Software Product Description

PRODUCT NAME: HSJ Family Array Controller Operating Firmware (HSOF), Version 2.5 **SPD 47.26.07**

DESCRIPTION

The HSJ Family Array Controller Operating Firmware (HSOF) is the software component of the HSJ40 and HSJ30 array controllers. These array controllers are intelligent mass storage servers that interface between host computer systems and SCSI-attached mass storage devices using Digital Equipment Corporation's CI bus. HSOF executes in the HSJ array controller; it processes MSCP I/O requests from hosts, performing the lower-level operations required to execute these requests.

HSOF FUNCTIONS

HSOF performs the following functions:

- Testing and diagnosis of the HSJ 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 HSJ 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.

Host Interconnect and Protocol Services

The HSJ40 and HSJ30 array controllers attach to host computer systems using the CI bus. Either controller may be installed in VMScluster configurations which include up to 32 nodes, of which up to 31 nodes may be hosts.

SCSI Device Control

HSOF converts host I/O requests expressed in the MSCP protocol 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.

For errors on the CI interface, HSJ array controller hardware and HSOF cooperate to provide the following:

- Automatic retransmission of data detected as being in error
- Automatic retransmission on an alternate path if a CI path fails
- Automatic detection of internal data path errors
- Automatic failover of attached devices between identically configured HSJ controllers installed in the same controller shelf

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 HSJ 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 OpenVMS operating system as a single disk drive.

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. Refer to the *HS Family of Array Controllers Optional Operating Firmware Software Product Description* (SPD 54.38.01) for HSOF Version 2.5 for further information.

Mirroring

HSOF treats sets of disk drives as mirrorsets (2 to 6 members) when the separately licensed Mirroring option is installed. Each mirrorset is presented to the hosts as a single large virtual disk. Refer to SPD 54.38.01 for HSOF Version 2.5 for further information.

CAUTION:

OpenVMS operating system versions prior to Version 6.0 do not support real or virtual disk devices larger than about 8.5 GB as file-structured devices. Using disk devices larger than 8.5 GB with earlier versions of the OpenVMS operating system causes data corruption.

Write-Back Cache

When the separately licensed Write-Back Cache option is installed, HSOF can provide improved I/O performance by supporting write-back caching for user selected disks, stripesets, RAIDsets, and mirrorsets. For further information concerning the Write-Back Cache option, refer to SPD 54.38.01.

Error Logging

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

Subsystem Management Services

HSOF provides the following subsystem management services:

Alteration of Subsystem Parameters

HSOF includes a Command Line Interpreter (CLI) utility that allows a system manager to display and manipulate controller parameters and device configuration information.

Dynamic Status Display

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

Local Program Support

HSOF supports the following local programs:

- DILX disk inline exerciser
- TILX tape inline exerciser
- VTDPY user display for current controller state and performance data
- C_SWAP for controller and/or cache module warm swap (for dual-redundant configurations)
- FLS for enabling and disabling optional licensed features
- CFMENU for configuring controller-attached storage devices
- Code Patch (CLCP) for firmware changes
- FMU for displaying controller last failure and memory system information and control of spontaneous event logging and last failure logging displays
- CONFIG for automatically adding new devices to your configuration
- CLONE utility for obtaining snapshot copies of data (requires mirroring)

HARDWARE REQUIREMENTS

HSOF requires an HSJ40 or HSJ30 array controller on which to execute.

The HSJ40 array controller includes six SCSI device buses for connecting storage devices. The HSJ30 includes three such SCSI buses. The specific devices supported by HSOF are listed in the *OPTIONAL HARDWARE* section of this document.

HSJ30/HSJ40 array controller options are as follows:

HSJ40–AD	StorageWorks Array Controller for 36 (dual-redundant) or 42 (nonredundant) SCSI-2 Disk/Tape/Optical Devices; 16 MB Read Cache
HSJ40–AF	StorageWorks Array Controller for 36 (dual-redundant) or 42 (nonredundant) SCSI-2 Disk/Tape/Optical Devices; 32 MB Read Cache
HSJ30–AA	StorageWorks Array Controller for 18 (dual-redundant) or 21 (nonredundant) SCSI-2 Disk/Tape/Optical Devices; no Read Cache
HSJ30–AD	StorageWorks Array Controller for 18 (dual-redundant) or 21 (nonredundant) SCSI-2 Disk/Tape/Optical Devices; 16 MB Read Cache
HSJ30–AF	StorageWorks Array Controller for 18 (dual-redundant) or 21 (nonredundant) SCSI-2 Disk/Tape/Optical Devices; 32 MB Read Cache

HSOF supports the following CI adapters:

- CIXCD–AB (for XMI-based systems)
- CIXCD–AC (for XMI-based systems)
- CIBCA–B*x* (for BI-based systems)
- CI780 (for SBI-based systems)

The following configuration restrictions apply:

- A maximum of six devices may be attached to a single SCSI device bus on dual-redundant HSJ40 or HSJ30 array controller configurations.
- A maximum of seven devices may be attached to a single SCSI device bus on nonredundant HSJ40 or HSJ30 array controller configurations.
- CD–ROM devices are supported with limitations. Refer to the *HSJ Array Controller Operating Firmware Release Notes* for more specific information.
- HSJ40–YC option requires Version 2 Read Cache modules. Refer to the *HS Family of Array Controllers User's Guide* for information for determining the version type of the Read Cache module.
- A maximum total of 20 mirrorsets and RAIDsets are supported by HSOF Version 2.5.
- A maximum combined total of 30 storagesets (mirrorsets, RAIDsets, and stripesets) are supported by HSOF Version 2.5.

The RAID and mirroring options require a Write-Back Cache option.

The Write-Back Cache option requires that the HSJ40–Y*x* cache option be installed.

Note: Configuration guidelines for the HSJ40 and HSJ30 array controllers are provided in the *HS Family of Array Controllers User's Guide*.

Host Node Hardware and Software Required

A valid OpenVMS VAX, OpenVMS Alpha, or VMScluster configuration with a supported CI interface (see *OPTIONAL HARDWARE* section) is required to run HSOF software.

OPTIONAL HARDWARE

HSOF supports the following optional hardware:

- HSJ40–XE Upgrades the HSJ40–AD to 32 MB Read Cache; Mandatory return of previously installed cache
- HSJ40–YA Upgrades an HSJ40–AD with a Version 1 16 MB Read Cache option to a 16 MB Write-Back Cache option (includes a Version 2 16 MB Read Cache option and an HSJ40–YC Write-Back Cache kit)
- HSJ40–YB Upgrades an HSJ40–AD with a Version 1 32 MB Read Cache option to a 32 MB Write-Back Cache option (includes a Version 2 32 MB Read Cache option and an HSJ40–YC Write-Back Cache K=kit)
- HSJ40–YC HSJ40 Write-Back Cache Kit, includes two batteries, a battery bracket, and a Write-Back Cache option license for HSJ40 controllers with Version 2 Read Cache modules
- HSJ30–XD Upgrades the HSJ30–AA option to include a 16 MB Read Cache option
- HSJ30–XE Upgrades the HSJ30–AD option's 16 MB Read Cache to a 32 MB Read Cache option
- HSJ30–XF Upgrades the HSJ30–AA option to include a 32 MB Read Cache option
- HSJ30–YC HSJ30 Write-Back Cache kit, includes two batteries, a battery bracket, and a Write-Back Cache option license

- HSJ3X–AA HSJ30 to HSJ40 array controller upgrade; increases connectivity from a maximum of 18 devices to 36 devices (for dual-redundant configurations) and from a maximum of 21 devices to 42 devices (for nonredundant configurations

HSOF supports the SCSI-attached devices listed in Table 1.

Table 1
HSJ Family Array Controller Supported Devices

Device	Type	Capacity Gbytes	Minimum Microcode Version	Min. H/W Rev.†
RZ25–VA	dd	0.426	0900	B01
RZ26–VA	dd	1.05	T392	D02
RZ26L–VA	dd	1.05	440C	A01
RZ28–VA	dd	2.1	435E	B01
RZ28B–VA	dd	2.1	0003	A01
RZ29B–VA	dd	4.3	0007	B01
RZ74–VA	dd	3.57	T427B	B07
TKZ60–EC [2]	td	0.440	111	B01
TL820 (A01) [2,3]	tlib	4,000‡	1d3M	L1
TLZ06–VA	td	4 ‡	0491	A04
TLZ6L–VA	tl	16 ‡	0491	A01
TLZ07–VA [2]	td	8.0‡	04AQ	AX01
TSZ07–AA [2]	td	0.140	0309	A01
TZ86–VA	td	6	430B	A02
TZ87–VA	td	20 ‡	930A	A01
TZ87N–VA [4]	td	20‡	930A	A01
TZ87–TC [2,3]	td	20‡	9514	B02
TZ867–AE/AF [2]	td	42	430B	A01
TZ875–NT [4,2]	td	100‡	930A	A01
TZ875–TA [2]	td	100‡	930A	A01
TZ877–AE/AF[2]	td	140 ‡	930A	A01
RRD42–VB/VU	CD	0.6	1.1a	A01
RRD43–AA	CD	0.6	0064	A02
RRD44–AA	CD	0.6	3493	A02

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

[3]Requires DWZZA–AA 8-bit-to-16-bit SCSI adapter.

[4]Cannot read TK50, TK70, TZ30 format tapes.

†Hardware revision.

‡Values represent compressed data (compression factor is device dependent based on individual device algorithms).

Table 1 (Cont.)
HSJ Family Array Controller Supported Devices

Device	Type	Capacity Gbytes	Minimum Microcode Version	Min. H/W Rev.†
RWZ52–VA [1,5]	mod	600MB /side	3404	A01
EZ51R–VA[5]	ssd	0.1069	V096	D01
EZ54R–VA[5]	ssd	0.4277	V096	A01
EZ58R–VA[5]	ssd	0.8553	V109	C01

[1]Must be set to transportable mode.

[5]This device cannot be warm swapped.

dd = disk drive
dl = disk library
td = tape drive
tlib = tape library
CD = CD-ROM reader
ssd = solid state disk
mod = magneto optical disk
†Hardware revision.

Note: Refer to the *StorageWorks Array Controllers HSJ30/40 Array Controller Operating Firmware Release Notes*, order number EK–HSFAM–RN, for the most current information on device support and device restrictions.

This list represents the **only** devices that are supported. Digital Equipment Corporation neither supports nor recommends any device not listed for use with either HSJ array controller and HSOF, regardless of 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 HSJ array controller itself, or on a Digital system configuration.

SOFTWARE REQUIREMENTS

HSOF requires one of the following versions of the OpenVMS operating system:

- OpenVMS Alpha Version 6.1
- OpenVMS Alpha Version 1.5
- OpenVMS VAX Version 6.1
- OpenVMS VAX Version 6.0
- OpenVMS VAX Version 5.5–2
- VAX VMS Version 5.5–1

All of these are supported with limitations identified in Chapter 8 of the *HS Family of Array Controllers User's Guide*.

CONFIGURATION RESTRICTIONS

Disks attached to an HSJ array controller may be used as initialization devices for DEC 7000 or DEC 10000 processors provided the following condition is met:

- The DEC 7000 or DEC 10000 processor console code is at Version 3.1 or higher.

Disks attached to an HSJ array controller may be used as manual *and* automatic initialization devices for VAX 7000 or VAX 10000 processors provided the following conditions are met:

- VAX 7000 and VAX 10000 console code must be at Version 3.2 and include the "Single Path" patch. Later versions of the console code include the patch.
- HSOF must be at Version 1.1J or higher for HSJ40 array controllers and Version 1.4 or higher for HSJ30 array controllers.

DISTRIBUTION MEDIA

HSOF is shipped on PCMCIA program card media only.

ORDERING INFORMATION

HSOF is shipped preinstalled with every hardware configuration that includes an HSJ40 or HSJ30 array controller.

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

Software Licenses: QL–0W9A9–AA

Software Media and Docs: QA–0W9AB–HS

Software Documentation: QA–0W9AA–GZ

Software Product Services: QT–0W9A*–**

* Denotes variant fields. For additional information on available licenses, services, and media, refer to the appropriate price book.

Refer to SPD 54.38.01 for RAID, Write-Back Cache, and Mirroring software license ordering information.

SOFTWARE LICENSING

An HSOF license is shipped with every hardware configuration that includes an HSJ40 or HSJ30 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 Mirroring options require separate licenses and require that a license key be installed for correct operation. When the RAID, Write-Back Cache, and Mirroring options are ordered with the controller, the license keys are factory installed. Refer to SPD 54.38.01 for more information. The following are the license order numbers for the Write-Back cache, RAID, and disk mirroring options:

- QL–3HWA9–AA CACHE FW HSJ TRAD LIC
- QL–3HWA9–RA CACHE FW HSJ TRAD UPD LIC
- QL–3HZA9–AA RAID FW HSJ TRAD LIC
- QL–3HZA9–RA RAID FW HSJ TRAD UPD LIC
- QL–4DSA9–AA MIRRORING FW HSJ TRAD LIC
- QL–4DSA9–RA MIRRORING FW HSJ TRAD UPD LIC

SOFTWARE PRODUCT SERVICES

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

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

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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