DECsystem 5500
Operation

Order Number EK–332AA–OP–001

Digital Equipment Corporation
Maynard, Massachusetts

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Preface

This manual describes how to use the DECsystem 5500 system. The system uses the RISC-based KN220 CPU module set and ULTRIX operating system. The DECsystem 5500 system is housed in the BA430 pedestal enclosure.

The manual is structured as follows:

- Chapter 1 provides an overview of the system.

- Chapter 2 describes how to use the system.

- Chapter 3 describes how to use options installed in the system.

- Appendix A lists related documentation.

- A glossary explains key terms.

Conventions

The following conventions are used in this manual:

Convention	Meaning
Return	A key name is shown enclosed to indicate that you press a named key on the keyboard.
Ctrl/x	A sequence such as Ctrl/x indicates that you must hold down the key labeled Ctrl while you press another key.
[ ]	Arguments enclosed in square brackets are optional.
Italic type	Italic type indicates an argument for which you must supply a value, environment variables, and references to other documents.
bold	This bold lowercase type indicates a command name. For example: The **setenv** command is described in the next section.
bold user input	This bold upper or lowercase type indicates user input. For example: Type **maint** at the console prompt. or >>> **show device**
NOTE	Notes provide general information about the current topic.
CAUTION	Cautions provide information to prevent damage to equipment or software. Read these carefully.
WARNING	Warnings provide information to prevent personal injury. Read these carefully.

Chapter 1

System Overview

DECsystem 5500 systems house all components in a BA430 enclosure. This enclosure is a free-standing pedestal that houses the following:

- Card cage

- System controls

- Central processing unit (CPU) module set

- Memory modules

- Communications controller modules

- Tape drive controller module

- Console module

- RF-series or RZ-series Integrated Storage Elements, or both

- TK70 tape drive or TLZ04 tape drive

- Power supply

- Fans

Up to four storage devices in the following combinations can be mounted inside the BA430 enclosure:

- Four RF-series or RZ-series Integrated Storage Elements (ISEs), or a combination of both

- One tape device, the TK70 or TLZ04 tape drive, and up to three RF-series or RZ-series ISEs, or a combination of both

This chapter describes the system components and their functions.

Chapters 2 and 3 describe how to use the system and options.

1.1 Front View and Physical Description

The front of the system has a divided door that restricts access to the system controls. Figure 1–1 shows the system with the front door closed.

Figure 1–1: DECsystem 5500 System
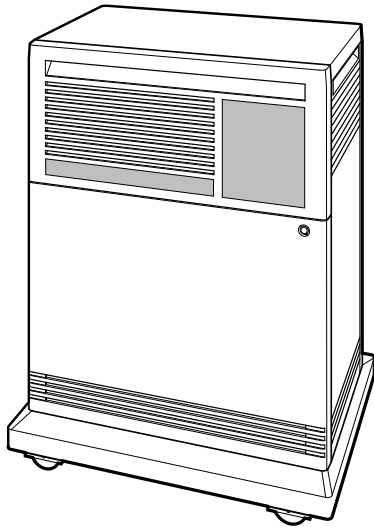
MLO-004032

A three-position rotary lock allows you to lock both the upper and lower doors, or to lock just the lower door. Opening the upper door allows you to access the controls for the storage devices and the System Control Panel (SCP). Opening the entire door allows you to access all system controls and cable connections.

Figure 1–2 shows the three key positions and the controls accessible in each position.

Figure 1–2:   Key Positions

Door Handle

Rotary Key Lock

Top Key Position:
Access to SCP, ISEs, and
Tape Drive Controls and
Indicators (Upper Door)

Middle Key Position:
No Access to Controls

Bottom Key Position:
Access to Power Switch;
All Controls and Indicators
(Both Doors)

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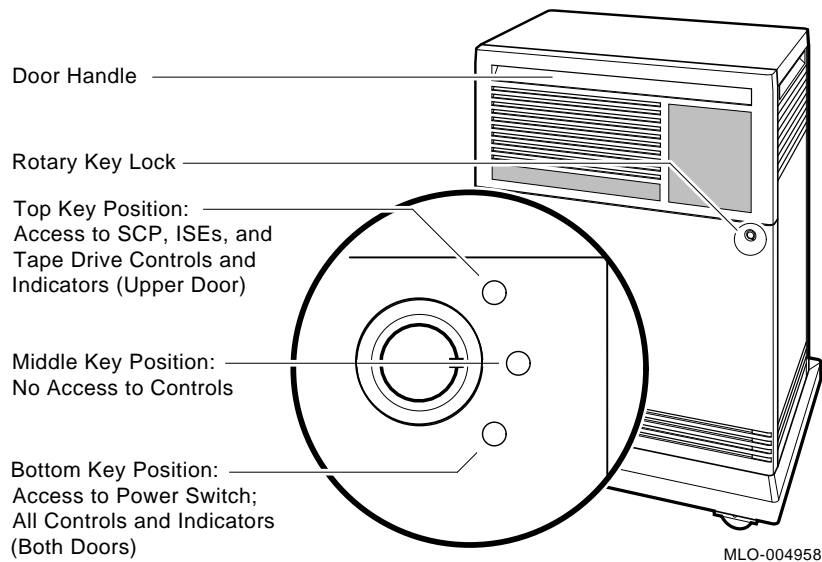
Opening and Closing the Divided Door

The divided door allows you to access the mass storage devices and system
control panel (SCP), while restricting access to the power switch and the
console module. Open and close the door as follows:

1. Insert the key in the lock on the front door. Turn the key to the top
    position (Figure 1–3) to open just the upper portion of the door, or to
    the bottom position (Figure 1–4) to open the entire door.

    With the key in the bottom position, the upper and lower doors will
    open together.

2. Swing the door open.

3. To close the door, simply reverse the procedure. When pushing the
    doors closed, push gently at the top right of the upper door and the
    bottom right of the lower door.

Figure 1–3:   Upper Door Opened
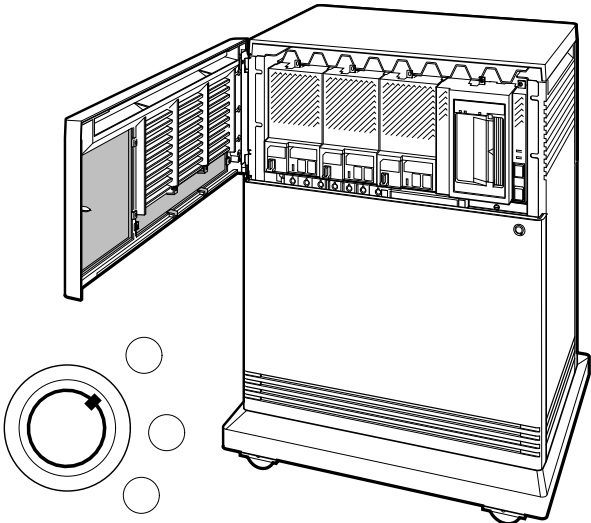
Top Key Position

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Figure 1–4: Entire Door Opened

Bottom Key Position

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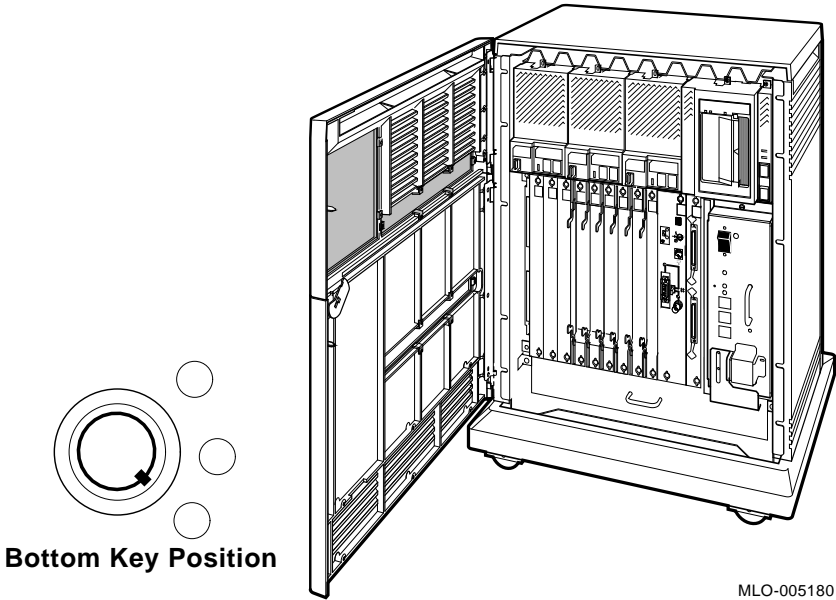
The next section describes the BA430 enclosure, which is exposed when you open the entire door.

1.1.1 The BA430 Enclosure

Opening the front door enables you to access the components housed in the BA430 enclosure. Figure 1–5 shows a typical configuration.

The BA430 enclosure can contain the following:

- Mass storage —

  - TK70 or TLZ04 tape drive and up to three RF-series or RZ-series ISEs, or a combination of both

  - No tape drive and up to four RF-series or RZ-series ISEs, or a combination of both

All DECsystem 5500 systems contain the following:

- System Control Panel (SCP)

- Card cage containing modules — CPU, memory, communications controllers, mass storage controllers

- CPU cover panel

- Power supply

- Fans

Figure 1–5: Front View of the BA430 Enclosure

Integrated Storage Elements (ISEs)

Tape Drive

System Control
Panel (SCP)

Power Supply

CPU Cover Panel

Fans

Card Cage
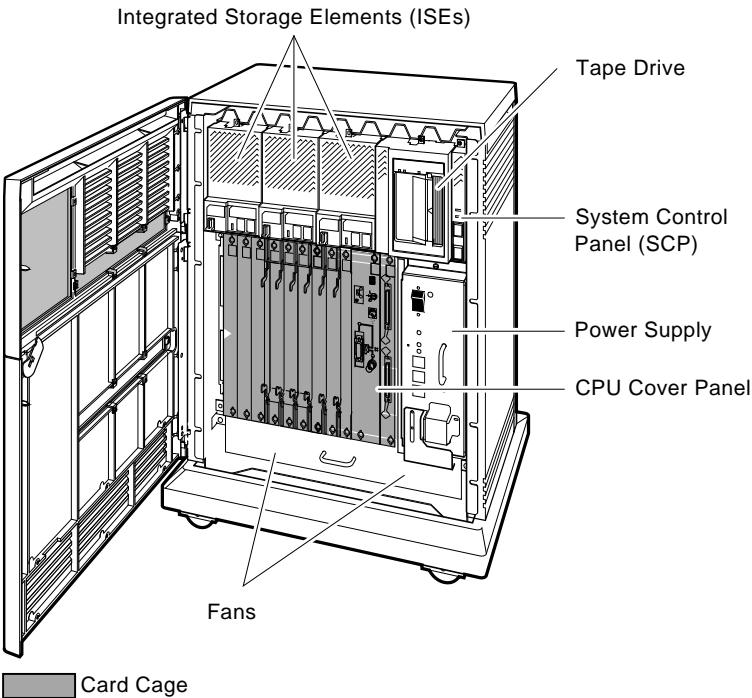
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1.1.1.1 Mass Storage Shelf

The mass storage shelf extends across the top of the enclosure. The shelf contains a system control panel (SCP), tape device, and up to three RF-series or RZ-series ISEs (tapeless systems can have up to four ISEs). Each ISE has its own panel with controls and indicators. Instructions for using mass storage devices are in Chapter 3. The SCP is to the right of the storage devices. Figure 1–6 shows the mass storage shelf.

NOTE: *RZ-series hard disk drives do not have controls or indicators on their front panel.*

Figure 1–6:   Mass Storage Shelf

MLO-005386
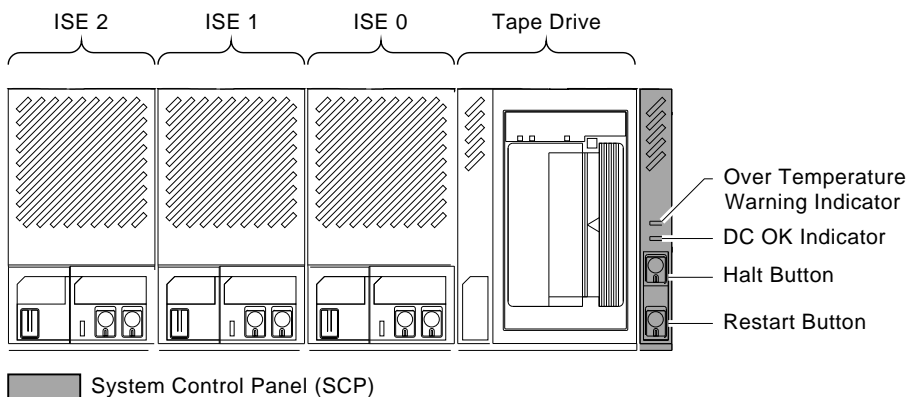
The SCP has two indicators: the DC OK indicator and the Over Temperature Warning indicator. The green DC OK light indicates that the power supply voltages are within the correct operating range. If the DC OK indicator is not lit when the system power is on, refer to the *DECsystem 5500 Troubleshooting and Diagnostics* manual included in the Customer Hardware Information Kit.

The red Over Temperature Warning indicator flashes to indicate that the system's internal temperature is approaching a level that may cause system components to overheat. In addition to the flashing Over Temperature Warning light, an audible alarm also provides warning of a possible over temperature condition. If the components continue to heat, the system will automatically shut down to prevent components from being damaged. Chapter 2 provides instruction for turning on the system after a preventive shutdown due to overheat conditions.

Below the indicators are the Halt and Restart buttons. The Halt button is a two-position button. When you press the button, the system halts. A red indicator on the Halt button lights when the button is set to the in position. Before you can enter console commands, you must press the Halt button again to return it to the out position. When the Halt button is returned to the out position, the console mode prompt (>>) is displayed on the console terminal screen. Now you can enter console commands. If you inadvertently press the Halt button, enter `continue` Return to continue. Chapter 2 describes halting the system in more detail.

CAUTION: *Pressing the Halt button halts the system regardless of the setting of the Function switch on the console module.*

Below the Halt button is the Restart button. The Restart button has a green indicator. When you press the Restart button, the system returns to a power-up condition and self-tests are run. If the *bootmode* variable is set to *a* and you have assigned a value to the *bootpath* environment variable, the system will reboot system software. Chapter 2 contains additional instructions on restarting your system.

NOTE: *The Halt and Restart buttons can be disabled to prevent accidental activation. Contact your Digital service representative if you want to disable the controls on the SCP.*

1.1.1.2 Card Cage

The modules in your system are mounted in a 12-slot card cage under the mass storage shelf, as shown in Figure 1–7.

Figure 1–7: Card Cage
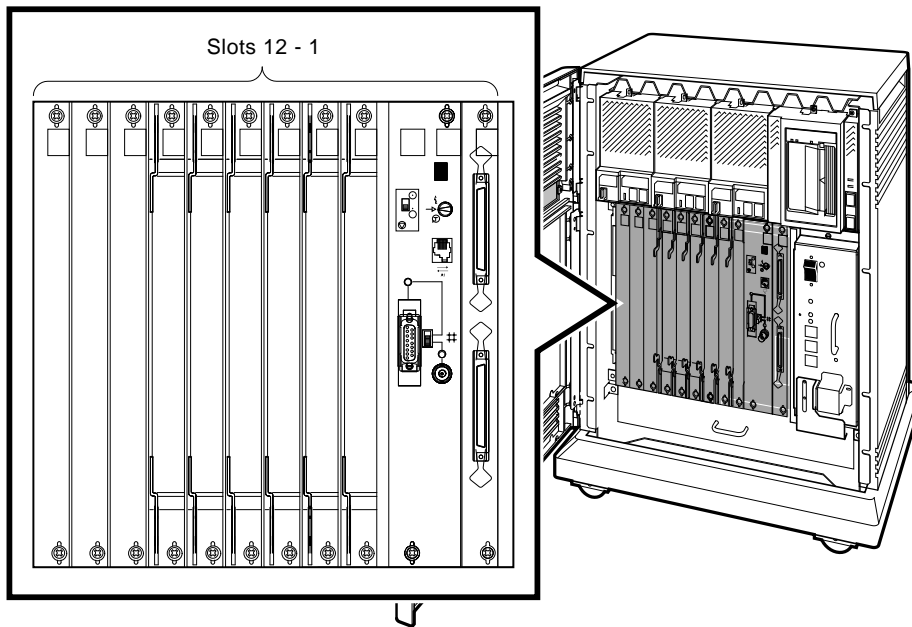
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The central processing unit (CPU) module set is installed in slots 1 and 2 with its associated memory module in slot 3. Additional memory modules may be installed in slots 4 through 6. Remaining slots are available for Q-bus option modules.

The number and type of modules installed in your system depend on your configuration. Each Q-bus slot, even an empty one, is protected by a module cover. Together the covers form a shield. The purpose of the shield is as follows:

- To protect external devices from electrical interference generated by the system

- To protect the system from electrical interference generated by external devices

- To maintain air flow integrity

CAUTION: *Do not operate the system without Digital-supplied module covers. The covers are required to protect the equipment and to meet*

international regulatory standards. Do not substitute other module covers as they may not meet the required specifications.

Operating the system without the module covers has the following consequences:

- *The system may overheat due to improper air circulation.*

- *The system will not comply with FCC and VDE requirements for electrostatic shielding and may produce electrical interference that affects other equipment.*

- *The system is susceptible to electrical interference or damage from external sources.*

The design of the module covers varies, depending on the type of module installed in the slot. Modules requiring external cable connections, such as communications controllers, have recessed covers that are riveted directly to the module. The recessed module covers allow space for connecting cables. Modules requiring no external cable connections, such as mass storage controllers, are covered by flush covers. Empty slots are also covered by flush covers which may be single or double width. All covers, except those covering empty slots, have a label identifying the module installed in the slot.

Cables connecting your system to peripheral devices (such as terminals, modems, and printers) are attached to communications controllers. Each cable can contain multiple lines. The cables run under the BA430 enclosure and out the back or side of the enclosure, where the cables are split into individual lines. Chapter 3 describes these connections in more detail.

1.1.1.3 CPU Cover Panel

The CPU module set is behind a double-width cover panel that has internal cable connections to the memory module(s). Figure 1–8 shows the CPU cover panel.

Figure 1–8: CPU Cover Panel
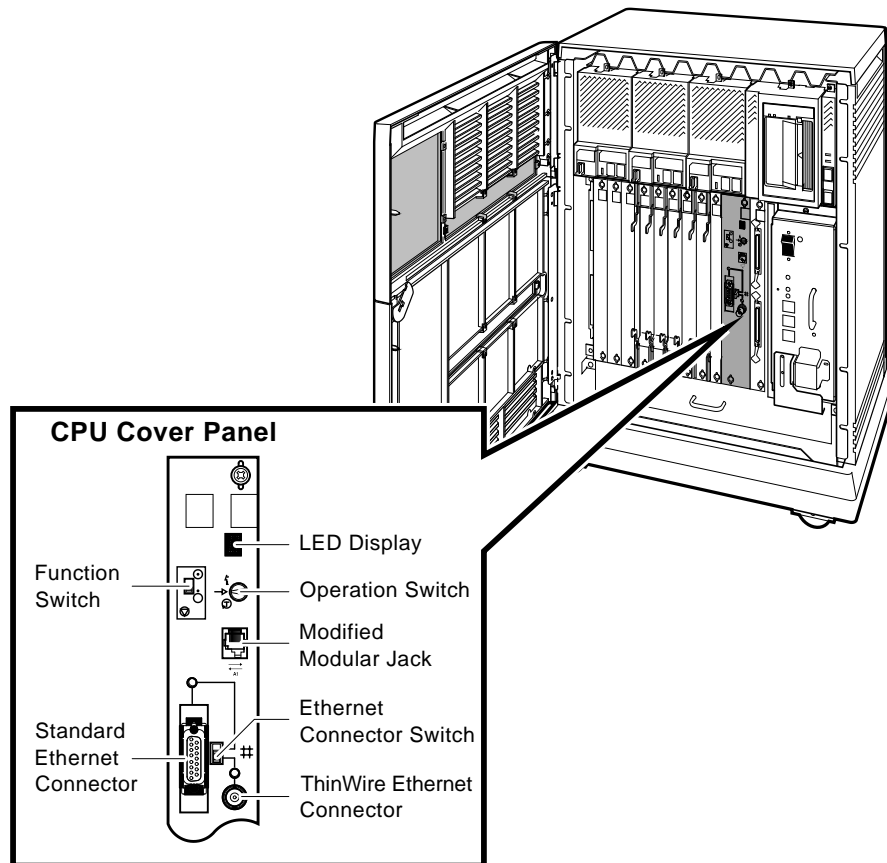
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The CPU cover panel has the following components:

⊘ Function switch — When the switch is down (dot outside the circle), breaks are disabled. When the switch is up (dot inside the circle), breaks are enabled. When breaks are enabled, pressing Break on the console terminal halts the processor and transfers control to the console program.

The setting of the Function switch is also used in conjunction with the three-position Operation switch to control what occurs during a power-up sequence.

- Operation switch — This three-position rotary switch determines how the system responds at power-up. The Operation switch and its uses relative to the Function switch setting are described below:

Action Mode — If the Function switch is set to down (dot outside the circle), the system displays a Language Selection Menu at power-up. If your console terminal does not support multiple languages, it defaults to English. After you select a language, the power-up tests are run, and the console prompt (>>) is displayed.

If the Function switch is set to up (dot inside the circle), the console serial line external loopback test is executed. This function requires special loopback connectors and is for Digital Field Service use only.

Normal Mode — Power-up self-tests run, and the system either enters Normal console mode, indicated by the >> prompt, or the system autoboots from a device previously defined by the user. The system autoboots only if you have set the *bootmode* environment variable to *a*, and have assigned a value to the *bootpath* environment variable.

If the Function switch is set to up (dot inside the circle), breaks are enabled. If the Function switch is set to down (dot outside the circle), breaks are disabled.

Maintenance Mode — Power-up self-tests run. Then the system enters Maintenance mode, indicated by the >>> prompt.

The light-emitting diode (LED) display shows the testing sequence during power-up.

Modified modular jack (MMJ) — This console terminal connector provides the connection for the console terminal.

Ethernet connectors — The CPU cover panel has two Ethernet connectors: a BNC-type connector for ThinWire Ethernet, and a 15-pin connector for a standard Ethernet transceiver cable. The Ethernet connector switch allows you to set the type of connection.

To use the standard transceiver cable connection, set the switch to the up position. To use the ThinWire cable connection, set the switch to the down position. A green indicator light (LED) for each connector indicates which connection is active.

1.1.1.4 DSSI and SCSI Connectors

Two panels provide connectors for DSSI and SCSI busses. The connectors allow you to expand your system by connecting additional mass storage devices to the busses. Figure 1–9 shows the locations of the DSSI and SCSI connectors available for mass storage expansion.

Figure 1–9: Connectors for DSSI and SCSI Busses

Internal SCSI Bus

DSSI BUS

SCSI In/Out

SCSI In/Out
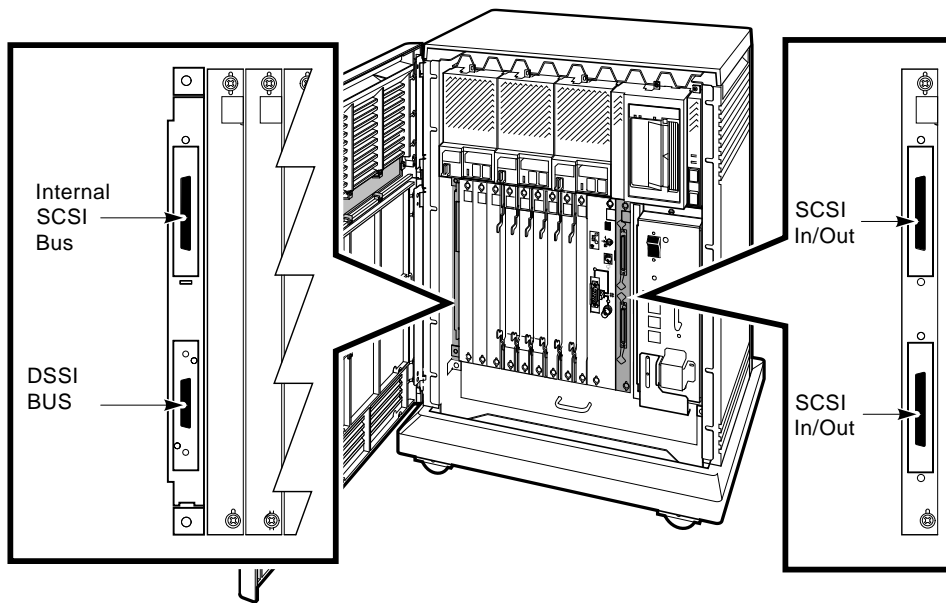
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1.1.1.5 Power Supply Controls and Indicators

To the right of the card cage is the power supply. The power supply provides power to the mass storage devices, the modules installed in the card cage, and the fans.

To prevent damage due to overheating, the power supply monitors the internal temperature and the speed of the fans. If the power supply detects overheating or a fan failure, the power supply will shut down the system.

Figure 1–10 shows the controls and indicators on the power supply.

Figure 1–10: Power Supply Controls and Indicators
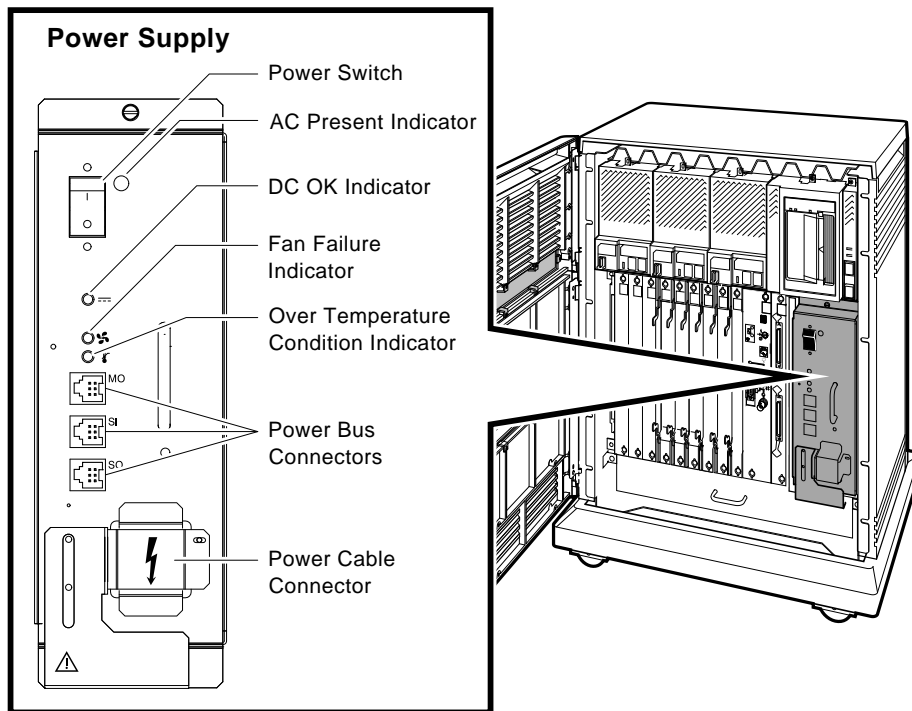
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The controls and indicator lights function as follows.

Power switch — The power switch is used to turn system power on and off. The off position is indicated by a 0; the on position is indicated by a 1.

The power switch also functions as the system circuit breaker. In the event of a power surge, the breaker will trip, causing the power switch to return to the off position (0). Turning on the system resets the circuit breaker. If the circuit breaker trips, wait one minute before turning on the system again.

- AC Present Indicator — The orange AC Present indicator lights when the power switch is set to on and voltage is present at the input of the power supply. If the AC Present indicator does not light when the power switch is set to on, refer to your *DECsystem 5500 Troubleshooting and Diagnostics* manual.

DC OK — When the green DC OK indicator is lit, the power supply voltages are within the correct operating range. If the DC OK indicator does not light when the power switch is set to on, refer to your *DECsystem 5500 Troubleshooting and Diagnostics* manual.

Fan Failure indicator — The amber Fan Failure indicator lights if either of the two cooling fans stop working. The power supply will automatically shut down the system as a precautionary measure when a fan failure is detected. Call your Digital service representative if a fan failure occurs.

Over Temperature Condition indicator — The amber Over Temperature Condition indicator lights if the enclosure has shut down due to an over temperature condition. Section 2.10 provides instructions on recovering from an over temperature condition.

- Power bus connectors — Three power bus connectors allow you to configure a power bus for systems expanded with a B400X or R400X expander. The power bus allows you to turn power on and off for one or more expanders through the power supply designated as the main power supply; this way, one power switch can control power for an entire expanded system. Figure 1–11 illustrates a possible power bus configuration for an expanded system.

MO The main out (MO) connector sends the power control bus signal to the expander. One end of a power bus cable is connected here, the other end is connected to the secondary in (SI) connector of an expander power supply.

SI The secondary in (SI) connector receives the power bus control signal from the main (system) power supply. In a power bus with more than one expander, the power control bus signal is passed along, using the secondary in and out connectors as shown in Figure 1–11.

SO   The secondary out (SO) connector sends the signal down the power bus for configurations of more than one expander.

Figure 1–11:   Sample Power Bus Configuration
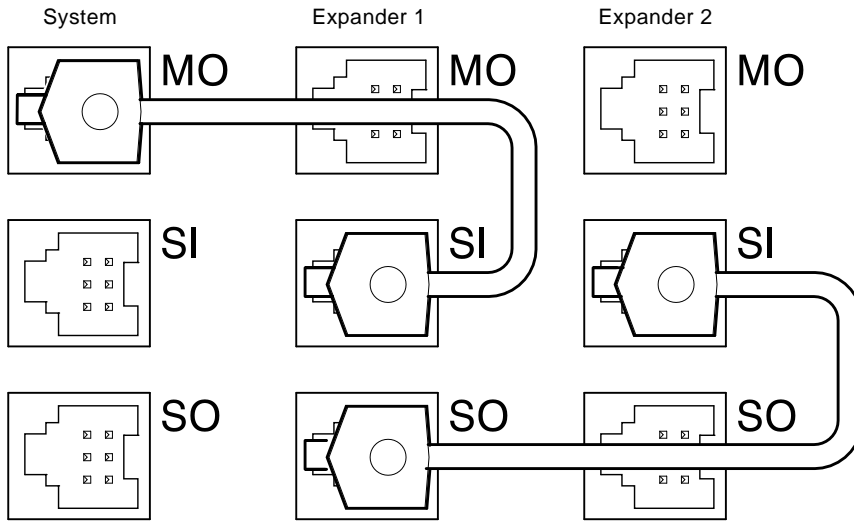
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1.1.1.6 Fans

Two fans located under the card cage draw air in through the top of the enclosure, down through the card cage, and out the bottom. The speed of the fans varies, depending on the surrounding room temperature. To reduce the load on the fans, keep the system away from heat sources. Figure 1–12 shows the air flow through the system enclosure.

NOTE: *The power supply monitors the fans. If either fan stops working, the Fan Failure indicator on the power supply lights, and the system automatically shuts down as a precautionary measure. Call your Digital service representative if a fan fails.*

NOTE: *The fan speed control can be set so that the fans will run at their maximum speed. This setting is recommended if you want potentially higher system module reliability, and do not object to the increased fan noise. Contact your Digital service representative to override the fan speed control.*

Figure 1–12:   System Air Circulation

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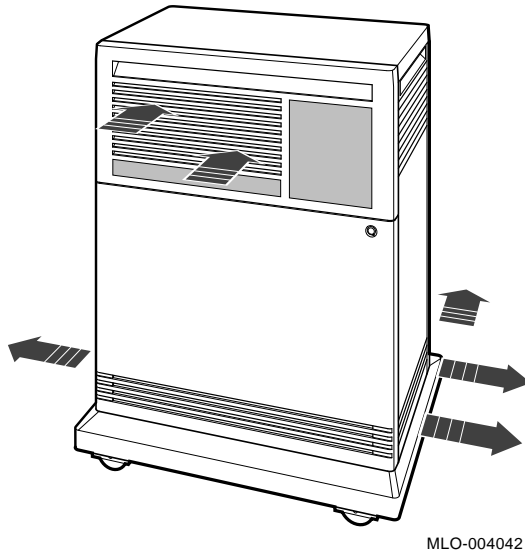
1.2 Functional Description of Base System

Each DECsystem 5500 includes base system components common to all systems. Your system may have optional components as well. Your system was configured at the factory, based on your order.

The following sections describe base system components and options, in turn.

1.2.1 Base System Components

Base system components include the following:

- Central processing unit (CPU)
- Console serial line unit (SLU)
- Main memory
- Network controller
- Embedded DSSI adapter
- Embedded SCSI adapter

1.2.1.1 Central Processing Unit (CPU)

The central processing unit (CPU) controls the execution of all instructions and processes. The CPU circuits contain the logic, arithmetic, and control functions used by the system. DECsystem 5500 systems use the RISC-based KN220 CPU module set.

1.2.1.2 Console Serial Line Unit (SLU)

Each system has a serial line unit connecting the console terminal to the system. The SLU connector (a modified modular jack) is located on the CPU cover panel. The console serial line provides a means of communicating with the CPU.

1.2.1.3 Main Memory

Main memory provides the electrical storage area for data and instructions used by the CPU. When you start your system, the operating system is loaded into main memory. Application programs must also be loaded into memory.

When the system cannot load everything into memory at once, it reads in units of data called pages (512 bytes of data) from disk. A large main memory increases the efficiency of processing, since fewer pages must be copied to and from the disk. Each configuration comes with a standard memory option and capacity for up to four memory modules. By adding more main memory, you can increase efficiency.

The contents of memory are volatile. This means they are lost when you turn off power to the system. Use mass storage devices, such as integrated storage elements and tape cartridges, to store software and data permanently.

1.2.1.4 Network Controller

Network communications controllers allow you to connect to an Ethernet network. With a network connection and appropriate network software, you can use network services, such as mail; access data stored on other systems; perform operations, such as editing and printing on remote systems; and share resources, such as laser printers. Your system comes with an on-board Ethernet controller that is part of the CPU module set. The system can be connected to either a standard Ethernet cable or a ThinWire Ethernet cable. Connectors for both types of cables are on the CPU cover panel.

1.2.1.5 Embedded DSSI Adapter

Your system has a Digital Storage System Interconnect (DSSI) adapter built into the CPU. The DSSI adapter provides a DSSI bus through which the CPU can communicate with the RF-series ISEs. A DSSI bus can support seven RF-series ISEs.

1.2.1.6 Embedded SCSI Adapter

Your system has a Small Computer System Interface (SCSI) adapter built into the CPU. The SCSI adapter provides a SCSI bus through which the CPU can communicate with the RZ-series ISEs, TLZ04 tape drive, or RRD40 compact disk drive. A SCSI bus can support up to seven devices.

1.2.2 Optional Components

System options can include multiples of components that are part of the base system (for example, additional memory modules or ISEs) and the following kinds of options:

- Mass storage devices and controllers

- Mass storage subsystems

- Mass storage expanders

- Communications controllers and adapters

- Printer interfaces

1.2.2.1 Mass Storage Devices and Controllers

Mass storage devices record data on magnetic media. The data recorded is not lost when you turn off the system, but can be altered or erased if you record over the data. Use mass storage devices to store data and software permanently. When the data or software is needed, the CPU transfers it from the mass storage device into main memory. The two primary types of mass storage devices are the RF-series or RZ-series ISEs, and devices with removable media, such as tape cartridges and compact disks.

RF-Series Integrated Storage Elements (DSSI)

Up to four DSSI RF-series ISEs can be installed in your system. An ISE is an intelligent storage device that contains its own controller. Special mounting hardware allows the device to plug directly into the BA400-series backplane.

RZ-Series Integrated Storage Elements (SCSI)

Up to four SCSI RZ-series ISEs can be installed in your system. RZ-series ISEs deliver the capacity, speed, and dependability required by DECsystem

5500 systems, while meeting SCSI standards. Each RZ-series ISE contains its own controller. Special mounting hardware allows the device to plug directly into the BA400-series backplane.

Devices with Removable Media

Devices with removable media, such as tape cartridges, are used as both input and output devices. In addition, compact optical disks are used as input devices when you install software or copy data to your system. You use tape cartridges and tapes as output devices when you copy software or data from your system. You can copy individual files or programs, or you can copy (back up) the contents of an entire fixed disk. Tapes are commonly used to archive data.

Mass Storage Controllers and Adapters

All mass storage devices require a controller, a device that controls activity between the CPU and the mass storage devices. While RF-series ISEs, RZ-series ISEs, and the TLZ04 tape drive have built-in controllers, other storage options require a controller module located in your system's card cage. The controller for the TK70 tape drive is the TQK70; the KDA50 is a controller for RA-series disk drives. Each KDA50 controller supports up to four RA-series disk drives.

The CPU communicates with the RF-series ISEs through a DSSI adapter, which is built into the CPU. The CPU communicates with the RZ-series ISEs and the TLZ04 tape drive through a SCSI adapter, which is also built into the CPU.

Additional DSSI busses can be added to your system by using the KFQSA DSSI storage adapter. Each KFQSA storage adapter can support up to seven RF-series ISEs. Additional SCSI busses can be added to your system by using the KZQSA SCSI storage adapter. Each KZQSA storage adapter can support up to seven SCSI devices.

1.2.2.2 Mass Storage Subsystems

Several optional mass storage subsystems are available for DECsystem 5500 systems. Such subsystems include RRD40 Digital Disk Subsystems, the RV20 Optical Disk Subsystem, TS05 and TU81 tape drives, and the SA600 Storage Array (with up to eight RA90 disk drives). If your system includes an optional mass storage subsystem, refer to the user's guide or owner's manual for that subsystem for instructions on how to operate the device.

1.2.2.3 Mass Storage and Q-bus Expanders

You can expand the mass storage capacity of your DECsystem 5500 system by using the R400X expander. The R400X expander provides space for up to seven additional RF-series or RZ-series ISEs, or a combination of both.

The B400X expander provides 11 additional Q-bus slots for a system total of 22 Q-bus slots. The B400X also has room for up to four mass storage devices. See your Digital representative for more information on these and other expander products.

1.2.2.4 Communications Controllers

Besides the console serial line, most systems have additional communications controllers for connecting additional terminals, and for communicating with other systems over telephone or network lines. Communications controllers provide standard interfaces between peripheral devices and the system. Many communications controllers provide support for multiple data lines.

The following types of communications controllers are available:

- Asynchronous serial controllers

- Synchronous serial controllers

- DECservers

- Network controllers

Serial controllers transmit data one character at a time. A device at the transmitting end breaks bytes of data into bits. A device at the receiving end assembles incoming bits into bytes of data.

Asynchronous Serial Controllers

Asynchronous serial controllers provide low-speed connections between peripheral devices and the system. Asynchronous communication between the system and the peripheral depends on recognition of a pattern of start and stop bits, not on a time interval.

Asynchronous serial controllers may be divided into those without modem support and those with modem support.

You use serial controllers without modem support to connect additional terminals and printers to your system. For example, the CXA16 module provides connections for up to 16 serial lines with no modem support.

NOTE: *Printers equipped with a microprocessor (intelligent printers) may require modem control signals to function correctly. Do not attach a printer requiring modem control signals to a controller with no modem support.*

Check your printer documentation to determine the proper communications interface for your printer.

Communications controllers with modem support allow you to communicate over telephone lines. With a modem connected to your system, you can access other computers and you can dial into your system from a remote terminal or computer.

Computers transmit digital signals, while telephone lines (with the exception of digital leased lines) transmit analog signals. When two computers communicate over telephone lines, a modem is required at both the transmitting and receiving ends of the line. At the transmitting end, the modem converts digital signals from the computer (or terminal) to analog signals prior to transmission. At the receiving end, another modem converts the analog signals back into digital signals the computer can process.

The degree of modem support depends on the number of modem control signals recognized by the device. Full modem support (according to Digital standards) requires recognition of eleven signals. The CXY08 module supports up to eight serial lines with full modem support.

Synchronous Serial Controllers

Synchronous serial controllers provide high-speed connections between systems. Communication between synchronous devices depends on time intervals that are synchronized before transmission of data begins. Synchronous devices can also have modem support.

DECservers

DECservers are terminal servers (a combination of hardware and software) that allow you to connect multiple terminals or printers to hosts in an Ethernet local area network (LAN).

Terminal servers perform the functions of traditional data terminal switches but multiplex the lines over the Ethernet. Using a DECserver offloads communications processing from the host system.

Network Controllers

The network controller function for your system is implemented on the CPU module, but a second network controller, the DESQA Ethernet adapter module, can be added to your system.

1.2.2.5 Printer Interfaces

Some printers require specific interfaces to communicate with the system. For example, the LG01, LG02, and LP25–LP29 printers require the LPV11–SA interface module.

1.2.2.6 Other Available Options

Your system arrives configured with the options you ordered. As your needs change, you can add more options. Your Digital sales representative can advise you on available options. *DECsystem 5500 Technical Information* describes the options currently available for DECsystem 5500 systems. Digital provides installation for additional options that you order.

Chapter 2

Operating the System

This chapter describes how to operate your DECsystem 5500 once the system software has been installed.

2.1 Before You Operate the System

This chapter assumes that your system has been properly installed. Installation includes running the diagnostic software shipped with your system and installing the ULTRIX operating system. To install the operating system or layered products, see the instructions in your system software installation manual or layered product installation manual. Some of the instructions may require you to remove the front panel of the system to change switch settings on the CPU cover panel.

NOTE: *The use of Prestoserve™ software, included with your operating system, requires a special CPU configuration. If the line*

```
?79 1 0A FF 0000 0000
```

is displayed during power-up tests, your CPU is not configured to run Prestoserve software. Contact your Digital service representative before running Prestoserve software.

The remainder of this chapter assumes that system software has been installed.

2.2 Switch Settings

Switch settings vary, depending on the operation being performed. The next two sections describe switch settings for normal and for special operations. Set the switches according to your needs.

2.2.1 Normal Operation

Switch settings for normal operation are the following:

- Digital recommends you run the system with breaks disabled (Function switch down, dot outside the circle) to prevent the user from

inadvertently halting the system by pressing Break on the console terminal. Halting the system causes all activity to stop.

- The Operation switch on the CPU cover panel is set to Normal (indicated by an arrow).

- The baud rate switch inside the CPU cover panel is set to 9600.

- The Write-Protect button for each RF-series ISE is set to out (not lit). This setting allows system software to write to the storage element.

- The Run/Ready button for each RF-series ISE is set to in (glows green when the storage element is not being used). This setting makes the storage element available for use (on line).

- The Halt button on the SCP is set to out (not lit).

- For expanded systems using power bus cables to link an expander(s), the power switches on all expander power supplies should remain on (set to 1) at all times. The system power supply sends the power bus signal needed to turn the expanders on or off.

2.2.2 Special Operation

Certain operations require that you change some of the normal operating settings.

- If you need the ability to halt the system from the console terminal, for example, when installing system software or performing certain types of backup, set the Function switch to up (dot inside the circle). This allows you to halt the system by pressing Break on the console terminal.

- If you want data on a particular ISE to be write-protected, during backup procedures for example, you must set the Write-Protect switch to in (glows).

    NOTE: *ISEs containing system software and user accounts must remain write-enabled. ISEs containing applications or sensitive data may be write-protected.*

- If you want to use the Language Selection Menu to select a new language for the console program before you turn on your system, set the Operation switch to the Action mode. A human profile indicates the Action mode. Set the Function switch to down (dot outside the circle). When you turn on your system, a Language Selection Menu appears, as shown in Figure 2–1.

Figure 2–1: Language Selection Menu

```
KN220-A Vn.n
 1) Dansk
 2) Deutsch (Deutschland/Österreich)
 3) Deutsch (Schweiz)
 4) English (United Kingdom)
 5) English (United States/Canada)
 6) Español
 7) Français (Canada)
 8) Français (France/Belgique)
 9) Français (Suisse)
10) Italiano
11) Nederlands
12) Norsk
13) Português
14) Suomi
15) Svenska
 (1..15):
```

Select a language by typing in the number listed next to the language.
Save the language you have selected by rotating the Operation switch
to Normal mode, indicated by an arrow.

NOTE: *If you do not select a language within thirty seconds, the system
defaults to English (United States/Canada).*

If the Operation switch is set to Normal mode (indicated by an arrow),
then the language selected is saved and is automatically used during
subsequent reboots of the system.

NOTE: *If the Operation switch is set to Action mode (indicated by the
human profile) and the Function switch is set to down (dot outside the
circle), the system will prompt for the language at each power-up.*

If your system has been powered off for more than 10 days, the battery
unit that saves the system clock and the language selection may have
run down. The Language Selection Menu will automatically display
when you power up your system, regardless of the Operation switch
setting. Once the system is booted, reset the system clock, as described
in your system software manual.

2.3 Turning On the System

Once you have set the switches correctly, you are ready to turn on the system. Use the following procedure:

1. Turn on the console terminal and wait for it to complete its self-tests.

2. Turn on the system by setting the power switch to 1.

   NOTE: *For systems using the R400X or B400X expander linked by a power bus cable, the power switch on the DECsystem 5500 provides the power control bus signal to the expander(s). Setting the power switch to on (1) on the DECsystem 5500 will cause the expander(s) to power up as well. The power switch on each expander should always remain set to on (1).*

When you turn on the power, you should see the indications listed in Table 2–1.

Table 2–1: Normal Power-Up Indications

Indicator	Normal Indication
System DC OK lights (power supply and SCP)	Glow green
AC Present light (power supply)	Glows orange
RF-series ISE Run/Ready lights	Glow green steadily within 20 seconds
RF-series ISE Fault light	Lights temporarily at power-up.
TK70 tape drive indicator lights	Orange, yellow, and green lights glow during self-tests. The green light remains on.
TLZ04 tape drive indicators	Tape and drive indicators flash during self-tests. The drive indicator glows green when self-tests are successfully completed.

If you do not observe the indications in Table 2–1, refer to *DECsystem 5500 Troubleshooting and Diagnostics*.

Every time you turn on your system, it runs a series of self-tests on the CPU and memory. Your console terminal first displays a line of information identifying the CPU, the version of the firmware, and the version of the hardware. In the sample screens provided in this chapter, the CPU is identified as a KN220–A, and the version of the firmware is indicated as Vn.n. Your system will display actual version numbers. The console

terminal then displays a countdown as the system tests itself. Depending on the value of the *bootmode* environment variable, when the self-tests are successful, the system either autoboots system software or goes into console mode, as described in Sections 2.4.1 and 2.4.2.

If your system detects an error during its self-tests, it displays an error summary consisting of several lines of hexadecimal numbers and enters Maintenance mode (>>>). A Digital service representative can use the error summary to diagnose the system. Depending on the type of error, one or more error summaries may display on the console terminal. A sample error summary is shown in Figure 2–2.

Figure 2–2:   Sample Error Summary

```
KN220-A Vn.n
Performing normal system tests.
83..82..81..80..79..78..77..76..75..74..73..72..71..70..69..68..67..
66..65..

?79 2 06 FF 0000 0007

P1 =28000000   P2 =2807FFFC   P3 =00000000   P4 =00000000   P5 =00000000
P6 =00000000   P7 =00000000   P8 =00000000   P9 =00000000   P10=00000000
P11=00000000   P12=00000000   P13=00000000   P14=00000000   P15=00000000
P16=00000000   P17=00000000   P18=00000000   P19=00000000   P20=00000000
gp =1C270008   sp =B8001B1C   fp =00000000   sr =B048FF04
epc=BFC2903C   badvaddr =00000000   cause =00000000
64..63..62..61..60..59..58..57..56..55..54..53..52..51..50..
49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..34..33..
32..31..30..29..28..27..26..25..24..23..22..21..20..19..18..17..16..
15..14..13..12..11..10..09..08..07..06..05..04..03..
Normal operation not possible.

>>>
```

If possible, print out or copy down the error summary and give it to your Digital service representative.

2.4 Booting the System

DECsystem 5500 systems boot in one of two ways. You can manually boot the system from console mode or you can configure the system to autoboot on power-up. The value of the *bootmode* environment variable determines how the system boots.

2.4.1 Booting the System from Console Mode

When the *bootmode* environment variable is not initialized (as shipped from the factory) the system powers up to console mode (>> prompt) after successfully completing its self-tests.

NOTE: *The memory size and Ethernet address are displayed when self-tests complete successfully.*

Figure 2–3 shows a successful power-up to console mode.

Figure 2–3:   Successful Power-Up to Console Mode

```
KN220-A Vn.n
Performing normal system tests.
83..82..81..80..79..78..77..76..75..74..73..72..71..70..69..68..67..
66..65..64..63..62..61..60..59..58..57..56..55..54..53..52..51..50..
49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..34..33..
32..31..30..29..28..27..26..25..24..23..22..21..20..19..18..17..16..
15..14..13..12..11..10..09..08..07..06..05..04..03..
Tests completed.
Memory Size: 16777216 (0x1000000)
Ethernet Address: 08-00-2b-0c-c4-7a
>>
```

NOTE: *If the line*

```
?79 1 0A FF 0000 0000
```

is displayed during power-up tests, your CPU is not configured to run Prestoserve™ software. Contact your Digital service representative before running Prestoserve software.

Loading System Software

To load system software from console mode, use the command

   boot [-f *file*] [-s | -m] [-n] [*arg...*]

For example,

```
>> boot -f tm(0,0)
```

tells the system to boot software from a cartridge in the TK70 tape drive. For a complete description of the **boot** command, refer to the section on console commands, Section 2.11.

Software manuals may instruct you to power up with the Function switch set to breaks enabled, or up (dot inside the circle), and to use the **boot** command.

2.4.2 Autobooting the System

By assigning values to environment variables, you can define a device from which the system will automatically boot at power up. Use the **setenv** command to assign values to the *bootpath* and *bootmode* environment variables. The *bootpath* variable specifies a device from which to autoboot. The *bootmode* variable must be set to *a* for the system to autoboot. For example,

```
>> setenv bootpath  rf(0,0,0)vmunix
>> setenv bootmode a
```

defines an RF-series ISE with controller 0, unit number 0, and logical block number 0 as the boot device; and a value of *a* (autoboot) is assigned to the *bootmode* variable. Now, when the system is powered up, the system runs self-tests and, on completion, attempts to load system software from ISE 0. For a complete description of the **setenv** and **unsetenv** commands, refer to Section 2.11.

Figure 2–4 shows a successful power-up and automatic boot when a boot device has been specified.

Figure 2–4:   Successful Power-Up and Automatic Boot

```
KN220-A Vn.n
Performing normal system tests.
83..82..81..80..79..78..77..76..75..74..73..72..71..70..69..68..67..
66..65..64..63..62..61..60..59..58..57..56..55..54..53..52..51..50..
49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..34..33..
32..31..30..29..28..27..26..25..24..23..22..21..20..19..18..17..16..
15..14..13..12..11..10..09..08..07..06..05..04..03..
Tests completed.

Autoboot:Waiting to load rf(0,0,0)vmunix(CTRL-C to abort)...loading
```

NOTE: *If the line*

```
?79 1 0A FF 0000 0000
```

is displayed during power-up tests, your CPU is not configured to run Prestoserve™ software. Contact your Digital service representative before running Prestoserve software.

Changing the Boot Device

Once you have set the environment variables to recognize a boot device and to autoboot, the system autoboots from that device each time you turn on the system. These environment variables are stored in nonvolatile memory and will remain in effect until you change their values. You can change the variables by using the **setenv** command to assign a new boot device. To display console environment variables and their current values, use the **printenv** command at the console prompt (>>). For a complete description of each console command, refer to Section 2.11.

2.5 Using Console Security

DECsystem 5500 systems have a console security feature as part of the console firmware. The security feature allows you to secure the system. When the system is secure, unprivileged users (users who do not know the security password) are limited to the **boot** command (with no arguments). Privileged users, knowing the security password, have access to all console commands.

Securing the System

To secure the system, use the **passwd** command as follows:

NOTE: *If unprivileged users are to be allowed to boot the system, the system manager should assign values to the bootpath and bootmode variables before securing the system. Once the system is secure, unprivileged users cannot issue the boot command with arguments.*

1. At the console prompt (>>), enter the set password command,

   `passwd -s.`

2. At the "New password:" prompt, enter a password of 8 to 32 characters.

   You must retype the password for verification.

3. After the password has been accepted, enter the command

   `passwd -u`

   which causes the console module to display the unprivileged console prompt (s>). Unprivileged users are limited to the **boot** command with no arguments.

   The following example shows how to secure the system.

```
>> passwd -s
New password:
Retype new password:
New password accepted
>> passwd -u
Memory Size: 16777216 (0x1000000) bytes
Ethernet Address: 08-00-2b-12-81-22
s>
```

4. To maintain security, the Operation switch should remain set to Normal mode (indicated by the arrow) and the lower front door should be locked.

Privileged Users

By entering the security password, privileged users have access to all the console commands. In the example below, the **passwd** command is used to access the privileged console prompt (>>).

```
s> passwd
Password:
Password accepted.
Memory Size: 16777216 (0x1000000) bytes
Ethernet Address: 08-00-2b-12-81-22
>>
```

For a complete description of the **passwd** command, refer to Section 2.11.13.

Unsecuring the System

Privileged users can remove the security restrictions by entering the **clear password** command, **passwd** -**c**, at the console prompt (>>). For example,

```
>> passwd -c
>>
```

removes all security restrictions from the console firmware. The system is now unsecure.

If you forget the security password, you must use the following procedure to clear the password.

1. Set the Operation switch to the Maintenance mode setting (indicated by a T inside a circle).

2. Press the Restart button on the System Control Panel (SCP).

3. After the system completes self-tests, enter the maintenance command **unpriv** at the Maintenance mode prompt (>>>).

4. Reset the Operation switch to the Normal mode setting (indicated by an arrow).

5. Press the Restart button and wait for self-test to complete. You can now enter a new security password.

For a complete description of the **passwd** and **unpriv** commands, refer to Section 2.11.

2.6 Using the System

Once the system software is loaded, the first screen for the system software is displayed on the console terminal after a few seconds. That display is described in the system software documentation.

You are now ready to use the system. Refer to the system software manuals and application manuals for more specific instructions on using the system.

Your system software manuals cover the following:

• Installing software on your system

• Running software to perform tasks

• Making and restoring backup copies of system software or data files

• Accessing devices and utilities in your system

2.7 Halting the System

Halting the system interrupts all processes and returns control to the console program. You may need to halt the system during software installation. Or, you may want to boot the system from another device, for example, a tape cartridge containing software.

CAUTION: *Halting your system without following the shutdown procedure described in your system software manuals may result in loss of data.*

You can halt the system in two ways:

• You can press the Halt button twice — in to halt the system, and out to enter console mode.

• If the Function switch on the CPU cover panel is set to up, or breaks enabled (dot inside the circle), you can press the Break key on the console terminal. If the Function switch is not set to up and you wish to halt the system by pressing Break, change the setting of the Function switch from down to up (dot inside the circle).

NOTE: *If the power is on when you change the setting of the Function switch, you must press the Restart button or power up your system again for the new setting to take effect.*

CAUTION: *If you shut off your console terminal while breaks are enabled, the system will interpret the action as a break, and the system halts.*

When the console mode prompt (>>) is displayed on your screen, the system is halted.

If you inadvertently halt the system, enter `continue` `Return` at the console prompt. The processes interrupted by the halt will continue.

2.8 Restarting the System

NOTE: *Restarting the system aborts all current and pending operations. To prevent loss of data, warn all users to log off prior to restarting the system. Follow the shutdown procedure described in your system software manuals before restarting the system.*

Restarting returns the system to a power-up condition. All current and pending operations are aborted and the usual power-up tests are run.

You restart the system by pressing in the Restart button on the system control panel.

NOTE: *The Halt button must be out (not lit) to effect a restart operation.*

2.9 Turning Off the System

CAUTION: *Turning off your system without following the shutdown procedure described in your system software manuals may result in loss of data.*

Once you have completed the recommended procedure, you can turn off your system by setting the power switch to 0.

NOTE: *For systems expanded with the R400X or B400X expander and linked by a power bus cable, you need only turn off the system. The expander(s) will power down when you set the system power switch to off (0). The power switch for each expander should always remain set to on (1). Note that the orange AC indicator on the expander power supply should remain lit even though the system is powered down.*

2.10 Recovering from an Over Temperature Condition

If your system's internal temperature approaches a level that may cause components to overheat, an audible alarm will sound and the Over Temperature Warning indicator on the SCP will flash. If the temperature continues to increase, the system will automatically shut down.

When the system shuts down due to overheating, the Over Temperature Condition indicator on the power supply remains lit. To recover from a shutdown, set the power switch to off (0) and wait five minutes before turning on the system.

To prevent an over temperature condition, use the following precautions:

- Make sure your system is away from heat sources.

- Check that the system's air vents are not blocked.

- Check that the room temperature is within acceptable operating limits: 10°C to 40°C (50°F to 104°F).

2.11 Console Commands

The console program displays the >> prompt when it is ready to accept commands. Observe the following rules when typing console commands:

- All commands typed at console level are case-sensitive. The console firmware does not recognize uppercase and lowercase letters as the same input.

- Command execution begins when you press Return.

- Enter numeric values as follows:

  — Enter *decimal values* as a string of decimal digits with no leading zeros (for example, 123).

  — Enter *octal values* as a string of octal digits with a leading zero (for example, 0177).

  — Enter *hexadecimal values* as a string of hexadecimal digits preceded by 0x (for example, 0x3ff).

  — Enter *binary values* as a string of binary digits preceded by 0b (for example, 0b1001).

  — When reading or writing to memory, you have a choice of data sizes: byte, halfword, or word. Because a word is four bytes, successive addresses, when referenced by a word, are successive

multiples of four. For example, the address following 0x80000004 is 0x80000008. An error will occur if you try to specify an address that is not on a boundary for the data size you are using.

Conventions Used in This Section

- Letters in `bold monospace` type are to be typed exactly as shown.

- Letters in *italics* represent arguments for which you supply values. (Note that help and menu screens display these arguments in all capital letters.)

- Arguments enclosed in square brackets ([ ]) are optional.

- Ellipses (...) follow an argument that can be repeated.

- A vertical bar (|) separates choices. You can think of it as a symbol meaning *or*.

- Parentheses are used as in algebraic expressions. For example,

      -(b | h | w)

  means enter -b or -h or -w.

Getting Help

You can get help with console command syntax in several ways:

- You can enter `help` or a question mark (**?**) to display a menu of all console commands.

- You can enter the name of the command for which you want help as an argument to **help** or **?**.

  For example, entering **? e** at the console prompt (>>) displays the syntax for the **examine (e)** command:

  ```
  e [-(b|h|w)] ADDR
  >>
  ```

- If you type an incorrect command line, you get a help screen.

  For example, the **e** command requires an *addr* argument. Entering **e -b** at the console prompt (>>) without entering an address causes the screen to display the correct syntax for the command:

  ```
  e [-(b|h|w)] ADDR
  >>
  ```

Operating the System   **2–13**

Console Commands

Table 2–2 lists the console commands.

Table 2–2: Console Commands

Command	Description
continue	Returns control to the processes interrupted by a **halt** signal
boot	Boots the operating system
d	Deposits data at a given address
dump	Dumps memory to the screen
e	Examines memory
exit[1]	Exits Maintenance mode and returns control to Normal console mode
fill	Deposits data in an address range
go	Resumes execution of the program in memory
help	Displays the syntax of console commands
?	Displays the syntax of console commands
init	Reinitializes memory
maint	Causes the console to enter Maintenance mode
passwd	Allows you to use the console security feature
printenv	Displays console environment variables
setenv	Sets console environment variables
show device[1]	Displays a list of available devices, their unit numbers, and controller numbers
show dssi[1]	Displays a list of available DSSI storage devices, their unit numbers, and controller numbers
show ethernet[1]	Displays the hardware address of your Ethernet controller.
show scsi[1]	Displays a list of available SCSI storage devices, their unit numbers, and controller numbers
unpriv[1]	Sets the security password to zero
unsetenv	Unsets console environment variables

[1]This command is only available in Maintenance mode.

2.11.1 The boot Command

boot [-f *file*] [-s | -m] [-n] [*arg...*]

This command loads the file that contains the operating system.

*   The optional -f flag followed by the *file* parameter specifies the file you want to use during a boot procedure. If you do not specify the -f flag and a file, the file specified by the environment variable *bootpath* is loaded.

    The *file* parameter has the format

    dev([*controller*][*,unit-number*] [*,logical block number*])[*filename*]

    — *dev* indicates the device from which you are booting the operating system. Typical devices are *rf* for RF-series ISEs, *rz* for RZ-series ISEs, *ra* for RA-series hard disk drives, *tm* for a TK70 tape drive, *tz* for a TLZ04 tape drive, and *mop* for a network. Entering *mop* nullifies the other arguments in the list, so that *file* takes the form *mop*( ). Table 2–3 lists the device names for each device.

Table 2–3: Device Names

Device Type	Protocol	Number of Units	Device Name
RF-series ISE	DSSI	8	*rf*
RZ-series ISE	SCSI	8	*rz*
RA-series fixed-disk	MSCP	4	*ra*
TK70 tape drive	TMSCP	4	*tm*
TLZ04 tape drive	SCSI	2	*tz*
Ethernet adapter	MOP	1	*mop*
Ethernet adapter	TFTP	1	*tftp*

    — *controller* indicates the ID number of the controller for the device from which you are booting the operating system.

    — *unit-number* indicates the unit number of the device from which you are booting the operating system.

    To display a list of devices, their unit numbers and controller numbers, enter Maintenance mode and enter the command `show device` at the Maintenance prompt >>>. After reviewing the display, enter `exit` and press Return to return to the Normal console prompt >>.

Example:

```
>> maint
>>>show device
DSSI Node 0 (R7QJNG)
 -rf(0,0,*)  (RF71)

DSSI Node 1 (TEST2)
 -rf(1,1,*)  (RF71)

DSSI Node 2 (BILLY)
 -rf(2,2,*)  (RF71)

DSSI Node 7 (*)

SCSI Node 0
 -tz(0,0,*) (.....) -DIA0

SCSI Node 1
 -rz(0,1,*) (RZ56 )

SCSI Node 7 (*)

Ethernet Adapter
 -mop() -EZA0  (08-00-2B-12-81-22)

VME Interface Board - Not Installed

>>>exit
>>
```

As in the preceding example, the **show device** command displays the device names followed by the controller number and unit number in parentheses. The asterisk indicates the logical block number variable, which is determined during installation of the operating system software.

— *logical block number* specifies the absolute block number from the beginning of the disk. Logical block numbers are only meaningful for disk devices.

— *file name* indicates the name of the operating system file.

— The optional -s flag causes the operating system to boot in single-user mode. Unless -s is specified, the system will boot in multiuser mode -m.

— The optional -n flag causes the specified file to be loaded but not executed.

— The optional *arg* parameter contains any information to be passed to the booted image.

Examples:

```
>> boot -f rf(2,2,0)vmunix
```

This command boots the file *vmunix*, located at logical block number 0 of the second RF-series ISE (unit number 2), using controller 2.

```
>> boot -f rz(0,2,0)vmunix
```

This command boots the file *vmunix*, located at logical block number 0 of the second RZ-series ISE (unit number 2), using controller 2.

```
>> boot -f ra(0,0,0)vmunix
```

This command boots the file *vmunix*, located at logical block number 0 of the first hard disk (unit number 0), using controller 0.

```
>> boot -f tm(0,0)
```

This command boots from a TK70 tape drive, which is unit 5 in this example.

```
>> boot -f tz(0,5)
```

This command boots from a TLZ04 tape drive, which is unit 0 in this example.

2.11.2 The continue Command

continue

This command returns control to the processes interrupted by a halt signal. Use this command if you inadvertently halt the system by pressing Break or the Halt button.

Pressing Break or the Halt button causes the system state to be saved in the halt state memory block. When you enter the **continue** command, the system state is reloaded and execution continued.

2.11.3 The d (deposit) Command

d [[[-(b | h | w)] [*addr*]] | [-H *reg-name*]] *val*

This command deposits a single byte, halfword, or word value at the specified address. If you repeat the command without specifying an address, the data will be deposited in the next word location.

The first parameter, which is optional, indicates the data size. If not given, data size defaults to word. If you do not specify a data size, a word is used.

• Use -b to deposit 1 byte of data.

- Use -h to deposit a halfword (2 bytes) of data.

- Use -w to deposit a word (4 bytes) of data.

The *addr* parameter indicates the address to which you want data written. System address space ranges from 0x80000000 to 0xbf000000.

The -H parameter specifies that the data is to be deposited to a register in the halt state memory block. This memory location is where all the R3000 internal registers are saved when the system is halted. The *reg-name* parameter specifies the name of the particular R3000 internal register for which you want data written.

The *val* parameter contains the data you want deposited at the given address.

Example:

```
>> d -w 0x80000000 0xffffffff
```

This command deposits the value 0xffffffff, with a data size of one word, at address 0x80000000.

Example:

```
>> d -H at 0x00ab
```

This command deposits the value 0x00ab, with a data size of one word, for the R3000 internal register named "at" currently stored in the halt state memory block.

2.11.4 The dump Command

dump [-H] | [[[[-(b | h | w)] [-(o | d | u | x | c | B)]] | [-I]] *rng*]

This command shows a formatted display of the contents of memory.

The -H parameter displays the contents of the halt state memory block. All R3000 internal registers are stored in the halt state memory block when the system is halted. The -H parameter option cannot be used with any other command parameter.

The second parameter, which is optional, indicates the data size. If you do not specify a data size, the system uses a word.

- -b displays memory in bytes.

- -h displays memory in halfwords.

- -w displays memory in words.

The next parameter, also optional, determines how data is displayed.

- -o displays memory in octal format.
- -d displays memory in decimal format.
- -u displays memory in unsigned decimal format.
- -x displays memory in hexadecimal format.
- -c displays memory in ASCII format.
- -B displays memory in binary format.

If no format argument is given, hexadecimal format is used.

The -I parameter displays memory in assembly language format.

The *rng* parameter indicates the range of memory you want to see. You can specify the range in one of two ways:

- *addr#cnt* displays the number of addresses specified by *cnt*, beginning at *addr*.
- *addr:addr* displays all values between the specified addresses.

Examples:

```
>> dump 0x80000000#0xf
```

This command uses hexadecimal format to dump the first 15 words of memory to the screen.

```
>> dump -b 0x80000000#0xf
```

This command uses hexadecimal format to dump the first 15 bytes of memory to the screen. The dump display shows rows of address contents. The left-most column gives the address of the first field in each row.

```
>> dump -I 0x80030200:0x80030220
0x80030200:     c048228     jal         0x801208a0
0x80030204:        2021     addu        a0,zero,zero
0x80030208:     8fbf0014    lw          ra,0x14(sp)
0x8003020c:     27bd0018    addiu       sp,0x18
0x80030210:     3e00008     jr          ra
0x80030214:           0     nop
0x80030218:     27bdffe8    addiu       sp,0xffe8
0x8003021c:     afbf0014    sw          ra,0x14(sp)
>>
```

This command displays in assembly language format, all values between the specified addresses. The first column lists the memory location in hexadecimal, the second column lists the contents of the memory location,

the third column lists the R3000 assembly language instruction, and the fourth column lists the corresponding operand.

2.11.5 The e (examine) Command

e [-(b | h | w)] *addr*

This command examines the byte, halfword, or word at the specified address. If you repeat the command without specifying an address, the next word location will be examined.

The first parameter, which is optional, indicates the data size. If not given, data size defaults to word. If you do not specify the data size, a word is used.

- -b indicates a single byte.

- -h indicates a halfword.

- -w indicates a word.

The *addr* parameter indicates an address in the range 0x80000000 to 0xbf000000.

When you enter the examine command, a display similar to the following appears:

```
0x80000005:  65 0x41    'A'
```

The left-most field echoes the address you entered.

The next three fields display the contents of the address in decimal, hexadecimal, and ASCII formats, respectively. If the ASCII character is unprintable, it is displayed as an octal value preceded by a backslash: for example, '\032'.

Example:

```
>> e 0x80000000
```

This command examines the word at address 0x80000000. The resulting display might look like this:

```
0x80000000:      1008385985      0x3c1abfc1    '\301'
```

2.11.6 The exit Command

exit

This command is used in Maintenance mode (>>>) to return control to Normal console mode (>>).

Example:

```
>>>exit
>>
```

2.11.7 The fill Command

fill [-(b | h | w)] [-v *val*] *rng*

This command writes a specified value to a range of memory. If you do not specify a value, the system puts zeros in the memory range.

The first parameter, which is optional, indicates the data size. If not given, data size defaults to word.

- -b indicates bytes.

- -h indicates halfwords.

- -w indicates words.

The optional parameter -v *val* specifies the numeric value to write to memory. If you do not specify a value, all zeros are written. If the size of *val* does not match the data size parameter, *val* is truncated or expanded as necessary.

The *rng* parameter indicates the memory range. You can specify the range in one of two ways:

- *addr#cnt* fills addresses beginning at *addr* and continuing for *cnt* locations.

- *addr:addr* fills all locations between the two given addresses.

Example:

```
>> fill -v 0xffffffff 0x80000010:0x800000ff
```

This command sets all bits to 1 at addresses 16 to 255.

2.11.8 The go Command

go [*pc*]

This command transfers control to the indicated entry-point address.

The optional *pc* parameter indicates the entry-point address you want to use.

If you do not specify an entry address, the system uses the entry point of the program module that was most recently loaded. If no program module was previously loaded, the system uses 0 as the entry-point address.

2.11.9 The help Command

help [*cmd*]

This command displays the correct syntax for the console commands.

The optional *cmd* parameter indicates the command for which you want information. If you do not specify *cmd*, the complete console menu appears.

2.11.10 The ? Command

? [*cmd*]

This command functions exactly like the help command.

2.11.11 The init Command

init

This command fully initializes the system.

The effect of the init command is identical to turning on the power or pressing the Reset button, except that the system does not execute its self-test. The memory size and Ethernet address are displayed.

2.11.12 The maint Command

maint

This command causes the console to enter Maintenance mode (>>>). This command must be used before entering Maintenance mode commands. Its companion command, **exit**, is used to return the console to Normal mode.

Example:

```
>>
>> maint
>>>
>>>exit
>>
```

2.11.13 The passwd Command

passwd [-s | -c | -u]

The four variants of this command are used to control the console security feature. Using the console security feature, you can secure the system and limit unprivileged users (users who do not know the security password) to the **boot** console command. Refer to Section 2.5 for more information.

The use of the **passwd** command with flags [-s | -c | -u] is restricted to privileged mode (>>), while the use of **passwd** without flags is restricted to unprivileged mode (s>).

passwd **-s** — This command is used to set a new security password. The security password can be from 8 to 32 characters long. This variant is available only in privileged mode (>>).

passwd **-u** — This command causes the console user to be unprivileged. The unprivileged console prompt (s>) is displayed.

passwd — This command enables the console user to enter the security password to access the privileged console prompt (>>).

passwd **-c** — This command removes security restrictions by clearing the security password.

2.11.14 The printenv Command

printenv [*evar*...]

This command displays the current value for the specified environment variable, or for all the environment variables.

The optional *evar* parameter indicates the variable whose value you want to see. If you do not specify a variable, the complete environment variable table is displayed. A typical display looks like this:

```
bootpath=
bootmode=*
console=0
scsiid0=7
scsiid1=7
scsiid2=7
scsiid3=7
scsiid4=7
scsiid5=7
scsiid6=7
scsiid7=7
baud=9600
systype=0x820b0a00
bitmap=0xa3ff0000
bitmaplen=0x1000
memdescriptor=0x5
osconsole=0
```

There are three types of variables: volatile (lost when power resumes), nonvolatile (maintained after power resumes), and fixed (rebuilt when power is turned on). Table 2–4 lists the default variables.

Table 2–4: Default Environment Variables

Variable	Type	Description
bootpath	Nonvolatile	Indicates the default bootpath. The system uses this variable when you type the **auto** command. An example of a bootpath definition is: rf(0,0,0)vmunix.
bootmode	Nonvolatile	Determines what programs run when the system is turned on or reset. Use one of the following codes: *a* Autoboots the operating system using the *bootpath* variable *d* Bypasses self-tests, system enters console mode (>>).
console	Fixed	The system always selects TTY(0) as the console device.
scsiid#	Fixed	The SCSI controller number. The variable may be 0–7. The default value is 7.
baud	Fixed	The baud rate of the console terminal line is determined by the Baud Rate switch inside the CPU cover panel. The factory setting is 9600. For instructions on changing the baud rate, refer to your *DECsystem 5500 Technical Information* manual. Allowed values are 300, 600, 2400, 4800, 9600, 19200, and 38400.
systype	Fixed	Identifies the processor. Bits 24–31 contain the CPU type; bits 16–23 contain the system type (6 for KN220); bits 08–15 contain the firmware revision level; and bits 00–07 contain the hardware version level.
bitmap	Fixed	Indicates the address of the memory bitmap. The bitmap keeps track of good and bad memory pages. Each bit corresponds to one page in memory; 1 indicates the page is good, and 0 indicates the page is bad. Do not change this variable.
bitmaplen	Fixed	Indicates the length of the memory bitmap. Do not change this variable.
memdescriptor	Volatile	Used to describe the memory configuration of the system. This variable is set using test 9A in Maintenance mode.
osconsole	Fixed	The system always selects TTY(0) as the console device.

2.11.15 The setenv Command

>**setenv** *evar str*

This command assigns new values to the specified environment variable. Refer to the discussion of the **printenv** command for a description of each variable.

- The *evar* parameter indicates the variable you want to set.

- The *str* parameter indicates the value you want to specify.

Example:

```
>> setenv bootmode a
```

The command in the above example assigns a value of *a* to the *bootmode* variable. This will cause the system to autoboot at power-up.

You can also add your own environment variables. These variables are stored in volatile memory. The environment variables table can contain up to 16 variables, for a total of 256 characters.

2.11.16 The show device Command

>**show device**

This Maintenance mode command displays a list of available devices, their unit numbers, and controller numbers. The device names are followed by the controller number and unit number in parentheses.

NOTE: *This command may require a few minutes to list devices.*

Example:

```
>> maint
>>>show device
DSSI Node 0 (R7QJNG)
 -rf(0,0,*)  (RF71)

DSSI Node 1 (TEST2)
 -rf(1,1,*)  (RF71)

DSSI Node 2 (BILLY)
 -rf(2,2,*)  (RF71)

DSSI Node 7 (*)

SCSI Node 0
 -tz(0,0,*) (.....)
```

```
SCSI Node 1
 -rz(0,1,*) (RZ56 )

SCSI Node 7 (*)

Ethernet Adapter
 -mop() -EZA0  (08-00-2B-12-81-22)

VME Interface Board - Not Installed
```
>>>**exit**
```
>>
```

2.11.17 The show dssi Command

show dssi

This Maintenance mode command displays a list of available DSSI storage devices. The device names are followed by the controller number and unit number in parentheses.

NOTE: *This command may require a few minutes to list devices.*

Example:

```
>> maint
>>>show dssi
DSSI Node 0 (R7QJNG)
 -rf(0,0,*)  (RF71)

DSSI Node 1 (TEST2)
 -rf(1,1,*)  (RF71)

DSSI Node 2 (BILLY)
 -rf(2,2,*)  (RF71)

DSSI Node 7 (*)

>>>exit
>>
```

2.11.18 The show ethernet Command

show ethernet

This Maintenance mode command displays the hardware address of your on-board Ethernet controller, as well as the address for any additional DESQA Ethernet controller in your system. As in the following example, the DESQA module is indicated by XQA0.

Example:

```
>> maint
>>>show ethernet
Ethernet Adapter
 -mop() -EZA0  (08-00-2B-12-81-22)

Ethernet Adapter 0 (774440)
 -XQA0 (08-00-2B-06-16-F2)
>>>exit
>>
```

2.11.19 The show scsi Command

show scsi

This Maintenance mode command displays a list of available SCSI storage devices. The device names are followed by the controller number and unit number in parentheses.

NOTE: *This command may require a few minutes to list devices.*

Example:

```
>> maint
>>>show scsi

SCSI Node 0
 -tz(0,0,*) (TLZ04)

SCSI Node 1
 -rz(0,1,*) (RZ56 )

SCSI Node 2
 -rz(0,2,*) (RRD40) -DIA2

SCSI Node 4
 -tz(0,4,*) (.....) -DIA4

SCSI Node 7 (*)

>>>exit
>>
```

A second variation of this command, **show scsi/full**, provides the following additional information for each SCSI device:

Device type
Storage capacity

Product identification
    Revision number
    Removable or fixed storage medium (r or f)

```
>> maint
>>>show scsi/full

Boot   Path     Dev    Cap (in Hex)     Product Id      Revs   r/f
-----------------------------------------------------------------
-tz(0,0,*)    TAPE      4B0 MBs    TLZ04 1989(C)DEC    0304    r
-rz(0,1,*)    DISK      27A MBs    RZ56     (C) DEC    0200    f
-rz(0,2,*)    CDROM     23B MBs    RRD40     TM DEC    250E    r
-tz(0,4,*)    TAPE       5A MBs    ................    ....    r

SCSI Node 7

>>>exit
>>
```

2.11.20 The unpriv Command

unpriv

This Maintenance mode command clears the security password by setting it to zero. This command is used to unsecure the console security feature if you forget the security password. To enter Maintenance mode, set the Operation switch to Maintenance mode (indicated by a T inside a circle). Press the Restart button on the SCP. After clearing the password, you must reset the Operation switch to Normal mode (indicated by an arrow) and press the Restart button again.

2.11.21 The unsetenv Command

unsetenv *evar*

This command removes the specified variable from the environment variables table.

The *evar* parameter indicates the variable you are removing. Refer to Table 2–4 earlier in this section for a description of each variable.

The **unsetenv** command does not affect the environment variables stored in nonvolatile memory. These variables are reset at the next reset or power cycle.

2.12 Control Characters

Table 2–5 lists the key combinations that have an immediate effect in console mode.

Table 2–5: Normal-Mode Control Characters

Character	Action
Return	Also <CR>. Ends a command line. Command characters are buffered until you press Return.
DELETE	Deletes the previously typed character. If you define the console terminal as hard copy (environment variable *term* set to *hardcopy*), the deleted text is displayed surrounded by backslashes. If the console terminal is a CRT (environment variable *term* set to *crt*), each delete is displayed with the sequence <BS><SP><BS>. Deletes received are ignored when there are no characters to be deleted.
CTRL/C	Causes the console to abort the processing of a command.
CTRL/O	Causes console output to be discarded until you enter the next CTRL/O or until the next console prompt or error message is issued. CTRL/O is also canceled when you enter CTRL/C.
CTRL/Q	Resumes console output that was suspended when you entered CTRL/S.
CTRL/R	Causes the current command line to be displayed without any deleted characters.
CTRL/S	Suspends output on the console terminal until you enter CTRL/Q.
CTRL/U	Discards all characters accumulated for the current line.
CTRL/V	Suppresses any special meaning associated with the next character.

Chapter 3
Operating the System Options

This chapter describes how to use options that may already be part of your system, or that you can add to your system. The following types of options are covered:

- Mass storage devices and controllers
- Communications controllers
- Printers

3.1 Mass Storage Options

The following mass storage options are available with DECsystem 5500 pedestal systems:

- TK70 tape drive
- TLZ04 tape drive
- RF-series Integrated Storage Elements
- RZ-series Integrated Storage Elements

NOTE: *In addition, the RV20 Optical Disk Subsystem, RRD40 Digital Disk Subsystems, and TSV05 and TU81 tape drives can be attached to the DECsystem 5500 system. If your system contains one of these options, refer to the user's guide or owner's manual for instructions on how to operate the device.*

This chapter describes how to use TK70 and TLZ04 tape drives; it also describes how to use the controls for RF-series and RZ-series ISEs. In the case of the tape drive, it also describes how to insert and remove the tape cartridge. To use any mass storage device, you must properly identify the device to the operating system and use appropriate operating system commands. Refer to your system software documentation for details.

3.1.1 TK70 Tape Drive

The TK70 tape drive is located behind the upper door of the system. To use the drive, move the key to the top position and open the door.

The TK70 tape drive holds one removable magnetic tape cartridge. The drive can read data written on either a CompacTape II or CompacTape cartridge. You can identify the type of cartridge by the label on the cartridge.

You can use a CompacTape II or CompacTape cartridge as an input device to load software or data into your system. The TK70 drive can read data on both types of cartridges, written by either a TK70 drive or a TK50 drive. (The TK50 drive records data in a format different from that of the TK70.)

You should use a CompacTape II as an output device to make copies or backups of software or data. The TK70 drive cannot write to a CompacTape II or CompacTape that has been previously written by a TK50 tape drive.

TK70 Tape Drive Controls

The tape drive has two primary controls: the cartridge insert/release handle (subsequently referred to as "the handle") and the Unload button. You use the handle to insert or remove cartridges and lock them into position. Pull the handle open to insert or remove a tape cartridge. Push the handle closed to lock a tape cartridge into position and load the tape.

You use the Unload button to rewind and unload the tape. Unloading and rewinding can also be controlled by software. Refer to your system software manuals for appropriate commands.

The drive also has three indicator lights that tell you the status of the drive.

- Orange light (Write-Protected): A steady orange light indicates that the cartridge is write-protected.

- Yellow light (Tape in Use): A steady yellow light indicates that the tape is loaded. A blinking yellow light indicates that the tape is in motion.

- Green light (Operate Handle): A steady green light indicates that you can move the handle to insert or remove a tape. A blinking green light indicates a cartridge load fault. You can also move the handle when the green light is blinking.

All three lights blinking simultaneously indicates a fault condition.

Figure 3–1 shows the TK70 tape drive with the controls and indicator lights labeled.

To operate the drive properly, you must carefully monitor the indicator lights. The instructions for inserting and removing cartridges, which appear later in this section, tell you what should happen at each step. A table at the end of the section summarizes light and control combinations.

Figure 3–1: TK70 Tape Drive

Orange Light

Yellow Light

Green Light

Unload Button

Handle

MLO-002292
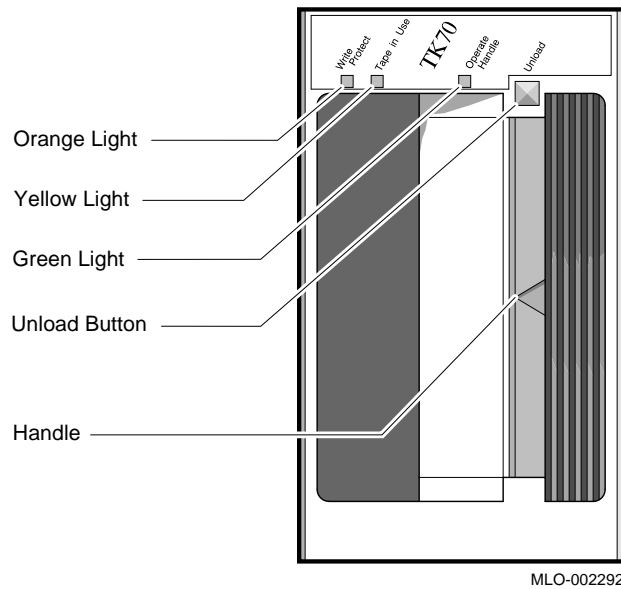
3.1.1.1 Design of the Drive

The TK70 tape drive operates like a reel-to-reel tape deck. Inside the drive is a take-up reel with a leader attached. Inside the cartridge is a single reel containing the magnetic tape. When you insert the cartridge and push in the handle, the leader in the drive automatically couples with the leader in the cartridge, and the tape winds onto the take-up reel. The coupling and winding process is called loading. When the automatic loading process is complete, the tape is ready to use.

Once the cartridge is loaded, you cannot remove it without rewinding and uncoupling the leaders, a process called unloading. Even if you have not used the tape, you must unload it before you can remove the cartridge. When you press the Unload button, the tape rewinds into the cartridge and the leaders uncouple.

Operating the System Options   **3–3**

3.1.1.2 Labeling a Tape Cartridge

When recording data on a cartridge, label its contents. For your convenience, a slot for the label is provided on the front of the cartridge. Write the identification on the label and insert the label in the slot on the front of the cartridge, as shown in Figure 3–2. The label is visible when the tape is in the drive.

Figure 3–2:   Labeling a Tape Cartridge

Label Slot
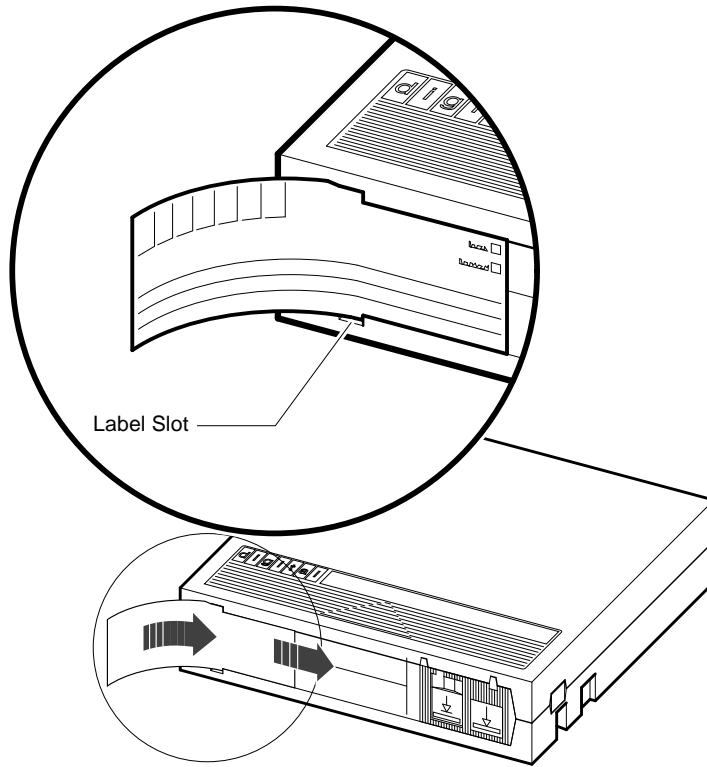
MLO-000960

To indicate that the tape was recorded on a TK70 tape drive, check the box labeled 296MB. The 95MB box is used for tapes recorded on a TK50 drive.

NOTE: *Do not write on the tape cartridge or attach labels to the top, bottom, or sides of the cartridge.*

3.1.1.3 Write-Protecting a Tape Cartridge

Write-protecting a tape cartridge prevents accidental erasure of information stored on the tape. You can write-protect a tape cartridge in two ways:

- Set the write-protect switch on the cartridge to the write-protect position.

- Write-protect the cartridge by using operating system commands described in your system software manuals.

Your system can read information on the tape regardless of the position of the write-protect switch or whether writing is software-disabled. However, the system cannot write data to the tape when the write-protect switch is set to the write-protect position, or when writing is software disabled.

When you use a cartridge to install software, make sure the cartridge is write-protected. Two icons on the switch indicate the write-protect status, as shown in Figure 3–3. An orange rectangle is visible when the switch is in the write-protect position. If you do not see an orange rectangle, slide the switch toward the label slot.

When you insert a write-protected cartridge into the drive, the orange indicator light comes on. The system recognizes the tape as being write-protected under any one of the following conditions:

- The write-protect switch on the cartridge is set to the write-protect position.

- An operating system command has write-protected the tape.

- A tape recorded on a TK50 tape drive is inserted into the drive.

Removing write-protection depends on how the tape was recorded and how it is write-protected. You cannot write-enable a tape recorded on a TK50 tape drive either by moving the write-protect switch on the cartridge or by using software commands. The TK70 drive always recognizes a tape recorded on a TK50 drive as write-protected. You can remove write-protection on tapes recorded on a TK70 drive as follows:

- If the cartridge is write-protected *only* by the write-protect switch on the cartridge and not the operating system, moving the switch to the write-enabled position causes the orange light to go out at the end of the executing command.

Figure 3–3: Tape Cartridge Write-Protect Switch

Write-
Protected

Not Write-
Protected

MLO-000961
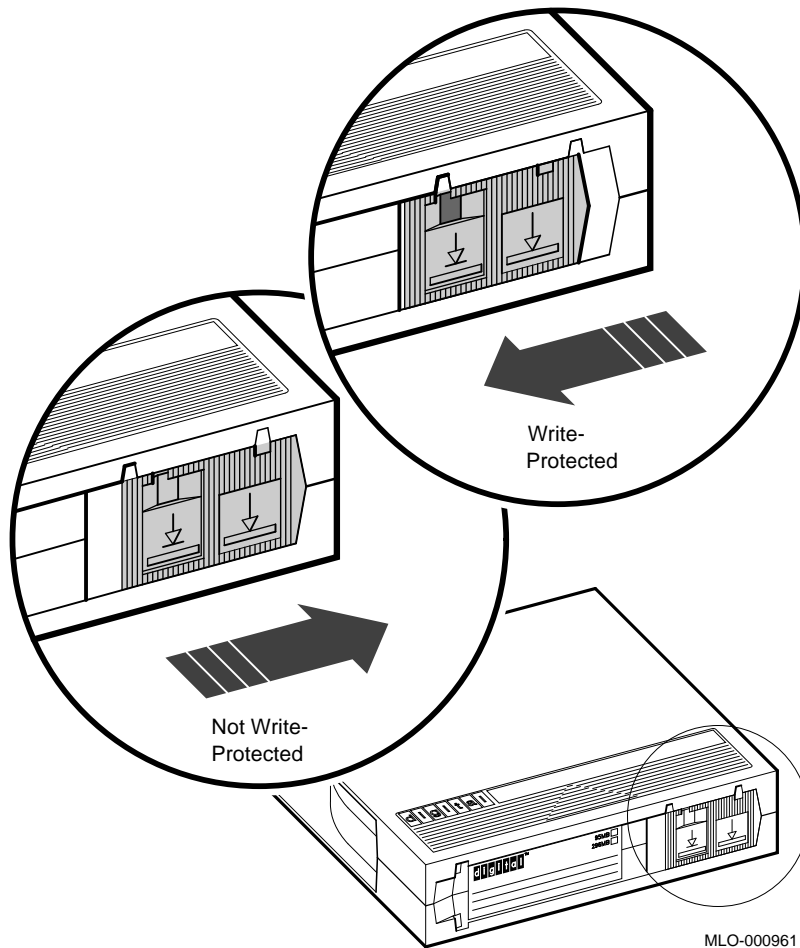
- If the cartridge is write-protected *only* by a software command and not the write-protect switch, removing the operating system restriction causes the orange light to go out.

- If the cartridge is write-protected by *both* the switch on the cartridge and a software command, you must change the switch setting and remove the operating system restriction.

When you use a CompacTape II cartridge to make a backup copy of files, make sure the orange write-protect light on the TK70 drive is off. If the light is not off, check for any of the write-protect conditions described above. Change the switch setting and/or operating system restriction as necessary. Do not begin your operation until the orange light goes off.

3.1.1.4 Tape Cartridge Handling and Storage Guidelines

• Do not touch the exposed surface of the tape.

• Do not drop the tape cartridge. The impact from a fall can damage the tape cartridge.

• Allow new tapes to stabilize at room temperature for 24 hours before using them.

• Place an identification label only in the label slot on the front of the tape cartridge.

• Store tape cartridges in a dust-free environment.

• Keep tape cartridges away from direct sunlight, heaters, and other sources of heat. Store tape cartridges in a stable temperature between 10° and 40° Celsius (50° and 104° Fahrenheit).

• Store tape cartridges where the relative humidity is between 20 and 80 percent.

• Keep tape cartridges away from magnets and equipment that generate magnetic fields, such as motors, transformers, terminals, and audio equipment.

• Keep tape cartridges away from x-ray equipment.

3.1.1.5 Inserting a Tape Cartridge

Before you use the tape drive, make sure the system is turned on (the power switch glows). During power-up, the TK70 drive runs self-tests that last a few seconds. All three lights (orange, yellow, and green) come on momentarily, then the yellow light blinks during the self-tests. At the end of the tests, the yellow light goes off and the green light comes on, accompanied by a short beep. The green light and the beep indicate that you can move the cartridge release handle.

CAUTION: *Move the handle only when the green indicator light is on. Moving the handle while the yellow light is on could damage the drive. If all three lights blink rapidly at any time, a fault condition exists. Press the Unload button once. If the fault is cleared, the tape unloads. The yellow light blinks during unloading, then the green light comes on. If the fault*

is not cleared, the three lights continue to flash. Do not attempt to use the tape drive or to remove the tape cartridge. Call your Digital service representative.

Use the following procedure to insert a tape cartridge (see Figure 3–4):

1. Pull the handle open.

2. Position the cartridge so the arrow on the cartridge faces left and points toward the drive. Insert the cartridge into the TK70 tape drive until you feel the cartridge lock into place.

3. Push the handle closed.

   The green light goes off and the yellow light blinks as the tape loads. When the yellow light glows steadily, the tape is ready to use.

   NOTE: *If the green light blinks rapidly when you push the handle closed, the drive has detected a cartridge fault. Pull the handle open and remove the cartridge. Use another cartridge.*

Refer to Appendix C of this manual for instructions on how to create backup files on a tape cartridge.

NOTE: *If a cartridge is new, the drive performs a calibration sequence that takes approximately 30 seconds when the drive receives the first command from the operating system. The yellow light blinks rapidly and irregularly during calibration.*

Figure 3–4:   Inserting a Tape Cartridge

Green Light is on

Handle

1

Cartridge Arrow
is Facing Left

2

Yellow Light Blinks

3
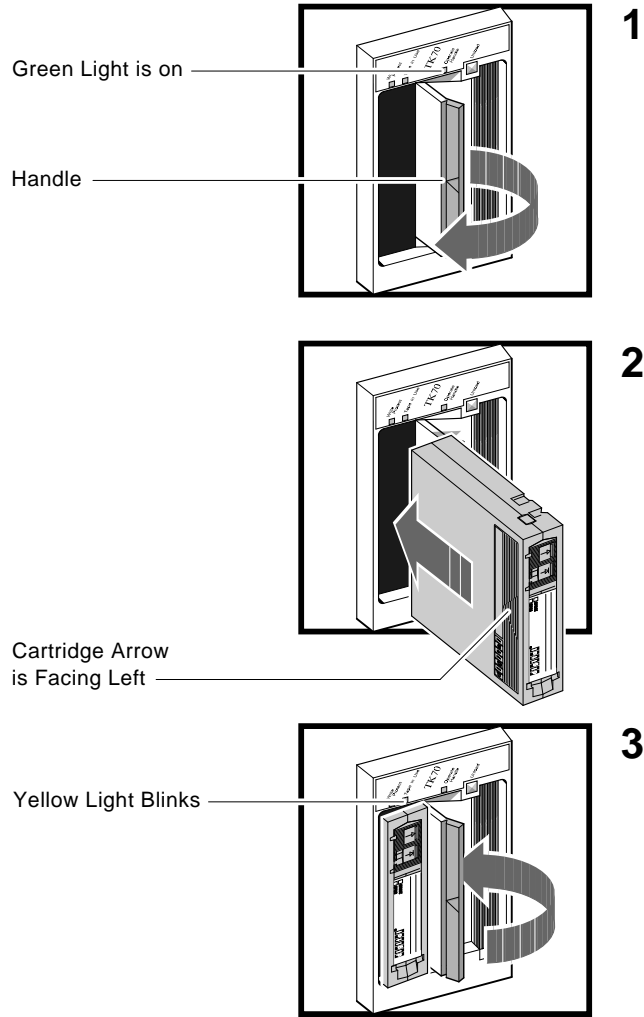
MLO-002459

3.1.1.6 Removing a Tape Cartridge

You must unload a tape before you can remove the cartridge from the tape drive. Use the following procedure (see Figure 3–5):

1. Press the Unload button. You can also issue a software command to unload the cartridge. Refer to your system software manuals for the appropriate command.

   The yellow light blinks slowly, as the tape rewinds and unloads into the cartridge. This may take up to 90 seconds.

2. When the yellow light goes off and the green light comes on (you also hear a beep), pull the handle open.

   CAUTION: *Move the handle only when the yellow indicator light is off and the green indicator light is on. Moving the handle while the yellow light is blinking could damage the drive.*

3. Remove the tape cartridge and store it in its container.

4. Push the handle closed.

The green light remains on, indicating that there is power to the drive and that you can safely move the handle.

CAUTION: *Remove the tape cartridge from the tape drive when the cartridge is not in use or before you turn off the system. Failure to remove the cartridge may damage the tape cartridge.*

Figure 3–5: Removing a Tape Cartridge

1

Unload Button
Yellow Light Blinks

2

Green Light is on

Handle

3

Cartridge Arrow is Facing Left

4

Green Light is on
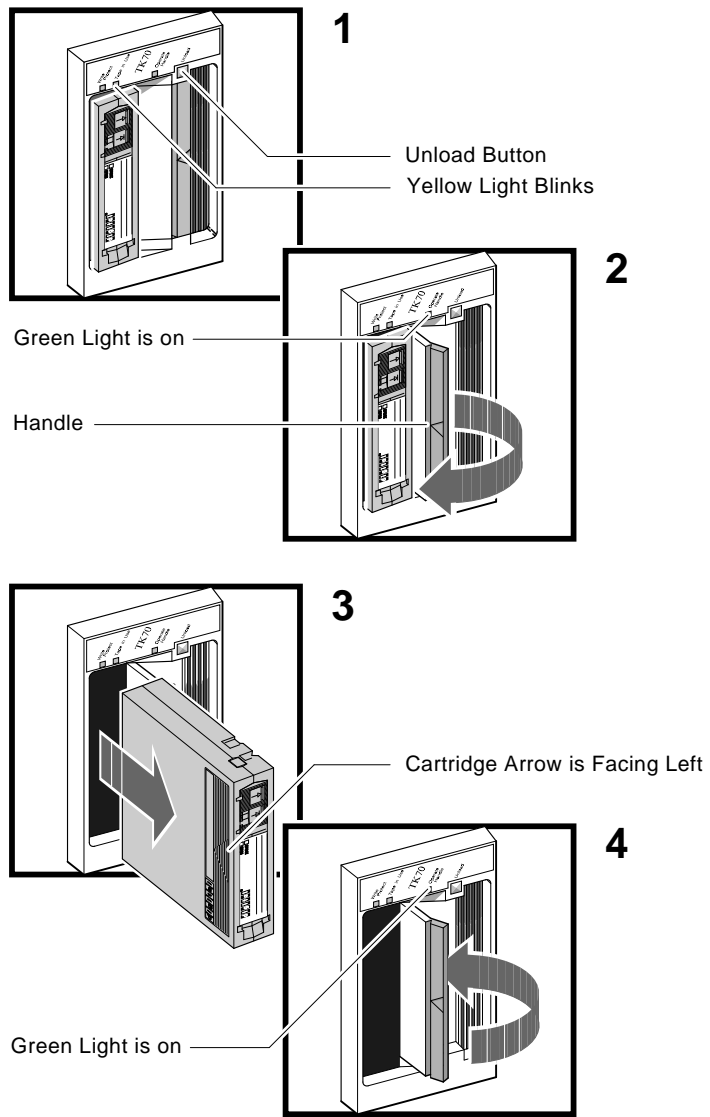
MLO-002460

3.1.1.7 Summary of TK70 Tape Drive Controls and Indicator Lights

Table 3–1 summarizes the TK70 tape drive controls. Table 3–2 describes the meaning of the indicator lights.

Table 3–1: TK70 Tape Drive Controls

Control	Position	Function
Handle	Open	Lets you insert or remove a tape after rewind and unload operations are completed.
	Closed	Locks tape in operating position and begins load sequence.
Unload button	Momentary contact switch	Rewinds and unloads the tape.

Table 3–2: TK70 Tape Drive Indicator Lights

Orange	Yellow	Green	Condition
Off	Off	Off	No power to the tape drive.
Off	Off	On steadily	Safe to move cartridge release handle. Power is present.
Off	Off	Blinking	Load fault. The cartridge leader may be defective. Pull out the handle and remove the cartridge. Do not use the cartridge.
On/Off	On steadily	Off	Tape is loaded but not in motion.
On/Off	Blinking	Off	Tape is in motion.
On	On steadily/ blinking	On	Cartridge is write-protected.
Blinking	Blinking	Blinking	A fault is occurring. Press the Unload button to unload the tape cartridge. If the fault is cleared, the yellow light blinks while the tape rewinds. When the green light comes on, you can move the handle to remove the cartridge. If the fault is not cleared, all three lights continue to blink. Do not attempt to remove the tape cartridge. Call your Digital service representative.

3.1.2 TLZ04 Tape Drive

The TLZ04 tape drive is located behind the upper door of the system. To use the drive, move the key to the top position and open the door.

The TLZ04 tape drive is a backup device that uses digital data storage (DDS) and digital audio tape (DAT) recording technologies. Digital audio tape, such as TLZ04 cassettes, takes advantage of the TLZ04 tape drive's helical scan technology. This technology allows more data to be stored on tape by recording data diagonally. DAT recording also minimizes "crosstalk," providing you with higher data integrity.

Digital data storage uses a recording format that supports the use of digital audio tape for computer applications. The DDS/DAT format allows you to back up 1.2 gigabytes of data in approximately 2 hours with no operator intervention. In addition, this format has three levels of error correction, which ensures high data integrity.

**TLZ04 Tape Drive Controls and Indicators**

Figure 3–6 shows the TLZ04 tape drive.

The unload button is used to eject the cassette tape. The Tape and Drive indicators show the status of the TLZ04 and can indicate possible error conditions.

CAUTION: *Pressing the unload button during normal tape operations may halt the tape operation in progress.*

Table 3–3 describes the TLZ04 drive indicators as they apply to normal operating conditions. Table 3–4 describes the TLZ04 drive indicators as they apply to abnormal operating conditions.

Figure 3–6:   TLZ04 Tape Drive
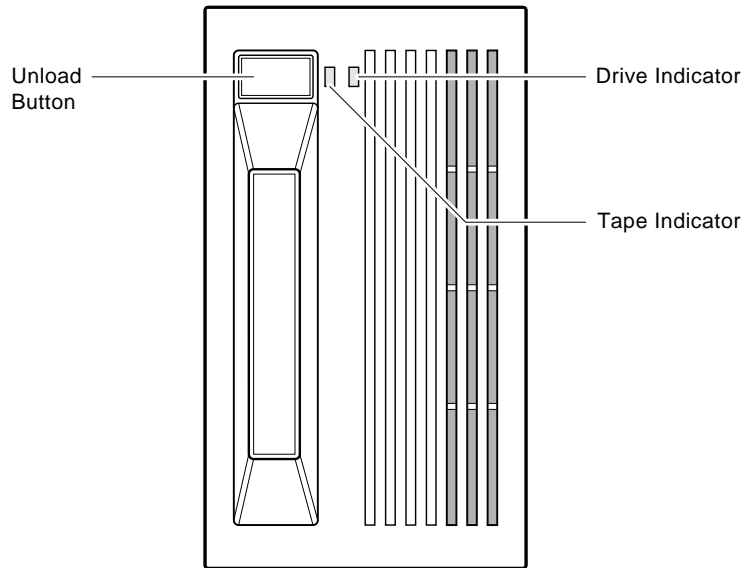
MLO-005328

Table 3–3:   TLZ04 Drive Indicators (Normal Conditions)

Indicator	Color(s)	Meaning
Tape		Indicates status of cassette tape as follows.
	Solid green	Tape loaded.
	Solid yellow	Tape loaded and write protected.
Drive		Indicates status of TLZ04 drive as follows.
	Solid green	Drive ready/power on.
	Flashing green	Drive active.
	Flashing yellow	Power-on self-test in progress.

Table 3–4: TLZ04 Drive Indicators (Abnormal Conditions)

Indicator	Color(s)	Meaning
Tape	Slow flashing green or yellow	Excessive tape errors. Use the head cleaning cassette. If failure repeats itself, use another cassette tape.
Tape and Drive	Solid yellow	High humidity. Adjust operating environment.
Tape	Flashing yellow 1-3 times	Power-on self-test failed.
Drive	Solid yellow	Power-on self-test failed.

3.1.2.1 Proper Handling of Cassette Tapes

Digital Equipment Corporation recommends that you use TLZ04 cassette tapes. To ensure optimal performance from your cassette tapes, observe the following guidelines when handling them.

- Avoid placing the cassette tapes near sources of electromagnetic interference, such as terminals, and video or X-ray equipment. Emissions from such equipment can erase data on the tape.

- Keep cassette tapes out of direct sunlight and away from heaters and other sources of heat.

- Store cassette tapes (and cleaning cassette) where the room temperatures are between 5°C and 32°C (40°F and 90°F).

- Store cassette tapes in a dust-free environment where the relative humidity is 20% to 60%.

3.1.2.2 Setting the Write-Protect Tab on the Cassette Tape

If you wish to read or copy from a tape, set the write-protect tab on the cassette to write protect. This disables writing to tape, and ensures data integrity. Use a pen (not pencil) to set the write-protect tab (Figure 3–7) to the desired position.

Observe the following guidelines when setting the write-protect tab.

- If you are reading data (copying from tape), set the write-protect tab to write protected.

- If you are writing data, set the write-protect tab to write enabled.

- Write-protect tab position displays in front panel tape indicator.

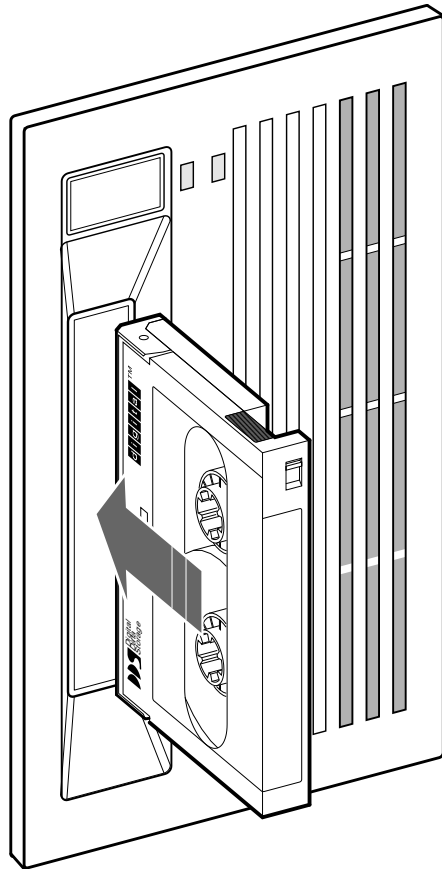**Figure 3–7:   Setting the Write-Protect Tab on the Cassette Tape**
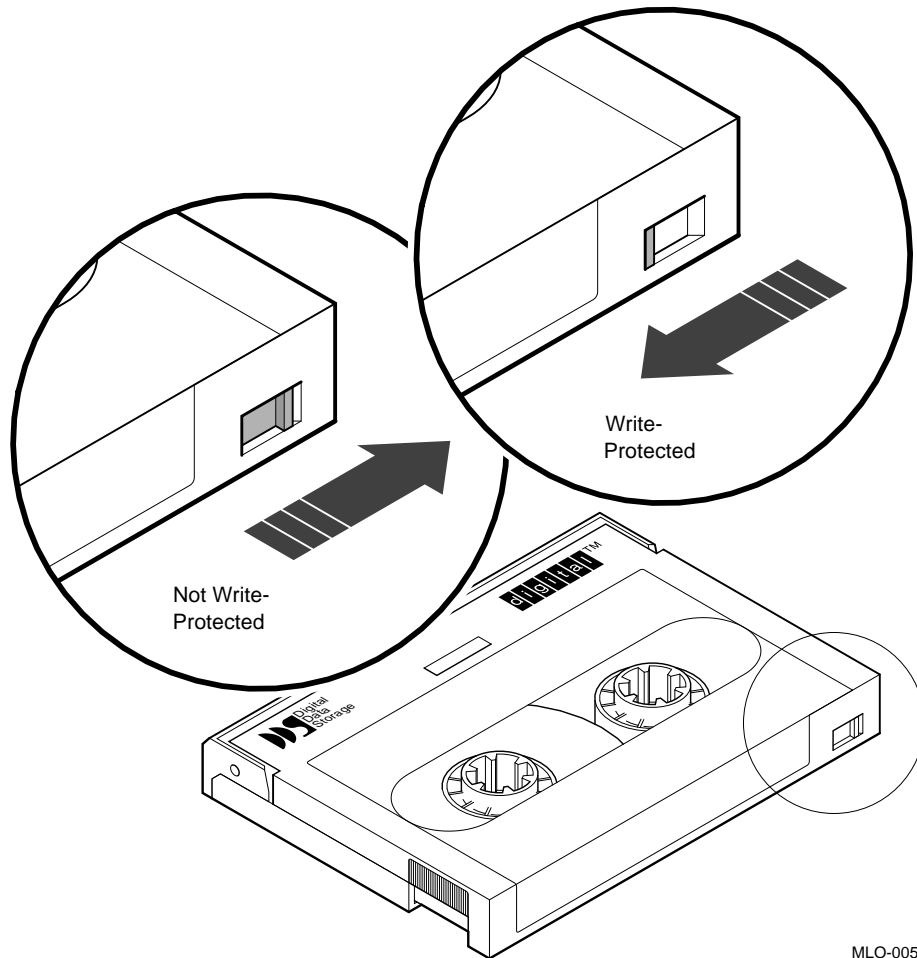
MLO-005329

3.1.2.3 Inserting a Cassette Tape into the Drive

Insert the TLZ04 cassette tape into the drive with the cassette's write-protect tab at the top, as shown in Figure 3–8.

Figure 3–8:   Inserting a Cassette Tape into the Drive

MLO-005331

3.1.2.4 System Software

System software allows you to execute commands to read and write data to
the cassette tape. Your operating system documentation describes specific
commands that allow you to do the following:

- Back up data from disk drives to a tape drive

- Copy data from disk to tape, or tape to disk

3.1.2.5 Cleaning the Heads

Statistics show that over ninety percent of drive-related problems are associated with the media. Therefore, Digital Equipment Corporation strongly recommends that you follow the instructions for handling cassette tapes and cleaning the heads of the drive.

This section shows you how to perform TLZ04 head cleaning. The heads are the components in a drive that magnetically read and write data to and from the media (in this case, a cassette tape).

NOTE: *Digital Equipment Corporation recommends that you perform the head cleaning procedure about every 2 weeks, or after every 25 hours of drive usage.*

Under normal conditions, it should not be necessary to exceed this cleaning schedule. If a particular cassette causes problems, try changing to another cassette.

CAUTION: *Never attempt to clean the heads in a manner other than described herein. Doing so will void the product warranty.*

To clean the heads, use the head cleaning cassette as follows:

1. Observe that the drive indicator is lit solid green.

2. Insert the head cleaning cassette (part number TLZ04–HA) into the drive as shown in Figure 3–9.

3. With the head cleaning cassette inserted, the drive automatically cleans the head. The drive ejects the head cleaning cassette after approximately 30 seconds.

4. In the space provided on the card enclosed with the head cleaning cassette, place a check mark every time you use the head cleaning cassette.

   Under normal conditions, the head cleaning cassette performs for approximately 25 cleanings. Additional cassettes are available from your Digital sales representative or DECdirect.

   If the head cleaning cassette has been used more times than it was designed to be used, the drive will eject the cartridge in approximately 8 to 10 seconds. No cleaning action will occur.

   CAUTION: *Do not exceed the recommended 25 uses of the cleaning cassette. After 25 uses, the cleaning cassette no longer cleans the heads. You must use a new cassette.*

Figure 3–9: Inserting the Head Cleaning Cassette
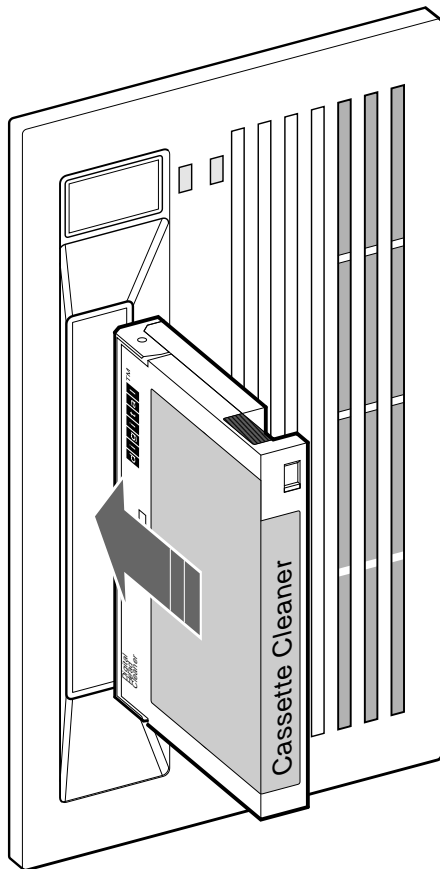
MLO-005332

3.1.3 RF/RZ-Series Integrated Storage Elements

Your system may have up to four RF/RZ-series ISEs, or up to three RF/RZ-series ISEs and a tape drive. When your system has multiple ISEs, Digital recommends that you separate them according to function. For example, if your system has two ISEs, you may want to use them as follows:

• ISE 0 contains the operating system and applications installed on the system.

- ISE 1 contains work areas for each user with an account on the system.

The storage capacities and other specifications for RF-series ISEs are listed in *DECsystem 5500 Technical Information.*

NOTE: *If your system has less than the maximum number of ISEs: three if you have a tape drive, or four without the tape drive, a blank ISE front panel with no controls or indicators is used to cover the empty ISE cavities. The front panels are required to meet international regulatory standards.*

RF-Series Controls and Indicators

Each RF-series ISE has controls and indicators on its front panel. To access the ISE controls you need only open the upper door (top key position). Figure 3–10 shows the front panel of an RF-series ISE.

Figure 3–10: RF-Series ISE Controls and Indicators

Run/Ready Button

Write-Protect Button

Bus Node
ID Plug
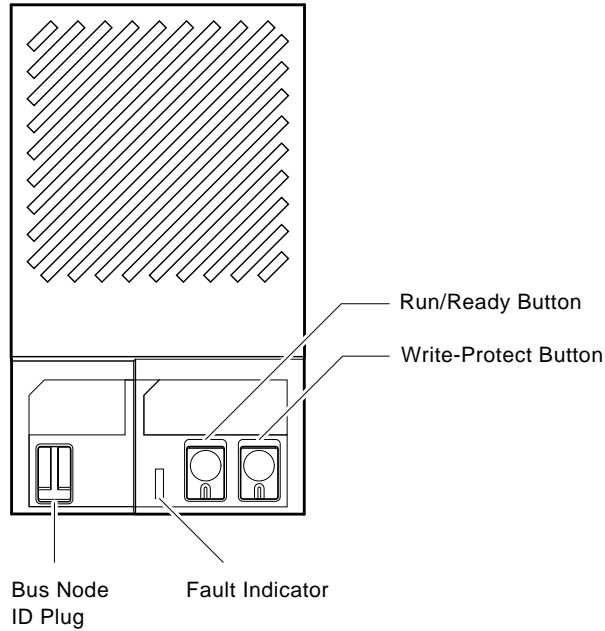
Fault Indicator

MLO-004044

Each ISE has the following controls and indicators on its front panel.

- Bus node ID plug

- Fault indicator
- Write-Protect button
- Run/Ready button

Bus node ID plugs identify the bus node number of the ISEs to the system, as well as the unit number by default. Bus node numbers are configured at the factory in consecutive order from right to left: the right-most ISE as 0, the center ISE as 1, and the left-most ISE as 2. (Tapeless systems can have up to four ISEs, with the left-most ISE as 3.)

Table 3–5 lists RF-series controls and indicators.

Table 3–5: RF-Series Controls and Indicators

Control	Position	Function
Bus Node ID Plug	Installed	The bus node ID plug identifies the bus node ID number of the ISE to the system and is, by default, the unit number. The ISE bus node ID is factory set to a number 0 through 6.
	Not installed	The ISE bus node number is undefined. The ISE Fault indicator lights.
Fault	Lit	Indicates an error condition in the ISE. The light is on temporarily during power-up sequence (normal condition).
	Not lit	Indicates an error-free condition in the ISE.
Run/Ready	In (lit, green)	ISE is on line. When the ISE is available for use, the green indicator light in the switch is on. Under normal operation the green indicator flashes as seek operations are performed.
	Out (not lit)	ISE is off line and cannot be accessed. The green indicator light cannot be lit when the Run/Ready button is out.
Write-Protect	In (lit, amber)	ISE is write-protected. Prevents system software from writing to the ISE.
	Out (not lit)	ISE is not write-protected. Normal position for software operation. System software is free to read from or write to the ISE.

The Write-Protect button controls whether the system can write data to the ISE. The system can read from the ISE regardless of the setting of the

Write-Protect button. When the Write-Protect button is out (not lit), the system can write to the ISE. Your system disk (the ISE containing system software) and ISEs containing work areas for users should be write-enabled, the normal operating setting.

If you want to write-protect an ISE containing sensitive data that you do not want changed or accidentally erased, set the Write-Protect button to in (lit).

RZ-Series Front Panel

Each RZ-series ISE has a front panel that contains a bus node ID plug. To access the front panel you need only open the upper door (top key position). Figure 3–11 shows the front panel of an RZ-series ISE.

Figure 3–11: RZ-Series ISE Front Panel
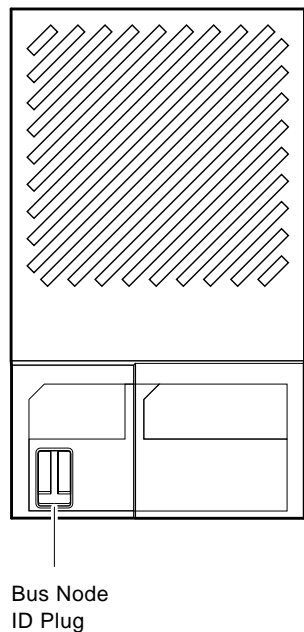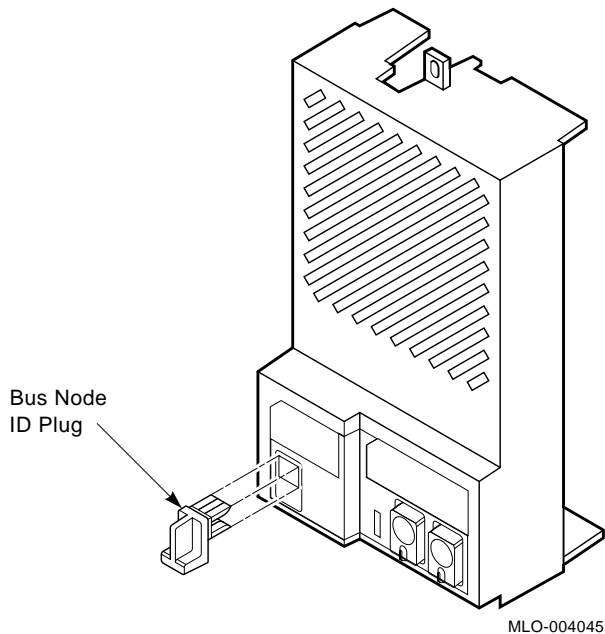

Bus Node
ID Plug

MLO-005185

Changing the Bus Node ID Plugs

Spare bus node ID plugs are supplied with your system. The DSSI plugs for RF-series ISEs are dark gray. The part number for these plugs is 12–28766–19. The SCSI plugs for RZ-series ISEs are a lighter gray. The part

number for these plugs is 12–28766–28. Use the spare plugs to renumber your ISEs if you reconfigure your system with an expander.

The bus node ID plugs have prongs on the back that indicate the bus node number (and by default, the unit number) of the ISE. To remove a bus node ID plug, grasp it firmly and pull straight out. To insert a bus node ID plug, align the two center prongs with the two center slots and press the plug into the slots. See Figure 3–12.

Figure 3–12: Inserting Bus Node ID Plugs

Bus Node
ID Plug

MLO-004045

Use the rules below for renumbering your storage elements:

- For each DSSI or SCSI bus, do not duplicate bus node numbers for your storage elements. You can only have one storage element on Bus 0 identified as bus node 1, one storage element as 2, and so on; you can only have one storage element on Bus 1 identified as bus node 1, one storage element as 2, and so on.

- By convention, the ISEs are numbered in increasing order from right to left.

NOTE: *If you change the bus node ID plugs while the system is operating, you must turn off the system and then turn it back on for the new plug positions to take effect.*

3.1.4 RV20 Optical Disk Subsystem

If your system includes an RV20 Optical Disk Subsystem, refer to the *RV20 Optical Disk Subsystem Owner's Manual* for instructions on how to operate the device.

3.1.5 RRD40 Digital Disk Subsystem

If your system includes an RRD40 Digital Disk Subsystem, refer to its user guide for instructions on how to operate the device.

3.1.6 TS05 Tape Drive

If your system includes a TS05 tape drive, refer to the *TS05 Tape Transport System User's Guide* for instructions on how to operate the device.

NOTE: *The TS05 is a data interchange device and is not supported as a backup device.*

3.1.7 TU81–Plus Tape Drive

If your system includes a TU81–Plus tape drive, refer to the *TU81–Plus Tape Subsystem User's Guide* for instructions on how to operate the device.

3.2 Communications Controller Options

The following types of communications controllers are available for the DECsystem 5500 systems:

- Asynchronous serial controllers (with or without modem support)
- Synchronous serial controllers (with or without modem support)
- Network controllers

3.2.1 Asynchronous Serial Controllers

The following asynchronous controllers are available for your DECsystem 5500 system, with and without modem support:

- CXA16 — 16-line multiplexer, Q-bus controller
- CXB16 — 16-line multiplexer

- CXY08 — 8-line multiplexer with modem control, Q-bus controller

3.2.1.1 Without Modem Support

Before using any peripheral device connected to a serial communications controller, check the following:

- Make sure the peripheral device is properly connected to the system.

- Make sure the peripheral device is properly installed, plugged into an appropriate power source, and turned on.

- Make sure the peripheral device is properly set up. Set-up involves choosing how the device operates. Some set-up choices are matters of personal choice, for example, the number of columns that display on a terminal screen. Others, like baud rate (a measure of the speed at which data is transmitted over a data line), must match the system setting if the peripheral device and system are to communicate. Refer to your terminal or printer manual for complete set-up instructions. Generally, the default settings for your terminal are acceptable.

  While most default settings are acceptable, you should perform the set-up procedure for your terminal to ensure appropriate set-up values. The two examples below provide set-up instructions for VT300-series and VT200-series terminals:

For VT300-Series Terminals:

1. Press Set-Up to display the Set-Up Directory screen.

2. Use the arrow keys to select the "Communications Set-Up" option and press Enter .

3. Make sure the "Transmit Speed" option in the "Current Setting" column is set to 9600. Use the left and right arrow keys to change the setting.

4. Make sure the "Receive Speed" option in the "Current Setting" column is set to "receive=transmit." Use the down arrow to move the cursor to this option, and the left and right arrows to change the setting.

5. Press Select to return to the Set-Up Directory screen.

6. Use the arrow keys to select the "Global Set-Up" option and press Enter .

7. Select the option "Comm Port."

8. If the port in the "Current Setting" column is selected for "RS–232," press Enter to select the "DEC–423" port.

9. Press $\boxed{\text{Select}}$ to return to the Set-Up Directory screen.

10. Use the arrow keys to select the "Save Current Settings" option. Press $\boxed{\text{Enter}}$ to save all current settings; then press $\boxed{\text{Set-Up}}$ to exit the Set-Up Directory.

For VT200-Series Terminals:

1. Press $\boxed{\text{Set-Up}}$ to display the Set-Up Directory screen.

2. Use the arrow keys to select the "Default" option and press $\boxed{\text{Enter}}$. Default correctly sets all values except transmit speed.

3. Use the arrow keys to select the "Comm" option and press $\boxed{\text{Enter}}$ to display the Communications Set-Up menu.

4. Use the arrow keys to select the "Transmit" option and press $\boxed{\text{Enter}}$ to set the speed to 9600.

5. Use the arrow keys to select the "To Directory" option and press $\boxed{\text{Enter}}$.

6. Use the arrow keys to select the "Save" option and press $\boxed{\text{Enter}}$; this option stores the set-up values. Then press $\boxed{\text{Set-Up}}$ to exit the Set-Up Directory.

Your operating system may have other requirements for using serial communications devices. Refer to your system software manual.

3.2.1.2 With Modem Support

Using serial devices with modem support requires that you install two modems: one connected to the system and one connected to the remote terminal. Both must be connected to phone lines.

Before using modems with your system, check the following:

1. Make sure each modem is connected to the system.

2. Make sure the modem is properly installed and connected to a phone jack.

3. Set controls on the modem according to instructions in the modem user's guide.

Before using the modem connected to the remote terminal, check the following:

1. Make sure the modem is properly installed and connected to a phone jack.

2. Set controls on the modem according to instructions in the modem user's guide.

3. Check the settings on the terminal attached to the modem. Depending on the type of modem and the type of lines used, the baud rate may be 300, 1200, or 2400. Other settings should be the same as those described in the previous section.

Before using a phone line with modem support, you must set certain parameters such as line speed. See your system software manuals for details.

3.2.2 Synchronous Controllers

The DSV11 dual-line synchronous controller is available for your DECsystem 5500 system:

Before using a synchronous controller you must verify the following:

- The system you want to communicate with has an appropriate synchronous controller. Synchronous communications require a synchronous controller on both the transmitting and receiving system.

- Both the transmitting and receiving systems must have supporting host software installed. Synchronous communications operate under specific protocols that define how data is interpreted. Two common protocols are X.25 and PSI. Appropriate host software is required to interpret the protocol.

3.2.3 Network Controllers

NOTE: *DECsystem 5500 systems contain an Ethernet controller embedded in the CPU module. You can have a second optional Ethernet controller, the DESQA module, included with your system.*

Before using a network controller you must do the following:

1. Make sure the Ethernet cable (either standard transceiver cable or ThinWire cable) is connected to the console module (or optional DESQA module). The light next to the connector should be lit, indicating an active connection. If not lit, move the Ethernet Connector switch to the proper position.

2. Make sure the Ethernet cable is properly connected to the network. A transceiver cable can be connected in one of the following ways:

    - To an H4000 or H4005 transceiver located on a traditional Ethernet

- To a local network interconnect (DELNI), which can be connected to a larger Ethernet or can serve to connect up to eight systems in a local area network

A ThinWire cable can be connected as follows:

- To a ThinWire Ethernet multiport repeater (DEMPR) or ThinWire single port repeater (DESPR), which can be connected to a larger Ethernet or can serve to connect many systems in a local area network

- To an available connection on a T-connector of other ThinWire nodes

3. Have the DECnet application installed on your system.

4. Register your node with the network manager so that your node is recognized by other systems in the network.

Some software products use the Ethernet hardware address of other systems to operate properly.

The hardware address of your on-board Ethernet device is displayed after the self-tests complete at each power-up. If you have an additional DESQA Ethernet adapter, use the **show ether** command at the Maintenance mode console prompt to display the hardware address. As in the following example, the DESQA module is indicated by XQA0:

```
>> maint
>>>show ether
Ethernet Adapter
 -mop() -EZA0  (08-00-2B-12-81-22)

Ethernet Adapter 0 (774440)
 -XQA0 (08-00-2B-06-16-F2)
>>>exit
>>
```

Refer to your software manuals and network manuals for other requirements and further instructions on using a network connection.

3.3 Printer Options

Before using a printer, make sure it is properly set up and passes any self-tests. Verify that the printer is connected to an appropriate controller. Some printers, such as the LG01 and LG02, require the LPV11–SA interface. Other printers require modem control signals. Consult your printer documentation for the interface requirements.

DECsystem 5500 systems have several printer options available. Consult the *DECsystem 5500 Technical Information* manual for a list of printers and printer interface requirements.

3.4 Adding Options

If you have available Q-bus slots, you may be able to add modules to your system. Possible limitations to adding modules include the following:

- Power limitations

- Physical space limitations

- Bus limitations (ac/dc loading)

Your Digital sales representative can advise you about modules available for your system and what you need to order. A Digital service representative should perform the installation, since the system must be properly configured to work correctly.

CAUTION: *Do not attempt to remove, rearrange, or install modules. Contact your Digital service representative for assistance.*

Appendix A
Related Documentation

Document	Order Number
Hardware Documentation	
KN220 CPU System Maintenance	EK–375AA–SM
R400X Expander Installation	EK–R400X–CM
B400X Expander Installation	EK–B400X–AD
RF30/RF71 User Guide	EK–RF71D–UG
Software Documentation	
ULTRIX Basic Installation Guide	AA–PBL0A–TE
ULTRIX Guide to System and Network Setup	QA–ME88B–TE
ULTRIX Reader's Guide	AA–ME82B–TE
ULTRIX Guide to Prestoserve for RISC	TBD

Documentation specific to supported options is listed with the option in *DECsystem 5500 Technical Information*.

Glossary

Application program

A program designed to meet specific user needs, such as a program that monitors a manufacturing process.

Allocation class

The allocation class is used by the operating system to derive a common lock resource name for multiple access paths to the same device.

Backplane

1. The connector block that printed circuit boards plug into.

2. A printed circuit board containing the bus.

Back up

The process of making copies of the data stored in the ISE(s) so that you can recover that data after an accidental loss. You make these copies on a tape cartridge and then store it in a safe place.

Backup copy

A duplicate copy of the operating system or data on the ISE that is stored on a tape cartridge.

Baud rate

The speed at which signals are transmitted serially over a communication line.

Binary

A number system that uses only two digits: 0 and 1. These digits are usually represented in circuitry by two voltage levels.

Bit

A binary digit, the smallest unit of information in a binary system of notation, designated as a 0 or a 1.

Boot

To use a bootstrap program to start a computer system.

Bootable medium

A fixed disk or magnetic tape containing software (such as an operating system) that the bootstrap program can load into the system memory.

Bootstrap

A program that you start when you turn on the system. The bootstrap loads software contained on a fixed disk or magnetic tape cartridge into memory. The system then stops executing the bootstrap and starts executing the software in memory. The software usually loads an operating system or other software into memory, so that the system can start processing.

Bug

An error in the design or implementation of hardware or software system components.

Bus

The connection between the central processing unit (CPU) and input/output devices in the system. Information signals such as address, data, and control signals are carried through the bus.

Byte

A group of eight binary digits (bits). A byte is one-half the size of a word and one-quarter the size of a longword.

Central processing unit (CPU)

The part of a computer system that controls the interpretation and execution of instructions.

Command

An order given by a user to a computer, often through a terminal keyboard.

Communication line

A cable along which electrical signals are transmitted. Systems or devices connected by communication lines can share information and resources.

Computer system

A combination of computer hardware, software, and external devices that performs specific operations or tasks.

Console terminal

The terminal you use when installing software and running diagnostic programs.

Controller

A component that regulates the operation of one or more peripheral devices. Controllers are often called interface units.

CPU

See *Central processing unit.*

Data

A representation of facts, concepts, or instructions, suitable for communication, interpretation, or processing by human beings or by machines.

Data transmission

The movement of data, in the form of electrical signals, along a communication line.

Debug

To detect, locate, and correct errors (bugs) in system hardware or software.

DECnet

Digital networking software that runs on nodes in both local and wide area networks.

DECwindows

Digital's workstation management product, a superset of the industry standard X Window System. It can be used to run windowing applications efficiently on single workstations, or in distributed processing networks of workstations and non-workstations systems.

Default

A value or setting that in most cases is normal or expected.

Device

The general name for any entity connected to a system that is capable of receiving, storing, or transmitting data.

Device name

The name by which a device or controller is identified within a system. You use the device name to refer to that device when communicating with the system.

Diagnostic program

A program that detects and identifies abnormal hardware operation. The MicroVAX Diagnostic Monitor software contains several diagnostic programs.

Disk

A flat circular plate with a coating on which data is stored magnetically in concentric circles (tracks).

Disk drive

A device that contains a fixed disk or one or more diskettes. The drive contains mechanical components that spin the disk or diskettes and move the read/write heads that store and read information on the surface of the disk or diskettes.

DSSI

Digital Storage System Interconnect (DSSI) is the technology used for efficient management of integrated disk storage products. DSSI is a member of the Digital Storage Architecture (DSA) product "family."

EIA

Electronic Industries Association.

Error message

A message displayed by the system to indicate it has detected an error or malfunction.

File

A collection of related information treated by the computer as a single item.

Firmware

Software instructions stored in a fixed form, usually in read-only memory (ROM). In a VAX 4000 system, the power-up self-tests and bootstrap program are firmware.

Formatted data

Data laid out in a particular pattern to conform to a predetermined structure. The structure is dictated by the system software.

Hardware

The physical components — mechanical and electrical — that make up a computer system. Compare *Software*.

Head

The part of a fixed-disk drive, diskette drive, or tape drive that reads, records, and erases data. Also called read/write head.

Input device

A piece of equipment used to transfer data into the computer. A keyboard is an input device.

Input/output (I/O) device

A piece of equipment that accepts data for transmission both to and from a computer. A terminal is an input/output device.

Interactive

The method of communicating with a computer system. You enter a command at the keyboard, the system executes the command, and then responds with a message or prompts for another command.

Integrated Storage Element

Integrated Storage Elements are intelligent storage devices that contain their own controller and MSCP server.

Interface

A device or piece of software that lets different components of a computer communicate with one another.

I/O

Abbreviation for input/output.

ISE

See *Integrated Storage Element.*

Kbyte

1024 bytes.

LED

Light-emitting diode. An LED on the console module displays a hexadecimal countdown during the power-up sequence.

Load

1. To move software, usually from a peripheral device into memory.

2. To place a disk in a disk drive, or tape in a tape drive.

Longword

A group of 32 bits, equal to two words or four bytes.

Magnetic tape

A long strip of plastic coated with magnetic oxide, used for storing data. Often called magtape. The tape contained in a tape cartridge.

Mbyte

1,048,576 bytes.

Memory

The area where a computer finds the instructions and data it will process.

Menu

A displayed list of options. The list usually contains commands you can enter.

Network

A group of individual computer systems that are connected by communications lines to share information and resources.

Network coordinator

The network coordinator manages the network, assigns unique node names and addresses for each system on the network, and provides administrative assistance to network users.

Node

An individual information processing unit, such as a computer, workstation, or device, that is connected to a network. A node is an end point to any branch of a network or a junction common to two or more branches.

Off line

Pertaining to equipment, devices, and events that are not under direct control of the computer system.

Operating system

A collection of programs that controls the overall operation of a computer and performs such tasks as:

- Assigning places in memory to programs and data

- Processing requests, scheduling jobs

- Controlling the operation of input and output devices

Output device

A device by means of which data can be extracted from a computer system, for example, a printer.

Peripheral device

Any device distinct from the central processing unit that provides it with additional memory storage or communication capability. Examples are disk and diskette drives, video terminals, and printers.

Power-up sequence

A series of ordered events that occurs when you supply power to a system by turning it on.

Printer

A peripheral device that provides paper copies of information stored in a computer.

Product Authorization Key (PAK)

A PAK is a printed certificate containing information that must be input to the License Management Facility to authorize the user to run a particular software product.

Program

The complete sequence of instructions necessary for a computer to perform a task. See *Software*.

Prompt

A character(s) or word(s) that a computer displays to indicate it is waiting for you to type a command.

Read-only memory (ROM)

A memory that does not allow modification of its contents. The computer can use data in a ROM but cannot change it.

Reboot

To restart a computer system. Pressing the Reset button reboots the system.

Record

A set of related data that a program can treat as a unit. A file consists of a number of records.

ROM

See *Read-only memory*.

Run

1. A single continuous execution of a program.

2. To execute a program.

Satellite system

A system that is booted remotely from the system disk on the boot node. A computer system that obtains a specific set of services from a server system.

Server

Hardware or software that provides a specific set of services to a satellite.

Server system

A computer that is used to start the satellite systems and to manage their use of common resources.

Software

Programs executed by a computer system to perform a chosen or required function. Compare *Hardware*.

Software package

A set of related programs that performs a specific task.

Storage medium

Any device capable of recording information, for example, a tape cartridge.

Store

To enter data into a storage device, such as a disk, or into memory.

System

A combination of computer hardware and software and external devices that performs specific processing operations.

System Disk

The disk or ISE that holds the system software.

System management

Tasks performed by the operating system to control the overall operation of the computer system.

Terminal

An input/output device generally used for communication between the users of a computer system and the system itself.

Video terminal

A terminal that displays information on the screen of a cathode ray tube (CRT).

TFTP

Trivial File Transfer Protocol.

Word

A word is 16 bits long.

Write-protect

To protect a disk, diskette, or other storage medium against the addition, revision, or deletion of information.

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