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MicroVAX 2000
Owner's Manual

Prepared by Educational Services
of Digital Equipment Corporation

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Preface

This manual describes how to operate and troubleshoot the MicroVAX 2000 hardware. It is one of a set of manuals that accompanies your MicroVAX 2000.

Recommended Reading Path

The MicroVAX 2000 hardware and software documentation should be read in the following order:

1. *MicroVAX 2000 Hardware Installation Guide*
2. *VAXstation 2000, MicroVAX 2000 and VAXmate Network Guide* for network information, if needed
3. Chapter 1 of the *MicroVAX 2000 Owner's Manual* (this manual) - before software installation
4. *MicroVMS VAXstation 2000/MicroVAX 2000 Installation Guide* or *ULTRIX-32 Basic Installation Guide for the MicroVAX 2000* for software installation information
5. *VAXstation 2000/MicroVAX 2000 Operations Guide* or *ULTRIX-32 System Management Guide* and *ULTRIX-32 Programmer's Manual* for software operation
6. *MicroVAX 2000 Owner's Manual* (this manual) for hardware operation and troubleshooting

MicroVAX 2000 Description

The MicroVAX 2000 is a multiuser desktop computer that uses the MicroVAX II processor chip with 2 megabytes of memory on-board. Its desktop enclosure holds one or two mass storage devices. The system allows up to four video terminals to be connected.

The following Digital hardware options are offered:

- 2- and 4-megabyte memory modules
- Expansion boxes for additional mass storage devices
- Expansion adapter to connect expansion box to system unit
- Mass storage

  Diskette drive with 1.2 megabytes of memory
  Fixed disk drives with 40 or 71 megabytes of memory respectively
  Tape drive with 94.5 megabytes of memory
- ThinWire Ethernet module
- Printers

  LN03, LN03 PLUS, and LPS40 laser printers
  LA210, LA100, LA75, and LA50 dot matrix printers
- Terminals

  LA100 and LA120 hardopy terminals
  VT220, VT240, and VT241 video terminals
- Modems

  DF112, DF124, and DF224 modems

MicroVAX 2000 software includes the following:

- MicroVMS operating system software
- ULTRIX-32 operating system software

System Manager

A system manager should oversee the hardware and software for systems that are located on the same network or in a local geographical area. This simplifies and centralizes the maintenance of equipment and software.

Special Notices

The following notices appear throughout this guide:

- **NOTES** - Contain supplemental information.
- **CAUTIONS** - Contain information to prevent equipment damage.
- **WARNINGS** - Contain information to prevent personal injury.

Conventions

- **Boldface—NOTES, CAUTIONS,** and **WARNINGS** are set in boldface.
- *Italics*—Document titles are italicized.

Chapter 1

Operating the MicroVAX 2000

This chapter describes how to operate the MicroVAX 2000 and its mass storage devices. Review this chapter before installing operating system software. Descriptions and operating information are included for the following:

- Enclosure
- Controls and indicators
- Fixed disk drives
- Diskette drive and diskettes
- Tape drive and tape cartridges
- Expansion adapter
- Expansion box

Setting Up and Handling the MicroVAX 2000

Use the *MicroVAX 2000 Hardware Installation Guide* to set up and test your system when you first receive it and any time you move the system from one location to another. The *MicroVAX 2000 Hardware Installation Guide* describes setting up each box either on its bottom or on its side. This manual describes and illustrates each box bottom-side-down only; system operation is the same for either orientation.

Graphic symbols, called icons, are molded into the back of the system unit enclosure. These identify the locations of connectors and controls.

The numbers 1, 2, and 3 are molded onto the converter that is attached to the rear of the system unit. These numbers identify the converter's connectors. The converter changes RS232 communications protocol to DEC423 protocol.

On the back of the system unit (Figure 1-3) and each expansion box is a cable restraining bar that relieves strain on cables installed in the rear of that box. This bar may be used as a handle when carrying the system unit or expansion boxes.

CAUTIONS:

1. Do not set the MicroVAX 2000 system unit or expansion boxes on their fronts. This may cause damage to the drive doors on the front of the boxes.

2. Be sure to turn off the MicroVAX 2000 before lifting or moving it. Dropping or jarring the system unit or an expansion box can cause damage to a fixed disk drive, and loss of data stored on that disk. This is especially true when power is applied to the system and the drive is active.

Controls and Indicators

The MicroVAX 2000 system unit contains the following controls and indicators (Figures 1-1 through 1-3 and Table 1-1):

- System on/off switch
- Halt button

In addition, the system unit and optional expansion boxes may contain the following controls and indicators:

- Red light on RX33 diskette drive
- Load/unload pushbutton with integral red light on TK50 tape drive
- Green light on TK50 tape drive

Figure 1-1: System Unit On/Off Switch and Diskette Drive Light

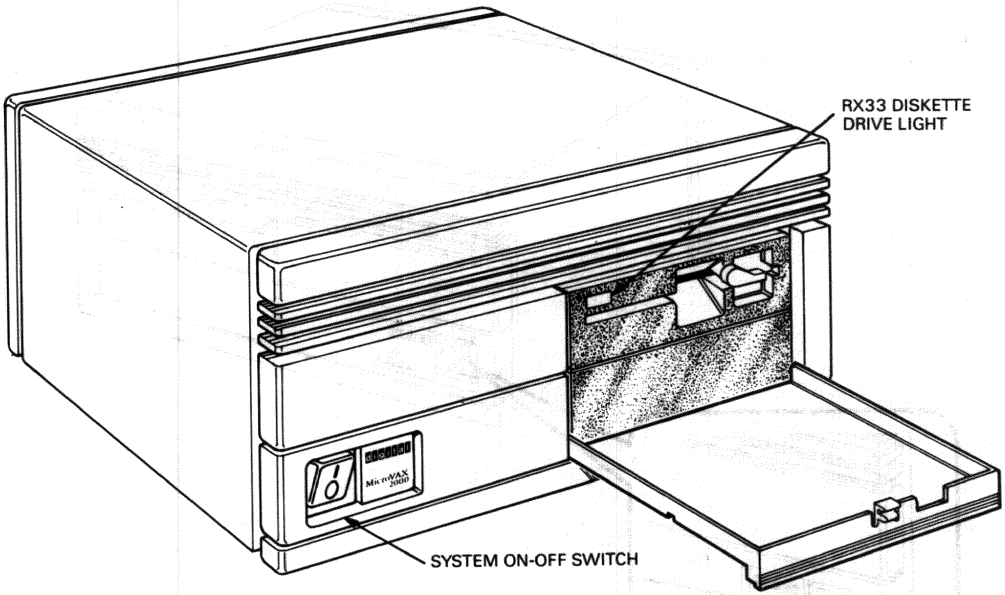

Figure 1-2: Setting On-Off Switch to 0

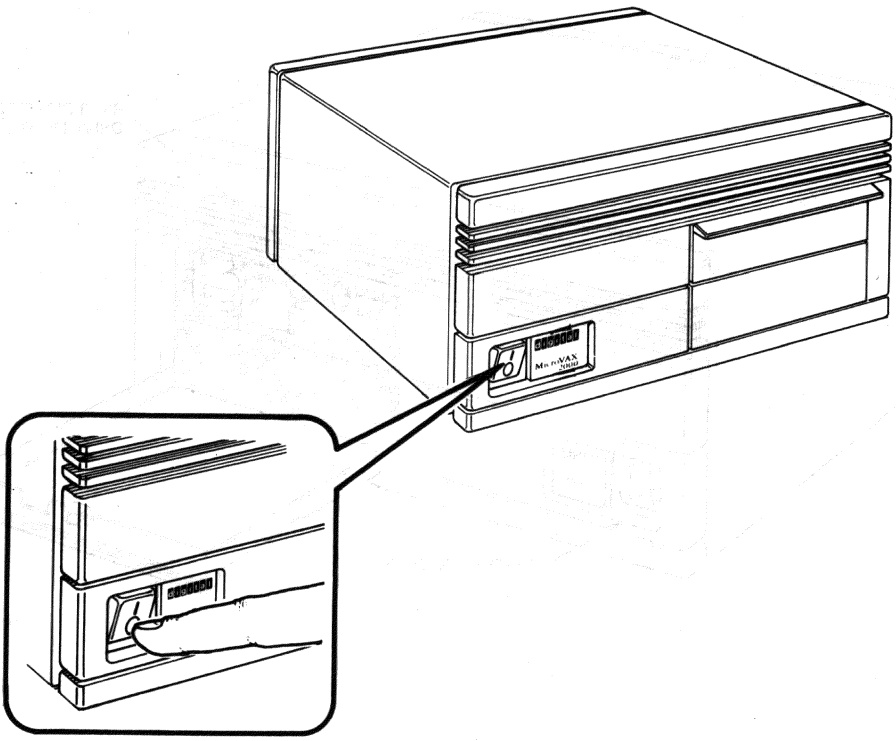

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Figure 1-3: Halt Button—Rear of System Unit

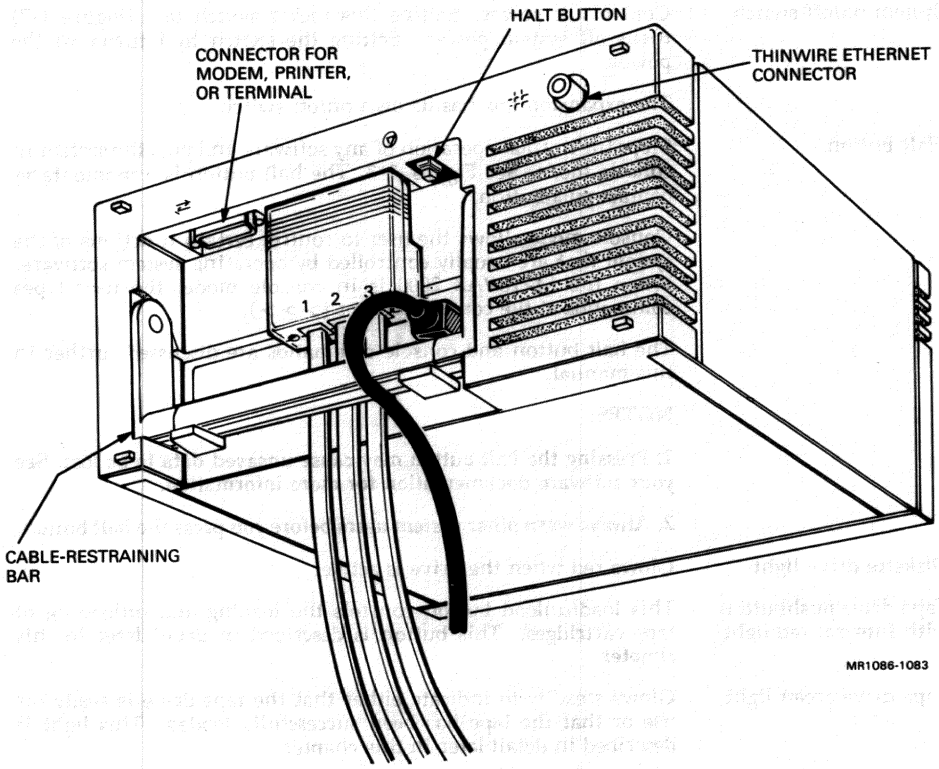


Table 1-1: Controls and Indicators

Control or Indicator	Function
System on/off switch	Controls ac power. Setting this rocker switch to 0 (Figure 1-2) turns off system power. Setting the switch to 1 turns on the power. The expansion box has its own on/off switch.
Halt button	Stops the normal operation of any software and puts the system in console mode. See Figure 1-3. The halt button is a momentary-contact pushbutton. Console mode allows the user to control certain functions of the system that are usually controlled by operating system software. When the MicroVAX 2000 is in console mode, the user types commands at the console prompt (>>>). The halt button and console commands are discussed further in this manual. **NOTES:** **1. Pressing the halt button may cause unsaved data to be lost. See your software documentation for more information.** **2. Always warn other system users before you press the halt button.**
Diskette drive light	Glows red when the drive is active.
Tape drive pushbutton with integral red light	This load/unload button controls the loading and unloading of tape cartridges. This button is described in detail later in this chapter.
Tape drive green light	Glows steadily to indicate either that the tape drive is ready for use or that the tape has been successfully loaded. This light is described in detail later in this chapter.

Terminal Controls and Indicators

Refer to your terminal's installation/user's guide for information on using the controls and indicators on the terminal. This document is shipped with each terminal.

Powering Up The System

Before powering up the system, install it according to the instructions in the *MicroVAX 2000 Hardware Installation Guide*.

If operating system software has not been installed in the MicroVAX 2000, use the documentation that came with your software to complete the installation.

1. Set the console terminal on/off switch to 1 (on).

   The console terminal is the terminal that is installed in connector 1 on the rear of the system unit.

2. Power up any expansion boxes and peripheral equipment such as the printer.

3. Set the system unit on/off switch to 1 (on).

After about 10 seconds, the console terminal displays the power-up test sequence.

CAUTION: Do not power down the MicroVAX 2000 until power-up testing is complete. Wait until you see the console prompt (>>>) or the first screen of your operating system software before powering down. Powering down before testing is complete may destroy data in the nonvolatile random-access memory.

NOTE: Important messages are displayed during power-up. Read the rest of this section for information on the screen display.

Figure 1-4 shows a sample power-up display.

Table 1-2 lists the system's normal power-up indications. The table includes indicators on optional equipment as well. Your system may not contain all of the listed devices.

Table 1-2: Normal Power-up Indications

Indicator	Normal Indication
Console terminal power indicator	Glows green
Diskette drive light on system unit	Glows red
Tape drive load/unload button on expansion box	Glows red for approximately 4 seconds and then goes out

The fan in the system box goes on at power up. You may be able to hear it if the room is quiet. The fan exhausts air through the vents on the rear of the system unit.

If you do not observe the normal indications listed in Table 1-2, refer to Chapter 2.

Figure 1-4: Sample Power-Up Display

```
KA140-A  V1.0

F_..E...D...C...B...A...9...8...7...6...5...4_..3_..2_..1_..

83 BOOT SYS

-DUA2

-DUA0
```

The power-up test sequence is displayed on the console terminal each time the MicroVAX 2000 is powered up. The display consists of a countdown from the letter F to the number 1. Then the device-names of one or more mass storage devices (if present) are shown (DUA2 and DUA0, for example, as shown in Figure 1-4). The last item on the list identifies the MicroVAX 2000 mass storage device that contains bootable software. If the last line on the list is MUA0, the system is booting from the tape drive. If the last line of the display is ESA0, the MicroVAX 2000 is searching for bootable software over the ThinWire Ethernet.

If the system cannot locate any bootable software, one of two things happens. An error message may be displayed:

```
Fatal error routine called from PC = 0000072E
Error code = 000008C2
84 FAIL
>>>
```

Or, if your system is connected to ThinWire Ethernet, the system may continue to search the ThinWire Ethernet for bootable software. In this case the console terminal displays the following message:

```
?54 RETRY
```

and no console prompt is displayed. If this happens, press the halt button. The console prompt is then displayed. Type BOOT at the console

prompt (>>>), or BOOT followed by the name of the device that contains operating system software, and press RETURN.

An underscore following a number in the countdown sequence indicates that the corresponding optional hardware has not been included in your system.

NOTE: If any number in the countdown sequence has a question mark or an asterisk beside it, as shown in Figure 1-5, there may be a fault in the system. See Chapter 2 for more information.

Figure 1-5: Sample Power Up Display With Error Messages

```
KA140-A  V1.0
F...E...D...C...B...A...9...8...7?..6...5...4_..3_..2_..1_..
 ?? 7    0090    1120.0020
```

When the first screen display for the operating system software appears, the system and all terminals are ready for use. Refer to the software documentation for instructions on using the MicroVAX 2000 software.

See Appendix B for a list of related documents.

Powering Down the System

To save data and ensure an orderly system shutdown, follow the shutdown procedure described in your operating system software documentation. After completing an orderly system shutdown, turn off the system in the following order:

1. Console terminal
2. Other peripheral equipment such as printer or modem
3. Expansion boxes
4. MicroVAX 2000 system unit

Fixed Disk and Diskette Drives for the System Unit

When you lower the drive door on the front of the MicroVAX 2000 system unit, you find one of the following two configurations:

1. An RX33 diskette drive (Figure 1-6) with a lever and slot in the upper portion of the opening and a blank metal plate in the lower portion.

   The RX33 diskette drive uses double-sided, high-density removable RX33K diskettes. Up to 1.2 megabytes of data can be stored on each RX33K diskette (.6 per side). The RX33 diskette drive also uses single-sided normal-density RX50K diskettes. Up to .4 megabytes of data can be stored on each RX50K diskette. The RX33 is a half-height (approximately 1 5/8 in high) device.

   The blank metal plate may cover an RD32 fixed disk drive. The RD32 stores up to 40 megabytes of data on a nonremovable disk. The RD32 is a half-height device. The metal plate covers the empty cavity if no RD32 is present.

2. Two blank metal plates covering the opening (Figure 1-7). The plates cover one of two possible configurations:

   - An RD53 fixed disk drive

     The RD53's fixed disk stores up to 71 megabytes of data. The disk is sealed in place. You cannot remove the disk. The RD53 can be used in the system unit or in the expansion box. The drive is a full-height (approximately 3 1/4 in high) device.

   - No fixed disk drive

     If your MicroVAX 2000 is part of a cluster (a group of computers networked together), you can use devices that reside on other systems to store your software and data. See your software documentation and the *VAXstation 2000, MicroVAX 2000 and VAXmate Network Guide* for more information.

To find the model numbers of the fixed disk drives in your system, see The Fixed Disk Verifier in Chapter 2.

Figure 1-6: Configuration with RX33 Diskette Drive and RD32 Fixed Disk Drive (or No Drive)

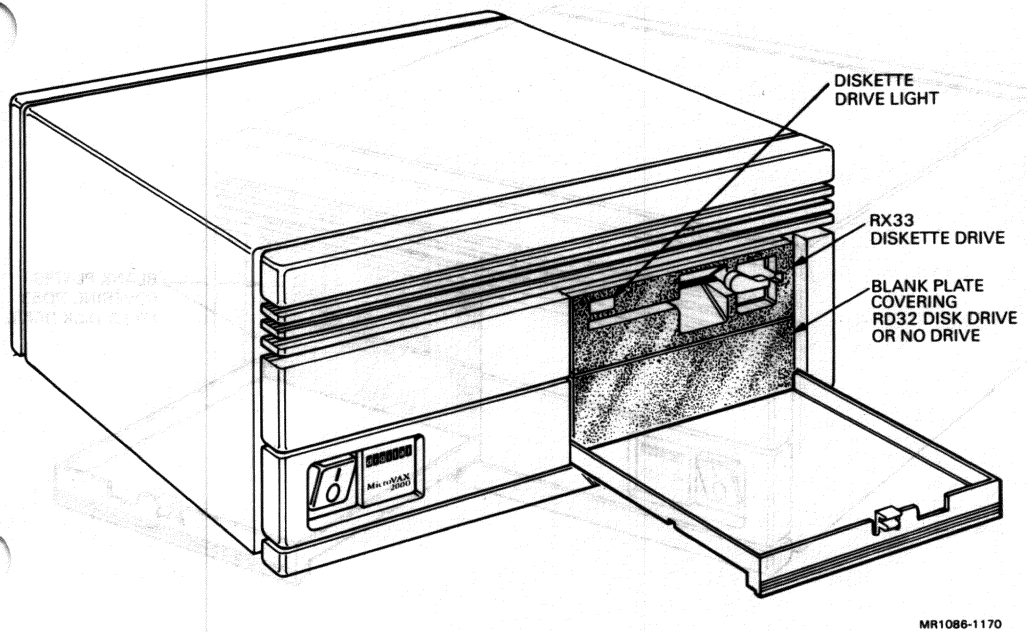
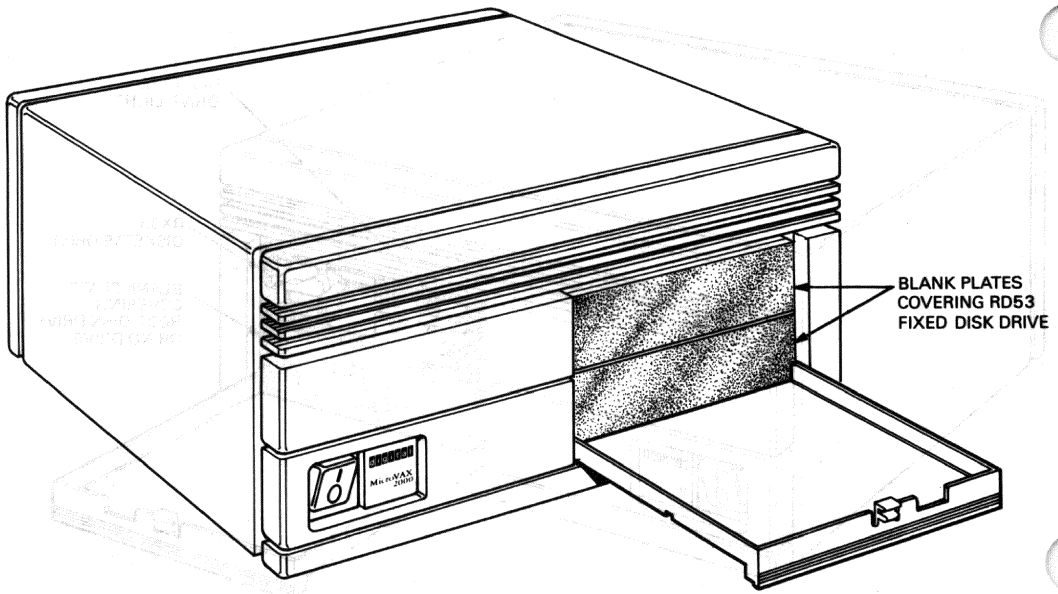


Figure 1-7: Configuration with Blank Plates



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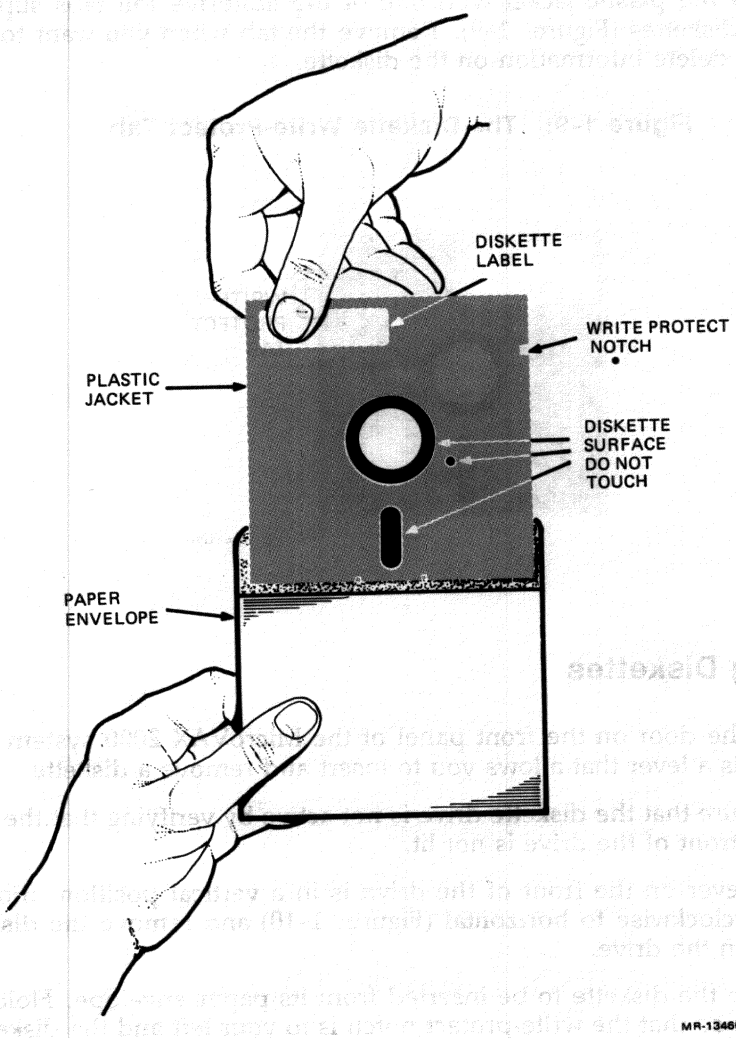
Diskettes

The RX33 diskette drive magnetically stores data on removable diskettes. Each RX33K diskette (Figure 1-8) is permanently enclosed inside a gray plastic jacket. When a diskette is inserted into the diskette drive and the drive is active, the diskette spins inside the jacket. The read/write head of the diskette drive contacts the diskette through the openings in the jacket. The fabric lining of the jacket continuously cleans the diskette. Do not attempt to remove the diskette from its jacket.

The RX33 diskette drive accepts RX50K diskettes as well as RX33K diskettes. An RX50K diskette can be distinguished from an RX33K diskette by its black plastic jacket with a printed orange arrow. RX50K diskettes are preformatted.

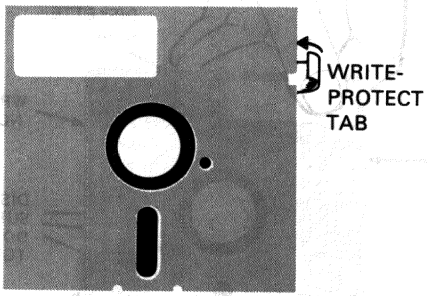
Figure 1-8: RX33K Diskette



Write-Protecting Diskettes

Both RX33K and RX50K diskettes have a write-protect feature to prevent accidental overwriting. To protect data, cover the write-protect notch on the side of the plastic jacket with one of the adhesive foil tabs supplied with your diskettes (Figure 1-9). Remove the tab when you want to add, change, or delete information on the diskette.

Figure 1-9: The Diskette Write-Protect Tab

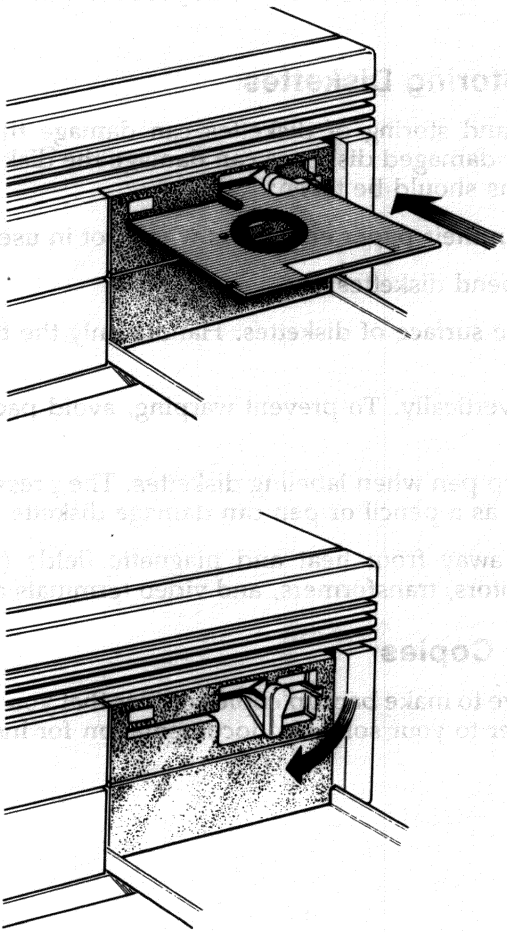


Inserting Diskettes

1. Open the door on the front panel of the MicroVAX 2000 system unit. Inside is a lever that allows you to insert and remove a diskette.
2. Make sure that the diskette drive is not active by verifying that the light on the front of the drive is not lit.
3. If the lever on the front of the drive is in a vertical position, move it counterclockwise to horizontal (Figure 1-10) and remove the diskette that is in the drive.
4. Remove the diskette to be inserted from its paper envelope. Hold the diskette so that the write-protect notch is to your left and the diskette's label is up.
5. Push the diskette into the slot until it snaps into place.
6. Move the lever clockwise to its vertical position.

NOTE: Do not force the lever. Make sure that the diskette is fully inserted. The diskette drive lever must be in a vertical position for the drive to function.

Figure 1-10: Inserting Diskettes



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Removing Diskettes

Before removing a diskette, check the light on the front of the drive. If the light glows red, the drive is active. Do not attempt to remove a diskette when the drive is active or the diskette may be damaged. Once the light is off, move the lever to the horizontal position and remove the diskette.

NOTE: During software installation, the light may remain lit when the drive is not active. Follow the instructions in your software documentation in this case.

Handling and Storing Diskettes

Incorrect handling and storing of diskettes can damage them and cause loss of data. In turn, damaged diskettes can damage the diskette drive. The following precautions should be taken:

- Keep diskettes in their paper envelopes when not in use.
- Do not fold or bend diskettes.
- Do not touch the surface of diskettes. Handle only the top (label area) of diskettes.
- Store diskettes vertically. To prevent warping, avoid packing diskettes tightly.
- Use only a felt-tip pen when labeling diskettes. The pressure of a sharp instrument such as a pencil or pen can damage diskette surfaces.
- Store diskettes away from heat and magnetic fields (such as those produced by motors, transformers, and video terminals and monitors).

Making Backup Copies

Use the diskette drive to make backup copies of files that you normally store on a fixed disk. Refer to your software documentation for instructions.

Formatting RX33K Diskettes

You must format each RX33K diskette before using it for the first time. Formatting prepares the diskette to accept data. The process consists of inserting the diskette in the drive and typing commands at the console terminal. Formatting a diskette takes about 2 minutes.

NOTE: RX50K diskettes are preformatted and do not require any preparation for use. Formatting an RX33K diskette that has already been formatted destroys data that may be stored on that diskette.

See the *VAXstation 2000/MicroVAX 2000 Operations Guide* for formatting procedures for systems containing MicroVMS operating system software.

1. Check your software documentation for shutdown instructions before you halt the system.
2. Put the system into console mode by pressing the halt button on the rear of the system.
3. Remove the diskette that you intend to format from its paper envelope.
4. Be sure that the diskette is not write-protected. (See Write-Protecting Diskettes in this chapter.)
5. With the diskette's label up and the write-protect notch to your left, insert the diskette until it snaps into place. Move the lever clockwise to its vertical position.

   NOTE: Do not force the lever. The diskette must be fully inserted in the drive for the lever to move freely.
6. Put the system into console mode by pressing the halt button on the rear of the system unit.
7. Type **TEST 70** and press RETURN at the the console prompt (>>>) on the console terminal. The following text appears on the console terminal screen:

   ```
   KA410-A RDRXfmt

   VSfmt_QUE_unitno (0-2) ?
   ```
8. Type the number **2** and press RETURN.

   CAUTION: Type only the number 2. Typing 0 or 1 starts up the fixed disk formatter, which may result in loss of software and data on the fixed disk.

If the following text appears, you must start over with the TEST 70 command at the console prompt:

```
VSfmt_RES_ERR #1
84 FAIL
>>>
```

If you continue to get the error message, see chapter 2 for information on isolating and solving problems.

The following text appears if there are no errors:

```
VSfmt_QUE_RXmedtyp
(1=RX33) ?
```

9. Type 1 and press RETURN. Any other number causes the following text to be displayed:

```
VSfmt_RES_Err #6
84 FAIL
>>>
```

This message is also displayed if you have mistakenly inserted an RX50K diskette, which is preformatted and should not be formatted in the MicroVAX 2000. The message also indicates that no diskette was inserted in the drive, or that the drive lever was not moved to the vertical position.

Start over with the TEST 70 command at the console prompt after this error.

The following text appears next if no errors exist:

```
VSfmt_QUE_RUsure (DUA2 1/0) ?
```

10. Type the number 1 and press RETURN to continue. The following message appears slowly.

```
VSfmt_STS_Fmting .................OK
VSfmt_STS_CkRxfmt ................OK
VSfmt_RES_Succ
>>>
```

The diskette has been successfully formatted and can now be used to store data.

If for any reason you do not want to continue, type the number 0. If you see any device number other than DUA2 in the text, type the number 0. When you do this, the following message appears:

```
VSfmt_RES_Abtd

84 FAIL
>>>
```

The formatter has now stopped. You must start at the beginning of the procedure when you are again ready to format a diskette.

If an error occurred during formatting, one of the following messages appears:

```
VSfmt_RES_ERR #3

84 FAIL
>>>
```

or

```
VS_RES_ERR #5

84 FAIL
>>>
```

Try formatting the diskette again. If that is unsuccessful, try another diskette. If you continue to see either error message, see Chapter 2 to isolate and solve the problem.

Formatting Fixed Disks

Before data can be stored on a fixed disk, the disk must be formatted. Formatting prepares the disk to accept data.

Formatting the fixed disk is part of the hardware installation process, as explained in the *MicroVAX 2000 Hardware Installation Guide*. However, it may be necessary to reformat the disk after repair, replacement or corruption of the data stored on that disk. If you want to determine whether your disk is already formatted, see The Fixed Disk Verifier in Chapter 2.

CAUTION: Reformatting a disk destroys stored software and data. Back up your disk before reformatting.

To format your fixed disk, follow these steps.

1. Type **TEST 70** and press RETURN at the console prompt (>>>). The following text appears on the console terminal screen:

```
KA410-A RDRXfmt

VSfmt_QUE_unitno (0-2) ?
```

2. Type the number 0 for a fixed disk drive in the system unit. Type the number 1 for a fixed disk drive in the expansion box.

   If everything is working normally, the following text appears:

```
VSfmt_STS_Siz
```

   If you type an invalid number, the following text appears:

```
VSfmt_RES_ERR #1
```

   If this happens, start over at the first step. If you continue to see the error message, turn to Chapter 2 for information on isolating and solving problems.

   If no error occurs, you see the following sample text as the formatter program determines the type of fixed disk drive you have selected for formatting:

```
VSfmt_STS_Siz ..... RD32
```

   In this case, the formatter has identified the disk drive as an RD32.

   If you see the following error message:

```
VSfmt_STS_Siz .....??
VSfmt_RES_Err # 2
84 FAIL
>>>
```

   the fixed disk drive or its controller may be faulty. See Chapter 2 to troubleshoot the problem.

   If no problem occurs with the drive, the following appears:

```
VSfmt_QUE_SerNbr (0-999999999) ?
```

3. Refer to the packing slip that came with your system shipment for the serial number of the fixed disk drive you are formatting. Type only the numbers and Press RETURN.

   If you cannot locate the serial number, assign a number of your choice to the drive. Be sure to record this number for later reference. Assign a different number to each drive you format.

   The following is a sample of the text that appears:

```
VSfmt_QUE_RUsure (DUA0 1/0)?
```

   Type the number 1 and press RETURN to continue. If for any reason you do not want to continue, type 0. If you do this, the following text appears:

```
VSfmt_RES_Abtd

84 FAIL
>>>
```

   The formatter has now stopped. You must start at the first step when you are again ready to format a drive.

   If you choose to continue, the following message appears gradually. An RD32 takes approximately 15 minutes to format. An RD53 takes approximately 25 minutes.

```
VSfmt_STS_RdMbb ..................OK
VSfmt_STS_Fmting..................OK
VSfmt_STS_CHKpss..................OK

VSfmt_STS_BBRvec := x

VSfmt_RES_Succ

>>>
```

   If you see this message in its entirety, the disk has been successfully formatted and is ready for use.

If a problem occurs, one of the following two messages appears:

```
VSfmt_STS_Fmting.................??

VSfmt_RES_ERR #3
84 FAIL
>>>
```

or

```
VSfmt_STS_CHKpss 1...............??

VS_RES_ERR #4
84 FAIL
>>>
```

If you see either of these messages, refer to Chapter 2 for information on isolating and solving problems.

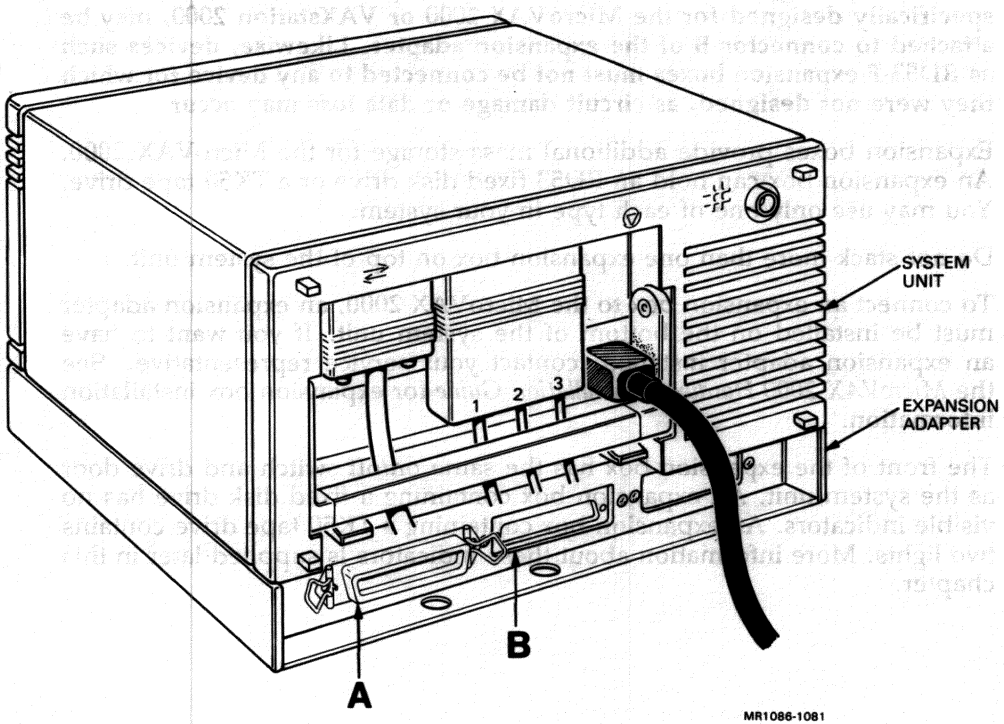
The Expansion Adapter

The expansion adapter (Figure 1-11) is an optional attachment for the MicroVAX 2000 system unit and permits communication between the expansion box (Figures 1-12 and 1-13) and the system unit.

If your system does not contain an expansion adapter and you want to connect an expansion box, call your service representative.

The expansion adapter contains two connectors: A and B. These letters are stamped on the expansion adapter to identify the connectors. A is the connector for an expansion box containing a tape drive. B is the connector for an expansion box containing a fixed disk drive. A third opening is covered by a metal plate.

Figure 1-11: The Expansion Adapter (Rear)



The Expansion Box

CAUTION: Only devices such as RD53-F expansion boxes, which are specifically designed for the MicroVAX 2000 or VAXstation 2000, may be attached to connector B of the expansion adapter. Likewise, devices such as RD53-F expansion boxes must not be connected to any device for which they were not designed, as circuit damage or data loss may occur.

Expansion boxes provide additional mass storage for the MicroVAX 2000. An expansion box can hold an RD53 fixed disk drive or a TK50 tape drive. You may use only one of each type in your system.

Do not stack more than one expansion box on top of the system unit.

To connect an expansion box to the MicroVAX 2000, an expansion adapter must be installed on the bottom of the system unit. If you want to have an expansion adapter installed, contact your service representative. See the *MicroVAX 2000 Hardware Installation Guide* for expansion box installation information.

The front of the expansion box has the same on/off switch and drive door as the system unit. An expansion box containing a fixed disk drive has no visible indicators. An expansion box containing a TK50 tape drive contains two lights. More information about these indicators is supplied later in this chapter.

Figure 1-12: Expansion Box (Front)

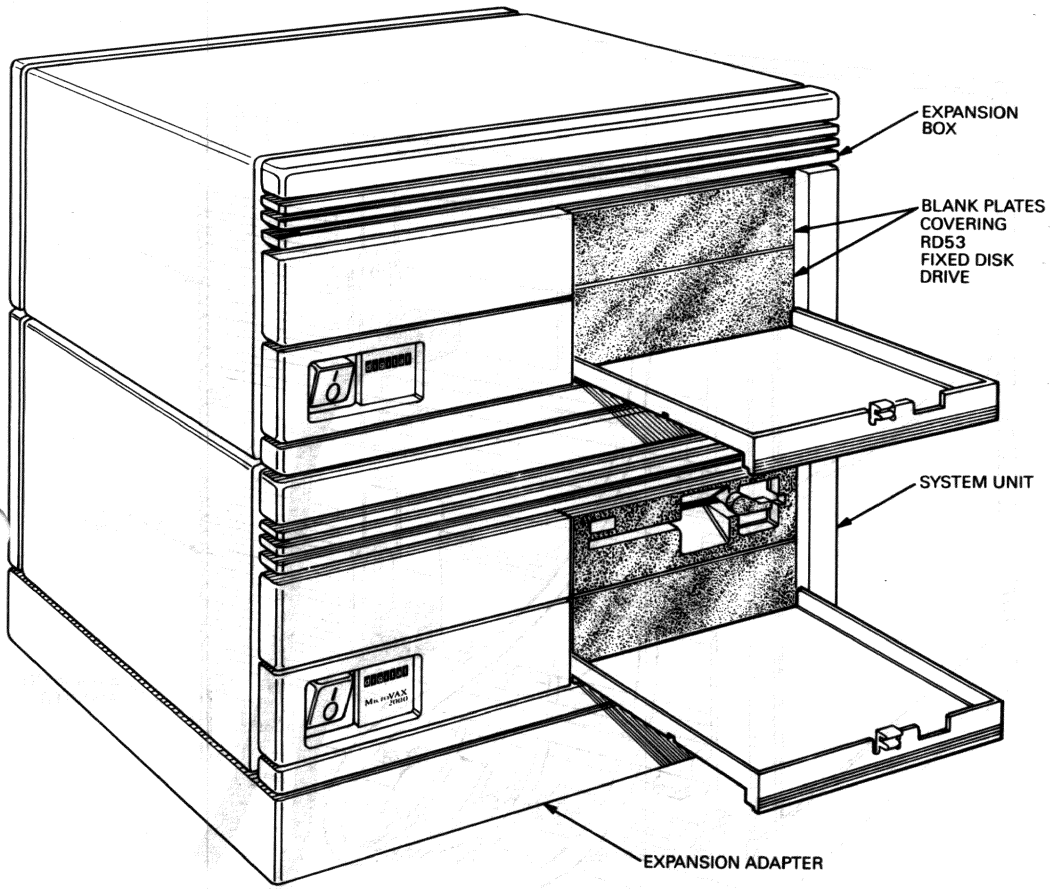
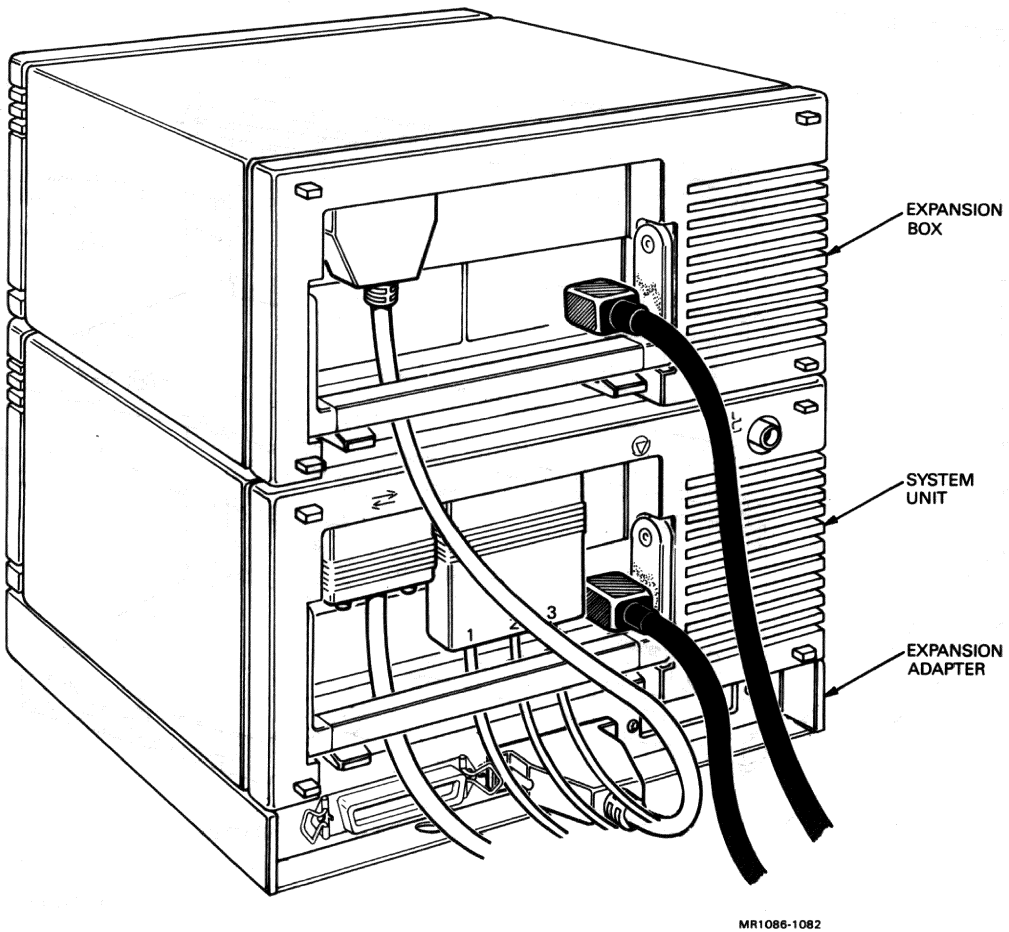


Figure 1-13: The Expansion Box—Rear (Fixed Disk Drive Cabling Shown)



The TK50 Tape Drive

The TK50 tape drive (Figure 1-14) holds one removable magnetic tape cartridge. The cartridge stores up to 94.5 megabytes of data. Use the tape cartridge as an input device to load software or data onto the MicroVAX 2000. Use it as an output device to make copies (or backups) of software or data.

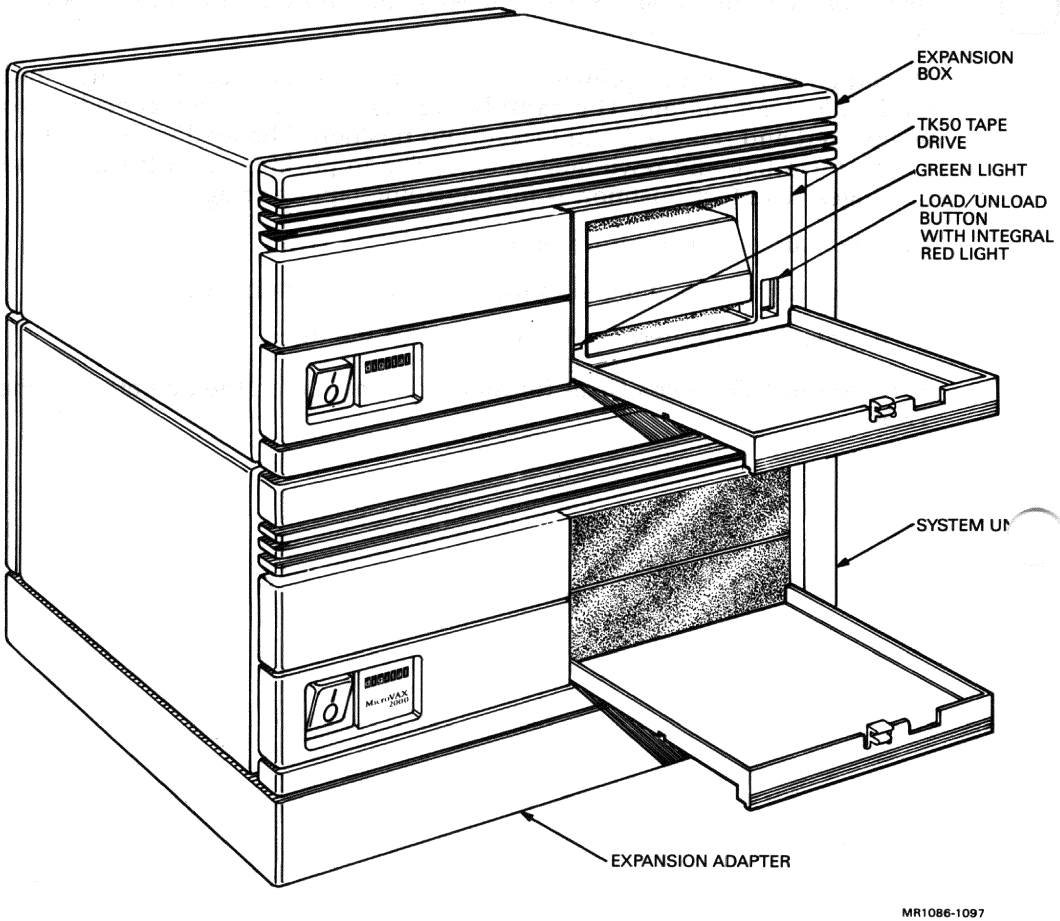
The tape drive has two primary controls: the cartridge release handle and the load/unload button. The cartridge release handle allows cartridges to be inserted and removed and locked into position. The load/unload button controls winding and rewinding of tape. The In position is for loading tape cartridges. The Out postition is for unloading tape cartridges.

The drive also has two indicators:

- a red light that is integral to the load/unload button, and
- a green light located on the right side of the drive.

Refer to the *TK50 User's Guide* for more information on the operation of the TK50.

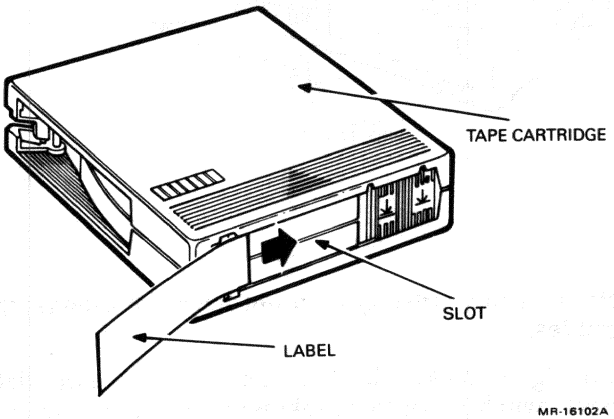
Figure 1-14: Expansion Box with TK50



Labeling a Tape Cartridge

Always label cartridges. There is a slot for the label provided on the front of the cartridge (Figure 1-15). This label is visible when the cartridge is in the drive. Labels or markings on any other part of the cartridge can interfere with proper operation of the drive. Do not write directly on the cartridge with pen or pencil.

Figure 1-15: Labeling

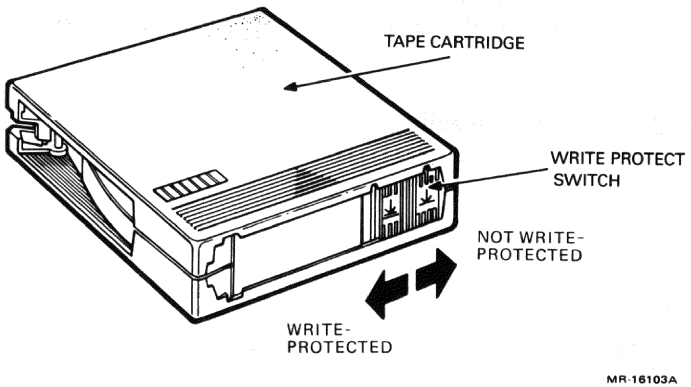


Write-protecting a Tape Cartridge

Write-protecting a tape cartridge prevents accidental erasure of information. Set the write-protect status with the two-position switch on the cartridge (Figure 1-16). The MicroVAX 2000 can read information on the tape regardless of the position of the write-protect switch. However, the MicroVAX 2000 cannot write data to the tape when it is write-protected.

When you use a cartridge to install software onto the MicroVAX 2000, make sure the write-protect switch on the front of the cartridge is set to write-protect. The switch has two icons indicating the write-protect status. An orange rectangle is also visible when the switch is in the write-protected position. If you do not see an orange rectangle, slide the switch toward the label slot.

Figure 1-16: Write-protecting



NOTE: Early versions of the cartridges do not have the orange rectangle. Use the icons as guides.

When you use a cartridge to make a backup copy or to write out data, make sure the write-protect switch is set to enable writing to the tape. To enable writing, slide the switch away from the label slot until it locks into place.

Handling and Storing Tape Cartridges

- Do not touch the exposed surface of the tape.
- Do not throw or drop the tape cartridge. The impact can damage the cartridge.
- Allow new tapes to stabilize at room temperature for 24 hours before using them.
- Write on the identification label before putting the label on the tape cartridge. Place the label only in the label slot on the front of the tape cartridge.
- Store tape cartridges away from dust.

- Keep tape cartridges away from direct sunlight, heaters, and other sources of heat. Store tape cartridges at an even temperature between 10 to 40 degrees C (50 and 104 degrees F). Store cartridges where the relative humidity is between 20 and 80 percent.
- Keep tape cartridges away from magnets and types of equipment that generate magnetic fields, such as motors, transformers, and video monitors and terminals.
- Keep tapes away from x-ray equipment.

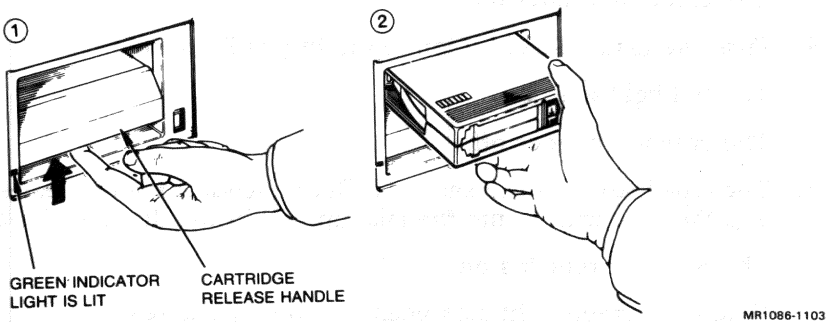
Inserting a Tape Cartridge

Make sure the TK50 load/unload button is in the Out (unload) position.

The load/unload button glows red for approximately four seconds during the tape drive automatic power-up test.

The red light goes off and the green light goes on, indicating that it is safe to move the cartridge release handle.

Figure 1-17: Lifting Release Handle and Inserting a Cartridge

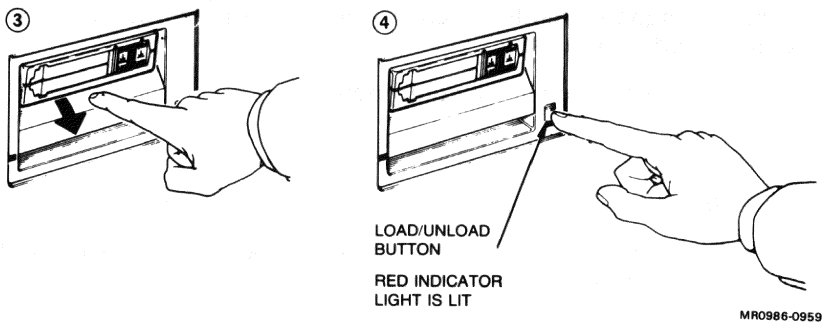


1. Pull up the cartridge release handle (Figure 1-17).
2. With the arrow on the cartridge facing up and pointing toward the drive, insert the cartridge into the TK50 drive.

   The red light goes on.

   The green light goes off.

Figure 1-18: Pushing Release Handle and Pressing Load/Unload Button



3. Push down the release handle (Figure 1-18).

   The red light goes off.

   The green light goes on.

4. Push the load/unload button to the In (load) position.

   The red light goes on.

   The green light goes off.

5. The tape loads in 10-15 seconds. During loading the two leaders couple and the tape winds onto the take-up reel inside the tape drive.

   The red light remains on.

   When the green light also goes on, the tape is ready to use. Refer to your software documentation for further instructions.

   NOTE: If a cartridge is new, the MicroVAX 2000 performs a calibration sequence that takes approximately 40 seconds. The green light flashes rapidly and irregularly during calibration.

   CAUTION: Never move the cartridge release handle unless the red light is off and the green light is on. Never move the cartridge handle while either light is flashing.

Removing a Tape Cartridge

Tape cartridges must be unloaded (rewound and uncoupled) before being removed from the drive. Follow these steps:

1. Ensure that the tape drive is not active. The red light should be off and the green light on.
2. Press the load/unload button to the Out (unload) position.

   The red and green lights flash slowly as the tape rewinds. This may take up to 90 seconds.

   The red light remains on and the green light goes off as the tape unloads into the cartridge.

   When the tape is completely unloaded, the red light goes off and the green light goes on.

   NOTE: Rewinding a tape can also be done under software control. Refer to your software documentation for information.
3. Push the cartridge release handle up.
4. Remove the cartridge.
5. Push the release handle down.

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

CAUTION: Always remove the tape cartridge from the tape drive when the cartridge is not in use. Remove it before turning off the system. Leaving the cartridge in the drive may result in damage to the cartridge.

Summary of TK50 Controls and Lights

Tables 1-3 and 1-4 summarize the functions and meanings of the TK50 tape drive's controls and indicator lights.

Table 1-3: TK50 Controls

Control	Position	Function
Load/unload button	In	Loads the tape (10-15 seconds.)
	Out	Rewinds and unloads the tape.
Cartridge release handle	Up	Lets you insert or remove a tape after rewind and unload operations are completed.
	Down	Locks tape in operating position.

Table 1-4: TK50 Lights

Green light	Red light	Meaning
Off	Off	No power to the tape drive.
On	Off	Safe to move cartridge release handle. Power is present.
Off	On	Do not move the cartridge release handle. One of the following is in effect: power-up test is occurring, cartridge is inserted but handle is still up, tape is loading or inloading, tape is stopped.
On	On	Tape loaded successfully.
Flashing	On	Tape is in motion (except rewind). Read/write commands are being processed. Irregular fast flashing means tape calibration is occurring.
Flashing slowly	Flashing slowly	Tape is rewinding.
Off	Flashing rapidly	There is a fault. See Chapter 2.

Chapter 2

Troubleshooting

This chapter guides you through a troubleshooting procedure, suggests corrective actions, and explains how to use the diagnostic programs in the MicroVAX 2000's read-only memory (ROM). More serious problems require the use of procedures in the *VAXstation 2000/MicroVAX 2000 Maintenance Guide*. To obtain this manual, see Appendix B and contact your sales representative.

Basic Troubleshooting

Use the troubleshooting flowchart to help you pinpoint a problem. The flowchart assumes that your MicroVAX 2000 has been installed according to the instructions in the *MicroVAX 2000 Hardware Installation Guide*.

If the problem with your system remains, call your service representative. Your sales representative will give you the name and telephone number of your service representative.

How to Use The Troubleshooting Flowchart

To determine the point at which your system's problem occurs, follow these steps:

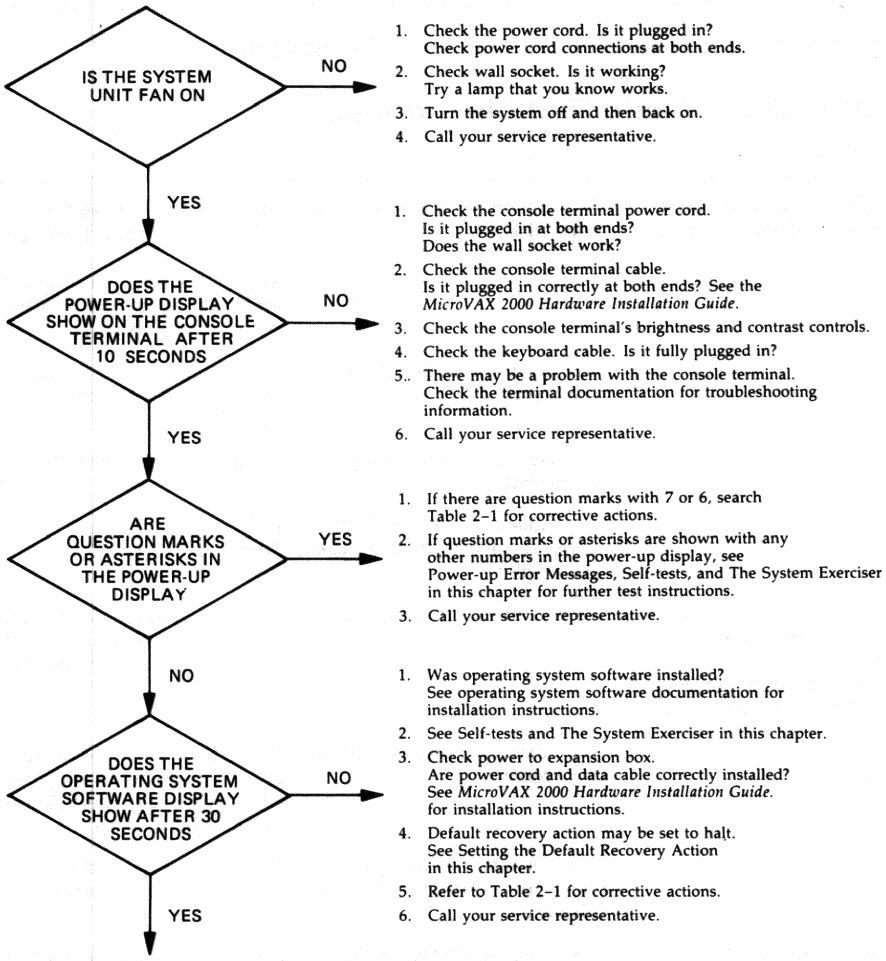
1. Power off all terminals and other peripherals such as a printer or modem.
2. Power off any expansion boxes.
3. Power off the MicroVAX 2000 system unit.

At this point all components should be off.

1. Power on the console terminal.
2. Power on any expansion boxes.
3. Power on the system unit.

Observe the results. Read the flowchart and follow the suggested actions on the right side of the chart in order. Make notes of the system conditions when failures occur. Also note the results you obtain from tests and procedures.

FOR THE MICROVAX 2000 OWNER'S MANUAL



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Troubleshooting Table

Table 2-1 suggests corrective actions for certain system problems. Before you use the table, review the troubleshooting chart on the previous page.

Information on diagnostic test messages follows this table.

Table 2-1: Basic Troubleshooting

Problem	Possible Cause	Corrective Action
Software does not boot from the fixed disk drive.	A problem exists with the fixed disk.	See The Fixed Disk Verifier in this chapter to run the fixed disk verifier. See Self Tests, Configuration, and the System Exerciser for instructions on these tests.
	The default boot device is set incorrectly.	See Changing the Default Boot Device in this chapter to set the default boot device.
	The recovery action may be set to halt.	See Setting the Recovery Action.
	A problem exists with the software (if installed) on the fixed disk.	Refer to your software documentation for help.
Software does not boot from the diskette drive. or A diskette read or write error message is displayed.	No diskette is in the diskette drive.	Insert a diskette with bootable software. Use the instructions in the software documentation.
	The diskette was inserted incorrectly.	Check that the write-protect notch on the diskette is to your left when you insert the diskette, and that the label is up.
	The diskette is damaged or does not contain bootable software.	Try another diskette that contains bootable software.
The TK50 tape drive red light flashes rapidly.	The drive mechanism is faulty.	Press and release the load/unload button four times to clear the fault. If the condition persists, do not attempt to remove the tape cartridge or use the tape drive. Call a service representative.

Table 2-1 (Cont.): Basic Troubleshooting

Problem	Possible Cause	Corrective Action
The TK50 passes the power-up test but does not operate.	No cartridge is in the drive, or the drive is not loaded.	Insert the cartridge and press the load/unload button.
The cartridge release handle does not lift.	The power-up display is still in progress.	Wait for the red light to go out and try again. If the problem persists, do not use the drive. Call for service.
The cartridge release handle does not lock.	The cartridge is not inserted properly.	Reinsert the cartridge. If the problem persists, call for service.
The tape does not load.	The load/unload button is in the unload position.	Put the load/unload button in the load position. Wait for the light to go out before removing the tape.

Power-up Error Messages

The MicroVAX 2000 displays important information during its power-up test sequence, as described in Chapter 1. If the sequence displayed during power-up contains question marks or asterisks, failures may exist in the system. Use Table 2-2 to identify the faulty device.

A single question mark indicates a "soft" error. A soft error is one that does not prevent normal operation of the system, and serves to report the status of the system. An example of a soft error is:

```
? E  0040  0000.0005
```

A double question mark indicates a "hard" error, that is, one that indicates a serious problem that may affect normal operation and use of some component of the MicroVAX 2000. An example is:

```
?? F  00C0  0001.7004
```

Three common power-up error messages are:

1. Clock not set

   ```
   ? E  0040  0000.0005
   ```

   This message indicates that the system clock has not been set. Setting the clock is part of the operating system software installation; see your operating system software documentation for instructions.

2. Low battery

```
? D 0050 0000.0005
```

This message indicates that the system battery's charge is low or completely discharged. Run the system for about 17 hours to fully recharge the battery.

3. No ThinWire Ethernet cable

```
?? 1 00C0.7004
```

This message indicates that the ThinWire Ethernet option module is present in the system, but no cable has been installed on the connector on the rear of the system unit. If you want to install this cable, see the *MicroVAX 2000 Hardware Installation Guide* for instructions. If you do not want to connect your system to ThinWire Ethernet, ignore the message.

Table 2-2: Power-up and Self-Test Display Identifiers

Test Identifier	Device
F	Base video
E	Time-of-year clock
D	Nonvolatile random-access memory (RAM)
C	Serial line controller
B	Memory
A	Memory-management unit
9	Floating point unit
8	Interval timer
7	Disk controller
6	Tape controller
5	Interrupt controller and ThinWire Ethernet ID ROM
4	Reserved for later use
3	Reserved for later use
2	Reserved for later use
1	Optional ThinWire Ethernet interconnect module

Some errors indicated by single question marks may not indicate problems that need immediate servicing. If you see single question marks on the power-up display, especially next to a 7 or 6 (disk and tape drive controllers), but operation of the system seems normal, continue to use the system. If you continue to see errors of this type during the power-up display, use the information in the rest of this chapter to solve the problems. In particular, see the sections The System Exerciser and The Fixed Disk Verifier. If the system continues to display error information or fails to operate normally, call a service representative.

Self-tests

The self-test diagnostic programs reside permanently in your MicroVAX 2000's read-only memory (ROM), as the other diagnostics do. You can run self-tests from the console terminal.

To test a device in your MicroVAX 2000 follow these steps:

1. Use Table 2-2 to find the number or letter that represents the device(s) you want to test.

   NOTE: Read your software documentation for shutdown procedures before halting the system.

2. Put the MicroVAX 2000 in console mode by pressing the halt button on the rear of the system.

3. Type TEST followed by the appropriate number or letter, then press RETURN:

   ```
   >>> TEST 7
   ```

   If you want to test a consecutive series of devices, type TEST followed by the first and last numbers of the series, then press RETURN:

   ```
   >>> TEST F 1
   ```

   The system displays the number of each device as it is tested, followed by a series of periods.

   If the self-test is successful, no question mark or error message is displayed, and the console prompt appears:

   ```
   7...
   >>>
   ```

   If a device fails the self-test, a failure message is displayed before the console prompt is returned.

```
7?..
84 FAIL
>>>
```

If a self-test results in a failure, run the configuration test.

Configuration Test

NOTE: Read your software documentation for shutdown procedures before halting the system.

1. Put the MicroVAX 2000 in console mode by pressing the halt button on the rear of the system. (See Chapter 1 for information on the halt button.)
2. Type **TEST 50** at the console prompt (>>>), then press RETURN. This displays the system configuration, as shown in Figure 2-1. The mnemonics for each device in the configuration are listed in table 2-3. Error information in this display is valuable to your service representative. Record this information before calling for service.

Figure 2-1: Sample System Configuration With Error

```
>>> TEST 50

KA410-A  V1.0
ID 08-00-2B-02-CF-A4
   CLK          0000.0001
   NVR          0000.0001
   DZ           0000.0001
        00000001 00000001 00000001 00000001 00000001 000012A0
   MEM          0002.0001
        00200000
   MM           0000.0001
   FP           0000.0001
   IT           0000.0001
 ? HDC          1730.0001
        00000000 00000000 00000320
   NI           0000.0001
 >>>
```

Run the system exerciser to obtain additional error information.

The System Exerciser

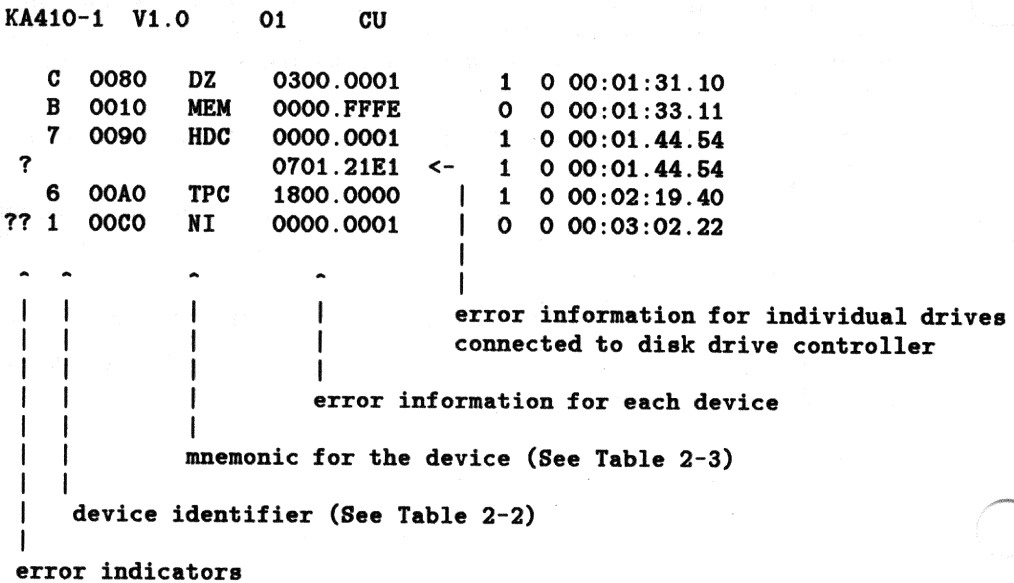
Use the system exerciser when the MicroVAX 2000 has intermittent problems, or when you see errors associated with 7 or 6 in your power-up display or self-tests. The system exerciser takes up to 11 minutes to complete.

NOTE: Read your software documentation for shutdown procedures before halting the system.

1. Put the MicroVAX 2000 in console mode by pressing the halt button on the rear of the system. (See Chapter 1 for information on the halt button.)
2. Type **TEST 0** at the console prompt (>>>), then press RETURN.

A sample system exerciser display is shown in Figure 2-2, with elements of the display identified.

Figure 2-2: System Exerciser Sample Display



Single and double question marks indicate errors. Note the mnemonic associated with the question mark. Table 2-3 gives the devices that correspond to each mnemonic. Record this information for your service representative.

The exerciser is complete when the console prompt appears on the screen.

Table 2-3: System Exerciser Mnemonics

Mnemonics	Device
CLK	System clock
NVR	Nonvolatile RAM
DZ	Serial line controller
MEM	Memory
HDC	Disk controller
MM	Memory management
FP	Floating point
IT	Interval timer
TPC	Tape controller
NI	Optional ThinWire Ethernet network interconnect module

Type BOOT (or BOOT followed by the name of the device that contains operating system software) at the console prompt and press RETURN to return to normal operation.

The Fixed Disk Verifier

The fixed disk verifier reports any faults in the fixed disks. It also can be used to determine whether a fixed disk has been formatted, and to determine what kind of drives are contained in the system.

If you see single question marks for the disk drive controller (mnemonic HDC) during power-up or while running the system exerciser, run the fixed disk verifier.

The verifier takes 5 minutes for an RD32 fixed disk drive and 8 minutes for an RD53.

NOTES:

1. The fixed disk verifier does not destroy software or data on the disk.

2. Read your software documentation for shutdown procedures before halting the system.

1. Put the MicroVAX 2000 in console mode by pressing the halt button on the rear of the system unit.
2. Type TEST 71 at the console prompt (>>>), then press RETURN.

The following text is displayed:

```
VSmsv_QUE_unitno (0-1)?
```

3. Type 0 to verify a fixed disk drive in the system unit or 1 to verify a fixed disk in the expansion box, then press RETURN.

   The following text is displayed:

```
VSmsv_STS_Siz ..... RDxx    [xx represents 32 or 53, depending
                             on the type of fixed disk drive.]

VSmsv_QUE_RUsure (DUAx 1/0) ?  [x represents the number
                                chosen, 0 or 1.]
```

   If the disk has not been formatted or there is a problem with the disk, the following text appears:

```
VSmsv_STS_Siz ..... ??

VSmsv_RES_Err #2
84 FAIL
>>>
```

   If you see this text, and you want to format your disk, format it according to the instructions in Chapter 1. If the disk is faulty, the formatter program will not be able to complete the formatting procedure. If this happens, call your service representative.

4. Type 1 and press RETURN if you want the verifier to continue. To stop the verifier, type anything other than 1. The verifier stops, an error message is displayed, and the console prompt (>>>) is returned. You may start over with the TEST 71 command or any other command.

   The following sample text is displayed after you type 1:

```
VSmsv_STS_RDing .....OK

VSmsv_STS_OBBcnt = 14

VSmsv_STS_NBBcnt = 0

VSmsv_RES_Succ

>>>
```

   This text verifies that the disk is in good operating condition. However, if you see the following text, the fixed disk is faulty and may need repair or replacement.

```
VSmsv_STS_NBBcnt = x  [where x indicates any number
                      higher than 50]
```

Call your service representative.

5. Type BOOT (or BOOT followed by the name of the device that contains operating system software) at the console prompt and press RETURN to return to normal operation.

Setting the Default Recovery Action

During manufacture your system is set to automatically start up the operating system software every time you power up, or in the event of an operating system software crash. To change this recovery action setting, follow these steps:

NOTE: Check your software documentation for shutdown procedures before halting your system.

1. Put the MicroVAX 2000 in console mode by pressing the halt button on the rear of the system.
2. At the console prompt (>>>) type TEST 53, then press RETURN.

   If the system is already set to reboot automatically, the following is displayed:

   ```
   2 ? >>>
   ```

3. Press RETURN at the console prompt if you want to retain this setting.

   If 3 is displayed instead of 2, your system is set to halt automatically after every power-up. If you want to change from automatic halt to automatic reboot, type 2 at the console prompt and press RETURN.

4. If you want your system to halt after every power-up, type 3 at the console prompt and press RETURN.

   In this case, your system will display the console prompt after every power-up sequence, and you must type BOOT (or BOOT followed by the device name of the device containing operating system software) every time you power up.

For more information on setting the default recovery action, see the *VAXstation 2000/MicroVAX 2000 Maintenance Guide*.

Changing the Default Boot Device

The boot default device should be set during installation of the MicroVAX 2000, when the installer determines where the operating system software resides. The MicroVAX 2000 then boots from that device at power up, provided that the default recovery action is set to BOOT. (See Setting the Default Recovery Action for more information.) The operating system software can reside in one of the following places:

- a fixed disk in the system unit
- a fixed disk in the expansion box
- a remote system that you access through the ThinWire Ethernet

Table 2-4 shows the name of each default boot device.

Table 2-4: Default Boot Device Names

Device and Location	Device Name
Fixed disk in system unit	DUA0
Fixed disk in expansion box	DUA1
Remote system accessed by ThinWire Ethernet	ESA0
Diskette drive in system unit	DUA2
Tape drive in expansion box	MUA0

Devices DUA2 and MUA0, although valid default boot devices, do not have enough storage capacity to contain operating system software.

To change the default boot device, follow these steps.

NOTE: Check your software documentation for shutdown procedures before halting your system.

1. Put the MicroVAX 2000 in console mode by pressing the halt button on the rear of the system.
2. At the console prompt (>>>) type TEST 51, then press RETURN.
3. If no boot device has been previously selected, the following is displayed:

   ```
   .... ? >>>
   ```

   Type the default boot device name you want, then press RETURN.

If a boot device has previously been chosen, that device is displayed as follows (DUA0 is a sample):

```
DUA0 ? >>>
```

To change the default boot device, enter the name of the device you want, followed by RETURN. If you do not wish to specify a default boot device, type a period (.) at the console prompt. At subsequent power ups, the MicroVAX 2000 will attempt to boot each device in the system in turn.

4. Type BOOT (or BOOT followed by the name of the device that contains operating system software) at the console prompt and press RETURN to return to normal operation.

For more information on setting the default boot device, see the *VAXstation 2000/MicroVAX 2000 Maintenance Guide*.

Restarting the System After Running Tests

While you are running any of the tests or procedures in this chapter, you are in console mode. To resume normal operation of the MicroVAX 2000 you must reenter program mode. There are two ways to do this.

- Type BOOT at the console prompt, then press RETURN. The system then searches each device in turn for operating system software.
- Type BOOT followed by a space and the device name of the device that contains operating system software, and then press RETURN, as shown in this example:

```
>>> BOOT DUA0
```

This enables the system to boot the operating system software immediately, without searching.

See your software documentation and the *VAXstation 2000/MicroVAX 2000 Maintenance Guide* for more information.

Summary of TEST Commands

A list of all TEST commands and the tests or utility programs they execute is shown in Table 2-5.

Table 2-5: Summary of TEST Commands

Command	Test or Utility Program
TEST 0	System exerciser
TEST F—1	Self-tests of each device in the system. See Table 2-2.
TEST 50	Configuration
TEST 51	Sets default boot device
TEST 53	Sets default recovery action
TEST 70	Diskette and fixed disk formatter
TEST 71	Fixed disk verifier

Service Information

If you have followed the corrective actions listed in this chapter and you continue to have problems with your MicroVAX 2000, call your service representative.

Your sales representative will give you the name and telephone number of your service representative.

Before you call:

1. Make notes based on the troubleshooting chart at the beginning of Chapter 2. This information helps your service representative know what state the system was in when the problem occurred.
2. Write down the serial and model numbers of your system. They are located on the back of the system unit.
3. Be prepared to read information from the screen and to type commands at the keyboard while you talk to your service representative on the telephone.

Chapter 3

Options for the MicroVAX 2000

The options currently supported by the MicroVAX 2000 fall into the following categories:

- Memory
- Mass Storage Devices—full-height disk drives, half height disk drives, tape drive, half-height diskette drive, disk expansion box, and expansion adapter
- ThinWire Ethernet Module
- Printers
- Terminals
- Modems

This chapter describes each option. Installation of expansion boxes, printers, terminals, and modems is described in the *MicroVAX 2000 Hardware Installation Guide* and in the documentation that ships with the option. For installation of other options, you must contact your service representative.

Documentation for each option is listed in Appendix B.

To order an option or cables after initial installation of your system, contact your sales representative.

Memory

The MicroVAX 2000 contains 2 megabytes of memory on its system module. Optional memory expansion modules allow you to expand to a total of 6 megabytes of memory. The following describes the additional memory expansion modules:

Module Number	Description
MS400-AA	2-megabyte memory expansion module
MS400-AB	4-megabyte memory expansion module

To order a memory module after the initial system installation, contact your sales representative. For module installation, contact your service representative.

Mass Storage Devices

Expansion Box and Expansion Adapter

An expansion box allows for the configuration of additional storage devices in your system. The expansion box contains a power supply, fan, and a cavity that can hold an RD53 full-height fixed disk drive or a TK50 tape drive.

A MicroVAX 2000 system may include a maximum of two expansion boxes: one containing a fixed disk drive and one containing a tape drive.

The expansion adapter is attached to the MicroVAX 2000 system box and allows for communication between the expansion box and system box.

CAUTION: Only devices such as the RD53-F expansion boxes, which were specifically designed for the MicroVAX 2000 or VAXstation 2000, may be attached to connector B of the expansion adapter. Likewise, devices such as the RD53-F expansion boxes must not be connected to any device for which they were not designed, as circuit damage or data loss may occur.

For a description of the expansion box and expansion adapter, see Chapter 1. To order an expansion box or expansion adapter after initial system installation, contact your sales representative. Contact your service representative to install this option.

Fixed Disk Drives

A fixed disk drive stores information on a nonremovable disk. Two fixed disks are available for the MicroVAX 2000: the full-height RD53 and the half-height RD32. Only one fixed disk drive may be installed in the system unit and only one in the expansion box, for a total of two fixed disk drives in the system.

For a description of the fixed disk drives, see Chapter 1. To order a fixed disk drive after initial system installation, contact your sales representative.

RX33 Diskette Drive

The half-height RX33 diskette drive may be installed in the system unit. It may not be installed in an expansion box. For a description of the half-height RX33 diskette drive, see Chapter 1. The RX33 diskette drive uses RX33K and RX50K diskettes. To order an RX33 diskette drive after initial system installation contact your sales representative. Contact your service representative to install this option.

The Tape Drive

The TK50 tape drive is available only in the expansion box. For a description of the TK50 tape drive, see Chapter 1. The TK50 tape drive requires TK50K tape cartridges. To order a TK50 tape drive after initial system installation, contact your sales representative. Contact your service representative to install this option.

The ThinWire Ethernet Module

To connect your MicroVAX 2000 to the ThinWire Ethernet, you must have the ThinWire Ethernet module intalled in your system. Contact your sales representative to order this module after initial system installation.
You must contact your service representative for module installation.

For more information about networking, see the *VAXstation 2000, MicroVAX 2000 and VAXmate Network Guide*. This guide describes how to configure your system on a network. The guide also lists network options and what to order.

Printers

The MicroVAX 2000 can be used with the following printers: the LN03, LN03 PLUS, the LPS40, the LA210, the LA50, the LA75, and the LA100. For installation information, see the *MicroVAX 2000 Hardware Installation Guide*.

The LN03

The LN03 laser printer (Figure 3-1) is a tabletop, nonimpact printer that produces letter-quality text at 8 pages/minute. For systems running MicroVMS or VMS,the printer can also display graphics.

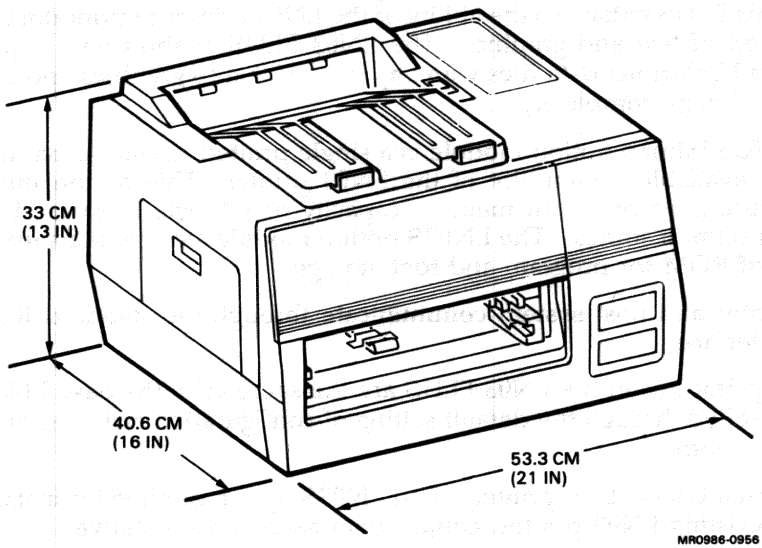
The LN03 offers 16 fonts, including Courier, Elite, and the VT100 Line-Drawing Set (the DIGITAL standard set). ASCII multinational technical character sets and 12 national language character sets can also be used.

The printer comes with three character sets. The LN03 can print up to 24 fonts on a page. To expand memory or add additional fonts, you can purchase more programmable RAM or precoded ROM cartridges from DIGITAL.

The LN03 uses only cut sheet paper. A paper cassette holds 250 sheets of paper. The printer automatically collates output for you in its face-down output tray. The LN03 can also handle preprinted single-part forms, transparencies, and labels. The LN03 can print in either landscape (horizontal) or portrait (vertical) mode.

The LN03 weighs 28 kilograms (66 pounds).

Figure 3-1: The LN03



To order an LN03 printer after the initial system installation, contact your sales representative. You can install the LN03 printer yourself. After assembling the printer, see the *MicroVAX 2000 Hardware Installation Guide*.

The LN03 PLUS

The LN03 PLUS is the upgrade configuration of the LN03 laser printer. The LN03 PLUS system consists of a base LN03 laser printer and an LN03S bitmap option module. The LN03 PLUS requires the firmware microcode v4.4 to be installed in the base LN03 printer.
The LN03 PLUS enhances the ability of the LN03 printer to print documents composed of text and graphics. The LN03 PLUS enables you to process ANSI and Tektronix data files with any ratio of text to graphics and with no limits on image complexity.

The LN03S bitmap option module is a single printed circuit board inserted into the available option slot of the LN03 printer. This option module's key feature is an on-board memory capacity of 1 Mbyte of dynamic RAM used for bitmap storage. The LN03S option module also contains up to 128 Kbytes of ROM for program and font storage.

The printer and host system communicate through the standard RS232-C serial interface.

All setup features in the LN03 PLUS are the same as in the base LN03 and are controlled through the default setting of configuration switches or under program control.

To order an LN03 PLUS printer, or an LN03S option module for installation into an existing LN03 printer, contact your sales representative.

The PrintServer 40 (LPS40)

The PrintServer 40 (Figure 3-2) is a MicroVAX II-based laser printer containing PostScript software. The PrintServer 40 is designed as an Ethernet node in order to serve many users.

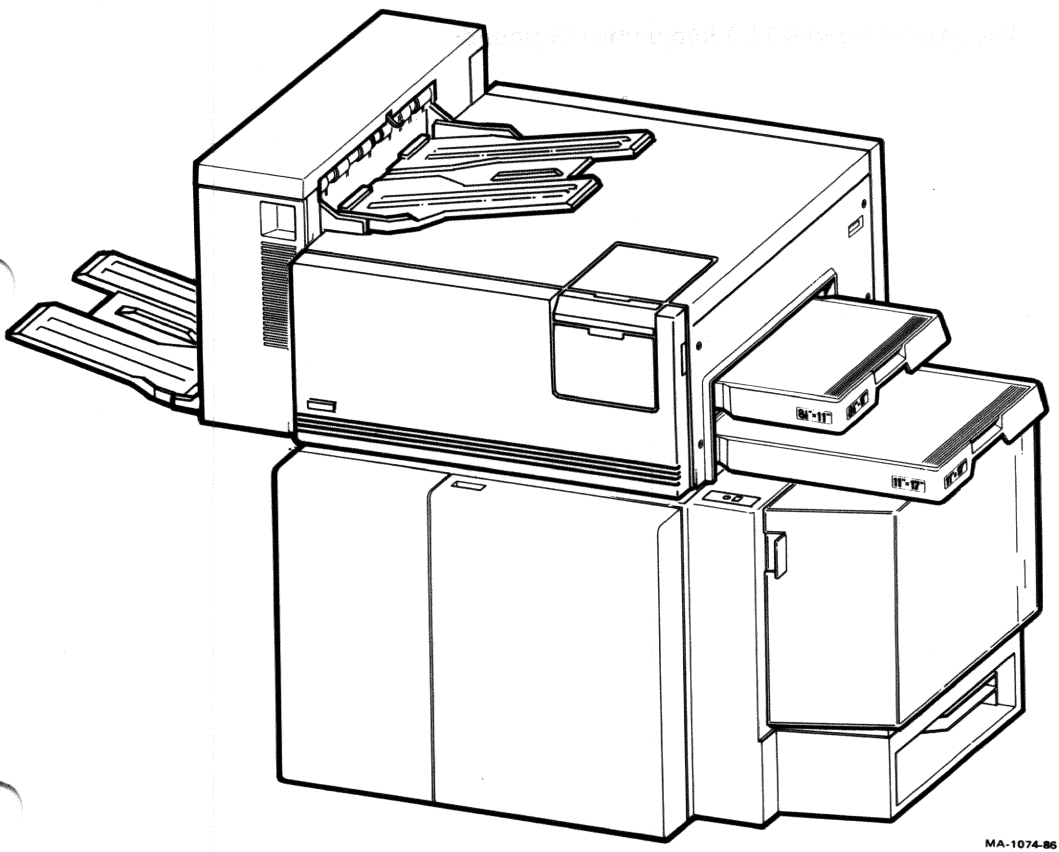
A dedicated MicroVAX II-based data controller interprets applications programs that output in PostScript, a powerful industry-standard page description language. The PrintServer 40 supports existing software using ANSI text/sixels, ReGIS, or Tektronix 4010/4014 format through the use of host-based translators.

The PrintServer 40 prints monochromatically at a rate of 40 pages per minute at a resolution of 300 x 300 dots per inch. Paper sizes include letter, legal, and ledger, and A4, A5, B4 and B5 metric sizes. A large capacity input tray holds 2,000 sheets of cut sheet paper and two auxiliary trays hold 250 sheets each.

The PrintServer 40 contains a library of 29 typefaces that may be scaled to any point size, rotaoted to any degree, and positioned anywhere on a page through the use of PostScript commands. The PrintServer 40 is 102.62 cm (40.4 in) high, 72.14 cm (28.4 in) deep, and 152.4 cm (60.0 in) wide. The PrintServer 40 weighs 219.99 kg (484 lbs).

To order a PrintServer 40 after the initial system installation, contact your sales representative. (Check with your sales representative on support of the PrintServer 40 with ULTRIX operating system software.) After the printer has been installed, see the *MicroVAX 2000 Hardware Installation Guide*.

Figure 3-2: The PrintServer 40 (LPS40)



MA-1074-86

The LA210

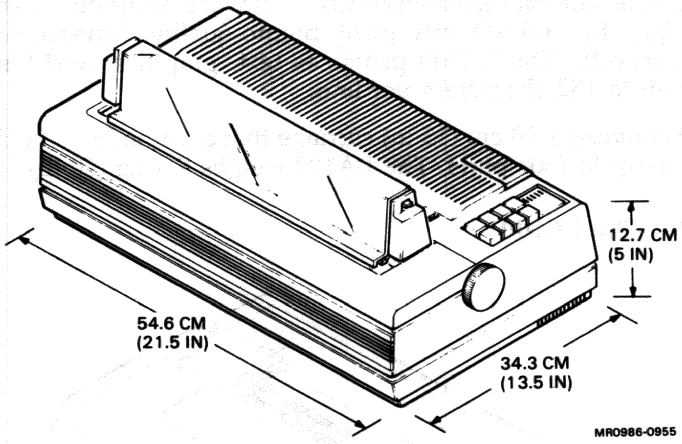
The LA210 (Figure 3-3) is a dot-matrix desktop printer that can produce high-speed drafts (240 characters/second) or near letter-quality correspondence (40 characters/second). With the addition of an optional font cartridge, the LA210 can print memo-quality correspondence (80 characters/second). The LA210 also prints bitmap graphics.

The printer can print in USASCII, 10 national languages in Courier 10, and the VT100 line-drawing set (the DIGITAL standard set). Other features include three optional typefaces and 30 optional character sets.

The LA210 prints on single-sheet and fanfold paper and handles forms with up to four parts. The printer's carriage accommodates paper ranging in width from 8.9 centimeters (3.5 inches) to 37.8 centimeters (14.9 inches).

The printer weighs 11.3 kilograms (25 pounds).

Figure 3-3: The LA210



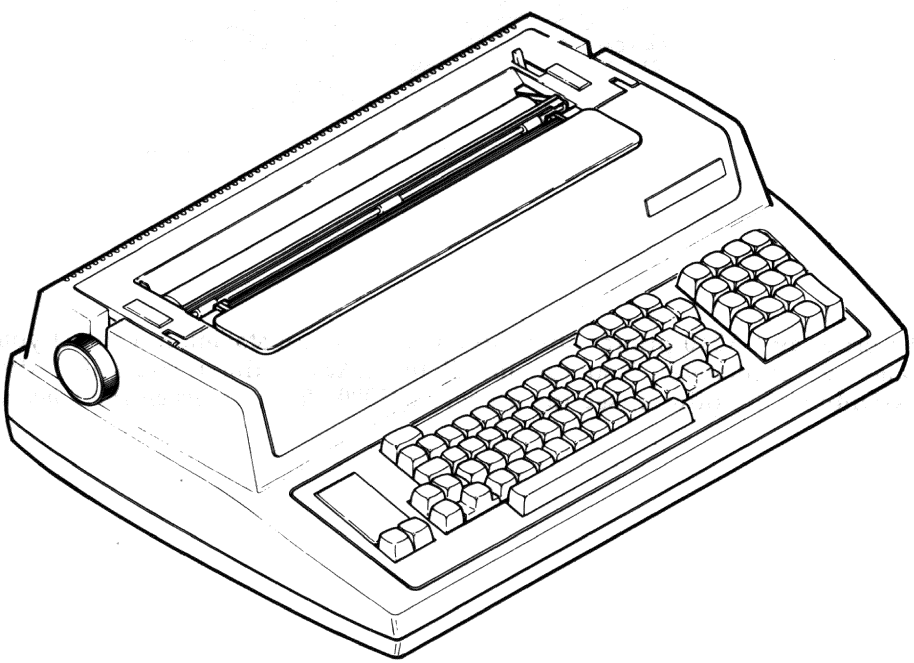
To order an LA210 printer after the initial system installation, contact your sales representative. You can install the LA210 printer yourself. After assembling the printer, see the *MicroVAX 2000 Hardware Installation Guide*.

The LA100

The LA100 (Figure 3-4) is a dot-matrix desktop printer. The LA100 produces high-speed drafts (240 characters/second) or near letter-quality correspondence (40 characters/second). With the addition of an optional font cartridge, the LA100 can print memo-quality correspondence (80 characters/second). The LA100 produces text, graphics, and line-drawing at a rate of 40 to 132 characters per line.

The LA100 contains a 39 cm (15 in) carriage that accomodates fanfold paper and forms in up to four parts. The LA100 weighs 9.1 kg (20 lb).

Figure 3-4: The LA100



MR-9562

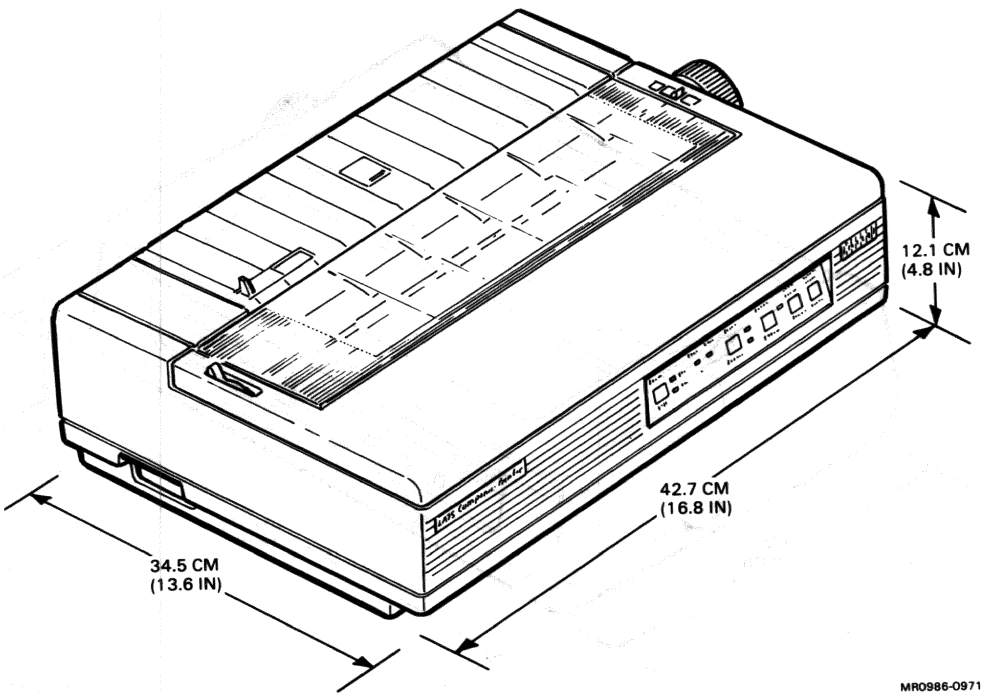
To order an LA100 after the initial system installation, contact your sales representative. You can install an LA100 printer yourself. After assembling the printer, see the *MicroVAX 2000 Hardware Installation Guide.*

The LA75

The LA75 (Figure 3-5) is a desktop dot-matrix printer that can produce sixel-protocol bitmap graphics. The LA75 prints in draft speed (250 characters/second), memo speed (125 characters/second), and letter quality speed (32 characters/second). The printer offers optional font cartridges and international character sets. You can use office stationery or fanfold paper.

The LA75 weighs 10.0 kg (22.0 pounds).

Figure 3-5: The LA75



To order an LA75 printer after the initial system installation, contact your sales representative. You can install the LA75 printer yourself. After assembling the printer, see the *MicroVAX 2000 Hardware Installation Guide*.

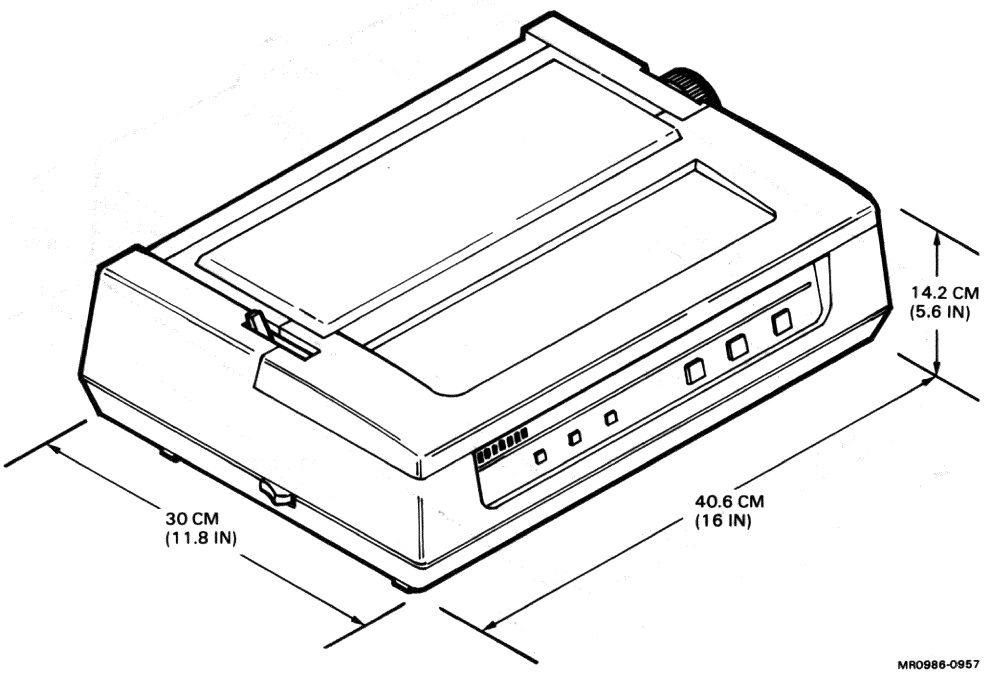
The LA50

The LA50 (Figure 3-6) is a desktop dot-matrix printer that can produce bitmap or character cell graphics.

The LA50 prints in draft speed (100 characters/second) and memo speed (50 characters/second). The printer offers one font and six character widths. Ten national character sets are available. You can use office stationery or fanfold paper.

The LA50 weighs 8.5 kg (18.7 lb).

Figure 3-6: The LA50



To order an LA50 after the initial system installation, contact your sales representative. You can install an LA50 printer yourself. After assembling the printer, see the *MicroVAX 2000 Hardware Installation Guide*.

Terminals

The following terminals are available for use with the MicroVAX 2000:

Terminal	Description
LA100	Tabletop hardcopy (printing) terminal
LA120	Floorstand hardcopy terminal
VT220	Desktop video terminal
VT240	Desktop video graphics terminal
VT241	Desktop color video graphics terminal

The LA100 and LA120 Hardcopy Terminals

The LA100 is a serial dot-matrix send/receive printer. The LA100 is a tabletop model and offers multiple print modes and character sets.
The LA120 is a a serial, dot-matrix, floorstand send/receive printer. The LA120 offers full and half-duplex modem support, selectable baud rates, and optional character sets.

The VT200-Series Video Terminals

The VT200-series terminals consist of separate video monitors and keyboards. Each contains set-up menus in three languages that allow the user to control display characteristics. Local hardcopy can be output to a printer. Keyboards are available in many languages. Both seven and eight-bit character support is offered.
The VT220 is a monochromatic text terminal with three phosphor display colors available.

The VT240 is a monochromatic text and graphics terminal with three phosphor display colors available.

The VT241 is a text and graphics terminal that uses a red-green-blue color monitor.

Modems

Three modems are available for use with the MicroVAX 2000:

Modem	Description
DF224	300, 1200 and 2400 bps (bits per second) full-duplex synchronous/asynchronous
DF124	1200 and 2400 bps full-duplex synchronous/asynchronous
DF112	300 and 1200 bps full-duplex synchronous/asynchronous

DF224

The DF224 modem provides full-duplex communication at speeds of 300, 1200, and 2400 bps (asynchronous) and 1200 and 2400 bps (synchronous). The DF224 allows both rotary and pushbutton dialing over dial-up or leased-line networks.

The DF224 contains an autodialer with memory and provides autoanswer capability in addition to manual operation. A data/talk switch and automatic adaptive equalizer are also provided. The DF224's diagnostics test the modem at each power up.

DF124

The DF124 modem provides full-duplex communication at speeds of 1200 and 2400 bps (asynchronous and synchronous) over dial-up or leased line networks. The DF124 contains an autodialer with memory, a data/talk switch and diagnostic self-tests.

DF112

The DF112 modem communicates at 300 and 1200 bps full-duplex (asynchronous and synchronous) over dial-up or leased line networks. An autodialer with memory and data/talk switch are provided. The DF112 is compatible with both rotary and pushbutton dialing.
To order a modem after initial system installation, contact your sales representative. To install a modem, see the *MicroVAX 2000 Hardware Installation Guide*.

Appendix A

System Specifications

Table A-1: System Dimensions

System Unit	
Width	33 cm (12.75 in)
Depth	29 cm (11.25 in)
Height	14 cm (5.5 in)
Weight	12.7 kg (28 lb)

System Unit with Expansion Adapter	
Width	33 cm (12.75 in)
Depth	29 cm (11.25 in)
Height	18 cm (7.0 in)
Weight	13.6 kg (30 lb)

Table A-1 (Cont.): System Dimensions

Expansion Box	
Width	33 cm (12.75 in)
Depth	29 cm (11.25 in)
Height	14 cm (5.5 in)
Weight	12.7 kg (28 lb)

Table A-2: System Electrical Requirements

Input	115 V AC	230 V AC
Voltage tolerance	88-132 V rms	176-264 V rms
Power source phasing	single	single
Frequency	60 Hz	50 Hz
Line frequency tolerance	47-63 Hz	47-63 Hz
Power consumption (maximum)	160 W	160 W

Table A-3: System Environmental Requirements

	Operating	Nonoperating	Storage
Maximum altitude	2400 m at 36°C	4900 m	2400 m
Temperature range	10°C-40°C	-40°C-66°C	5°C-50°C
Temperature change rate	11°C/hr max	-	-
Maximum wet bulb temperature	28°C	28°C	32°C
Relative humidity	10-90% (non-condensing, no diskette) 20-80% (diskette in use)	95% at 66°C (may condense)	10-95% (non-condensing)
Minimum dew point	2°C	2°C	2°C
Heat dissipation	155 watts max	-	-

Table A-4: RD32 Fixed Disk Drive

Storage capacity	41,820 Kilobytes
Average seek time	40 milliseconds
Data bit rate	5.0 MHz
Rotation speed	3,600 rpm
Cylinders	820
Heads	6
Height	4.3 cm (1.7 in)
Width	14.6 cm (5.75 in)
Depth	20.32 cm (8.0 in)
Weight	1.31 kg (2.9 lb)

Table A-5: RD53 Fixed Disk Drive

Storage capacity	69,632 Kilobytes
Average seek time	30 milliseconds
Data bit rate	5.0 MHz
Rotation speed	3,600 rpm
Cylinders	1024
Heads	8
Height	8.25 cm (3.25 in)
Width	14.6 cm (5.75 in)
Depth	20.32 cm (8.0 in)
Weight	3.18 kg (7.0 lb)

Table A-6: RX33 Diskette Drive

Number of tracks	80
Number of heads	2
Track density	96 tracks/in
Track step rate	3 millisec/track
Diskette size	13.13 cm (5.25 in)
Diskettes/diskette drive	1
Data capacity	1200 kilobytes (RX33K)
	400 kilobytes (RX50K)
Recording surfaces/diskette	2 (RX33K)
	1 (RX50K)
MFM data bit rate	500 KHz (RX33K)
	250 KHz (RX50K)
Rotation speed	360 rpm (RX33K)
	300 rpm (RX50K)
512-byte sectors per track	15 (RX33K)
	10 (RX50K)
Height	4.3 cm (1.7 in)
Width	14.6 cm (5.75 in)
Depth	20.32 cm (8.0 in)
Weight	1.31 kg (2.9 lb)

Table A-7: TK50 Tape Drive

Mode of operation	Streaming
Read/write method	Serpentine
Recording method	MFM
Recording medium	magnetic tape
Tape width	1.2 cm (.5 in)
Tape length	185 m (600 ft)
Recording density	6667 bits/in
Number of tracks	22
Capacity	131.0 megabytes (unformatted)
	94.5 megabytes (formatted)
Tape speed	75 in/sec
Read time	35 min for full tape
Tape start time	300 msec maximum

Appendix B

Related Documents

NOTE: For option and system hardware part numbers, contact your sales representative.

Not all of the following documents are available in every country. Check with your sales representative for availability.

Hardware Manuals and Kits

- MicroVAX 2000 Hardware Installation Guide (EK-MVXAA-IG)
- MicroVAX 2000 Hardware Information Kit (EK-ZNAAG-GZ))
- VAXstation 2000, MicroVAX 2000, and VAXmate Network Guide (EK-NETAA-UG)
- VAXstation 2000/MicroVAX 2000 Maintenance Guide (EK-VSTAA-MG)

Software Manuals

MicroVMS

- Installing MicroVMS on a VAXstation 2000/MicroVAX 2000 (AA-JE60A-TN)
- VAXstation 2000/MicroVAX 2000 Operations Guide (AA-JE59A-TN)
- MicroVMS User's Manual (AA-Z209D-TE)

ULTRIX-32

- ULTRIX-32 Basic Installation Guide for the MicroVAX 2000 (TBS)
- ULTRIX-32 Network Management Guide (AA-JD76A-TE)
- ULTRIX-32 Programmer's Manual (AA-BG53D-TE, AA-BG54D-TE, and AA-BG56D-TE)
- ULTRIX-32 System Management Guide (AA-BG59B-TE)

Options Manuals

- VT220 Installation Guide (Order No. EK-VT220-IN)
- VT220 Owner's Manual (Order No. EK-VT220-UG)
- VT220 Programmer's Reference Manual (Order No. EK-VT220-RM)
- VT240 Series Installation Guide (Order No. EK-VT240-IN)
- VT240 Series Owner's Manual (Order No. EK-VT240-UG)
- VT240 Series Programmer's Reference Manual (Order No. EK-VT240-RM)
- VT240 Series Technical Manual (Order No. EK-VT240-TM)
- Installing and Using the LN03 (Order No. EK-0LN03-UG)
- LN03 Programmer Reference Manual (Order No. EK-0LN03-RM)
- LN03 Maintenance Kit Guide (Order No. EK-LN03U-MG)
- LN03 Toner Kit Guide (Order No. EK-0LN03-MG)
- LN03 PLUS User Guide (Order No. EK-LN03S-UG)
- LN03 PLUS Programmer Reference Manual (Order No. EK-LN03S-RM)
- LN03S Bitmap Option Installation Guide (Order No. EK-LN03S-IG)
- PrintServer 40 Operator's Guide (Order No. EK-LPS40-OP)
- PostScript Language Tutorial and Cookbook (Order No. AA-HL86A-TE)
- Installing the LA210 Letterprinter (Order No. EK-LA210-IN)
- LA210 Letterprinter User Guide (Order No. EK-LA210-UG)
- LA210 Letterprinter Programmer Reference Manual (Order No. EK-LA210-RM)

- LA210 Letterprinter Operator and Programmer Reference Guide (Order No. EK-LA210-RC)
- LA210 Letterprinter Emulation Modes Reference Guide (Order No. EK-LA210-RG)
- LA100 Letterwriter User Documentation Kit (Order No. EK-LW100-UG)
- Installing and Using the LA75 Companion Printer (Order No. EK-OLA75-UG)
- LA75 Companion Printer Programmer Reference Manual (Order No. EK-OLA75-RM)
- LA75 Companion Printer Programmer Reference Card (Order No. EK-OLA75-RC)
- LA75/LA75P Technical Manual (Order No. EK-OLA75-TM)
- Installing and Using the LA50 Printer (Order No. EK-0LA50-UG)
- LA50 Printer Programmer Reference Manual (Order No. EK-0LA50-RM)
- The RX33 Diskette Drive Technical Description (Order No. EK-RX33T-TM)
- RD53 Fixed Disk Drive Technical Description (Order No. EK-RD53A-TD)
- TK50 Tape Drive Subsystem Owner's Manual (Order No. EK-LEP05-OM)
- TK50 User's Guide (Order No. EK-OTK50-UG-004)
- TK50 Technical Manual (Order No. EK-OTK50-TM)

Glossary

application program

A program that performs an end-user task, such as a financial spreadsheet program.

ASCII

American Standard Code for Information Interchange. A set of 7- or 8-bit binary numbers representing the alphabet, punctuation, numerals, and other special symbols used in text representation and communications protocol.

backup process

The process of making copies of the data stored on your disk so that you can recover that data after an accidental loss. You make backup copies on RX33 diskettes, TK50 tape cartridges, or over a network.

backup copy

A copy of data stored on your disk. The duplicate copy is stored on either RX33 diskettes or TK50 tape cartridges.

baud rate

The speed at which signals are serially transmitted along a communications line. One baud equals one bit/second.

binary

A number system that uses two digits: 0 and 1. They are represented in system circuitry by two voltage levels, and programs are executed in binary form.

bit

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

BNC connector

The connector on the rear of the MicroVAX 2000 system unit to which the ThinWire Ethernet cable is attached.

boot

See **bootstrap**.

bootable medium

A fixed disk, diskette, or magnetic tape containing software (such as operating system software) that a bootstrap program can load into the system memory and execute.

boot device

A device in the system, such as a fixed disk drive, that can be used to store bootable software.

bootstrap, (or boot)

Verb - To execute the bootstrap loader program. The bootstrap loader loads the operating system software from a mass storage device and executes it.
Noun - A bootstrap program.

byte

A group of eight binary digits (bits). A byte is one-quarter of a VAX system word.

central processing unit (CPU)

The part of the system that controls the interpretation and execution of instructions. In the MicroVAX 2000 system, CPU functions are contained on one MicroVAX II CPU chip.

cluster

A group of computers networked together.

communications line

A cable along which electrical signals are transmitted. Devices or systems that are connected by a communications line can share information and resources.

computer system

A combination of system hardware, software, and external devices that performs operations and tasks.

console mode

The state in which the computer is controlled from the console terminal. The MicroVAX 2000 can be put in console mode by pressing the halt button on the rear of the MicroVAX system unit. Console mode is indicated by the console prompt (>>>) on the monitor or console terminal screen. The other mode the system can operate in is program mode. (See **program mode**.)

console terminal

The terminal connected to port 1 on the rear of the MicroVAX 2000 system unit. This terminal is used to enter console commands and perform other system functions.

controller

A system component, usually a printed circuit board, that regulates the operation of one or more peripheral devices.

converter

A small device attached to the back of the MicroVAX 2000 system unit that converts RS232 protocol signals to DEC423 protocol signals.

CPU

Abbreviation for central processing unit. (See **central processing unit**.)

CRT (Cathode ray tube)

A vacuum tube that generates and guides electrons onto a fluorescent screen to produce characters or graphics. This term is often used to refer to a monitor.

data

A formal representation of information suitable for communication, interpretation, and processing by humans or computers.

data transmission

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

debug

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

device

The general name for any unit connected to the system that is capable of receiving, storing, or transmitting data. (See **input device**, **output device**, **input/output device**, and **controller**.)

device name

The name by which a device or controller is identified in the system. Use that name to refer to that device when you are communicating with the system.

diagnostics

Programs that detect and identify abnormal system hardware operation. The diagnostic programs for the MicroVAX 2000 system are located in read-only memory. (See **read-only memory**.)

disk

A flat circular plate with a coating on which data is magnetically stored in concentric circles (tracks). A fixed disk resides permanently inside a disk drive, while a diskette is removable.

disk drive

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

diskette

A flexible, "floppy" disk contained in a square jacket. Diskettes can be inserted and removed from diskette drives.

diskette drive

A disk drive that only reads or writes on removable diskettes.

dot matrix

A method of generating characters for printing that uses dots to produce readable characters.

down-line load

See **remote install**.

error message

A message displayed by a system to indicate a mistake or malfunction.

Ethernet

A type of local area network based on Carrier Sense Multiple Access with Collision Detection (CSMA/CD).

file

A collection of related information treated by the system as a single unit.

fixed disk

See **disk**.

formatted data

Data that is structured in a particular pattern to be understood by the system software.

hardcopy terminal

A terminal that displays information on paper. Compare to **video terminal**.

hardware

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

host

The primary or controlling computer in a multiple computer network.

icon

A graphic symbol that gives a visual image of a device or a procedure's function. Icons often appear on the system's enclosure to aid the user in locating connectors and controls.

input/output (I/O) device

A piece of equipment that accepts data for transmission to (input) and from (output) the system. For example, a terminal.

interactive

A method of communicating with the system. In an interactive session, you type a command at the keyboard and the system executes the command and responds with a prompt character for another command.

interface

A device or piece of software that allows the components of the system to communicate with each other.

I/O

Abbreviation for input/output. (See **input/output (I/O) device**.)

K

The symbol that means 2 to the 10th power (or 1024 in decimal notation). Also an abbreviation for kilo (thousand).

kilobyte

1024 bytes.

load

To copy software (usually from a peripheral device) to memory. To physically place a disk in a disk drive or a tape in a tape drive.

local area network (LAN)

A data communications system designed for a small geographic area that offers high-speed communications channels optimized for connecting information processing equipment. For example, ThinWire Ethernet.

M

The symbol for 1024 squared (1,048,576 in decimal notation). Also an abbreviation for mega (million).

magnetic tape

A tape used for storing data that is made of plastic and coated with magnetic oxide. Also called magtape.

megabyte

1,048,576 bytes.

memory

The area of the system that electrically stores instructions and data, often temporarily.

memory module

A printed circuit board that contains additional memory for the system.

module

A printed circuit board that contains electrical components and electrically conductive pathways between components. A module stores data or memory or controls the functions of a device. (See **printed circuit board.**)

MicroVMS

The VAX/VMS operating system software. This operating system is specifically designed for MicroVAX-based systems.

network

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

node

An individual information-processing unit, such as a computer, workstation, or peripheral device, that is connected to a network.

off-line

Pertaining to equipment, devices, and events that are not controlled by the system, or have been logically disconneted from the system.

on-line

Pertaining to equipment, devices, and events that communicate with the system.

operating system

A collection of system programs that control the operation of the system and allow the user access to data files, input/output devices, and applications programs. The operating system software performs such tasks as assigning memory to programs and data, processing requests, and scheduling jobs. MicroVMS and ULTRIX are the two operating systems offered for the MicroVAX 2000.

output device

A device that accepts data from the system. A printer is an example of an output device.

peripheral device

A device that provides the CPU with additional memory storage or communication capability. Examples are disk and diskette drives, video terminals, and printers.

port

The name of the socket or connector at the back of the computer to which a terminal, printer, or other communication devices are connected.

power-up sequence (power up)

A series of ordered events that occur when you supply power by turning on the system.

printed circuit board

A piece of fiberglass board used to make modules. (See **module**.)

printer

A peripheral device that provides paper copies of information stored on the system.

program

The sequence of instructions the system uses to perform a task. (See **software**.)

program mode

The state in which the computer is controlled by the operating system. After the operating system is installed, the system will always operate in program mode, unless you put it into console mode. (See **console mode**.

prompt

Words or characters that the system displays to indicate that it is waiting for you to type a command.

RAM

Abbreviation for random-access memory. (See **random-access memory (RAM)**.)

random-access memory (RAM)

Memory that can be both read and written into and randomly access any one location during normal operations. The type of memory the system uses to store the instructions of programs currently being run.

read-only memory (ROM)

A memory whose contents cannot be modified. The system can use the data contained in a ROM but cannot change it.

remote install

To send a copy of a system image or other file over a line to the memory of a target node.

ROM

Abbreviation for read-only memory. (See **read-only memory (ROM)**.)

run

Noun - A single continuous execution of a program.
Verb - To execute a program.

software

Programs executed by the system to perform a chosen or required function. Compare to **software**.

storage medium

Any device capable of recording information; for example, a diskette.

store

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

system

A combination of system hardware, software, and peripheral devices that performs specific processing operations.

system image

The image that is read into memory from disk when the system is started up (booted).

system management tasks

Tasks performed by an assigned person to operate and maintain the system. That person is usually the system manager.

tape drive

A device that contains mechanical components and holds, turns, reads, and writes on magnetic tape.

T-connector

A connector used in ThinWire Ethernet. One part of the connector attaches directly to a station such as the MicroVAX 2000. The other two parts connect to ThinWire Ethernet cable.

terminal

An input/output device that allows you to communicate with the system. Terminals are divided into two categories: video and hardcopy.

terminator

A special connector used on one or both ends of an Ethernet segment that provides the 50-ohm termination resistance needed for the cable.

text cursor

A block or line, usually blinking, displayed on a CRT screen to indicate where the next character typed will appear.

ThinWire

A Digital trademark used to describe its 10base2 (IEEE standard 802.3 compliant) Ethernet products used for local distribution of data.

32-bit length

The length of the internal data path of the CPU. This length provides more concentrated data, allows more data types, and enables more data to be transferred at one time than a 16-bit internal data path.

ULTRIX-32

An interactive, time-sharing operating system derived from UNIX and enhanced by Digital to work with MicroVAX hardware and software.

user input device

A piece of equipment that is used to transfer data to the system. For example, keyboard, disk, tape, and system are input devices.

user command

An order you give to the system through a keyboard, mouse, or other input device.

video terminal

A terminal that displays information on the screen of a cathode ray tube (CRT). Compare to **hard-copy terminal**.

VLSI

Very Large Scale Integration of integrated circuit chips. A large number of chips can fit on a printed circuit board; therefore, fewer boards are needed, and the system can be smaller.

VT200-series terminals

A family of video terminals offered by Digital. The VT200-series includes the VT220, VT240, and VT241 terminals.

winchester disk

A hard disk permanently sealed in a drive unit to prevent contaminants from affecting the read/write head. The sealed head/disk assembly (HDA) helps to increase drive reliability and ensure data integrity. (See **fixed disk**.)

word

The largest number of bits (32) that the MicroVAX 2000 system can handle in an operation. The system can also handle longwords (that is, two words or 64 bits).

write-protect

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

write-protect notch

The small notch on the side of an RX33K or RX50K diskette that you can cover with an adhesive-backed foil label or tab to prevent loss of data by accidental overwriting.

write-protect switch

The switch that you slide down on a TK50 tape cartridge to prevent loss of data by accidental overwriting.

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