

# StorageWorks™ Solutions

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## StorageWorks FDDI Server Installation Guide

Order Number: EK-FSERV-IG. A01

This guide describes the procedures necessary to install, configure, and use the StorageWorks FDDI Server. Mechanical cabinet configuration and power configuration as well as software installation and configuration are covered in this guide.

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**September 1995**

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# Preface

This manual describes the procedures necessary to install, configure, and use the StorageWorks™ Fiber Distributed Data Interface (FDDI) Server. Mechanical cabinet configuration and power configuration as well as software installation, configuration, and upgrade procedures are covered in this manual.

## Intended Audience

This manual is intended for use by customers and Digital™ Multivendor Customer Services personnel responsible for installing and configuring a StorageWorks FDDI Server.

## Structure

This manual is organized as follows:

Chapter 1	Provides an overview of the StorageWorks FDDI Servers and a description of their major components.
Chapter 2	Provides site preparation information.
Chapter 3	Describes the unpacking and placement of a StorageWorks FDDI Server.
Chapter 4	Describes installing StorageWorks FDDI Server software.
Chapter 5	Describes configuring the StorageWorks FDDI Server storage devices.
Chapter 6	Describes how to connect the server to the FDDI interconnect and prepare for operations.
Chapter 7	Describes supporting and operating the StorageWorks FDDI Server in a VMScCluster™ system.
Chapter 8	Describes system software maintenance tasks.
Glossary	Defines the acronyms and specialized terms used in the StorageWorks environment.

## Related Documents

Table 1 lists the StorageWorks-related user documents organized by use, system, or product. It also lists the OpenVMS Alpha™ operating system-related documents.

**Table 1 StorageWorks Related Documentation**

Document Title	Order Number
<b>StorageWorks Primary Publications</b>	
<i>StorageWorks Solutions Configuration Guide</i>	EK-BA350-CG
<i>StorageWorks Solutions Shelf and SBB User's Guide</i>	EK-BA350-UG
<i>StorageWorks Solutions BA356-SB 16-Bit Shelf User's Guide</i>	EK-BA356-UG
<i>StorageWorks Array Controllers HS Family of Array Controllers User's Guide</i>	EK-HSFAM-UG
<b>StorageWorks FDDI Server Publications</b>	
<i>StorageWorks Solutions StorageWorks FDDI Server HS110 Upgrade Installation Guide</i>	EK-HS110-IG
<i>StorageWorks Solutions StorageWorks FDDI Server Upgrade Installation Guide</i>	EK-FSUPG-IG
<i>StorageWorks Solutions StorageWorks FDDI Server HS1MM/HS2MM Server Processor Memory Installation Guide</i>	EK-HS1MM-IG
<i>StorageWorks Solutions StorageWorks FDDI Server HS1PW Server Processor Power Supply Installation Guide</i>	EK-HS1PW-IG
<i>StorageWorks Solutions StorageWorks FDDI Server Server Processor Component Manual</i>	EK-HSASP-CM
<b>StorageWorks Enclosures</b>	
<i>StorageWorks Solutions SW500 and SW800 Cabinet Metric Shelf Bracket Kit Installation Guide</i>	EK-35XRD-IG
<i>StorageWorks RETMA Shelf Rail Kit Installation Guide</i>	EK-35XRB-IG
<i>StorageWorks Solutions SW800-Series Data Center Cabinet Cable Distribution Unit Installation Guide</i>	EK-SWCDU-IS
<i>StorageWorks Solutions SW800-Series Data Center Cabinet Installation and User's Guide</i>	EK-SW800-IG
<b>Storage Devices</b>	
<i>StorageWorks Building Blocks User's Guide</i>	EK-SBB35-UG
<i>StorageWorks Solutions 3½-Inch Storage Device Installation Guide</i>	EK-MC350-IG
<i>StorageWorks Solutions 5¼-Inch Storage Device Installation Guide</i>	EK-MC525-IG

(continued on next page)



**Table 1 (Cont.) StorageWorks Related Documentation**

Document Title	Order Number
<b>OpenVMS Alpha Operating System Related Documentation</b>	
<i>A Comparison of System Management on OpenVMS Alpha and OpenVMS VAX</i>	AA-PV71B-TE
<i>OpenVMS System Manager's Manual: Essentials</i>	AA-PV5MC-TK
<i>DECnet for OpenVMS Guide to Networking</i>	AA-PV5ZA-TK
<i>OpenVMS License Management Utility Manual</i>	AA-PVXUC-TK
<i>VMScluster Systems for OpenVMS</i>	AA-PV5WB-TK
<i>OpenVMS Alpha Version 6.2 Upgrade and Installation Manual</i>	AA-PV6XC-TE
<i>Guide to OpenVMS Performance Management</i>	AA-PV5XA-TE
<i>OpenVMS System Manager's Manual: Tuning, Monitoring and Complex Systems</i>	AA-PV5NC-TK
<i>OpenVMS Alpha Systems Dump Analyser Utility Manual</i>	AA-PV6UB-TE
<i>Volume Shadowing for OpenVMS</i>	AA-PVXMC-TE
<i>OpenVMS System Management Utilities Reference Manual: A-L</i>	AA-PV5PC-TK
<i>OpenVMS System Management Utilities Reference Manual: M-Z</i>	AA-PV5QC-TK
<b>General Reference Publications</b>	
<i>Digital Systems and Options Catalog</i>	†
† Available from your Digital account representative.	

## Documentation Conventions

The following conventions are used in this manual:

- |                      |  |
|----------------------|--|
| <b>boldface type</b> | Boldface type indicates the first instance of terms being defined in text, in the glossary, or both.                               |
| <i>italic type</i>   | Italic type indicates emphasis and complete manual titles. In the glossary, italic type also is used to indicate cross-references. |



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## Manufacturer's Declarations

Following are manufacturer's declarations applicable to the StorageWorks FDDI Server:

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**CAUTION**

This is a class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

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**ACHTUNG !**

Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen die Benutzer für entsprechende Gegenmaßnahmen verantwortlich sind.

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**ATTENTION !**

Ceci est un produit de Classe A. Dans un environnement domestique, ce produit risque de créer des interférences radiélectriques, il appartiendra alors à l'utilisateur de prendre les mesures spécifiques appropriées.

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**Note**

The equipment described in this manual is listed by the Underwriters Laboratories Incorporated and bears the UL Listing mark. The StorageWorks FDDI Server cabinets also are certified by the Canadian Standards Association and TUV Product Service GmbH and bear both the CSA certification and TUV GS marks.

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**Table 2 Acoustics—Preliminary Declared Values per ISO 9296 and ISO 7779**

Product†	Sound Power Level $L_{WAd}$ , B‡		Sound Pressure Level $L_{pAm}$ , dBA (Bystander Positions)	
	Idle	Operate	Idle	Operate
HS2xx with only cabinet fans operating	7.6	7.6	59	59
HS2xx with 2 BA350–M shelves and 12 BA350–S shelves, each containing 6 RZ26–VA disk drives	7.6	7.6	59	59
<b>Per device when installed in HS2</b>				
BA350–S shelf containing 6 RZ26–VA disk drives	5.7	5.7	39	39
BA350–M shelf	5.6	5.6	39	39

† Current values for specific configurations are available from Digital representatives.  
‡ 1 B = 10 dBA.

**Note**

Table 3 is a translation of the English language specifications in Table 2 into the German language.

**Table 3 Schallemissionswerte—Vorläufige Werteangaben nach ISO 9296 und ISO 7779/DIN EN27779**

Gerät†	Schalleistungspegel $L_{WAd}$ , B‡		Schalldruckpegel $L_{pAm}$ , dBA (Beistehende Position)	
	Leerlauf	Betrieb	Leerlauf	Betrieb
HS2xx nur mit kabinett Lüftern in Betrieb	7,6	7,6	59	59
HS2xx mit 2 BA350–MA shelves und 12 BA350–S shelves, jedes bestückt mit 6 RZ26–VA disk drives	7,6	7,6	59	59
<b>Pro Gerät installiert im HS1</b>				
BA350–S shelf mit 6 RZ26–VA disk drives	5,7	5,7	39	39
BA350–M shelf	5,6	5,6	39	39

† Aktuelle Werte für spezielle Ausrüstungsstufen sind über die Digital Equipment Vertretungen erhältlich.  
‡ 1 B = 10 dBA.

This chapter presents a system overview of the StorageWorks FDDI Server, describes each of its major components, and lists the upgrade options. The final section of this chapter provides information on how to use the remainder of the guide.

## 1.1 System Overview

The StorageWorks FDDI Servers integrate Digital's Alpha technology with StorageWorks modular design to meet the storage requirements of large FDDI-based VMScluster systems. The StorageWorks FDDI Servers support a wide range of StorageWorks solid state disk, magnetic disk, tape, optical, and loader devices, for configuring the exact FDDI storage solution to meet your application's needs. The StorageWorks FDDI Server family extends the StorageWorks line with both standard and highly available servers to meet the I/O needs of even the largest FDDI-based VMScluster systems. Each StorageWorks FDDI Server comprises part of an FDDI-based VMScluster environment.

The following StorageWorks FDDI Servers currently are available:

- HS241-AA, AB
- HS221-AA, AB
- HS211-AA, AB
- HS121-AA, AB
- HS111-AA, AB

The following expansion options are also available:

- HS280-AA, AB
- HS210-AA
- HS110-AA

In addition, many kits to upgrade your FDDI Server are available. See the *Digital Systems and Options Catalog* for a complete list.

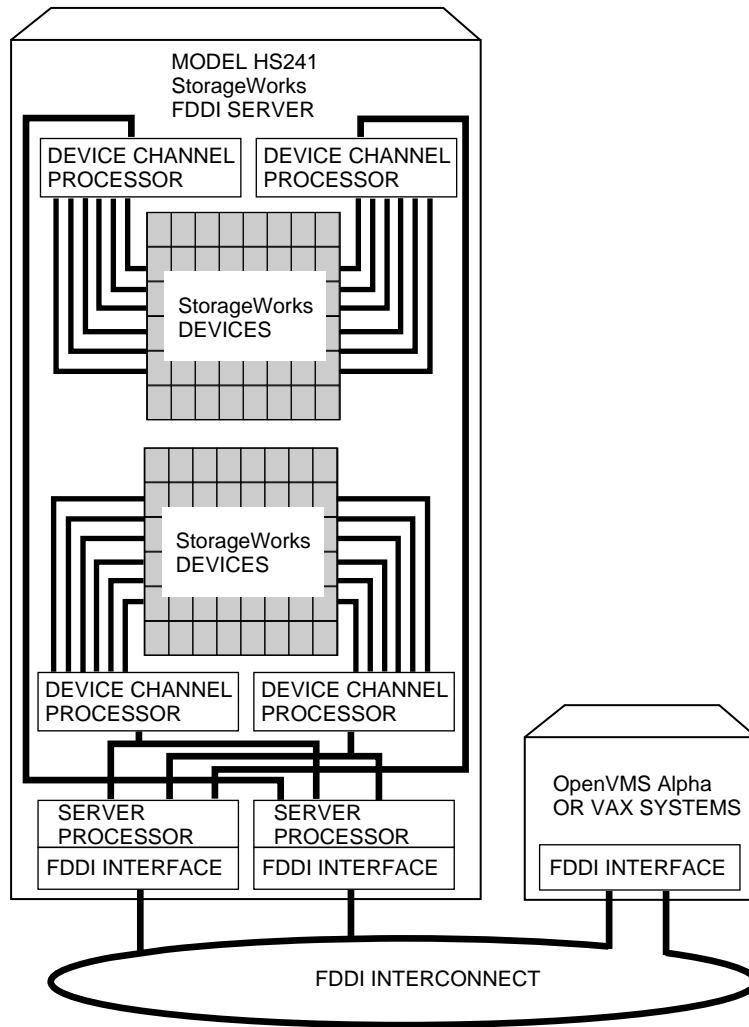
### 1.1.1 HS241 Description

Figure 1-1 shows a conceptual model of the HS241 StorageWorks FDDI Server. Ideal for large networks running "bet-your-business" applications, the HS241 server flies at 4300 I/Os per second and provides high server availability via dual-redundant server processors and four dual-redundant device channel processors. Housed in a single StorageWorks SW800 cabinet, this server can connect up to 72 redundant devices. Maximum HS241 online disk capacity is 309 GB using RZ29 disk drives. Consult the Software Product Description (SPD), *HS1CP Device Channel Processor Operating Firmware Version 2.5 for the StorageWorks FDDI Server*, SPD 64.19.01, for a complete list of supported StorageWorks

devices. Nearline storage of 10-plus terabytes is possible by adding up to two StorageWorks tape libraries for backups and archiving.

During normal operation, I/O performance is enhanced by balancing the I/O load across the redundant system components in a customer-definable manner. If a component failure occurs, the redundant partner takes over, providing continued service until the failed component can be repaired or replaced. All HS2.xx redundant StorageWorks FDDI Server components can be hot swapped or replaced without interrupting I/O service.

**Figure 1-1 HS241 Diagram**

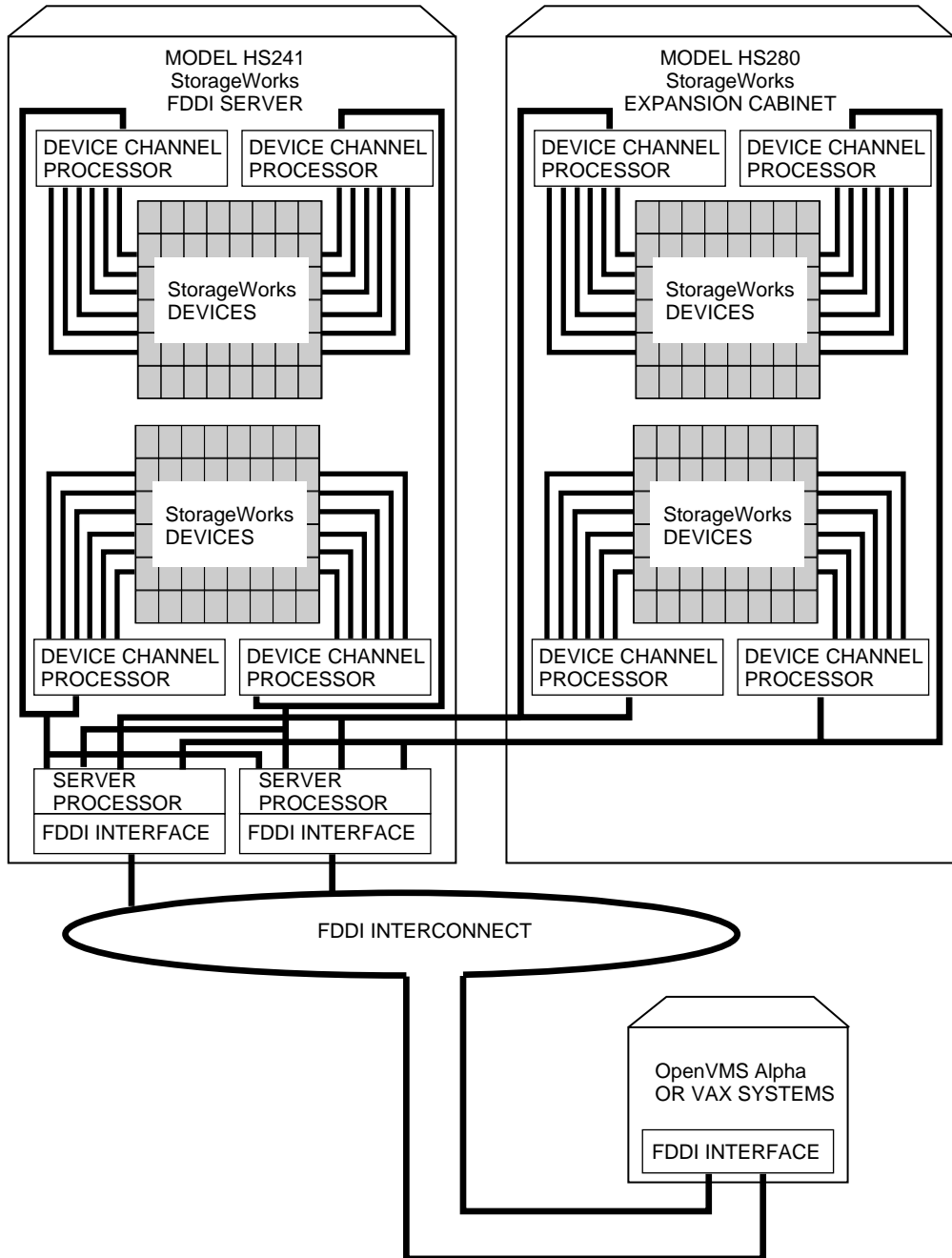


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### 1.1.2 HS280 Description

Double the device support (to 144 devices) and online disk capacity to 619 GB by connecting the HS241 to an optional HS280 expansion cabinet. The HS280 includes a second StorageWorks SW800 cabinet and four additional redundant device channel processors. Redundant power and cooling are also standard at the SW800 cabinet level. Figure 1-2 shows a conceptual model of the HS241 StorageWorks FDDI Server with the HS280 expansion option installed.

Figure 1–2 HS241 with HS280 Diagram



CXO-4962A-MC

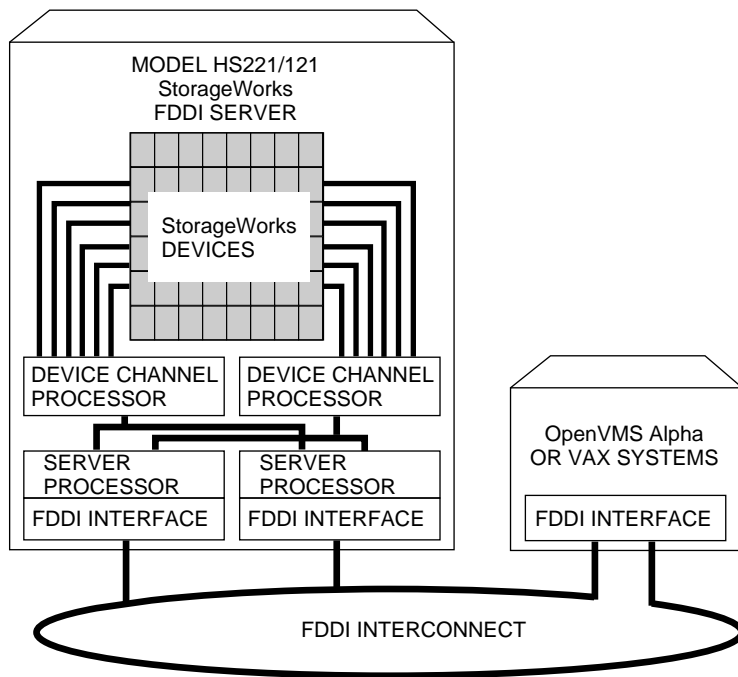
### 1.1.3 HS221/121 Description

Figure 1–3 shows a conceptual model of the HS221/121 StorageWorks FDDI Server. It is a fully redundant, high-availability FDDI storage solution offering full protection against any single component failure. These servers are suited to medium-sized operations running “mission-critical” applications. High server availability is assured with fully redundant server processors, two paths to the FDDI interface, two paths to every storage device, standard redundant power, and cooling. The full range of StorageWorks redundant power and cooling features for devices are also available.

The basic HS221/121 StorageWorks FDDI Server provides fully redundant access to up to 36 redundant StorageWorks device connections. Consult the Software Product Description, *HS1CP Device Channel Processor Operating Firmware Version 2.5 for the StorageWorks FDDI Server*, SPD 64.19.01, for a complete list of supported StorageWorks devices. Using the RZ29 disk drive, 154 GB of online, redundant storage per server are available. The model HS221/121 StorageWorks FDDI Server and its attached storage devices are housed in a single StorageWorks SW800 cabinet.

During normal operation, I/O performance is enhanced by balancing the I/O load across the redundant system components in a customer-definable manner. If a component failure occurs, the redundant partner takes over, providing continued service until the failed component can be repaired or replaced. All HS2xx redundant StorageWorks FDDI Server components can be hot swapped.

**Figure 1–3 HS221/121 Diagram**



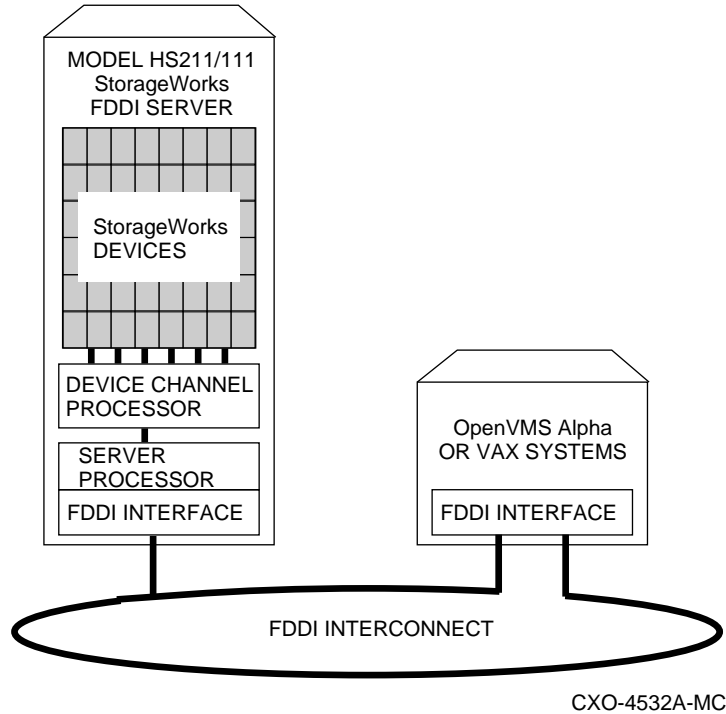
CXO-4533A-MC

### 1.1.4 HS211/111 Description

Figure 1–4 shows a conceptual model of the HS211/111 StorageWorks FDDI Server. Suited to medium-sized operations where you need distributed access and storage management benefits, these servers consist of a single Alpha-based server processor with a FDDI DAS (HS211) or SAS (HS111) network interface and a device channel processor (HS1CP) capable of connecting the server processor to as many as 42 StorageWorks devices. Consult the Software Product Description, *HS1CP Device Channel Processor Operating Firmware Version 2.5 for the StorageWorks FDDI Server*, SPD 64.19.01, for a complete list of supported StorageWorks devices. Using the RZ29 disk drive, up to 180 GB of nonredundant online storage per server are available. The model HS211/111 StorageWorks FDDI Server and its attached storage devices are housed in a single StorageWorks SW800 cabinet.



Figure 1-4 HS211/111 Diagram



### 1.1.5 HS210/110 Description

The HS210/110 contains all the major components of an HS211/111 except for the StorageWorks SW800 cabinet. These options provide for the conversion of an existing SW800 cabinet to a StorageWorks HS211/111 FDDI Server. The *StorageWorks FDDI Server Upgrade Installation Guide* describes the HS210 installation while the *StorageWorks FDDI Server HS110 Upgrade Installation Guide* describes the HS110 installation.

### 1.1.6 HS2xx/1xx Series Software and Firmware Components

The HS2xx/1xx series server processor runs the OpenVMS Alpha operating system. This means that, in addition to serving online storage to hosts, the HS2xx/1xx StorageWorks FDDI Server can use a wide range of StorageWorks and POLYCENTER™ storage management software to provide an optimally managed storage environment.

StorageWorks FDDI Servers support block I/O services and, used with TCP/IP services for OpenVMS Alpha software, support NFS (Network File Server) services. A distributed, mixed environment that can include OpenVMS clusters, CI clusters, UNIX® workstations, and PCs can be supported for any system with NFS Version 2 client capabilities.

As full members of a VMScLuster, StorageWorks FDDI Servers merge seamlessly into existing clusters and can evolve in parallel with or independent of the operating system. The StorageWorks FDDI Servers can manage storage services to as many as 95 other host computers or workstations in a VMScLuster system.

To further enhance both performance and data availability, host-based RAID or the optional controller-based RAID can be added to the server in addition to the standard, nonvolatile write-back cache. Consult the Software Product Description, *HSICP Device Channel Processor Optional Operating Firmware, Version 2.5*, SPD 64.20.01, for further information.

## 1.2 Available Upgrades

The StorageWorks FDDI Servers have a number of applicable upgrades: some are StorageWorks FDDI Server specific, others are applicable to the SW800 enclosure or StorageWorks shelves and support the StorageWorks FDDI Server upgrades. Each upgrade is briefly described in the Table 1-1. A complete description of each upgrade and its installation instructions can be found in the manuals entitled the *StorageWorks FDDI Server Upgrade Installation Guide* and the *StorageWorks FDDI Server HS110 Upgrade Installation Guide*.

**Table 1–1 StorageWorks FDDI Server Upgrades**

<b>Upgrade Order Number</b>	<b>Description</b>
<b>StorageWorks FDDI Server-Specific Upgrades</b>	
HS280-AA, AB	StorageWorks FDDI Server expansion cabinet for attachment to HS241 Server. Expands the number of device buses to 8 and available device ports to 144. Available in 50 and 60 Hz options.
HS210-AA	Expands an existing SW800 cabinet to an HS211, providing nonredundant access to the installed StorageWorks devices.
HS110-AA	Expands an existing SW800 cabinet to an HS111 or upgrades an HS111-AA, AB to an HS121-AA, AB. If installing into an SW800 cabinet containing StorageWorks storage devices only, this option provides nonredundant access to the installed StorageWorks devices. If upgrading an HS111-AA, AB, this option provides redundant access to the installed StorageWorks storage devices. The HS111-to-HS121 upgrade requires purchase of additional parts not included in the HS110 kit.
HS211-AX	Upgrades an HS111 to an HS211.
HS221-AX	Upgrades an HS121 to an HS221.
HS221-BX/BY	Upgrades an HS211 to an HS221; available in 50 and 60 Hz options.
HS241-AX	Upgrades an HS121 to an HS241.
HS241-BX	Upgrades an HS221 to an HS241.
HS1MM-AA	StorageWorks FDDI Server 64 MB server memory expansion.
HS2MM-AA	StorageWorks FDDI Server 128 MB server memory expansion.
HS1PW-AA	StorageWorks FDDI Server server processor redundant power supply.
<b>Software and Firmware Components</b>	
QL-4D7A9-AA	HS1CP RAID firmware license (one required for each device channel processor attached to a RAID array).
QL-4E3A9-AA	HS1CP Mirroring firmware license (one required for each HS1CP).
QB-HS2AA-AA	FDDI Network Server File Server solution kit.
<b>Supporting Upgrades</b>	
BA350-JA	StorageWorks device shelf with mounting kit and power supply. Provide mounting for up to seven StorageWorks devices.
BA35X-HA	StorageWorks device shelf power supply.
SW8XP-AX	Additional power controller for the SW800 cabinet.

## 1.2.1 StorageWorks FDDI Server Specifications

Tables 1–2 and 1–3 provide the StorageWorks FDDI Server specifications.

**Table 1–2 StorageWorks FDDI Server HS2xx/1xx Specifications**

	Models HS211/111	Model HS221/121
<b>Storage Capacity</b>		
Maximum number of disks	42 nonredundant connections	36 redundant connections
Maximum disk capacity using RZ29 disks	180 GB	154 GB
Maximum number of tapes	See the <i>StorageWorks Solutions Configuration Guide</i> for configuration guidelines.	
Maximum number of Solid State disks	See the <i>StorageWorks Solutions Configuration Guide</i> for configuration guidelines.	
<b>I/O Performance</b>		
Saturation performance: single-block disk I/O request rate	800	2,100
Saturation performance: Maximum data transfer rate (to/from FDDI interconnect)	2.5 MB/second	5.5 MB/second
I/O response time for typical OpenVMS load	12 ms (cache disabled) 7 ms (read and write cache enabled)	12 ms (cache disabled) 7 ms (read and write cache enabled)
<b>Power Requirements</b>		
Voltage	100 to 240 V ac	100 to 240 V ac
Frequency	50/60 Hz	50/60 Hz
Device channel processor battery backup	Standard	Standard
Redundant Power	Optional	Standard
<b>Environmental</b>		
Operating temperature	10 C to 40 C	10 C to 40 C
Nonoperating temperature	-40 C to 66 C	-40 C to 66 C
Relative humidity	10% to 80%	10% to 80%
Altitude	Sea level to 2400 m (8000 ft)	Sea level to 2400 m (8000 ft)

(continued on next page)

**Table 1–2 (Cont.) StorageWorks FDDI Server HS2xx/1xx Specifications**

	Models HS211/111	Model HS221/121
<b>Physical Dimensions</b>		
Height	1700 mm (67 in)	1700 mm (67 in)
Width	800 mm (31 in)	800 mm (31 in)
Depth	875 mm (34.5 in)	875 mm (34.5 in)
Weight (without devices)	310 kg (685 lbs)	355 kg (780 lbs)

**Table 1–3 StorageWorks FDDI Server HS241/280 Specifications**

	Model HS241	Model HS241 with HS280 Installed
<b>Storage Capacity</b>		
Maximum number of disks	72 redundant connections	144 redundant connections
Maximum disk capacity using RZ29 disks	309 GB	619 GB
Maximum number of tapes	See the <i>StorageWorks Solutions Configuration Guide</i> for configuration guidelines.	
Maximum number of Solid State disks	See the <i>StorageWorks Solutions Configuration Guide</i> for configuration guidelines.	
<b>I/O Performance</b>		
Saturation performance: single-block disk I/O request rate	4,300	4,300
Saturation performance: Maximum data transfer rate (to/from FDDI interconnect)	11 MB/second	11 MB/second
I/O response time for typical OpenVMS load	12 ms (cache disabled) 7 ms (read and write cache enabled)	12 ms (cache disabled) 7 ms (read and write cache enabled)
<b>Power Requirements</b>		
Voltage	100 to 240 V ac	100 to 240 V ac
Frequency	50/60 Hz	50/60 Hz
Device channel processor battery backup	Standard	Standard
Redundant Power	Optional	Standard

(continued on next page)

**Table 1–3 (Cont.) StorageWorks FDDI Server HS241/280 Specifications**

	<b>Model HS241</b>	<b>Model HS241 with HS280 Installed</b>
<b>Environmental</b>		
Operating temperature	10 C to 40 C	10 C to 40 C
Nonoperating temperature	-40 C to 66 C	-40 C to 66 C
Relative humidity	10% to 80%	10% to 80%
Altitude	Sea level to 2400 m (8000 ft)	Sea level to 2400 m (8000 ft)
<b>Physical Dimensions</b>		
Height	1700 mm (67 in)	1700 mm (67 in)
Width	800 mm (31 in)	800 mm (31 in)
Depth	875 mm (34.5 in)	875 mm (34.5 in)
Weight (without devices)	310 kg (685 lbs)	355 kg (780 lbs)

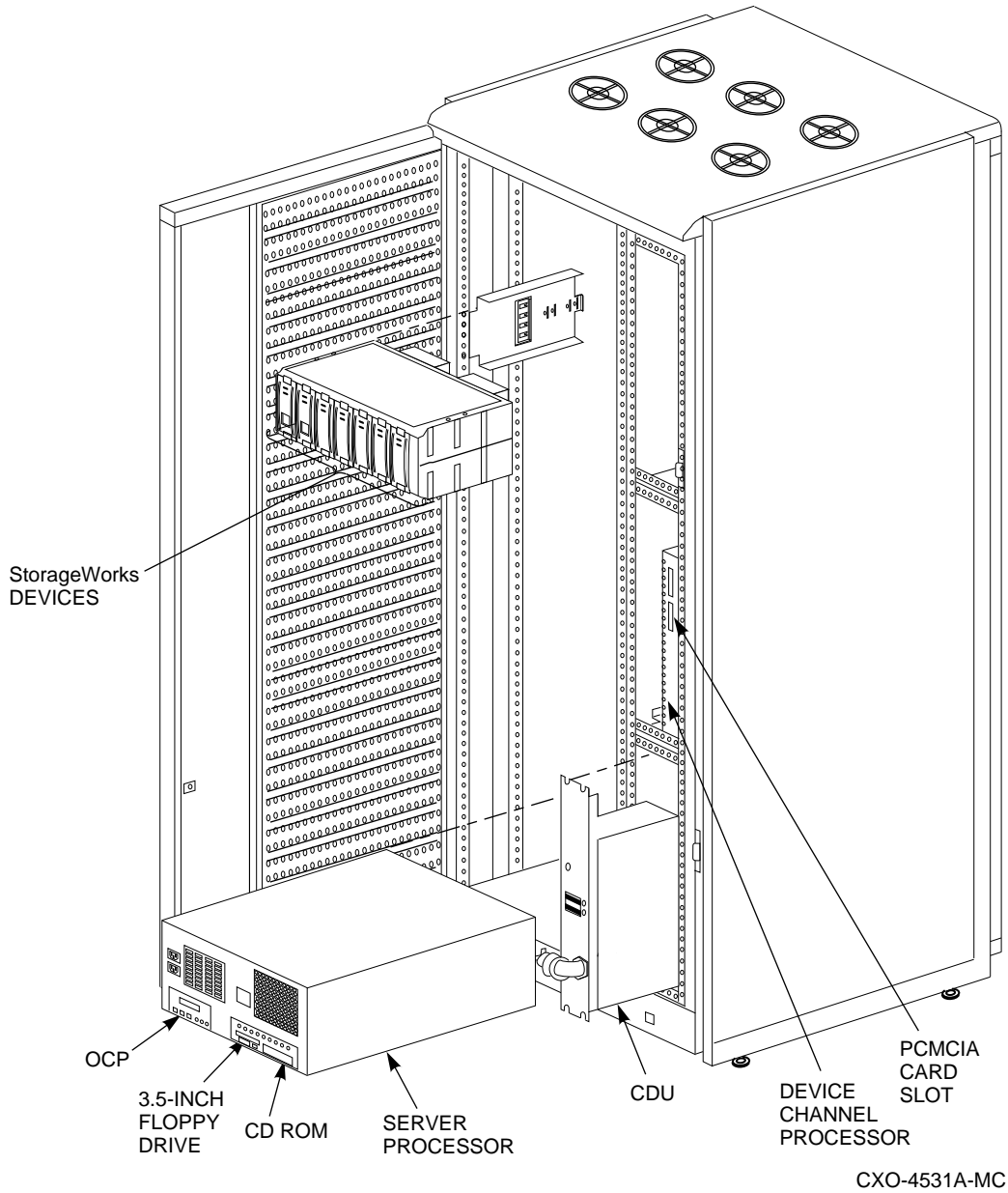
### 1.3 Major Components

Figure 1–5 shows a StorageWorks FDDI Server calling out each of the major components and subcomponents. The major components are as follows:

- Server processor
- Device channel processor (HS1CP)
- StorageWorks storage devices

The subcomponents are explained in Section 1.3.1 through Section 1.3.3.

Figure 1-5 StorageWorks FDDI Server Major Components



### 1.3.1 Server Processor

The StorageWorks FDDI Server's server processor combines Digital's advanced Alpha technology with 64 MB RAM to provide the internal performance required to handle the I/O load of FDDI-based VMScluster systems.

In the model HS241/221/121 StorageWorks FDDI Server, two server processors share the I/O load under normal circumstances. When a failure occurs, the operational server processor takes over the load of its failed partner and continues to deliver data from all devices until repair is effected. Because server processors are separately powered and cooled, a power supply or cooling failure does not interrupt data access.

### 1.3.1.1 System Disk

The system disk contains the OpenVMS Alpha operating system, the Software Customization Procedure (SCP), various relevant documents, and required layered software components. It consists of an RZ28 disk drive located inside the server processor.

### 1.3.1.2 CD-ROM Drive

The CD-ROM drive is used to mount the two CD-ROMs and to access files for various purposes. The FDDI Server includes two CD-ROMs, an operating system CD-ROM and a documentation CD-ROM.

The operating system CD-ROM is used for system rebuild operations if there is no system disk backup, for updating the server operating system to a new version of the OpenVMS Alpha operating system, or for operations performed directly from the CD-ROM such as backup. The documentation CD-ROM is used to access documentation related to the OpenVMS Alpha operating system.

For more detailed information on the use of these two CD-ROMs, see Section 1.4.

### 1.3.1.3 3.5-Inch Floppy Drive

The 3.5-inch floppy drive is used to run the EISA Configuration Utility (ECU) whenever configuration changes are made to the server processor's internal bus, such as during a hardware upgrade.

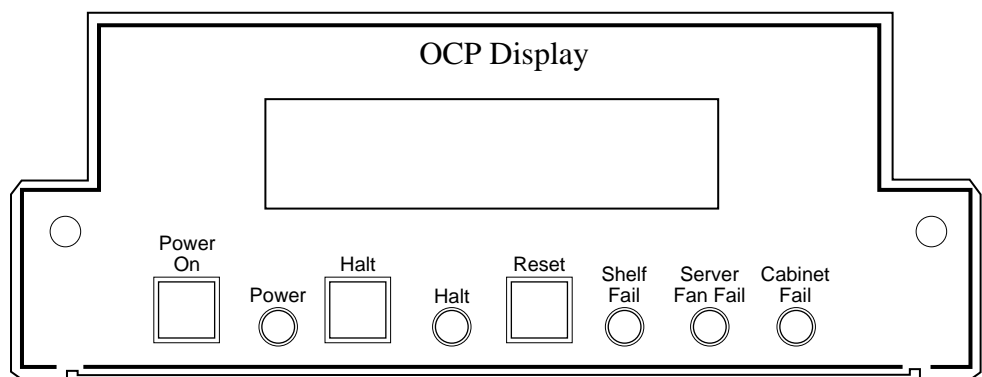
### 1.3.1.4 Operator Control Panel

The operator control panel (OCP) gives you another interface to the StorageWorks FDDI Server. It provides information about and allows you to control the operation of the server processor.

#### Description of OCP Controls and Indicators

Figure 1-6 shows the OCP. Table 1-4 describes the controls and indicators on the OCP.

Figure 1-6 StorageWorks FDDI Server OCP



CXO-4586A-MC



**Table 1–4 StorageWorks FDDI Server OCP Controls and Indicators**

Control or Indicator	Description
OCP Display	This display provides server processor status information.
Power On switch	This switch applies power to and removes power from the server processor.
Power indicator	This indicator shows that power is enabled to the server processor when lighted.
Halt switch	This switch halts the server processor.
Halt indicator	This indicator shows that the server processor has been halted.
Reset switch	This momentary switch resets the server processor.
Shelf Fail indicator	This indicator is not used.
Server Fan Fail indicator	This indicator shows failure of fans 1 or 2 in the server processor when lighted. See Server Fan Fail Indicator for more information.
Cabinet Fail indicator	This indicator is not used.

#### **Cycling Power with the OCP**

During the installation procedure, you are directed to cycle (remove, then restore) power to the server processor. Use the Power On switch on the OCP to perform this step when directed to cycle the server processor.

#### **Server Fan Fail Indicator**

The Server Fan Fail indicator lights when either fan 1 or fan 2 fails. Periodically check to make sure the Server Fan Fail indicator is not lighted.

Failure of fan 3 (the fan cooling the microprocessor) causes the server processor to shut down. The indicator will not light in this instance. In the event of a fan 3 failure, the following message appears on the server processor terminal:

```
System Machine Check Through Vector 00000660
logout frame address 0x6048 code 0x223
Machine Check Code---> 0x223 Fan 1 Failure
```

---

#### **Note**

---

Fan 3 is the hardware designation for the fan which provides the primary cooling air to the microprocessor. This fan is designated as fan 1 to the server processor software. Because of this, the error message shown indicates fan 1 failure.

---

In the event of a fan failure, call your service representative.

### **1.3.2 Device Channel Processor**

The device channel processor can provide nonredundant connections between a server processor and up to 42 industry-standard SCSI–2 devices on six independent fast (10 MB/second) SCSI–2 buses. The device channel processor supports a wide range of StorageWorks magnetic, solid state, and optical disks, tapes, and media loader devices.

To support the I/O demands on this much storage, each device channel processor is capable of processing up to 1000 I/O requests per second. The device channel processor firmware automatically balances stripeset I/O across member disks as well as enabling the following features:

- Redundant access
- Read/Write caching
- RAIDset configuration support (optional feature)

Each of these features is described later in this section.

The device channel processor firmware resides on a PCMCIA card that ships with the StorageWorks FDDI Server. The PCMCIA card is located in the slot located on the front of the device channel processor.

### 1.3.2.1 Redundant Access

In model HS111/121 StorageWorks FDDI Servers, two device channel processors optionally can be configured as a dual-redundant pair connected to the same storage devices. In this configuration, each device channel processor can assume control of all storage devices in the event of its partner's failure, including flushing any unsaved data from the partner's write cache to storage media. This feature is standard on the model HS221/241 StorageWorks FDDI Server.

### 1.3.2.2 Read/Write Cache

Each device channel processor includes a 32 MB nonvolatile read/write cache that reduces I/O request execution times. Firmware allocates the cache dynamically based on actual I/O activity. For optimal resource utilization, management facilities allow you to enable or disable both read and write caching for each storage unit attached to a device channel processor. In the event of a power failure, on-board batteries keep write cache contents intact for up to 100 hours, so no data is lost.

---

#### Note

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The write-back cache module installed in your StorageWorks FDDI server contains batteries that were completely charged at the factory. It is normal for these batteries to discharge slightly in shipment. The server's write-back cache and RAID features require fully-charged batteries to maintain absolute data integrity. After installation, these advanced features may not be available until the batteries have had an opportunity to completely recharge. The charging process may take up to 4 hours to complete.

---

### 1.3.2.3 RAIDset Configuration Support

As an optional upgrade, the device channel processor provides for Digital's implementation of parity RAID technology, which dynamically adjusts to the I/O workload, optimizing I/O performance in both high data-transfer rate and high transaction-rate environments. Using distributed parity, the StorageWorks FDDI Server RAID option economically provides continued access to data in the event of a disk failure. In the fully redundant model HS221/241 StorageWorks FDDI Server, this increases data availability to a level comparable to that of shadowing at significantly lower cost.

### 1.3.3 StorageWorks Storage Devices

Because StorageWorks FDDI Servers support a wide selection of Digital's StorageWorks components, storage subsystems can be custom configured to meet virtually any application need. For increased reliability, the SW800 cabinet that houses both StorageWorks FDDI Server models supports the full suite of StorageWorks redundant power and cooling features.

StorageWorks enclosure components and supported storage devices are all available on a configure-to-order basis. Consult the Software Product Description for the HS1CP device channel processor for an up-to-date list of supported StorageWorks devices.

## 1.4 Using the CD-ROM

The StorageWorks FDDI Server ships with the current version of the OpenVMS Alpha operating system installed on the system disk; consequently, the operating system CD-ROM is not needed for installation or for day-to-day operation. However, it is needed to perform upgrades of the system disk or to restore or rebuild the system disk in the event of a system disk failure if no backup is available. It is also useful in performing complete backups of the server's system disk. A simple standalone-mode menu, executed from the operating system CD-ROM, offers you a quick and easy way to perform the appropriate task.

The operating system CD-ROM contains the following:

- Files to install the OpenVMS Alpha operating system
- A bootable subset of the OpenVMS Alpha operating system that permits a limited system boot directly from the CD-ROM
- The Software Customization Procedure (SCP)
- Applicable Software Product Descriptions (SPDs)

The documentation CD-ROM contains OpenVMS Alpha documentation in Bookreader™, PostScript®, and ASCII text formats.

### 1.4.1 Handling the CD-ROM

Each CD-ROM is enclosed in an antistatic envelope. Be careful to handle the disk only by the edges; fingerprints or smudges should be cleaned using a soft cloth.

To insert the CD-ROM into the drive, press the button on the right side of the drive. The CD tray should then extend out; it may require pulling to its fully extended position. Place the CD-ROM in the tray with the printed side facing up; no disc caddy is required. With the CD-ROM seated properly in the tray, press the drive button again; the tray will retract back into the drive, and the drive light will momentarily illuminate as the drive establishes the presence of the disk.

To remove the CD-ROM, press the drive button again, and replace the CD-ROM in its protective envelope.

## 1.4.2 Accessing Documentation

The FDDI Server includes a documentation CD-ROM containing documentation related to the OpenVMS Alpha operating system. Documents are available in the following formats:

- Files with the filetype .PS are PostScript files that are printed on a PostScript printer.
- Files with the filetype .TXT are ASCII text files that are printed or viewed on a character cell terminal.
- Files with the filetype .DECW\$BOOK are Bookreader files. You must have DECwindows Motif® software installed to read these files with Bookreader. For more information on Bookreader, refer to the *DECwindows Motif for OpenVMS Applications Guide*.

---

### Note

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Prior to accessing documentation on the CD-ROM device, you must load the documentation CD-ROM into the CD-ROM drive and mount it using a command similar to the following:

```
$ MOUNT/CLUSTER $13$DKA500:DOCVMS062
```

---

Some frequently used documentation for OpenVMS Alpha software is located on the FDDI Server's system disk in the [DOCUMENTATION.V0xx] directory where xx represents the OpenVMS operating system software version number. For example, for Version 6.2, the directory is [DOCUMENTATION.V062]. Documentation on the operating system CD-ROM is in directory [ALPHA062.DOCUMENTATION].

See Section 6.2 for more information on how to access the documentation.

## 1.5 How to Use This Guide

Before your StorageWorks FDDI Server is ready to use, you must understand and perform the installation tasks outlined in this guide. The tasks and references to them are listed in Table 1-5.

**Table 1-5 Installation Tasks**

When you . . .	You must . . .	See . . .
Receive the StorageWorks FDDI Server	Understand the product description and installation tasks before you proceed	Chapter 1, Introduction.
<b>Unpacking and Installing the Server Hardware</b>		
Prepare the site	Perform environment and service checks to make sure your site is suitable for installing a StorageWorks FDDI Server	Chapter 2, Preparing Your Site.
Install the hardware	Remove the StorageWorks FDDI Server from its shipping container, place it where you want, connect a terminal and apply power	Chapter 3, Unpacking, Placing, and Applying Power to the StorageWorks FDDI Server.

---

**Configuring Server Software and Devices**

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First boot the StorageWorks FDDI Server processors	Consider VMScluster system issues and execute the Software Customization Procedure to set processor parameters	Chapter 4, Customizing Server Operating System Parameters.
Configure the StorageWorks storage system	Determine and set up the configurations that will meet your needs and configure the system	Chapter 5, Configuring the StorageWorks FDDI Server Storage Devices.

---

**Integrating the Server into the VMScluster System**

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Prepare the StorageWorks FDDI Server to join the VMScluster system	Connect the StorageWorks FDDI Server to the FDDI interconnect and perform other related tasks	Chapter 6, Integrating the Server into the VMScluster System.
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**Supporting and Operating the Server**

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Determine StorageWorks FDDI Server processor system management strategies	Consider installing additional software	Chapter 7, Supporting and Operating the StorageWorks FDDI Server.
Receive new StorageWorks FDDI Server system software, or recover from a system disk failure	Upgrade or restore data from the CD-ROM	Chapter 8, System Software Maintenance.

---



## Preparing Your Site

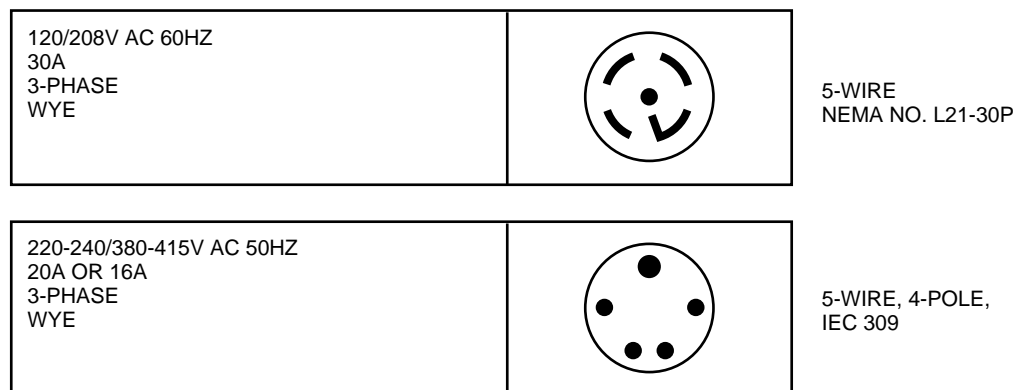
You must ensure that the site selected for installing a StorageWorks FDDI Server satisfies requirements for power, grounding, safety, and service. This chapter discusses preparing your site to meet those requirements.

### 2.1 Power Requirements

The StorageWorks FDDI Server is intended for installation in Class A computer room environments. Before installing the StorageWorks FDDI Server, make sure that your site meets the following power requirements:

- The primary power source can supply the required amount of ac power, as specified in the specifications table (see Chapter 1).
- The proper power receptacles are installed for the cabinet. Figure 2-1 specifies the primary power plugs supplied with both 60 Hz and 50 Hz power versions of the StorageWorks FDDI Server.

**Figure 2-1 StorageWorks FDDI Server Primary Power Plugs**



CXO-3807B-MC

## 2.2 Grounding Requirements

The StorageWorks FDDI Server usually is connected to other equipment by one or more FDDI interconnect cables. For both safe and reliable operation, the cabinet and other equipment require proper grounding.

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### WARNING

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If cabinets are not connected to a common ground, there is a potential for personal injury as a result of electric shock.

---

Make sure that site power distribution systems meet local electrical codes prior to the installation of StorageWorks FDDI Server.

To make sure that the power distribution system will perform satisfactorily, a power system survey should be done before installation. The following areas should be investigated:

- Do all outlets have power ground connections?
- Do the power cords on all equipment at the site have grounding prongs?
- Are all power outlet neutral connections isolated from ground?
- Are the grounds for all outlets connected to the same power distribution panel?
- Are all devices that are connected to the same breaker as the StorageWorks FDDI Server UL or IEC approved?

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### CAUTION

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If there is a deficiency found in any area during the power survey, a qualified electrician must correct it before installation may begin. Failure to resolve power survey deficiencies before installing the equipment may result in personal injury as a result of electric shock.

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If no problems are found during the survey, the site grounding system may be considered to be adequate for safe and reliable StorageWorks FDDI Server operation.

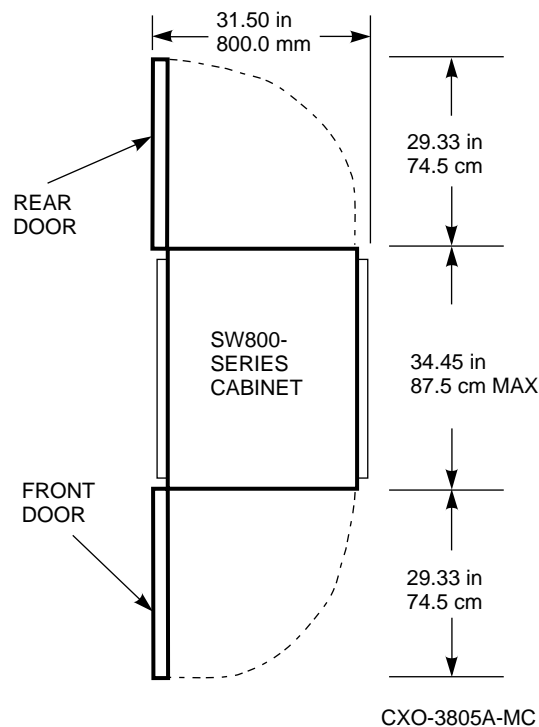


## 2.3 Safety and Service Requirements

The following general safety and service requirements refer to the floor location chosen for placing the StorageWorks FDDI Server:

- The site floor must safely bear the weight of the cabinet, as specified in Chapter 1. The entire weight of the cabinet is supported by the four leveler feet when the cabinet is installed in its final position.
- The space around the cabinet must allow for opening the front and rear doors, for accessing cables, and for adequate airflow. See Figure 2–2 for specific space requirements.

Figure 2–2 Minimum Installation Clearances



- If the cabinet is positioned next to other cabinets, there must be sufficient service loop in any connecting cables to allow the cabinet to be moved out for access.

---

### Note

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The StorageWorks FDDI Server is not designed to be fastened to adjacent cabinets.

---



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## Unpacking, Placing, and Applying Power to the StorageWorks FDDI Server

This chapter describes unpacking and placing the StorageWorks FDDI Server followed by descriptions of connecting a terminal to and applying power to the StorageWorks FDDI Server.

### 3.1 Unpacking the Cabinet

The StorageWorks FDDI Server arrives packed in a corrugated carton attached to a wooden shipping pallet, as shown in Figure 3–1. Unpack the cabinet as follows:

---

**Note**

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Before unpacking the equipment, inspect the shipping carton for signs of external damage. Report any damage to the local carrier and to Digital Multivendor Customer Services or your local Digital sales office.

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1. Remove the cover, the fasteners, and the corrugated board from the pallet.
2. Remove the cartons containing the ramp set and skirt kit and set them aside.
3. Cut the shipping straps. Some cabinets are packaged in a plastic or barrier bag. If the cabinet arrives in a plastic bag, leave the bag in place until the cabinet has adjusted to the local temperature and humidity, as follows:

---

**CAUTION**

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Failure to thermally stabilize storage subsystems may damage drive media or associated electronics when the unit is turned on. Environmental stabilization begins when the equipment is placed in the room in which it is to be installed.

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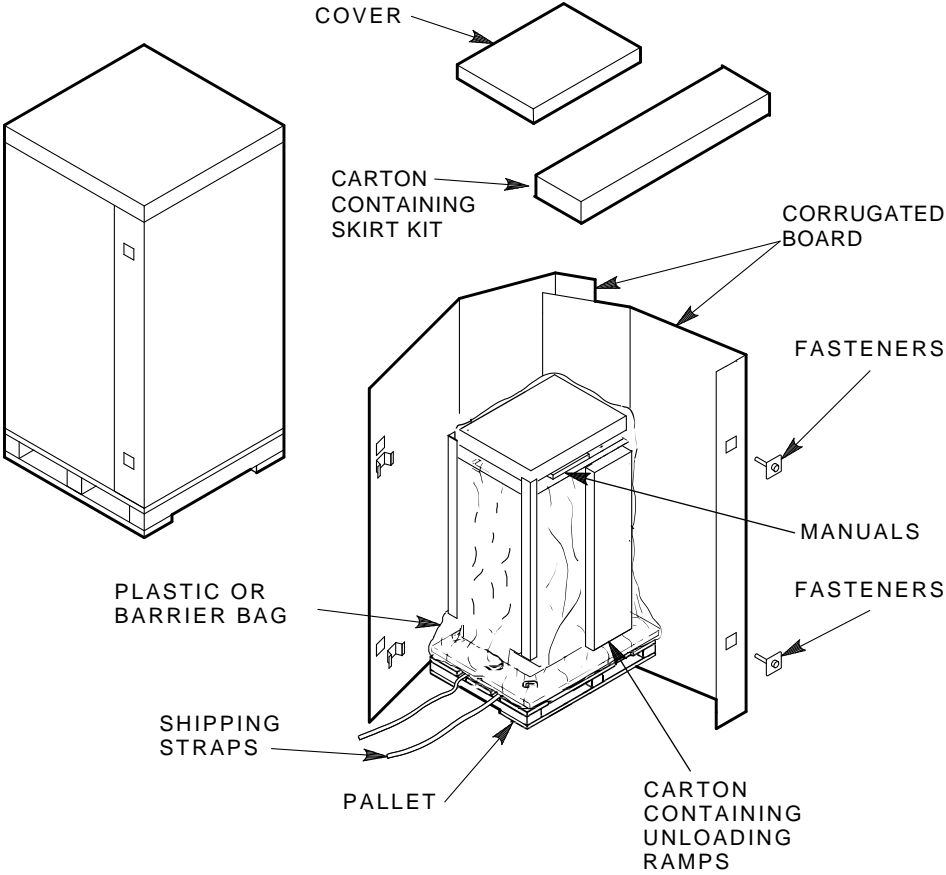
- To ensure proper operation of Digital storage devices, the StorageWorks building block (SBB) temperature must be within 18°C to 29°C (65°F to 85°F). Table 3–1 specifies the time required to thermally stabilize SBBs based on the ambient shipping temperature.

**Table 3–1 Thermal Stabilization Specifications**

<b>Ambient Temperature Range °C</b>	<b>Ambient Temperature Range °F</b>	<b>Minimum Stabilization Time</b>
60 to 66	140 to 151	3 hours
50 to 59	122 to 139	2 hours
40 to 49	104 to 121	1 hour
30 to 39	86 to 103	30 minutes
18 to 29	65 to 85	None
10 to 17	50 to 64	30 minutes
0 to 9	32 to 49	1 hour
-10 to -1	14 to 31	2 hours
-20 to -11	-4 to 13	3 hours
-30 to -21	-22 to -5	4 hours
-40 to -31	-40 to -21	5 hours

- If condensation *is visible* on the outside of the storage device, stabilize the device and the SBB in the operating environment for 6 hours or until the condensation is no longer visible, whichever is longer.
  - If condensation *is not visible* on the outside of the storage device, thermally stabilize the device for the amount of time specified in Table 3–1.
4. Once the cabinet is unpacked, examine the front and rear doors, right and left side panels, top panel, and undercarriage for any apparent damage. Report such problems immediately to Digital Multivendor Customer Services or your local Digital sales office.
  5. Retain the shipping container and all packing materials.

Figure 3-1 Shipping Container Contents



CXO-3533A-TI

## 3.2 Removing the Cabinet from the Pallet

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### WARNING

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Three people are required to remove the cabinet from the shipping pallet. Failure to use sufficient personnel and correct safety precautions can result in injury and equipment damage. All personnel should wear safety glasses.

---

Use the following procedure to remove the cabinet from the shipping pallet:

1. Remove any packing material remaining on the pallet.
2. Remove and inspect the two unloading ramps. The ramps, ramp side rails, and metal hardware should be inspected for the following defects:
  - Cracks more than 25 percent of the ramp depth, either across or lengthwise on the ramp
  - Knots or knotholes going through the thickness of the ramp and greater than 50 percent of the ramp width
  - Loose, missing, or broken ramp side rails
  - Loose, missing, or bent metal hardware

If any of these defects exist, do not use the ramp. Investigate alternate means of removing the cabinet or order a new ramp. (The part number for the ramp set is 99-08897-05.)

3. Attach the ramps by fitting the metal prongs into the holes on the pallet, as shown in Figure 3-2. Make sure that the arrows on the ramps match up with the arrows on the pallet.
4. Extend the ramps to their full length.
5. See Figure 3-3 for the location of the shipping bolts. Remove the bolts.
6. Remove the shipping brackets, shown in Figure 3-3, from the cabinet leveler feet and set aside.
7. Loosen the leveler locking nuts and screw the four cabinet leveler feet all the way up into the cabinet.

---

### WARNING

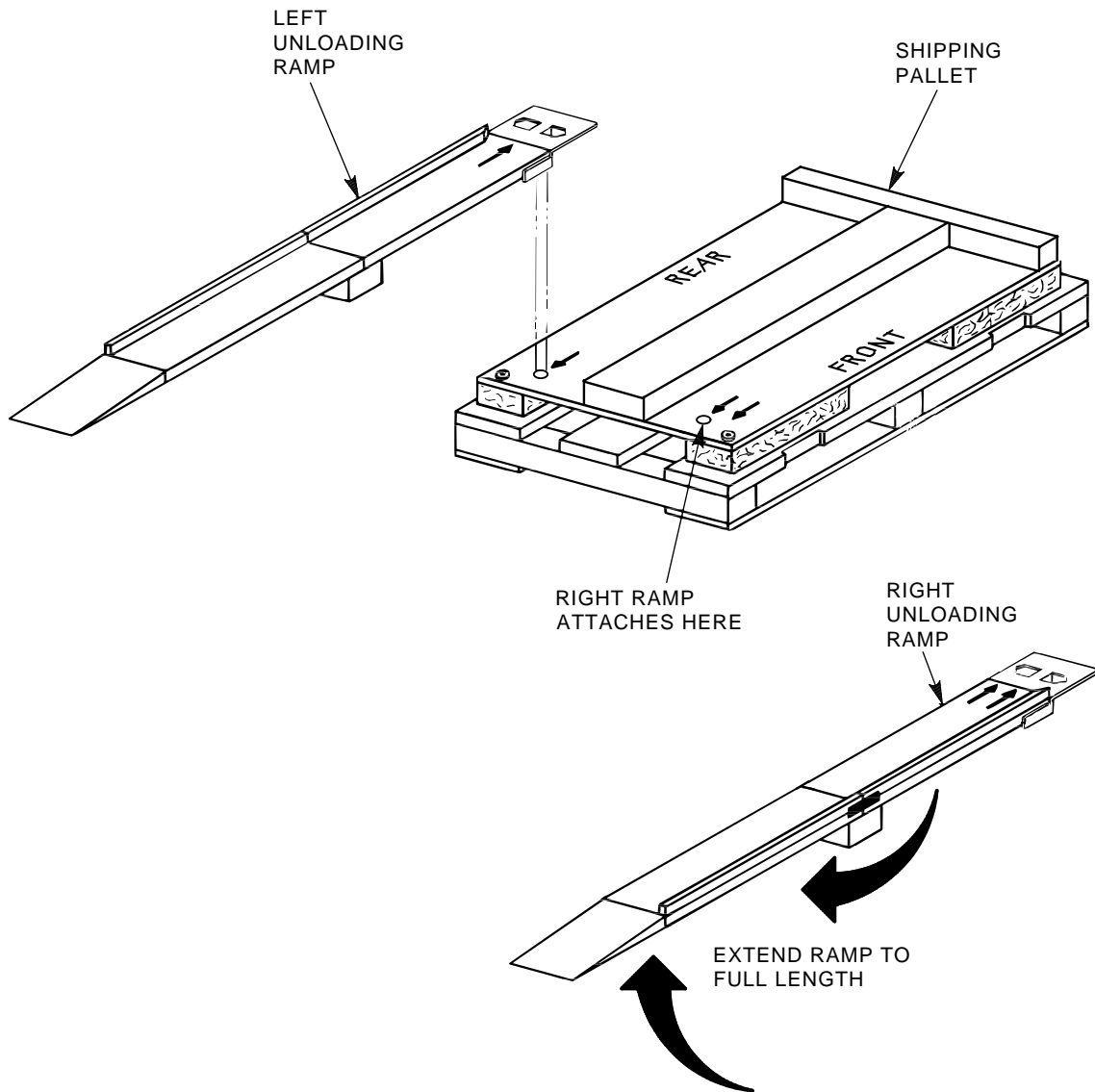
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The leveler feet must be raised fully for the cabinet to roll easily down the unloading ramps. Failure to do so can result in the cabinet tipping off the pallet or ramp.

---

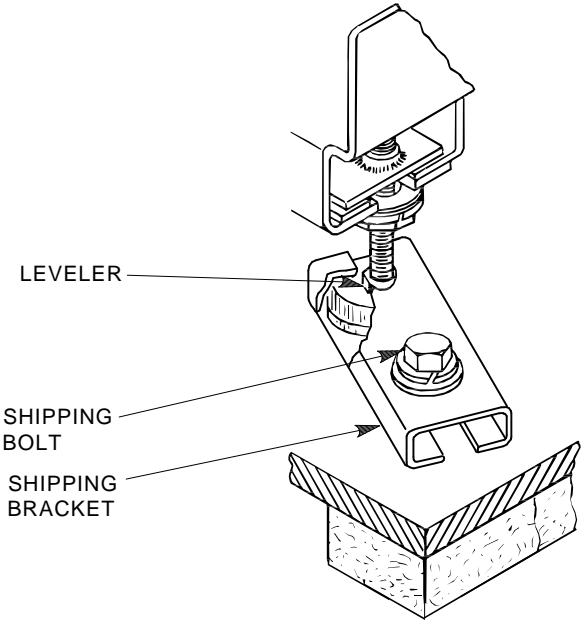
8. Carefully roll the cabinet off the pallet and down the ramps to the floor as shown in Figure 3-4.

**Figure 3-2 Shipping Pallet Ramp Installation**



CXO-688D\_S

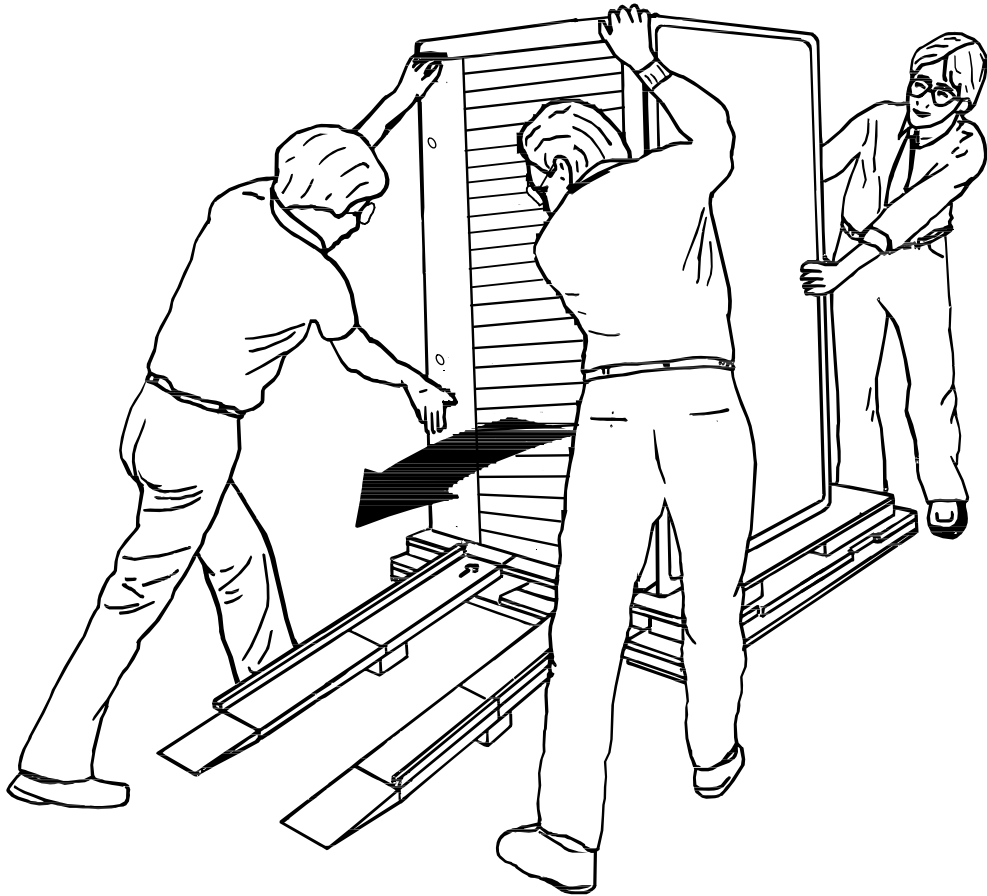
**Figure 3-3 Shipping Bolts and Brackets**



SHR\_X1102A\_89\_SCN



Figure 3–4 Removing the Cabinet from the Pallet



CXO-3808A

### 3.3 Placing the Cabinet

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**WARNING**

---

Use extreme caution when rolling the cabinet across the floor. Failure to raise all leveler feet and to provide a clear path for the cabinet's casters can result in the cabinet tipping over and injury to personnel.

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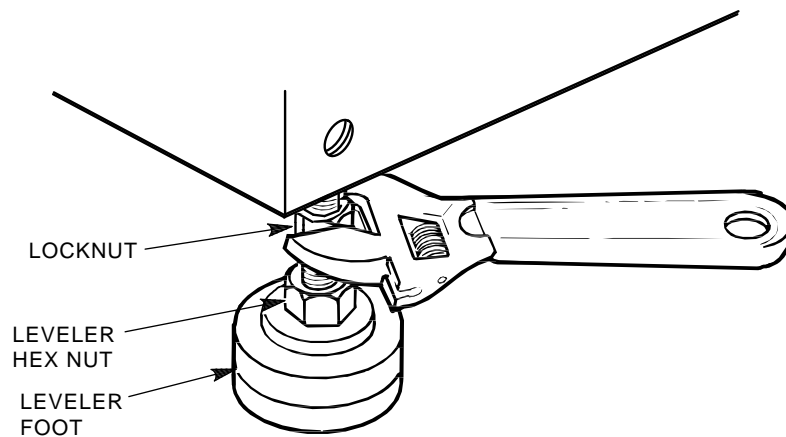
Once the cabinet has been removed from the pallet, the cabinet can be rolled to its final installation position. Secure loose cabinet cables up and out of the way when rolling the cabinet.

### 3.4 Leveling the Cabinet

Level the cabinet in its final position as follows:

1. Loosen the locknuts on all four leveler feet as shown in Figure 3-5.
2. Turn each leveler hex nut clockwise until the leveler foot contacts the floor.
3. Adjust all four leveler feet until the cabinet is level and the load is removed from all casters. Verify that the casters spin freely.
4. Tighten the locknuts on all four leveler feet.

Figure 3-5 Leveler Foot Adjustment



CXO-3829A

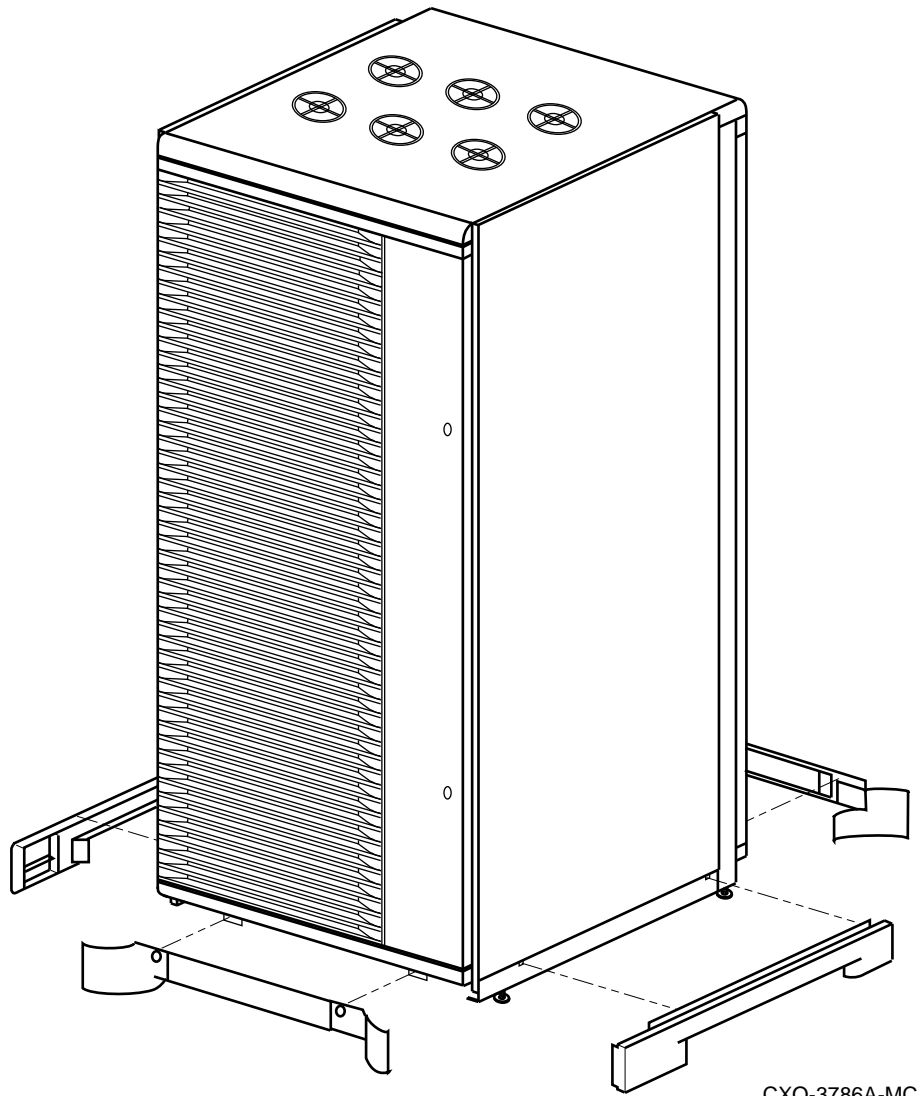
### 3.5 Installing the Skirt Kit

The skirt kit is packaged separately inside the corrugated carton with the cabinet. Installation of the skirt kit is optional. If you are installing the skirt kit, proceed as follows:

1. Unpack the skirt kit carton, using Figure 3-6 for reference, identify the right, left, front, and rear skirts.
2. Using Figure 3-6 for reference, position the skirts next to the cabinet.
3. The skirt fasteners are quarter-turn fasteners. Position each skirt against the cabinet such that the fasteners mate with the receptacles on the cabinet's base.
4. Using a screwdriver, push each fastener into its mating receptacle on the cabinet base, and turn it one quarter-turn clockwise.

(Once the skirts are installed, there is a small amount of play that allows them to be adjusted slightly up or down for proper alignment.)

**Figure 3–6 Cabinet Skirt Installation**



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### **3.6 Inspecting the Cabinet**

Inspect the cabinet installation as follows:

1. Make sure that all four leveler feet are lowered to support the full weight of the cabinet and that the cabinet is level.
2. The remaining steps require access to the cabinet interior. To access the cabinet interior perform the following:
  - a. Release the door locks mounted on the smooth vertical panel of each door by turning the locks counterclockwise with a 5/32-inch hex wrench.
  - b. Swing the doors open.
  - c. Move the cabinet away from adjacent cabinets.

- d. Remove the side panels.

---

**Note**

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There are three side panel hanger clips on each side of the cabinet. A matching set of hanger clips are attached to each side panel.

---

- e. Loosen the top cover by pushing up on its front and rear edges until it snaps free of its fasteners.

---

**WARNING**

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The top cover is heavy and awkward to lift. Removing it requires two people. Failure to use sufficient personnel can result in personnel injury or equipment damage.

---

- f. Using two people, lift the top cover from the cabinet and set it aside.
  - g. Remove the bolts attaching the side panels to the top side rails of the cabinet.
  - h. Grasp a panel along its front and rear edges and lift up until the hanger clips disengage. Lift the panel away from the cabinet.
  - i. Repeat the previous step to remove the other panel.
3. Make sure that the circuit breaker on the CDUs is in the ○ (OFF) position.
  4. Make sure that all hardware within the cabinet is fastened securely, and that there are no loose pieces present in the cabinet interior.
  5. Check each of the cabinet fans to make sure that the blades turn freely and are not obstructed.
  6. Make sure that there are no obstructions to the airflow from the shelf blowers.
  7. Check the identification label on the rear of the cabinet to verify that the cabinet is configured to accept the power available at the site.
  8. Make sure that all ac power cords connected from the shelves and cabinet fans to the CDUs are firmly seated in their connectors at both ends.
  9. Make sure that all SBBs are seated firmly in their shelves.
  10. Make sure that any necessary external interface cables are installed and firmly seated in their connectors.
  11. Replace the side panels and top cover by reversing the procedures described in step 2.

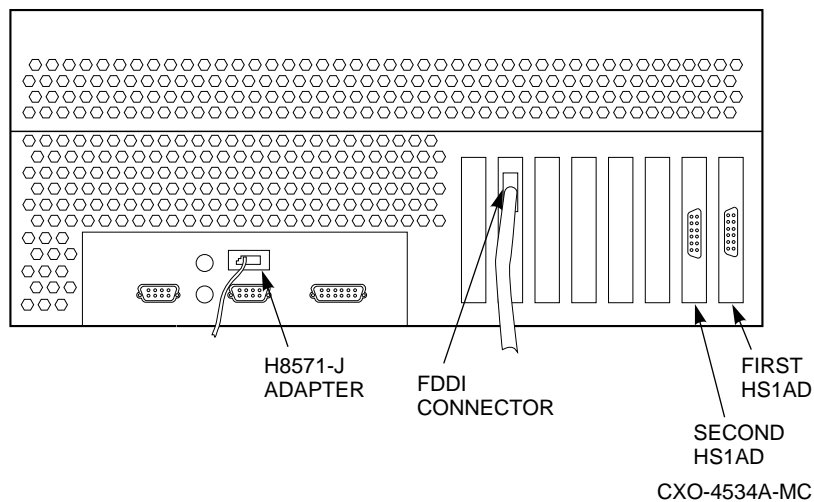
### 3.7 Connecting a Terminal to the StorageWorks FDDI Server

Communicating with the StorageWorks FDDI Server requires that you connect a terminal to it. Any terminal that supports ANSI control sequences can be used, including graphics displays that provide emulation of an ANSI compatible video terminal.

Use the following procedure to connect most EIA compatible terminals:

1. Make sure the power switch on the back of the terminal is OFF (0).
2. Connect one end of the terminal cable to the back of the terminal.
3. Connect the other end of the terminal cable to the EIA terminal port on the rear of the StorageWorks FDDI Server cabinet using an H8571-J adapter as shown in Figure 3-7.

Figure 3-7 Connecting to the Terminal Port of the StorageWorks FDDI Server



4. Turn the terminal power switch to the ON position.
5. Set the terminal at 9600 baud, with 8 data bits, 1 stop bit, and no parity. Refer to your terminal documentation for terminal setup instructions.

## 3.8 Applying Power to the Cabinet

Once the cabinet has been inspected and the terminal has been connected to the StorageWorks FDDI Server, apply power as follows:

1. Plug the primary power cable from CDU A into the appropriate site power receptacle.
2. Plug the auxiliary power cable from CDU B into the appropriate site power receptacle.
3. Switch the circuit breaker on each CDU to the | (ON) position.
4. Verify that all cabinet fans and shelf blowers are operating and that both status indicators on each shelf power supply SBB are illuminated. Refer to the *StorageWorks Solutions Shelf and SBB User's Guide* for further information on shelf status indicators.
5. Apply DC power to each server processor. The DC power switch is located on the OCP of the server processor. Figure 1-5 shows the location of the OCP.
6. Observe that the server processor power-on self-tests were successful by examining the terminal and looking for the self-test information as shown in Example 3-1.

### Example 3-1 Server Processor Self Test Display

```
*** keyboard not plugged in...
ff.fe.fd.fc.fb.fa.f9.f8.f7.f6.f5.
ef.df.ee.f4.ed.ec.eb.....ea.e9.e8.e7.e6.e5.e4.e3.e2.e1.e0.
V1.1-1, built on Nov  4 1994 at 16:44:07
>>>
```

---

## Customizing Server Operating System Parameters

This chapter describes the tasks that you perform to customize operating system parameters in the StorageWorks FDDI Server.

### 4.1 Software Configuration Overview

Each StorageWorks FDDI Server ships from the factory with the OpenVMS Alpha operating system preloaded on the system disks. You set StorageWorks FDDI Server processor operating system parameters the **first time** you boot the servers.

Because each StorageWorks FDDI Server processor is a VMSccluster node, it is important that you perform the software configuration in the recommended sequence. Table 4–1 describes the configuration tasks in this and following chapters.

**Table 4–1 Software Configuration Tasks**

Step	Action	Refer to
1	Customize the parameters on the first server processor by running the Software Customization Procedure. Reboot the server processor upon completion.	Section 4.3, Executing the Software Customization Procedure.
2	If your StorageWorks FDDI Server has two server processors, move the terminal to the second server processor and customize the parameters on the second server processor by running the Software Customization Procedure (see Connecting a Terminal to the StorageWorks FDDI Server). Reboot the server processor upon completion.	Section 4.3, Executing the Software Customization Procedure.
3	Configure the StorageWorks storage devices according to your needs.	Chapter 5, Configuring the StorageWorks FDDI Server Storage Devices.

(continued on next page)

**Table 4–1 (Cont.) Software Configuration Tasks**

Step	Action	Refer to
4	Connect the server to the FDDI interconnect. For each server processor:  1. Shut down the server processor.  2. Reboot into the VMScluster system.	Section 6.1, Connecting to the FDDI Interconnect.
5	Ensure VMScluster system compatibility and server readiness.	Section 6.3, Ensuring VMScluster System Compatibility.

## 4.2 VMScluster System Considerations

Introducing the StorageWorks FDDI Server to a VMScluster system requires you to consider some broad, clusterwide issues. Among them are the VMScluster quorum scheme, enabling you to maintain an available VMScluster system, and Volume Shadowing interoperability. This section addresses each of these topics with some guidelines for you to consider.

### 4.2.1 Considering the VMScluster Quorum Scheme

The addition of a StorageWorks FDDI Server to an existing VMScluster may impact existing VMScluster voting and quorum schemes. Two sample configurations may provide insight into possible VMScluster voting and quorum schemes:

**Example 1:**

The FDDI Server is being added to an existing cluster (perhaps on a new FDDI ring) with an existing and working quorum scheme. In this case, the FDDI Server is providing device serving only and does not contain a VMScluster system disk for other cluster nodes. In this case, the FDDI Server should have ZERO votes and should contain no quorum disk (which may already exist in another part of the cluster). The expected votes on the FDDI Server should be set to the current value in the cluster.

**Example 2:**

The FDDI Server provides the VMScluster system disk for other VMScluster satellites (nodes without votes). There are no other voting nodes in the cluster. This case would occur in a new cluster being formed with an FDDI Server as the core. In this case, the nodes in the FDDI Server must provide all the votes for the cluster. For the two-node servers, a quorum disk on the server is recommended so that the cluster can continue with only one server node operational. In the voting scheme, each of the two server nodes would have one vote; the quorum disk would have a single vote; and the expected votes for the cluster would be three. For the HSx11 (single-node servers), there is no need for a quorum disk, because only the single node in the HS211/111 will be contributing to quorum. In this case, the HSx11 node would have one vote and the expected votes for the cluster would be one. Note that the cluster will hang if the HS211/111 is unavailable.



Many other cluster configurations are possible, and appropriate quorum and voting schemes should be designed by knowledgeable system and network managers, perhaps with assistance from consulting services. Extensive information regarding quorum and voting issues may be found in the *VMScCluster Systems for OpenVMS* manual and the *Guidelines for VMScCluster Configurations* manual.

### 4.2.2 Volume Shadowing Interoperability

Each server processor in your FDDI Server is a node in your VMScCluster running the OpenVMS Alpha Version 6.2 operating system. Introduction of this operating system version into your cluster has clusterwide implications that should be considered by knowledgeable system managers. OpenVMS Alpha Version 6.2 includes Phase II Volume Shadowing interoperability changes from previous ECO kits. If you are using Phase II Volume Shadowing, then you must install the Volume Shadowing interoperability patches on any cluster member running an operating system version earlier than OpenVMS Version 6.2 to ensure correct shadowing operation throughout your cluster.

More information regarding these patches is available in the Problem Description section of the release notes supplied with the patch kits. Please read these notes regarding the cluster impact of patch installation. For your convenience, the FDDI Server Version 1.1 CD-ROM contains the release notes and shadowing remedial kits current at the time the CD-ROM was built. The release notes and kits are located in the [SHADOW\_KITS] directory.

Digital recommends that you contact the Digital Customer Support Center to obtain the latest Volume Shadowing ECOs for all operating system versions in your cluster. TIMA remedial kits containing these changes are available through Digital Customer Services worldwide.

## 4.3 Executing the Software Customization Procedure

---

**Note**

---

The Software Customization Procedure should be performed by an experienced cluster manager who is knowledgeable about the clusters at the installation site. Network knowledge also is required to complete the procedure.

---

---

**Note**

---

You must perform the Software Customization Procedure on each StorageWorks FDDI Server Server Processor.

---

The Software Customization Procedure is self-explanatory and provides immediate help for determining responses to questions asked during the procedure. To get help, type a question mark (?) as your response to a procedure question and press the Return key.

The Software Customization Procedure requires specific information in order to complete successfully. Before starting, make sure that you have the information described in Table 4-2. (Table 4-2 can be used as a worksheet. Use the underlined space in column 1 to record your response to each of the questions in advance.)

Once completed, the Software Customization Procedure will not run again. However, if you abort the procedure before it completes, it will appear the next time you boot the system.

After completing the Software Customization Procedure, manage the StorageWorks FDDI Server using normal OpenVMS Alpha system management procedures. For information on managing the server, consult appropriate documentation on the OpenVMS Alpha operating system.

**Table 4-2 Required Information for Customizing the OpenVMS Alpha Operating System**

Use the information for the . . .	To respond to the prompts . . .
Current date and time _____	The current system date is dd-mmm-yyyy Is this date correct? [YES]: no Type the current date []:  and  The current system time is hh:mm:ss Is this time correct? [YES]: no Type the current time []:
System password _____	Type the password for the system account:  and  To verify the password is correct, type it again now. Password verification:
DECnet node name of the StorageWorks FDDI Server _____	What is the server's DECnet node name?
DECnet address of the StorageWorks FDDI Server _____	What is the server's DECnet node address?
Cluster group number _____	Enter this cluster's group number:
Cluster password _____	Enter this cluster's password:  and  Re-enter this cluster's password for verification:
Value of the disk ALLOCLASS parameter _____	Enter a value for xxxxxx's † ALLOCLASS parameter?
Value of the tape ALLOCLASS parameter _____	Enter a value for xxxxxx's † TAPE_ALLOCLASS parameter?

†Where xxxxxx is the server's name.

(continued on next page)

**Table 4–2 (Cont.) Required Information for Customizing the OpenVMS Alpha Operating System**

<b>Use the information for the . . .</b>	<b>To respond to the prompts . . .</b>
Name of the quorum disk ‡	What is the device name of the quorum disk?
The number of votes the server will contribute toward quorum	Enter a value for the number of votes:
The expected number of votes in the cluster	Enter a value for the number of expected votes:

‡The quorum disk, if specified, must be attached to the server's device channel processor; that is, it must be a DUA disk and not the server's local system disk.

To begin the Software Customization Procedure, type B at the >>> system prompt on the terminal attached to the server processor. Examples 4–1 and 4–2 show sample Software Customization Procedure log files and provide sample answers to the questions in the Software Customization Procedure. All user input is shown in bold text except for passwords, which are not echoed, and carriage returns.

**Example 4–1 Software Customization Procedure Log File—Part 1**

```
>>> BOOT
(boot dka0.0.0.6.0 -flags 0)
block 0 of dka0.0.0.6.0 is a valid boot block
reading 1035 blocks from dka0.0.0.6.0
bootstrap code read in
base = 14e000, image_start = 0, image_bytes = 81600
initializing HWRPB at 2000
initializing page table at 140000
initializing machine state
setting affinity to the primary CPU
jumping to bootstrap code
```

```
+-----+
|                                     |
|                               Welcome to the                               |
|                               StorageWorks FDDI Server                       |
|                               Software Customization Procedure                 |
|                                     |
+-----+
```

Please wait while the Software Customization procedure initializes the system. This will take less than one minute.

```
+-----+
|                               Software Customization Procedure                 |
|                               Introduction                                     |
+-----+
```

(continued on next page)

## Example 4-1 (Cont.) Software Customization Procedure Log File—Part 1

The Software Customization procedure will ask you to enter the information required for the factory installed software to be custom configured for your site.

To answer a question, type the requested information and press Return. To get help at any time, type a question mark (?) and press Return.

Press Return to continue:

No licenses have been registered on this system.

To register your license PAKs, type the following command after the system restarts and you have logged in to the system manager's account:

```
$ @SYS$UPDATE:VMSLICENSE
```

Press Return to continue:

The following information is essential to ensure that the server can be customized correctly:

- o The current date and time
- o The password for the system manager's account on the server
- o Cluster Information
  - The DECnet node name of the server
  - The DECnet address of the server
  - The cluster group number and password
  - The value of the ALLOCLASS parameter for disk and tape
  - Whether this server will serve tapes
  - The name of a quorum disk if a quorum disk will be installed on the server. (This disk must be attached to the server's Device Channel Processor; that is, it must be a DUA disk and not the server's local system disk.)
  - The number of Votes the server will contribute toward quorum
  - The expected number of Votes in the cluster

You cannot complete the Software Customization procedure if you do not have all the essential information. If you do not have this information, you can obtain it from your system manager or network administrator.

Are you ready to proceed with the Software Customization? [YES]:

At the end of the Software Customization procedure, the server will restart itself. Then it will be ready for use.

```
+-----+
|                Set the system date and time                |
+-----+
```

To set the server up correctly, you must set the system date and time.

To get help, type a question mark (?) and press Return.

The current system date is 21-AUG-1995.

Is this date correct? [YES]:

The current system time is 22:58:12

Is this time correct? [YES]:

The current system date and time is 21-AUG-1995 22:58:13.60

Are the date and time correct? [YES]:

(continued on next page)

### Example 4-1 (Cont.) Software Customization Procedure Log File—Part 1

```
+-----+
|                               |
|                               |
|                               |
|                               |
+-----+
```

The system password gives you access to the system manager's account on the server. When the Software Customization procedure completes, you will be able to log in to the system manager's account on the server by typing the user name SYSTEM, followed by the system password.

The system password that you specify must contain at least 8 characters. For security reasons, the characters you type are not displayed on the screen.

IMPORTANT: Do not forget the system password, otherwise you will be unable to log in to the system manager's account.

Type the password for the SYSTEM account:

To verify that the password is correct, type it again now.

Password verification:

The password for the SYSTEM account has been verified.

```
+-----+
|                               |
|                               |
|                               |
|                               |
+-----+
```

What is the server's DECnet node name? FSERV1

What is the server's DECnet node address? 63.849

Enter this cluster's group number: 3396

Enter this cluster's password:

Re-enter this cluster's password for verification:

Do you wish FSERV1 to automatically serve disks? (Y/N) Y

Enter a value for FSERV1's ALLOCLASS parameter: 27

Do you wish FSERV1 to automatically serve tapes? (Y/N) Y

Enter a value for FSERV1's TAPE\_ALLOCLASS parameter: 27

Will a quorum disk be installed on the server? (Y/N) N

Enter the number of votes that the server will contribute toward quorum: [1] 0

Enter a value for the number of expected votes in the cluster: [1] 3

You have chosen the following cluster parameters:

Server name (SCSNODE)	FSERV1
System id (SCSSYSTEMID)	65361 (63.849)
Cluster group number	3396
Automatically serve disks	YES
Disk allocation class (ALLOCLASS)	27
No quorum disk selected	
Tape server (TMSCP_LOAD)	YES
Tape allocation class (TAPE_ALLOCLASS)	27
Number of Votes for this server	0
Number of Expected Votes in the cluster	3

Would you like to change any of these parameters? (Y/N): N

If you respond with an N to the last question shown in the previous example, the Software Customization Procedure continues as shown in Example 4-2. If you respond with a Y, then the previous script repeats.

#### Example 4-2 Software Customization Procedure Log File—Part 2

```
*****
*
*   The following parameters have been set for FSERV1:
*           VOTES = 1
*           QDSKVOTES = 1
*
*   After FSERV1 has booted into the cluster, you must
*   adjust the value for EXPECTED_VOTES in every cluster
*   member's MODPARAMS.DAT. You must then run AUTOGEN on
*   each node and shutdown and reboot the cluster. This
*   will cause EXPECTED_VOTES to be correct on each
*   node.
*
*   For example, if the server includes two Alpha VMS
*   systems and a quorum disk, then EXPECTED_VOTES for
*   each cluster member will have to be increased by
*   a total of 3.
*
*****
```

Cluster set-up complete. Continuing...

```
+-----+
|           Volume Shadowing for OpenVMS Alpha ECO kits           |
+-----+
```

Note that the OpenVMS Alpha V6.2 operating system contains Volume Shadowing interoperability changes from previous ECO kits. If you are using Volume Shadowing, you must install the Volume Shadowing interoperability patches on any cluster member running an operating system version earlier than OpenVMS V6.2 to ensure correct shadowing operation throughout your cluster.

More information regarding these patches is available in the Problem Description section of the release notes supplied with the patch kits. Please read these notes regarding the cluster impact of patch installation. The release notes are located in the SYS\$HELP directory of the server's system disk in the following files:

```
ALPSHAD01_062.RELEASE_NOTES    ALPSHAD07_061.RELEASE_NOTES
VAXSHAD01_062.RELEASE_NOTES    VAXSHAD03_060.RELEASE_NOTES
VAXSHAD07_061.RELEASE_NOTES
```

Press Return to continue:

For your convenience, the shadowing remedial kits current at the time this server was built have been provided in the following directory of the server's system disk and in the equivalent directory of the FDDI Server's distribution CD-ROM.

```
sys$sysdevice:[shadow_kits]ALPSHAD01_062.*
sys$sysdevice:[shadow_kits]ALPSHAD07_061.*
sys$sysdevice:[shadow_kits]VAXSHAD01_062.*
sys$sysdevice:[shadow_kits]VAXSHAD03_060.*
sys$sysdevice:[shadow_kits]VAXSHAD07_061.*
```

(continued on next page)

## Example 4-2 (Cont.) Software Customization Procedure Log File—Part 2

TIMA remedial kits containing these changes are available through Digital Customer Services worldwide. Digital recommends that you contact your Customer Support Center to obtain the latest Volume Shadowing ECOs for all operating system versions in your cluster.

Press Return to continue:

```
+-----+
|                               End of Data Entry                               |
+-----+
```

This is the end of the data entry part of the Software Customization procedure -- you do not need to provide any more information.

The server will now shut down and restart automatically as a standalone node; it will not join or create a cluster. After this reboot, you can log in to the system manager's account using the user name SYSTEM and the password that you specified earlier. You may then install any license PAK's, configure the storage attached to the server, add a command to the startup procedure to mount the quorum disk (if any), perform additional system customization, etc.

The third time the server is started, it will attempt to join the cluster using the parameters you have entered above. If it has been attached to the FDDI interconnect, the server will join the FDDI cluster. Dual-processor servers will form a cluster with each other if they do not find a cluster to join.

Press Return to complete the Customization procedure:

The server is now being configured. This will take less than one minute.

Please wait...

Server is being configured... 22:59:19

The server SYSGEN parameters have been set. The server will now restart automatically. Please wait...

halted CPU 0

halt code = 5  
HALT instruction executed  
PC = ffffffff8004df84

CPU 0 booting

```
(boot dka0.0.0.6.0 -flags 0)
block 0 of dka0.0.0.6.0 is a valid boot block
reading 1035 blocks from dka0.0.0.6.0
bootstrap code read in
base = 14e000, image_start = 0, image_bytes = 81600
initializing HWRPB at 2000
initializing page table at 140000
initializing machine state
setting affinity to the primary CPU
jumping to bootstrap code
```

OpenVMS (TM) Alpha Operating System, Version V6.2

After the server has shut down, it may be necessary to cycle power for the server processor. If the reboot does not proceed beyond the banner shown above, power cycle the server processor by pressing its power switch off and then on again. After the power-on self-tests complete and the system prompt >>> appears, type B to reboot the system. (See Example 3-1 for an example display of the power-on self-tests.)

Pressing the Return key at this point results in the system prompting you for a user name and password.

---

**Note**

---

If you specified a quorum disk as part of the StorageWorks FDDI Server software installation, the quorum disk must be mounted after the OpenVMS Alpha operating system is running. As soon as possible, add a command to mount the quorum disk on the server to the startup procedure for the server's processor. This allows you to maintain quorum in the event one of the server processors fail (see Section 7.1.1).

---



---

## Configuring the StorageWorks FDDI Server Storage Devices

The StorageWorks FDDI Server requires you to configure the StorageWorks storage system to meet your particular storage needs. The *StorageWorks Array Controllers HS Family of Array Controllers User's Guide* provides a detailed description of stripesets and RAIDsets that you can configure for the StorageWorks FDDI Server.

This chapter begins by providing a few general guidelines to help you decide how you may want to configure the StorageWorks storage system, continues with the steps required to use the CFMENU utility from a terminal connected to the server processor, and concludes by providing a sample configuration.

### 5.1 General Considerations for Configuring a StorageWorks Storage System

Configuring the storage system is the process of defining, through parameters, the logical organization of the storage devices. The storage devices may be configured as one or more of the following:

- **Stripeset**—A virtual disk drive with its physical data spread across multiple physical disks.
- **RAIDset**—Three or more physical disks that are connected to present an array of disks as a single virtual unit to the host.
- **Spareset**—A pool of disk drives used by the device channel processor to replace failing members of a RAIDset.
- **Failedset**—A group of disk drives that have been removed from RAIDsets due to a failure or a manual removal.
- **Container**—An entity that is capable of storing data, whether it is one physical device or a group of physical devices. A disk, a stripeset, and a RAIDset are examples of a container.
- **Passthrough Container**—A virtual device used to pass SCSI commands that perform operations other than simple device read or write operations. A passthrough container typically is used with tape libraries that contain standard tape devices plus a robotic mechanism for selecting and loading cartridges from a pool of tapes. A passthrough container must exist to pass SCSI commands to the robotic mechanism.
- **Unit**—A logical entity composed of one or more devices and treated as a single addressable storage structure by the cluster members. Units can be single devices, stripesets, or RAIDsets.

## 5.2 Running CFMENU from the StorageWorks FDDI Server Terminal

Before CFMENU can be invoked from a terminal connected to the StorageWorks FDDI Server, you must establish a logical connection to the device channel processor. To create a logical connection to the device channel processor, perform the following steps:

1. Log into the system manager's or other appropriate account on the StorageWorks FDDI Server (the account must have DIAGNOSE privilege).
2. At the DCL prompt, enter the SHOW CLUSTER command. The system will respond with default cluster information similar to that shown in Figure 5-1 and return control to the DCL command level.

Figure 5-1 Example Cluster Information

View of Cluster from system ID 65315 Node: FUTBAL

1-JAN-1995 12:54:34

SYSTEMS		MEMBERS
NODE	SOFTWARE	STATUS
GNDBAL	VMS V6.2	MEMBER
FUTBAL	VMS V6.2	MEMBER
SOFBAL	VMS V6.2	MEMBER
RLRBAL	VMS V6.2	MEMBER
HS1CP1	HSD V25D	
HS1CP2	HSD V25D	

3. Identify the names of the device channel processors (note, there may be more than one). The device channel processor can be identified by searching for the nodes that are named HS1CP1, HS1CP2, and so on.
4. Change the terminal format to accommodate 132 characters with this command:

```
$ SET TERMINAL/WIDTH=132
```

5. Logically connect the StorageWorks FDDI Server terminal to the device channel processor by entering the following command at the DCL prompt:

```
$ SET HOST/DUP/SERVER=mscp$dup/TASK=CLI node-name
```

Where:

*node-name* is the name assigned to the device channel processor (for example, HS1CP1).

The device channel processor responds with its prompt (for example, HS1CP>).

6. Enter the following command to start the CFMENU utility:

```
HS1CP> RUN CFMENU
```

The CFMENU utility begins executing. After CFMENU's initial message, press the Return key to get to CFMENU's main menu as shown in Figure 5–2. Any recognized devices that have not been added to your configuration will appear, with their Port Target LUN (PTL), in the column to the right of the menu options. All the devices shown in Figure 5–2 are attached but not yet configured.

**Figure 5–2 CFMENU Main Menu**

```

MAIN MENU:                |Unconfig'd|  Config'd Device   Product   Stor.set Stor.set Chunk Trn In- Re-   W W
1. Add/delete devices     | Dev.PTLs |    PTLs   Name     ID        Name   Type  Size  sp. it'd duc  Unit P B
2. Add/delete stripesets  |-----|  -----
3. Add/delete raidsets/   | 100 (dsk)|
   sparesets/failedsets   | 110 (dsk)|
4. Add/delete passthrough | 120 (dsk)|
5. Initialize devices     | 130 (dsk)|
   and/or storagesets     | 140 (dsk)|
6. Add/delete units       | 150 (dsk)|
7. Setup terminal         | 200 (dsk)|
8. Exit CFMENU           | 210 (dsk)|
                           | 220 (dsk)|
                           | 230 (dsk)|
                           | 240 (dsk)|
                           | 250 (dsk)|
                           | 300 (dsk)|
   D=Scroll down U=Scroll up
Enter menu choice (1,5) [5] ?5
----- CFMENU Configuration Menu Utility -----

```

---

**Note**

---

If your terminal is capable of displaying more than 24 rows, you may want to enter option 7 from the main menu to set the number of rows CFMENU will display.

---

Table 5–1 describes the information headings of the main menu. To avoid confusion, the information headings are presented exactly as they appear on the main menu.

**Table 5–1 CFMENU Information Headings**

Information Heading	Description
Main Menu	Lists the major operations that are available
Unconfig'd Dev.PTLs	Unconfigured PTLs—The device PTLs that are recognized by the HS1CP device channel processor but that have not yet been added to the configuration.
Config'd PTLs	Configured PTLs—The device PTLs that have been configured by the HS1CP device channel processor.
Device Name	Device name—The name automatically assigned to the device when it is configured by the HS1CP device channel processor. The name can be changed through use of the CLI commands.
Product ID	Product ID—Information that identifies the device.
Stor.set Name	Storage set name—The name assigned by CFMENU to the storage set. The name is assigned using one of the following conventions: <ul style="list-style-type: none"><li>• Sx for stripesets</li><li>• Rx for RAIDsets</li><li>• Px for passthrough containers</li></ul> The number denoted by <i>x</i> is assigned sequentially beginning with 1 for each type of storage set. The name can be changed through use of the CLI commands. (See the <i>StorageWorks Array Controllers HS Family of Array Controllers User's Guide</i> for complete descriptions of the CLI commands.)
Stor.set Type	Storage Set—The type of storage set: STRP for stripesets, RAID for RAIDsets, PASS for passthrough containers.
Chnk Size	Chunksize—The size, in blocks, of data transfers with the device.
Trn sp.	Transportable—The letter, Y or N, to indicate if the device is transportable or not. A transportable device is one that does not have metadata written on it. A nontransportable device has a small amount of metadata written on it.
In-it'd	Initialized—The letter, Y or N, to indicate if the device has been initialized.
Re-duc	Reduced—Valid for RAIDsets only, indicates the RAIDset is missing one member.
Unit	Unit—The logical number of the unit as assigned by you and preceded by the letter D for disk or T for tape.
W P	Write Protected—The letter, Y or N, to indicate whether the device is write protected.
W B	Write-back—The letter, Y or N, to indicate if the device has write-back caching enabled.

## 5.3 Configuring Storage Devices Using CFMENU

CFMENU allows you to quickly configure storage devices attached to the HS1CP device channel processor. CFMENU presents, in a menu format, configuration commands normally entered at the Command Line Interpreter (CLI). Because CFMENU prompts you to choose options for devices, storagesets, and units based on the command qualifiers of the CLI, you should have a good understanding of the various CLI commands. A complete discussion of CLI commands can be found in *StorageWorks Array Controllers HS Family of Array Controllers User's Guide*.

---

### Note

---

The following configuration is a sample only. It does not configure all the devices.

---

The following sample configuration assumes an HS121 model StorageWorks FDDI Server with a complement of 36 storage devices. It is further assumed that you have decided to configure the following:

- Two stripesets, one consisting of six drives, the other consisting of five drives
- One RAIDset consisting of five drives
- One spareset with two drives

In order to create the configuration you will perform the following tasks:

- Add the attached storage devices to the configuration
- Add the two stripesets
- Add the RAIDset
- Add devices to the spareset
- Initialize the containers
- Add the units

---

### Note

---

Each HS1CP device channel processor must be configured identically. You may copy this configuration to other HS1CPs, as required.

---

### 5.3.1 Adding Devices

From the main menu, enter option 1, then press the Return key. The device menu appears as shown in Figure 5–3. The list of unconfigured devices appears to the right of the options. If the list is too long to be shown on one screen, enter D or U to scroll the information down or up.

**Figure 5–3 CFMENU Device Menu (Before Adding Devices)**

```

----- CFMENU Configuration Menu Utility -----
DEVICE MENU:      |Unconfig'd|  Config'd Device  Product  Stor.set Stor.set Chnk Trn In- Re-   WW
1. Add a device from list |Dev.PTLs|  PTLs   Name      ID       Name   Type  Size  sp. it'd duc Unit P B
   of PTLs not configured |-----|  -----
   (marked with ^)      |^100 (dsk)|
2. Delete an unbounded device |^110 (dsk)|
   (marked with *)      |^120 (dsk)|
3. Add all devices from list |^130 (dsk)|
   of PTLs not configured |^140 (dsk)|
   (marked with ^)      |^150 (dsk)|
4. Delete all unbounded |^200 (dsk)|
   devices (marked with *) |^210 (dsk)|
5. Return to main menu    |^220 (dsk)|
                        |^230 (dsk)|
                        |^240 (dsk)|
                        |^250 (dsk)|
D=Scroll down U=Scroll up|^300 (dsk)|

```

In Figure 5–3, none of the devices have been added to the configuration yet. If you enter option 1, CFMENU prompts you as to whether or not (y/n/q) to add each device on the list. If you enter option 3, CFMENU will add *all* the unknown devices. The y/n/q prompt asks whether you want the option (yes), do not want the option (no), or want to stop what you are doing (quit).

After entering option 1 and adding all of the devices, the screen resembles Figure 5–4.

**Figure 5–4 CFMENU Device Menu (After Adding Devices)**

```

----- CFMENU Configuration Menu Utility -----
DEVICE MENU:      |Unconfig'd|  Config'd Device  Product  Stor.set Stor.set Chnk Trn In- Re-   WW
1. Add a device from list |Dev.PTLs|  PTLs   Name      ID       Name   Type  Size  sp. it'd duc Unit P B
   of PTLs not configured |-----|  -----
   (marked with ^)      |disks: 100 * DISK100 RZ28 (C) DEC          N  Y
2. Delete an unbounded device |          |  110 * DISK110 RZ28 (C) DEC          N  Y
   (marked with *)      |          |  120 * DISK120 RZ28 (C) DEC          N  Y
3. Add all devices from list |          |  130 * DISK130 RZ28 (C) DEC          N  Y
   of PTLs not configured |          |  140 * DISK140 RZ28 (C) DEC          N  Y
   (marked with ^)      |          |  150 * DISK150 RZ28 (C) DEC          N  Y
4. Delete all unbounded |          |  200 * DISK200 RZ28 (C) DEC          N  Y
   devices (marked with *) |          |  210 * DISK210 RZ28 (C) DEC          N  Y
5. Return to main menu    |          |  220 * DISK220 RZ28 (C) DEC          N  Y
                        |          |  230 * DISK230 RZ28 (C) DEC          N  Y
                        |          |  240 * DISK240 RZ28 (C) DEC          N  Y
                        |          |  250 * DISK250 RZ28 (C) DEC          N  Y
D=Scroll down U=Scroll up|^300 * DISK300 RZ28 (C) DEC          N  Y

```

After adding devices, return to the main menu.

### 5.3.2 Adding Stripeseets

Enter option 2 from the main menu to configure stripeseets. From the stripeseet menu (see Figure 5–5), enter option 1 to create a stripeseet. CFMENU prompts you for how many and which devices from the configured PTLs list you wish to include in the stripeseet (2 to 14 devices allowed). Figure 5–6 shows the result of creating two stripeseets from the disks at the PTLs shown.

Figure 5–5 CFMENU Stripeseet Menu

```

-----CFMENU Configuration Menu Utility-----
STRIPSEET MENU: |Unconfig'd| Config'd Device Product Stor.set Stor.set Chnk Trn In- Re- WW
1. Create a stripeseet | Dev.PTLs | PTLs Name ID Name Type Size sp. it'd duc Unit P B
(eligible devices marked by ^) |-----|
2. Delete an unbounded | | 100 ^ DISK100 RZ28 (C) DEC N Y
stripeseet (marked by *) | | 110 ^ DISK110 RZ28 (C) DEC N Y
3. Delete all unbounded | | 120 ^ DISK120 RZ28 (C) DEC N Y
stripeseets (marked by *) | | 130 ^ DISK130 RZ28 (C) DEC N Y
4. Return to main menu | | 140 ^ DISK140 RZ28 (C) DEC N Y
| | 150 ^ DISK150 RZ28 (C) DEC N Y
| | 200 ^ DISK200 RZ28 (C) DEC N Y
| | 210 ^ DISK210 RZ28 (C) DEC N Y
| | 220 ^ DISK220 RZ28 (C) DEC N Y
| | 230 ^ DISK230 RZ28 (C) DEC N Y
| | 240 ^ DISK240 RZ28 (C) DEC N Y
| | 250 ^ DISK250 RZ28 (C) DEC N Y
D=Scroll down U=Scroll up | | 300 ^ DISK300 RZ28 (C) DEC N Y

Enter menu choice (1,4) [4] ?1

```

Figure 5–6 CFMENU Showing Created Stripeseets

```

-----CFMENU Configuration Menu Utility-----
STRIPSEET MENU: |Unconfig'd| Config'd Device Product Stor.set Stor.set Chnk Trn In- Re- WW
1. Create a stripeseet | Dev.PTLs | PTLs Name ID Name Type Size sp. it'd duc Unit P B
(eligible devices marked by ^) |-----|
2. Delete an unbounded | | 640 ^ DISK640 RZ28 (C) DEC N Y
stripeseet (marked by *) | | 650 ^ DISK650 RZ28 (C) DEC N Y
3. Delete all unbounded | | strps: 100 DISK100 RZ28 (C) DEC * S1 STRP unk N
stripeseets (marked by *) | | 110 DISK110 RZ28 (C) DEC " " " "
4. Return to main menu | | 120 DISK120 RZ28 (C) DEC " " " "
| | 130 DISK130 RZ28 (C) DEC " " " "
| | 140 DISK140 RZ28 (C) DEC " " " "
| | 150 DISK150 RZ28 (C) DEC " " " "
| | 200 DISK200 RZ28 (C) DEC * S2 STRP unk N
| | 300 DISK300 RZ28 (C) DEC " " " "
| | 400 DISK400 RZ28 (C) DEC " " " "
| | 500 DISK500 RZ28 (C) DEC " " " "
D=Scroll down U=Scroll up | | 600 DISK600 RZ28 (C) DEC " " " "

Enter menu choice (1,4) [4] ?

```

After adding stripeseets, return to the main menu.

### 5.3.3 Adding RAIDsets

Enter option 3 from the main menu to configure RAIDsets. From the RAIDset menu (see Figure 5–7), enter option 1 to add a RAIDset. CFMENU prompts you for how many and which devices from the configured PTLs list you wish to include in the RAIDset (3–14 devices allowable). Figure 5–8 shows the result of creating a RAIDset from disks at the PTLs shown.

**Note**

RAIDsets require that write-back cache be licensed and enabled.

**Figure 5–7 CFMENU RAIDset Menu**

```

----- CFMENU Configuration Menu Utility -----
RAIDSET MENU: |Unconfig'd| Config'd Device Product Stor.set Stor.set Chnk Trn In- Re- WW
1. Create a raidset (eligible | Dev.PTLs | PTLs Name ID Name Type Size sp. it'd duc Unit P B
   devices marked by ^) |-----| -----
2. Delete an unbounded | | disks: 210 ^ DISK210 RZ28 (C) DEC " " " " " "
   raidset (marked by *) | | 220 ^ DISK220 RZ28 (C) DEC " " " " " "
3. Delete all unbounded | | 230 ^ DISK230 RZ28 (C) DEC " " " " " "
   raidsets (marked by *) | | 240 ^ DISK240 RZ28 (C) DEC " " " " " "
4. Add/delete device in | | 250 ^ DISK250 RZ28 (C) DEC " " " " " "
   SPARESET or FAILEDSET | | 310 ^ DISK310 RZ28 (C) DEC " " " " " "
5. Replace member of a | | 320 ^ DISK320 RZ28 (C) DEC " " " " " "
   reduced raidset | | 330 ^ DISK330 RZ28 (C) DEC " " " " " "
6. Return to main menu | | 340 ^ DISK340 RZ28 (C) DEC " " " " " "
   | | 350 ^ DISK350 RZ28 (C) DEC " " " " " "
   | | 410 ^ DISK410 RZ28 (C) DEC " " " " " "
   | | 420 ^ DISK420 RZ28 (C) DEC " " " " " "
   D=Scroll down U=Scroll up | | 430 ^ DISK430 RZ28 (C) DEC " " " " " "

```

**Figure 5–8 CFMENU Showing Created RAIDsets**

```

----- CFMENU Configuration Menu Utility -----
RAIDSET MENU: |Unconfig'd| Config'd Device Product Stor.set Stor.set Chnk Trn In- Re- WW
1. Create a raidset (eligible | Dev.PTLs | PTLs Name ID Name Type Size sp. it'd duc Unit P B
   devices marked by ^) |-----| -----
2. Delete an unbounded | | 130 DISK130 RZ28 (C) DEC " " " " " "
   raidset (marked by *) | | 140 DISK140 RZ28 (C) DEC " " " " " "
3. Delete all unbounded | | 150 DISK150 RZ28 (C) DEC " " " " " "
   raidsets (marked by *) | | 200 DISK200 RZ28 (C) DEC S2 STRP unk " " "
4. Add/delete device in | | 300 DISK300 RZ28 (C) DEC " " " " " "
   SPARESET or FAILEDSET | | 400 DISK400 RZ28 (C) DEC " " " " " "
5. Replace member of a | | 500 DISK500 RZ28 (C) DEC " " " " " "
   reduced raidset | | 600 DISK600 RZ28 (C) DEC " " " " " "
6. Return to main menu | | raid5: 210 DISK210 RZ28 (C) DEC * R1 RAID unk " N N
   | | 220 DISK220 RZ28 (C) DEC " " " " " "
   | | 230 DISK230 RZ28 (C) DEC " " " " " "
   | | 240 DISK240 RZ28 (C) DEC " " " " " "
   D=Scroll down U=Scroll up | | 250 DISK250 RZ28 (C) DEC " " " " " "
Enter menu choice (1,6) [6] ?

```



### 5.3.4 Adding to Sparesets

Enter option 4 from the RAIDset menu to configure sparesets and failedsets associated with RAIDsets. From the spareset/failedset menu shown in Figure 5–9, enter option 1 to add a device to the spareset. CFMENU prompts you for which devices from the configured PTLs list that you wish to include in the spareset. In Figure 5–10, two devices, PTL 310 and PTL 320, were added to the spareset.

Figure 5–9 CFMENU Spareset/Failedset Menu

```

----- CFMENU Configuration Menu Utility -----
SPARESET/FAILEDSET MENU: |Unconfig'd| Config'd Device Product Stor.set Stor.set Chunk Trn In- Re- WW
1. Add a device to the | Dev.PTLs | PTLs Name ID Name Type Size sp. it'd duc Unit P B
   SPARESET (eligible |-----| -----|-----|-----|-----|-----|
   devices marked by ^) | | disks: 310 ^ DISK310 RZ28 (C) DEC " " " " " "
2. Remove a device from the | | 320 ^ DISK320 RZ28 (C) DEC " " " " " "
   SPARESET | | 330 ^ DISK330 RZ28 (C) DEC " " " " " "
3. Move a device from a | | 340 ^ DISK340 RZ28 (C) DEC " " " " " "
   RAIDSET to the FAILEDSET | | 350 ^ DISK350 RZ28 (C) DEC " " " " " "
   (eligible devices marked | | 410 ^ DISK410 RZ28 (C) DEC " " " " " "
   by *) | | 420 ^ DISK420 RZ28 (C) DEC " " " " " "
4. Remove a device from the | | 430 ^ DISK430 RZ28 (C) DEC " " " " " "
   FAILEDSET | | 440 ^ DISK440 RZ28 (C) DEC " " " " " "
5. Return to RAIDSET menu | | 450 ^ DISK450 RZ28 (C) DEC " " " " " "
   | | 510 ^ DISK510 RZ28 (C) DEC " " " " " "
   | | 520 ^ DISK520 RZ28 (C) DEC " " " " " "
   | | 530 ^ DISK530 RZ28 (C) DEC " " " " " "
   D=Scroll down U=Scroll up
Enter menu choice (1,6) [6] ?1

```

Figure 5–10 CFMENU Showing Created Spareset

```

----- CFMENU Configuration Menu Utility -----
SPARESET/FAILEDSET MENU: |Unconfig'd| Config'd Device Product Stor.set Stor.set Chunk Trn In- Re- WW
1. Add a device to the | Dev.PTLs | PTLs Name ID Name Type Size sp. it'd duc Unit P B
   SPARESET (eligible |-----| -----|-----|-----|-----|-----|
   devices marked by ^) | | 150 DISK150 RZ28 (C) DEC " " " " " "
2. Remove a device from the | | 200 DISK200 RZ28 (C) DEC S2 STRP unk " " "
   SPARESET | | 300 DISK300 RZ28 (C) DEC " " " " " "
3. Move a device from a | | 400 DISK400 RZ28 (C) DEC " " " " " "
   RAIDSET to the FAILEDSET | | 500 DISK500 RZ28 (C) DEC " " " " " "
   (eligible devices marked | | 600 DISK600 RZ28 (C) DEC " " " " " "
   by *) | | raid5: 210 DISK210 RZ28 (C) DEC R1 RAID unk " N N
4. Remove a device from the | | 220 DISK220 RZ28 (C) DEC " " " " " "
   FAILEDSET | | 230 DISK230 RZ28 (C) DEC " " " " " "
5. Return to RAIDSET menu | | 240 DISK240 RZ28 (C) DEC " " " " " "
   | | 250 DISK250 RZ28 (C) DEC " " " " " "
   | | spare: 310 DISK310 RZ28 (C) DEC " " " " " "
   | | 320 DISK320 RZ28 (C) DEC " " " " " "
   D=Scroll down U=Scroll up
Enter menu choice (1,5) [5] ?

```

After adding sparesets, return to the main menu via the RAIDset menu.

### 5.3.5 Adding Passthrough Containers

Enter option 4 from the main menu to add passthrough containers. From the passthrough menu (see Figure 5–11), enter option 1. CFMENU prompts you (y/n) as to whether you want to create a passthrough container from the eligible devices. Figure 5–12 shows the device LDR120 has been created as a passthrough container.

Figure 5–11 CFMENU Passthrough Menu

```

-----
PASSTHROUGH MENU:      |Unconfig'd|  CFMENU  Configuration Menu Utility
                        | Dev.PTLs |  Config'd Device      Product
1. Create a passthrough |-----|  PTLs     Name         ID
   (eligible devices marked
   by ^)
2. Delete an unbounded | |          |          |          |
   passthrough (marked | |          |          |          |
   by *)
3. Delete all unbounded | |          |          |          |
   passthroughs (marked | |          |          |          |
   by *)
4. Return to main menu | |          |          |          |
                        | |          |          |          |
D=Scroll down U=Scroll up | |          |loadr: 120 ^  LDR120 TL820 (C) DEC
-----
Enter menu choice (1,4) [4] ?1
Create passthrough to device LDR120 (y/n/q) [n] ?y

```

Figure 5–12 CFMENU Passthrough Menu Showing a Passthrough Container

```

-----
PASSTHROUGH MENU:      |Unconfig'd|  CFMENU  Configuration Menu Utility
                        | Dev.PTLs |  Config'd Device      Product
1. Create a passthrough |-----|  PTLs     Name         ID
   (eligible devices marked
   by ^)
2. Delete an unbounded | |          |          |          |
   passthrough (marked | |          |          |          |
   by *)
3. Delete all unbounded | |          |          |          |
   passthroughs (marked | |          |          |          |
   by *)
4. Return to main menu | |          |          |          |
                        | |          |          |          |
D=Scroll down U=Scroll up | |          |pass: 120  LDR120 TL820 (C) DEC * P1 PASS
-----
Enter menu choice (1,4) [4] ?

```

### 5.3.6 Initializing Containers

Enter option 5 from the main menu to initialize containers (devices or storagesets). From the initialization menu (see Figure 5–13), enter option 1. CFMENU prompts (y/n) whether you want to initialize each eligible container.

In addition, CFMENU prompts you to decide on other operating qualifiers, depending on whether the container is a device, stripeset, or RAIDset.

In Figure 5–14, the stripesets S1 and S2 are initialized. Notice that each now has a chunksize specified.

Figure 5–13 CFMENU Initialization Menu

```

----- CFMENU Configuration Menu Utility -----
INITIALIZATION MENU: |Unconfig'd| Config'd Device Product Stor.set Stor.set Chk Trn In- Re- WW
1. Initialize a device or | Dev.PTLs | PTLs Name ID Name Type Size sp. it'd duc Unit P B
storageset (eligible
entities marked with ^) |-----|
2. Return to main menu | | 150 DISK150 RZ28 (C) DEC " " " "
| | 200 DISK200 RZ28 (C) DEC ^ S2 STRP unk N
| | 300 DISK300 RZ28 (C) DEC " " " "
| | 400 DISK400 RZ28 (C) DEC " " " "
| | 500 DISK500 RZ28 (C) DEC " " " "
| | 600 DISK600 RZ28 (C) DEC " " " "
| |raid5: 210 DISK210 RZ28 (C) DEC ^ R1 RAID unk N N
WARNING! Initialization of | | 220 DISK220 RZ28 (C) DEC " " " "
any device or storageset | | 230 DISK230 RZ28 (C) DEC " " " "
will destroy all of its | | 240 DISK240 RZ28 (C) DEC " " " "
current data. | | 250 DISK250 RZ28 (C) DEC " " " "
| |spare: 310 DISK310 RZ28 (C) DEC
D=Scroll down U=Scroll up | | 320 DISK320 RZ28 (C) DEC
Enter menu choice (1,2) [2] ?

```

Figure 5–14 CFMENU Showing Initialization Results

```

----- CFMENU Configuration Menu Utility -----
INITIALIZATION MENU: |Unconfig'd| Config'd Device Product Stor.set Stor.set Chk Trn In- Re- WW
1. Initialize a device or | Dev.PTLs | PTLs Name ID Name Type Size sp. it'd duc Unit P B
storageset (eligible
entities marked with ^) |-----|
2. Return to main menu | | 610 ^ DISK610 RZ28 (C) DEC " " " N Y
| | 620 ^ DISK620 RZ28 (C) DEC " " " N Y
| | 630 ^ DISK630 RZ28 (C) DEC " " " N Y
| | 640 ^ DISK640 RZ28 (C) DEC " " " N Y
| | 650 ^ DISK650 RZ28 (C) DEC " " " N Y
| |strps: 100 DISK100 RZ28 (C) DEC ^ S1 STRP 85 Y
| | 110 DISK110 RZ28 (C) DEC " " " "
WARNING! Initialization of | | 120 DISK120 RZ28 (C) DEC " " " "
any device or storageset | | 130 DISK130 RZ28 (C) DEC " " " "
will destroy all of its | | 140 DISK140 RZ28 (C) DEC " " " "
current data. | | 150 DISK150 RZ28 (C) DEC " " " "
| | 200 DISK200 RZ28 (C) DEC ^ S2 STRP 85 Y
D=Scroll down U=Scroll up | | 300 DISK300 RZ28 (C) DEC " " " "
Enter menu choice (1,2) [2] ?

```

After initializing containers, return to the main menu.

### 5.3.7 Adding Units

Enter option 6 from the main menu to configure units. From the unit menu, shown in Figure 5–15, enter option 1 to add a unit. CFMENU prompts you for which initialized containers you wish to create units from.

CFMENU also will prompt you to assign a unit number. (The program automatically assigns a “D” or “T” to the unit number when listing the unit, as shown in Figure 5–16.) In addition, CFMENU prompts you to decide on other unit qualifiers.

In Figure 5–16, three units were created from disks at PTLs 330, 340, and 350.

**Figure 5–15 CFMENU Unit Menu**

```

----- CFMENU Configuration Menu Utility -----
UNIT MENU: |Unconfig'd| Config'd Device Product Stor.set Stor.set Chnk Trn In- Re- WW
1. Create a unit (eligible | Dev.PTLs | PTLs Name ID Name Type Size sp. it'd duc Unit P B
entities marked by ^) |-----| -----
2. Delete a unit (eligible | | disks: 330 ^ DISK330 RZ28 (C) DEC N Y
units marked by *) | | 340 ^ DISK340 RZ28 (C) DEC N Y
3. Return to main menu | | 350 ^ DISK350 RZ28 (C) DEC N Y
| | 410 ^ DISK410 RZ28 (C) DEC N Y
| | 420 ^ DISK420 RZ28 (C) DEC N Y
| | 430 ^ DISK430 RZ28 (C) DEC N Y
| | 440 ^ DISK440 RZ28 (C) DEC N Y
| | 450 ^ DISK450 RZ28 (C) DEC N Y
| | 510 ^ DISK510 RZ28 (C) DEC N Y
| | 520 ^ DISK520 RZ28 (C) DEC N Y
| | 530 ^ DISK530 RZ28 (C) DEC N Y
| | 540 ^ DISK540 RZ28 (C) DEC N Y
| | 550 ^ DISK550 RZ28 (C) DEC N Y
D=Scroll down U=Scroll up
Enter menu choice (1,3) [3] ?1

```

**Figure 5–16 CFMENU Showing Created Units**

```

----- CFMENU Configuration Menu Utility -----
UNIT MENU: |Unconfig'd| Config'd Device Product Stor.set Stor.set Chnk Trn In- Re- WW
1. Create a unit (eligible | Dev.PTLs | PTLs Name ID Name Type Size sp. it'd duc Unit P B
entities marked by ^) |-----| -----
2. Delete a unit (eligible | | disks: 330 DISK330 RZ28 (C) DEC N Y * D330 N Y
units marked by *) | | 340 DISK340 RZ28 (C) DEC N Y * D340 N N
3. Return to main menu | | 350 DISK350 RZ28 (C) DEC N Y * D350 N N
| | 410 ^ DISK410 RZ28 (C) DEC N Y
| | 420 ^ DISK420 RZ28 (C) DEC N Y
| | 430 ^ DISK430 RZ28 (C) DEC N Y
| | 440 ^ DISK440 RZ28 (C) DEC N Y
| | 450 ^ DISK450 RZ28 (C) DEC N Y
| | 510 ^ DISK510 RZ28 (C) DEC N Y
| | 520 ^ DISK520 RZ28 (C) DEC N Y
| | 530 ^ DISK530 RZ28 (C) DEC N Y
| | 540 ^ DISK540 RZ28 (C) DEC N Y
| | 550 ^ DISK550 RZ28 (C) DEC N Y
D=Scroll down U=Scroll up

```

## 5.4 Completing the Device Channel Processor Configuration

After the storage devices have been defined as described in Section 5.3, the configuration of the device channel processor must be completed as described in this section.

### 5.4.1 Modifying Allocation Classes

During the Software Customization Procedure, you were prompted to type in the MSCP and TMSCP allocation classes of the FDDI Server. The HS1CP device channel processors must have the same MSCP and TMSCP allocation class as the server processors. Set the allocation classes with this procedure:

1. From the currently active menu, type in the number to select the option:

```
Return to main menu
```

2. Exit from the CFMENU utility to return to the HS1CP> prompt. From the Main Menu type in 8 at the Enter Menu choice:

```
(1,8) [8]?
```

3. Enter the following command to determine the MSCP allocation class and the TMSCP allocation class:

```
HS1CP> SHOW THIS
```

4. If the display shows the correct allocation class information, then proceed with step 7. If the display shows the incorrect or incomplete allocation class information, then continue.

5. Set the MSCP allocation class by entering this command:

```
HS1CP> SET THIS MSCP_ALLOCATION_CLASS = n
```

Where:

*n* is the number you entered for the server.

The following will be displayed on the terminal screen:

```
Warning 4020: A restart of both this and the other controller is
              required before all the parameters modified will
              take effect.
Restart of this controller required
Restart of the other controller required
```

6. Set the TMSCP allocation class by entering this command:

```
HS1CP> SET THIS TMSCP_ALLOCATION_CLASS = n
```

Where:

*n* is the number you entered for the server.

The following will be displayed on the terminal screen:

```
Warning 4020: A restart of both this and the other controller is
              required before all the parameters modified will
              take effect.
Restart of this controller required
Restart of the other controller required
```

7. If you are configuring storage for an HSx21 server, copy the configuration from this HS1CP to the other HS1CP with the following command:

```
HS1CP> SET FAILOVER COPY = THIS
```

These messages will appear on the screen:

```
Restart of this controller required
Restart of the other controller required
```

If you are configuring storage for an HS111 server, proceed to step 9.

8. Restart the other HS1CP device channel processor with this command:

```
HS1CP> RESTART OTHER
```

These messages will appear on the screen:

```
Received LAST GASP message from other controller, Fail Code: 08080000
HS1CP>
%PAx0, Software is Closing Virtual Circuit -- REMOTE NODE HS1CPx
```

9. Restart the HS1CP device channel processor to which you are currently connected with this command:

```
HS1CP> RESTART THIS
```

These messages will appear on the screen:

```
%PAx0, Software is Closing Virtual Circuit -- REMOTE NODE HS1CPx
%HSCPAD-F-NOLOCEXE, Local program not executing
-SYSTEM-F-VCBROKEN, virtual circuit broken
%HSCPAD-S-END, Control returned to node XXXXXX
```

At this time you will return to the DCL prompt from which you connected to the HS1CP, and your configuration procedure is complete.

## 5.4.2 Configuring Storage for the Second HS1CP in a Dual-Redundant Pair

In FDDI Server models with dual-redundant pairs of HS1CPs (HS121/221/241), both device channel processors in each pair must have the same configuration. This procedure describes how to copy the storage configuration from one device channel processor to another in a dual-redundant pair.

If you have just completed the procedure in Section 5.4.1, you have already performed the tasks to copy the storage configuration (steps 7 through 9), and it is not necessary to perform this procedure. You can continue with Section 5.5.

1. To begin, make sure the terminal is displaying the HS1CP> prompt.
  - If you have exited the CFMENU utility, then the terminal should be displaying the HS1CP> prompt.
  - If your terminal is currently displaying a CFMENU display, exit with this procedure:
    - a. From the currently active menu, type in the number to select the option:

```
Return to main menu
```
    - b. Exit from the CFMENU utility to return to the HS1CP> prompt. From the Main Menu, type in 8 at the Enter Menu choice:

```
(1,8) [8]?
```
  - If the terminal is displaying the DCL prompt, then you must connect to the device channel processor with this command:

```
$ SET HOST/DUP/SERVER=MSCP$DUP/TASK=CLI node-name
```

Where:

*node-name* is the name assigned to the device channel processor (for example, HS1CP1).

2. Copy the configuration from this HS1CP to the other HS1CP with the following command:

```
HS1CP> SET FAILOVER COPY = THIS
```

These messages will appear on the screen:

```
Restart of this controller required  
Restart of the other controller required
```

3. Restart the HS1CP device channel processor to which you copied the configuration with this command:

```
HS1CP> RESTART OTHER
```

These messages will appear on the screen:

```
Received LAST GASP message from other controller, Fail Code: 08080000  
HS1CP>  
%PAx0, Software is Closing Virtual Circuit -- REMOTE NODE HS1CPx
```

4. Restart the HS1CP device channel processor to which you are currently connected with this command:

```
HS1CP> RESTART THIS
```

These messages will appear on the screen:

```
%PAx0, Software is Closing Virtual Circuit -- REMOTE NODE HS1CPx  
%HSCPAD-F-NOLOCEXE, Local program not executing  
-SYSTEM-F-VCBROKEN, virtual circuit broken  
%HSCPAD-S-END, Control returned to node XXXXXX
```

At this time, you will return to the DCL prompt from which you connected to the HS1CP, and your configuration procedure is complete.

### 5.4.3 Configuring Storage for Additional Device Channel Processor Pairs

The HS241 FDDI Server contains two pairs of dual-redundant device channel processors, and four pairs when coupled to an HS280 expansion cabinet. Configure the storage to be attached to each dual-redundant pair as described in Section 5.2 through Section 5.4.

## 5.5 Saving the Configuration Setup

After defining each Device Channel Processor or dual-redundant pair configuration setup, make sure it is printed and kept available to assist in servicing the subsystem in the future. Make a new printout each time you change your configuration.

To capture your device setup, you should perform the following steps:

1. Enter the following command at the DCL prompt to logically connect the StorageWorks FDDI Server terminal to the device channel processor and record the results of the session in a file called CONFIG.LOG in the SYS\$MANAGER directory on the server's system disk.

```
$ SET HOST/DUP/SERVER=mscp$dup/TASK=CLI/LOG=SYS$MANAGER:CONFIG.LOG node-name
```

Where:

*node-name* is the name assigned to the device channel processor (for example, HS1CP1).

The device channel processor responds with a brief display and its prompt.

```
Copyright (C) Digital Equipment Corporation 1994
HS1CP Firmware version E35D-0, Hardware version AX01
Last fail code: 018000A0
Press " ?" at any time for help.
HS1CP>
```

2. At the HS1CP> prompt enter the following command:

```
HS1CP> SHO DEVICE FULL
```

The following information will be captured in the CONFIG.LOG file in the SYSSMANAGER directory on the server's system disk as it appears on the screen:

Name	Type	Port	Targ	Lun	Used by
DISK100	disk	1	0	0	D1100
	DEC RZ28	(C) DEC	D41C		
	Switches:				
	NOTTRANSPORTABLE				
DISK110	disk	1	1	0	D1110
	DEC RZ28B	(C) DEC	0003		
	Switches:				
	NOTTRANSPORTABLE				
DISK120	disk	1	2	0	D1120
	DEC RZ28	(C) DEC	D41C		
	Switches:				
	NOTTRANSPORTABLE				
DISK130	disk	1	3	0	D1130
	DEC RZ28	(C) DEC	D41C		
	Switches:				
	NOTTRANSPORTABLE				

3. Exit the display by typing this command at the prompt:

```
HS1CP> EXIT
```

At this point, the HS1CPs and their storage devices have been configured. You should leave the terminal attached to the server processor while you perform other tasks in the installation procedure.



---

## Integrating the Server into the VMScLuster System

After you have customized the OpenVMS Alpha operating system parameters and configured the storage system, you can complete the installation by connecting the server to the FDDI interconnect and by performing a few additional tasks. In addition, there are other optional postinstallation tasks that you may want to complete. This chapter discusses each task, required and optional, to complete the installation.

### 6.1 Connecting to the FDDI Interconnect

After the software customization and storage configuration have been completed, you can connect the StorageWorks FDDI Server to the FDDI interconnect and boot the server so that it becomes a member of the cluster containing the client nodes. Perform the following steps to accomplish the task:

1. Shut down the StorageWorks FDDI Server OpenVMS Alpha operating system as follows:
  - a. Log in to a privileged account such as the system manager account established earlier.
  - b. Execute the system shutdown command file. For example, entering the following command invokes a system shutdown:

```
$ @SYS$SYSTEM:SHUTDOWN
```
  - c. Answer the questions asked during the server's execution of the shutdown command file and wait until the system has completed a logical shutdown.
2. Connect the StorageWorks FDDI Server to the FDDI interconnect as follows:
  - a. Remove the dust covers attached to the FDDI connections of the StorageWorks FDDI Server.
  - b. Place the dust covers in a protective container such as a resealable plastic bag. Place the container in a safe place for later use if you disconnect the StorageWorks FDDI Server from the FDDI interconnect.
  - c. Connect the StorageWorks FDDI Server to the FDDI interconnect.
3. Cycle power for the server processor by pressing its power switch off and then on again. After the power-on self-tests complete and the system prompt >>> appears, type B to reboot the system. (See Example 3-1 for an example display of the power-on self-tests.)

As the StorageWorks FDDI Server boots, it will automatically request membership in the cluster containing the client nodes. On completion of the boot process, the StorageWorks FDDI Server will be able to serve its storage devices to the client nodes.

At this point, you have set the StorageWorks FDDI Server operating system parameters, configured your StorageWorks storage devices, and connected the StorageWorks FDDI Server to your VMScluster FDDI interconnect.

## 6.2 Accessing Important Documentation

Before completing the StorageWorks FDDI Server installation procedure, you may want to access and print some documentation provided on the server system disk. For example, if this is the first Alpha-based node joining your cluster, you should print the *OpenVMS Alpha Version 6.2 Upgrade and Installation Manual*, located on the StorageWorks FDDI Server's system disk. This manual provides detailed information on system halt, shutdown, and boot procedures.

Some frequently used documentation for OpenVMS Alpha software is located on the FDDI Server's system disk in the [DOCUMENTATION.V0xx] directory where xx represents the OpenVMS operating system software version number. For example, for Version 6.2, the directory is [DOCUMENTATION.V062]. Documentation on the operating system CD-ROM is in directory [ALPHA062.DOCUMENTATION].

When needed, take these steps to print the documentation:

1. Copy the appropriate document from SYSSYSDEVICE (the server's system disk) or from the documentation CD-ROM to one of the devices on the server that can be accessed by another VMScluster node.
2. From another VMScluster node, print the file on an available printer.

## 6.3 Ensuring VMScluster System Compatibility

After installing the StorageWorks FDDI Server software, there remain some tasks that will ensure the system operates correctly in the cluster. The required tasks are as follows:

- Install the Volume Shadowing Interoperability (I14Y) Kit on VAX and/or Alpha nodes in your cluster as appropriate. See the release notes (*ALPSHADnn-062.RELEASE\_NOTES* and *VAXSHADnn-062.RELEASE\_NOTES* where nn refers to the kit version) found on the server's system disk for reference information. Refer to Section 4.2.2 for additional information on volume shadowing interoperability.
- Update other nodes in the cluster as required by any changes to the quorum scheme caused by installation of the StorageWorks FDDI Server. You must update the EXPECTED\_VOTES value in each cluster member's MODPARAMS.DAT file, then run AUTOGEN on each node followed by shutting down and rebooting the cluster. For example, if you add an HS121 and a quorum disk, then each cluster member will need to have its EXPECTED\_VOTES parameter increased by 3. See *VMScluster Systems for OpenVMS* for additional information on quorum issues.
- Run AUTOGEN on the server to update cluster parameters. Refer to Section 7.5 for details on running AUTOGEN.

## 6.4 Activating Shadowing Functionality on the FDDI Server

By default, shadowing functionality is enabled on the server. For additional information about shadowing system parameters and managing shadowing in a VMScLuster environment, refer to the manual *Volume Shadowing for OpenVMS*.

## 6.5 Installing and Registering Licenses

The FDDI Server ships with licenses included as paper Product Authorization Keys (PAK) for the OpenVMS Alpha operating system (OPENVMS-ALPHA), volume shadowing (VOLSHAD), and OpenVMS Clustering (VMSCLUSTER).

You must perform the following tasks to use the software products included with the FDDI Server (including the OpenVMS operating system):

1. Set up the license database for each server node.
2. Register each of the software product licenses provided with the FDDI Server in the cluster license database.

---

### Note

---

It is important to note that in a VMScLuster, one of the following conditions MUST be maintained:

- There is a single, common license database.
  - If there are multiple databases, then all must be identical.
- 

### 6.5.1 Setting Up the License Database on a Cluster

The default license database for an unmodified OpenVMS operating system is on the system disk in SYSSCOMMON:[SYSEXEC]LMF\$LICENSE.LDB. If you move the database, you must define the logical name LMF\$LICENSE at the system level to point to the new database. Place permanent systemwide logical name definitions in the file SYSSCOMMON:[SYSMGR]SYLOGICALS.COM (see Section 6.5.1.1).

In a VMScLuster environment, each node in the cluster must access either the same license database or an identical copy of the database seen by the other nodes.

If there is a disk in the cluster that will always be available to the cluster nodes, then it is normally convenient to put your common license database on that disk (which may be the system disk for some of the cluster nodes). For any systems that boot from a separate system disk, you must redirect LMF to the license database. This is done by defining the logical name LMF\$LICENSE to point to the common license database.

If it is not possible to provide a common disk for all cluster nodes, then you must keep separate identical license databases. Whenever one database is modified, you must copy it to the other locations in order to update the other databases.

Further information about managing software licenses on OpenVMS VAX and OpenVMS Alpha systems can be found in the system management manual *OpenVMS License Management Utility Manual*.

### 6.5.1.1 Common License Database

After the first reboot of the FDDI Server server processor during the Software Customization Procedure (while the server is not yet part of the cluster), modify SYSSMANAGER:SYLOGICALS.COM to do the following:

1. Mount the disk where the license database is located.
2. Define the logical LMF\$LICENSE to point to the database.

#### Example:

In SYSSCOMMON:[SYSMGR]SYLOGICALS.COM, add the following lines:

```
$ MOUNT/SYSTEM/NOASSIST $17$DKA23: FSERV 1$SYSTEM
$ DEFINE/SYSTEM/EXEC LMF$LICENSE-
  $17$DKA23:[VMS$COMMON.SYSEXE]LMF$LICENSE.LDB
```

### 6.5.1.2 Separate License Databases

Obtain a copy of one of the cluster license databases. This step should be done after the second reboot of each FDDI Server server processor during the Software Customization Procedure so that the server will be part of the existing cluster and will be able to mount disks where a copy of the database is located.

#### Example:

After rebooting the server processor to bring the FDDI Server into the cluster, log into the server's operating system through the console port and enter the following commands:

```
$ MOUNT/NOASSIST $17$DKA23:FSERV1$SYSTEM
$ COPY $17$DKA23:[VMS$COMMON.SYSEXE]LMF$LICENSE.LDB-
  SYSSCOMMON:[SYSEXE]LMF$LICENSE.LDB
```

## 6.5.2 Registering the Licenses

After the second server processor reboot (the server now being part of cluster, but having no licenses loaded):

1. Log into the system account on a console attached to the FDDI Server's server processor.
2. Register each license (three for each server node in a dual processor server) using the licensing procedure SYSSUPDATE:VMSLICENSE.COM.

#### Example:

Assume in a dual-processor system that the two server nodes have SCS node names of FSERV1 and FSERV2 (selected during the Software Customization Procedure and written to the SYSGEN parameter SCSNODE on each node). In addition, assume the following authorization numbers for the two OPENVMS-ALPHA PAKs:

```
ALS-WM-95099-5555
ALS-WM-95099-7777
```

Enter the following command:

```
$ @SYS$UPDATE:VMSLICENSE
```

A menu of options will be displayed. Select option 1, "REGISTER a Product Authorization Key," and follow the instructions to register each license.

3. Modify each OPENVMS-ALPHA license to include the name of the specific server node on which this license is being installed.

Because licenses for the OpenVMS operating system software specify the NO\_SHARE option on their PAKs, in a VMScluster environment, you must restrict each OpenVMS license to a single node. Use the license command LICENSE MODIFY/INCLUDE=node\_name, specifying only one SCS node name for each OpenVMS license.

**Example:**

```
$ LICENSE MODIFY OPENVMS-ALPHA-  
  /INCLUDE=FSERV1/AUTHORIZATION=ALS-WM-95099-5555  
$ LICENSE MODIFY OPENVMS-ALPHA-  
  /INCLUDE=FSERV2/AUTHORIZATION=ALS-WM-95099-7777
```

4. Load the licenses by either rebooting the server processor at this point or by using the following command to load the OPENVMS-ALPHA license:

```
$ LICENSE LOAD OPENVMS-ALPHA
```

If the site uses separate license databases, then the updated license database on each node in the FDDI Server must be copied to each place where a separate license database exists.

If the FDDI Server is being added to an existing cluster, then the licenses may be registered all at one time in the existing cluster license database (or databases) before the FDDI Server is installed. The remaining task after the servers are installed is to ensure that each server node has access to the common database. This can be accomplished either by defining LMF\$LICENSE in SYLOGICAL.COM (as described above) or by copying the updated LMF\$LICENSE.LDB to SYS\$COMMON:[SYSEXE]LMF\$LICENSE.LDB on each server node. During subsequent reboots, the licenses will be loaded automatically on each server.

## 6.6 Ensuring Viability of the Write-Back Cache

The write-back cache module installed in your StorageWorks FDDI Server contains batteries that were completely charged at the factory. It is normal for these batteries to discharge slightly in shipment.

The server's write-back cache and RAID features require fully charged batteries to maintain absolute data integrity. After installation, these advanced features may not be available until the batteries have had an opportunity to completely recharge. The charging process may take up to 4 hours to complete.



---

## Supporting and Operating the StorageWorks FDDI Server

This chapter discusses system management issues for the StorageWorks FDDI Server such as preparing for and installing system management software, setting certain operational parameters, and backing up the server's system disk.

---

### Note

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For optimal performance of StorageWorks FDDI Servers, you should limit the applications you install on the server processors to storage management and system management applications. By installing and executing production software on the processors, you could degrade the performance of the StorageWorks FDDI Server.

You also should consider the kinds of operations you plan to perform with the servers. For example, to realize optimal performance of your StorageWorks FDDI Server, you should perform backup operations of online storage to devices controlled by the same server.

---

## 7.1 Customizing the System

Manage the StorageWorks FDDI Server processors as you would other VMSccluster nodes with respect to maintaining a functional, highly reliable computing environment. You can customize system files and install DECnet software and layered products as needed.

Before you make changes to the files on the server system disk, you should make a backup copy (see Section 7.3). If the changes you make cause configuration problems, you can restore your configuration to a known state.

### 7.1.1 Customizing System Files

You can edit system files that allow you to tailor your system management environment. If you created a quorum disk on the server, you need to add a MOUNT command in the system startup file to mount the quorum disk during server startup.

When customizing your environment, you may decide to set system parameters in the following command files:

- SYCONFIG.COM
- SYLOGICALS.COM

- SYLOGIN.COM
- SYSTARTUP\_VMS.COM

The release notes, release notes addendum, and *A Comparison of System Management on OpenVMS Alpha and OpenVMS VAX* contain detailed information for notes and restrictions that might be relevant to your customization plans. Additional information about maintaining the server's performance can be found in the *Guide to OpenVMS Performance Management*.

---

**Note**

---

Immediately after changing your server processor system parameters, you should make a backup copy to protect your modifications.

---

### 7.1.2 Configuring and Starting DECnet for OpenVMS Alpha Software

If you plan to run DECnet™ for OpenVMS Alpha software, you must do the following:

1. After you have registered the license for the DECnet for OpenVMS Alpha software, execute the interactive command procedure SYSSMANAGER:NETCONFIG.COM to automatically configure your system for networking. See the *DECnet for OpenVMS Guide to Networking* for instructions on using NETCONFIG.COM.
2. After you start the queue manager (see the *OpenVMS System Manager's Manual*), edit the commands in SYSSCOMMON:[SYSMGR]SYSTARTUP\_VMS.COM that pertain to networking so that the DECnet for OpenVMS software starts automatically when your system is booted. Choose one of the following commands to start the network and remove the comment delimiter (!) from that command:

```
$! IF F$SEARCH("SYSS$SYSTEM:NETACP.EXE") .NES. "" THEN @SYSS$MANAGER:STARTNET
$! IF F$SEARCH("SYSS$SYSTEM:NETACP.EXE") .NES. "" THEN SUBMIT SYSS$MANAGER:STARTNET.COM
```

Both of the previous commands perform the same task. However, the first command executes STARTNET.COM and delays further processing until the procedure is completed; the second submits STARTNET.COM to a batch queue and continues executing SYSTARTUP\_VMS.COM.

---

**Note**

---

Immediately after changing your server processor system parameters, you should make a backup copy to protect your modifications.

---



### 7.1.3 Installing Layered Products

The StorageWorks FDDI Server ships from the factory with all the layered products required for its operation. If you decide to install additional layered products such as Storage Library System for OpenVMS or Host Based RAID, note the following:

- You must register the licenses for OpenVMS Alpha layered products such as Host Based RAID for OpenVMS Alpha software.

You can invoke the OpenVMS License utility by entering the following command:

```
$ @SYS$UPDATE:VMSLICENSE
```

(You also can use the LICENSE REGISTER command.)

For additional information about registering licenses, see the *OpenVMS License Management Utility Manual*.

- For general information about installing layered products, see the *OpenVMS System Manager's Manual*. For more specific information, see the documentation you received with each layered product.

The DECwindows components provided with the OpenVMS Alpha Version 6.2 operating system supply only DECwindows base support and workstation support files. To get full DECwindows support, you also must install the separate DECwindows™ Motif® for OpenVMS Alpha layered product, which supports both the Motif and XUI environments.

See the most recent version of the *DECwindows Motif for OpenVMS Installation Guide* for information about installing the separate DECwindows Motif for OpenVMS Alpha layered product. After the installation, follow the directions in that manual and in *Managing DECwindows Motif for OpenVMS Systems* to customize your DECwindows environment.

---

#### Note

---

Immediately after changing your server processor system parameters, you should make a backup copy to protect your modifications.

---

## 7.2 Booting a Server Processor

At various times, you may have to boot the server processor. You can boot a server processor from either the server's system disk or the CD-ROM device.

After the processor has been halted or after it has been powered up, the terminal connected to the processor displays the >>> prompt. To determine the name of the device from which you want to boot the server processor, then boot the device, follow this procedure:

1. Determine the names of the devices available to the server processor. Enter the following command at the >>> prompt:

```
>>> SHOW DEVICE
```

A display similar to the following appears:

```
dka0.0.0.6.0      DKA0  ❶ RZ28      D41C
dka500.5.0.6.0   DKA500 ❷ RRD43      0064
dva0.0.0.1       DVA0
era0.0.0.3.1     ERA0      08-00-2B-BC-06-99
fra0.0.0.3.1     FRA0      08-00-2B-A6-0B-D4
pka0.7.0.6.0     PKA0      SCSI BUS ID 7
```

Where:

- ❶ DKA0 is the name of the server processor system disk, an RZ28 drive.
  - ❷ DKA500 is the name of the server processor CD-ROM drive, an RRD43 drive.
2. To boot the server processor, specify the device by name in the boot command. For example, the following command shows how to boot from the CD-ROM shown in the previous example:

```
>>> BOOT DKA500
```

## 7.3 Backing Up the Server System Disk

After you create a backup copy of the files on the system disk, you should keep the copy in a safe location. For complete information about backup operations, see the *OpenVMS Alpha Upgrade and Installation Manual*.

Perform the following steps to back up the StorageWorks FDDI Server OpenVMS Alpha operating system:

- Shut down the server.

---

**Note**

---

Any node in the VMScluster system whose system disk is served through a single server node (HS111 or HS211) also should be shut down. Shut down that system before shutting down the HS111/211 server.

---

- Boot the server from the CD-ROM (see Section 7.2). This starts the menu-driven command procedure shown in the following example:

OpenVMS Alpha (TM) Operating System, Version 6.2  
Copyright (c) 1995 Digital Equipment Corporation. All rights reserved.  
Installing required known files...  
Configuring devices...

\*\*\*\*\*

You can install or upgrade the OpenVMS Alpha operating system or you can install or upgrade layered products that are included on the OpenVMS Alpha operating system CD-ROM.

You can also execute DCL commands and procedures to perform "standalone" tasks, such as backing up the system disk.

Please choose one of the following:

- 1) Install or upgrade OpenVMS Alpha Version V6.2
- 2) List layered product kits that this procedure can install
- 3) Install or upgrade layered product(s)
- 4) Execute DCL commands and procedures
- 5) Shut down this system

Enter CHOICE or ? to repeat menu: (1/2/3/4/5/?) 1

- Enter 2, then press the Return key.
- At the triple dollar sign prompt (\$\$\$), enter the SHOW DEVICES command.
- Examine the list of devices so you can determine which device is the source drive (the system disk you want to back up) and which device is your target drive (the supported disk or tape device that will hold the backed up files).
- When you have determined which devices will be the source drive and target drive, mount those devices (and any other output devices you plan to use) before you perform any backup operations. Enter the MOUNT commands in the following format:

```
$$$ MOUNT/OVERRIDE=IDENTIFICATION source-drive  
$$$ MOUNT/FOREIGN target-drive
```

Where:

*source-drive* is the name of the drive holding the system disk.  
*target-drive* is the name of the drive that will hold the backup files.

- When the system disk and output devices are mounted, back up the system disk by entering the BACKUP command in the following format:

```
$$$ BACKUP/IMAGE/VERIFY source-drive: target-drive:
```

You also must include the save set name and the /SAVE\_SET qualifier if the target drive is a tape device.

In this example, the system disk and a target disk are mounted so the BACKUP command can create a backup disk. (You can use a backup disk as a system disk.)

```
$$$ MOUNT/OVERRIDE=IDENTIFICATION DKA200  
$$$ MOUNT/FOREIGN DKA300  
$$$ BACKUP/IMAGE/VERIFY DKA200: DKA300:
```

In this example the system disk and a target tape device are mounted so the BACKUP command can create a backup tape.

```
$$$ MOUNT/OVERRIDE=IDENTIFICATION DKA200  
$$$ MOUNT/FOREIGN MKA300  
$$$ BACKUP/IMAGE/VERIFY DKA200: MKA300:APR_06_BACKUP.BCK/SAVE_SET
```

The BACKUP command creates a system disk that includes a set of volume parameters provided by Digital, including a CLUSTER\_SIZE (disk access scheme) that is appropriate for your system. (The CLUSTER\_SIZE refers to the way files are stored on the disk, not to VMScluster environments.) You can change most volume parameters later with the SET VOLUME command.

However, to change the CLUSTER\_SIZE, you must back up the system disk to a disk that has been previously initialized with the CLUSTER\_SIZE that you want. For more information about initializing a disk and using the BACKUP command, see the *OpenVMS System Manager's Manual* and the *OpenVMS System Management Utilities Reference Manual*, and see the description of the INITIALIZE and BACKUP commands in the OpenVMS DCL Dictionary.

After you complete the backup operation, do the following:

- Enter the LOGOUT command to exit from the DCL environment and return to the menu.
- Choose the shutdown option (3).
- After the shutdown completes, boot from the system disk.

## 7.4 Defining Packet Sizes

The StorageWorks FDDI Server operating system is OpenVMS Alpha operating system Version 6.2. The SYSGEN parameter governing packet size has been preset to 4468. All other nodes in the same cluster and on the FDDI interconnect should be set to the same packet size according to the following rules:

If the Operating System of the Node Is . . .	Then Set the SYSGEN Parameter . . .
OpenVMS VAX Version 6.2	NISCS_MAX_PKTSZ to 4468
OpenVMS Alpha Version 6.2	NISCS_MAX_PKTSZ to 4468
OpenVMS Version 5.5-2	LRPSIZE to 4474

More information on packet sizes and related configuration considerations can be found in the manual titled *VMScluster Systems for OpenVMS*.

## 7.5 Running AUTOGEN

When you installed the operating system, the system executed the AUTOGEN.COM procedure to set the values of system parameters and the sizes of the page, swap, and dump files according to the system configuration. As a postinstallation procedure, you need to run the AUTOGEN.COM procedure again to properly tune the system.

Run AUTOGEN as follows:

1. After 24 hours of operation, run AUTOGEN in feedback mode and reboot the system.
2. Run AUTOGEN again in feedback mode two workdays later, and then reboot the system.
3. Digital recommends that you run AUTOGEN from SAVPARAMS through TESTFILES on a weekly basis thereafter, and examine AGEN\$PARAMS.REPORT to determine the need for additional changes.

Based on your examination of `AGENS$PARAMS.REPORT`, you might need to modify parameter values in `MODPARAMS.DAT`. If so, note the following:

- Hardcoded values in `MODPARAMS.DAT` should not hinder AUTOGEN's ability to calculate feedback parameters. AUTOGEN generally does not reduce the value of parameters that allocate resources; it considers current parameter values to be minimum values, which means that you do not have to add `MIN_*` symbols to `MODPARAMS.DAT`.
- AUTOGEN does increase parameter values according to its calculations unless you have specified explicit or maximum values (by adding `MAX_*` symbols) in `MODPARAMS.DAT`.

For more information about the `MODPARAMS.DAT` file and about using AUTOGEN in general, see the *OpenVMS System Manager's Manual*. Also, see the *OpenVMS System Manager's Manual: Tuning, Monitoring and Complex Systems* for information on running AUTOGEN and for additional information on system tuning.

## 7.6 Balancing I/O Load on the Dual-Processor Servers

When a device is accessed on a server from multiple client nodes, performance can be enhanced if the access pathways used in device mounting are different. In the dual-processor server models (HS121/221/241), the two processors and two or more HS1CP controllers typically offer four or more possible paths to a given disk device. By distributing mount connections to a device, bandwidth contention along a given path is minimized. When the load is balanced across the two server processors, the server provides better performance than if one server processor was heavily loaded while the other was mostly idle.

Load balancing can be implemented in one or both of two domains: at the device bus level, and at the server/network (mount path) level.

### 7.6.1 Device-Level Balancing

To ensure that all resources connected to the device bus are utilized fairly equally in server's with dual-redundant device channel processors, the HS1CP provides a means of tuning their usage via the PREFER qualifier. This can be done on one of the HS1CP device channel processors:

```
HS1CP> SET unit PREFERRED_PATH=HS1CP_NAME
```

where *unit* specifies a device and *HS1CP\_NAME* is THIS (for the HS1CP currently used) or OTHER (for the alternate HS1CP).

### 7.6.2 Mount Path-Level Balancing via the DCL PREFER Command

A DCL-level command, PREFER, can be incorporated into the DCL command table to provide a means of explicitly specifying a preferred disk path at mount time, or to change an existing mount path. You can use the PREFER command to set up device paths for each VMScluster node to take maximum advantage of the pathways available.

The PREFER command files should be available in the `SYS$EXAMPLES` directory of your system disk (as `PREFER.*`). To set up the PREFER command:

1. Place `PREFER.EXE` in the `SYS$SYSTEM` directory. (Another directory may be used; edit the 'image' line in file `PREFER.CLD` to specify the directory.)

2. To define PREFER in the local process DCL command table, issue the command:

```
$ SET COMMAND PREFER
```

To define PREFER in the systemwide DCL command table, issue the following command from an account with CMKRNL privilege:

```
$ SET COMMAND /TABLE=SYS$LIBRARY:DCLTABLES -  
_ $ /OUTPUT=SYS$COMMON:[SYSLIB]DCLTABLES PREFER
```

VMS Install is needed to make PREFER available to other users, again requiring CMKRNL privilege:

```
$ INSTALL  
INSTALL> REPLACE SYS$LIBRARY:DCLTABLES  
INSTALL> EXIT
```

---

#### Note

---

The Install utility commands must be executed from all nodes in a VMScluster system. If your system configuration deviates from the standard usage of DCLTABLES, modify the above commands to suit your site. For further information on defining command verbs or using the Install utility, consult the VMS documentation set.

---

To use the preferred path functionality, enter the command:

```
$ PREFER unit/HOST=host[/FORCE]
```

where *unit* specifies a device and *host* is the name of the server node that constitutes the preferred path. /FORCE is an optional qualifier described in following paragraphs.

In the following example, device \$10SDUA10: has a primary path through node FSERV1 and a secondary path through node FSERV2. To select FSERV1 as the primary path, enter the following command:

```
$ PREFER $10SDUA10:/HOST=FSERV1
```

This command sets the preferred path on the local node so that the next mount will use the selected path. If the /CLUSTER qualifier is used on the MOUNT command, all nodes in the cluster will use the selected path. Note that no change is made to the SHOW DEVICE output.

The /FORCE qualifier is used to select a preferred path for mounted disks. If the disk is mounted (not /FOREIGN), then the /FORCE qualifier will force the drive into mount verification and move it to the new controller. For example:

```
$ PREFER $10SDUA10:/HOST=FSERV1/FORCE
```

The path used to remount the disk will be the preferred path of the node that performs the mount verification. No other nodes in the VMScluster system will alter their paths to the device. For proper operation, the /FORCE qualifier should be issued only from a host on which the device is mounted.

To select a preferred path for all nodes in a VMScluster system, use the VMS SYSMAN Utility to set the preferred path on all nodes in the cluster before executing the PREFER command with the /FORCE qualifier.

---

**Note**

---

The PREFER command must be defined as a DCL command verb on all nodes in the VMScluster system before using it within SYSMAN.

---

In the following example, the SYSMAN PREFER command sets the preferred path on all nodes so that the next mount command from any node will use the selected path. The DCL PREFER command using the /FORCE qualifier causes the device to enter mount verification. After mount verification completes, the device will be remounted by all nodes through the preferred path, FSERV1.

```
SYSMAN> SET ENVIRONMENT/CLUSTER
SYSMAN> DO PREFER $10$DUA10:/HOST=FSERV1
SYSMAN> EXIT
$ PREFER $10$DUA10:/HOST=FSERV1/FORCE
```





---

## System Software Maintenance

Much of the information contained in this chapter is found in the current *OpenVMS Alpha Upgrade and Installation Manual*, available in hardcopy as well as documentation files on the server system disk and documentation CD-ROM. These documents also include other information that can be used in maintaining server and client nodes in a VMScluster environment.

### 8.1 Upgrading the OpenVMS Alpha Software Version

---

**Note**

---

Digital recommends that you first make a backup copy of your system disk prior to upgrading it. If there is any problem during the upgrade that might affect the integrity of the disk, you will have the backup copy as a safeguard.

---

Perform the following steps to upgrade the StorageWorks FDDI Server OpenVMS Alpha operating system:

1. Shut down the server.

---

**Note**

---

Any node in the VMScluster system whose system disk is served through a single server node (HS111 or HS211) also should be shut down. Shut down that system before shutting down the HS111/211 server.

---

2. Boot the server from the CD-ROM (see Section 7.2). This starts the menu-driven command procedure shown in the following example:

```
OpenVMS Alpha (TM) Operating System, Version 6.2
Copyright (c) 1995 Digital Equipment Corporation. All rights reserved.
Installing required known files...
Configuring devices...
*****
```

You can install or upgrade the OpenVMS Alpha operating system or you can install or upgrade layered products that are included on the OpenVMS Alpha operating system CD-ROM.

You can also execute DCL commands and procedures to perform "standalone" tasks, such as backing up the system disk.

Please choose one of the following:

- 1) Install or upgrade OpenVMS Alpha Version V6.2
- 2) List layered product kits that this procedure can install
- 3) Install or upgrade layered product(s)
- 4) Execute DCL commands and procedures
- 5) Shut down this system

Enter CHOICE or ? to repeat menu: (1/2/3/4/5/?) 1

The OpenVMS Alpha V6.2 operating system includes Volume Shadowing interoperability changes from previous ECO kits. If you are using Volume Shadowing and you upgrade this node to V6.2, then you must install the Volume Shadowing interoperability patches on any cluster member running an operating system version earlier than OpenVMS V6.2 to ensure correct shadowing operation throughout your cluster.

More information regarding these patches is available in the Problem Description section of the release notes supplied with the patch kits. Please read these notes regarding the cluster impact of patch installation. The release notes are located in the directory [SHADOW\_KITS] on this CD-ROM in the following files:

ALPSHAD01_062.RELEASE_NOTES	ALPSHAD07_061.RELEASE_NOTES
VAXSHAD01_062.RELEASE_NOTES	VAXSHAD03_060.RELEASE_NOTES
VAXSHAD07_061.RELEASE_NOTES	

Press Return to continue...

For your convenience, the shadowing remedial kits current at the time this CD was built have been provided in the following directory of the FDDI Server distribution CD-ROM.

```
sys$sysdevice:[shadow_kits]ALPSHAD01_062.*
sys$sysdevice:[shadow_kits]ALPSHAD07_061.*
sys$sysdevice:[shadow_kits]VAXSHAD01_062.*
sys$sysdevice:[shadow_kits]VAXSHAD03_060.*
sys$sysdevice:[shadow_kits]VAXSHAD07_061.*
```

TIMA remedial kits containing these changes are available through Digital Customer Services worldwide. Digital recommends that you contact your Customer Support Center to obtain the latest Volume Shadowing ECOs for all operating system versions in your cluster.

Do you want to continue the upgrade or installation? (Yes/No) [YES]

3. **The above question gives you the opportunity to safely abort the upgrade if you decide you are not ready to proceed due to Volume Shadowing interoperability issues. If you answer this question NO, the upgrade procedure returns to the selection menu without making any changes to your system disk. If you answer YES, the procedure continues with the upgrade as shown in the remainder of this example.**

\*\*\*\*\*

The installation procedure will ask a series of questions.

- () - encloses acceptable answers
- [] - encloses default answers

Type your response and press the <Return> key. Type:

- ? - to repeat an explanation
- ^ - to change prior input (not always possible)
- Ctrl-Y - to exit the installation procedure

The system disk on this StorageWorks FDDI Server has been identified as the following:

Target disk DKA0:  
Current label FSERV1\$SYS.

By default this disk will be upgraded to OpenVMS Alpha Version V6.2. All data on the target system disk will be preserved.

Is this OK? (Yes/No) yes

DKA0: is now labeled FSERV1\$SYS.

Do you want to keep this label? (Yes/No) [Yes]

OpenVMS Alpha will be upgraded on DKA0:.

The installation can provide brief or detailed descriptions.  
In either case, you can request the detailed descriptions by typing "?".

Do you always want detailed descriptions? (Yes/No) [No]

The following product has been selected:

DEC AXPVMS VMS V6.2 [Available]

\*\*\* DEC AXPVMS VMS V6.2: OpenVMS Operating System, Version V6.2

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Digital Equipment Corporation

Do you want all the default values for this product? [YES]

Do you want to view the values? [NO]

%PCSIUI-I-DONEASK, execution phase starting

The following product will be installed:

DEC AXPVMS VMS V6.2

%PCSI-I-VOLINFO, estimated space information for volume DISK\$FSERV1\$SYS

-PCSI-I-VOLSPC, -14 required; 3298176 available; 3298190 net

Portion Done: 0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%

The following product has been installed:

DEC AXPVMS VMS V6.2

The upgrade is now complete.

When the newly upgraded system is first booted, a special startup procedure will be run. This procedure will:

- o Run AUTOGEN to set system parameters.
- o Reboot the system with the newly set parameters.

When the special startup procedure has completed, you may resume normal operations on your FDDI Server.

You may shut down now or continue with other operations.

Process AXPVMS\_INSTALL logged out at 21-AUG-1995 22:45:24.45

4. The upgrade procedure returns to the selection menu. You may continue with other operations or shut down the server. The upgraded operating system becomes active when the server is rebooted.

Refer to the *OpenVMS Alpha Upgrade and Installation Manual* for detailed information on upgrading the OpenVMS Alpha operating system.

## 8.2 Restoring the System Disk from a Backup

Perform the following steps to restore the StorageWorks FDDI Server OpenVMS Alpha operating system:

1. Shut down the server.

---

**Note**

---

Any node in the VMScLuster system whose system disk is served through a single server node (HS111 or HS211) also should be shut down. Shut down that system before shutting down the HS111/211 server.

---

2. Boot the server from the CD-ROM (see Section 7.2). This starts the menu-driven command procedure shown in the following example.

```
OpenVMS Alpha (TM) Operating System, Version 6.2
Copyright (c) 1995 Digital Equipment Corporation. All rights reserved.
Installing required known files...
Configuring devices...
*****
```

```
You can install or upgrade the OpenVMS Alpha operating system
or you can install or upgrade layered products that are included
on the OpenVMS Alpha operating system CD-ROM.
```

```
You can also execute DCL commands and procedures to perform
"standalone" tasks, such as backing up the system disk.
```

```
Please choose one of the following:
```

- ```
1) Install or upgrade OpenVMS Alpha Version V6.2
2) List layered product kits that this procedure can install
3) Install or upgrade layered product(s)
4) Execute DCL commands and procedures
5) Shut down this system
```

```
Enter CHOICE or ? to repeat menu: (1/2/3/4/5/?) 4
```

3. Enter 4, then press the Return key to begin a limited DCL environment that is identified by a triple dollar sign prompt (\$\$\$).
4. At the triple dollar sign prompt (\$\$\$), enter the SHOW DEVICES command.
5. Examine the list of devices so you can determine which device is the source drive (the drive holding the backed up files you want to restore) and which device is your target drive (the disk on which you want the files restored).
6. When you have determined which devices will be the source drive and target drive, mount those devices (and any other output devices you plan to use) before you perform any restore operations. Enter the MOUNT commands in the following format:

```
$$$ MOUNT/OVERRIDE=IDENTIFICATION source-drive
$$$ MOUNT/FOREIGN target-drive
```

where:

*source-drive* is the device holding the files you want to restore.  
*target-drive* is the destination.

(Note, however, that you must use the MOUNT/FOREIGN command if the source drive is a tape device.)

7. Enter the BACKUP command in the following format:

```
$$$ BACKUP/IMAGE/VERIFY source-drive: target-drive:
```

(You also must include the save set name and the /SAVE\_SET qualifier if the source drive is a tape device.)

In this example, a backup disk and a target disk are mounted so the BACKUP command can restore the system disk from the backup disk:

```
$$$ MOUNT/OVERRIDE=IDENTIFICATION DKA300
$$$ MOUNT/FOREIGN DKA200
$$$ BACKUP/IMAGE/VERIFY DKA300: DKA200:
```

In this example, a backup tape and a target disk are mounted so the BACKUP command can restore the system disk from the backup tape:

```
$$$ MOUNT/FOREIGN MKA300
$$$ MOUNT/FOREIGN DKA200
$$$ BACKUP/IMAGE/VERIFY MKA300:APR_06_BACKUP.BCK/SAVE_SET DKA200:
```

After you complete the restore operation, do the following:

- Enter the LOGOUT command to exit from the DCL environment and return to the menu.
- Choose the shutdown option (5).
- After the shutdown completes, boot from the server's system disk.

## 8.3 Rebuilding the System Disk from the Server CD-ROM

Perform the following steps to rebuild the StorageWorks FDDI Server OpenVMS Alpha operating system:

1. Shut down the server.

---

### Note

---

Any node in the VMScluster system whose system disk is served through a single server node (HS111 or HS211) also should be shut down. Shut down that system before shutting down the HS111/211 server.

---

2. Boot the server from the CD-ROM (see Section 7.2). This starts the menu-driven command procedure shown in the following example:

```
OpenVMS Alpha (TM) Operating System, Version 6.2
Copyright (c) 1995 Digital Equipment Corporation. All rights reserved.
Installing required known files...
Configuring devices...
*****
```

You can install or upgrade the OpenVMS Alpha operating system or you can install or upgrade layered products that are included on the OpenVMS Alpha operating system CD-ROM.

You can also execute DCL commands and procedures to perform "standalone" tasks, such as backing up the system disk.

Please choose one of the following:

- 1) Install or upgrade OpenVMS Alpha Version V6.2
- 2) List layered product kits that this procedure can install
- 3) Install or upgrade layered product(s)
- 4) Execute DCL commands and procedures
- 5) Shut down this system

Enter CHOICE or ? to repeat menu: (1/2/3/4/5/?) 1

The OpenVMS Alpha V6.2 operating system includes Volume Shadowing interoperability changes from previous ECO kits. If you are using Volume Shadowing and you upgrade this node to V6.2, then you must install the Volume Shadowing interoperability patches on any cluster member running an operating system version earlier than OpenVMS V6.2 to ensure correct shadowing operation throughout your cluster.

More information regarding these patches is available in the Problem Description section of the release notes supplied with the patch kits. Please read these notes regarding the cluster impact of patch installation. The release notes are located in the directory [SHADOW\_KITS] on this CD-ROM in the following files:

|                             |                             |
|-----------------------------|-----------------------------|
| ALPSHAD01_062.RELEASE_NOTES | ALPSHAD07_061.RELEASE_NOTES |
| VAXSHAD01_062.RELEASE_NOTES | VAXSHAD03_060.RELEASE_NOTES |
| VAXSHAD07_061.RELEASE_NOTES |                             |

Press Return to continue...

For your convenience, the shadowing remedial kits current at the time this CD was built have been provided in the following directory of the FDDI Server distribution CD-ROM.

```
sys$sysdevice:[shadow_kits]ALPSHAD01_062.*
sys$sysdevice:[shadow_kits]ALPSHAD07_061.*
sys$sysdevice:[shadow_kits]VAXSHAD01_062.*
sys$sysdevice:[shadow_kits]VAXSHAD03_060.*
sys$sysdevice:[shadow_kits]VAXSHAD07_061.*
```

TIMA remedial kits containing these changes are available through Digital Customer Services worldwide. Digital recommends that you contact your Customer Support Center to obtain the latest Volume Shadowing ECOs for all operating system versions in your cluster.

Do you want to continue the upgrade or installation? (Yes/No) [YES]

3. **The above question gives you the opportunity to safely abort the installation if you decide you are not ready to proceed due to Volume Shadowing interoperability issues. If you answer this question NO, the installation procedure returns to the selection menu without making any changes to your system disk. If you answer YES, the procedure continues with the installation as shown in the remainder of this example.**

\*\*\*\*\*

The installation procedure will ask a series of questions.

- () - encloses acceptable answers
- [] - encloses default answers

Type your response and press the <Return> key. Type:

- ? - to repeat an explanation
- ^ - to change prior input (not always possible)
- Ctrl-Y - to exit the installation procedure

The system disk on this StorageWorks FDDI Server has been identified as the following:

Target disk DKA0:  
Current label FSERV1\$SYS.

By default this disk will be upgraded to OpenVMS Alpha Version V6.2. All data on the target system disk will be preserved.

Is this OK? (Yes/No) no

There are two choices for Installation/Upgrade:

INITIALIZE - removes all software and data files that were previously on the target disk and installs OpenVMS Alpha.

PRESERVE -- installs or upgrades OpenVMS Alpha on the target disk and retains all other contents of the target disk.

\* NOTE: You cannot use PRESERVE to install OpenVMS Alpha on a disk on which OpenVMS VAX or any other operating system is installed.

Do you want to INITIALIZE or to PRESERVE? [PRESERVE] initialize

You must enter the device name for the target disk on which OpenVMS Alpha will be installed.

Enter device name for target disk: (? for choices) dka0:

DKA0: is now labeled FSERV1\$SYS.

Do you want to keep this label? (Yes/No) [Yes]

You have chosen to install OpenVMS Alpha on a new disk.

The target system disk, DKA0:, will be initialized.

It will be labeled FSERV1\$SYS.

Any data currently on the target system disk will be lost.

Is this OK? (Yes/No) yes

Initializing and mounting target....

The installation can provide brief or detailed descriptions.

In either case, you can request the detailed descriptions by typing "?".

Do you always want detailed descriptions? (Yes/No) [No]

The following product has been selected:

DEC AXPVMS VMS V6.2

\*\*\* DEC AXPVMS VMS V6.2: OpenVMS Operating System, Version V6.2

COPYRIGHT (c) 24-MAY-1995 -- All rights reserved

Digital Equipment Corporation

Do you want all the default values for this product? [YES]

Do you want to view the values? [NO]

%PCSIUI-I-DONEASK, execution phase starting

The following product will be installed:

DEC AXPVMS VMS V6.2

%PCSI-I-VOLINFO, estimated space information for volume DISK\$FSERV1\$SYS

-PCSI-I-VOLSPC, 337699 required; 4104424 available; 3766725 net

Portion Done: 0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%

The following product has been installed:

DEC AXPVMS VMS V6.2

Copying FDDI Server Software Customization Procedures to disk  
Copying documentation directory to new system disk

The installation is now complete.

When the newly installed system is first booted, the StorageWorks FDDI Server Software Customization Procedure will run. This procedure will ask you to enter information required to custom configure the server for your site.

You may shut down now or continue with other operations.

Process AXPVMS\_INSTALL logged out at 21-AUG-1995 22:45:24.45

- 4. The installation procedure returns to the selection menu. You may continue with other operations or shut down the server. The FDDI Server Software Customization Procedure will run when the server is rebooted.**

**For further information on the operating system installation refer to the *OpenVMS Alpha Upgrade and Installation Manual*.**



---

# StorageWorks Glossary

**ac distribution**

The method of distributing ac power in a cabinet.

**ac power supply**

A power supply designed to produce dc power from an ac input.

**adapter**

A device that converts the protocol and hardware interface of one bus type into that of another without changing the functionality of the bus. *See* **signal converter**.

**American National Standards Institute**

*See* **ANSI**.

**ANSI**

American National Standards Institute. An organization that develops and publishes electronic and mechanical standards.

**array controller**

A hardware/software device that facilitates communications between a host and one or more devices organized in an array. HS-family controllers are examples of array controllers.

**BA350–Mx controller shelf**

The StorageWorks controller shelf used for HS-family controller modules, cache modules, and shelf power units.

**BA350–Sx SBB shelf**

A StorageWorks shelf used for only power units and SBBs.

**cable distribution unit**

*See* **CDU**.

**carrier**

A standard, StorageWorks shelf-compatible, plastic shell into which a device can be installed. Sometimes called SBB carrier.

**CDU**

Cable distribution unit. The AC power entry device for StorageWorks cabinets. The unit provides the connections necessary to distribute ac power to cabinet shelves and fans.

**CLI**

Command line interpreter. Operator command line interface for the HS1CP firmware.

**command line interpreter**

*See* **CLI**.

**controller**

A hardware/software device that facilitates communications between a host and one or more devices. A controller translates bus protocols and hardware interfaces and adds functionality to the host/device communications.

**controller shelf**

A StorageWorks shelf designed to contain controller and cache memory modules.

**data center cabinet**

A generic reference to the large cabinets, such as the SW800 series, in which StorageWorks components can be mounted.

**Diagnostics and Utilities Protocol**

*See* **DUP**.

**dual cabinet power configuration**

A cabinet ac power configuration in which two ac sources and two ac power supplies are used to provide redundant dc power to each of the cabinet's SBB shelves.

**dual shelf power configuration**

A cabinet ac power configuration in which one ac source and two ac power supplies are used to provide redundant dc power to each of the cabinet's SBB shelves.

**dual-redundant configuration**

A controller configuration consisting of a primary and backup controller in one controller shelf. If the primary controller fails, the backup controller assumes control over the failing controller's devices.

**DUP**

Diagnostic and Utility Protocol. Host application software that allows a host operator terminal to connect to the controller's command line interpreter. *See also* **virtual terminal**.

**failover**

Failover is the process that takes place when one controller in a dual-redundant configuration fails, and the other controller takes over the direction of the storage subsystem. The other controller continues to direct the storage subsystem until the failed controller becomes operational or is replaced.

**fan**

An airflow device mounted in a StorageWorks cabinet.

**field replaceable unit**

*See* **FRU**.

**filler panel**

A sheet metal or plastic panel used to cover unused mounting areas in StorageWorks cabinets and shelves.

**FRU**

field replaceable unit. A hardware component that can be replaced in the field.

**full-height device**

A single device that occupies an entire 5.25 inch SBB carrier. StorageWorks full-height devices have an order number suffix of “-VA.”

**half-height device**

A device that occupies half of a 5.25 inch SBB carrier. Two half-height devices can be mounted in a 5.25 inch SBB carrier. The first half-height device is normally mounted in the lower part of the carrier. The second device is normally mounted in the upper part of the carrier.

**logical units**

A group of devices addressable as a virtual unit.

**maintenance terminal**

The operator terminal used to identify an HS-family controller, to enable its host paths, to define its subsystem configuration, and to check its status. The HS-family maintenance terminal interface is designed to accept any terminal conforming to EIA-423. The maintenance terminal is only required to configure a storage subsystem and is not required for normal operations.

**nonredundant**

A configuration in which there is no backup hardware in place for the hardware that is present.

**qualified device**

A device that has been fully tested in all appropriate StorageWorks hardware and software configurations, and is in complete compliance with Digital and country-specific standards, for example, FCC and TÜV.

**quiesce**

To make a bus inactive or dormant. The operator must quiesce SCSI bus operations, for example, during a device warm swap.

**RAID**

Redundant array of independent disks. A set of storage techniques devised to increase the performance and availability of a storage subsystem.

**Redundant Array of Independent Disks**

*See* **RAID**.

**SBB**

StorageWorks building block. A device housed in a standard StorageWorks SBB carrier. An SBB has a standard physical and electrical interface that is compatible with those of StorageWorks shelves and enclosures.

**SBB shelf**

StorageWorks building block shelf. A StorageWorks shelf, such as the BA350–Sx, designed to house plug-in SBB modules.

**shelf brackets**

Sheet metal components designed to attach and position StorageWorks shelves in their associated enclosures.

**signal converter**

A device that converts the protocol and hardware interface of one bus type into that of another without changing the functionality of the bus. *See* **adapter**.

**single cabinet power configuration**

A cabinet ac power configuration in which only one ac source and one ac power supply is used to supply dc power to the cabinet's SBB shelves.

**skirt**

A trim panel designed to mount around the base of the cabinet.

**storage sets**

A grouping of disk drives that make up a new distinct container.

**StorageWorks**

Digital's family of modular data storage products that allows customers to design and configure their own storage subsystems. Components include power, packaging, cabling, devices, controllers, and software. Customers can integrate devices and array controllers in StorageWorks enclosures to form storage subsystems.

**StorageWorks building block**

*See* **SBB**.

**stripesets**

In a RAID configuration, a virtual disk drive with its physical data spread across multiple physical disks. Stripset configurations do not include a data recovery mechanism.

**supported device**

A device tested as functionally compatible with an approved StorageWorks hardware and software configuration.

**virtual terminal**

A software path from an operator terminal on the host to the controller's CLI interface. The path can be established via the host port on the controller (using DUP) or via the maintenance port through an intermediary host (VCS). A virtual terminal is also sometimes called a host console.

**warm swap**

A controller function that allows devices to be added, removed, or replaced while the subsystem remains operational. All activity on the device's SCSI bus must normally be halted for the duration of the warm swap operation.

**write-back cache**

A cache configuration that increases the performance of host write requests. When the host requests a write operation, the cache writes the host's data first to the cache memory, completing the host's request quickly. It performs the slower operation of flushing the data to the external storage device at a later time. The host sees the write operation as complete when the data has reached the cache.



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