9145 OPENstorage Disk Systems Assurance Guide

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Information contained in this publication is subject to change. In the event of changes, this publication will be revised.

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About This Guide

This systems assurance guide contains information about planning, configuration, and installation requirements used during the sale, delivery, and installation of a 9145 OPENstorage Disk Disk–Array Processor Enclosure (DPE).

The information in this guide is intended for StorageTek account executives, systems engineers (SEs), and customer service engineers (CSEs) involved with installation planning. This guide is designed to provide information on what you can and cannot do.

To use this guide successfully, you should be familiar with:

- RAID configurations
- server and subsystem configurations
- disk configuration benefits and tradeoffs

Note: You can find RAID configuration information in the *The RAID Book by Paul Massiglia* (ISDN number 1–879936–90–9) manual available from the Corporate Information Center located at:

http://gandalf.stortek.com/bbs

Note: You can also find generic information regarding RAID configurations in the *Planning a 913X OPENstorage Disk Installation – Open Environments* (document number 95720) manual. You can view this manual online at:

http://gandalf.stortek.com/ctp/9131_Customer/913x.html

Organization of Information

The information in this guide is organized as follows:

"Before You Begin" contains rules, helpful hints, and open issues that you should be aware of. Additionally there are sections containing terms and URLs used in this guide.

Chapter 1 "Product Descriptions," contains specific information on the currently available 9145 OPENstorage Disk product models. Additionally, this chapter contains information about related products and available features for these product models.

Chapter 2 "Host Attachments," contains information about multi-initiator support, different host types, and the currently supported host types.

Chapter 3 "Preparing for the installation," contains customer and configuration worksheets you must fill-in and fax to the Orders Management Department.

Chapter 4 "Making Sure Everything is Ready," contains the requirements for the preinstallation meeting and a preinstallation checklist.

Appendix A "Product Specifications," contains the physical and electrical specifications for the 9145 DPE, and the 9145-P20 and CBNT C02 cabinets.

Appendix B "Feature Codes," contains information on the currently available storage system models, cabinet models, host interface features, storage processor features, disk drive features, fibre cables, and optional features.

Appendix C "Sample Configurations," contains sample 9145 DPE configurations.

Appendix D "Training," identifies the product-related training courses for Customer Service Engineers and System Engineers.

Appendix E "Documentation Information," lists and describes how to order all of the currently available product-related publications.

A Reader's Comment Form at the back of the guide is for communicating suggestions or requests for change. We encourage and appreciate reader feedback.

Trademarks

End of Preface

Before You Begin

This chapter contains rules and helpful hints you should be aware of when using this guide to configure a 9145 OPENstorage Disk Disk–Array Processor Enclosure (9145 DPE). There are some aspects of the 9145 DPE that are not fully defined. These open issues are also discussed in this chapter.

Additionally, this chapter contains terms and URLs used in this guide.

Rules

- 9145 DPE does NOT support remote maintenance.
- 9145 DPE does NOT support JBOD disk drives.
- 9145 DPE does NOT support multi–initiator configurations.
- 9145 DPE requires a minimum of 4 RAID drives.
- The Navisphere GUI requires a PC running Windows NT or Windows 95. See "Navisphere" in Chapter 1.
- Converting from 520 RAID disk drives to 512 JBOD disk drives is NOT currently supported.
- Configurations using hubs do NOT support two HBAs connected to the same SP.
- Host interface cables are NOT automatically supplied and must be ordered separately. See "Host Interface Features" in Appendix B.
- Disk drives are NOT automatically supplied and must be ordered separately. See "Disk Drive Features" in Appendix B.
- Cache is NOT automatically supplied and must be ordered separately. See "9145 Read/Write Cache SP Features" in Appendix B.
- The minimum amount of write cache required to enable cache is 32 Mbytes.
- The 9145 DPE has mandatory dual power cords on the 9145–002 and dual power cords on the 9145–P20. See "Electrical Specifications" under the appropriate cabinet type in Appendix A.
- The number of host interface kits with STK supplied HBAs must be ordered based on the number of physical attaches. See "Host Interface Kits" in Chapter 1.
- A single link control card (LCC) in a 9145 does NOT support a 9140–002 expansion unit.
- The operating system must have the most current patches installed.

- Write caching requires these hardware elements:
  - Two working power supplies
  - Two working storage processors
  - Two LCCs in the disk processor
  - Disk modules in slots 0 through 8
  - At least one standby power supply with a fully charged battery
  - Two working fans in the 9145 DPE

Helpful Hints

- Configurations using an SNFC–H01 hub have a copper cable length restriction of 10 meters (per SNBG) because of the passive GBIC type used in the hub. See "Hubs" in Chapter 1.
- The maximum copper cable length between the 9145 DPE and the 9140 DAE is 10 meters.
- Dual and single host interface kits without HBAs are now the same price and have the same content. The content is 1 or 2 CD–ROMs based on the host type, not based on whether you order a dual or single host interface kit. See "Host Interface Kits" in Chapter 1.
- Cable length limits:
  - Fibre channel copper cables (HBA to 9145) – 30 meters
  - Fibre channel copper cables (SNFC–H01) – 10 meters
  - Fibre channel optical cables – 500 meters (50 Micron optical cables)
  - Maximum distance between DAEs – 10 meters
- Navisphere is designed to replace ArrayGUIde. The Navisphere GUI only runs under Windows NT or Windows 95. See "Navisphere" in Chapter 1.
- If ordering host interface kits without HBAs it is strongly recommended that the customer use an HBA already certified by StorageTek's Open Systems Validation & Analysis (OSVA).

Open Issues

OSVA is currently addressing the following 9145 DPE and Navisphere issues. The Pinnacle issue number (where applicable) and a brief description of the issue are provided. Some of these issues might have been resolved and others added since the release of this document.

- Setting the host type was to be handled using Navisphere, but this option has not been implemented.
- Setting cache was to be handled using Navisphere, but this option has problems. See Pinnacle issue 568234.

- 559773 – SAM (HP's System Admin Manager) does not distinguish each LUN as a separate disk.
- 559786 – After rebinding LUNs, the original LUN configuration is still reported.
- 560309 – Cannot copy data from 9145 disks back to Windows NT or Windows 95.
- 564171 – After LUNs are finished binding they do not enable to the default SP. The Navisphere Manager shows them in the unowned LUN window and they cannot be seen by the server.
- 564550 – HP ioscan doesn't report true LUN configuration.
- 565216 – Replaced HDA failed to rebuild.
- 567748 – SPs intermittently stop communicating with the Navisphere Agent.
- 567915 – Veritas VxVM cannot access previously configured non-STK disks.
- 567942 – Need dual-host/dual-initiator configurations on HP platforms.
- 567943 – 9145 write cache settings are incorrect and Navisphere cannot turn off mirrored cache.
- 567986 – Emulex driver goes away after binding process ends.
- 568234 – Powertools does not correctly set cache parameters.
- 569759 – Must power off/on to implement changes.
- 573561 – Excessive Head Disk Assembly failures.
- 578892 – Panic 08-14.
- 579982- After disk failed and was replaced, disk did not become available.
- 583065- LUN failure, data lost.
- 584603 – Navisphere 3.00.12 does not correctly support serial port connections.

Terms

This section contains general information, terms, and definitions you will read about in this guide.

- The 9145 OPENstorage Disk product models (9145-002 and 9145-P20) are also known as a storage systems and as drawers.
- Multi-host refers to two server connections one into each drawer on different FC-ALs. This configuration is currently supported only on UNIX (AIX, HP-UX, IRIX, and Solaris) and Windows NT hosts.
- An HBA (host bus adapter) is a fibre channel interface card installed in the host system.

- A battery backup unit (BBU) and standby power supply (SPS) are the same component.
- A node is a generic term for any component on a network. For example a node can be a 9145, a server, or a hub.
- SCSI-FCP is a SCSI protocol implemented in fibre channels.
- An array server is a host directly attached to an array running the Navisphere agent.
- Management station is a Windows NT or Windows 95 host used to remotely manage disk arrays on array servers.
- This guide supports several host types. The currently supported host types and their operating systems are:

Host Type	Operating System
Hewlett-Packard (HP)	HP-UX
IBM - PCI Bus	AIX
Intel PC - PCI Bus	Windows NT
SGI	IRIX
Sun - PCI and Sbus	Solaris

- Command Line Interface (CLI)
- Disk-Array Enclosure (DAE) also known as array modules, which is the 9140-002 (RAID)
- Disk-Array Processor Enclosure (DPE)
- Dual Inline Memory Modules (DIMMS)
- Fibre channel arbitrated loop (FC-AL)
- GigaBit Interface Converter (GBIC)
- GigaBit Link Module (GLM)
- High speed serial data connector (HSSDC)
- Graphical User Interface (GUI)
- Just a Bunch of Disks (JBOD), which is the 9140-001
- Licensed Internal Code (LIC)
- Link Control Card (LCC)
- Multi-Platform Systems Support (MPSS)
- Network Systems Group (NSG see Storage Net Business Group)
- Open Systems Validation & Analysis (OSVA)
- Power distribution unit (PDU)
- Remote procedure call (RPC)
- Standby power supply (SPS)
- Storage area network (SAN)

- Storage Net Business Group (SNBG) formerly known as Network Systems Group (NSG)
- Storage Processor (SP)
- Storage system options package (SSOP)
- Uniform Resource Locator (URL), identifies the path you use to access the Web references in this guide

URLs

The information in this guide is changing rapidly. For the most current information refer to these URLs (which are also subject to change):

- 914X Product Specific Manuals:
  http://gandalf.stortek.com/ctp/9131_Customer/914x.html
- Knowledge Map:
  http://wwfokm.stortek.com/stkmap/Online/9145.html
- Multi-Platform Manufacturing:
  http://gandalf.stortek.com/MP_Mfg/procedures/clariion
- Multi-Platform Systems Support:
  http://americas1.stortek.com/mpss/TechTips/index.htm
- Open Systems Validation & Analysis (OSVA):
  http://bifrost.stortek.com
- Partners Page:
  http://www.stortek.com/Partners
- RAID Manuals:
  http://gandalf.stortek.com/bbs

WARNING:
All of the URL references in this guide are subject to change.

End of Before

Product Descriptions

1

This chapter contains 9145 OPENstorage Disk Disk–Array Processor Enclosure (9145 DPE) product model descriptions, related products, and features.

Models

The 914X OPENstorage Disk family currently contains these four storage system models:

- 9145–002
- 9145–P20
- 9140–002 (RAID)
- 9140–001 (JBOD)

9145 DPE

A 9145 Disk–Array Processor Enclosure (DPE) connects to a server using the server's fibre channel host–bus adapter (FC adapter) or an external hub.

Using its Fibre Channel Arbitrated Loop (FC–AL) interface, with simple FC–AL cabling, a single CBNT C02 cabinet can support one DPE and up to seven Disk–Array Enclosures (DAEs), although performance efficiency diminishes near 60 drives. The 9145 DPE can support up to eleven DAEs, but not within the same cabinet.

A 9145 DPE can reside in either a pedestal (9145–P20) or rackmount (CBNT C02) cabinet.

Table 1-1 contains additional STK and CLARiiON associations for the 9145 DPE and 9140 DAE.

Table 1-1. STK and CLARiiON Associations

Model	STK Family ID	CLARiiON
9145–002	321	FC5500
9145–P20	327	FC5500
9140–001	320	FC5000
9140–002	320	FC5000

9140-001 DAE

The 9140-001 OPENstorage Disk Disk-Array Enclosure (9140-001 DAE) is a disk array (JBOD) that uses an FC-AL as its interconnect interface. Its modular, scalable design provides additional disk storage as your needs increase.

The 9140-001 cannot be connected behind a 9145 DPE, but can be used as stand-alone disks, or combined with host-based RAID software.

A 9140-001 DAE is a basic disk enclosure without a storage processor (SP) that uses 512 bytes per sector (JBOD) disk drives.

Note: Conversion from 512 JBOD disk drives to 520 RAID disk drives is currently supported. See Conversion Bill #96992.

9140-002 DAE

The 9140-002 OPENstorage Disk Disk-Array Enclosure (9140-002 DAE) is an expansion unit for the 9145 DPE that uses 520 bytes per sector (RAID) disk drives.

Additional storage can be added to the 9145 DPE using one or more 9140-002 DAEs.

The 9140-002 DAE can reside in the same cabinet as the 9145 DPE, or in one or more separate cabinets.

Note: Conversion from 520 RAID disk drives to 512 JBOD disk drives is NOT currently supported.

Characteristics

Table 1–2 lists the characteristics for the currently available storage system models.

Table 1–2. Model Characteristics

Feature	9145–002	9145–P20	9140–002
Disk slots	10	20	10
Drawer capacity (9/18 Gbytes)	82.3/166.1 Gbytes	164.6/332.2 Gbytes	82.3/166.1 Gbytes
Storage Processor (SP)	1 Gbyte	1 Gbyte	N/A
Number of SPs	2	2	0
Redundant power & cooling	Yes	Yes	Yes
Hot pluggable components	Yes	Yes	Yes
RAID levels	0, 1, 1/0, 3, 5	0, 1, 1/0, 3, 5	Slave
Global (hot) spare disks	Yes	Yes	Slave
Read cache	Yes	Yes	Slave
Mirrored write cache[1]	Yes	Yes	Slave
Minimum memory per SP for write cache[2]	32 Mbytes	32 Mbytes	N/A
Host interface per SP	100 Mbytes Fibre Channel	100 Mbytes Fibre Channel	N/A
Drive interface (Number of buses)[3]	100 Mbytes/second Fibre Channel (with redundancy)	100 Mbytes/second Fibre Channel (with redundancy)	100 Mbytes/second Fibre Channel (with redundancy)
Pedestal cabinet	No	Yes	No
Rackmount cabinet	Yes	No	Yes
Maximum capacity per cabinet (9/18 Gbytes) (90 drives)	740.7/1494.9 Gbytes	164.6/332.2 Gbytes	740.7/1494.9 Gbytes

Note 1: 512 Mbytes of write cache on an SP is divided into 256 for use by this SP and 256 to mirror the peer SP.

Note 2: Minimum configuration for write cache is 9 drives, 2 SPs with 32 Mbytes each, 2 power supplies, a standby power supply, and 2 LCCs.

Note 3: Performance might vary depending on the capabilities of the HBA being used.

Related Products

This section describes these related products:

- Navisphere
- Powertools
- DAE Monitor
- Hubs
- Media Interface Adapters
- Switch
- Bridge

Requirements

This section contains requirements for running Navisphere products.

- Intel-compatible laptop, workstation, or server running Windows NT Workstation or Server Rev 4.0 (or greater) with Service Pack 3
- 64 Mbytes of RAM
- 6 Mbytes of free disk space
- Monitor with a minimum screen resolution of 1024 x 768 and 256 colors with small fonts (required to run Navisphere Analyzer, but not other Navisphere software)
- Fibre connection to the 914X from a Windows NT workstation or server on which Powertools is installed

  - OR -

  Fibre or serial connection to the disk array from a LUN connected to the host running the Navisphere Agent
- TCP/IP protocol installed and configured

Navisphere

This section contains information about Navisphere storage management software tools.

Agent/CLI

The Navisphere Agent for UNIX (AIX, HP-UX, and Solaris) and Windows NT (with Service Pack 3) environments let Navisphere CLI, Supervisor, Manager, Organizer, and Analyzer (referred to as Navisphere storage management software or client utilities) access 9145 Fibre Channel disk-array storage systems on UNIX and Windows NT hosts.

The Navisphere CLI (Command Line Interface) is an interface to the Navisphere Agent and an alternative to the Navisphere Supervisor/Manager. The Navisphere Agent and client utilities communicate with each other over a TCP/IP network using remote procedure calls (RPCs). The Navisphere Agent and the storage system (LIC running in an array's SPs) communicate with each other using a SCSI–FCP over an FC–AL, or a serial communication port. The Navisphere CLI runs on an array server or a management station. CLARiiON recommends that you run the Navisphere CLI from a management station.

Supervisor

The Navisphere Supervisor is supplied in the host interface kit (free of charge) and is a minimized version of the Navisphere Manager. Remote management is performed by the Navisphere Manager.

Manager

The Navisphere Manager provides a graphical user interface that lets you configure and manage 9145 fibre channel storage systems, from a physical component viewpoint. The Navisphere Manager can be used to configure a storage system's physical disks into logical units (LUNs) and monitor the status of the physical disks and other field–replaceable units (FRUs) that make up a storage system. The Navisphere Manager provides remote management over a network for non–direct attach arrays.

Event Monitor

The Navisphere Event Monitor logs the status of 9145 DPEs with fibre channel disks connected to servers on a network. You can specify the storage systems for which the Navisphere Event Monitor logs status and the range of event messages to log.

When the Navisphere Event Monitor logs a status message, you can have Navisphere Event Monitor automatically start any application that is invoked from the command line. Such an application might send an error message to the system event log or an electronic mail message, fax, or page to the administrator of the storage systems.

Organizer

The Navisphere Organizer provides a graphical user interface that lets you manage 9145 DPEs with fibre channel disks from a logical viewpoint, rather than from the physical component viewpoint that Navisphere Manager provides. The Navisphere Organizer can monitor the status and performance of LUNs, and groups of LUNs on the storage systems. The LUNs within a group can be on different storage systems on different hosts. For example, if you have different storage systems each with LUNs that store parts of the

same large database, you can group these LUNs together, and monitor the status and performance of the entire database group, in addition to monitoring the status and performance of the LUNs that make up the group.

Analyzer

The Navisphere Analyzer performance monitor program measures the performance of 9145 DPEs and slave 9140 DAEs.

Powertools

Powertools is a single, comprehensive collection of maintenance and diagnostic tools that run on Windows NT (agent) or Windows 95 platforms (GUI). Powertools provides access to all critical information contained within the Licensed Internal Code (LIC) via a disk-array serial port.

Agent

The Agent reads a configuration file on startup to determine several operating parameters, including the communication path. The Agent runs on UNIX (AIX, HP-UX, and Solaris) and Windows NT servers attached directly to an array.

Supervisor

The Supervisor is supplied in the host interface kit (free of charge) and is a minimized version of the Manager. The Supervisor only functions on the host. Remote management is performed by the Navisphere Manager.

CLARVOiiANT

CLARVOiiANT is a graphical interface that provides point and click access to the 9145 DPEs status and performance. The tool's script generating feature creates and saves scripts that provide information required for troubleshooting. CLARVOiiANT also provides the ability to download LIC (FLARE) or disk drive microcode, and retrieve LIC dump information. CLARVOiiANT only runs on Windows NT or Windows 95 platforms.

DAE Monitor

The DAE Monitor (DAE Mon) lets you monitor the operation of 9140-001 DAEs connected to Windows NT. DAE Mon runs on the server with the attached 9140-001 DAEs. DAE Mon is a minimal GO-NO-GO tool that verifies communication and function of a 9140-001.

Hubs

Hubs add flexibility to a fibre channel arbitrated loop (FC–AL). Hubs allow multiple interface media (copper and optic) types to exist within the same FC–AL. Hubs also allow for uninterrupted operation of the FC–AL if one subsystem is removed for service or reallocation of resources.

Each hub can only be part of one FC–AL regardless of the number of interfaces it contains. Therefore, the total bandwidth of the hub is limited to 100 Mbytes/second.

There are two supported hubs for the 9145 DPE:

- SNFC–H01 (copper and fiber optic)
- CHUB–001 and CHUB–002 (copper only)

SNFC–H01

The StorageNet Fibre Channel Hub 1000 model number SNFC–H01 (Vixel). These hubs have seven ports for connecting nodes. Each port consists of a removable module called a GigaBit Interface Converter (GBIC). GBICs are copper or fiber optic based.

Note: A copper interface (by standard) supports a cable length of 30 meters, but the currently supplied passive copper GBIC only supports 10 meters. A 30 meter active copper GBIC is planned for future release.

The 50 Micron fiber optic GBIC is shortwave laser technology and supports a distance of up to 500 meters. A longwave (9 Micron) fiber optic GBIC is planned for future release and will support 10 kilometer distances.

Note: You are required to order special cables for the SNFC–H01.

If this hub is used in a configuration, both the copper and optical GBIC features must be ordered even if the quantity is zero.

CHUB–001 and CHUB–002

The supported copper native fibre channel hubs for the 9145 DPE are model number CHUB–001 and CHUB–002 (Gadzooks). These hubs have nine ports for connecting nodes. These hubs do NOT support GBICs.

CHUB hubs support a cable length of 30 meters. CHUB hubs use DB9/DB9 cables or can be used with Media Interface Adapters for optical attaches. See “Media Interface Adapters” in Appendix B.

Note: You are required to order special cables for the CHUBs.

Hubs can be installed in a CBNT C02 (using 2U) which houses one or two fibre channel hubs.

Appendix B lists the currently available hubs.

Media Interface Adapters

A media interface adapter (MIA) converts a copper interface connection to optical and vice versa. MIAs allow fiber optic cable lengths up to 500 meters between nodes.

MIAs can be attached to a DB9 copper HBA, hub, or subsystem.

MIAs are ordered in sets of one, two, three, or four. Four MIAs can be used in a high availability configuration with two optical HBAs.

Appendix B lists the currently available MIAs.

FC-AL Rules and Guidelines for cabling

StorageNet hubs support fiber optic cables with an optical GBIC instead of an MIA. Copper cables are connected to the hub with a High Speed Serial Data Connector (HSSDC) and a DB9 connector at the 9145 end (or at the host end).

HP connections use a native HP fibre channel card which has an optical cable interface.

For example, to connect an HP server running HP-UX 10.20 (with dual HBAs) to a 9145-P20 that is 200 meters away, you could use:

- One (1) StorageNet hub
- Two (2) optical GBICs
- Two (2) copper GBICs
- Two (2) 10 meter copper cables
- Two (2) 250 meter optical cables

For another example, to connect a PC running Windows NT 4.0 to a 9145-P20 that is 200 meters away, you could use:

- Two (2) MIAs - **OR** - One (1) MIA and One (1) HBA with an optical Gigabit Link Module (GLM)
- One (1) 200 meter optical cable

Switch

The StorageNet Fibre Channel Switch 4000 (switch) is a 16–port fibre channel gigabit switch consisting of a motherboard, processor board, connectors for supporting up to eight dual–port interface cards, and software for building and managing a fabric. A fabric is an active intelligent, nonshared interconnect scheme for nodes. Connecting one or more switches creates a fibre channel fabric.

The switch will allow zoning to LUN granularity with zone definition commands. Each host exclusively sees its own LUNs (when available).

Bridge

The StorageNet Fibre Channel/SCSI Bridge 3100 (bridge) provides a migration path for legacy SCSI devices to connect to fibre channel based Storage Area Networks (SANs).

The bridge is attached to an FC–AL or switch on its fibre channel interface and a SCSI bus to support up to 15 SCSI target devices on its SCSI interface. Using configuration settings, the bridge makes the SCSI bus devices available on a fibre channel based SAN. Once configuration is defined, operation of the bridge can also be deployed as a means to connect a SCSI based server to a fibre channel based SAN when HBAs are not available for the particular server or when the customer wants to implement a conservative migration from SCSI to a fibre channel based SAN.

Features

The scalability and configurability of the 9145 OPENstorage Disk models require many features. This section describes:

- Host interface kits
- Storage processor options
- Disk drives
- Cabinet types
- Fibre cables
- Terminator

Host Interface Kits

A host interface kit contains the necessary components for connecting a storage system to the customer's host system.

There are two (single and dual) host interface kits for each host type.

- **Single SP attach** – attaches one SP to one host bus adapter (HBA) to a single server.
- **Homogeneous SP attach** – dual attaches two SPs to two separate HBAs of the same server type.
- **Heterogeneous SP attach** – dual attaches to two SPs to two separate HBAs of different server types. (SSOP must match.)

The dual host interface kit is essentially the same as two single host interface kits, but only one set of documentation ships with the dual kit.

You can view the most current list of host interface kits at this URL:

http://gandalf.stortek.com/MP_Mfg/procedures/clariion

Depending on the host type, the host interface kit might contain:

- Host bus adapter (HBA) card – is provided for all PC and Sun (except JBOD) environments.
- Host Software Media (HSM) – contains installation scripts or drivers that need to be loaded when the storage system is installed.
- Navisphere software and documentation (if applicable) – runs on Windows NT or Windows 95 host platforms and allows monitoring and control of the storage system.
- Manual for attaching the storage system to a specific host.
- RS–232 cable – attaches a serial COM port on an NT workstation to one SP COM port on the storage system enabling configuration of the storage system if the Navisphere Agent software is not available on the host platform.

Appendix B lists the currently available host interface kit feature codes.

Storage Processor Options

Storage processors (SPs) are available in single or dual configurations with cache sizes ranging from 32 Mbytes to 1 Gbyte, although cache with less than 128 Mbytes is not recommended.

Appendix B lists the currently available SP feature codes.

Disk Drives

The 9145 and attached 9140–002 expansion units use 520 bytes per sector (RAID) disks which can be bound in any supported RAID configuration. Capacities can be intermixed in a drawer, however intermixing within a RAID group (LUN) is not supported.

Disk drives are available in two sizes:

- 9 Gbytes (usable capacity is 8.23 Gbytes)
- 18 Gbytes (usable capacity is 16.61 Gbytes)

Disk drives are available in two different formats: JBOD and RAID. Only RAID disk drives can be used for the 9145 DPE. JBOD drives MUST NOT be used or mixed on a 9145 DPE and its 9140–002 DAE expansion units.

Currently when you place a new order, you can only order one size disk drive per storage system. After the original order, you can order additional disk drives via a conversion bill, even a different size, to install in the storage system.

Appendix B lists the currently available disk drives.

Capacity Range

Table 1–3 contains the minimum and maximum number of drives for each storage system.

Table 1–3. Capacity Range

Storage System	Number of drives	Supported Gbytes	Number of HDAs for Write Cache
9145–002	3 to 10 per storage system	9 and 18	9
9145–P20	3 to 20 per storage system	9 and 18	9

Hot Spare

A hot spare, once bound, is global and can be used as a replacement drive for LUNs attached to either SP A or SP B.

A hot spare CANNOT be:

- defined in a database (FLARE code drive) location
- bound in a cache vault drive location (enclosure 0 slots 0 through 8)

Note: In the DPE cabinet only slot 9 can be a hot spare. A hot spare can be in any slot in the 9140–002 expansion units.

Table 1–4 lists the cache vault drive and database drive locations that you cannot use for a hot spare.

Table 1–4. Drive Locations

Storage System	Vault drives	Database drives
9145–002	0 – 8	0_0, 0_1, 0_2
9145–P20	0 – 8	0_0, 0_1, 0_2

RAID Drives

Table 1–5 contains the allowable number of drives for each RAID configuration.

Table 1–5. RAID Drive Requirements

RAID Configuration	Number of drives
RAID 0	3 – 16
RAID 1	2
RAID 1/0	4 – 16
RAID 3	5
RAID 5	3 – 16
Hot spare	1

Usable RAID Capacity

Each RAID LUN extracts a certain amount of storage from the total usable capacity, except for RAID 0 which is the only unprotected RAID group. Table 1–6 lists the percentage of lost capacity in each of the supported RAID configurations.

Table 1–6. Lost Capacity Percentage

RAID Configuration	Lost Capacity	Comments
RAID 0	0%	Data striping – no data protection
RAID 1	50%	One drive mirrored to another
RAID 1/0	50%	A mirrored RAID 0 group
RAID 3	20%	One drive of 5 is a parity device
RAID 5	1 disk	Only one drive of the 3 to 16 drives in the LUN is allocated for rotating parity

Non-RAID Drives

Any unused disk in a cabinet can be configured as an individual disk. There is no lost capacity for this LUN. There is no data protection for this disk.

Cabinet Types

Storage systems can reside in either a pedestal (9145-P20) or rackmount (CBNT C02) cabinet.

All pedestal and rackmount cabinets ship with one or more servicing manual(s) for the type of storage system(s) in the cabinet.

Appendix A lists the currently available cabinets.

Pedestal

A pedestal cabinet (9145-P20) can be used by all storage system models and contains a DPE and one DAE mounted vertically.

The 9145-P20's power source is auto-ranging from 100 to 240 VAC at 47 to 63 Hz. The pedestal cabinet can be plugged into a standard single phase wall outlet. The circuit must be capable of supplying the 8.0 Amps (maximum start up current @ 100 VAC) which is required by these pedestal cabinets.

The power cord that automatically ships with the 9145 DPE is the North American standard three-prong 120 VAC (NEMA 5-15P) to IEC-320 type.

Appendix B lists the specifications for the currently available 9145-P20, and the part number and feature code for the power cord.

Rackmount

A rackmount cabinet (CBNT C02) can be used by all 9145-002s and 9140-002s, and can contain one to eight horizontally mounted drawers. CBNT C02s allow customers to mount multiple drawers of the same, or combinations of, storage system models in one cabinet.

The currently available rackmount cabinets are:

- CBNT C02 cabinet
- Customer-supplied cabinet

Storage systems can be mixed in a rackmount cabinet. Refer to the *CBNT C02 Installation Manual* (document number 95794), for the rules on intermixing storage systems in a rackmount cabinet.

Kits provide rack mounting hardware for the CBNT C02 (feature code C02R) cabinet. If a customer wants to mount the drawers in a customer-supplied cabinet, the customer must provide the rack mounting hardware.

The CBNT C02 is connected to the AC power source by a NEMA or Hubbell power cord on all North American installations.

Note: You are required to order a feature code for power cords for every CBNT C02 cabinet.

The CBNT C02's AC distribution unit (ACDU) supplies AC power to the installed storage system(s). The internal power cords for rackmount cabinets are automatically supplied with the CBNT C02 cabinet.

Appendix B lists the specifications for the currently available CBNT C02, and the part numbers and feature codes for the power cords.

Fibre Cables

This section describes the fibre cables:

- Host interface cables (single and dual kits)
- Expansion unit cables

Host Interface Kit Cables

The single host interface kits for the 9145/9140–002 attach one SP to one host bus adapter (HBA) in a specific host type.

The dual host interface kits attach two SPs to two separate HBAs of the same host type. The HBAs are normally in the same machine, but can be in two different hosts as long as they use the same storage system options package parameter (multi–host, not multi–initiator.)

Note: Cables do NOT ship with the host interface kits. You must order the cables for the host interface kits separately.

Appendix B lists the part numbers for the currently available host interface cables.

Expansion Unit Cables

A .3 meter expansion unit fibre cable feature connects:

- a 9145 to a 9140–002
- multiple 9140–002s together

Note: This expansion unit cable ships automatically with the 9145 DPE and each DAE (one cable per LCC).

Terminator

Fibre channel topology does not require termination, therefore no external terminators are used or provided.

End of Chapter

Host Attachments

2

This chapter contains host attachment information, including information on:

- Multi-initiator support
- Different host types (connecting to)
- Supported host types

Multi-Initiator Support

The issue of multi-initiator support arises when the customer wants to connect two or more HBAs to the same FC-AL bus for redundancy, manual failover, or concurrent access.

Note: It is strongly recommended by CLARiiON and STK that you do not connect two HBAs to the same 9145 SP. Cluster software is required for multi-initiator configurations.

Different Host Types

Setting the host type was to be handled using Navisphere, but this option has not been implemented. See "Known problems" in Before You Begin.

STK currently supports two multi-host configurations:

- Windows NT to Windows NT
- Windows NT to Sun

Additional multi-host configurations might be available since the release of this document. You can view the most current configurations at this URL:

http://gandalf.stortek.com/MP_Mfg/procedures/clariion

Supported Host Types

This section lists these currently supported host platforms and the supported operating system levels of those host types:

- HP – HP supplied HBA (D, K9000, or T600 class only)
- IBM – PCI Bus
- Intel PC – PCI Bus
- SGI
- Sun – PCI and Sbus

Additional host platforms might be available since the release of this document. You can view the most current list at this URL:

http://gandalf.stortek.com/MP_Mfg/procedures/clariion

HP

HP attaches require special FLARE code.

You must set the storage system options package (SSOP) to 2 or A (depending on the configuration). For specific information on the configuration, see this URL:

http://americas1.stortek.com/mpss/TechTips/index.htm

Table 2–1. HP

Hardware	D, K9000, or T600 class machines
HBA	A3404A, A3591A, A3636A
Software	HP–UX 10.20 and higher
Navisphere Agent/CLI	3.00.12
Navisphere Event Monitor	3.00.12
Navisphere Supervisor for Windows NT	3.00.12
Navisphere Analyzer	3.00.12 for Windows NT 4.0
ATF	N/A

IBM – PCI Bus

Table 2–2. IBM – PCI Bus	
Hardware	RS/6000 machines (except for S70 machines)
HBA	Emulex LP6502–T1, 7000E–T1, 7000N1 (fiber optic)
Software[1]	AIX 4.2.1, 4.3, 4.3.1
Navisphere Agent/CLI	3.00.12
Navisphere Event Monitor	3.00.12
ATF	2.1.6
Note 1: ATF 2.1.6 does NOT support AIX 4.3.1.	

Intel PC – PCI Bus

Table 2–3. Intel PC – PCI Bus	
Hardware	All PCI–based Intel processor PCs
HBA	CLARiiON supplied QLogic QL2700, Emulex LP6502–T1, 7000E–T1, 7000N1 (fiber optic)
Software	Windows NT 4.0 with Service Pack 3
Navisphere Agent/CLI	3.00.12 for Windows NT 4.0
Navisphere Event Monitor	3.00.12 for Windows NT 4.0
Navisphere Supervisor	3.00.12 for Windows NT 4.0
Navisphere Analyzer	3.00.12 for Windows NT 4.0
ATF	1.05

SGI

Table 2–4. SGI	
Hardware	All Origin, Onyx, and Octane machines
HBA	Emerald[1]
Software	IRIX 6.3
Navisphere Agent/CLI	N/A
ATF	N/A
Note 1: SGI proprietary HBA. Tested by OSVA.	

Sun – PCI Bus

Table 2–5. Sun – PCI Bus	
Hardware	All SPARC, Ultra, (except Ultra 5, 10, and 60 servers), and Enterprise class machines
HBA	Emulex LP6502E–T1, 7000E–T1, 7000N1 (fiber optic)
Software	Solaris 2.5.1, 2.6
Navisphere Agent/CLI	3.00.12
Navisphere Event Monitor	3.00.12
Navisphere Supervisor for Windows NT	3.00.12 for Windows NT 4.0
ATF	1.29

Sun – Sbus

Table 2–6. Sun – Sbus	
Hardware	All SPARC, Ultra, (except Ultra 5, 10, and 60 servers), and Enterprise class machines
HBA	Jaycor 1063, Sun X6730A[1]
Software	Solaris 2.5.1, 2.6
Navisphere Agent/CLI	3.00.12
Navisphere Event Monitor	3.00.12
Navisphere Supervisor for Windows NT	3.00.12 for Windows NT 4.0
ATF	N/A
Note 1: This HBA must be ordered directly from Sun.	

End of Chapter

Preparing for the Installation

3

This chapter contains the worksheets that identify the STK and customer personnel, and the configuration worksheets that must be completed prior to installing a 9145 OPENstorage Disk Disk–Array Processor Enclosure (9145 DPE) at a customer site.

Instructions:

1. Identify the customer and StorageTek contacts.
2. Ask the following questions to complete the worksheets:
   a. Is this a *unique* configuration, such as two different hosts or expansion 9140–002 units?
   b. Are any cables required?

      Note: Cables are NOT automatically supplied and must be ordered separately.
   c. Is customer–supplied HBA supported?

   Note: If a. is yes, or c. is no, open a Pinnacle issue now.
3. Review the items with the customer.
4. Fax a copy of the worksheets to Orders Management at 1–303–673–2640.

The information provided in these worksheets helps to ensure a successful installation.

■ Worksheets

This section contains the worksheets you need to fill out and fax to the Orders Management Department (OMD). These worksheets are compared to the order to ensure that all of the necessary components, contacts, and miscellaneous stuff has been considered.

The fax number for Orders Management is 1–303–673–2640.

STK Representatives

The STK account executive needs to provide OMD with STK representative information.

Figure 3–1 provides a place to record this STK representative information.

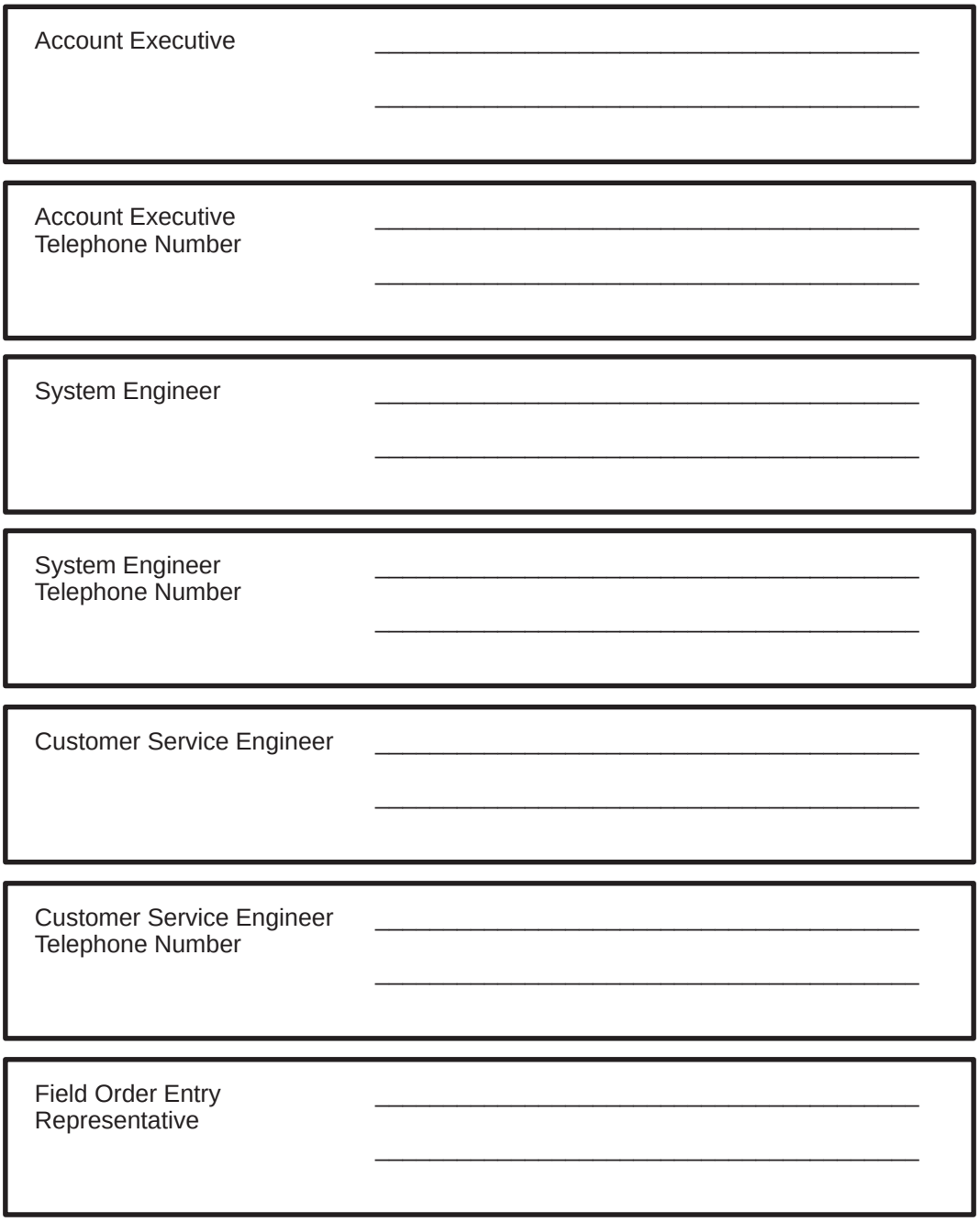


Figure 3–1. STK Representative Information

Customer Information

Figure 3–2 provides a place to record customer information.

Account Name	_____
	_____
Site Location Number	_____
Shipping Address	_____
	_____
	_____
	_____
Computer Room Telephone Number(s)	_____
	_____
Receiving Contact Name	_____
Receiving Contact Telephone Number	_____
System Administrator Contact Name	_____
System Administrator Contact Telephone Number	_____

Figure 3–2. Customer Information

Configuration Information

Table 3–1 and Table 3–2 are designed to help the field and headquarters understand exactly what the customer is ordering.

If SPA and SPB are connected to the same host, you can just write "same host" in that column.

You can view a list of currently supported configurations at this URL:

http://wwfokm.stortek.com/stkmap/Online/913x_Connect/b05june98.html

–OR–

You can view a list of currently supported configurations following this path from the MPSS URL:

http://wwfokm.stortek.com

1. Select **Online** in the left–hand frame
2. Select **OPENstorage Disk Family – 9140** under Products
3. Select **Connectivity** under Technical
4. Select **913X, 9140, and 9145 Engineering Support Notification**

If the configuration is not supported, you **MUST** complete and return the Host Configuration Survey to the Sales Support Desk (fax 303–661–2800 or Email SalesSupport@louisville.stortek.com). The survey is at this URL:

http://bifrost.stortek.com/unsupported.htm

If SPA and SPB are connected to different platforms, or if the host bus adapter (HBA), or if the cables are different between two SPs in the same drawer, write the specifics of each attach under the column for the SP.

Be sure to include the host attachments for the SPs and indicate whether any 9140–002 expansion units are configured.

Table 3–1. Configuration Information		
Is this a supported configuration?	Yes No	
Drawer Type	9145–002 9145–P20	
Power Source Type[1]	9955 9956 9953	9930
Cabinet Type	Rackmount	Pedestal
	SPA	**SPB**
Read cache		
Write cache		
Host Platform		
Host Bus Type		
HBA Model		
SSOP Number		
Cable Type		
Cable Length		
Hub Type	SNFC–H01 CHUB–001 CHUB–002	
Drawer Number	Cab #__ Drw #__	Cab #__ Drw #__
Drives[2] 0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
Note 1: Appendix B contains power source information.		
Note 2: Specify drive size (for example 9 Gbyte or 18 Gbyte).		

Table 3–2. 9140–002 Expansion Unit Information			
		SPA	**SPB**
Drawer Number		Cab #__ Drw #__	Cab #__ Drw #__
Drives[1]	0		
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
	9		
Drawer Number		Cab #__ Drw #__	Cab #__ Drw #__
Drives[1]	0		
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
	9		

Table 3–2. 9140–002 Expansion Unit Information			
		SPA	**SPB**
Drawer Number		Cab #__ Drw #__	Cab #__ Drw #__
Drives[1]	0		
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
	9		
Drawer Number		Cab #__ Drw #__	Cab #__ Drw #__
Drives[1]	0		
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
	9		
Note 1: Specify drive size (for example 9 Gbyte or 18 Gbyte).			

Sample Configuration Information

This section contains samples of completed configuration information worksheets.

Table 3–3. Configuration Information Example			
Is this a supported configuration?		*Yes* No	
Drawer Type		*9145–002* 9145–P20	
Power Source Type[1]		*9955* 9956 9953	9930
Cabinet Type		*Rackmount*	Pedestal
		SPA	**SPB**
Read cache		*128*	*128*
Write cache		*128*	*128*
Host Platform	*HP*		
Host Bus Type			
HBA Model	*A3404A*		
SSOP Number		*2*	*2*
Cable Type	*optical*		
Cable Length	*50 meters*		
Hub Type		SNFC–H01 CHUB–001 CHUB–002	
Drawer Number		Cab # *1* Drw # *0*	Cab # *1* Drw # *0*
Drives[2]	0	*9 – RAID 5*	
	1	*9 – RAID 5*	
	2	*9 – RAID 5*	
	3	*9 – RAID 5*	
	4	*9 – RAID 5*	
	5		*9 – RAID 1/0*
	6		*9 – RAID 1/0*
	7		*9 – RAID 1/0*
	8		*9 – Hot Spare*
	9	*9 – RAID 5*	
Note 1: Appendix B contains power source information.			
Note 2: Specify drive size (for example 9 Gbyte or 18 Gbyte).			

Table 3-4. 9140-002 Expansion Unit Information Example			
		SPA	**SPB**
Drawer Number		Cab # 1 Drw # 1	Cab # 1 Drw # 1
Drives[1]	0	*9 – RAID 1*	
	1	*9 – RAID 1*	
	2		*9 – RAID 5*
	3		*9 – RAID 5*
	4		*9 – RAID 5*
	5		*9 – RAID 5*
	6		*9 – RAID 5*
	7	*9 – Hot Spare*	
	8	*9 – Hot Spare*	
	9	*9 – Individual Disk*	
Drawer Number		Cab # 1 Drw # 2	Cab # 1 Drw # 2
Drives[1]	0	*9 – RAID 3*	
	1	*9 – RAID 3*	
	2	*9 – RAID 3*	
	3	*9 – RAID 3*	
	4	*9 – RAID 3*	
	5		*9 – RAID 3*
	6		*9 – RAID 3*
	7		*9 – RAID 3*
	8		*9 – RAID 3*
	9		*9 – RAID 3*

Delivery Information

Use Table 3–5 to record delivery information. Answer all of the questions as completely as possible. This information helps resolve any delivery issues.

Table 3–5. Delivery Information

Item Description		
Receiving dock available	Yes	No
Access for 45’ truck	Yes	No
Receiving dock height	Standard 36” to 46”	Nonstandard _____
Receiving dock clearance	Standard 14’ or over	Nonstandard ____
Receiving dock hours		
Dock access limitation(s)	Yes	No
Lift gate truck required	Yes	No
Inside delivery required	Yes	No
If inside delivery, is equipment uncrated?	Yes	No
Fork lift available	Yes	No
Pallet jack available	Yes	No
Upstairs delivery required	Yes	No
Floor covering	Yes	No
Length of floor covering		
Type of floor covering		
Elevator available	Yes	No
Elevator inside dimensions		
Elevator hours		
Maximum weight		

End of Chapter

Making Sure Everything is Ready

4

This chapter provides a preinstallation checklist to make sure everything is ready to install the 9145 OPENstorage Disk Disk–Array Processor Enclosure (9145 DPE).

Preinstallation Meeting

The preinstallation meeting should be scheduled by the StorageTek marketing representative as soon as the Worldwide Orders and Movements department issues a delivery schedule. The meeting must take place *at least one week prior* to the shipment. All StorageTek and customer team members should be present.

At the preinstallation meeting, the members should:

1. Review each part of this *System Assurance Guide* to ensure that all preshipment requirements have been met or will be met on time.
2. Assure that the appropriate StorageTek personnel have received the required training for the installation of the storage system at the customer site.
3. Verify that all necessary manuals and documentation have been distributed and/or ordered.
4. Verify that the operating system has the most current patches installed.
5. Schedule vendor service representative to install HBA, if necessary.
6. Document any preinstallation requirements that have not been met and initiate action to complete the tasks before shipment.

Note: Installations of the 9145 DPE are more successful when ALL of these preinstallation issues are met.

Preinstallation Checklist

Review and verify that all issues listed in Table 4–1 have been addressed and resolved. Circle the appropriate response for each item. For unresolved issues, assign a required action with a due date to the appropriate team members.

Table 4–1. Preinstallation Checklist

Item Description	Yes/No/NA	Action Required / Due Date / Person Responsible
Site Preparation		
Floor plans completed	Yes/No/NA	
Future expansion considered	Yes/No/NA	
Clearance adequate	Yes/No/NA	
Floor tiles prepared	Yes/No/NA	
Power requirements met (Two 30 Amp breakers are required for each CBNT C02)	Yes/No/NA	
Cooling adequate	Yes/No/NA	
Cable lengths determined	Yes/No/NA	
Cable routing established	Yes/No/NA	
Dock facilities scheduled	Yes/No/NA	
Hardware Procurement		
Storage system ordered	Yes/No/NA	
Options or features ordered	Yes/No/NA	
Interface kits ordered	Yes/No/NA	
Additional fibre cables ordered (optional)	Yes/No/NA	
Face panels ordered	Yes/No/NA	

Table 4–1. Preinstallation Checklist		
Item Description	**Yes/No/NA**	**Action Required / Due Date / Person Responsible**
Service Hardware Requirements		
ISP (spare parts) ordered (To be available at install time)	Yes/No/NA	
Phone line available	Yes/No/NA	
Modem ordered	Yes/No/NA	
Remote cables ordered	Yes/No/NA	
MARS switch ordered	Yes/No/NA	
Training Issues		
CSE/CSSS training completed	Yes/No/NA	
SE/SSR trained	Yes/No/NA	
Hardware Installation		
Delivery schedule completed	Yes/No/NA	
Dock hours scheduled	Yes/No/NA	
Pre-staging area set	Yes/No/NA	
Installation team identified	Yes/No/NA	
Site access arranged	Yes/No/NA	
Installation hours defined	Yes/No/NA	
Channel attachment time or server downtime defined	Yes/No/NA	

End of Chapter

Product Specifications

A

This appendix contains the physical and electrical specifications for the 9145 DPE, and 9145–P20 and CBNT C02 cabinets.

9145 DPE

Figure A–1 illustrates the physical specifications for the 9145–002 DPE.

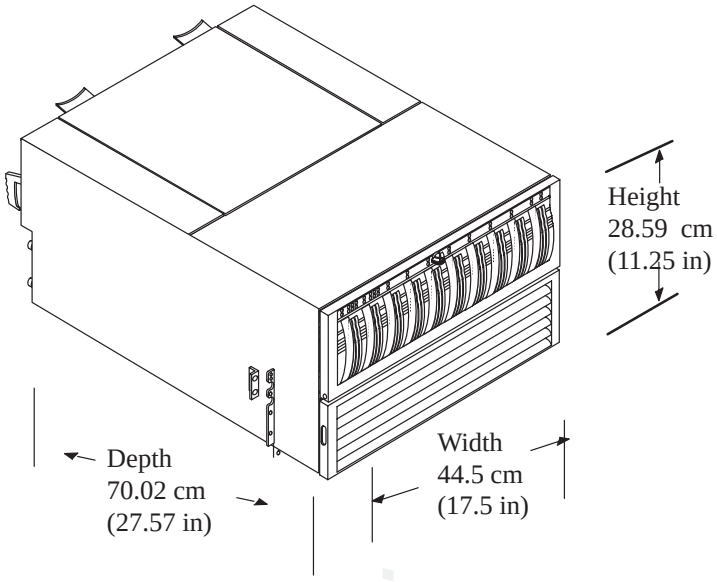


Figure A–1. 9145–002 Physical Specifications

The maximum weight (without packaging) is 52 kg (114.4 lbs.). This weight includes 10 disk modules, 2 SPs, 2 LCCs, and 2 power supplies.

Note: Installing the 9145–002 in a cabinet requires two people.

Electrical Rating

Table A–1 contains the electrical ratings for the 9145 DPE.

Table A–1. 9145 DPE Electrical Ratings

Amps (max)	VA	Phase	BTU per hour	Voltage rating	Hz
8.0	800	1	2400	100–240	47–63

You can view the online manual *9145 OPENstorage Disk Processor Enclosure (DPE) Installation and Service Manual* (document number 95794) at:

http://gandalf.stortek.com/ctp/9131_Customer/914x.html

Power Specifications

Table A–2 contains the power specifications for the 9145 DPE.

Table A–2. 9145 DPE Power Specifications

# of Drives	10	20	100
VA	800	120	4400
Input Watts	700	109	4230
Current A (@ 100 Vrms)	8.0	12	44 (22 @ 200)
Heat Dissipation BTU/hr. average	239	373	14,450

Environmental Specifications

Table A–3 contains the environmental specifications for the 9145 DPE.

Table A–3. 9145 DPE Environmental Specifications

Temperature	50 – 104 degrees F (10 – 40 degrees C)
Temperature Gradient	10 degrees C/hr
Relative Humidity	20% – 80% (non–condensing)
Elevation	8000 ft (2438.4 m) @ 98.6 degrees F (40 degrees C) max. 10,000 ft (3048 m) @ 98.6 degrees F (37 degrees C) max.
Operating Shock	3 G @ 11 ms, 1/2 sine pulse
Operating Vibration	.25 G @ 5 – 500 Hz

9145–P20 Specifications

This section contains the physical and electrical specifications for the 9145–P20 pedestal cabinet.

You can view the online manual *9145 OPENstorage Disk Series FC5400 and FC5500 Disk–Array Processor Enclosure (DPE) Installation and Service for Deskside Models* (document number 95812) at:

http://gandalf.stortek.com/ctp/9131_Customer/914x.html

Physical Specifications

Figure A–2 illustrates the physical specifications for the 9145–P20 pedestal cabinet.

The maximum weight (without packaging) of the 9145–P20, with 20 modules and 2 SPSs is 143.6 kg. (316 lbs.) including the covers.

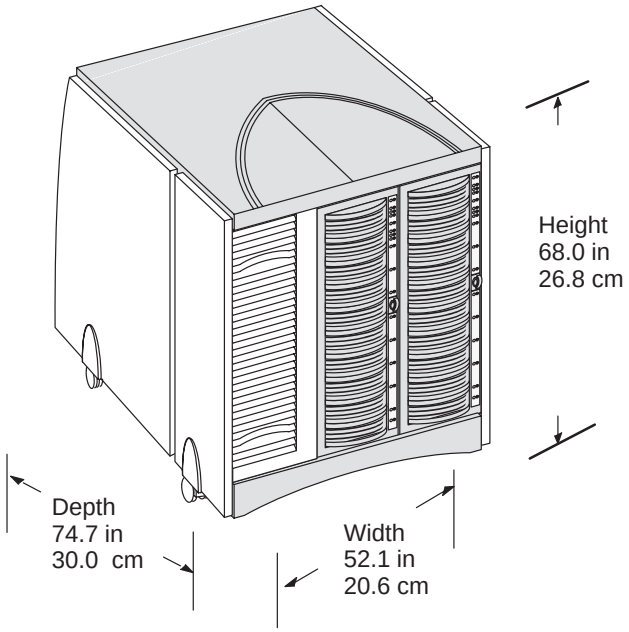


Figure A–2. 9145–P20 Physical Specifications

Clearance Specifications

The 9145–P20 requires a clearance space of 91.5 cm (36 in) in the front and 76.2 cm (30 in) in the back.

Electrical Rating

Table A–6 contains the electrical ratings for the 9145–P20 with installed drawers.

Table A–4. 9145–P20 Electrical Ratings			
Amps (max)	**VA**	**Phase**	**Hz**
16	100–240	1	47–63

Note: The cumulative amperage ratings of products installed in the 9145–P20 must not exceed 16 A.

■ CBNT C02 Specifications

This section contains specifications for the CBNT C02 rackmount cabinet.

You can view the online manual *CBNT C02 Installation Manual* (document number 95794) at:

http://gandalf.stortek.com/ctp/9131_Customer/914x.html

EIA units (U) and alignment

An EIA unit (U for short) equals 1–3/4 inches. Most rackmountable equipment is built in sizes of even U multiples.

Table A–5 contains the U sizes for the CBNT C02 components.

Table A–5. U sizes		
Component	**U**	**Inches**
9145 DPE	6.5	11–3/8
SPS (BBU)	1	1–3/4
9140 DAE	3.5	6–1/8

Configuration Rules

The maximum allowable configuration in the CBNT C02 is:

- One (1) 9145–002
- Eight (8) 9140–002s

This configuration passed the 10 degree tip test. The 9145–002 was installed in the bottom of the cabinet.

Physical Specifications

Figure A–3 illustrates the physical specifications of the CBNT C02.

The weight (without packaging) of the CBNT C02, without any drawers, is 114 kg. (250 lbs.) including the covers.

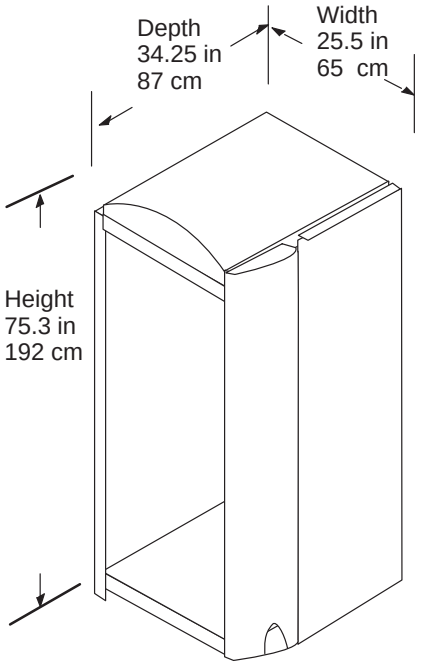


Figure A–3. CBNT C02 Physical Specifications

Floor Space Specifications

The cut–out for the raised floor needs to be 10.2 cm (4 in) deep x 35.6 cm (14 in) wide.

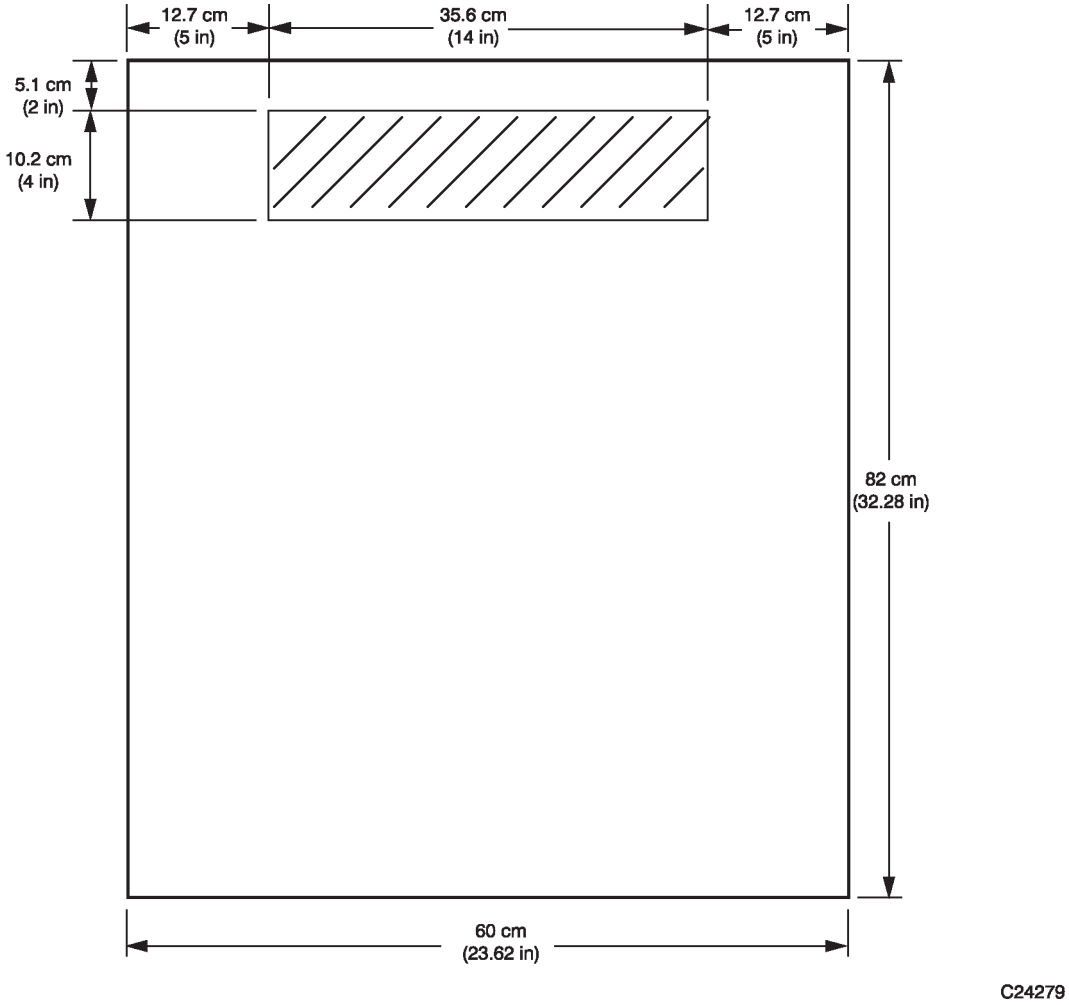


Figure A–4. CBNT C02 Floor Space Specifications

Clearance Specifications

The CBNT C02 requires a clearance space of 91.5 cm (36 in) in the front and 76.2 cm (30 in) in the back.

Electrical Rating

Table A–6 contains the electrical ratings for the CBNT C02 with installed drawers.

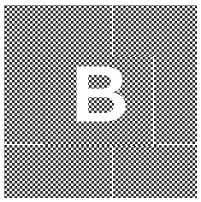
Table A–6. CBNT C02 Electrical Ratings

Amps (max)	VA	Phase	Hz
16	200–240	1	47–63

Note: The cumulative amperage ratings of products installed in the CBNT C02 must not exceed 16 A.

End of Appendix

Feature Codes



This appendix contains the feature codes and/or part numbers for components used by the 9145 OPENstorage Disk Disk–Array Processor Enclosure (DPE) products. This appendix contains information on:

- Storage system models
- Cabinet model features
- Host interface features
- Storage processor features
- Disk drive features
- Fibre cables
- Optional features

Each storage system requires these components to be specified:

- storage system model
- cabinet type
- host interface kit
- disk drives – how many and what size
- power cord
- standby power supply
- cache
- host interface cables

Storage System Models

There are two 9145 storage system model numbers:

- 9145–002
- 9145–P20

Cabinet Model Features

9145 Cabinet Models

Table B–1. 9145 Cabinet Options

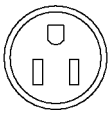
Model	Description	Number of Storage Systems Per Cabinet
9145–002	Rackmount	5
9145–P20	Pedestal	1

Power Source

9145–P20 Power Source

Table B–2 lists the feature code and part number for the 9145–P20 power cord.

Table B–2. 9145–P20 Power Cord

Feature	Description	Part Number	Picture
9930	North American standard three–prong 120 VAC (NEMA 5–15P) to IEC–320 type	310976001	

The CBNT C02 is connected to the AC power source by a NEMA power cord on all North American installations. The CBNT C02 requires the customer (or local STK office) to provide the power connector for all International installations.

The CBNT C02's AC distribution unit (ACDU) supplies AC power to the installed storage system(s).

CBNT C02 Power Source

Table B–3 lists the feature codes and part numbers for the CBNT C02 power cords.

Table B–3. CBNT C02 Power Cords

Feature	Description	Picture
9955	North American standard three–prong 120 VAC (NEMA L6–30P) to IEC–309–332P6 type	
9956	North American three–prong 220 VAC (NEMA L7–30P) to IEC–309–332P6 type	
9953	IEC–309–332P6 type	

Standby Power Supply

The 9145 DPE automatically ships with one standby power supply (SPS). This feature code is necessary for a second redundant system.

The SPS and the battery backup unit (BBU) are the same component. The same SPS is used for both the CBNT C02 and 9145–P20 cabinets.

Table B–4 lists the feature code for the SPS.

Table B–4. Standby Power Supply

Feature	Description
BBU2	Additional Standby Power Supply/Battery Backup Unit

Host Interface Features

Table B–5. Host Interface Features

Feature	Description	STK Supplied[1]	Customer Supplied[2]
HHS0	HP Single interface kit without HBAs		X
HHD0	HP Dual interface kit without HBAs		X
NCS1	Intel PC PCI Single interface kit with HBAs	X	
NCD1	Intel PC PCI Dual interface kit with HBAs	X	
GFS0	SGI Single interface kit without HBAs		X
GFD0	SGI Dual interface kit without HBAs		X
RCS1	RS/6000 Single interface kit with HBAs	X	
RCD1	RS/6000 Dual interface kit with HBAs	X	
SSS1	Sun Sbus Single interface kit with HBAs	X	
SSD1	Sun Sbus Dual interface kit with HBAs	X	
SFS1	Sun PCI Single interface kit with HBAs	X	
SFD1	Sun PCI Dual interface kit with HBAs	X	

Note 1: These host interface cards are automatically shipped by STK.

Note 2: These host interface cards must be supplied by the customer (or local STK office) from the host supplier.

Storage Processor Features

This section contains features codes for:

- 9145 read cache SP features
- 9145 write cache SP features

Mirrored Cache

Write cache is only enabled and always mirrored if two SPs are present. Read cache is not mirrored and is unique to each SP.

Initially half of the write cache (on each SP) is used for private (nonshared) write cache for the SP it resides on. The other half of the write cache on each SP is used to mirror the peer SPs private write cache.

Mirrored write cache is dynamically shared between the SPs. That is, depending on the I/O activity of each SP, the mirrored cache allocation fluctuates to meet the transient demands of both SPs.

Write caching must meet these hardware requirements:

- Two working power supplies
- Two working storage processors
- Two LCCs in the disk processor
- Disk modules in slots 0 through 8
- one standby power supply with a fully charged battery
- Two working fans in the 9145 DPE

9145 Read Cache SP Features

9145 read cache sizes are:

- 32 Mbytes
- 64 Mbytes
- 128 Mbytes
- 256 Mbytes
- 512 Mbytes

Cache is not automatically supplied with the controller card. Cache MUST be ordered separately.

The minimum required amount of read cache is 32 Mbytes. The maximum read cache per SP is 512 Mbytes. The amount of cache specified is in terms of a single SP.

Table B–6. 9145 Read Cache Features

Feature	Description	Amount of Cache
U032	Single SP	32 Mbytes
U064	Single SP	64 Mbytes
U128	Single SP	128 Mbytes
U256	Single SP	256 Mbytes
U512	Single SP	512 Mbytes
M032	Dual SP	32 Mbytes
M064	Dual SP	64 Mbytes
M128	Dual SP	128 Mbytes
M256	Dual SP	256 Mbytes
M512	Dual SP	512 Mbytes

9145 Write Cache SP Features

9145 write cache sizes are:

- 32 Mbytes
- 64 Mbytes
- 128 Mbytes
- 256 Mbytes
- 512 Mbytes

Cache is not automatically supplied with the controller card. Cache MUST be ordered separately. Additionally, an SPS must be installed.

The minimum amount of write cache required to enable cache is 32 Mbytes. The maximum write cache per SP is 512 Mbytes. The amount of cache specified is in terms of a single SP.

Table B–7. 9145 Write Cache Features

Feature	Description	Amount of Cache
N032	Mirrored SP	32 Mbytes
N064	Mirrored SP	64 Mbytes
N128	Mirrored SP	128 Mbytes
N256	Mirrored SP	256 Mbytes
N512	Mirrored SP	512 Mbytes

Disk Drive Features

9 Gbyte RAID Drive Features

Table B–8 shows the currently available 9 Gbyte 520 Format (RAID) drive feature codes. 9 Gbyte 520 Format drives are available in quantities from 1 to 10 for the 9140–P20 and 1 to 20 for the CBNT C02.

Note: The usable media is 8.23 Gbytes per drive.

Table B–8. 9 Gbyte Drive Features

Feature	Description
NF00	No Fibre Drives
R901	1 – 9 Gbyte 520 Format RAID Drives
R902	2 – 9 Gbyte 520 Format RAID Drive
. .	. .
R919	19 – 9 Gbyte 520 Format RAID Drives
R920	20 – 9 Gbyte 520 Format RAID Drives

18 Gbyte RAID Drive Features

Table B–9 shows the currently available 18 Gbyte 520 Format (RAID) drive feature codes. 18 Gbyte 520 Format drives are available in quantities from 1 to 20.

Note: The usable media is 16.61 Gbytes per drive.

Table B–9. 18 Gbyte Drive Features

Feature	Description
R800	No Fibre Drives
R801	1 – 18 Gbyte 520 Format RAID Drives
R802	2 – 18 Gbyte 520 Format RAID Drives
. .	. .
R819	19 – 18 Gbyte 520 Format RAID Drives
R820	20 – 18 Gbyte 520 Format RAID Drives

Fibre Cables

This section describes the host interface cables:

- Fibre channel
- Fiber optic

Host Interface Cables

Additional host interface cables might be available since the release of this document.

Table B–10 contains the currently available fibre channel host interface cables.

Table B–10. Fibre Channel Host Interface Cables (copper)

Feature	Description	Part Number
CNOC	No Fibre Channel cable	
CA01	One 1 meter DB9/DB9 Fibre Channel cable	10083551
CA02	One 3 meter DB9/DB9 Fibre Channel cable	10083584
CA03	One 5 meter DB9/DB9 Fibre Channel cable	10083553
CA04	One 10 meter DB9/DB9 Fibre Channel cable	10083554
CA05	One 30 meter DB9/DB9 Fibre Channel cable	10083558
C001	Two 1 meter DB9/DB9 Fibre Channel cable	10083551 x 2
C003	Two 3 meter DB9/DB9 Fibre Channel cable	10083584 x 2
C005	Two 5 meter DB9/DB9 Fibre Channel cable	10083553 x 2
C010	Two 10 meter DB9/DB9 Fibre Channel cable	10083554 x 2
C030	Two 30 meter DB9/DB9 Fibre Channel cable	10083558 x 2

Table B–11 contains the currently available fiber optic host interface cables.

Table B–11. Fiber Optic Host Interface Cables

Feature	Description	Part Number
ONOC	No Fiber Optic cable	
OA01	One 5 meter SC/SC–Duplex Fiber Optic cable	10800133
OA02	One 10 meter SC/SC–Duplex Fiber Optic cable	10800134
OA03	One 50 meter SC/SC–Duplex Fiber Optic cable	10800137
OA04	One 100 meter SC/SC–Duplex Fiber Optic cable	10800138
OA05	One 250 meter SC/SC–Duplex Fiber Optic cable	10800139
OA06	One 500 meter SC/SC–Duplex Fiber Optic cable	10800140
O005	Two 5 meter SC/SC–Duplex Fiber Optic cable	10800133 x 2
O010	Two 10 meter SC/SC–Duplex Fiber Optic cable	10800134 x 2
O050	Two 50 meter SC/SC–Duplex Fiber Optic cable	10800137 x 2
O100	Two 100 meter SC/SC–Duplex Fiber Optic cable	10800138 x 2
O250	Two 250 meter SC/SC–Duplex Fiber Optic cable	10800139 x 2
O500	Two 500 meter SC/SC–Duplex Fiber Optic cable	10800140 x 2

Table B–12 contains the currently available host interface cables needed for the NT PCI QLogic card.

Table B–12. SNFC–H01 Fibre Channel Hub Copper Cables

Feature	Description	Part Number
DHNC	No DB9/HSSDC connector copper cable	
DH00	One 1 meter DB9/HSSDC connector copper cable	10083559
DH01	One 3 meter DB9/HSSDC connector copper cable	10083585
DH02	One 5 meter DB9/HSSDC connector copper cable	10083561
DH03	One 10 meter DB9/HSSDC connector copper cable	10083562
DH04	One 30 meter DB9/HSSDC connector copper cable	10083565
DH10	Two 1 meter DB9/HSSDC connector copper cable	10083559 x 2
DH11	Two 3 meter DB9/HSSDC connector copper cable	10083585 x 2
DH12	Two 5 meter DB9/HSSDC connector copper cable	10083561 x 2
DH13	Two 10 meter DB9/HSSDC connector copper cable	10083562 x 2
DH14	Two 30 meter DB9/HSSDC connector copper cable	10083565 x 2

SNFC–H01 Fibre Channel Hub Features

The DB9/HSSDC copper cables are used between the hub and either an HBA or a 9145. The HSSDC/HSSDC copper cables are used between two hubs and cannot be used to connect to a 9145 DPE or 9140 DAE.

Table B–13 contains the currently available fibre channel copper cables for the SNFC–H01 (Vixel) hub.

Table B–13. SNFC–H01 Fibre Channel Hub Features

Model	Feature	Description
SNFC–H01		Fibre Channel Hub Base Unit – Copper
SNFC–H01		Fibre Channel Hub Base Unit – Shortwave
	SHUB	Single Copper Hub
	DHUB	Dual Copper Hub
	0GBC	No Copper GBICs
	1GBC	One Copper GBIC
	2GBC	Two Copper GBICs
	3GBC	Three Copper GBICs
	4GBC	Four Copper GBICs
	5GBC	Five Copper GBICs
	6GBC	Six Copper GBICs
	7GBC	Seven Copper GBICs
	0GBS	No Shortwave fibre optic GBICs
	1GBS	One Shortwave fibre optic GBIC
	2GBS	Two Shortwave fibre optic GBICs
	3GBS	Three Shortwave fibre optic GBICs
	4GBS	Four Shortwave fibre optic GBICs
	5GBS	Five Shortwave fibre optic GBICs
	6GBS	Six Shortwave fibre optic GBICs
	7GBS	Seven Shortwave fibre optic GBICs
	DH01	One 3 meter DB9/HSSDC copper cable
	DH02	One 5 meter DB9/HSSDC copper cable
	DH03	One 10 meter DB9/HSSDC copper cable
	DH11	Two 3 meter DB9/HSSDC copper cable
	DH12	Two 5 meter DB9/HSSDC copper cable
	DH13	Two 10 meter DB9/HSSDC copper cable
	DH21	Three 3 meter DB9/HSSDC copper cable

Table B–13. SNFC–H01 Fibre Channel Hub Features		
Model	**Feature**	**Description**
	DH22	Three 5 meter DB9/HSSDC copper cable
	DH23	Three 10 meter DB9/HSSDC copper cable
	DH31	Four 3 meter DB9/HSSDC copper cable
	DH32	Four 5 meter DB9/HSSDC copper cable
	DH33	Four 10 meter DB9/HSSDC copper cable
	HH01	One 3 meter HSSDC/HSSDC copper cable
	HH02	One 5 meter HSSDC/HSSDC copper cable
	HH03	One 10 meter HSSDC/HSSDC copper cable
	HH11	Two 3 meter HSSDC/HSSDC copper cable
	HH12	Two 5 meter HSSDC/HSSDC copper cable
	HH13	Two 10 meter HSSDC/HSSDC copper cable
	OA01	One 5 meter fiber optic cable
	OA02	One 10 meter fiber optic cable
	OA03	One 50 meter fiber optic cable
	OA04	One 100 meter fiber optic cable
	OA05	One 250 meter fiber optic cable
	OA06	One 500 meter fiber optic cable
	OA07	One 30 meter fiber optic cable
	O005	Two 5 meter fiber optic cable
	O010	Two 10 meter fiber optic cable
	O030	Two 30 meter fiber optic cable
	O050	Two 50 meter fiber optic cable
	O100	Two 100 meter fiber optic cable
	O250	Two 250 meter fiber optic cable
	O500	Two 500 meter fiber optic cable
	OA11	Three 5 meter fiber optic cable
	OA12	Three 10 meter fiber optic cable
	OA13	Three 50 meter fiber optic cable
	OA14	Three 100 meter fiber optic cable
	OA15	Three 250 meter fiber optic cable
	OA16	Three 500 meter fiber optic cable
	OA17	Three 30 meter fiber optic cable
	OA21	Four 5 meter fiber optic cable

Table B–13. SNFC–H01 Fibre Channel Hub Features		
Model	**Feature**	**Description**
	OA22	Four 10 meter fiber optic cable
	OA23	Four 50 meter fiber optic cable
	OA24	Four 100 meter fiber optic cable
	OA25	Four 250 meter fiber optic cable
	OA26	Four 500 meter fiber optic cable
	OA27	Four 30 meter fiber optic cable

CHUB–001/002 Fibre Channel Hub Features

Table B–14 contains the currently available fibre channel copper cables for the CHUB–001 and CHUB–002 (Gadzooks) hub.

Table B–14. CHUB–001/002 Fibre Channel Hub Features		
Model	**Feature**	**Description**
CHUB–001		Fibre Channel Hub Base Unit – Table Top
CHUB–002		Fibre Channel Hub Base Unit – Rackmount
	SHUB	Single Copper Hub
	DHUB	Dual Copper Hub
	CNOC	No Fibre Channel cable
	CA01	One 1 meter Fibre Channel cable
	CA02	One 3 meter Fibre Channel cable
	CA03	One 5 meter Fibre Channel cable
	CA04	One 10 meter Fibre Channel cable
	CA05	One 30 meter Fibre Channel cable
	C001	Two 1 meter Fibre Channel cable
	C003	Two 3 meter Fibre Channel cable
	C005	Two 5 meter Fibre Channel cable
	C010	Two 10 meter Fibre Channel cable
	C030	Two 30 meter Fibre Channel cable

Media Interface Adapters

Additional media interface adapters (MIAs) might be available since the release of this document. You can view the most current list at this URL:

http://americas1.stortek.com/mpss/TechTips/index.htm

Note: MIAs are used on CHUB hubs, copper HBAs, and on the 9145 DPE.

Table B–15 contains the available MIAs.

Table B–15. Media Interface Adapters

Feature	Description	Part Number
MIA0	No Media Interface Adapter	
MIA1	1 Media Interface Adapter	31097401
MIA2	2 Media Interface Adapters	31097401 x 2
MIA3	3 Media Interface Adapters	31097401 x 3
MIA4	4 Media Interface Adapters	31097401 x 4

■ Optional Features

This section contains information on Application Transparent Failover and Navisphere software.

Application Transparent Failover

Application Transparent Failover (ATF) is a software application that monitors for I/O path errors/failures. ATF automatically reroutes the SCSI or fibre I/O path in the event of a cable, host adapter, or SP failure (requires that the failing component is redundant).

Table B–16 contains the part numbers for the ATF software.

Table B–16. Application Transparent Failover Feature

Model	Host type	Conversion Bill	Supported Operating System
AFOS–001	Sun	97000	Solaris 2.5.1, 2.6
AFOS–002	IBM	97002	AIX 4.1.5, 4.2, 4.3.1
AFOS–003	Windows NT	97004	NT 4.0

Navisphere Models

Table B–17 contains the model number, feature code, and conversion bill for the Navisphere software models.

Note: These Navisphere models run on Windows NT only.

Table B–17. Navisphere Models

Model	Feature	Conversion Bill	Part Number	Description
NALZ–001			3117183xx	Navisphere Analyzer
	NAVW/UPDN	96998	3117183xx	Navisphere Analyzer Upgrade
NMGR–001			3117146xx	Navisphere Manager
	NAVW/UPDN	96994	3117146xx	Navisphere Manager Upgrade
NORG–001			3117186xx	Navisphere Organizer
	NAVW/UPDN	96996	3117186xx	Navisphere Organizer Upgrade

Navisphere Software

Table B–17 contains the part numbers for the Navisphere software.

This Navisphere software is supplied in the host interface kits and is updated via field bills.

Table B–18. Navisphere Software

Part Number	Description	Supported Platform
3117521xx	Navisphere Event Monitor	HP
3117522xx	Navisphere Agent/CLI	HP
3117639xx	Navisphere Agent/CLI	IBM
3117640xx	Navisphere Event Monitor	IBM
3117506xx	Navisphere Event Monitor	NT 4.0
3117507xx	Navisphere Agent/CLI	NT 4.0
3117508xx	Navisphere Supervisor	NT 4.0
3117510xx	Navisphere Event Monitor	Sun
3117511xx	Navisphere Agent/CLI	Sun

End of Appendix

Sample Configurations

C

This appendix contains these sample configurations:

- 9145–P20
- 9145–002

9145–P20 System Configuration

This is an example of one 9145–P20 Fibre Channel RAID configuration connected to one HP host with active paths from the host to each of the dual SPs in the 9145 (total of 2 paths). No hub is needed in this example. This configuration has a raw capacity of 164.6 Gbytes (using 8.34 Gbyte fibre channel RAID drives) with 20 drives.

Table C–1. Sample 9145–P20 System Configuration

Model	Feature	Quantity	Description
9145–P20		1	20–slot pedestal module with one BBU, two Power Supplies, two SPs, two LCCs
	M128	2	128 Mbyte Read Cache for each SP
	N128	2	128 Mbyte Mirrored Write Cache for each SP (64 Mbytes usable write cache per SP)
	HHD0	1	HP Dual interface kit without HBAs
	R920	1	20 RAID drives per enclosure
	GB52	1	Five Copper GBICs Two Shortwave fiber optic GBICs
SNFC–H01		1	Fibre Channel Hub Base Unit
	9930	1	Power Cord
	BBU2	1	Additional Standby Power Supply
	311752101	1	Navisphere Event Monitor – HP
	311750801	1	Navisphere Supervisor– Windows NT
	311750701	1	Navisphere Agent – Windows NT
	311752201	1	Navisphere Agent – HP

9145–002 System Configuration

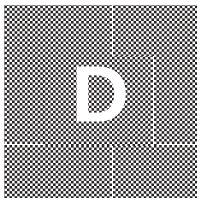
This is an example of two 9145–002 RAID configurations connected to one Sun Sbus host with active paths from the host to dual SPs in the 9145s (for a total of 4 paths from host) with dual hubs in a CBNT C02 rackmount cabinet. Each 9145 has a raw capacity of 576.1 Gbytes (using 8.23 Gbyte fibre channel RAID drives) with 70 drives per 9145; each uses the maximum allowable cache (1 Gbyte read, 512 Mbyte usable write cache, 512 Mbyte mirrored write cache).

Table C–2. Sample 9145–002 Configuration

Model	Feature	Quantity	Description
9145–002		2	10–slot rackmount module with 1 BBU, 2 Power Supplies, 2 Storage Processors, 2 LCCs
9140–002		12	Expansion unit (10 slot module, two power supplies, and two LCCs)
	M512	4	512 Mbytes read cache for each SP – total 1 Gbyte for each 9145 (x2)
	N512	4	512 Mbytes mirrored write cache for each SP (256 Mbytes usable write cache per SP)
	SSD1	2	Sun Sbus Dual interface kit with HBAs
	8912998704	8	10 meter DB9/HSSDC connector copper cable
SNFC–H01		2	Fibre Channel Hub Base Unit
	GBC7	2	Seven Copper GBICs
	R910	14	Ten 9 Gbyte 520 Format RAID Drives (x14)
	9956	2	Power Cord (total of two for each cabinet)
	BBU2	2	Additional Standby Power Supply
	311751001	1	Navisphere Event Monitor – Sun
	311750801	1	Navisphere Supervisor– Windows NT
	311750701	1	Navisphere Agent – Windows NT
	311751101	1	Navisphere Agent – Sun
CBNT–C02		2	Rackmount cabinet with dual PDU

End of Appendix

Training



This chapter contains a list of the available 9145 OPENstorage Disk Disk-Array Processr Enclosure (9145 DPE) related-training courses available to StorageTek CSEs and SEs.

WARNING:
All of the URL references in this guide are subject to change.

■ StorageTek CSE and SE Training

Table D-1 lists the current course available for StorageTek CSEs and SEs. There are no prerequisites for the course.

Table D-1. 9145 OPENstorage Disk Courses

Course Name	Course Number	Course Description
914X OPENstorage Disk Subsystem	OSY121	A three-day course that covers the hardware and software topics necessary to install, configure, and monitor the Fibre Channel storage array in a variety of operating system environments. Students identify and replace FRUs/CRUs and use internal software to configure and monitor the product.

You can view the online *Workforce Development Course Catalog* for the latest course offerings and schedules. You can enroll in these courses from the Workforce Development website (home page) located at:

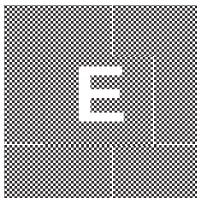
http://wfd.stortek.com/WFD/training/

■ Customer Training

There is no customer training available at this time.

End of Appendix

Documentation Information



This appendix lists and describes how to order all of the currently available documentation for the 9145 OPENstorage Disk Disk–Array Processor Enclosure (9145 DPE) product.

WARNING:
All of the URL references in this guide are subject to change.

■ Available Publications

Additional publications might be available since the release of this document. You can view the most current list at these URLs:

http://gandalf.stortek.com/ctp/9131_Customer/914x.html

Table E–1 lists all of the currently available publications for the 9145 DPE.

Table E–1. 9145 OPENstorage Disk Publications	
Document Title	**Part Number**
9145 OPENstorage Disk Processor Enclosure (DPE) Installation and Service Manual	95792
CBNT C02 Installation Manual	95794
9145 OPENstorage Disk Navisphere CLI Installation and Operation for UNIX Environments	95805
9145 OPENstorage Disk Navisphere Agent Installation for UNIX Environments	95806
9145 OPENstorage Disk Navisphere Event Monitor Installation for Microsoft Windows NT Environments	95807
9145 OPENstorage Disk Navisphere CLI Installation and Operation for Microsoft Windows Environments	95808
9145 OPENstorage Disk Navisphere Organizer Installation and Operation for Microsoft Windows Environments	95809
9145 OPENstorage Disk Standby Power Supply (SPS) Installation and Maintenance	95810
9145 OPENstorage Disk Series FC5400 and FC5500 Disk–Array Processor Enclosure (DPE) Installation and Service for Deskside Models	95812
Sun Solaris Server Setup for 9145 OPENstorage Disk Fibre Channel Disk–Array Storage Systems with Fibre Channel Disks	95815
9145 OPENstorage Disk Systems Assurance Guide	MO 5003 A 9/98
914X OPENstorage Disk Manual Kit (contains **ALL** of these documents, except for the 9140 and 9145 OPENstorage Disk Systems Assurance Guides)	311703901

Ordering Publications

You can order any of the publications listed in the previous section prior to ordering a 9145 DPE.

Use one of the following methods to order the manuals:

- **Field**

  Order manuals (except for this systems assurance guide) from the Customer Service Materials Coordinator (Logistics Specialist) at your local parts Depot. You need to provide them with the part number(s) of the manual(s) you want and an account or charge number. The delivery time for the manuals is two weeks or less. You CANNOT order manuals code ″A″ (emergency, machine down), the order will be cancelled and the requester asked to resubmit the order as a code ″C″.

- **Headquarters**

  Order manuals from Hardware Manuals Scheduling. You need to send an email (CarroCA@louisville.stortek.com) with the part number(s) of the manual(s) you want and an account or charge number. The delivery time for the manuals is two weeks or less through internal STK mail.

- **9145 OPENstorage Disk Systems Assurance Guide**

  Order 9145 OPENstorage Disk Systems Assurance Guides from the Literature Distribution website located at:

  http://gandalf.stortek.com/literature/index2.html

End of Appendix

READER'S COMMENT FORM

Manual Name: _____ Manual PN: _____

Please check or fill in the items; adding explanations/comments in the space provided.

Which of the following terms best describes your job?

- ☐ Field Engineer
- ☐ Engineer
- ☐ Instructor
- ☐ Manager
- ☐ Mathematician
- ☐ Operator
- ☐ Programmer
- ☐ Sales Representative
- ☐ Student/Trainee
- ☐ Systems Analyst
- ☐ Systems Engineer
- ☐ Other (explain below)

How did you use this publication?

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- ☐ Reference manual
- ☐ Student/Trainee
- ☐ Instructor text
- ☐ Other (explain) _____

Did you find the material easy to read and understand? ☐ Yes ☐ No (explain below)

Did you find the material organized for convenient use? ☐ Yes ☐ No (explain below)

Specific criticisms (explain below):

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Additions on pages _____

Deletions of pages _____

Errors on pages _____

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