digital

UNIX TruCluster Available AlphaServer 4x00

DIGITAL HiTest Notes

EK-HTCUA-HN. B01

March 1997

Revision/Update Information:	This is a revised manual Version 1.2.
Operating System and Version:	DIGITAL UNIX Version 4.0b

Digital Equipment Corporation makes no representations that the use of its products in the manner described in this publication will not infringe on existing or future patent rights, nor do the descriptions contained in this publication imply the granting of licenses to make, use, or sell equipment or software in accordance with the description.

The following are trademarks of Digital Equipment Corporation: AlphaServer, DEClaser, DIGITAL, EtherWorks, OpenVMS, PATHWORKS, and the DIGITAL logo.

The following are third-party trademarks:
Adobe and PostScript are registered trademarks of Adobe Systems, Incorporated.
Helvetica and Times are registered trademarks of Linotype Co.
Microsoft and MS-DOS are registered trademarks and Windows is a trademark of Microsoft Corporation.
UNIX is a registered trademark in the United States and other countries, licensed exclusively through X/Open Company Ltd.
Oracle is a registered trademark of Oracle Corporation.

Table of Contents

Figures

Table

Preface

This document provides an overview of HiTest System and detailed technical information about interoperability test results for an Internet UNIX TruCluster Available Server 4000/4100 running DIGITAL UNIX Version 4.0b.

Audience

Primary users of this document are DIGITAL and Partners sales representatives, technical support personnel, and DIGITAL customers (when configuring and upgrading systems and working configuration problems); product managers (for extracting data needed by sales tools); personnel responsible for installing, setting up, and operating a HiTest System.

Road Map

This document contains the following sections:

1. Introduction — Provides a brief summary of the benefits of HiTest Templates and an overview of the template covered in this document.

2. Configuration Data — Gives tables of configuration data about the hardware and software components that define the template, and special configuration rules if any.

3. HiTest System Installation and Setup — Presents information useful when installing and tuning a HiTest System configured from this HiTest Template.

4. Interoperability Tests and Results — Describes how the tests were set up (including database organization), what data and programs were placed on what disks, and how the tests were run.

5. System Limits and Characterization Data — Summarizes any system limitations or performance data that were identified during testing.

6. Problems and Resolutions — Discusses any problems and Resolutions that were discovered during testing.

Appendix A: Detailed Hardware Configuration — Contains a more detailed treatment of the hardware and software components listed in the Configuration Data section.

Feedback and Ordering Information

What our readers think of this or any other DIGITAL documentation is important to us. If you have any comments, no matter how great or small, we'd appreciate hearing from you. Send your comments to: *reader-comments@digital.com*.

Please reference the document title and part number in your correspondence about this manual.

Copies of this and other DIGITAL documents can be ordered by calling 1-800-DIGITAL.

1
Introduction

DIGITAL HiTest Suite and Its Advantages

DIGITAL HiTest Suites are guidelines for configuring a set of prequalified computer systems. A HiTest Suite often contains all the hardware and software needed for a complete customer solution. DIGITAL HiTest Suites can be used as a basis for configuring systems that satisfy a wide set of customer requirements. Typically, Suites target specific markets such as Data Warehousing or Continuous Computing.

DIGITAL Product Management and Engineering select the components and design the configurations in each HiTest Suite to ensure high system reliability, application performance, and upgradability. A Suite's hardware and software components have been successfully tested for interoperability.

A HiTest Suite specifies allowed ranges of hardware and software components, as well as each component's part number, description, and revision information. These specifications are listed in the *DIGITAL HiTest Template*.

The components in a HiTest Suite are organized into two groups, *the DIGITAL HiTest Foundation* and the *DIGITAL HiTest AppSet*. The HiTest Foundation includes the hardware, operating system, middleware, and database software. The HiTest AppSet includes the software specific to one class of customer solutions.

Configuring a DIGITAL HiTest Suite is easy. Simply select components from the HiTest Template to configure a DIGITAL HiTest System. Any system configured as specified in the DIGITAL HiTest Template can be called a DIGITAL HiTest System.

The HiTest Suite is documented in the *DIGITAL HiTest Notes*. The HiTest Notes list the HiTest Foundation and HiTest AppSet components. HiTest Notes also describe the testing of the Suite and include configuration details, installation instructions, tuning parameters, problems encountered and their solutions, and system diagrams.

Some components listed in the HiTest Foundation or AppSet may be optional. If the minimum quantity is zero (0), then the component is optional. If the minimum quantity is one or more, then you must order at least the minimum quantity.

The maximum quantities represent the largest group of components that were tested for interoperability with all the other components in the Suite. Although it may be possible to place more than the specified maximum quantity of a component on a DIGITAL system, extensive interoperability testing was not done at that level and such a system would not be considered a DIGITAL HiTest System.

You can select any combination of components with quantities ranging from the minimum to the maximum specified. Occasionally, special configuration rules give further guidance or

restrict configurations. These rules appear in the Configuration Data section of the HiTest Notes.

A customer can include the Suite-specified hardware and software they need and then layer on additional software. Other types of hardware, called *add-on hardware*, can also be added to a DIGITAL HiTest System. The add-on hardware is specified in the Configuration Data section of the HiTest Notes, and in the HiTest Systems Web Pages, available through the following URLs:

```
http://cosmo.tay.dec.com              (Intranet)
http://www.partner.digital.com:9003 (Internet)
```

Even though the customer may install application software that is not specified in the Suite, the customer and DIGITAL still experience the advantages of knowing that all of the Suite base hardware and software interoperates correctly. Of course, the full benefit of configuring a system from a HiTest Suite is obtained when the system includes only specified HiTest Foundation and AppSet components.

Overview of this DIGITAL HiTest Suite

The UNIX TruCluster Available Server 4000/4100 HiTest Suite will meet the server needs of medium to high-end UNIX users. This template covers a range from small Server 4000 systems to large Server 4100 systems. This HiTest Suite is a solid foundation for customers requiring a TruCluster Available Server (formerly ASE).

2
Configuration Data

Configuration data includes the hardware, software, and firmware components that were tested together. Special configuration rules are explained if required.

HiTest Template Components

The following table describes the range of hardware and software components that can be configured using the Internet UNIX TruCluster Available Server 4000/4100 HiTest Template. This range includes both the Server 4000 and the Server 4100. Each system can have one or two CPUs, and 512MB to 2 GB of memory.

A wide selection of other options can be configured, including storage and network adapters.

Configuration Data

Table 2-1: UNIX TruCluster Available Server 4000/4100 HiTest Template

Line Item	Description	Part Number	Tested Range	
			Min	Max
<td colspan="5" align="center">**TruCluster Available Server *HiTest Appset*** **DIGITAL UNIX AlphaServer 4000/4100 *HiTest Foundation***</td>
<td colspan="5" align="center">*For documentation and updates:* http://cosmo.tay.dec.com *and* http://www.partner.digital.com:9003 *For hardcopy of this Suite's HiTest Notes, order* EK-HTCUA-HN</td>
<td colspan="5" align="center">**Appset Software**</td>
1	*For Appset, add your own applications to the following foundation.* **None.**			
<td colspan="5" align="center">**Foundation Hardware**</td>
2	*Select two base systems: HiTest recommends identical systems.* **AS4100 5/400 Drawer UNIX 512 MB** **AS4100 5/400 Drawer UNIX 1 GB** **AS4100 5/400 Drawer UNIX 2 GB** **AS4000 5/400 Drawer UNIX 512 MB** **AS4000 5/400 Drawer UNIX 1 GB** **AS4000 5/400 Drawer UNIX 2 GB** *Hardware includes*: • 5/400-MHz CPU with 2-MB cache • Memory • S3 Trio64 PCI 1 MB Graphics Adapter • DE500-AA 10/100 Mbit Fast Ethernet • KZPDA-AA FWSE SCSI and cable • RRD46-AB SCSI 12X CD-ROM drive • RX23L-AB 1.44 MB Floppy drive • LK47W-A2 PS/2 style keyboard • Three-button PS/2 compatible mouse *Software includes*: • DIGITAL UNIX • ServerWorks	**DA-51HAB-EB** **DA-51HAB-FB** **DA-51HAB-GB** **DA-52HAB-EB** **DA-52HAB-FB** **DA-52HAB-GB**	2	2
3	**Cabinet Enclosure** *Hardware includes*: • 4.3 GB Wide Disk (RZ29B-VW) • 19-in cabinet with StorageWorks Shelf and mounting kit. Cabinet supports up to seven more StorageWorks shelves.	**H9A10-ED/EE**[*]	1	1
4	**400 Mhz CPU DIGITAL UNIX SMP UPG**	**KN304-BA**	0	2
5	*Provides redundancy (N+1) for up to two CPUs per system.* **450 Watt Power Supply**	**H7291-AA**	0	2
<td colspan="5">*Note: This HiTest Template supports a memory range from 512 MB to 2 GB per system. When selecting memory options, stay within the Template's 2 GB maximum.* *The AlphaServer 4100 System Drawer supports three additional memory options.* *The AlphaServer 4000 System Drawer supports one additional memory option.* *The largest memory option should be placed in Memory Slot 0, the next largest in Slot 1, etc.*</td>
6	**128 MB Memory Option**	**MS320-CA**	0	4
7	**512 MB Memory Option**	**MS330-EA**	0	2

---

[*]Where two part numbers or variants are separated by a "/", the first number applies to the Americas and Asia Pacific and the second number applies to Europe.

	TruCluster Available Server *HiTest Appset* DIGITAL UNIX AlphaServer 4000/4100 *HiTest Foundation*				
	For documentation and updates: http://cosmo.tay.dec.com *and* http://www.partner.digital.com:9003 *For hardcopy of this Suite's HiTest Notes, order* EK-HTCUA-HN				
Line Item	Description	Part Number	Tested Range		
			Min	Max	
8	**1 GB Memory Option**	**MS330-FA**	0	2	
9	*Order when more than 5 additional StorageWorks shelves are ordered.* **StorageWorks Cabinet**	**SW500-AC**	1	1	
10	*Each shelf holds seven RZ29B-VW disks.* **Rackmount StorageWorks Shelf**	**BA36R-RA/JA**[*]	2	14	
11	*This number is reduced by one for TLZ09 or by three for TLZ9L and TLZ7L tape drives.* **4.3 GB 7200 RPM 16-bit Wide SCSI Disks**	**RZ29B-VW**	6	81	
12	*Order one kit when three or more StorageWorks shelves are used.* **Cabinet Power kit for additional shelves**	**CK-H9A10-EB/ CK-H9A10-EC**[*]	1	1	
13	**PCI one-port FWD SCSI controller**	**KZPSA-BB**	1	4	
14	*Order one for each KZPSA-BB ordered.* **2 meter 16-bit SCSI cable (internal)**	**BN21K-02**	1	4	
15	*Quantity limited to 3 with HSZ present.* *This quantity can be increased to four if there is no HSZ52-AJ present.* **StorageWorks shelf signal converter**	**DWZZB-VW**	1	4	
16	**StorageWorks Array Controller with 32-MB cache**	**HSZ52-AJ**	0	2	
	Order the following items when an HSZ52-AJ is ordered:				
17	**Rackmount StorageWorks controller shelf**	**BA35R-MR/ BA350-MB**[*]	0	2	
18	**IEC to IEC power cord, gray**	**BN30B-02**	0	21	
19	**SCSI Y cable, 68-pin**	**BN21W-0B**	1	8	
20	**SCSI Tri-link connector**	**H885-AA**	0	6	
21	**SCSI Differential terminator**	**H879-AA**	0	8	
22	*Order one cable for each StorageWorks shelf that will be attached to the HSZ5X controller.* **Cable for Connection HSZ to Shelf**	**BN21N-02**	2	8	
23	**PCI to FDDI Adapter, single attachment station (SAS), multimode fiber (MMF), and SC connector**	**DEFPA-AB**	0	2	
24	**Cable for PCI to FDDI Adapter**	**BN34B-20**	2	2	
25	*Only one drive is needed per system. If ordering an autoloader, reduce the number of single drives accordingly. Similarly each cluster only needs one autoloader.* **8 GB DAT Tape Drive**	**TLZ09-VA**	0	2	
26	**8 GB 4mm DAT 93 MB/min (compressed) 5.25-inch Tape Drive**	**TLZ9L-VA**	0	1	
27	**32/96 GB 4mm 1.5 GB/hr 5.25-inch SCSI Tape Loader**	**TLZ7L-VA**	0	1	

<table>
<tr><th colspan="5">TruCluster Available Server <i>HiTest Appset</i>
DIGITAL UNIX AlphaServer 4000/4100 <i>HiTest Foundation</i></th></tr>
<tr><td colspan="5"><i>For documentation and updates:</i> http://cosmo.tay.dec.com <i>and</i> http://www.partner.digital.com:9003
<i>For hardcopy of this Suite's HiTest Notes, order</i> EK-HTCUA-HN</td></tr>
<tr><td rowspan="2">Line Item</td><td rowspan="2">Description</td><td rowspan="2">Part Number</td><td colspan="2">Tested Range</td></tr>
<tr><td>Min</td><td>Max</td></tr>
<tr><td>28</td><td><i>Select one high resolution color monitor:</i>
15-in Flat-square with 0.28 dot pitch
17-in Trinitron aperture grille, 0.26mm
21-in Diamondtron aperture grille, 0.30mm</td><td>VRC15-WA
VRT17-WA
VRC21-WA</td><td>1</td><td>2</td></tr>
<tr><td colspan="5" align="center">Foundation Software</td></tr>
<tr><td colspan="5">NOTE: <i>Order the exact versions and revisions of the software shown below. Paper documentation can be ordered separately.</i></td></tr>
<tr><td>--</td><td>DIGITAL UNIX V4.0b and ServerWORKS</td><td>Included with Item 1.</td><td></td><td></td></tr>
<tr><td>29</td><td>ServerWORKS</td><td>Included with item 1.</td><td></td><td></td></tr>
<tr><td>30</td><td>StorageWorks</td><td>QB-5CJAA-SA</td><td>0</td><td>2</td></tr>
<tr><td>31</td><td>Advance File System V4.02 license</td><td>QI-0EGAx-AA</td><td>2</td><td>2</td></tr>
<tr><td>32</td><td>LSM 1.2a license</td><td>QL-2GVAx-AA</td><td>2</td><td>2</td></tr>
<tr><td>33</td><td>Networker 4.2a license</td><td>QL-2ALAx-AA</td><td>2</td><td>2</td></tr>
<tr><td>34</td><td>DIGITAL UNIX V4.0b CD-ROM Media</td><td>AG-QTM9C-BE</td><td>1</td><td>1</td></tr>
<tr><td>35</td><td><i>For additional information on available services, refer to the appropriate price book.</i>
TruCluster Available Server License and documentation</td><td>QB-05SA-AA</td><td>2</td><td>2</td></tr>
</table>

For more details on the hardware configuration, see Appendix A.

The following table lists the revision levels for the hardware and software components that were tested.

Table 2-2: Component Firmware Revision Levels

Hardware Component	Hardware Revision	Firmware Revision	Software Revision
SRM Console	n/a	V3.0-10	n/a
Tape (TLZ09-VA)	A01	n/a	n/a
Tape Autoloader TLZ9L-VA	A01	n/a	n/a
Tape Autoloader TLZ7L-VA	B05	n/a	n/a
4.3 GB disk (RZ29B-VW)	n/a	0014	n/a
4.3 GB disk (RZ29B-VA)	n/a	0014	n/a
HSZ52	n/a	V5.0	n/a
DECchip 21040-AA	A03/2.4	n/a	n/a
DEC PCI FDDI	n/a	2.46	n/a
PALcode	n/a	n/a	V1.21-12
KZPSA	n/a	P01-A10	n/a
DEFPA	010	n/a	n/a
AlphaBIOS	n/a	5.24-0	n/a
KZPDA	A01	n/a	n/a
Graphics board (S3)	-2	n/a	n/a

Firmware Component

Table 2-3: Component Firmware Revision Levels

Description	Part Number	Minimum	Maximum
Alpha Firmware update 3.8	AG-PTMWV-BS	1	1

Special Configuration Rules

Make sure that each node has a unique SCSI host ID for all of the controllers attached to shared devices. For example, set one node's SCSI host ID to 6 and the other node's SCSI host ID to 7.

Make sure that each system in the TruCluster has the same SCSI devices in the same configuration. This is most easily accomplished by having identical option cards in the same slot for each system.

Remove the internal terminating resistors from all shared SCSI controllers. These will be replaced by the Y-cable and external terminator (BN21W-0B / H879-AA).

The SW500 cabinet is not necessary for smaller configurations. There is a maximum of 6 storage shelves in the systems cabinet with two system drawers. For configurations with more than 36 disks, order the additional cabinet with enough shelves to accommodate the additional disks. (Note: A fully populated SW500 can go beyond the limits of this template depending on the configuration of the system cabinet.) The distribution of the individual disks between the system cabinet and SW500 is flexible.

It is possible to order too many memory options. A HiTest System for this template should have between 512 MB and 2 GB total memory.

The *AlphaServer System Drawer User's Guide* (order number EK-4100A-UG) provides more details. The guide gives the detailed configuration information needed to properly install CPU and memory options, as well as PCI options.

3

HiTest System Installation and Setup

The following information provides guidelines for system installation and setup.

Procedure

Perform the following software installations:

1. Install DIGITAL UNIX using the instructions provided with the software media. Take all defaults with this exception: use AdvFS for all file systems instead of UFS.

2. Load all pertinent licenses.

3. Install TruCluster Available Server using the instructions provided.

4. After the initial TruCluster Available Server setup, install the application(s) to be managed by TruCluster Available Server.

5. Once these are installed and configured, it may be necessary to edit startup and stop scripts. If this is required, then do so at this time. See the TruCluster Available Server documentation for instructions.

4

Interoperability Tests and Results

Test Tools

A database application workload was used to test these systems. This was driven by an automated tool that performed user logins and transactions against the database. Verification of data integrity is a part of this tool suite. There were no data corruptions during testing.

Test Configuration

Minimum Configuration

For testing the minimum configuration the AlphaServer was configured to use one RZ29 for its system disk. Swap and spool space was placed on two more RZ29s.

The test application was loaded onto remaining disks.

Table 4-4: Disk Usage for the Minimum ConfigurationPer System

Quantity	Capacity (GB)	Disk Content/Data	Controller
1	4.3	System disk	KZPDA-AA
1	4.3	Swap/paging space	KZPDA-AA
1	4.3	Application software	KZPSA-BB

Maximum Configuration

For testing the maximum configuration the AlphaServer was configured to use two RZ29 disks for system and swap disks. Applications were then loaded onto the remaining disks.

Table 4-5: Disk Usage for the Maximum Configuration

Quantity	Capacity (GB)	Disk Content/Data	Controller
1	4.3	System Disk	KZPDA-AA
1	4.3	Swap/paging space	KZPDA-AA
36	4.3	Application Software	KSPSA-BB /HSZ52-AJ
36	4.3	Application Software	KZPSA-BB /HSZ52-AJ
5	4.3	Application Software	KZPSA-BB
3	4.3	Application Software	KZPSA-BB

Test Process

The AlphaServers were set up according to the information in Chapters 2 and 3. Then the following tests were performed. The average test duration was 16 hours.

For minimum configuration the following failures were tested:

- Routine shutdown of the system that the service was running on
- Power failure of system
- Machine halt or panic
- Shared disk cable disconnect
- Disconnection of network connection

For maximum configuration the following failures were tested:

- Routine shutdown of the system that the service was running on
- Power failure of system
- Machine halt or panic
- Shared disk cable disconnect
- Disconnection of network connection(s)
- Hotswapping of disks (single, then multiples)
- Power failure of BA356 storage shelf
- Power failure of HSZ50
- Reboot of HSZ50
- Disconnect of cable to HSZ50
- Disconnect of second cable to HSZ50

For load testing the following loads were tested:

- Database load.

For the minimum configuration this was a small (500 KB) database. These tests were run for one day.

For the maximum configuration this was a large (24 GB) database. These tests were run for five days. The smaller (500KB) database load was also run concurrently.

- NetWorker backups and restores.

  This was run concurrently with database testing. Restore was run after shutting the database down.

- DIGITAL Internet AlphaServer (IAS Version 3.1.1)

  This consisted of Web, mail, and news group traffic loads.

  See the *DIGITAL HiTest Notes for Internet UNIX AlphaServer 4000/4100* for more detailed information.

Test Results

The TruCluster Available Server performed without problem in all test cases.

For simple failover the TruCluster Available Server relocated the service as intended. The application restarted on the designated node when the original node running it failed (or became unavailable).

With the maximum configuration the TruCluster Available Server performed as intended. The service did not always fail over to another node due to the double-redundant nature of the configuration. If a primary link failed, the backup would keep the service functioning on the original node. When all links failed, then the service was relocated to the designated node.

Database load tests were successful. Users were able to query, insert, update and delete rows from the databases without problems.

Internet AlphaServer load tests were successful. See the *Digital HiTest Notes for Internet UNIX AlphaServer* for more information.

Backup and restore tests with PolyCenter NetWorker were also successful.

5
System Limits and Characterization Data

Failover is not instantaneous. It takes time for other nodes to recognize that the node providing this service has failed. In the case of power down or system reboot, it happens relatively quickly. In the case of a network connection failure it takes longer. There is also the inherent delay in starting the applications being failed over.

There are limitations to failover and availability. The system keeps running only if you have levels of redundancy greater than or equal to the number of failures. With the mirrored disks, if the first set fails, LSM automatically rebuilds the other disk set(s) as soon as it is (they are) available. If the copy LSM is running from also fails (that is, all mirrored sets fail at the same time) then the service fails. Similarly, if all nodes crash simultaneously then the service becomes unavailable.

For load testing, a single node was able to support all applications. It should be noted that as application load increased, response time did also. Thus the response time from the database with 200 users was more than the response time for with 50 users. Similarly response time increased as the number of applications or processes running increased.

6

Problems and Resolutions

There were no problems with the software when installed according to instructions, with the exception of altering a member's net interfaces from primary. It is recommended that this not be attempted. With a properly configured network this should not be necessary.

The following problems may appear if TruCluster Available Server is improperly installed, or if requirements outlined in the TruCluster Available Server installation manual are not met.

Kernel Build

Problem   The following message may appear during the kernel build portion of the TruCluster Available Server installation:

```
> Make: Don't know how to make
/usr/opt/TCR140/sys/data/rm_data.c
```

Resolution   Make sure that the systems net mask was properly set during the initial configuration (check the online SYSMAN Configuration Checklist).

Boot Failure

Problem   The system or systems pass hardware init checks but fail during boot due to lack of a name server.

Resolution   Make sure that a valid name server is running and available to the network segment the TruCluster Available Server members are attempting to boot in. TruCluster Available Server will not work without a valid name server available during the boot process. The name server may be (but does not have to be) a part of the TruCluster Available Server.

Shared Disks Not Available

Problem   The shared disks are not accessible by any member of the TruCluster Available Server.

Resolution   • Make sure that, when the systems are booted, the name server is operating.

• Make sure that the timeout parameter for starting the service is set to a large enough value to allow the scripts to execute before timing out.

• Use the init command, then boot the system.

• Make sure the boot_reset environment variable is set to on.

asemgr Hangs

Problem	asemgr hangs when modifying a service.
Resolution	• Make sure the start and stop action scripts are correct (work properly) before activating them.
	• Make sure that the timeout parameter for starting the service is set to a large enough value to allow the scripts to execute before timing out.

Problem	asemgr hangs when `maxuprc` (maximum user processes) is exceeded.
Resolution	Increase `maxuprc` and reboot the system.

Altering Member Net Interfaces

Problem	When altering a member's net interfaces from primary, static routings become unavailable.
Resolution	TruCluster Available Server must be stopped for static routings to be reestablished. It is recommended that users not change the net interfaces from primary.

TruCluster Available Server Member Not Found While Running asesetup

Problem	When running asesetup one or more members are not found.
Resolution	Make sure all members are in the /etc/hosts file.
Resolution	Make sure all license packs are installed **before** installing TruCluster Available Server. If this was not the case, reboot the machine after installing the appropriatelicense.

Disk Service Disappears During Configuration

Problem	Disk service disappears during configuration when a node in the TruCluster Available Server reboots.
Resolution	Do not reboot any systems while configuring a service. The TruCluster Available Server needs to update the TruCluster Available Server database on all nodes. It cannot do this while a system is in the boot process.

A
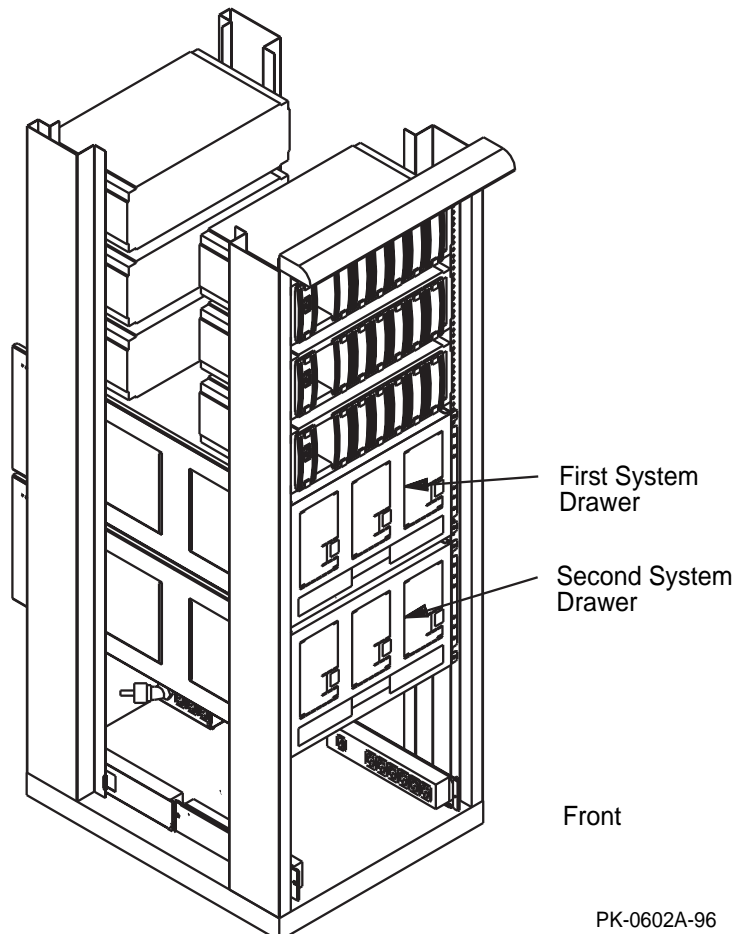# Detailed Hardware Configuration

This appendix describes the minimum and maximum hardware configuration for the following:

- PCI Motherboard

- System Motherboard

- BA356 Storage Shelves

Figure A-1: 4000/4100 Dual Rackmount Cabinet

First System
Drawer

Second System
Drawer

Front

PK-0602A-96

Minimum Configuration

The minimum configuration tested consisted of the system cabinet, two drawers, two shelves, one DWZZB, one KZPSA, one KZPDA, one DE500, one monitor, and cables.

The first shelf was is set up in split bus mode. System disks (nonshared) were inserted into appropriate slots. KZPDAs were connected to this shelf. The second shelf was connected to the KZPSAs via the DWZZB. See the *KZPSA SCSI Storage Adapter User's Guide* (EK-KSPSA-UG) Appendix B for further details.

Maximum Configuration

The maximum configuration tested consisted of the system cabinet, SW500, 14 storage shelves, two controller shelves, four KZPSAs, one KZPDA, one DE500, one DEFPA, four HSZ50s, one monitor, and cables.

The System Cabinet contains six storage shelves and two system drawers.

The SW500 holds two controller shelves and eight storage shelves. All shelves are configured without a split bus. One shelf per system is dedicated to system disks. Attach this shelf to the KZPDA.

Shared shelves are attached to a KZPSA via a DWZZB and through a trilink connector (H885-AA).

Attach each HSZ50 to a KZPSA. Shelves in the SW500 are then attached via the HSZ50.

For each controller shelf where dual redundant mode is desired, install two HSZ50 controllers, a trilink connector (H885-AA) on the host port of each, and a jumper cable (BN-21L-OB).

See the *KZPSA SCSI Storage Adapter User's Guide* (EK-KSPSA-UG) Appendix B, and page 17 of HSZ50 Array Controllers HSOF Version 5.0 (EK-HSZ50-CG.B01) , for more information.

PCI Motherboard

The following information describes the minimum and maximum hardware configuration for the PCI motherboard.

Compare the slots in the illustration at left to the slots listed in the following tables.

Figure A-2: PCI Motherboard
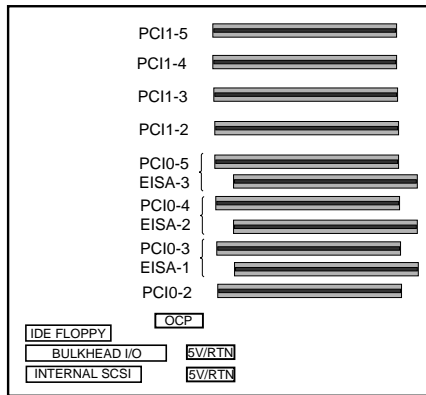
PK-0615-96

Table A-1: Minimum Configuration for PCI Motherboard

PCI slot	Part Number	Description
PCI1-5	KZPSA-BB	PCI FWSE SCSI Controller
PCI1-4	open	
PCI1-3	KZPDA-AA	PCI to SCSI adapter
PCI1-2	DE500-AA	Fast Ethernet adapter
PCI0-5	open	
EISA-3	open	
PCI0-4	open	
EISA-2	open	
PCI0-3	open	
EISA-1	open	
PCI0-2	PB2GA-JB	PCI-based S3 Trio Video card

Table A-2: Maximum Configuration for PCI Motherboard

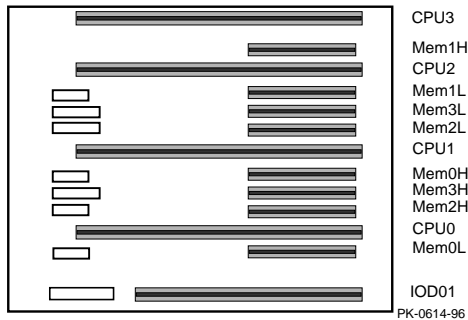| PCI slot	Part Number	Description
PCI1-5	KZPSA-BB	PCI FWSE SCSI Controller
PCI1-4	KZPSA-BB	PCI FWSE SCSI Controller
PCI1-3	KZPDA-AA	PCI to SCSI adapter
PCI1-2	DE500-AA	Fast Ethernet Adapter
PCI0-5	KZPSA-BB	PCI FWSE SCSI Controller
EISA-3	open	
PCI0-4	KZPSA-BB	PCI FWSE SCSI Controller
EISA-2	open	
PCI0-3	DEFPA-AB	FDDI adapter

EISA-1	open	
PCI0-2	PB2GA-JB	PCI-based S3 Trio Video card

System Motherboard

The following information describes the minimum and maximum hardware configuration for the AlphaServer 4100 system motherboard. The configuration is similar for the AlphaServer 4000.

Compare the slots in the illustration at left to the slots listed in the following tables.

Figure A-3: System Motherboard


```
                                    CPU3
                                    Mem1H
                                    CPU2
                                    Mem1L
                                    Mem3L
                                    Mem2L
                                    CPU1
                                    Mem0H
                                    Mem3H
                                    Mem2H
                                    CPU0
                                    Mem0L

                                    IOD01
                                    PK-0614-96
```

Table A-3: Minimum Configuration for System Motherboard

Slot	Part Number	Description
CPU3	open	
Mem1H	open	
CPU2	open	
Mem1L	open	
Mem3L	open	
Mem2L	open	
CPU1	open	
Mem0H	MS320-CA	board 2 of 2
Mem3H	open	
Mem2H	open	
CPU0	KN304-BC	400 MHz CPU 4 MB cache
Mem0L	MS320-CA	board 1 of 2
IOD01		

Table A-4: Maximum Configuration for System Motherboard

Slot	Part Number	Description
CPU3	open	
Mem1H	MS330-FA	board 2 of 2
CPU2	open	
Mem1L	MS330-FA	board 1 of 2
Mem3L	open	
Mem2L	open	

CPU1	KN304-BC	400 MHz CPU 4 MB cache
Mem0H	MS330-FA	board 2 of 2
Mem3H	open	
Mem2H	open	
CPU0	KN304-BC	400 MHz CPU 4 MB cache
Mem0L	MS330-FA	board 1 of 2
IOD01		