DEC 10000 AXP System
VAX 10000
Operations Manual

Order Number EK–1000B–OP.002

This manual is intended for the system manager or system operator and covers the basic operations of a DEC 10000 or VAX 10000 system.

digital equipment corporation
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Preface

Intended Audience

This manual is written for the system manager or system operator who has training in systems management and is running a DEC 10000 AXP system or a VAX 10000 system.

Document Structure

This manual uses a structured documentation design. Topics are organized into small sections for efficient on- line and printed reference. Each topic begins with an abstract. You can quickly gain a comprehensive overview by reading only the abstracts. Next is an illustration or example, which also provides quick reference. Last in the structure are descriptive text and syntax definitions.

This manual has four chapters and three appendixes, as follows:

- **Chapter 1, DEC 10000 and VAX 10000 Systems,** and **Chapter 2, System Components,** give a basic introduction to your system and its parts.
- **Chapter 3, Controls and Indicators,** describes how the system presents information and how you use the switches.
- **Chapter 4, Booting,** explains how you turn on the system and get it running.
- **Appendix A, Console Commands,** lists the console commands with a brief explanation of each command.
- **Appendix B, Boot Options,** lists the options used with the boot command to control various phases of booting.
- **Appendix C, Updating Firmware,** explains how to run the Loadable Firmware Update (LFU) Utility.
- A **Glossary** and **Index** provide additional reference support**.**

Conventions Used in This Document

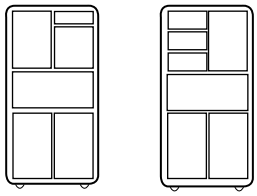
Terminology. Unless specified otherwise, the use of "system" refers to either a DEC 10000 AXP or VAX 10000 system. The DEC 10000 AXP systems use the Alpha AXP architecture. References in text use DEC 10000 to refer to DEC 10000 AXP systems.

When a discussion applies to only one system, an icon is used to highlight that system. Otherwise, the discussion applies to both systems. Thus, the abstract for a module that applies only to DEC 10000 systems would look like this:

DEC 10000 **This section shows a sample boot of OpenVMS Alpha AXP from the RRD42 CD drive for DEC 10000 systems. The first step is issuing the show device command to determine the location of the RRD42.**

Book titles. In text, if a book is cited without a product name, that book is part of the hardware documentation. It is listed in Table 1 along with its order number.

Icons. Icons such as those shown below are used in illustrations for designating part placement in the system described. A shaded area in the icon shows the location of the component or part being discussed.



Documentation Titles

Table 1 lists the books in the DEC 10000 and VAX 10000 documentation set. Table 2 lists other documents that you may find useful.

Table 1 DEC 10000/VAX 10000 Documentation

Title	Order Number
Installation Kit	EK–1000B–DK
Site Preparation Guide	EK–1000B–SP
Installation Guide	EK–100EB–IN
Hardware User Information Kit	EK–1001B–DK
Operations Manual	EK–1000B–OP
Basic Troubleshooting	EK–1000B–TS
Service Information Kit—VAX 10000	EK–1002A–DK
Platform Service Manual	EK–1000A–SV
System Service Manual	EK–1002A–SV
Pocket Service Guide	EK–1000A–PG
Advanced Troubleshooting	EK–1001A–TS
Service Information Kit—DEC 10000	EK–1002B–DK
Platform Service Manual	EK–1000A–SV
System Service Manual	EK–1002A–SV
Pocket Service Guide	EK–1100A–PG
Advanced Troubleshooting	EK–1101A–TS

Table 1 DEC 10000/VAX 10000 Documentation (Continued)

Title	Order Number
Reference Manuals	
Console Reference Manual	EK–70C0B–TM
KA7AA CPU Technical Manual	EK–KA7AA–TM
KN7AA CPU Technical Manual	EK–KN7AA–TM
MS7AA Memory Technical Manual	EK–MS7AA–TM
I/O System Technical Manual	EK–70I0A–TM
Platform Technical Manual	EK–7000A–TM
Upgrade Manuals	
KA7AA CPU Installation Guide	EK–KA7AA–IN
KN7AA CPU Installation Guide	EK–KN7AA–IN
MS7AA Memory Installation Guide	EK–MS7AA–IN
KZMSA Adapter Installation Guide	EK–KXMSX–IN
DWLMA XMI PIU Installation Guide	EK–DWLMA–IN
DWMBB VAXBI PIU Installation Guide	EK–DWMBB–IN
H7237 Battery PIU Installation Guide	EK–H7237–IN
H7263 Power Regulator Installation Guide	EK–H7263–IN
BA654 DSSI Disk PIU Installation Guide	EK–BA654–IN
BA655 SCSI Disk and Tape PIU Installation Guide	EK–BA655–IN
Removable Media Installation Guide	EK–TFRRD–IN

Table 2 Related Documents

Title	Order Number
General Site Preparation	
Site Environmental Preparation Guide	EK–CSEPG–MA
System I/O Options	
BA350 Modular Storage Shelf Subsystem Configuration Guide	EK–BA350–CG
BA350 Modular Storage Shelf Subsystem User's Guide	EK–BA350–UG
BA350-LA Modular Storage Shelf User's Guide	EK–350LA–UG
CIXCD Interface User Guide	EK–CIXCD–UG
DEC FDDIcontroller 400 Installation/Problem Solving	EK–DEMFA–IP
DEC LANcontroller 400 Installation Guide	EK–DEMNA–IN
DEC LANcontroller 400 Technical Manual	EK–DEMNA–TM
DSSI VAXcluster Installation and Troubleshooting Manual	EK–410AA–MG
InfoServer 150 Installation and Owner's Guide	EK–INFSV–OM
KDM70 Controller User Guide	EK–KDM70–UG
KFMSA Module Installation and User Manual	EK–KFMSA–IM
KFMSA Module Service Guide	EK–KFMSA–SV
RRD42 Disc Drive Owner's Manual	EK–RRD42–OM
RF Series Integrated Storage Element User Guide	EK–RF72D–UG
TF85 Cartridge Tape Subsystem Owner's Manual	EK–OTF85–OM
TLZ06 Cassette Tape Drive Owner's Manual	EK–TLZ06–OM

Table 2 Related Documents (Continued)

Title	Order Number
Operating System Manuals	
Alpha Architecture Reference Manual	EY–L520E–DP
DEC OSF/1 Guide to System Administration	AA–PJU7A–TE
DECnet for OpenVMS Network Management Utilities	AA–PQYAA–TK
Guide to Installing DEC OSF/1	AA–PS2DA–TE
OpenVMS Alpha Version 1.0 Upgrade and Installation Manual	AA–PQYSA–TE
VMS Upgrade and Installation Supplement: VAX 7000–600 and VAX 10000–600 Series	AA–PRAHA–TE
VMS Network Control Program Manual	AA–LA50A–TE
VMSclusters and Networking	
HSC Installation Manual	EK–HSCMN–IN
SC008 Star Coupler User's Guide	EK–SC008–UG
VAX Volume Shadowing Manual	AA–PBTVA–TE
Peripherals	
Installing and Using the VT420 Video Terminal	EK–VT420–UG
LA75 Companion Printer Installation and User Guide	EK–LA75X–UG

Chapter 1

DEC 10000 and VAX 10000 Systems

DEC 10000 and VAX 10000 systems are designed for growth offering configuration flexibility, an outstanding I/O subsystem, and expansion capability in a multicabinet environment. The system can support many users in a time- sharing environment. These systems do the following:

- Support the full range of system applications of OpenVMS Alpha AXP or OSF/1 for DEC 10000 systems and OpenVMS VAX for VAX 10000 systems
- Allow for expansion of processors, memory, and I/O
- Use a high- speed system interconnect bus (LSB bus) which has an effective bandwidth of 640 Mbytes/sec.
- Support up to 14 Gbytes of physical memory
- Provide self- contained uninterruptible power system (UPS) capability that supports the system in case of power failure
- Perform automatic self- test on power- up, reset, reboot, or system initialization
- Operate as a standalone system, a member of a cluster, or as a boot node of a local area cluster

The chapter describes the system package and introduces the location of components in the cabinets—both front and rear views. Sections include:

- System Characteristics
- System Architecture
- Sample System
- System Front View
- System Rear View

1.1 System Characteristics

DEC 10000 and VAX 10000 systems share characteristics as shown in the tables. Figure 1-1 shows a system footprint.

Figure 1-1 Sample System Footprint

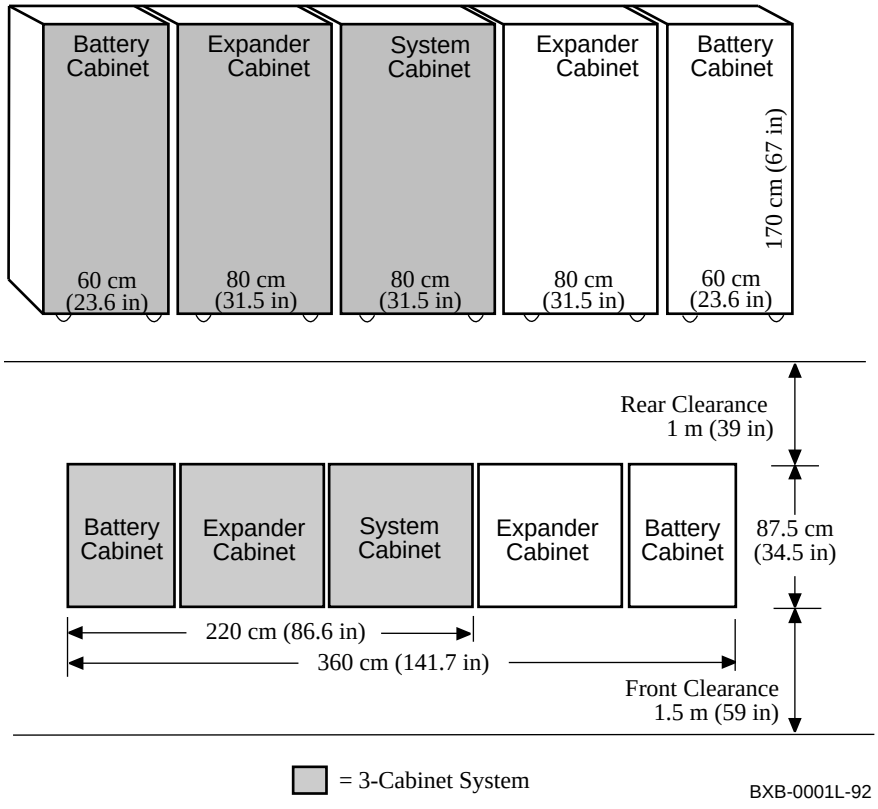


Table 1- 1 summarizes characteristics of both the 3- cabinet and 5- cabinet versions of the systems. The values are configuration dependent.

Table 1- 1 Electrical Characteristics

Electrical	Specification
3- phase AC input voltage	202 V RMS 120/208 V RMS 380–415 V RMS
Nominal frequency	50–60 Hz
AC current, nominal, (per phase)	24 A (202 V) 24 A (120/208 V) 12.8 A (380–415 V)
Maximum current (per phase)	30 A (202 V) 30 A (120/208 V) 16 A (380–415 V)
AC power consumption (maximum)	6,600 watts (3- cabinet) 10,900 watts (5- cabinet)

Table 1- 2 Environmental Characteristics

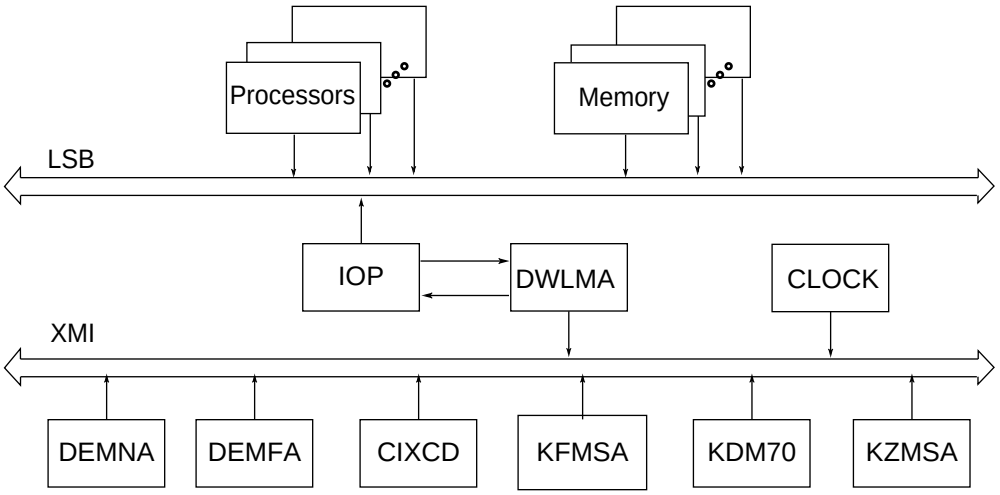
Environmental	Operating	Storage
Maximum heat dissipation	22,500 Btu/hr (3- cabinet) 37,200 Btu/hr (5- cabinet)	– –
Temperature[1]	15°–28° C (59°–82° F)	- 40°–66° C (- 40°–151° F)
Relative humidity[1]	20–80%	10–95%
Altitude	0–2.4 km (0–8000 ft)	0–9.1 km (0–30,000 ft)

[1]Recommended operating temperature is 18°–24° C (65°–75° F) and 40–60% relative humidity.

1.2 System Architecture

The high-speed LSB bus is used to interconnect processors, memory modules, and the IOP module.

Figure 1-2 Sample System Architecture



The LSB bus is a synchronous 128- bit system bus that interconnects the processors, memory modules, and the I/O port (IOP) module. The IOP module connects the LSB bus to I/O buses through separate I/O adapter modules.

The LSB bus uses the concept of a **node.** The LSB bus has three types of nodes: processors, memories, and an I/O port controller.

A **processor node** is a single- module scalar processor. It consists of a CPU chip, the LSB bus interface, cache, and support logic. DEC 10000 systems use the KN7AA- AB processor, and VAX 10000 systems use the KA7AA processor.

In a multiprocessing system, one processor becomes the boot processor during power- up, and that boot processor loads the operating system and handles communication with the operator console. The other processors become secondary processors and receive system information from the boot processor.

A **memory node** is one memory module. Memory is a global resource equally accessible by all processors on the LSB. Memory modules can have 64, 128, 256, or 512 Mbytes of memory with ECC and associated control logic. The memories are automatically interleaved when the system is configured with multiple memory banks. The system supports up to seven memory modules.

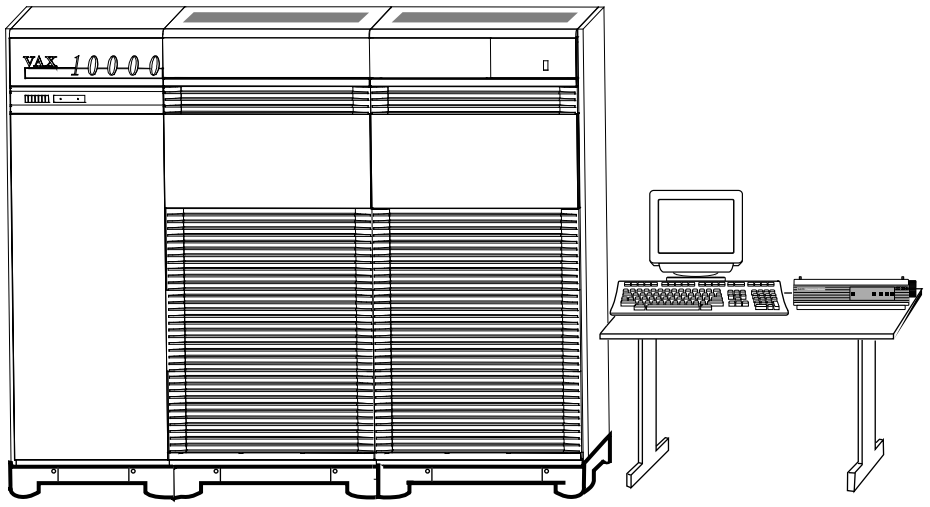
The **I/O port controller** is the IOP module, which serves as the interface between the LSB bus and up to four I/O buses. In Figure 1- 2 the DWLMA module is the I/O bus adapter module that connects the XMI I/O channel to the IOP module.

The XMI I/O channel also has I/O bus adapter modules that connect to various interconnects (such as CI, DSSI (for VAX 10000 systems only), SDI/STI, SCSI (for DEC 10000 systems only), FDDI, and Ethernet.

1.3 Sample System

Figure 1- 3 shows a sample 3- cabinet system. The system includes a console terminal and printer, an accessories kit, and a documentation set, which includes this manual. Three- cabinet systems consist of a system cabinet, an expander cabinet, and a battery cabinet. Five- cabinet systems consist of a system cabinet, two expander cabinets, and two battery cabinets.

Figure 1- 3 Sample System (3- Cabinet)



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Your Digital customer service engineer has installed your system and verified that it is running properly. Before you turn on the system, familiarize yourself with its components:

- The **system cabinet** houses the LSB card cage, a power system including battery PIUs, a cooling system, and the control panel with status indicators. Optional hardware includes an in- cabinet tape drive and disk drives.
- The **expander cabinet** provides space for I/O devices and houses the XMI I/O bulkheads, a power system, a cooling system, and optional disk PIUs. There is one expander cabinet in a 3- cabinet system and two in a 5- cabinet system.
- The **battery cabinet** houses battery PIUs. There is one battery cabinet in a 3- cabinet system and two in a 5- cabinet system.
- The **console load device** is used for installing operating systems and software.
- The **console terminal** is used for booting and for system management operations. A VAXstation 4000 Model 60 System Management Workstation is optional.

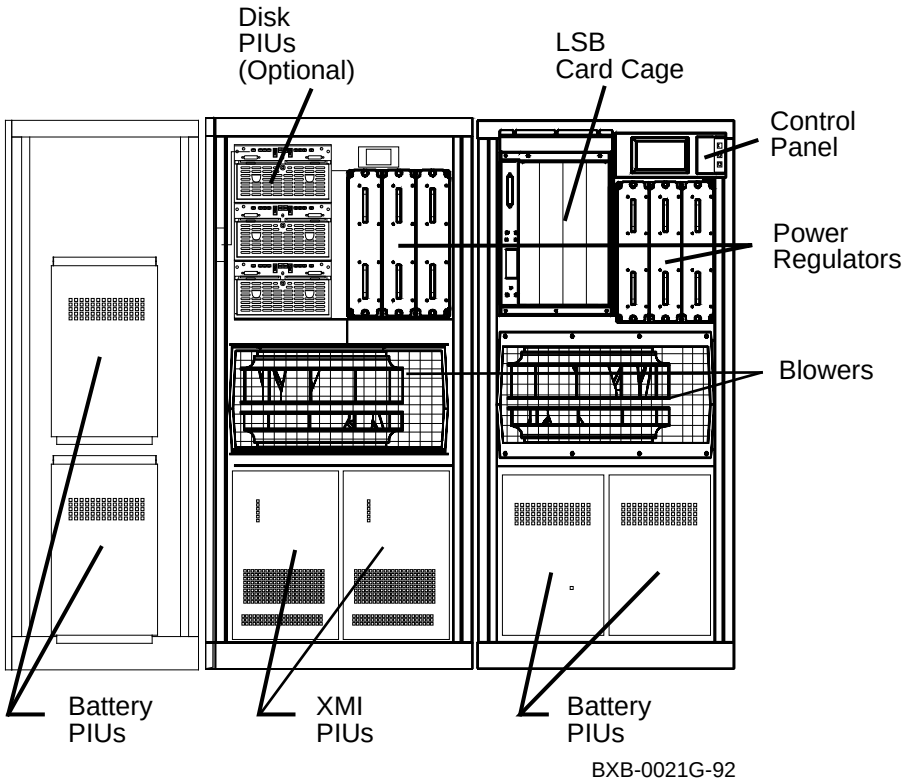
NOTE: The console terminal is not to be used as the primary user interface for text editing.

- The **console printer** provides a hardcopy record of system operations.
- A **system documentation kit**

1.4 System Front View

The control panel, plug- in unit panels, and optional in- cabinet tape drive are on the front of the system cabinet. With the front door open, Digital customer service engineers can access the LSB card cage, power regulators, cooling system, and optional plug- in units.

Figure 1- 4 System Front View (3- Cabinet)



These components are visible from the inside front of the cabinet (see Figure 1- 4 for their location):

- Control panel
- Power regulators (48 VDC)
- LSB card cage (holds CPU/memory; slots 0–3)
- XMI plug- in units (PIUs)
- Battery PIUs
- Cooling system (blowers)

Optional components visible from the inside front include:

- In- cabinet I/O devices

  DEC 10000 RRD42 compact disk drive

  VAX 10000 TF85 in- cabinet tape drive

- I/O plug- in unit (PIU)

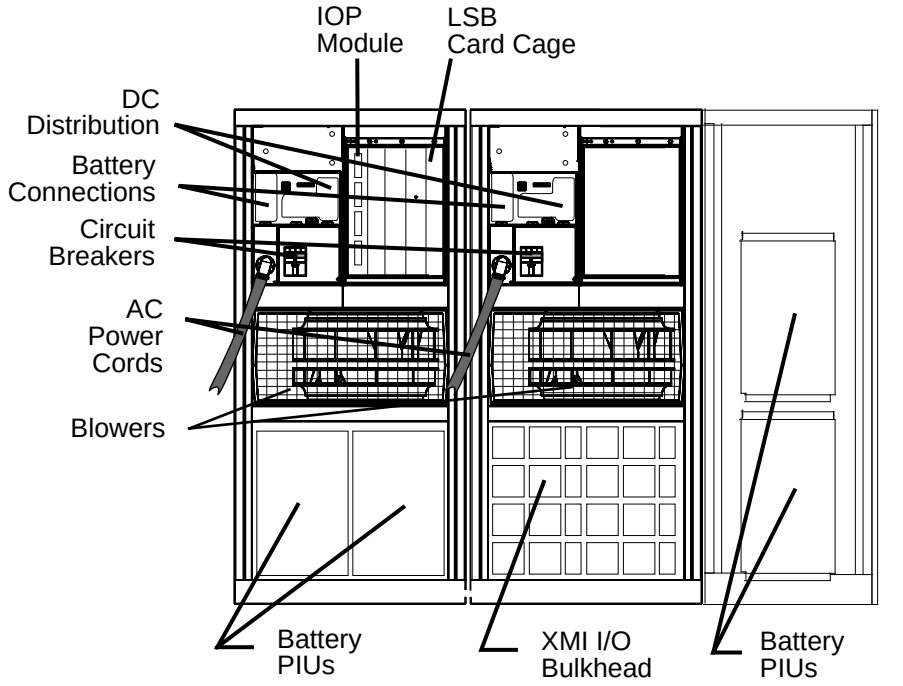
  DEC 10000 Small Computer System Interface (SCSI) disk and tape PIU

  VAX 10000 Digital Storage Systems Interconnect (DSSI) disk PIU

1.5 System Rear View

With the rear door open, Digital customer service engineers can access the LSB card cage, DC distribution box, battery connections, AC power cords, circuit breakers, blowers, XMI I/O bulkheads, and battery PIUs.

Figure 1- 5 System Rear View (3- Cabinet)



The following components are visible from the rear of the cabinet (see Figure 1- 5):

- LSB card cage (slots 4–8)
- IOP module (slot 8)
- DC distribution boxes
- Battery PIU connections
- AC power cords and connectors
- Circuit breakers
- Blowers
- I/O bulkhead
- Battery PIUs

Optional components visible from the inside rear include:

- I/O bulkhead

SCSI PIU

DSSI PIU

Chapter 2

System Components

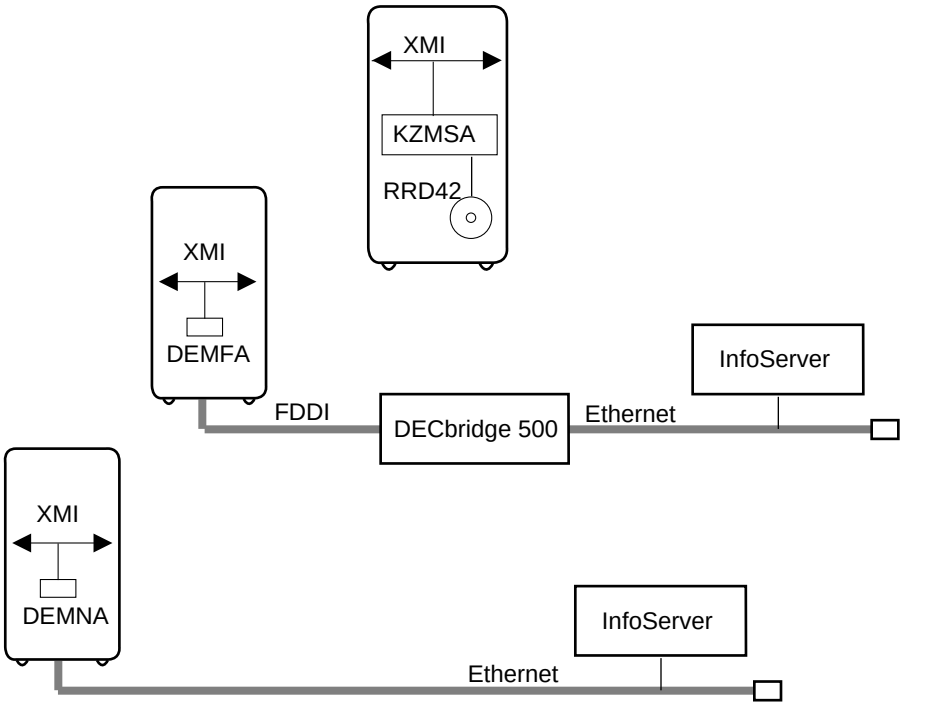
This chapter describes system components, their locations, and functions. Sections include:

- Console Load Devices
- In- Cabinet Tape Drives
- Power System
- LSB Card Cage
- Control/Status and I/O Connections
- Cooling System
- System Options

2.1 Console Load Devices

The RRD42 compact disk (CD) drive is the in- cabinet console load device for DEC 10000 systems. The InfoServer is the console load device for VAX 10000 systems. During system installation the console load device is used to boot standalone backup. It is also used to boot the Loadable Firmware Update (LFU) Utility.

Figure 2- 1 Accessing the Console Load Device



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The console load device is used for:

- Installing or updating software
- Loading the standalone backup program
- Interchanging user data
- Updating module firmware

DEC 10000

The RRD42 compact disk (CD) drive is the console load device for DEC 10000 systems. It is installed in the system cabinet and used to access software and on- line documentation. The KZMSA adapter is installed in the XMI card cage and provides access to the RRD42.

VAX 10000

The InfoServer is the console load device for VAX 10000 systems. It is an Ethernet- based compact disk (CD) drive, which is part of a local area network. The InfoServer is used to access CD- ROMs for software installation and for on- line documentation on VAX 10000 systems.

The DEMNA and DEMFA adapters are interfaces that allow access to the InfoServer. These adapters are modules installed in the XMI card cage. A bulkhead connector, which connects to the Ethernet, mounts on the rear of the XMI PIU bulkhead panel. Figure 2- 1 shows how the DEMFA provides access to the FDDI (Fiber Distributed Data Interface) network, which requires a DECbridge 500 for connection to the Ethernet. Section 4.6.2 describes how to boot OpenVMS VAX over the Ethernet using the InfoServer.

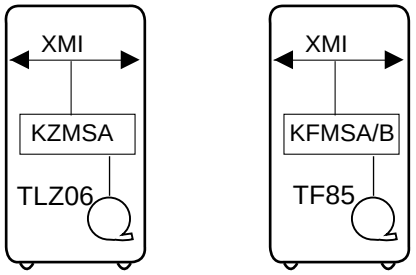
For more information:

RRD42 Disc Drive Owner's Manual
InfoServer 150 Installation and Owner's Guide

2.2 In- Cabinet Tape Drives

The TLZ06 tape drive is mounted in the SCSI PIU for use in DEC 10000 systems. The TF85 tape drive is located in the front of the system cabinet in the upper right corner for use in VAX 10000 systems. User applications can use the tape drive as an I/O device.

Figure 2- 2 Accessing the In- Cabinet Tape Drive



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Tape drives are used as backup storage devices.

The TLZ06 (a SCSI device) is connected to the DEC 10000 system through the KZMSA adapter in the XMI card cage.

The TF85 (a DSSI device) is connected to the VAX 10000 system through the KFMSA- BA adapter in the XMI card cage.

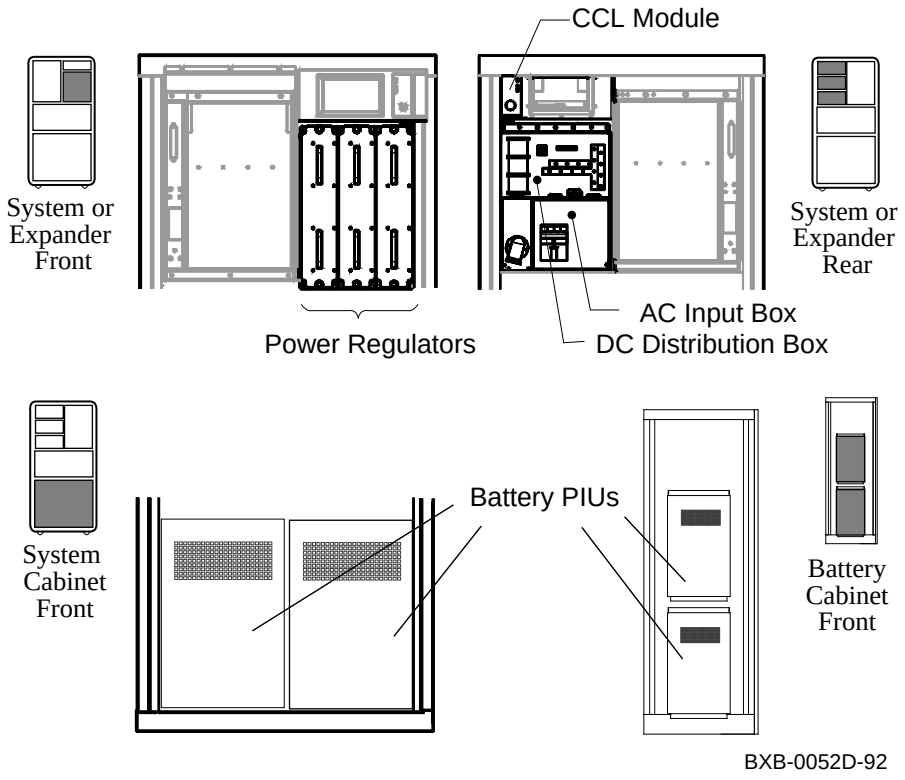
For more information:

TLZ06 Cassette Tape Drive Owner's Manual
TF85 Cartridge Tape Subsystem Owner's Manual

2.3 Power System

The power system includes AC input boxes, DC distribution boxes, power regulators, cabinet control logic modules, battery PIUs, power distribution cables, and signal interconnect cables.

Figure 2- 3 Power System



Each DC distribution box and AC input box is located on the upper left of a system or expander cabinet (when viewing the cabinet from the rear). The 48 VDC power regulators are located at the upper right side (when viewing the system cabinet from the front).

System and expander cabinet AC input boxes provide the interface for the system to the AC utility power. The input circuit breaker on the AC input box, contains a circuit breaker trip indicator to indicate an open circuit breaker. The DC distribution box connects the AC input box and power regulators. It distributes the 48 VDC power within a cabinet.

The system has three power regulators in each system cabinet and three in each expander cabinet. These regulators are used in parallel, two for the required load plus an additional regulator for backup in case of failure.

The cabinet control logic (CCL) module in a system cabinet or an expander cabinet contains a power LED. When this LED is on, the power regulators in the cabinet are receiving 48 VDC power from the DC distribution box.

Uninterruptible power system (UPS) capability is provided by battery PIUs in the event of a power failure. The battery PIUs are mounted in the bottom of the system cabinet and in the battery cabinet(s) and provide about 60 minutes of full system operating time.

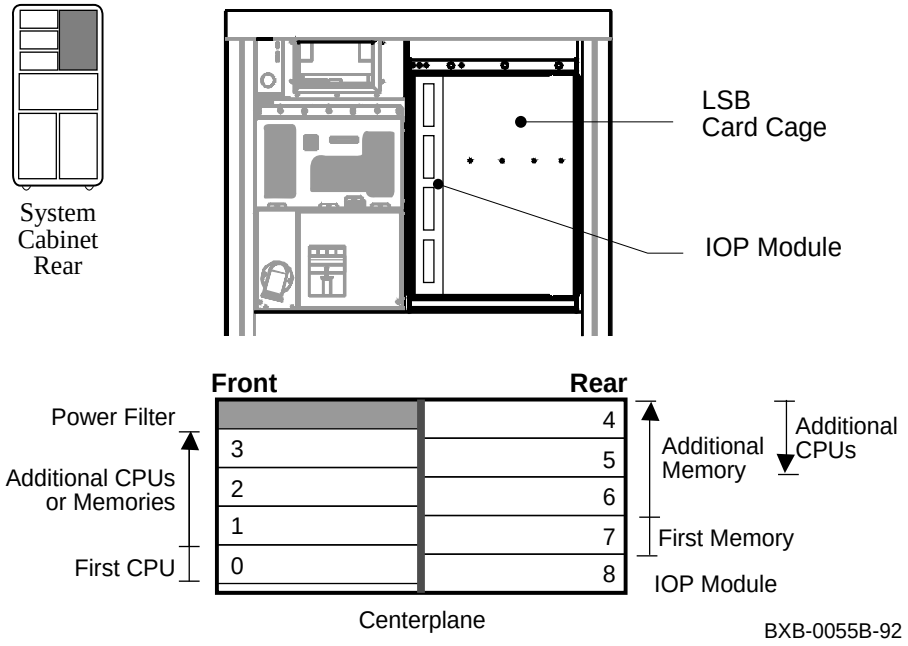
For more information:

Basic Troubleshooting

2.4 LSB Card Cage

The LSB card cage is a 9- slot card cage that contains slots for up to six CPU modules, up to seven memory array modules, and one IOP module. The LSB bus interconnects the CPU, memory, and IOP modules.

Figure 2- 4 LSB Card Cage



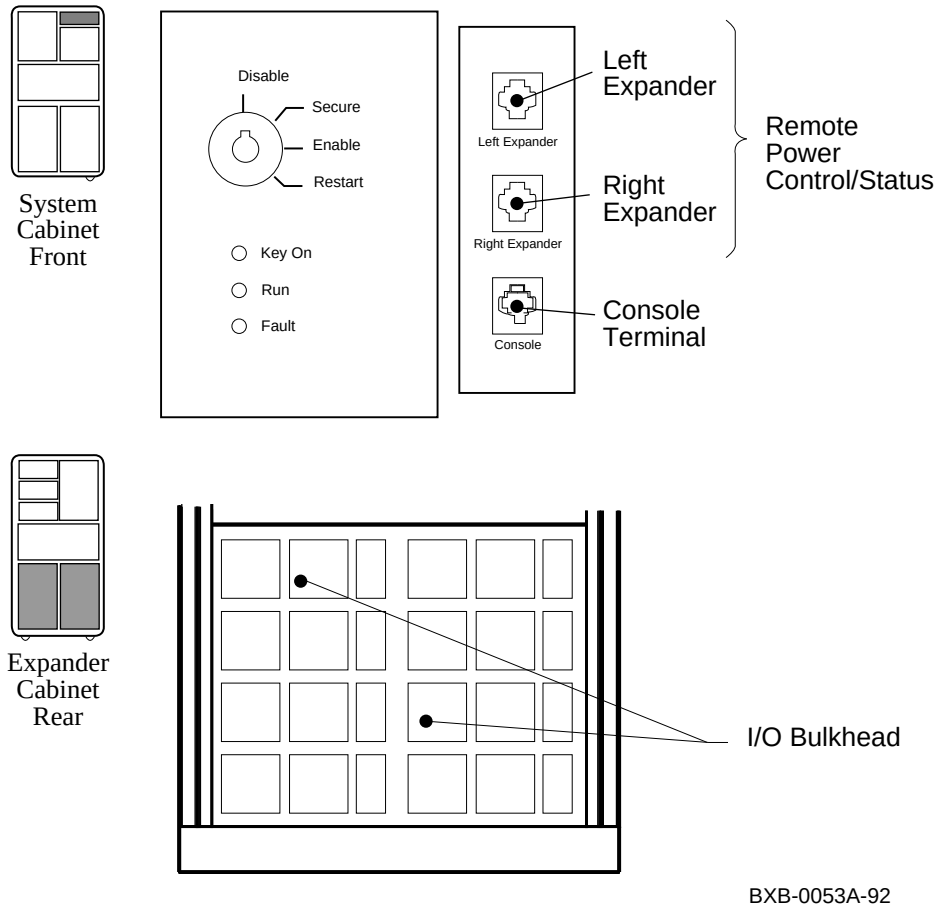
The 9- slot LSB card cage is located in the upper left (front and rear) of the system cabinet, as viewed from the front. The LSB card cage must contain one IOP module, which is always installed in slot 8. The other eight slots contain a combination of memory and CPU modules. Unused slots contain filler modules, which manage the airflow through the cabinet.

The LSB card cage slots are numbered 0 through 3 from right to left in the front of the cabinet and slots 4 through 8 right to left in the rear of the cabinet.

2.5 Control/Status and I/O Connections

Console terminal I/O and expander cabinet remote power control/status connections are located to the right of the control panel. Ethernet and other I/O connections are located on the I/O bulkhead in the lower rear of the cabinet.

Figure 2- 5 Control/Status and I/O Connections



Console terminal I/O and expander cabinet remote power control/status connections are located to the right of the control panel. These three modular jacks allow power control/status connections to the left expander cabinet, right expander cabinet (if present), and I/O connections to the console terminal. The console terminal modified modular jack is keyed so that an expander cabinet connector cannot be plugged into its jack.

An expander cabinet has four quadrants in the bottom of the cabinet. The XMI PIU can be installed in two quadrants and the other two quadrants are used for expansion bays. These expansion bays can contain another XMI PIU, a SCSI PIU (for DEC 10000 systems), or a DSSI PIU (for VAX 10000 systems). The number of expansion bays used by each PIU varies depending on the type of PIU. An expander cabinet can also have two PIUs in the top of the cabinet.

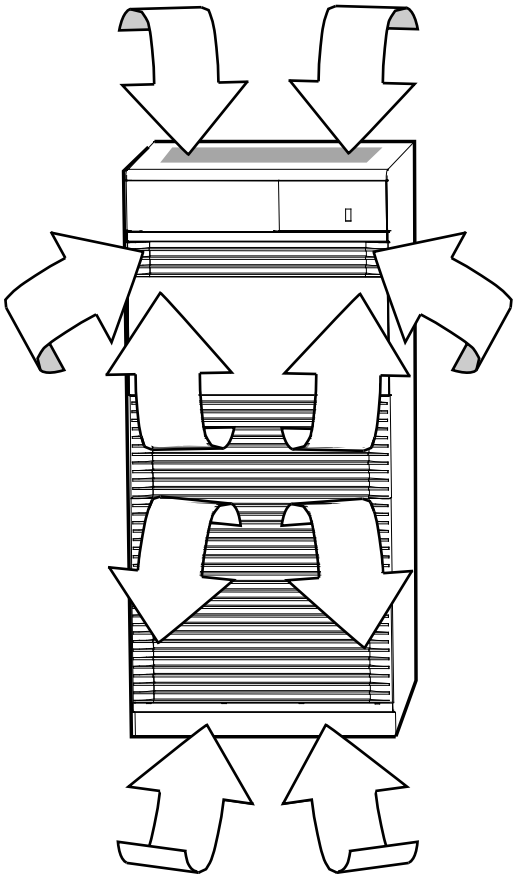
A PIU contains an I/O bulkhead, which houses the I/O connections for the devices in the PIU (such as adapter modules and disk drives). These I/O connections are located on a panel that is installed on the I/O bulkhead. The I/O bulkhead can have single, dual, quad, and octal panels.

The XMI PIU occupies two expansion bays and is designed to accommodate a variety of I/O connectors (depending on the adapter used). The standard Ethernet port is a 15- pin connector that is installed in a single panel. The connector contains a red LED that is on when 13.5 VDC power is applied to the Ethernet transceiver.

2.6 Cooling System

In each system cabinet and expander cabinet, the cooling system cools the power system, the LSB card cage, control logic, and PIUs.

Figure 2- 6 Airflow



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The cooling system is designed to keep system components at an optimal operating temperature. It is important to keep the front and rear doors free of obstructions, leaving a minimum clear space of 1.5 meters (59 inches) in the front and 1 meter (39 inches) in the rear between cabinets to maximize airflow (see Figure 1- 1).

The blower, located in the center of the cabinet, draws air downward through the power regulators and LSB card cage. It draws air upward through the PIUs. Filler modules, located in the LSB card cage, help to direct airflow. Air is exhausted at the middle of the cabinet front and rear. The blower speed varies based on the system's ambient temperature.

The cooling system has safety detectors: static air pressure sensors and a temperature sensor. The static air pressure sensors measure the air pressure across the LSB card cage. If air pressure drops below a certain level across these units, DC power is disabled. The temperature sensor measures the ambient air temperature of the system. If the temperature sensor is tripped, the system could shut down. If either condition occurs, call your Digital customer service engineer.

CAUTION: Anything placed on top of the cabinet could restrict airflow. This will cause the system to power down.

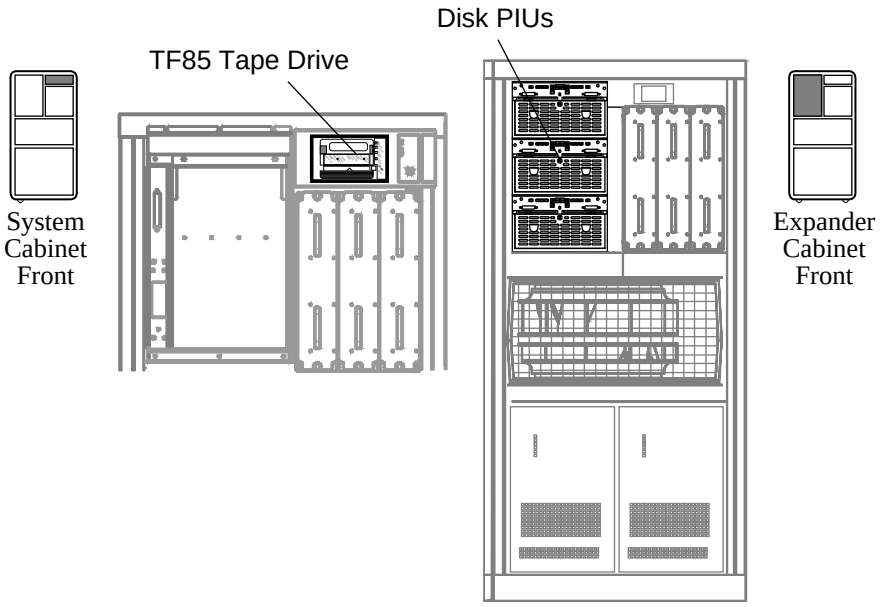
For more information:

Basic Troubleshooting

2.7 System Options

System options include SCSI PIUs (DEC 10000), DSSI PIUs (VAX 10000), and an in- cabinet tape drive.

Figure 2- 7 System Options



SCSI PIU

Up to two SCSI PIUs can be installed in a DEC 10000 expander cabinet (along with the XMI PIU). A SCSI PIU can have two shelves. Each shelf holds up to seven SCSI disks or tapes: RZ26, RZ73, and TLZ06.

DSSI PIU

Up to two DSSI PIUs can be installed in a VAX 10000 expander cabinet (along with the XMI PIU). A DSSI PIU contains up to three storage array building blocks (SABB). Each SABB can contain two RF73 disks.

In- Cabinet Tape Drive

A TLZ06 tape drive can be installed in the SCSI PIU in the DEC 10000 system cabinet A TF85 tape drive can be installed in the VAX 10000 system cabinet. The tape drive can be used as a backup storage device or as an I/O device for user applications.

Chapter 3

Controls and Indicators

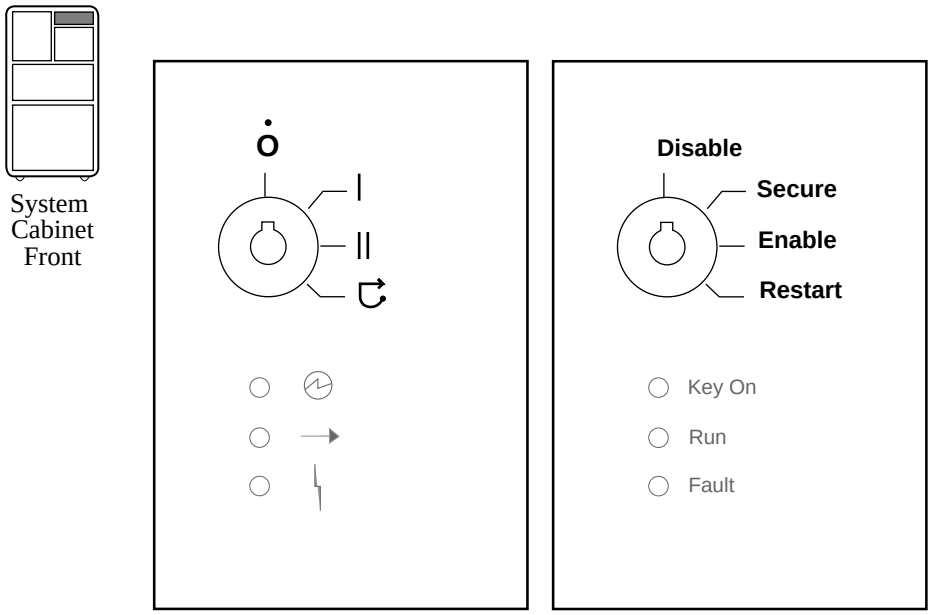
This chapter introduces the system controls and indicators. Sections include:

- Control Panel Keyswitch
- Control Panel Indicator Lights
- Circuit Breakers and AC Power Indicators

3.1 Control Panel Keyswitch

The system control panel, located in the upper right front of the system cabinet, contains a keyswitch and status lights. The keyswitch regulates power going into the system, determines the use of the console terminal, and controls system operation. The four switch positions are Disable, Secure, Enable, and Restart. See Figure 3- 1.

Figure 3- 1 Control Panel Keyswitch



The keyswitch labels can be in English or international versions as shown in Figure 3- 1.

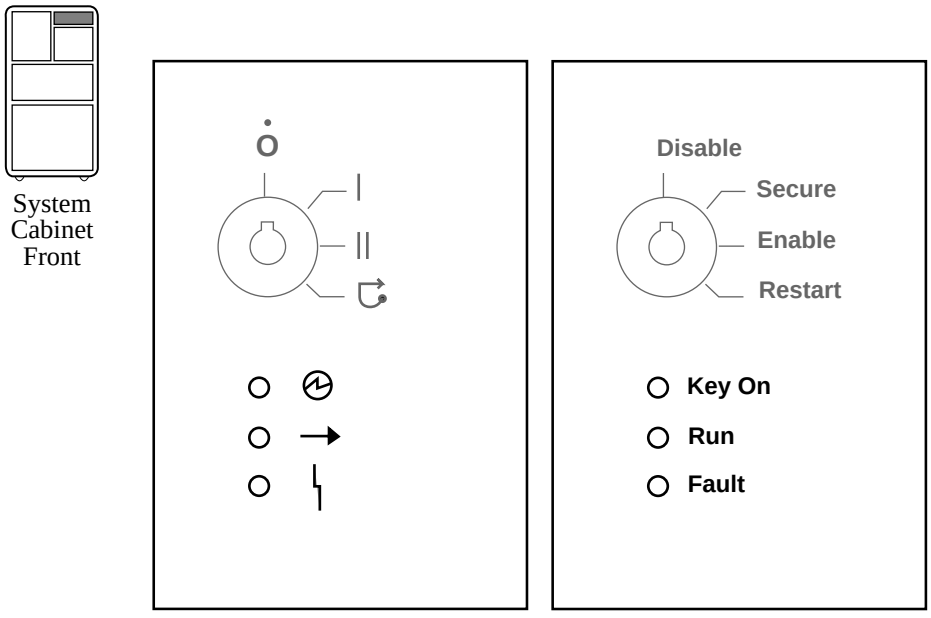
Table 3- 1 Keyswitch Positions

Position	Effect
Disable	Removes 48 VDC power from the system. Power is still supplied to the CCL module.
Secure	Prevents entry into console mode; position used while machine executes programs.
Enable	Allows entry into console mode; position used while machine executes programs.
Restart	A momentary switch position, used to reinitialize the system; causes self- test to start running.

3.2 Control Panel Indicator Lights

The control panel has three status indicator lights: Key On, Run, and Fault. These lights indicate the operating status of the system.

Figure 3- 2 Control Panel Indicator Lights



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Three status indicator lights (see Figure 3- 2) show the state of the system: (Key On) DC power supplied, (Run) execution, and (Fault) errors. Table 3- 2 describes the conditions indicated by the lights.

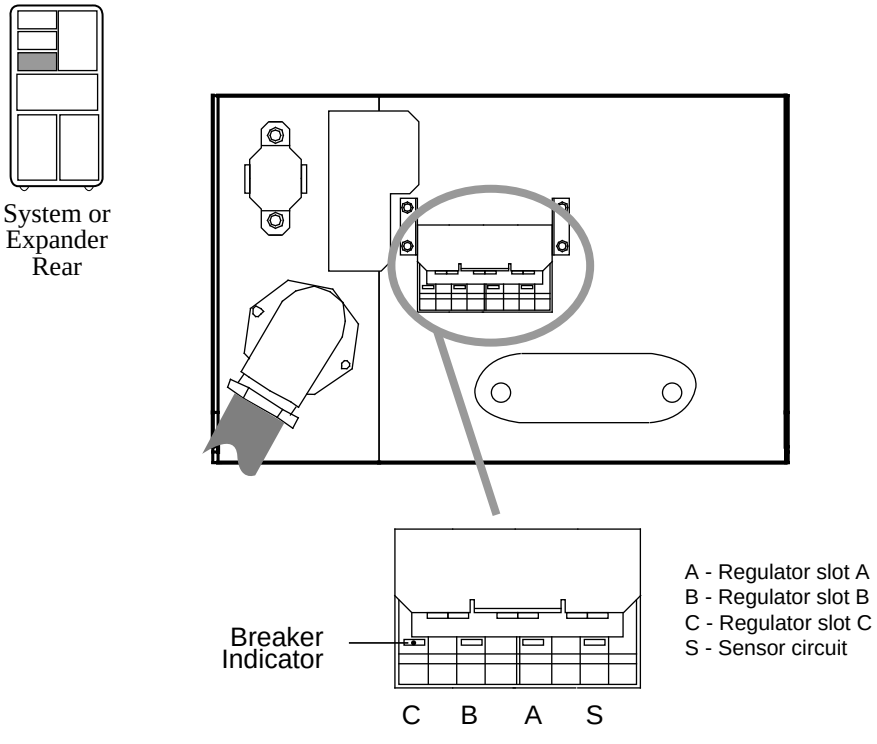
Table 3- 2 Control Panel Indicator Lights

Light	Color	State	Meaning
Key On	Green	On	Power is supplied to entire system; the blower is running.
		Off	Power is supplied only to the cabinet control logic module.
Run	Green	On	System is executing operating programs or certain power- up tests. Ctrl/P halts the execution of operating system programs.
		Off	System is in console mode, operating system is not running, or the system is turned off.
Fault	Yellow	On	Fault on LSB, XMI bus, or an I/O bus.
		Slow Flash	Power sequencing is in progress or airflow error is detected.
		Fast Flash	Power system error, airflow error, or keyswitch in Disable position transition detected.
		Off	No faults were found.

3.3 Circuit Breakers and AC Power Indicators

Circuit breakers are located on the left side of the rear of the system and expander cabinets, just above the blower assembly. Circuit breakers can be secured in the off position with a lock.

Figure 3- 3 Circuit Breaker and AC Power Indicators



Circuit breakers and power indicators are at the rear of the system and expander cabinets.

Circuit Breakers

A circuit breaker controls power to its associated cabinet, including its power regulators, blower, battery PIUs, and in- cabinet options. Current overload causes the breaker to trip to the off position, so that power to the cabinet is turned off.

For normal operation, the circuit breaker must be in the on position, in which the handle is pushed up. To shut the circuit breaker off, push the handle down.

AC Power Indicators

Power indicators are located below the circuit breaker handle. When the system is powered on, the power indicators are red. When the circuit breaker is off, tripped, or open, the power indicators change to green. When one phase has tripped, the power indicator for that phase will change to green.

NOTE: The power indicators in the 202V version are different. If one phase trips, all power indicators trip, so that all indicators are green.

Circuit Breaker Lockout

The circuit breaker lockout secures the circuit breaker in the off position. The lockout consists of a hinged plate that is placed over the circuit breaker handle. A padlock can be placed on the right or left side of the lockout, so that no one can turn the power on.

Chapter 4

Booting

This chapter describes how to boot the system. Sections include:

- Boot Devices
- Booting Overview
- Boot Command Syntax
  - — Console Environment Variables
  - — Set Commands for Booting
- Booting Concepts
  - — How Bootblock Booting Works
  - — Boot Processor Selection
- Booting from a Local Device
  - — Local Device Booting Concepts
  - — CD- ROM OpenVMS Alpha AXP Booting
  - — CD- ROM OSF/1 Booting
  - — Local Device Booting Examples
  - — CD- ROM Booting
- Booting from an InfoServer
  - — InfoServer Concepts
  - — InfoServer OpenVMS VAX Booting
  - — Selecting an Ethernet Service
- Booting from a VMScluster
  - — VMScluster Concepts
  - — CI Booting
  - — Shadow Set OpenVMS VAX Booting
  - — DSSI OpenVMS VAX Booting

4.1 Boot Devices

The operating system can be loaded from a number of boot devices: a local system disk, a disk connected to the system through a CIXCD adapter, by Ethernet from a remote disk on another system, through an InfoServer, or an RRD42 CD drive.

Figure 4- 1 Boot Devices

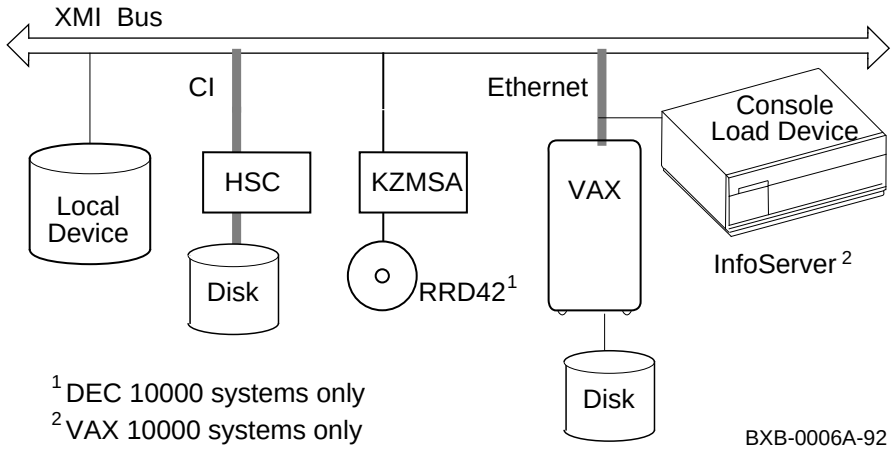


Table 4- 1 Boot Devices

Device	Location
Local device	Disk connected to the system through a KDM70, KFMSA (for VAX 10000 systems), KZMSA (for DEC 10000 systems) adapter on the XMI bus.
CI disk	Disk located on the system's HSC controller connected to the system by a CIXCD adapter on the XMI bus.
Remote disk	Disk connected to another system on the Ethernet, through the DEMNA Ethernet port interface or the DEMFA adapter. For VAX 10000 systems only.
InfoServer	A network- based server used for booting standalone backup or the Loadable Firmware Update (LFU) Utility. See Appendix C. For VAX 10000 systems only.
RRD42	In- cabinet compact disk drive connected to the DEC 10000 system through a KZMSA adapter on the XMI bus.

4.2 Booting Overview

You can boot files in a number of ways such as through an RRD42 CD drive, an InfoServer, an HSC disk, a local disk, or over the Ethernet. The boot command syntax is shown in Figure 4- 2.

Figure 4- 2 Device Boot Commands

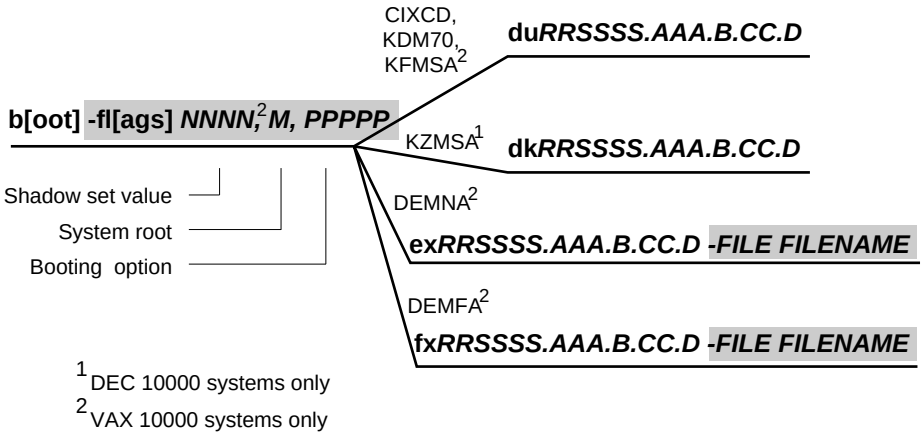


Table 4- 2 Sample Boot Commands

Boot Command	Boot From	Procedure Section
boot dua2.2.0.1.0	Local device	4.5.4
boot - flags 0,0 dka100.1.0.1.0[1]	RRD42	4.5.2, 4.5.3
boot exa0 - flags 0,0 - file ISL_LVAX_BL10[2]	InfoServer on Ethernet	4.6.2
boot fxa0 - file ISL_LVAX_BL10[2]	InfoServer on FDDI	4.6.2
boot - fl 4,0 dua20.14.0.2.0[2]	CI VMScluster	4.7.2, 4.7.3, 4.7.4
b - fl 8DAC,2,0 dua3500.14.0.12.1, dua63.14.0.12.1[2]	Shadow set	4.7.5
boot - flags 3,0 dub1.1.0.6.0	DSSI[2] VMScluster	4.7.6

[1]For DEC 10000 systems only.
[2]For VAX 10000 systems only.

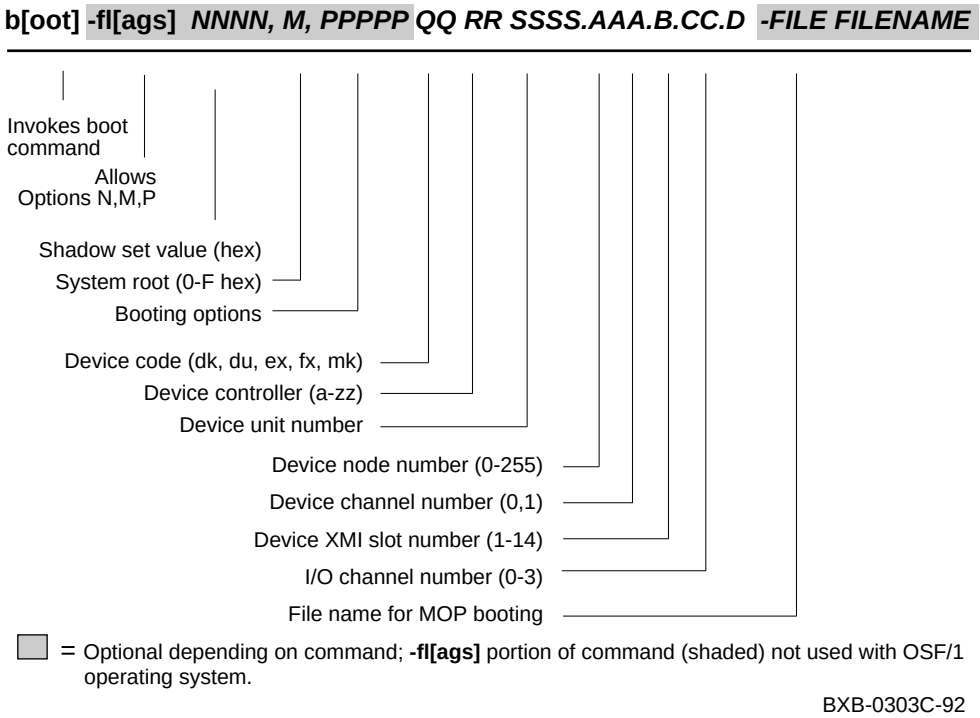
*NOTE: Boot device names can be found using the **show device** and **show network** commands (see Sections 4.5.2 and 4.6.2).*

For more information:
OpenVMS Alpha Version 1.0 Upgrade and Installation Manual
DEC OSF/1 Guide to System Administration

4.3 Boot Command Syntax

With the system in console mode, you can issue a boot command. You must give a complete specification in which the parameters determine the boot device. (These parameters can be defined and stored as a nickname used for future booting.)

Figure 4- 3 Boot Command



*NOTE: The **boot** command can be shortened to **b**, the **-file** parameter to **fi**, and the **-flags** parameter to **-fl**.*

Figure 4- 3 shows the components of the **boot** command. The **- flags** parameter allows the use of additional **boot** command parameters. Not all parameters are required; some are optional. The **- flags** parameter is not used with the OSF/1 operating system. The parameters are:

VAX 10000

NNNN is the shadow set value which is dependent on the system configuration, and is used with OpenVMS VAX. This optional parameter (up to 4 hex digits) is deposited into bits 16–31 of General Purpose Register R3. This parameter is not used on DEC 10000 systems.

- **M** is the system root of the boot device in hex which is dependent on the system configuration. This value can be between 0 and F. This parameter is deposited into bits 28–31 of General Purpose Register R5 for VAX 10000 systems. For DEC 10000 systems, it is deposited using the console environment variable **boot_osflags**.
- **PPPPP** is the hex value for the Alpha primary boot program (APB) as listed in Appendix B. It is also used with the virtual memory boot program (VMB) options as listed in Appendix B. This parameter is deposited into bits 0–27 of General Purpose Register R5. For DEC 10000 systems, it is deposited using the console environment variable **boot_osflags**.
- **QQ** is part of the device name indicating the device type as shown in Table 4- 3.

Table 4- 3 Device Names

Device Type	Name	Device Adapter
Disk (MSCP)	duRRSSSS.A.B.C.D	CIXCD, KDM70, KFMSA
Disk (SCSI), CD- ROM[1]	dkRRSSSS.A.B.C.D	KZMSA
InfoServer (Ethernet)[2]	exRRSSSS.A.B.C.D	DEMNA
InfoServer (FDDI)[2]	fxRRSSSS.A.B.C.D	DEMFA

[1]For DEC 10000 systems only.
[2]For VAX 10000 systems only.

- **RR** is the device controller designation determined by the location of the I/O adapter module in the backplane. Controller designators are assigned from low to high XMI slots, and from low to high I/O channel numbers.
- **SSSS** is the device unit number. It is 0 for DEMFA and DEMNA, but for other devices it can be up to 4 decimal digits long.
- **AAA** is the device node number. The device node number can be up to 3 hex digits long. Its decimal values are:
  - — 0 for DEMFA, DEMNA, and KDM70
  - — Node number of the disk drive for KFMSA and KZMSA
  - — CI node number of the HSC for CIXCD
- **B** is the device channel number. It is a decimal number (0 or 1) for KFMSA and KZMSA each with two channels. It supports two DSSI buses from a single adapter; otherwise it is 0.
- **CC** is the XMI slot number in which the I/O adapter is located. This is a two- digit decimal value between 1–14.
- **D** is the XMI I/O channel number which is a decimal number between 0 and 3.

FILENAME is the name of the maintenance operations protocol (MOP) file used in booting the system. The file name must be in uppercase letters. This parameter is used on VAX 10000 systems only.

Boot command flag parameters can be shortened, since values zero or commas (which can be used as placeholders), do not have to be specified. These parameters are read from right to left (PPPPP, M, NNNN). For example, **boot - fl 0,0,100** or **boot - fl „100** are the same as **boot - fl 100** where **100** is the value of the **PPPPP** option.

NOTE: The console prompt for a uniprocessor system is ***>>>,*** *which is used throughout this document. For a multiprocessor system, the console prompt is* ***P0n>>>****, where* ***n*** *is dependent on where the primary processor is installed in the LSB. The* ***P0n>>>*** *is not used with the OSF/1 operating system.*

For more information:

Console Reference Manual

4.3.1 Console Environment Variables

Console environment variables are used in booting to modify how the console commands function.

Environment variables consist of a name and value which are maintained by the console program. The name is usually made up of characters that describe the operation, and value is an ASCII string up to 128 characters in length or an integer.

The environment variable values can be created, modified, displayed, or deleted using **create**, **set**, **show**, and **clear** commands. Environment variables used for system installation and basic operations are listed in Table 4- 4.

Table 4- 4 Environment Variables

Environment Variable	Function
auto_action	Specifies the action that the console takes after an error halt. **Auto_action** can be used for restarting, booting, and halting the system. **Set auto_action** to automatically restart after an error halt using the default boot device defined by **bootdef_dev.**
baud	Sets the console terminal port baud rate to 300, 600, 1200, 2400, 4800, or 9600, with the default being 9600.
bootdef_dev	Specifies the default device or device list from which booting is attempted when the **boot** command does not specify a device name.
boot_file	The default file name used by the primary bootstrap when no file name is specified by the **boot** command, if appropriate.
boot_osflags	Additional parameters passed to the system during booting if none are specified by the **boot** command with the **- flags** qualifier.

Table 4- 4 Environment Variables (Continued)

Environment Variable	Function
boot_reset	Resets the system and displays self- test results during booting. Default value is **on**.
cpu	Selects the current boot processor.
cpu_enabled	A bitmask that indicates which processors are enabled to run (leave console mode). Default is **0xff**.
cpu_primary	A bitmask that indicates which processors are enabled to become the next boot processor, following the next reset. Default is **0xff**.
dump_dev[1]	Complete device specification of the device to which operating system dumps are written. The default value when the system is shipped is a valid device.
enable_audit	If set to **on** (default), enables the generation of audit trail messages. If set to **off**, audit trail messages are suppressed. Console initialization sets this to **on**.
interleave	The memory interleave specification. The value must be **default**, **none**, or an explicit interleave list. The default value is **default**.
language	Determines whether the system displays message numbers or message text in English (default).

[1]For DEC 10000 systems using OpenVMS Alpha AXP only.

For more information:

Console Reference Manual

4.3.2 Set Commands for Booting

Use the set command to define a default boot device or issue a nickname as shown in Example 4- 1.

Example 4- 1 Set Boot Commands

```
>>> set boot_reset on              ❶
>>> set bootdef_dev dua2.4.0.2.0 ❷
>>> set boot_osflags "0,6,7"     ❸
>>> boot                          ❹

 [the system now initializes and boots]

>>> create -nv work               ❺
>>> set work "-flags 0,6,7 dua6.14.0.12.1" ❻
>>> set auto_action restart       ❼
>>> boot work                     ❽

 [the system now initializes and boots]
```

❶ **Set boot_reset on** to initialize the system before booting.

❷ If you boot from the same boot device each time, you can store the disk name by defining the default boot device. This is done by using the **set bootdef_ dev** command. The default boot device is used for booting during power- up and auto restarts.

❸ Use **set boot_osflags** to define the boot command flag parameters of 0, 6, and 7. The APB/VMB option of 7 is made up of the combination of bits 0, 1, and 2 as shown in Appendix B. The flags can also be specified as done in step 6.

❹ Booting can now be done from that device by typing **boot** or just **b**.

❺ Use the **create** command to create the environment variable **work**. The **- nv** option stores the environment variable **work** in a nonvolatile EEPROM.

❻ This is an example of booting from a system that is part of a VMScluster. To boot from the cluster system disk, a nickname is created by equating the boot parameters to an environment variable as shown. A nickname is used so boot parameters do not have to be entered each time the system is booted.

❼ Used to set the **auto_action** environment variable so the system will restart after an error halt.

❽ Booting can now be done from that device by typing **boot work**.

For more information:

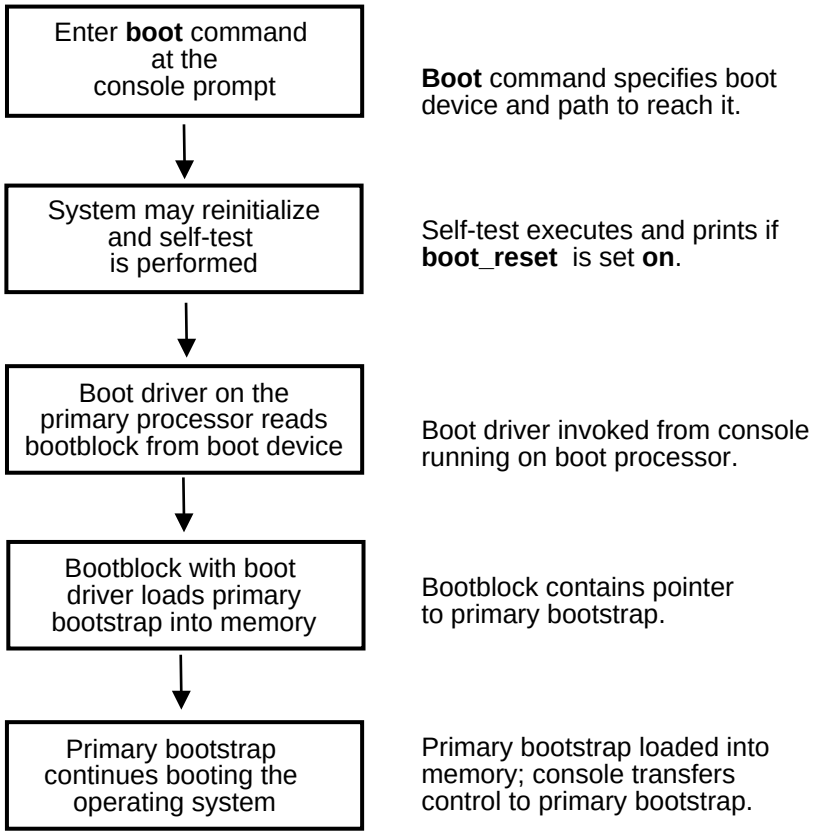
Console Reference Manual

4.4 Booting Concepts

4.4.1 How Bootblock Booting Works

The boot program reads the primary bootstrap program from the boot device. The primary bootstrap in turn boots the operating system.

Figure 4- 4 Boot Procedure



Boot driver

The console firmware provides a boot driver for each supported boot device. During booting, the boot driver reads the bootblock from the specified boot device and then loads the primary bootstrap or OSF/1 image into memory. Upon completion of the load, the boot driver passes control to either program which then starts executing.

Boot device

The boot device contains the bootblock and typically also contains the primary bootstrap. OpenVMS Alpha AXP or OpenVMS VAX can be booted from standalone backup. Not used with the OSF/1 operating system.

Bootblock

The bootblock is logical block zero on the system disk; it contains the block number where the primary bootstrap program is located on the system disk. The console reads the primary bootstrap from the system load device to memory.

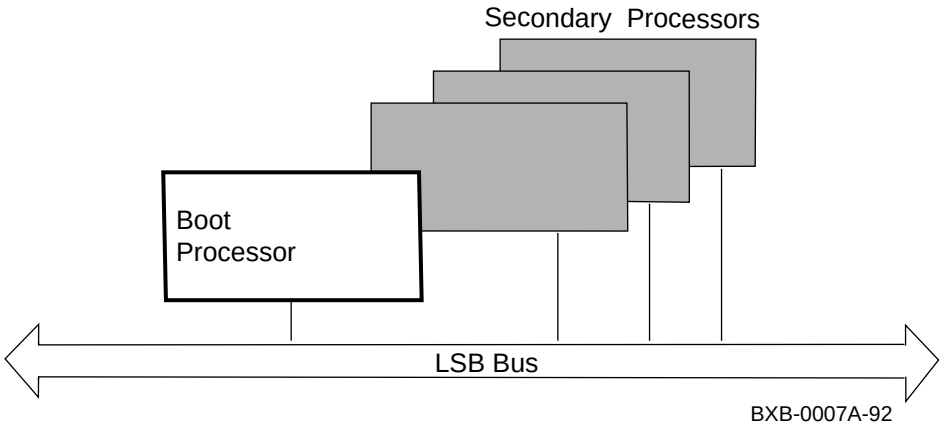
Primary bootstrap

The primary bootstrap, which is stored on the boot device, boots the operating system. The goal of booting is to read the primary bootstrap from the boot device and load the operating system. The primary bootstrap loads the operating system into memory and passes control to memory.

4.4.2 Boot Processor Selection

One processor is selected as the boot processor, and all other processors become secondary processors. This determination is made by the system at power- up or initialization, and can be altered using console commands.

Figure 4- 5 Determining the Boot Processor



One processor is designated as the boot processor (or primary processor) and becomes the primary communicator to the console terminal.

At power- up or initialization of the system, the console program in each processor begins parallel execution. Each processor performs self- test and then checks with the other processors to determine which processor becomes the boot processor. The default boot processor is the processor with the lowest node ID number, passing self- test, that is eligible to become the boot processor. Once the boot processor has been determined, all other processors on the system wait for commands from the boot processor.

Console commands can be used to select the boot processor. The **set cpu_primary** command is used to select the primary (or boot) processor. This command is not stored in the EEPROM, so its parameters are not saved during a reset. The **set cpu_enabled** command is used to disable selected processors, so they are not eligible to become the boot processor.

For more information:

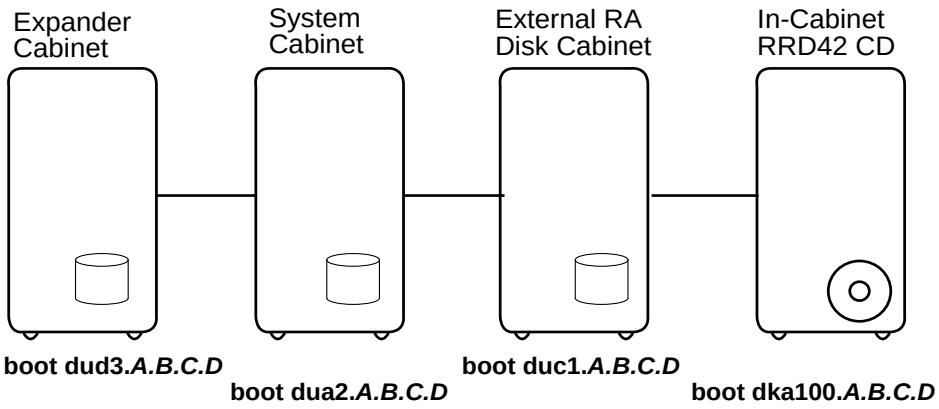
Console Reference Manual

4.5 Booting from a Local Device

4.5.1 Local Device Booting Concepts

Figure 4- 6 shows system booting through a local device.

Figure 4- 6 Local Device Booting



Where:
dk, du = device name
a, c, d = controller
1, 2, 3, 100 = unit number
A = device node number
B = device channel number
C = XMI node number
D = I/O channel number

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Figure 4- 6 shows the locations of local devices that can be used to boot the operating system.

DEC 10000

Local devices can be installed in the DEC 10000 system. The DEC 10000 system cabinet can contain up to two SCSI PIUs, the expander cabinet can contain up to six SCSI PIUs, and the external RA disk cabinet can contain RA disks.

VAX 10000

Local devices can be installed in the VAX 10000 system. The VAX 10000 system cabinet can contain up to two DSSI PIUs, the expander cabinet can contain up to six DSSI PIUs, and the external RA disk cabinet can contain RA disks.

NOTE: To boot from a local device, the operating system must already be installed on that device. Otherwise, booting must be done from another source.

4.5.2 CD- ROM OpenVMS Alpha AXP Booting

NOTE:

This section shows a sample boot of OpenVMS Alpha AXP from the RRD42 CD drive for DEC 10000 systems. The first step is issuing the show device command to determine the location of the RRD42.

Example 4- 2 CD- ROM OpenVMS Alpha AXP Boot

```
>>> show device                          ❶
polling for units on kzmsa0, slot 1, xmi0...
dka100.1.0.1.0      dka100          RRD42
polling for units on kdm700, slot 6, xmi1...
dub1.1.0.6.1      R2TDYC$DIA1   RF73
dub2.2.0.6.1      R2TDYC$DIA2   RF73
>>> boot -flags 0,0 dka100.1.0.1.0   ❷
Booting...                            ❸
Connecting to boot device dka100
initializing HWRPB at 2000
initializing page table at 1ee000
initializing machine state
jumping to bootstrap at 1fa000
OpenVMS AXP (TM) Operating System, Version V1.0 ❹
```

❶ **Show device** displays information about each I/O device. Polling checks the XMI bus for device configurations. The next line contains three columns. The first column contains the device type and unit number, node number, device channel number, XMI node number, and I/O channel number, separated by periods. The second column displays the name of the device given by the device controller. The third column shows the device type.

❷ In the **boot** command, **- flags** indicates that additional command parameters follow, **0** is the system root of the boot device, **0** is the bootstrap option, **dk** is the device code of the boot device, **a** is the boot device controller designation, and **1** specifies the hexadecimal unit number of the boot device. The **1** is the node number, **0** is the channel number, **1** is the XMI node number, and **0** is the I/O channel number.

❸ The system boots standalone backup from the RRD42.

❹ The operating system banner appears.

For more information:

OpenVMS Alpha Version 1.0 Upgrade and Installation Manual

4.5.3 CD- ROM OSF/1 Booting

DEC 10000 **This section shows a sample boot of OSF/1 from the RRD42 CD drive for DEC 10000 systems. The first step is issuing the show device command to determine the location of the RRD42.**

Example 4- 3 CD- ROM OSF/1 Boot

```
>>> show device                          ❶
polling for units on kzmsa0, slot 2, xmi0...
dka100.1.0.2.0      dka100          RRD42
polling for units on kdm700, slot 6, xmi1...
dub1.1.0.6.1      R2TDYC$DIA1   RF73
dub2.2.0.6.1      R2TDYC$DIA2   RF73
>>> boot dka100.1.0.2.0                 ❷
Booting...                              ❸
Connecting to boot device dka100.1.0.2.0
Created boot device: dka100.1.0.2.0
block 0 of dka100.1.0.2.0 is a valid boot block
reading 16 blocks from dka100.1.0.2.0
bootstrap code read in
base = 1fe000, start = 0
initializing HWRPB at 2000
initializing page table at 1f2000
initializing machine state
jumping to bootstrap at 1fe000
Resetting IO subysystem... ❹
[I/O subsystem reset information, memory information
displayed, I/O bus adapters displayed, configured devices
displayed, network configuration information displayed]

The system is ready.

DEC OSF/1 Version 1.2 console ❺
```

❶ **Show device** displays information about each I/O device. Polling checks the XMI bus for device configurations. The next line contains three columns. The first column contains the device type and unit number, node number, device channel number, XMI node number, and I/O channel number, separated by periods. The second column displays the name of the device given by the device controller. The third column shows the device type.

❷ In the **boot** command, **dk** is the device code of the boot device, **a** is the boot device controller designation, and **100** specifies the hexadecimal unit number of the boot device. The **1** is the node number, **0** is the channel number, **2** is the XMI node number, and **0** is the I/O channel number.

❸ The system boots from the RRD42.

❹ The system displays information about the I/O subsystem reset, memory, I/O bus adapters, configured devices, and network configurations.

❺ The operating system banner appears.

For more information:

DEC OSF/1 Guide to System Administration

4.5.4 Local Device Booting Examples

This section shows sample boot procedures from local disks installed in system cabinets, expander cabinets, and external RA disk drive cabinets. The first step is issuing the show device command which is used to determine the location of the boot device.

Example 4- 4 Sample Local Device Boots

```
>>> show device       ❶
polling for units on kfmsa0, slot 1, xmi0... ❷
dua2.2.0.1.0      R2TDYC$DIA2   RF73
dua3.3.0.1.0      R2TDYC$DIA3   RF73
polling for units on kdm700, slot 2, xmi0...
duc1.0.0.2.0      DUA1          RA92
polling for units on kfmsa1, slot 1, xmi1...
dud3.3.0.1.1      XYZ$DIA3      RF73

>>> boot dua2.2.0.1.0 ❸

>>> boot duc1.0.0.2.0 ❹

>>> boot dud3.3.0.1.1 ❺
```

❶ **Show device** displays information about each I/O device. Polling checks the XMI bus for device configurations. The next line contains three columns. The first column contains the assigned console device name. The second column displays the name of the device given by the device controller. The third column shows the device type.

❷ Polling sizes the XMI bus for devices connected to <device>. The <device> is the name the console assigns to an I/O adapter or device in the system. A list of installed adapters is given in the **show configuration** command display. Refer to the *Basic Troubleshooting* or *Console Reference* manuals for details on the **show configuration** command.

❸ In this example, this is a boot from a disk in the system cabinet, since the last digit in the first column of the **show device** command is 0. The zero indicates I/O channel 0 which connects to devices in the system cabinet.

The device code of the boot device is **du**, **a** is the boot device controller designation, and **2** specifies the unit number of the boot device. The next **2** is the node number, **0** is the device channel number, **1** is the XMI node number, and **0** is the I/O channel number.

❹ This is a boot from a disk in an external RA disk cabinet, since the last column of the **show device** command is RA92. This indicates an RA92 disk in an external RA disk cabinet. The device code of the boot device is **du**, **c** is the boot device controller designation, and **1** specifies the unit number of the boot device. The **0** is the node number, **0** is the device channel number, **2** is the XMI node number, and **0** is the I/O channel number.

❺ This is a boot from a disk in the expander cabinet, since the last digit in the first column of the **show device** command is 1. The 1 indicates I/O channel 1 which connects to devices in the expander cabinet. The device code of the boot device is **du**, **d** is the boot device controller designation, and **3** specifies the unit number of the boot device. The next **3** is the node number, **0** is the device channel number, **1** is the XMI node number, and **1** is the I/O channel number.

For more information:

Basic Troubleshooting

Console Reference Manual

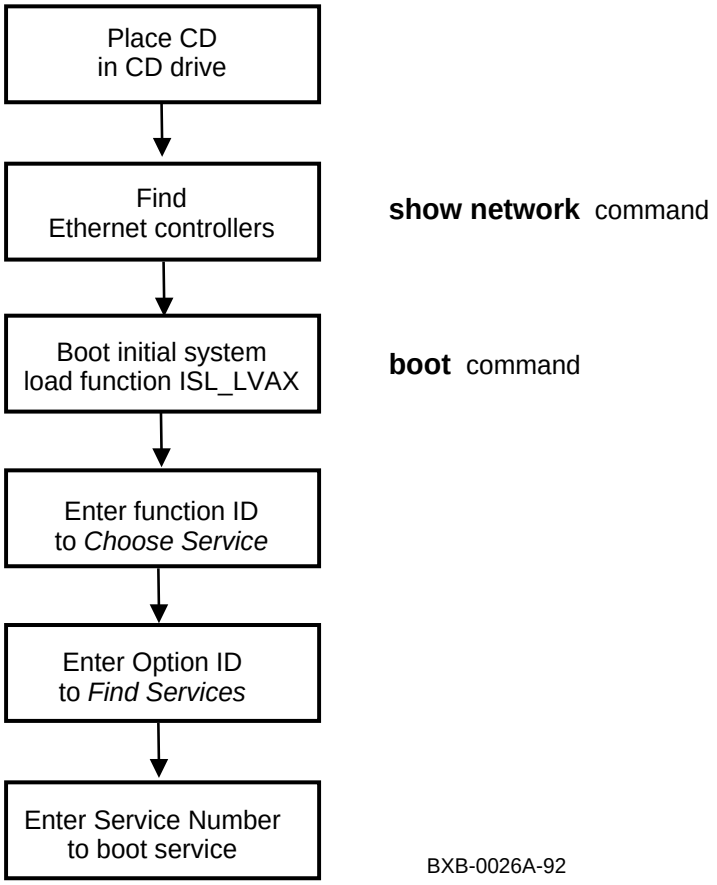
4.6 Booting from an InfoServer

4.6.1 InfoServer Concepts

VAX 10000

The InfoServer is an Ethernet-based compact disk (CD) server used to first load the operating system for the VAX 10000. First, find the available InfoServer services and then select one of them.

Figure 4-7 InfoServer Selection Flowchart

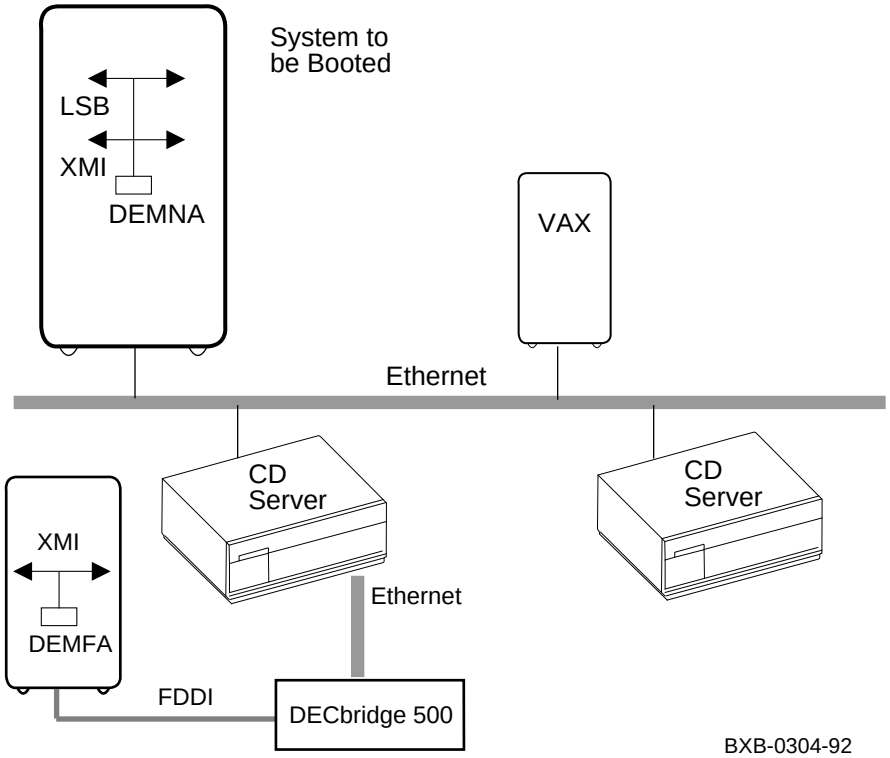


Some systems use Ethernet- based CD servers to load the operating system. The InfoServer consists of one or two CD drives and connects to standard Ethernet or ThinWire groups or networks.

Before loading the operating system during system installation, a number of steps are needed to find and connect to an InfoServer. Figure 4- 7 illustrates these steps. See Section 4.6.2 for information on **show network** and **boot** commands.

Each InfoServer drive has its own address, so either drive can contain the CD needed to load the operating system. In large system configurations, a number of InfoServers can be connected to the system. Figure 4- 8 shows a configuration of systems and InfoServers.

Figure 4- 8 InfoServer Configuration



4.6.2 InfoServer OpenVMS VAX Booting

VAX 10000

This section shows a sample boot of OpenVMS VAX from an InfoServer using the Ethernet. The first step is issuing the show network command.

Example 4- 5 InfoServer OpenVMS VAX Boot

```
>>> show network ❶
polling for units on demna0, slot 3, xmi0...
exa0.0.0.3.0 08-00-2B-0B-BB-ED
>>> boot exa0 -flags 0,0,0 -file ISL_LVAX_BL10 ❷
Initializing...
F  E  D  C  B  A  9  8  7  6  5  4  3  2  1  0  NODE # ❸
                   A  M  .  .  .  .  .  P  P  TYP
                   o  +  .  .  .  .  .  +  +  ST1
                   .  .  .  .  .  .  .  E  B  BPD
                   o  +  .  .  .  .  .  +  +  ST2
                   .  .  .  .  .  .  .  E  B  BPD
                   +  +  .  .  .  .  .  +  +  ST3
                   .  .  .  .  .  .  .  E  B  BPD

   .  .  .  .  +  .  +  .  .  .  .  +  .  +     C0 XMI +
   .  .  .  .  +  .  +  .  .  .  .  +  .  +     C1 XMI +
   .  .  .  .  .  .  .  .  .  .  .  .  .  .     C2
   .  .  .  .  .  .  .  .  .  .  .  .  .  .     C3

                      . A0  .  .  .  .  .  .  .  ILV
                      .256  .  .  .  .  .  .  .  256Mb
Firmware Rev = V1.0-1625 SROM Rev = V1.0-0 SYS SN = GAO1234567
Booting...
Connecting to boot device exa0 -flags 0,0,0
-file ISL_LVAX_BL10
Created boot device: exa0.0.0.3.0
Resulting file is mopdl:ISL_LVAX_BL10/exa0.0.0.3.0
.....
Load complete !
```

❶ **Show network** displays information about Ethernet controllers. Polling checks the XMI bus for device configurations. **Show network** includes information such as the console device name of the network device with path information (exa0.0.0.3.0) and the Ethernet controller's hardware address in hex (08- 00- 2B- 0B- BB- ED).

❷ Boot standalone backup across the Ethernet by specifying the console device name of the network device **exa0**, additional command parameters **- flags 0,0,0**, the Initial System Load (ISL) file name **ISL_LVAX_** and its version number **BL10**. To boot over the FDDI, the device mnemonic is **fx** rather than **ex**.

❸ System self- test results are displayed if the environment variable **boot_reset** is set **on**.

NOTE: The ISL file name must be specified in uppercase letters.

For more information:
Console Reference Manual

VMS Upgrade and Installation Supplement:
VAX 7000- 600 and VAX 10000- 600 Series

4.6.3 Selecting an Ethernet Service

NOTE:

VAX 10000

The second step of booting over the Ethernet with an InfoServer is selecting the service that boots OpenVMS VAX for VAX 10000 systems.

Example 4- 6 Selecting an Ethernet Service

```
Network Initial System Load Function    ❶
Version 1.1
FUNCTION          FUNCTION
   ID
   1      -      Display Menu
   2      -      Help
   3      -      Choose Service
   4      -      Select Options
   5      -      Stop
Enter a function ID value: 3           ❷
   OPTION         OPTION
     ID
     1    -      Find Services
     2    -      Enter known Service Name
Enter an Option ID value: 1            ❸
Working
Servers found: 2                       ❹
Service Name Format:
       Service Number
       Service Name
       Server Name
       Ethernet ID
#1
VMS054
ESS_08002B0BBBED
08-00-2B-0B-BB-ED
#2
CD_BIN_83371
ESS_08002B0BBBED
08-00-2B-0B-BB-ED
```

```
#1
INFO3$RZ57
INFO3
08-00-2B-26-A6-98

#2
CD_DOC_0050
INFO3
08-00-2B-16-04-98

Enter a Service number or <CR> for more: 1  ❺
     [operating system banner appears]
```

❶ The Network Initial System Load Function menu is displayed.

❷ The system prompts you for a function ID value. Enter a 3 to select the Choose Service function.

❸ The Service options menu is displayed. Enter 1 to display the available Ethernet servers and services. In this example two servers are found on the Ethernet.

❹ Each server has two services, 1 and 2. The service names are listed (such as INFO3$RZ57) followed by the InfoServer names (such as INFO3), and the Ethernet ID (such as 08- 00- 2B- 26- A6- 98). In this example, service #1 of server #1 VMS054, is used to boot OpenVMS VAX.

❺ Enter 1 to select service #1.

For more information:
InfoServer 150 Installation and Owner's Guide

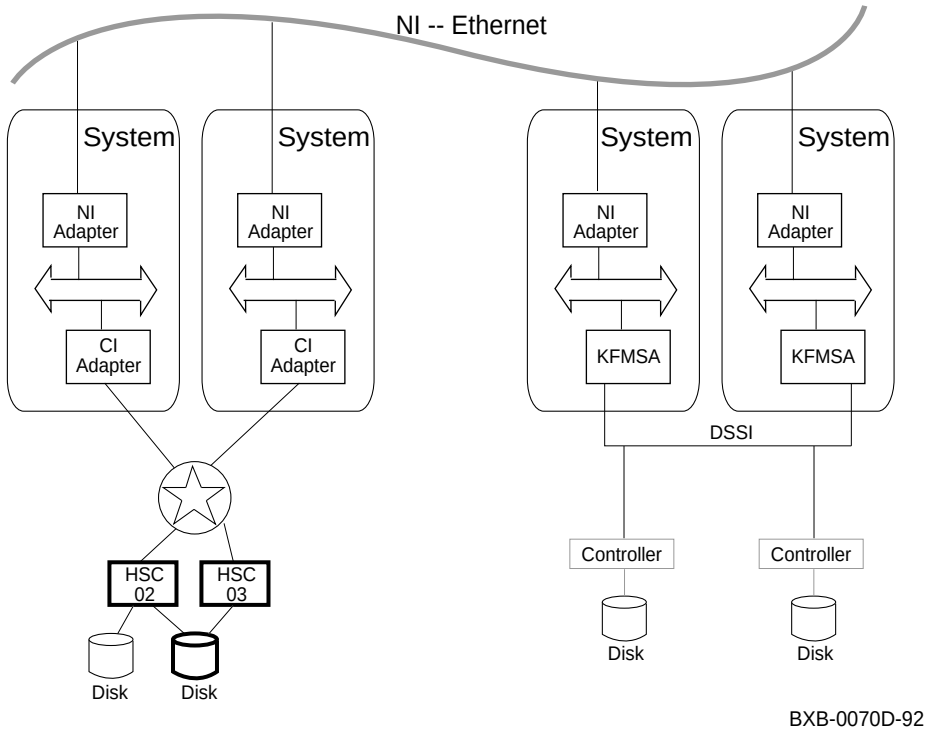
VMS Upgrade and Installation Supplement: VAX 7000- 600 and VAX 10000- 600 Series

4.7 Booting from a VMScluster

4.7.1 VMScluster Concepts

You can boot from a VMScluster using a CI configuration with a Star Coupler and HSC disk controller or a DSSI configuration with a KFMSA and controller as shown in Figure 4- 9.

Figure 4- 9 Booting from CI and DSSI VMSclusters



When you boot from a VMScluster, the minimum boot command options include the boot device, the device type, and its unit number. This is allowed if options such as shadow set value, system root, and optional APB or VMB parameters are zero.

Figure 4- 9 shows sample VMScluster configurations. Logically, each DSSI bus is equivalent to a small CI with a Star Coupler. The RF devices on the DSSI are functionally equivalent to a combination of HSC and RA devices on the CI. Sections 4.7.2–4.7.4 discuss sample CI boots, Section 4.7.5 discusses shadow set booting, and Sections 4.7.6–4.7.8 discuss sample DSSI boots.

4.7.2 CI OpenVMS Alpha AXP Booting

This section shows a sample boot of OpenVMS Alpha AXP for a system in the CI configuration shown in Figure 4- 9.

Example 4- 7 CI OpenVMS Alpha AXP Boot

```
>>> show device ❶
polling for units on cixcd0, slot 2, xmi0...
dua20.14.0.2.0     $100$DUA20    RA82
dua31.14.0.2.0     $100$DUA31    RA82
dua80.15.0.2.0     $100$DUA80    RA90
>>> boot -fl 4,0 dua20.14.0.2.0 ❷
Booting... ❸
Connecting to boot device dua20
initializing HWRPB at 2000
initializing page table at 1ee000
initializing machine state
jumping to bootstrap at 1fa000
OpenVMS AXP (TM) Operating System, Version V1.0 ❹
```

❶ **Show device** displays information about each I/O device. Polling checks the XMI bus for device configurations. The next line contains three columns. The first column contains the console device name. The second column displays the name of the device given by the device controller. The third column shows the device type.

❷ In the **boot** command, **- fl** indicates that additional command parameters follow, **4** is the booting system root on the cluster system disk, **0** is the bootstrap option, **du** is the device code of the boot device, **a** is the boot device controller designation, and **20** specifies the unit number of the boot device. The **14** is the HSC controller node number that the boot device is connected to, **0** is the channel number, **2** is the XMI node number, and **0** is the I/O channel number.

❸ The system boots standalone backup.

❹ The operating system banner appears.

For more information:

OpenVMS Alpha Version 1.0 Upgrade and Installation Manual

4.7.3 CI OSF/1 Booting

DEC 10000 **This section shows a sample boot of OSF/1 for a system in the CI configuration shown in Figure 4- 9.**

Example 4- 8 CI OSF/1 Boot

```
>>> show device ❶
polling for units on cixcd0, slot 2, xmi0...
dua20.14.0.2.0     $100$DUA20    RA82
dua31.14.0.2.0     $100$DUA31    RA82
dua80.15.0.2.0     $100$DUA80    RA90
>>> boot dua31.14.0.2.0 ❷
Booting... ❸
Connecting to boot device dua31.14.0.2.0
Connecting to boot device dua31.14.0.2.0
Created boot device: dua31.14.0.2.0
block 0 of dua31.14.0.2.0 is a valid boot block
reading 16 blocks from dua31.14.0.2.0
bootstrap code read in
base = 1fe000, start = 0
initializing HWRPB at 2000
initializing page table at 1f2000
initializing machine state
jumping to bootstrap at 1fe000
Resetting IO subysystem... ❹
[I/O subsystem reset information, memory information
displayed, I/O bus adapters displayed, configured devices
displayed, network configuration information displayed]

The system is ready.

DEC OSF/1 Version 1.2 console ❺
```

❶ **Show device** displays information about each I/O device. Polling checks the XMI bus for device configurations. The next line contains three columns. The first column contains the console device name. The second column displays the name of the device given by the device controller. The third column shows the device type.

❷ In the **boot** command, **du** is the device code of the boot device, **a** is the boot device controller designation, and **31** specifies the unit number of the boot device. The **14** is the HSC controller node number that the boot device is connected to, **0** is the channel number, **2** is the XMI node number, and **0** is the I/O channel number.

❸ The system boots the OSF/1 operating system.

❹ The system displays information about the I/O subsystem reset, memory, I/O bus adapters, configured devices, and network configurations.

❺ The operating system banner appears.

For more information:

DEC OSF/1 Guide to System Administration

4.7.4 CI OpenVMS VAX Booting

This section shows a sample boot of OpenVMS VAX for a system in the CI configuration shown in Figure 4- 9.

Example 4- 9 CI OpenVMS VAX Boot

```
>>> show device ❶
polling for units on cixcd0, slot 2, xmi0...
dua20.13.0.2.0     $100$DUA20    RA82
dua31.14.0.2.0     $100$DUA31    RA82
dua80.15.0.2.0     $100$DUA80    RA90
>>> boot -fl 0,4,0 dua20.13.0.2.0 ❷
Booting... ❸
Connecting to boot device dua20
block 0 of dua20 is a valid boot block
reading 85 blocks from dua20
bootstrap code read in
base = 116000, start = 200
boot device name = dua20.14.0.2.0
boot flags 0,4,0
boot device type = 2b
controller letter = A
unit number = 20
node ID = 13
channel = 0
slot = 2
hose = 0
jumping to bootstrap at 116200
```

❶ **Show device** displays information about each I/O device. Polling checks the XMI bus for device configurations. The next line contains three columns. The first column contains the console device name. The second column displays the name of the device given by the device controller. The third column shows the device type.

❷ In the **boot** command, **- fl** indicates that additional command parameters follow, **0** indicates no shadow set, **4** is the booting system root on the cluster system disk, **0** is the VMB option, **du** is the device code of the boot device, **a** is the boot device controller designation, and **20** specifies the unit number of the boot device. The **13** is the HSC controller node number that the boot device is connected to, **0** is the channel number, **2** is the XMI node number, and **0** is the I/O channel number.

❸ With the **set enable_audit** environment variable **on**, audit trail messages appear during booting.

For more information:

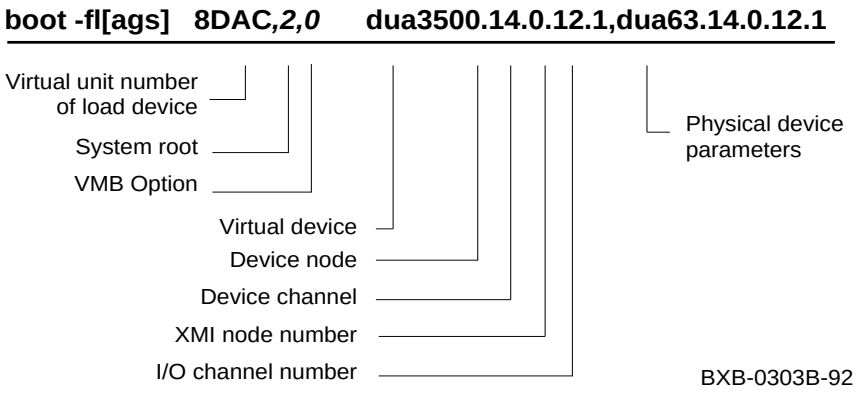
VMS Upgrade and Installation Supplement: VAX 7000- 600 and VAX 10000- 600 Series

4.7.5 Shadow Set OpenVMS VAX Booting

VAX 10000

Shadow set booting is used with OpenVMS VAX to boot from a virtual disk that is set up by the console.

Figure 4- 10 Shadow Set OpenVMS VAX Booting



❶ The virtual unit number of the load device is **8DAC**, where **8** indicates shadow set booting is used, and **DAC** is the hexadecimal value of the virtual device unit number of **3500** (decimal). This value is passed to bits 16–31 of General Purpose Register R3.

❷ The system root is **2**, which are bits 28–31 of General Purpose Register R3.

❸ The VMB option is **0** as listed in Appendix B, which are bits 0–27 of General Purpose Register R5.

❹ The device search list contains **dua3500**, which is the virtual device, and **dua63**, which is the physical device. The console first attempts to boot from the virtual device followed by the physical device.

❺ The device node is **14**. The path through HSC 14 will be tried first.

❻ The device channel number is **0**.

❼ The XMI node number for the I/O adapter module is **12**.

❽ The I/O channel number is **1**.

❾ The parameters for the physical device are the same as the virtual device except that the device unit number is **63**.

For more information:
VAX Volume Shadowing Manual

VMS Upgrade and Installation Supplement:
VAX 7000- 600 and VAX 10000- 600 Series

4.7.6 DSSI OpenVMS VAX Booting

VAX 10000

This section shows a sample boot of OpenVMS VAX for a system in the DSSI configuration shown in Figure 4- 9.

Example 4- 10 DSSI OpenVMS VAX Boot

```
>>> show device                    ❶
polling for units on kdm700, slot 1, xmi0...
dua1.1.0.1.0      DUA1          RA92
polling for units on kfmsa0, slot 6, xmi1...
dub1.1.0.6.1      R2TDYC$DIA1   RF73
dub2.2.0.6.1      R2TDYC$DIA2   RF73
>>> boot -flags 0,3,0 dub1.1.0.6.0 ❷
Initializing...
F  E  D  C  B  A  9  8  7  6  5  4  3  2  1  0  NODE # ❸
                    A  M  .  .  .  .  .  P  P  TYP
                    o  +  .  .  .  .  .  +  +  ST1
                    .  .  .  .  .  .  .  E  B  BPD
                    o  +  .  .  .  .  .  +  +  ST2
                    .  .  .  .  .  .  .  E  B  BPD
                    +  +  .  .  .  .  .  +  +  ST3
                    .  .  .  .  .  .  .  E  B  BPD

   .  .  .  .  +  .  +  .  +  .  .  .  .  +     C0 XMI +
   .  .  .  .  +  .  +  .  +  .  .  .  .  +     C1 XMI +
   .  .  .  .  .  .  .  .  .  .  .  .  .  .     C2
   .  .  .  .  .  .  .  .  .  .  .  .  .  .     C3

                    . A0  .  .  .  .  .  .  .  ILV
                    .256  .  .  .  .  .  .  .  256Mb
Firmware Rev = V1.0-1625 SROM Rev = V1.0-0 SYS SN = GAO1234567
```

❶ **Show device** displays information about each I/O device. Polling checks the XMI bus for device configurations. The next line contains three columns. The first column contains the device type and unit number, node number, device channel number, XMI node number, and I/O channel number, separated by periods. The second column displays the name of the device given by the device controller. The third column shows the device type.

❷ In the **boot** command, **- flags** indicates that additional command parameters follow, **0** is the shadow set unit, **3** is the system root of the boot device, **0** is the VMB option, **du** is the device code of the boot device, **b** is the boot device controller designation, and **1** specifies the hexadecimal unit number of the boot device. The **1** is the node number, **0** is the channel number, **6** is the XMI node number, and **0** is the I/O channel number.

❸ System self- test results are displayed if the environment variable **boot_reset** is set **on**.

For more information:

VMS Upgrade and Installation Supplement: VAX 7000- 600 and VAX 10000- 600 Series

Appendix A

Console Commands

Table A- 1 lists the console commands. Commands such as **clear**, **create**, **set**, and **show** use environment variables. These variables control various console reatures and pass console information to the operating system.

Table A- 1 Console Commands

Command	Function
boot	Initializes the system causing a self- test and begins the boot program.
build eeprom	Creates a new EEPROM image or restores a corrupted one.
cdp	Configures DSSI devices.
clear[1]	Removes an environment variable.
continue	Resumes processing at the point where it was interrupted by a Ctrl/P or halt command.
crash	Restarts the operating system and generates a memory dump.
create[1]	Creates a new environment variable.
deposit	Stores data in a specified location.
examine	Displays the contents of a memory location, register, device, or a file.

[1]These commands use environment variables.

Table A- 1 Console Commands (Continued)

Command	Function
help	Provides basic information on the console commands.
initialize	Performs a reset on the system or specified node.
mchk	Dumps internal state information.
repeat	Reexecutes a command.
set[1]	Changes an option or environment variable.
show[1]	Displays an option or environment variable.
start	Starts the execution of instructions at the specified address.
stop	Stops a secondary CPU.
test	Tests the system, a subsystem, or a specified option.
update	Copies the contents of the boot processor's EEPROM to the EEPROM of the specified processor.
#, !	Introduces a comment.

[1]These commands use environment variables.

Environment variables such as **baud, bootdef_dev, boot_file, boot_reset**, and **term** are used by the system operator. The EEPROM contents can be manipulated with the **clear**, **set**, and **show** commands.

For more information:

Console Reference Manual

Appendix B

Boot Options

Table B- 1 lists the Alpha primary boot (APB) options used with the **boot** command for OpenVMS Alpha AXP. Table B- 2 lists the OSF/1 options used with the **boot** command. Table B- 3 lists the virtual memory boot (VMB) options used with the **boot** command for OpenVMS VAX. These options allow you to control various phases of booting. The VMB options set bits in General Purpose Register R5.

Table B- 1 OpenVMS Alpha AXP Boot Options

Hexadecimal Value	Function
1	Allows a conversational boot.
2	Maps XDELTA to a running system.
4	Stops the boot procedure at the initial system breakpoint.
8	Performs a diagnostic bootstrap.
10	Stops the boot procedure at the bootstrap breakpoints.
20	Omits the header from the secondary bootstrap image.
40	Inhibits memory testing.
80	Prompts for the name of the secondary bootstrap file.
100	Halts the system before the secondary bootstrap.
2000	Marks corrected read data error pages as bad.
10000	Enables debug messages in the APB.EXE, SYSBOOT.EXE, and EXEC_INIT.EXE files.
20000	Enables user messages in the APB.EXE, BOOT.EXE, and EXEC_INIT.EXE files.

The OpenVMS Alpha AXP options are used as qualifiers in the **set boot_osflags** command.

Table B- 2 OSF/1 Boot Options

Option	Function
- a	Boots the system disk to multiuser mode.
- d	Do full clumps.
- i	Boot to interactive mode plus options.
- s	Default boot option.

Table B- 3 VMB Boot Options

Bit	Function
0	Conversational boot. The secondary bootstrap program, SYSBOOT, prompts you for system parameters at the console terminal.
1	Debug. If this bit is set, the operating system maps the code for the XDELTA debugger into the system page tables of the running operating system.
2	Initial breakpoint. If this bit is set, the operating system executes a breakpoint (BPT) instruction early in the bootstrap program.
3	Secondary boot from bootblock. The secondary boot is a single 512- byte block whose logical block number is specified in the General Purpose Register R4.
4	Not used.
5	Boot breakpoint. This stops the primary and secondary loaders with a breakpoint (BPT) instruction before testing memory.
6	Image header. The transfer address of the secondary loader image comes from the image header for that file. If this bit is not set, control shifts to the first byte of the secondary loader.
8	File name. APB or VMB prompts for the name of a secondary loader.
9	Halt before transfer. APB or VMB executes a HALT instruction before transferring control to the secondary loader.
13	No effect, since console program tests memory.
15	Not used.
16	Do not discard CRD pages.
31:28	Specifies the top- level directory number for system disks.

Appendix C

Updating Firmware

Use the Loadable Firmware Update (LFU) Utility to update system firmware. LFU runs without any operating system and can update the firmware on any system module. LFU handles modules on the LSB bus (for example, the CPU) as well as modules on the I/O buses (for example, a CI controller on the XMI bus). You are not required to specify any hardware path information, and the update process is highly automated.

Both the LFU program and the firmware microcode images it writes are supplied on a CD- ROM. You start LFU on DEC 10000 systems by booting the RRD42. On VAX 10000 systems you start LFU by booting the InfoServer on your Ethernet.

A typical update procedure is:

1. Boot the LFU CD- ROM.
2. Use the LFU **show** command to indicate modules whose firmware needs to be updated.
3. Use the LFU **list** command if you want to check the firmware version numbers on the CD- ROM.
4. Use the LFU **update** command to write the new firmware.
5. Exit.

C.1 Booting LFU on a DEC 10000 System

LFU is supplied on the DEC 7000/10000 AXP Console CD-ROM (Part Number AG- PQW3*- RE, where * is the lette that denotes the disk revision). Make sure this CD- ROM is mounted in the RRD42 in- cabinet CD drive. Boot LFU from the CD- ROM.

Example C- 1 RRD42 LFU Booting

```
>>> show device                          ❶
polling for units on kzmsa, slot 1, xmi0...
dka100.1.0.1.0      dka100          RRD42
polling for units on kdm70, slot 6, xmi0...
dub1.1.0.6.0      R2TDYC$DIA1   RF73
dub2.2.0.6.0      R2TDYC$DIA2   RF73

>>> boot dka100                          ❷
Booting...
                  Copyright Digital Equipment Corporation
                                    1992
                               All Rights Reserved.
       Loadable Environment Rev: V1.0-1625    Jul 12 1992  10:50:56


                ***** Loadable Firmware Update Utility *****
                 Version 2.1                 16-jun-1992


------------------------------------------------------------------
     Function      Description
------------------------------------------------------------------

     Display       Displays the system's configuration table.
     Exit          Return to loadable offline operating environment.
     List          Lists the device types and firmware revisions
                   supported by this revision of LFU.
     Modify        Modifies port parameters and device attributes.
     Show          Displays device mnemonic, hardware and firmware
                   revisions.
     Update        Replaces current firmware with loadable data
                   image.
     Verify        Compares loadable and device images.
     ? or Help     Scrolls the function table.
------------------------------------------------------------------

Function?          ❸
```

❶ Use the **show device** command to find the name of the RRD42 CD drive.

❷ Enter the **boot** command to boot from the RRD42. The RRD42 has a device name of dka100.

❸ LFU starts, displays a summary of its commands, and issues its prompt (Function?).

C.2 Booting LFU on a VAX 10000 System

LFU is supplied on the VAX 7000/10000 Console CD- ROM (Part Number AG- PQW1*- RE, where * is the letter that de notes the disk revision). Make sure this CD- ROM is mounted in one of the system's InfoServers. Boot the In- itial System Load (ISL) program, and select the service cor- responding to the console CD- ROM.

Example C- 2 Booting LFU

```
>>> boot exa0 -flags 0,0,0 -file ISL_LVAX_V01  ❶
Resulting file is mopdl:ISL_LVAX_V01/exa0
 ..... Load complete!
      [boot information]

Network Initial System Load Function
Version 1.1
FUNCTION   FUNCTION
ID
1     -          Display Menu
2     -          Help
3     -          Choose Service
4     -          Select Options
5     -          Stop
Enter a function ID value: 3                  ❷
OPTION               OPTION
ID
1     -          Find Services
2     -          Enter known Service Name
Enter an Option ID value: 1                   ❸

Working
Servers found:: 3
Service Name Format:
Service Number
Service Name
Server Name
Ethernet ID
#1
INFO4$RZ57
INFO4
08-00-2B-26-A6-98

#2
6000_DIAG_H
INFO3
08-00-2B-16-04-D4
#3
VAX7000_V01
OPUS_ESS
08-00-2B-18-A9-75
Enter a Service Number or <CR> for more: 3      ❹
```

```
                              All Rights Reserved.
       Loadable Environment Rev: V1.0-1625    Jul 12 1992  10:50:56


                 ***** Loadable Firmware Update Utility *****
                  Version 2.1                  16-jun-1992


------------------------------------------------------------------
     Function      Description

------------------------------------------------------------------

     Display       Displays the system's configuration table.
     Exit          Return to loadable offline operating environment.
     List          Lists the device types and firmware revisions
                   supported by this revision of LFU.
     Modify        Modifies port parameters and device attributes.
     Show          Displays device mnemonic, hardware and firmware
                   revisions.
     Update        Replaces current firmware with loadable data
                   image.
     Verify        Compares loadable and device images.
     ? or Help     Scrolls the function table.
------------------------------------------------------------------

Function?          ❺
```

❶ Enter the **boot** command to boot from the InfoServer. Note that the ISL file name must be typed in upper case. The final two characters are the ISL file version, which you can read from the last two characters of the volume label printed on the CD- ROM.

❷ Enter 3, to select Choose Service from the Function menu.

❸ Enter 1 to select Find Services from the Option menu.

❹ Enter the number of the service named VAX7000_Vnn. This service name is the volume label printed on the CD- ROM. In this example, service number 3 supplies the console CD- ROM.

❺ LFU starts, displays a summary of its commands, and issues its prompt (Function?).

C.3 Show

The show command shows the current revision of firmware and hardware for every module in the system that contains microcode. In the display, each module that needs to be updated is indicated by a plus sign (+) following the device mnemonic.

Example C- 3 Show Command

```
Function? show                ❶

Device Mnemonic(s)? ?         ❷
------------------------------------------------------------------
Valid Device
 Entries             Selected function is:
------------------------------------------------------------------
Device Mnemonic#     performed to a single device.
Device Mnemonic*     performed to all devices of the same type.
* or All             performed to all devices in the system.
Exit                 not performed. Program returns to Selection
                     prompt.
------------------------------------------------------------------
Device Mnemonic(s)? exit      ❸

Function? sho *               ❹  ❺

                Firmware        Hardware
                Revision        Revision

kn7aa0  +         1.0             E04
ms7aa0             --              --               not supported.
iop0               --              --               not supported.
xmi0               --              --               not supported.
kdm700            3.0         Cannot be read
demna0            6.8         Cannot be read
demfa0             --              --               not supported.
cixcd0  +        69.0             A01
kzmsa0            4.2              F01

                '+' indicates the update firmware revision
                    is greater than the adapter's firmware revision.
Function?
```

❶ If you type just the command **show** without a device mnemonic, LFU prompts for the device mnemonic. All the commands that require device mnemonics will prompt.

❷ If you enter **?** (or **help**) for the device, a table displays the syntax for specifying devices. All the commands that require device specifications use this syntax. Note the use of wildcards. For example, **show kdm70*** would display all KDM70 controller modules.

❸ If you enter an **exit** command at the device prompt, LFU returns to the function prompt for another command.

❹ The most useful form of the command is **show** * which displays every module in the system. Note in this example that the CPU and CIXCD modules require updating. (In other words, the + means that the firmware version on the CD- ROM is higher than the version on the module.)

❺ VAX 10000 systems do not support kn7aa and kzmsa. The following devices show up in the display instead:

```
ka7aa0  +         1.1             E04
kfmsa0            5.6             A04
```

C.4 List

The list command displays the inventory of update firmware on the CD-ROM. Only the devices listed at your terminal are supported for firmware updates.

Example C-4 List Command

```
Function? l ❶

Loadable Firmware Update Utility      Version 2.1 ❷

Name            Mnemonic        Update Firmware      Update Hardware
                                      Revision              Revision

CIXCD            cixcd*             70.0              A01  -  A01

KDM70            kdm70*              3.0              All Revisions

KN7AA            kn7aa*              1.1              All Revisions

KZMSA            kzmsa*              2.0              All Revisions

Function?
```

❶ The **list** command shows the revisions of firmware corresponding to the revisions of hardware for each device. (There may be several hardware revisions for a particular device, but only one firmware revision corresponds to any hardware revision.) Comparing the output of the **list** and **show** commands helps you understand which devices should receive firmware updates.

❷ VAX 10000 systems do not support kn7aa and kzmsa. The following devices show up in the display instead:

```
KA7AA       ka7aa*              1.1             All Revisions
KFMSA       kfmsa*              5.6             A02  -  A01
                                4.0             All Remaining
                                                Revs
```

C.5 Update

The update command writes new firmware from the CD- ROM to the module. Then LFU automatically verifies the update by reading the new firmware image from the module back into memory and comparing it with the CD- ROM image.

Example C- 5 Update Command

```
Function?  update kn7aa0 cixcd0          ❶

Update kn7aa0? [Y/(N)] y                 ❷

WARNING: updates may take several minutes to complete for each device.

                         DO NOT ABORT!
kn7aa0   Updating to 1.1... Reading Device... Verifying 1.1...PASSED.❸

Update cixcd0? [Y/(N)] y                 ❹

WARNING: updates may take several minutes to complete for each device.

                         DO NOT ABORT!
cixcd0   Updating to 70.0... Reading Device... Verifying 70.0... PASSED.

Function? update *                       ❺

      Name     Type     Rev      Mnemonic  FW Rev   HW Rev
LSB
0+    KN7AA    (8002)   0000     kn7aa0    1.1      E04
7+    MS7AA    (4000)   0000     ms7aa0    N/A      A01
8+    IOP      (2000)   0001     iop0      N/A        A

C0 XMI                                    xmi0
8+    DWLMA    (102A)   A5A6     dwlma0    N/A        A
E+    DEMNA    (0C03)   060B     demna0    6.8

Update ALL devices? [Y/(N)] y            ❻

WARNING: updates may take several minutes to complete for each device.

                         DO NOT ABORT!
kn7aa0  Updating to 1.1... Reading Device... Verifying 1.1...PASSED
ms7aa0  not supported.
iop0    not supported.
xmi0    not supported.
demna0  firmware rev is greater or equal to update rev.
```

```
Continue? [Y/(N)] y        ❼

WARNING: updates may take several minutes to complete for each device.

                          DO NOT ABORT!
demna0  Updating to 6.6... Reading Device... Verifying 6.6... PASSED.
Function? update demna*    ❽

Update all demna?
[Y/(N)] n
Function?
```

❶ This command specifically requests firmware updates for the CPU and CIXCD modules. Note the syntax of a device list, separated by spaces.

❷ LFU requires you to confirm each update, if you named the modules specifically.

❸ Status message reports update and verification progress.

❹ LFU prompts for each device in turn.

❺ This is a second example. When you specify the * wildcard, LFU tries to update all modules.

❻ LFU prints the configuration table and prompts before all devices are updated.

❼ This message appears because, in this example, the firmware on the DEMNA module is not at a lower revision level than the firmware image on the CD- ROM. You can still request LFU to perform the update. If the module version is equal to the update firmware, you may have previously tried the update (making the module and CD- ROM firmware images the same revision). However, if the verification process had reported an error, you can repeat the update. Also, this feature allows you to update a module with an older revision of firmware.

❽ This is another example, using a wildcard to request LFU to update all DEMNA adapters in the system. When you use a device mnemonic followed by a wildcard *, LFU prompts once for all devices of the same type. A wildcard alone updates all devices.

CAUTION: Never abort an update operation; you will corrupt the firmware on the module.

C.6 Exit

The exit command terminates the LFU program, causes system initialization and self- test, and returns to the system console prompt.

Example C- 6 Exit Command

```
Function?  show
Device Mnemonic(s)?  exit      ❶

Function? exit                 ❷

Initializing...

F  E  D  C  B  A  9  8  7  6  5  4  3  2  1  0  NODE #
                    A  M  .  .  .  .  .  P  P  TYP
                    o  +  .  .  .  .  .  +  +  ST1
                    .  .  .  .  .  .  .  E  B  BPD
                    o  +  .  .  .  .  .  +  +  ST2
                    .  .  .  .  .  .  .  E  B  BPD
                    +  +  .  .  .  .  .  +  +  ST3
                    .  .  .  .  .  .  .  E  B  BPD

   .  .  .  .  +  .  +  .  +  .  .  .  +  .     C0 XMI +
   .  .  .  .  +  .  +  .  +  .  .  .  +  .     C1 XMI +
   .  .  .  .  .  .  .  .  .  .  .  .  .  .     C2
   .  .  .  .  .  .  .  .  .  .  .  .  .  .     C3

                    . A0  .  .  .  .  .  .  .  ILV
                    .256  .  .  .  .  .  .  .  256Mb
Firmware Rev = V1.0-1625 SROM Rev = V1.0-0 SYS SN = GAO1234567
P00>>>                         ❸
```

❶ From within the "Device Mnemonic(s)?" prompt, **exit** returns to the Function prompt.

❷ At the Function prompt, **exit** causes the system to be initialized.

❸ The console prompt appears.

C.7 Display and Verify Commands

Display and verify commands are used in special situations. Display shows the physical configuration. Verify repeats the verification process performed by the update command.

Example C- 7 Display and Verify Commands

```
Function? disp      ❶
      Name     Type     Rev    Mnemonic  FW Rev   HW Rev
LSB
0+    KN7AA    (8001)   0000   kn7aa0    1.0      E04
5+    MS7AA    (4000)   0000   ms7aa0    N/A      A01
7+    MS7AA    (4000)   0000   ms7aa0    N/A      A01
8+    IOP      (2000)   0001   iop0      N/A        A

C0 XMI                          xmi0
8+    DWLMA    (102A)   A5A6   dwlma0    N/A        A
C+    KDM70    (0C22)   IE11   kdm700    3.0
E+    DEMNA    (0C03)   060B   demna0    6.6

C1 XMI                          xmi1
1+    ?????    (0000)   0000   unknown0
8+    DWLMA    (102A)   A5A6   dwlma0    N/A        A
A+    CIXCD    (0C05)   EB11   cixcd0    69.0     A01

Function? verify kdm700     ❷

kdm700  Reading Device... Verifying 3.00... FAILED.
At Address 3d830❸Hardware data 41570020  Update data 20200020
At Address 3d834  Hardware data 4E494E52  Update data 20202020
At Address 3d838  Hardware data 54203A47  Update data 54202020
At Address 3d844  Hardware data 65696620  Update data 20202020
At Address 3d848  Hardware data 7420646C  Update data 302E3356
At Address 3d84c  Hardware data 20747365  Update data 20202020
At Address 3d988  Hardware data 69662020  Update data 20202020
At Address 3d98c  Hardware data 00646C65  Update data 00202020
At Address 3d998  Hardware data 73657420  Update data 20202020
At Address 3d99c  Hardware data 65722074  Update data 65722020 ❹
```

❶ **Display** shows the system physical configuration. **Display** is equivalent to issuing the console command **show configuration**. Because it shows the LSB slot for each module, **display** can help you identify unknown devices.

❷ **Verify** reads the firmware from the module into memory and compares it with the update firmware on the CD- ROM. If a module already verified successfully when you updated it, but later failed self-test, you can use **verify** to tell whether the firmware has become corrupted.

❸ The address displayed for a failed compare is relative to the beginning of the update firmware image.

❹ **Verify** terminates after 10 comparisons fail.

Glossary

AC input box

Receives three- phase AC power and outputs that to the power regulators. The system circuit breaker and a Dranetz port are on the AC input box. See also *Power*.

Address space

See *Physical address space* and *Virtual address space.*

Alpha primary boot program (DEC 10000 system)

The Alpha primary boot program (APB.EXE) that boots OpenVMS Alpha AXP. APB is the primary bootstrap program and is stored on the boot device.

Asymmetric multiprocessing

A multiprocessing configuration in which the processors are not equal in their ability to execute operating system code. In general, a single processor is designated as the primary, or master, processor; other processors are the slaves. The slave processors are limited to performing certain tasks, whereas the master processor can perform all system tasks. Contrast with *Symmetric multiprocessing*.

Bandwidth

The data transfer rate measured in information units transferred per unit of time (for example, Mbytes per second).

Battery backup

Provides power to the entire system cabinet (or to an expander cabinet) in the event of a power failure. A system can maintain power for approximately 60 minutes. Each power regulator requires a battery pack of eight batteries.

Boot device

A storage device that holds the software that carries out the system bootstrap process.

Boot primitives
Small programs stored in ROM on each processor with the console program. Boot primitives read the bootblock from boot devices. There is a boot primitive for each type of boot device.

Boot processor
The CPU module that boots the operating system and communicates with the console; also known as the primary processor.

Bootblock
Block zero on the system disk; it contains the block number where the Alpha primary boot (APB), OSF/1 boot, or virtual memory boot (VMB) program is located on the system disk and contains a program that, with the boot primitive, reads APB or VMB from the system load device into memory.

CD- ROM, DEC 10000, VAX 10000 Console CD- ROM
Contains the LFU utility used in upgrading firmware and copies of the firmware for all modules in the system, including the console and diagnostic firmware.

Centerplane
The LSB backplane, located in the center of the card cage, which physically shortens the bus thus increasing bandwidth.

CCL module
Module at the top right of the system cabinet that provides the control panel interface and power sequencing; includes air pressure and temperature sensors.

CIXCD
XMI CI port interface; connects a system to a Star Coupler.

Compact disk server
In- cabinet CD server (for DEC 10000 systems) or Ethernet- based CD server (for VAX 10000 systems); provides access to CD- ROMs for software installation, diagnostics, and on- line documentation.

Console language

Used by the system operator at the console terminal to communicate with the primary processor; provides the interface to diagnostics. The console language uses options, environment variables, and arguments.
Options modify the action of the command in some way, or give details of how the command is to operate; they appear in the form - xxx and are preceded by a space.
Environment variables determine the environment; some are set in manufacturing and set up a default environment. Most environment variables are defined with the **set** command. See also *Environment variables*.

Console mode

A mode of operation where the processor is not running the operating system but allows a console terminal operator to communicate with nodes on the LSB bus and I/O bus adapters and devices.

Console program

The code that the boot processor executes during console mode. Each processor has a copy of this code in flash ROMs. After a boot processor has been determined, that processor begins console initialization. The console code is then loaded into memory.

Control panel

Consists of a keyswitch to control the state of the system and three status LEDs.

CPU module

The KN7AA processor is the CPU module used in DEC 10000 systems. The KA7AA processor is the CPU module used in VAX 10000 systems.

Device

From the console perspective, "device" can be used to refer to a physical device, a block of memory, or a set of registers. The console commands operate on byte streams, so any of these can be expressed as a byte stream.

Each physical device in a system has a unique mnemonic assigned by the console program, which is displayed as part of the **show configuration, show device**, and **show network** commands.

DEMFA

XMI adapter to the FDDI (Fiber Distributed Data Interface).

DEMNA
XMI adapter; Ethernet port interface.

DSSI
Digital Storage Systems Interconnect. A Digital Storage Architecture interconnect used by the KFMSA adapter and RF and TF series integrated storage elements to transfer data and to communicate with each other.

DSSI PIU
Houses DSSI based disks inside the system and expander cabinets (BA654).

DWLMA adapter
An XMI adapter that is the interface between the LSB bus and the XMI bus; always node 8 of the XMI. The XMI plug- in unit includes the T2028-AA module and necessary cables and the XMI clock card. See also *XMI PIU* and *XMI clock*.

DWMBB
The XMI- to- VAXBI adapter; a 2- module adapter that allows data transfer from the XMI to the VAXBI.

Environment variables
UNIX- like options used with console commands. An environment variable consists of an identifier (ID) and a byte stream value maintained by the console. See also *Console language.*

Expander cabinet
A cabinet to hold plug- in units that can be installed on either side of the system cabinet.

FDDI
Fiber Distributed Data Interface. A high- performance fiber optic network that can be accessed by the XMI DEMFA adapter.

Filler module
Required to fill unused LSB slots when fewer than six CPU, memory, or I/O modules are installed.

Flash ROM

Flash- erasable programmable read- only memory, which can be bulk erased and reprogrammed. The KN7AA and KA7AA processors use flash ROMs to hold the console and diagnostic firmware. In addition, one flash ROM holds initialization code that bootstraps the main console/diagnostic firmware. It also holds flash ROM recovery code. See also *SROM code* and *Flash ROM recovery code.*

Flash ROM recovery code (FRRC)

The minimum amount of code necessary for remote flash ROM recovery; used if the console/diagnostic ROMs have become corrupted.

Gbus

The path between the processor and the console/diagnostic firmware and to two UART chips. The Gbus has two lines, one to the console terminal and one to the power supply.

Hardware restart parameter block (HWRPB)

A page- aligned data structure shared between the console and system software; a critical resource during bootstraps, recovery from power failures, and other restart situations.

Hose

The interconnect between the IOP module on the LSB bus and the interface module on another bus, such as the DWLMA module on the XMI bus.

IOP module (I/O port module)

The LSB module that provides the interface from the LSB bus to I/O buses. The IOP module has four ports to support up to four I/O channels. Each channel is known as a "hose." The IOP module must be node 8 of the LSB. Node 8 is dedicated as both the highest and lowest arbitration level; the IOP usually arbitrates at the highest priority. Besides providing for I/O, the IOP module also generates the clock signals for the LSB bus.

KA7AA CPU module (VAX 10000)

The LSB CPU module that uses the NVAX+ chip, a CMOS- 4 implementation with a macropipelined design. An 8- Kbyte cache is part of the CPU chip and a 4- Mbyte cache is implemented in RAMs. The KA7AA processor supports writeback caching.

KN7AA- AB CPU module (DEC 10000)

The LSB CPU module that uses the DECchip 21064 using CMOS- 4 implementation with a super scalar super- pipelined design. An 8- Kbyte cache is part of the CPU chip and a 4- Mbyte cache is implemented in RAMs. The KN7AA- AB processor supports writeback caching.

KDM70

XMI adapter for RA disks and TA tapes used to enable connection to nodes on a DSSI bus.

KFMSA

XMI adapter for RF disks and TF tapes used in VAX 10000 systems. It enables connection to nodes on a DSSI bus. Each KFMSA adapter supports two DSSI buses.

KZMSA

XMI adapter to the SCSI (Small Computer System Interface) used in DEC 10000 systems. It enables connection to nodes on a SCSI bus.

ISE (integrated storage element)

All DSSI storage devices, such as RF disks and TF tapes, are ISEs.

LDC (local disk converter)

Converts 48 VDC to +5V and +12V needed by the storage arrays in the DSSI PIU (BA654).

LEVI interface

The logical and physical interface of the CPU module to the LSB bus. Two different chips are used. The LEVI interface also determines if data is in the backup cache or if it must do a transaction to memory.

LFU (Loadable Firmware Update) Utility

Used to update firmware on LSB and I/O device modules.

LSB bus

The 128- bit system bus. The LSB bus is implemented in a 9- slot card cage with its "backplane" in the center of the cage, so that modules are installed from the front and the back. Module placement is indicated by a node number 0 through 8. Node 8 is reserved for the LSB I/O port (IOP) module.

Mailbox

A software- created data structure in memory used to read and write to I/O device registers.

Memory

Systems use the MS7AA memory modules, available with 64, 128, 256, or 512 Mbytes of memory. Total memory supported is determined by the operating system. Memory transfers are 64 bytes in length.

Memory interleaving

Method to optimize memory access time; the console program automatically interleaves the memories in the system unless a command is used to set a specific interleave or no interleave (which would result in serial access to each memory module). Interleaving causes a number of memories to operate in parallel.

More protocol

A protocol used on the XMI bus that allows XMI nodes to make noninterlocked memory reads and writes. Using the More protocol increases I/O performance.

Node, LSB

LSB nodes are numbered from 0 to 8 and correspond to specific slots in the LSB card cage.

Physical address space

The 1 terabyte of physical address space that the LSB bus can access using a 40- bit memory address space.

Power

Three- phase AC power is supplied to the AC input box which is then fed to three power regulators that provide 48 VDC. Power enters the LSB card cage through a 48V filter and then is distributed to the bus bars on the centerplane. Each module on the LSB bus has a power converter, which converts the 48V to the voltage required by the module. Power sequencing logic is provided by the CCL module. Plug- in units are powered by the system, but in addition bus PIUs have their own power regulators. Batteries in the system cabinet and expander cabinet(s) supply power to the system for approximately 60 minutes.

Plug- in units (PIUs)

Self- contained assemblies that are easily installed in the system cabinet or expander cabinet. There are PIUs for the XMI bus, the VAXBI bus, disks, and batteries.

Reset sequence

A process leading to the execution of a copy of the console firmware from memory. Purpose is to test the machine, establish the console environment, indicate that the console is executing, and dispatch to entry handling procedures. Power- up testing executes from the backup cache, a boot processor is determined, which creates the HWRPB and copies the console image from ROM/cache to memory. Registers are set to their default values, and internal console data structures are initialized. After power- up the secondary processors also use the console code from memory.

SCSI (Small Computer System Interface)

An industry- standard interface for connecting disks and other peripheral devices to computer systems. Requires the KZMSA XMI adapter.

SCSI PIU

Houses SCSI based disks and tapes inside system and expander cabinets (BA655).

SROM (serial ROM) code

The initialization code that bootstraps the main console/diagnostic firmware.

Symmetric multiprocessing

A multiprocessing system configuration in which all processors have equal access to operating system code residing in shared memory and can perform all, or almost all, system tasks.

Transactions

LSB transactions consist of a command and four data cycles, which follow some fixed time after an arbitration cycle. All LSB modules monitor the request lines to see which of them wins the bus. Up to three transactions can be in progress at one time. Because arbitration occurs on a dedicated set of control lines, it can overlap with data transfer.

TF85 tape drive

A 5.25- inch tape drive on the DSSI bus, which is supported by the KFMSA adapter; used in VAX 10000 systems.

TLZ06 tape drive

A 5.25- inch tape drive on the SCSI bus, which is supported by the KZMSA adapter; used in DEC 10000 systems.

VAXBI PIU

A plug- in unit consisting of a VAXBI card cage and two power regulators which occupy two quadrants. The VAXBI PIU must be installed next to an XMI PIU. Installation of a VAXBI PIU means that battery backup cannot be supported. The 12- slot VAXBI includes a DWMBB/B module installed in slot 1, which connects to the DWMBB/A in the XMI.

Virtual address space

Memory space available to a user program. The operating system dynamically maps a given virtual address to a physical adddress.

VMB

The virtual memory boot program (VMB.EXE) that boots the OpenVMS VAX operating system. VMB is the primary bootstrap program and is stored on the boot device.

XMI clock

Implemented on the T2030- YA module which must be node 7 of the XMI.

XMI PIU

A plug- in unit consisting of an XMI card cage and two power regulators which occupy two quadrants. Each XMI requires a DWLMA module in slot 8 and a clock module at slot 7. The first I/O option must be installed in slot 1 or 14 to terminate the XMI bus. Also known as the XMI I/O channel PIU.

XMI- to- LSB interface

On the XMI the interface is the DWLMA module which must be node 8 of the XMI. On the LSB bus the interface is the IOP module, which must be node 8 of the LSB. The connection between the two modules is known as a "hose." See also *IOP module*.

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