COMPAQ

Software Product Description

PRODUCT NAME: **HSG80 Array Controller**   **SPD: 70.47.04**
                                    Software Version 8.6-1G for Fibre Channel/
                                    Arbitrated Loop

DESCRIPTION

HSG80 Array Controller Software for Fibre Channel Arbitrated Loop provides storage controller software capability for the StorageWorks HSG80 Array Controller in Fibre Channel arbitrated loop environments. The HSG80 is configured into product offerings which include the Modular Array (MA) 8000, Enterprise Modular Array (EMA) 12000, RAID Array (RA) 8000 and Enterprise Storage Array (ESA) 12000 storage systems.

Supported operating system platforms as of the publication date are:

Platform	Current Solution Kit Version	Operating System Versions	FC-AL
Windows 2000 Windows NT ProLiant & x86	V8.6	Windows 2000 SP 1, NT V4.0 SP 6a	Yes
Compaq Tru64 UNIX	V8.6	V4.0f/g, 5.1 & 5.1a	Yes
Novell NetWare	V8.6	V4.2 & V5.1	Yes
Sun Solaris	V8.6	V2.6 (32 bit), V7, & V8 (32/64bit)	Yes
HP-UX	V8.6	10.20 & 11.0	Yes
SGI IRIX	V8.6	V6.5.10 & 6.5.11	Yes
IBM AIX	V8.6	V4.3.2 & V4.3.3	Yes
Linux ProLiant & x86	V8.6	Red Hat Linux 6.2 or 7.0, SuSE Linux 6.3 or 7.0	Yes
Linux Alpha	V8.6	Red Hat Linux 6.2 or 7.0, SuSE Linux 6.3 or 7.0	Yes

The HSG80 Array Controller Software is designed to be common across multiple operating system platforms. However, there may be operational differences between platforms, and there may also be features that are not supported on every platform. Platform dependencies, interconnect configurations, feature restrictions, and requirements for host software and hardware are shown in the individual host platform kit, HSG80 Solution Software kit, V8.6x. These kits must be purchased separately, one per operating system.

Array Controller Software for HSG80

Description of ACS
The HSG80 Array Controller Software is the software component of the HSG80 Array Controller. The HSG80 Array Controller is an intelligent mass storage controller that interfaces between host computer systems using a Fibre Channel bus and attached mass storage devices, using Ultra Wide Single Ended SCSI buses. ACS software executes in the HSG80 Array Controller; it processes I/O requests from hosts, performing the device-level operations required to satisfy the requests.

ACS Software Functions

ACS software includes the following capabilities:

Host Interconnect and Protocol Services

Microsoft Cluster Server (MSCS) Support

Support for up to 84 devices per storage system

Dual Redundant Controller Operation

Testing and diagnosis of the HSG80 Array Controller

SCSI device control

Transparent Controller Failover Support

Asynchronous Disk Swap (Hot Swap)

ACS system management services

Local program support

Mirrored Write-Back Cache support

Read Ahead Cache support

Disk Mirroring capability (RAID 1)

Disk Striping capability (RAID 0, 0+1)

RAID capability (RAID 3/5)

StorageSet Expansion

Selective Storage Presentation

Disk Partitioning capability

Support for 14 drives per SCSI bus

Support for 96 host connections

The following sections describe these capabilities:

Host Interconnect and Protocol Services

HSG80 Array Controllers also utilize hubs in Fibre Channel Arbitrated Loop configurations. In loop configurations there can be a maximum of 2 dual redundant storage systems, supporting up to 8 single servers or 2 clustered pairs configured in separate loops.

The number of servers and controllers supported is operating system dependent; check the operating system solution kit for configuration and support requirements when configuring the controllers.

Microsoft Cluster Server (MSCS)

MSCS enables the hosts to share the storage system through the fibre channel bus with Windows NT cluster software. Should a failure occur on one host, the storage I/O is re-routed to the functioning host.

Storage System Device Support

HSG80 controllers using ACS V8.6-1G provide support for up to 14 devices per device port and 84 devices per dual-redundant storage system.

Dual Redundant Controller Operation

HSG80 controllers using ACS can operate as a redundant pair of controllers when configured identically and running identical software versions, including patches, and connected in the same backplane. ACS provides facilities to detect controller failure and perform automatic controller failover.

Testing and Diagnosis of the HSG80 Array Controller

ACS software internal diagnostics execute automatically whenever controller power is turned on, whenever the array controller is reset and periodically during use. LED's on the controller's front bezel provide diagnostic information upon controller failure. A local serial connection asynchronous I/O port is provided for configuration and diagnosis.

SCSI Device Control

ACS converts host I/O requests into device-specific SCSI commands. ACS software supports concurrent commands and data transfers on multiple SCSI device buses for supported disks.

ACS device control functions include the following:

Error Detection and Recovery
ACS recovers from device errors, including bad block replacement for supported disk drives that do not perform this function for themselves. For errors on the Fibre Channel host interface, HSG80 Array Controller hardware and ACS cooperate to provide the following:

- Automatic retransmission of data, if errors are detected in the original transmission.
- Automatic detection of internal data path errors.
- Automatic failover of attached devices between HSG80 controllers operating as dual redundant controllers.

Device Integrity Testing
>   ACS executes Device Integrity Test programs upon system manager command. These tests
>   perform the following functions:

- Verify correct operation of individual disk devices and units.
- Place the HSG80 Array Controller under load to verify correct storage system operation.

Error Logging
>   ACS uses SCSI protocol messages to report faulty or failing devices and controller faults to
>   connected hosts that have error logging enabled.

Save Configuration on Disk
>   ACS can save device configuration information, HSG80 controller configuration information and
>   controller software patches on to a disk. The stored information can be restored for use by a HSG80
>   replacement controller. This functionality is used for HSG80-to-HSG80 controller replacements in
>   non-redundant configurations and certain array controller product upgrades. For additional
>   information refer to the HSG80 Array Controller ACS V8.6-1 Installation and Configuration Guide
>   and the HSG80 Array Controller ACS V8.6-1 CLI Reference Guide.

Transparent Controller Failover

The ACS supports the connection of two host fibre channel buses to a dual-redundant HSG80 controller pair.
This configuration provides active ports on two separate paths. The use of transparent controller failover is
independent of the host operating system.

The controller pair provides 2 active and 2 standby ports. If the active port, on one controller, becomes non-
operational the standby port, on the other controller, will be presented to the host without host intervention.

Asynchronous Disk Swap (Hot Swap)

ACS supports asynchronous disk swaps, (also known as Disk Hot Swap). This is defined as disk removal and
insertion without regard to a quiescent device bus. Disks can be removed or inserted at any time with some
restrictions. Restrictions are noted in the user documentation.

ACS System Management Services

ACS software provides the following storage system management services:

Alteration of Storage System Parameters
>   ACS includes a command line interface (CLI) that allows a system manager to display and
>   manipulate controller parameters and device configuration information as required.
>
>   The CLI utility provides type ahead, recall and editing features. Any of the last four commands
>   entered may be recalled and edited.

Environmental Monitor Unit (EMU)
>   ACS monitors data on the state of the HSG80 controller and storage system. This data can be
>   reported via CLI and is reported in Environmental Monitor Unit (EMU) LEDs and in some cases
>   activate an audible alarm.

Local Program Support

ACS software supports the following local utilities and commands:

CLONE utility for obtaining physical copies of data in concert with Disk Mirroring software. The CLONE Utility cannot be used with partitioned units.

Code Load/Code Patch (CLCP) for controller software changes.

CONFIG for automatically adding new devices to the configuration.

DILX disk inline exerciser

FMU for displaying controller last failure and memory system failure information as well as control of spontaneous event logging and last failure logging displays.

ACS Dynamic Status Display - The ACS VTDPY utility allows a system manager to view the HSG80-based storage system's state dynamically. Terminal port connections are supported at 9600, and 19200bps.

HSUTIL - The HSUTIL utility provides the functions of device format and device code load:
- Device format enables the system manager to perform a basic format operation on a single or multiple disk device(s).
- Device code load provides the functionality to download device firmware onto supported drives via the controller.

Mirrored Write-Back Cache Capability

The battery or UPS backed write-back cache capability provides the following functions:

Stores data to be written temporarily in controller write-back cache and if the mirrored option is set, the write-back data is mirrored in the redundant controller cache for fault tolerance. The controller then 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 period of time.

Consolidates contiguously located data blocks from multiple host write requests into a single device request to reduce average latency.

On recovery from a single cache failure or power outage, the controller detects that unwritten data still exists in cache and writes it to disk media before enabling normal controller operations.

Read Ahead Cache Capability

If sequential read requests are received from the host, Read Ahead Cache allows the controller to anticipate subsequent read requests and prefetch the next data blocks. This provides read performance optimization.

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 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.

The 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.

ACS disk mirroring can utilize the UNMIRROR command to change mirrorsets back to single-disk units.

Disk Striping (RAID 0 & 0+1)

ACS treats sets of disk drives as stripesets (2 to 24 members up to a maximum storageset size of 1.024 TB) for improved I/O performance through load distribution. A stripeset appears to the operating system as a single virtual disk drive.

Striping of mirrorsets can be used for high-performance access to large amounts of highly available data.

RAID Capability (RAID 3/5)

The RAID capability provides the following functions:

Manages up to 20 sets of between 3 and 14 disks as RAIDsets (up to a maximum RAIDset size of 1.024 TB). The host views a RAIDset as a single virtual 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 5 and RAID Level 3-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.

Settable chunksize to match RAIDset performance attributes to host I/O profile.

For information regarding default chunksize, refer to the HSG80 Array Controller ACS V8.6-1 Installation and Configuration Guide and the HSG80 Array Controller ACS V8.6-1 CLI Reference Guide.

StorageSet Expansion

StorageSet Expansion allows for the joining of 2 of the same kind of storage container. StorageSet Expansion can be utilized to easily expand a storage container by concatenating RAIDsets, Stripesets or individual disks thereby forming a larger virtual disk that is presented as a single unit.

The joining of RAIDsets provides the user with the same redundancy and reliability as the individual sets without having to back-up and restore the data. StorageSet Expansion of RAID 3/5 sets provides the same functional capabilities as the original RAID 3/5 sets. In addition to the easy creation of a larger RAIDset, expanded RAIDsets can tolerate the failure of two member disks (a single member out of each original RAIDset) without loss of ability to deliver data to hosts. See the solution documentation for configuration information and restrictions.

Selective Storage Presentation

Selective Storage presentation is a feature of the HSG80 controller that enables the user to control the allocation of storage space and shared access to storage across multiple hosts. This is also known as "Restricting Host Access". In a subsystem that is attached to more than one host or if the hosts have more than one adapter, it is possible to reserve certain units for the exclusive use of certain host connections.

Disk Partitioning

ACS 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 8 partitions may be created per storage set or disk drive. Disk partitioning is supported in transparent failover. See the operating system configuration manual for any restrictions.

SCSI Bus Drive Support

ACS supports 14 devices per SCSI bus. In a maximum 6-bus configuration, the total drives supported is 84.

Host Connection Support

The ACS supports 96 host connections to a single array controller allowing the user to build and manage larger SANs by attaching to up to 24 single servers or 12 clustered pairs.

ACS HARDWARE REQUIREMENTS

ACS requires an HSG80 Array Controller on which to execute. The HSG80 Array Controller includes six ultra wide single-ended device ports. Up to 84 devices can be supported and up to 512MB of cache per controller (1.02GB per pair). Ultra SCSI wide single-ended disks may be attached to the HSG80 Array Controller. The specific devices supported are listed in the *Supported Operating Systems, Adapters, and Devices* section.

Configuration Restrictions

The following configuration restrictions apply:

> HSG80 controllers, used in FC-AL configurations, require a minimum ACS revision level of V8.6-1G for features in this document.

> With ACS 8.6-1G, the minimum cache for the HSG80 controller is 128 and 256 MB

> Two controllers in the same controller backplane must be configured as a dual-redundant configuration.

A maximum of 84 devices may be configured on a pair of HSG80.

Supports Hubs in fibre channel arbitrated loop configurations. See the Solution Kit documentation for qualified hubs and switches.

Supported Operating Systems, Adapters, and Devices

A valid operating system configuration with a supported Fibre Channel interface, as referenced in the following section, is required to operate an HSG80 controller with ACS software.

Table 1 lists the Microsoft Windows 2000 and Windows NT, ProLiant and other x86 system Hardware, Software, and host platform kit information.

Table 2 lists the Compaq Tru64 UNIX Hardware, Software, and host platform kit information.

Table 3 lists the Solaris Hardware, Software, and host platform kit information.

Table 4 lists the Novell NetWare Hardware, Software, and host platform kit information

Table 5 lists the Hewlett Packard Hardware, Software, and host platform kit information.

Table 6 lists the IBM AIX Hardware, Software, and host platform kit information.

Table 7 lists the SGI IRIX Hardware, Software, and host platform kit information.

Table 8 lists the Linux ProLiant and other x86 system Hardware, Software, and host platform kit information.

Table 9 lists the Linux Alpha Hardware, Software, and host platform kit information.

Tables 10 and 11 list the supported disk drive information.

Table 1 Windows 2000 and Windows NT on ProLiant and other x86 Systems

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
380574-001	Windows 2000 SP 1 or Windows NT 4.0 SP 6a	(KGPSA-BC) PCI to Fibre Host Bus Adapter	222322-B21
176479-B21	Windows 2000 SP1 or Windows NT 4.0 SP6a	(KGPSA-CB) PCI to Fibre Host Bus Adapter	222322-B21

Table 2 Compaq Tru64 UNIX

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
168794-B21	V4.0f/g, V5.1, and V5.1a	64-bit PCI to Fibre Channel Host Bus Adapter for Tru64 and OVMS	222320-B21
380574-001	V4.0f/g, V5.1, and V5.1a	(KGPSA-CA) PCI to Fibre Host Bus Adapter	222320-B21

Table 3 Sun Solaris

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
380576-001	V2.6 (32 bit), V7 and V8	PCI 32-bit to Fibre Host Bus Adapter	222324-B21
123503-001	V7 and V8 (64bit)	SBUS 64-bit to Fibre Host Bus Adapter	222324-B21

Table 4 Novell NetWare

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
120186-B21	V4.2 and V5.1	PCI to Fibre Channel LC Host Bus Adapter (FC-AL and Switch)	223323-B21
223180-B21	V4.2 and V5.1	Fibre Host Bus Adapter (FC-AL)	223323-B21

Table 5 Hewlett Packard

Adapter	Operating System	Adapter Description	Operating System Platform Kit
A3404A (HSC bus) A3591A (HSC bus) A3663A (HSC bus)	V10.20 and V11.0 V10.20 and V11.0 V10.20 and V11.0	HP9000/800 K- Class model 2xx, 3xx, 4xx, 5xx HP9000/800 D- Class model 2xx, 3x	222325-B21
A3636A (HSC bus)	V10.20 and V11.0	HP9000/800 T-Class	222325-B21
A5158A (PCI bus)	V11.0 V11.0 V11.0	HP9000/800 A- Class, L-Class HP9000/800 V- Class model 2250,2500 HP9000/800 N-Class	222325-B21
A3740A (PCI bus)	V10.20 and V11.0 V11.0 V11.0	HP9000/800 T- Class model 600 HP9000/800 V- Class model 2250,2500 HP9000/800 N-Class	222325-B21
218409-B21	V11.0	PCI Fibre Channel Host Bus Adaptor	222325-B21

Table 6 IBM AIX

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
149841-B21	V4.3.2 and V4.3.3	PCI to Fibre Channel Adapter for IBM (FC-AL)	222326-B21
197819-B21	V4.3.2 and V4.3.3	PCI to Fibre Channel Adapter for IBM (FC-AL, FC-SW)	222326-B21

Table 7 SGI IRIX

Adapter	Operating System	Adapter Description	Operating System Platform Kit
PCI-FC-1P & X-F-OE-KIT	V6.5.10 and V6.5.11	PCI to Fibre Channel HBA for IRIX (FC-AL)	222327-B21
XT-FC-2P & X-F-OE-KIT	V6.5.10 and V6.5.11	XIO Fibre Channel HBA (FC-AL)	222327-B21

Table 8 Linux on ProLiant and other x86 Systems

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
167432-001	Red Hat V6.2 and V7.0 SuSE V6.3 and V7.0	64-bit PCI to Fibre Channel HBA for Linux (FC-AL)	222328-B21
167433-B21	Red Hat V6.2 and V7.0 SuSE V6.3 and V7.0	64-bit PCI to Fibre Channel HBA for Linux (FC-AL, FC-SW)	222328-B21

Table 9 Linux Alpha

Compaq Adapter	Operating System	Adapter Description	Operating System Platform Kit
167432-001	Red Hat V6.2 and V7.0 SuSE V6.3 and V7.0	64-bit PCI to Fibre Channel HBA for Linux (FC-AL)	222329-B21
167433-B21	Red Hat V6.2 & V7.0 SuSE V6.3 & V7.0	64-bit PCI to Fibre Channel HBA for Linux (FC-AL, FC-SW)	222329-B21

Table 10 Supported Ultra SCSI Wide Disks

Part Number	Device/Model	Capacity GB	Microcode[1]	H/W Rev[2]
176494-B21	BC072638A2	72.8	BDC4	A01
176496-B22	BD03663622	36.4	BDC4	A01
	BD0366349C		3B02/3B06	A01
	BD036635C5		B020	A05
127968-001	DS-RZ1FC-VW	36.4	3B02/2B07/B020/BDC4	A01
147599-001	DS-RZ1FB-VW	36.4	N1H1/0372/1614/3B05	A01
188122-B22	BF01863644	18.2	3B01	A01
188120-B22	BF00963643	9.1	3B01	A01
147598-001	DS-RZ1EA-VW	18.2	3B05	A01
380589-B21	DS-RZ1ED-VW	18.2	0306/1614/3B07b020/BDC4	A01
380694-B21	DS-RZ1EF-VW	18.2	N1H1/0372	A01
388144-B22	N/A	18.2	3B05	A01
128418-B22	N/A	18.2	B016	A01
142673-B22	BD01862376 BD01862A67	18.2	BCJE B007	A01 A01
147597-001	DS-RZ1DA-VW	9.1	3B05/B020	A01
380588-B21	DS-RZ1DD-VW	9.1	0306/1614/3B07/B020	A01
380595-B21	DS-RZ1DF-VW	9.1	N1H1/0372/1614	A01
123065-B22	N/A	9.1	3B05	A01
328939-B22	N/A	9.1	3B07	A01
142671-B22	BD00962373 BD00962A66	9.1	BCJE B007	A01 A01

[1]Minimum Microcode Version
[2]Minimum Hardware Revision Level

Table 11 Other Supported Ultra SCSI Wide Disks

Part Number	Device	Capacity GB	Microcode[1]	H/W Rev[2]
—	DS-RZ1CB- VW	4.3	LYJ0/0656	A01
—	DS-RZ1CD-VW	4.3	0306	A01
380691-B21	DS-RZ1CF-VW	4.3	N1H1/1614	A01
—	DS-RZ1DB-VW	9.1	LYJ0/0307	A01

[1]Minimum Microcode Version
[2]Minimum Hardware Revision Level

Devices qualified for Compaq support are identified in the Disk Table. Compaq will not assure correct operation of any unqualified device nor assure that such devices when used will not have impact on other supported devices, on the operation of the controller, or on the operation of the system configuration.

ORDERING INFORMATION

HSG80 Array Controller Software kit is available for the HSG80 Controller when utilized in a fibre channel arbitrated loop configurations. The kit provides the software media containing ACS V8.6-1G.

A separate kit is required for each HSG80 Array Controller.

A co-requisite software kit is an operating system platform kit, HSG80 Solution Software kit, containing SWCC, and the appropriate installation scripts and drivers for each operating system. One kit is required per operating system supported. Table 12 lists the software kit part number and Table 13 lists the solution kit part numbers.

Table 12 HSG80 Array Controller Software Kit Part Number

Part Number	Service Reference Part Number	Description
235094-B21	QB-675AA-SA	HSG80 Array Controller Software (ACS) FC-AL, V8.6-1G Media and License package

Table 13 HSG80 Solution Software Platform Kit Part Numbers

Part Number	Description
222322-B21	HSG80 Solution Software for Windows NT/Windows 2000 ProLiant and other x86 systems, Media, and License package
222320-B21	HSG80 Solution Software for Tru64 UNIX, Media, and License package
222324-B21	HSG80 Solution Software for Sun Solaris, Media, and License package
222325-B21	HSG80 Solution Software for HP-UX, Media, and License package
222327-B21	HSG80 Solution Software for SGI, Media, and License package
222326-B21	HSG80 Solution Software for IBM AIX, Media, and License package
222323-B21	HSG80 Solution Software for Novell NetWare, Media, and License package
222328-B21	HSG80 Solution Software for Linux ProLiant and other x86 systems, Media, and License package
222329-B21	HSG80 Solution Software for Linux Alpha, Media, and License package

Software Product Services

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

Software service for HSG80 Solution Software is covered under the terms and conditions of the Integrated Hardware and Software Customer Service contracts.

Multivendor Customer Services for the HSG80 controller and HSG80 Solutions Software are covered under the terms and conditions of the following:

> Hardware Customer Service contract
>
> Software Customer Service contract
>
> Software Subscription Service contract

Software Warranty

HSG80 Array Controller Software is provided with 90-day Telephone Support and 90 days conformance to Software Product Description (SPD).

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