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Software Product Description

PRODUCT NAME: HSZ40 Array Controller Operating Software (HSOF), Version 2.7 **SPD 53.54.07**

DESCRIPTION

The HSZ40 Array Controller Operating Software (HSOF) is the software component of the HSZ40–B*x*/C*x* array controller. This array controller is an intelligent mass storage server that interfaces between host computer systems and SCSI-attached mass storage devices using a SCSI–2 bus. HSOF executes in the HSZ40 array controller; it processes SCSI I/O requests from hosts, performing the device-level operations required to satisfy the requests.

HSOF FUNCTIONS

HSOF performs the following functions:

- Testing and diagnosis of the HSZ40 array controller
- Host interconnect and protocol services
- SCSI device control
- Subsystem management services
- Local program support

The following sections describe these functions.

Testing and Diagnosis of the HSZ40 Array Controller

HSOF 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.

An asynchronous I/O port is provided for configuration and diagnosis. *Cache Battery Diagnostic*

Software Version 2.7 checks the condition of the optional write-back cache batteries 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, the controller with good cache batteries can be set to service the RAIDsets and disk mirrorsets. Refer to the *HSZ40 Array Controller Operating System Software Release Notes*, EK–HSZ40–RN. H01, for further information.

Host Interconnect and Protocol Services

The HSZ40 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 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 device control functions include the following:

Error Detection and Recovery

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

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For errors on the SCSI host interface, HSZ40 array controller hardware and HSOF 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 HSZ40–B*x*/C*x* controllers installed in the same controller shelf with Digital UNIX® Version 3.2 and higher operating systems as well as OpenVMS™ Version 6.2 and higher.

Device Integrity Testing

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

- Verify correct operation of individual devices
- Place the HSZ40 array controller under load to verify correct subsystem operation

Disk Striping

HSOF 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.

Error Logging

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

Asynchronous Device Swap

HSOF Version 2.7 supports asynchronous device swaps—device removal and insertion without first quiescing the device bus. Devices can be removed or inserted at any time with some restrictions. Refer to the *HSZ40 Array Controller Operating Software Version 2.7 Release Notes*, EK–HSZ40–RN. H01, for further detail.

Optional Functionalities

RAID, disk mirroring, and write-back cache are available as options. Refer to the *HS Family of Array Controllers Optional Operating Software for HSOF Version 2.7*, Software Product Description, SPD 54.38.01, for further option information.

Subsystem Management Services

HSOF provides the following subsystem management service:

Alteration of Subsystem Parameters

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

Dynamic Status Display

The HSOF VTDPY utility allows a system manager to view the HSZ40-based subsystem's state dynamically. This utility can use VT200-, VT300-, and VT400-series video terminals.

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. Refer to the *HSZ40 Array Controller Operating Software Version 2.7 Release Notes*, EK–HSZ40–RN. H01, for further detail.

Environmental Monitor Unit (EMU)

HSOF Version 2.5 and higher support EMU functionality in SW300-series cabinets for HSZ40–B*x*/C*x* products only.

Local Program Support

HSOF supports the following local utilities:

- 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 optional 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)
- SAVE_CONFIGURATION allows controllers to save a copy of the controller configuration on one or more devices in the subsystem
- DILX disk inline exerciser

- FLS for enabling and disabling optional 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: The C_SWAP implementation procedure for use with HSOF V2.0 and V2.5 was revised in January 1996. Use of the revised C_SWAP procedure is **MANDATORY** when utilizing C_SWAP on controllers running HSOF V2.0 and V2.5. HSOF V2.7 provides a higher level of subsystem availability when utilizing C_SWAP and upgrading systems to V2.7 is recommended. For a copy of the revised C_SWAP procedure contact your local MCS representative.

HARDWARE REQUIREMENTS

HSOF software requires an HSZ40–B*x*/C*x* array controller module on which to execute. The FWD SCSI bus must be properly terminated.

The HSZ40 array controller includes six SCSI device buses for connecting storage devices. The specific devices supported by HSOF Version 2.7 are listed in Table 1. 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 HSZ40 array controller via 32 SCSI LUNs.

The HSZ40–B*x*/C*x* array controller supported configurations are as follows:

HSX40–BA /CA	StorageWorks Array Controller for 36 (dual-redundant) or 42 (nonredundant) SCSI–2 and SSD devices; no Read Cache
HSZ40–BD /CD	StorageWorks Array Controller for 36 (dual-redundant) or 42 (nonredundant) SCSI–2 and SSD disk devices; includes 16 MB Read Cache
HSZ40–BF /CF	StorageWorks Array Controller for 36 (dual-redundant) or 42 (nonredundant) SCSI–2 and SSD disk devices; includes 32 MB Write-Back Cache, Disk Mirroring, and RAID options
HSZ40–TL	Two HSZ40–B*x*/C*x*StorageWorks Array Controllers for 36 dual-redundant SCSI–2 and SSD disk devices; both with 32 MB Write-Back Cache, Disk Mirroring, RAID options and a 20M cable

Configuration Restrictions

The following configuration restrictions apply:

- HSZ40–A*x* is not currently supported by the Version 2.7 release.
- Two controllers in the same BA350–M*x* controller shelf must be configured as a dual-redundant configuration.
- HSZ40–B*x* and HSZ40–C*x* controllers may be used in a dual-redundant pair with HSOF V2.7 and higher. The HSZ40–C*x* is not supported on V2.5 and lower.
- For dual-redundant configurations, HSZ40–A*x* and HSZ40–B*x*/C*x* controller modules are NOT supported in the same controller shelf.
- For HSZ40–B*x*/C*x* dual-redundant configuration failover, Digital UNIX Version 3.2 or OpenVMS Version 6.2 or higher operating system versions are required.
- A maximum of six devices may be attached to a single SCSI device bus on dual-redundant HSZ40 array controller configurations.
- A maximum of seven devices may be attached to a single SCSI device bus on nonredundant HSZ40 array controller configurations.
- A maximum combined total of 20 disk mirrorsets and RAIDsets are supported with HSOF Version 2.5 or higher.
- A maximum combined total of 30 storagesets (mirrorsets, RAIDsets, and stripesets) are supported with HSOF Version 2.5 or higher.

Host Node Hardware and Software Required

A valid Digital UNIX or OpenVMS Alpha configuration with a supported FWD SCSI interface, as referred to in the following section, is required to run HSOF software.

OTHER HARDWARE

The RAID and disk mirroring options require a write-back cache module. The Write-Back Cache option requires the HSZ40–YX cache option along with the appropriate cache module option.

Note: Hardware configuration guidelines for HSZ40 array controllers are provided in the *HS Family of Array Controller User's Guide*, EK–HSFAM–UG. D01.

The following host adapters are supported by the **Digital UNIX** operating system for HSZ40–B*x*/C*x* controllers:

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

- KZTSA (for DEC 3000™ systems)
- PMAZC (for DEC 3000 systems, requires a DWZZA signal converter)

The following host adapters are supported by the **Digital OpenVMS Alpha** operating system Version 6.2 or higher for HSZ40–B*x*/C*x* controllers:

- KZMSA (for DEC 7000, DEC 10000, and requires a DWZZA signal converter)
- KZPAA (for Digital AlphaServers 1000/2000/2100 systems)
- KZPSA (for Digital AlphaServers 1000/2000/2100)
- KZTSA (for DEC 3000 systems)
- PMAZC (for DEC 3000 systems, requires a DWZZA signal converter)

HSOF supports the following optional cache hardware:

- HSZ40–XD (Upgrades the HSZ40–BA/CA option to include a 16 MB Read Cache option)
- HSZ40–XE (Upgrades the HSZ40–BD/CD option's 16 MB Read Cache to a 32 MB Read Cache option)
- HSZ40–XF (Upgrades the HSZ40–BA/CA option to include a 32 MB Read Cache option)
- HSZ40–YX (HSZ40 Write-Back Cache option kit, includes two batteries, a battery bracket, and a Write-Back Cache option license)

HSOF supports the following optional software (HSZ40–YX is a prerequsite to these options):

- QL–4DTA9–AA HSZ Disk Mirroring Software License
- QL–3J0A9–AA HSZ RAID Software License

HSZ40–B*x*/C*x* controllers, mounted in a BA350–MA controller basic shelf, support the following packaging components:

- BA350–S*x* 8-bit SCSI shelf for devices and up to two single-ended buses
- BA356–S*x* 16-bit SCSI shelf for devices and up to two single-ended buses with 8-bit I/O module
- BA35*x*–HF 150 Watt, 48 Volt Power Supply in System Building Block (SBB), 3½ inch form factor
- BA35X-MG 8-Bit I/O Module

Table 1
HSZ40–B*x*/C*x* 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
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
RZ28M–VA/VW[3]	DD	2.1	466	A01
RZ29B–VA/VW[3]	DD	4.3	0007	B01
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–VW[4]	SSD	0.475	V064	A01
EZ69–VW[4]	SSD	0.950	V064	A01
TZ87–VA[5]	TD	20[6]	930A	A01
TZ87N–VA[57]	TD	20[6]	930A	A01
TZ87–TA[589]	TD	20 [6]	9514	B02
TZ875–NT[5]	TDL	100[6]	930A	A01
TZ875–TA[58]	TDL	100 [6]	930A	A01
TZ877–AE/AF[5]	TDL	140	930A	A01
TZ88N–VA	TD	20/40	CC33	A01
TZ885–NT[8]	TDL	100/200	CC33	A01
TZ885–TA[8]	TDL	100/200	CC33	A01
TZ887–AE[8]	TDL	140/280	CC33	A01
RRD42-VB/VU	CD	0.6	1.1a	A01
RRD43-VA	CD	0.6	0064	A02
RRD44-VA	CD	0.6	3493	A02
RRD45-VA/VU	CD	0.6	1645	A01

[1]Device types are indicated as follows: DD for disk drive, SSD for solid state device, TD for tape drive, TDL for tape drive loader, and CD for CD–ROM.

[2]Minimum hardware revision supported with the BA350 shelf.

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

[4]This device cannot be warm swapped. Make sure that the device shelf power is off when inserting or removing a solid state device.

[5]Requires KZPSA or PMAZC host adapter in configuration.

[6]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 0.2 meter SCSI–1 to SCSI–2 transition cable, Digital internal part number 17–03831–01.

[9]Requires DWZZA–AA 8-bit SE to 16-bit differential SCSI signal converter.

This list represents the **only** devices that are supported. Digital Equipment Corporation neither supports nor recommends any device not listed for use with the HSZ40 array controller and HSOF Version 2.7, regardless of the supplier or stated conformance to ANSI SCSI specifications. 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 2.0 operating system or higher. Digital highly recommends the use of Digital UNIX Version 3.2 or higher with HSZ40–B*x*C*x* controllers for failover operations. This operating system is supported with limitations identified in Chapter 8 of the *HS Family of Array Controller User's Guide*, EK–HSFAM–UG. D01.

OpenVMS Alpha Version 6.2 operating system or higher.

DISTRIBUTION MEDIA

HSOF is shipped on PCMCIA program card media only.

ORDERING INFORMATION

HSOF is shipped preinstalled with every hardware configuration that includes an HSZ40–B*x*/C*x* array controller.

For self-maintenance customers, or others who require separate ordering of software, HSOF for the HSZ40 array controllers may be ordered separately as follows:

Table 2
Distribution and Documentation Option

QL–2YJA9–AA	SWKS HSZ40 MSC TRAD LIC
QL–2YJA9–RA	SWKS HSZ40 MSC TRAD UPD LIC
QA–2YJAD–HS	SWKS HSZ40-B/C MSC PCRM KIT
QA–2YJAC–GZ	SWKS HSZ40-B/C MSC DOC KIT
QT–2YJ9A*–**	HSOF Software Product Services

Refer to SPD 54.38.01 for optional RAID, write-back cache, and disk mirroring software license ordering information.

OPTIONAL SOFTWARE

Refer to the *HS Family of Array Controllers Optional Operating Software (HSOF), Version 2.7*, SPD 54.38.01, for further information regarding the following optional software products.

RAID (RAIDsets)

HSOF treats sets of disk drives as RAIDsets (3 to 14 members) when the separately licensed RAID option is installed. Each RAIDset is presented to the hosts as a single large virtual disk.

Disk Mirroring

HSOF treats sets of disk drives as mirrorsets (2 to 6 members) when the separately licensed disk mirroring option is installed. Each mirrorset is presented to the hosts as a single large virtual disk.

Write-Back Cache

When the separately licensed write-back cache option is installed, HSOF can provide improved I/O performance by supporting write-back cache for user selected disks, stripesets, RAIDsets, and mirrorsets.

SOFTWARE LICENSING

An HSOF license is shipped with every hardware configuration that includes an HSZ40 array controller.

This software is furnished only under a license. For more information about Digital's licensing terms and policies, contact your local Digital office.

The RAID, write-back cache, and disk mirroring options require separate licenses and require that a license key be installed for correct operation. Refer to the *HSOF Array Controllers Optional Operating Software (HSOF), Version 2.7*, SPD 54.38.01, for further licensing information.

SOFTWARE PRODUCT SERVICES

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

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

Multivendor Customer Services for the HSZ40 controller and HSOF 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

Warranty for this software product is provided by Digital as defined in the Software Warranty Addendum of this SPD.

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