failure of a single RAIDset member disk and invokes data regeneration algorithms to provide continued data availability to hosts.
- Captures a designated spare (if one exists) in the event of a member disk failure and reconstructs the data and parity of the failed member disk onto it.

For information regarding default chunksize, refer to the *Configuring Your StorageWorks Subsystem HSZ50 Array Controllers HSOF Version 5.0* EK–HSZ50–CG.

Disk Mirroring Capability (RAID 1)

The disk mirroring capability provides the following functions:

- Real-time maintenance of up to six identical copies of data on mirrorsets of separate disks attached to a single HS array controller.
- Protects data against disk failure by replicating all data on each member of the mirrorset. Disk mirroring offers extremely high data reliability.
- Striping of mirrorsets, for high-performance access to large amounts of highly available data.

- Captures a designated spare (if one exists) in the event of a mirrorset member disk failure and reconstructs the data of the failed member disk onto it.
- Ability to increase or decrease the number of members in a mirrorset as requirements change.
- Flexible policy options for determining both how read requests are satisfied and the speed of copying when a new member is being added.
- HSOF software disk mirroring can utilize the UNMIRROR command to change devices back to a single-disk unit.

Partitioning

HSOF software allows partitioning of disk drives or storage sets for improved device management. A partition appears to the operating system as a single virtual disk. Up to 4 partitions may be created per storage set or disk drive.

Limits on the Total Number of Storagesets

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

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

HARDWARE REQUIREMENTS

HSOF software requires an HSZ50 array controller module on which to execute. The FWD SCSI bus must be properly terminated.

The HSZ50 array controller includes six SCSI connecting storage devices. The specific devices supported by HSOF Software Version 5.0 are listed in Tables 1, 2 and 3. Up to 42 (in a nonredundant configuration) or up to 36 (in a dual-redundant configuration) SCSI–2 and SSD devices may be attached to the HSZ50 array controller via 32 SCSI LUNs.

The HSZ50 array controller supported configurations are as follows:

HSZ50–AF	StorageWorks array controller for 36 (dual-redundant) or 42 (nonredundant) SCSI–2 disk/tape/optical devices; 32 MB Read /Write-back Cache, RAID, Disk Mirroring and one single External Cache Battery unit (ECB) (Prerequisite: One HSOF Software kit ordered separately, (1) QB-5CJAA-SA)
HSZ50–AH	StorageWorks array controller for 36 (dual-redundant) or 42 (nonredundant) SCSI–2 disk/tape/optical devices; 64 MB Read /Write-back Cache, RAID, Disk Mirroring and one single External Cache Battery unit (ECB)(Prerequisite: One HSOF Software kit ordered separately, (1) QB-5CJAA-SA)
HSZ50–AJ	StorageWorks array controller for 36 (dual-redundant) or 42 (nonredundant) SCSI–2 disk/tape/optical devices; 128 MB Read /Write-back Cache, RAID, Disk Mirroring and one single External Cache Battery unit (ECB)(Prerequisite: One HSOF Software kit ordered separately, (1) QB-5CJAA-SA)
HSZ52–AF	One set (two HSZ50-AF controllers) of dual-redundant StorageWorks array controllers for 72 SCSI–2 disk/tape/optical devices; 64MB Read/Write-back Cache, RAID Disk Mirroring and one dual External Cache Battery units (ECB)(Prerequisite: Two HSOF Software kits ordered separately, (2) QB-5CJAA-SA)
HSZ52–AH	One set (two HSZ50-AJ controllers) of dual-redundant StorageWorks array controllers for 72 SCSI–2 disk/tape/optical devices; 128MB Read/Write-back Cache, RAID Disk Mirroring and one dual External Cache Battery units (ECB)(Prerequisite: Two HSOF Software kits ordered separately, (2) QB-5CJAA-SA)
HSZ52–AJ	One set (two HSZ50-AJ controllers) of dual-redundant StorageWorks array controllers for 72 SCSI–2 disk/tape/optical devices; 256MB Read/Write-back Cache, RAID Disk Mirroring and one dual External Cache Battery units (ECB)(Prerequisite: Two HSOF Software kits ordered separately,(2) QB-5CJAA-SA)
HSZ54–AJ	Two sets (four HSZ50-AJ controllers) of dual-redundant StorageWorks array controllers for 144 SCSI–2 disk/tape/optical devices; 512MB Read/Write-back Cache, RAID, Disk Mirroring and two dual External Cache Battery units (ECB)(Prerequisite: Four HSOF Software kits ordered separately, (4) QB-5CJAA-SA)

DS–SWXRA–W0	StorageWorks RAID Array 450 with 24 System Building Block (SBB Pedestal Cabinet Storage Subsystem). Includes: HSZ50 6 channel controller, tri-link with terminator, 32MB write back cache expandable to 64MB or 128MB, single cache battery in SBB, 24 SBB slot Wide (16-bit) SCSI cabinet, 5 power supplies, redundant cooling, EMU, host to controller cable BN21K-05 (68 Pin SCSI to 68 Pin 90 degree). Serial line assembly with adapters (9 pin and 25 Pin). Requires RA450 platform kit, host adapter, and disks ordered separately
DS-SWXRA-W4	SorageWorks RAID Array 450 with 24 System Building Block (SBB) (Rackmount Storage Subsystem). Includes: HSZ50 6 channel controller, tri-link with terminator, 32MB write back cache expandable to 64 or 128MB, single cache battery in SBB, 24 SBB slot Wide (16-bit) SCSI rack, 5 power supplies, redundant cooling, and host to controller cable BN21K-10 (68 Pin SCSI to 68 Pin 90 degree). Serial line assembly with adapters (9 pin and 25 Pin). Metric Mounting kit for Data Center Cabinet (SW800/SWXSC-Dx). Requires RA450 Platform kit, host adapter,and disks ordered separately. Mounting in 19" RETMA cabinet requires BA35X-RB option

Configuration Restrictions

The following configuration restrictions apply:

- Two controllers in the same controller shelf must be configured as a dual-redundant configuration.
- HSZ40 or SWXRC-04/05 controllers may not be used in a dual-redundant pair with the HSZ50.
- HSZ50 minimum supported revision level is HSOF V5.0 software.
- A maximum of six devices may be attached to a single SCSI device bus on dual-redundant HSZ50 array controller configurations.
- A maximum of seven devices may be attached to a single SCSI device bus on nonredundant HSZ50 array controller configurations.
- A maximum combined total of 20 disk mirrorsets and RAIDsets are supported with HSOF Software Version 5.0.
- A maximum combined total of 30 storagesets (mirrorsets, RAIDsets, and stripesets) are supported with HSOF Software Version 5.0.
- There can be a maximum of 4 partitions per disk or storagesets.

Host Node Software and Hardware Required

A valid operating system configuration with a supported FWD SCSI interface, as referred to in the following section, is required to run HSOF Software software.

The following host adapters are supported by the **Digital UNIX** operating system V3.2c, 3.2d and 3.2g for HSZ50 controllers:

- KZMSA (for DEC 7000™, DEC 10000 ™, and AlphaServers™ 8200/8400 systems, requires a DWZZ-series signal converter)
- KZPSA (for Digital AlphaServers 1000/2000/2100 /8200/8400)
- KZTSA (for DEC 3000™ systems)
- PMAZC (for DEC 3000 systems, requires a DWZZ-series signal converter)

The following host adapters are supported by the **Digital OpenVMS Alpha** operating system Version 6.2 for HSZ50 controllers:

- KZMSA (for DEC 7000, DEC 10000, and requires a DWZZ-series signal converter)
- KZPAA (for Digital AlphaServers 1000/2000/2100 systems)
- KZPSA (for Digital AlphaServers 1000/2000/2100 /8200/8400)
- KZTSA (for DEC 3000 systems)
- PMAZC (for DEC 3000 systems, requires a DWZZ-series signal converter)
- KFTIA (for TurboLaser 8200 embedded SCSI)

The following host adapters are supported by the **Windows NT** ™ Alpha ™ operating system Version 3.5.1 for HSZ50 controllers:

- KZPSA (for Digital AlphaServers 400/1000/2000 /2100)

The following host adapters are supported by the **Windows NT** ™Intel™ operating system Version 3.5.1 for HSZ50 controllers:

- SWXA3-BC (for PCI based systems)
- SWIA3-BB (for EISA based systems)

The following host adapters are supported by the **Sun Solaris** ™ operating system Version 2.4, 2.5 and 2.5.1 for HSZ50 controllers:

- X1062 (SUN product number)
- SWSAP-BC (Digital product for SUN)

The following host adapters are supported by the **HP-UX** ™ operating system Version 10.01 and 10.10 for HSZ50 controllers:

- SWHAP-BC (800 series, Digital product for HP)

- HP28696A (800 series, HP product number)
- HPA2696A (K class, HP product number)
- Embedded adapter (735/755/C and D class, HP product number)
- HPA4107A (J class, HP product number)

The following host adapters are supported by the **Novell Netware** ™ operating system Version 4.1 for HSZ50 controllers:

- SWXA3-BC (Digital Product for Novell)

The following host adapters are supported by the **IBM** ™ operating system Version 4.1.4 and 4.2 for HSZ50 controllers:

- FC2416 (Micro Channel systems, IBM product number)
- FC2412 (Micro Channel systems, IBM product number)
- FC2409 (PCI systems, IBM product number)

OTHER HARDWARE

HSOF software supports the following optional hardware:

- HSSIM–AA 32MB SIMM Pack for HS*x*50 controllers, add additional 32MB SIMMs to upgrade HSZ50 controllers to the supported 64MB and 128MB configurations.
- HS35X-BA Single External Cache Battery (ECB) Replacement
- HS35X-BB Dual External Cache Battery (ECB) Replacement

Note: Hardware configuration guidelines for HSZ50 array controllers are provided in the *Configuring your StorageWorks HSZ50 Array Controller*, EK–HSZ50–CG.

Table 1
HSZ50 Array Controller Supported Devices

Device	Type[1]	Capacity GB	Minimum Microcode Version	Min H/W Rev[2]
RZ25–VA	DD	0.426	0900	B01
RZ26–VA	DD	1.05	T392	D02
RZ26L–VA/VW[3]	DD	1.05	440C	A01
RZ26N–VA/VW[3]	DD	1.05	446	A01
SWXD3-SF/WF[3]	DD	1.05	446	A01
RZ28–VA/VW[3]	DD	2.1	435E	B01
RZ28B–VA	DD	2.1	0003	A01
RZ28D–VA/VW[3]	DD	2.1	0008	A01
SWXD3-SG/WG[3]	DD	2.1	0008	A01
RZ28M–VA/VW[3]	DD	2.1	466	A01
SWXD3-SH/WH[3]	DD	2.1	466	A01
RZ29B–VA/VW[3]	DD	4.3	0007	B01
SWXD3-SE/WE[3]	DD	4.3	0007	C02/A01
RZ74–VA	DD	3.57	T427B	B07
EZ31–VW[4]	SSD	0.134	V064	A01
EZ32–VW[4]	SSD	0.268	V064	A01
EZ51R–VA[4]	SSD	0.10	V096	D01
EZ54R–VA[4]	SSD	0.42	V096	A01
EZ58R–VA[4]	SSD	0.85	V109	C01
EZ64–VA[4]	SSD	0.475	V064	A01
EZ69–VA[4]	SSD	0.950	V064	A01

[1] Device types are indicated as follows: DD for disk drive and SSD for solid state devices.

[2] Minimum hardware revision supported with BA350 shelf.

[3] VW models require BA356 wide device shelves and 8-bit I/O modules.

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

Table 2
HSZ50 Tape, and Tape Library

Device	Type[1]	Capacity GB	Minimum Microcode Version	Min H/W Rev[2]
TL812[3489]	TLB	1040/2080[5]	1.2 robot /CC33 drive	A01
TL822 [3489]	TLB	5080/10560[5]	1g4F robot /CC33 drive	A01
TL826 [3489]	TLB	3520/7040[5]	1g4F robot /CC33 drive	A01
TZ87–VA[10]	TD[8]	20[5]	930A	A01
TZ87N–VA[78]	TD	20[5]	930A	A01
TZ87–TA[349]	TD	20[5]	9514	B02
TZ875–NT[38910]	TDL	100[5]	930A	A01
TZ875–TA[389]	TDL	100[5]	930A	A01
TZ877–AE /AF[38910]	TDL	140	930A	A01
TZ88N–VA[78910]	TD	20/40	CC33	A01
TZ885–NT[35789]	TDL	100/200	CC33	A01
TZ885–TA[35789]	TDL	100/200	CC33	A01
TZ887–AE[3578910]	TDL	140/280	CC33	A01

[1]Device types are indicated as follows: TD for tape drive, TDL for tape drive loader, TLB for tape library, CD for CD–ROM, OP for magneto-optical disk devices, and OPJ for optical jukebox.

[2]Minimum hardware revision supported.

[3]Requires 0.2 meter SCSI–1 to SCSI–2 transition cable, Digital internal part number 17–03831–01 for DWZZA-AA, and Digital part number 17-04367-01 for SBB DWZZA-VA and DWZZB-VW.

[4]Requires DWZZA/DWZZB single-ended to differential SCSI signal converter.

[5]Values represent compressed data. The compression factor is device dependent based on individual device algorithms.

[7]Cannot read TK50, TK70 or TZ30 format tapes.

[8]Requires KZPSA or PMAZC host adapter.

[9]Not supported by Windows NT™ systems.

[10]Tape Device Code load is supported.

Table 3
HSZ50 CD–ROM and Optical Support

Device	Type[1]	Capacity GB	Minimum Microcode Version	Min H/W Rev[2]
RRD42–VB/VU[8]	CD	0.6	1.1a	A01
RRD43–VA[8]	CD	0.6	0064	A02
RRD44–VA[8]	CD	0.6	3493	A02
RRD45–VA/VU[8]	CD	0.6	1645	A01

[1]Device types are indicated as follows: TD for tape drive, TDL for tape drive loader, TLB for tape library, CD for CD–ROM, OP for magneto-optical disk devices, and OPJ for optical jukebox.

[2]Minimum hardware revision supported.

[8]Do not warm swap this device. Make sure that the device shelf power is off when inserting or removing this device.

These lists represent the **only** devices that are supported. Digital Equipment Corporation neither supports nor recommends any device not listed for use with the HSZ50 array controller and HSOF Software Version 5.0, regardless of the supplier or stated conformance to ANSI SCSI standards. Digital will not assure correct operation of any unqualified device nor assure that such devices will not have impact on other supported devices, on the controller itself, or on a Digital system configuration.

SOFTWARE REQUIREMENTS

Digital UNIX Version 3.2c, 3.2d and 3.2g operating system.

OpenVMS Alpha Version 6.2 operating system.

Windows NT™ Alpha™ Server Version 3.51

Windows NT™ Intel ™ Server Version 3.51

SUN Solaris™ Version 2.4, 2.5 and 2.51

HP-UX™ Version 10.01 and 10.10

IBM AIX™ Version 4.1.4 and 4.2

Novell Netware™ Version 4.1

Note: Check with your local Digital Representative or reseller for additional operating system support.

DISTRIBUTION MEDIA

HSOF Software is shipped on PCMCIA program card media only.

ORDERING INFORMATION

Customers wishing to purchase HSOF Software V5.0 Software Kits or Services may order them using the following part numbers:

Table 4
Distribution and Documentation Option

QB–5CJAA–SA	HSOF HSZ50 LIC/MCD/DOC KIT
QA–5CJAA–GZ	HSOF HSZ50 DOC KIT
QT–5CJ**–**	HSOF HSZ50 Software Product Services

Customer wishing to purchase Platform software kits, including HSOF Software V5.0, documentation and any required platform specific software may order them using the following part numbers:

Table 5
Platform Kits and Adapters

Host Platform	Platform S/W kit
Digital UNIX	QB–5JCAB–SA
Digital OpenVMS	QB–5JCAC–SA
Windows NT /Alpha	QB–5JCAD–SA
Windows NT /Intel	QB–5JCAE–SA
Sun Solaris	QB–5JCAG–SA
HP-UX	QB–5JCAJ–SA
Novell Netware	QB–5JCAF–SA
IBM AIX	QB–5JCAK–SA

Note: See Host Node Software and Hardfware Required section for specific adapter support.

SOFTWARE PRODUCT SERVICES

A variety of service options are available from Digital. For more information, contact your local Digital office.

Software service for HSOF software is covered under the terms and conditions of the Integrated Hardware and Software Customer Service contracts.

Multivendor Customer Services for the HSZ50 controller and HSOF software are covered under the terms and conditions of the following:

- Hardware Customer Service contract
- Software Customer Service contract
- Media and Documentation Distribution Service (MDDS) contract

SOFTWARE WARRANTY

A 90 day Telephone Support and one year conformance to SPD Software Warranty is provided with HSOF Software V5.0. HSOF Software V5.0 is ordered and shipped separately from the HSZ50.

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