VAX 4000 Model 400/500/600 Installation

Order Number EK–448AD–IN.004

Digital Equipment Corporation
Maynard, Massachusetts

First Printing, November 1991
Revised, February 1992
Revised, April 1992
Revised, July 1992

The information in this document is subject to change without notice and should not be construed as a commitment by Digital Equipment Corporation.

Digital Equipment Corporation assumes no responsibility for any errors that may appear in this document.

The software, if any, described in this document is furnished under a license and may be used or copied only in accordance with the terms of such license. No responsibility is assumed for the use or reliability of software or equipment that is not supplied by Digital Equipment Corporation or its affiliated companies.

Restricted Rights: Use, duplication or disclosure by the U.S. Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013.

The Reader's Comments form at the end of this document requests your critical evaluation to assist in preparing future documentation.

The following are trademarks of Digital Equipment Corporation: CompacTape, CX, DDCMP, DEC, DECconnect, DECdirect, DECnet, DECscan, DECserver, DECUS, DECwindows, DELNI, DEMPR, DESQA, DESTA, DSRVB, DSSI, IVAX, KDA, KLESI, KRQ50, MicroVAX, MSCP, Q-bus, Q22-bus, RA, RQDX, RV20, SA, SDI, ThinWire, TK, TMSCP, TQK, TS05, TU, VAX, VAX 4000, VAXcluster, VAX DOCUMENT, VAXELN, VAXlab, VAXserver, VMS, VT, and the DIGITAL logo.

FCC NOTICE: The equipment described in this manual generates, uses, and may emit radio frequency. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such radio frequency interference.

Operation of the equipment in a residential area may cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

S1975

This document was prepared using VAX DOCUMENT, Version 2.1

Contents

1 Verify Site Preparation 1

2 Check the Shipment 2

3 Position the System 5

4 Open the System Doors 6

5 Install the Console Terminal 8

6 Set the System Controls 10

7 Connect Additional Devices to the System 16

7.1 Connecting Terminals and Serial Printers 19

7.2 Connecting Parallel Printers 23

7.3 Connecting Synchronous Modems 25

7.4 Connecting Asynchronous Modems 29

7.5 Connecting to an Ethernet Network at the H3604 Console Module 33

7.5.1 Making a ThinWire Network Connection 34

7.5.2 Making a Standard Network Connection 38

7.6 Connecting to an Ethernet Network at the DESQA Module 40

7.6.1 Making a ThinWire Network Connection 41

7.6.2 Making a Standard Network Connection 46

7.7 Connecting an Embedded TLZ04 Tape Drive 47

8 Connect an Expander, If Required 52

8.1 Connecting the Q–bus Cables 53

8.2 Connecting the DSSI Cable 54

8.3 Connecting the KZQSA External Cable 56

8.4 Connecting the Power Control Bus Cable 58

8.5 Connecting the Ground Cable 59

9 Connect the System Power Cable 59

10 Turn On the System and Select a Language 61

11 Close the System Doors 64

12 After Installation 65

Index

1 Verify Site Preparation

CAUTION: *Review your system warranty. It may require that a Digital service representative install your system to prevent damage to equipment or software.*

If you are installing a DSSI VAXcluster configuration, and you are a licensed self-maintenance customer, you should be familiar with the contents of your *DSSI VAXcluster Installation and Troubleshooting* manual.

CAUTION: *If you are installing a DSSI configuration, to prevent system performance degradation or data corruption caused by excessive ground offset voltages, make sure your site power distribution system does not have any of the grounding faults listed in your Site Preparation manual.*

The installation instructions that follow assume:

- Your site meets all the requirements listed in the system *Site Preparation* manual.
- All cables that you plan to connect to your system are in place and clearly labeled.

  Terminal data cables?

  Telephone cables?

  Network cables?

- You have the following tools (not included in your shipment).

  Scissors

  Flat-blade screwdriver

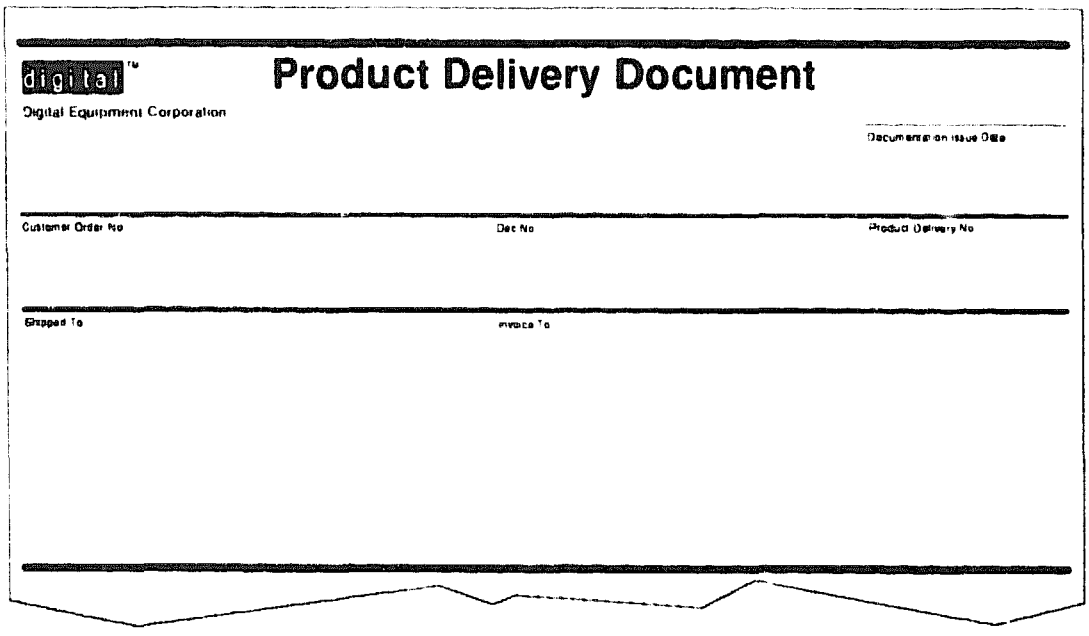
  Phillips (cross-point) screwdriver

  Adjustable wrench

  Voltmeter calibrated for millivolts

2 Check the Shipment

1. Find the Product Delivery Document. It is inside or attached to one of the shipping cartons.


digital™

Product Delivery Document

Digital Equipment Corporation

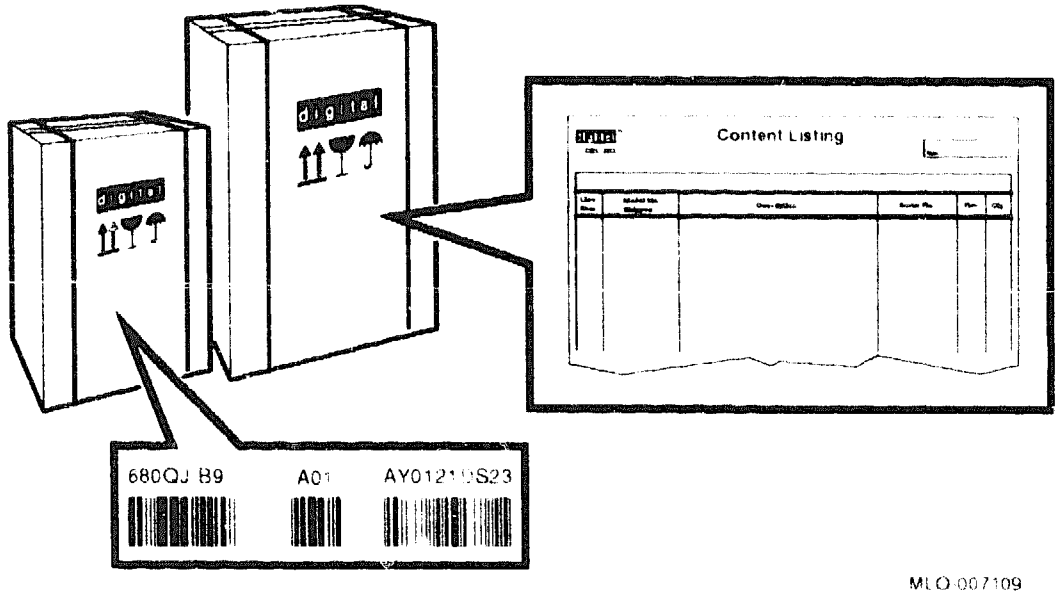
Documentation Issue Date

Customer Order No | Doc No | Product Delivery No

Shipped To | Invoice To

MLO-007108

2. Make sure your shipment is complete by checking that each item listed as shipped on the Product Delivery Document appears on a Content Listing or on a Barcode Label on the outside of one of the cartons in your shipment.

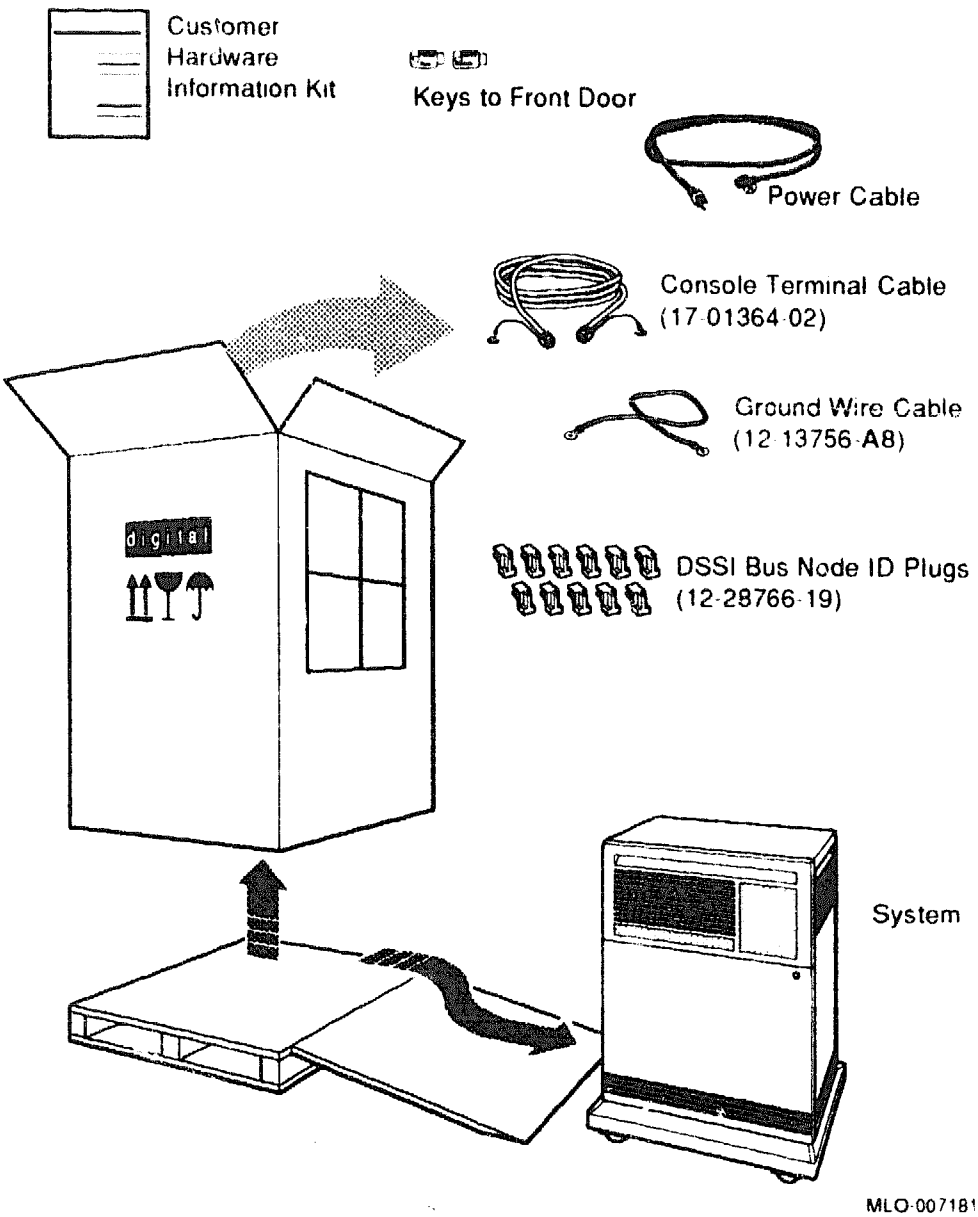


MLO-007109

A Content Listing may also be attached to a smaller container (bag or box) packed inside a shipping carton.

3. Use the unpacking illustrations on the cartons as a guide to unpack your shipment.

   WARNING: *The system weighs 68 kilograms (150 pounds) with all options installed. To prevent personal injury, two or more people should move the system.*



4. Check the contents of each carton against the Content Listing to ensure you received all items.

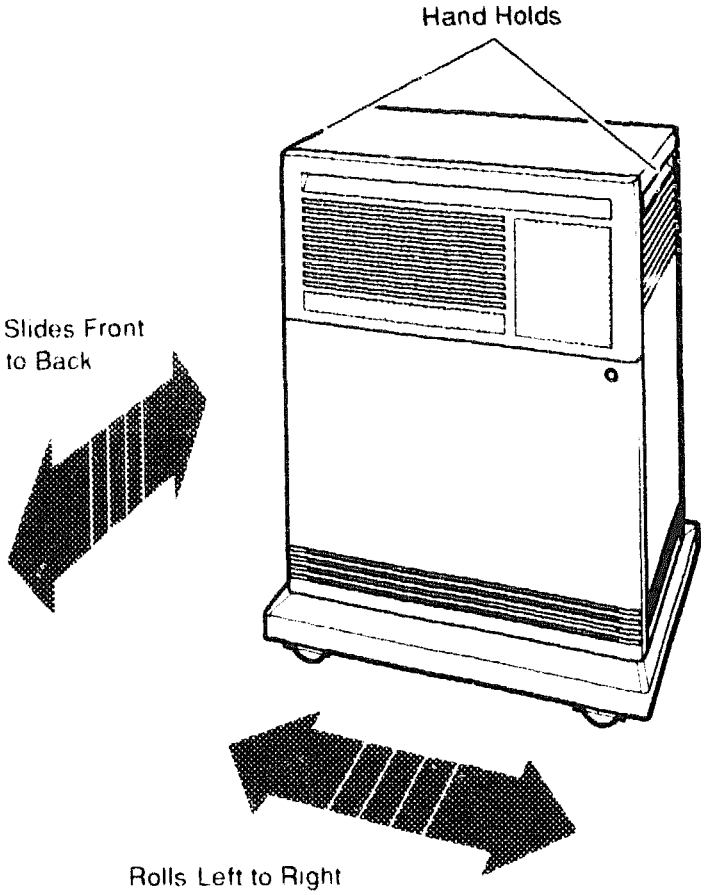
5. If any item is missing or damaged:

   Contact your delivery agent.

   Contact your Digital sales representative.

3 Position the System

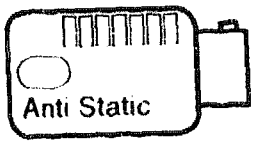
WARNING: *To prevent personal injury, do not use the hand holds to lift the system.*



For now, leave space behind the system for routing cables.

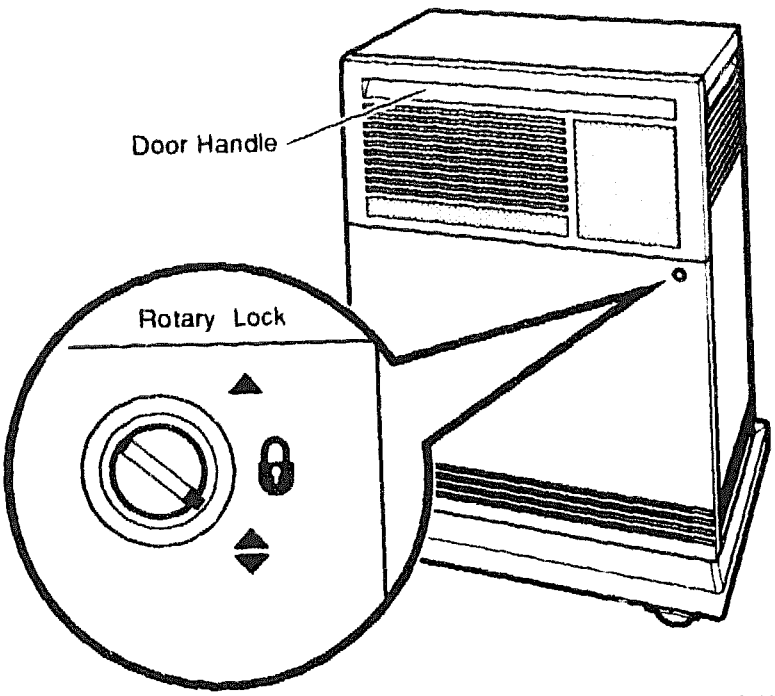
4 Open the System Doors

1. Find a key in the shipping carton (two are provided).



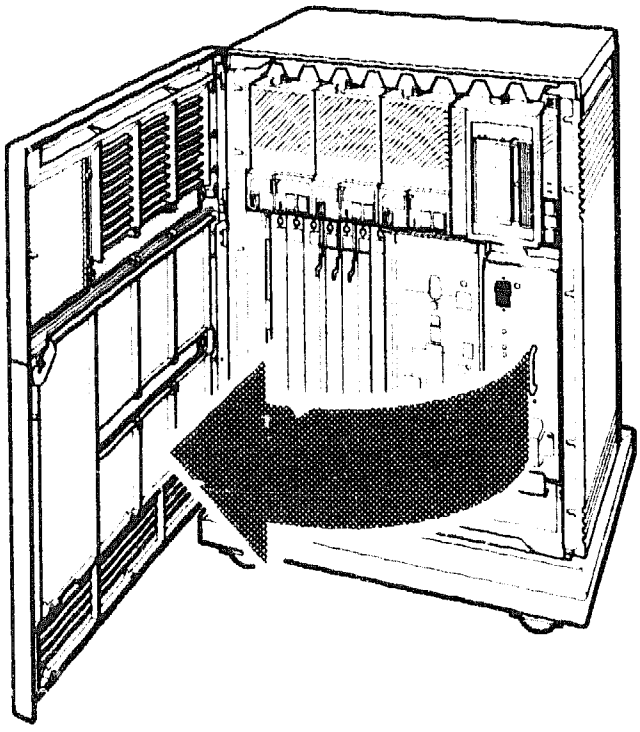
MLO-007110

2. Insert that key in the rotary lock, and turn it to the bottom position.



MLO-007111

3. Open the doors by pulling the handle on the upper door.



MLO 004013

4. Review the meaning of the following warning symbols which appear on the power supply.

Indicates a risk of electric shock.

To reduce the risk of injury, do not remove modules, Integrated Storage Elements (ISEs), the tape drive, or the power supply. No user-serviceable parts are inside. Refer servicing questions to your Digital service representative or to your licensed self-maintenance personnel.

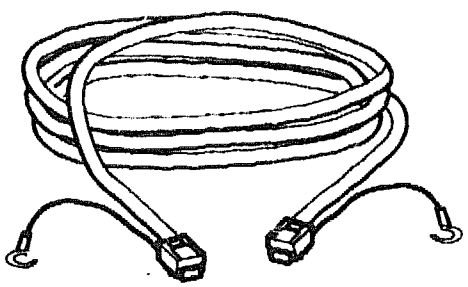
5 Install the Console Terminal

1. Use the instructions in your terminal installation guide to connect the various parts of the terminal.
2. Turn on the terminal.
3. After the terminal passes its self-test, perform the setup operations.

   Be sure to:

   - Read all the applicable documentation provided with your terminal.
   - Follow the setup instructions for your terminal.

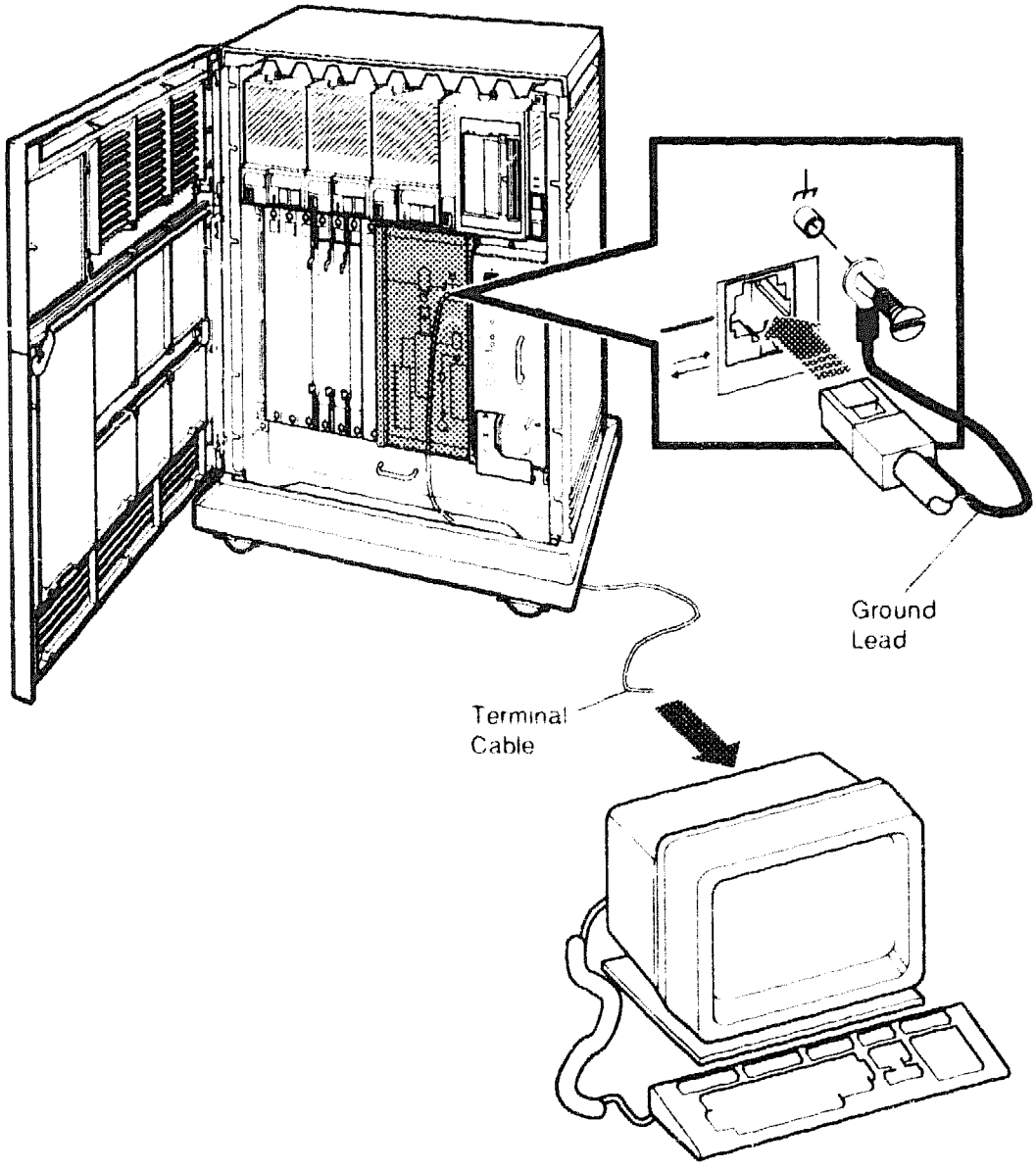
   NOTE: *A Digital terminal is shipped with the baud rate set to 9600. If you want to use that rate, you can ignore the baud rate setup instructions.*
4. Turn off the terminal.
5. Find the console terminal cable.



MLO-007112

6. Connect the terminal cable to the modular jack on the rear of the terminal, as described in your terminal installation guide.

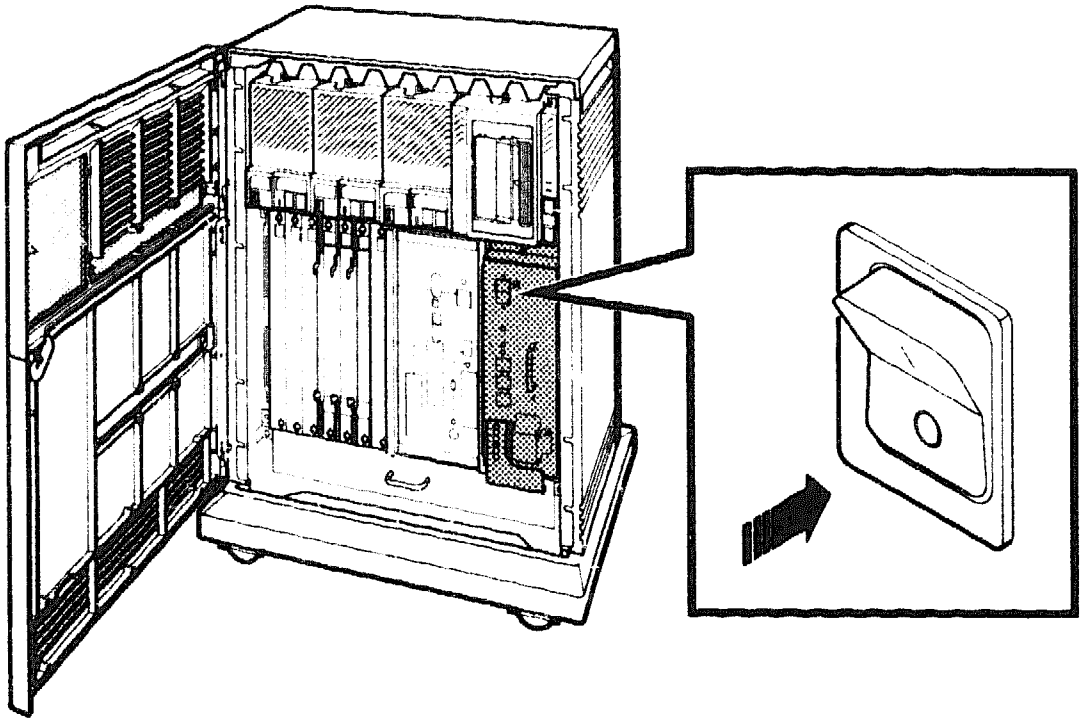
NOTE: *Shading in this and subsequent illustrations indicates the general location of the connections you will make.*



7. Insert the terminal cable into the modular jack on the system console module, and connect the cable ground lead, as shown above.

6 Set the System Controls

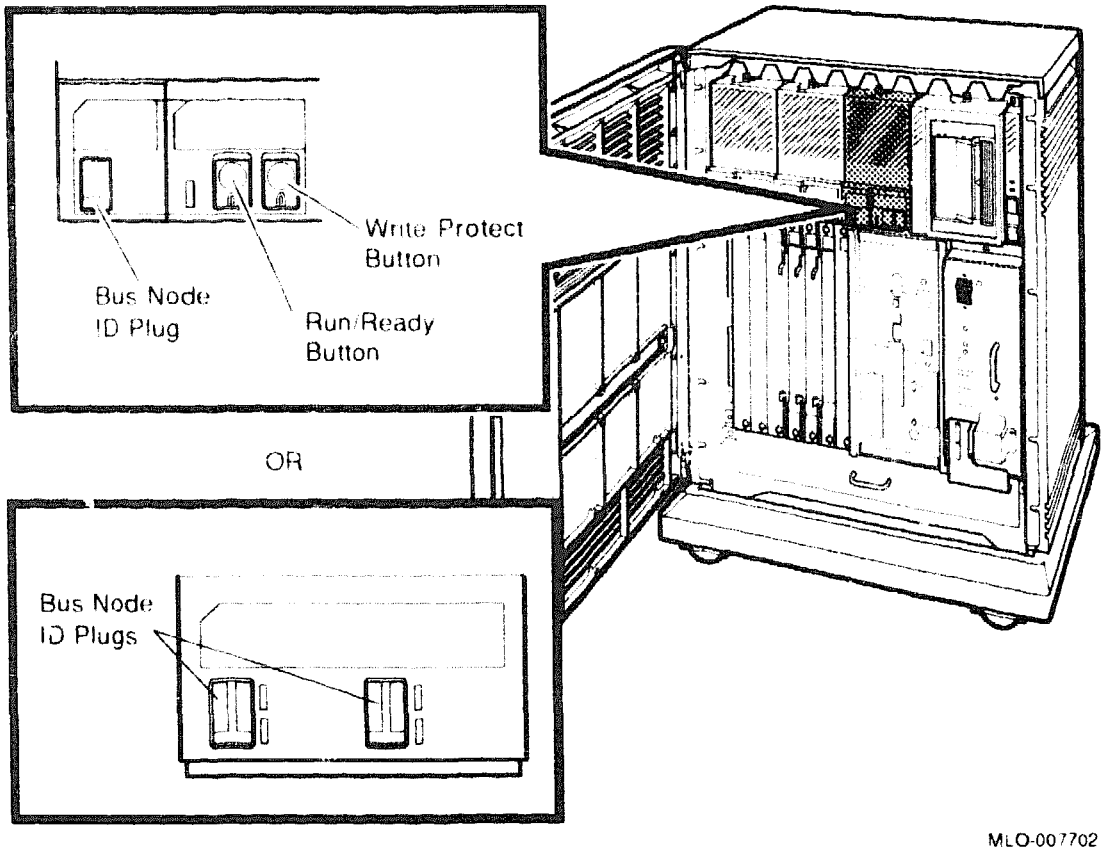
1. Check the setting of the Power switch on the power supply. It should be off (set at 0).



MLO-007113

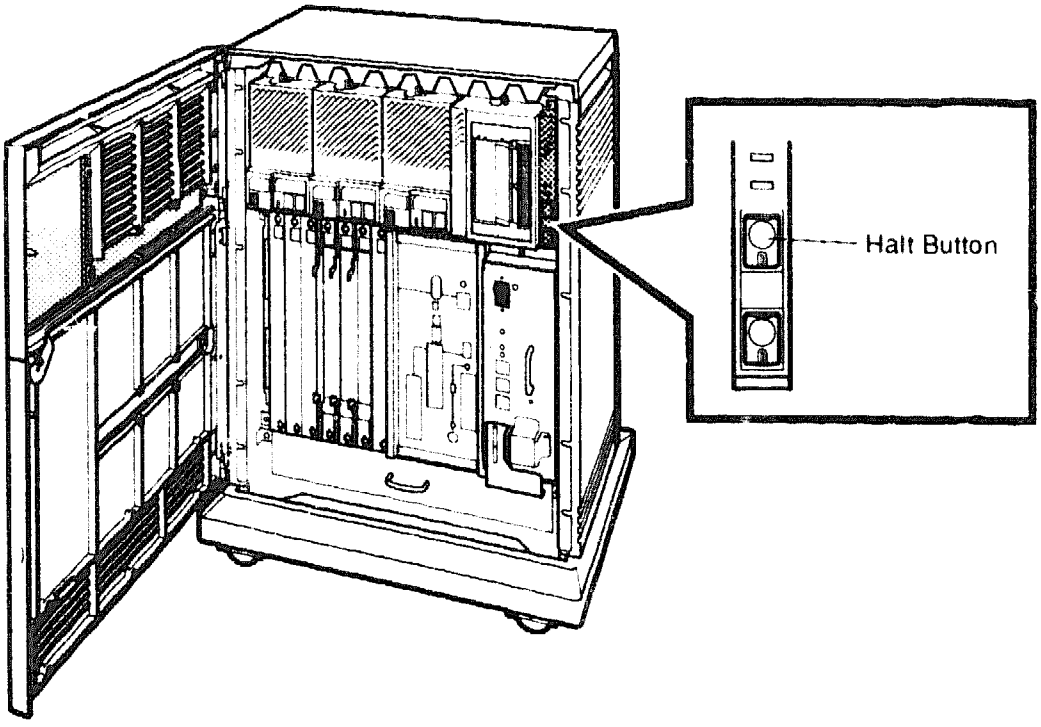
2. Check the settings on each RF-series Integrated Storage Element (ISE):

   - The Write-Protect button should be out (write-enabled position).
   - The Run/Ready button should be in (ready position).
   - Verify that uniquely numbered bus node ID plugs are inserted into the ISEs.



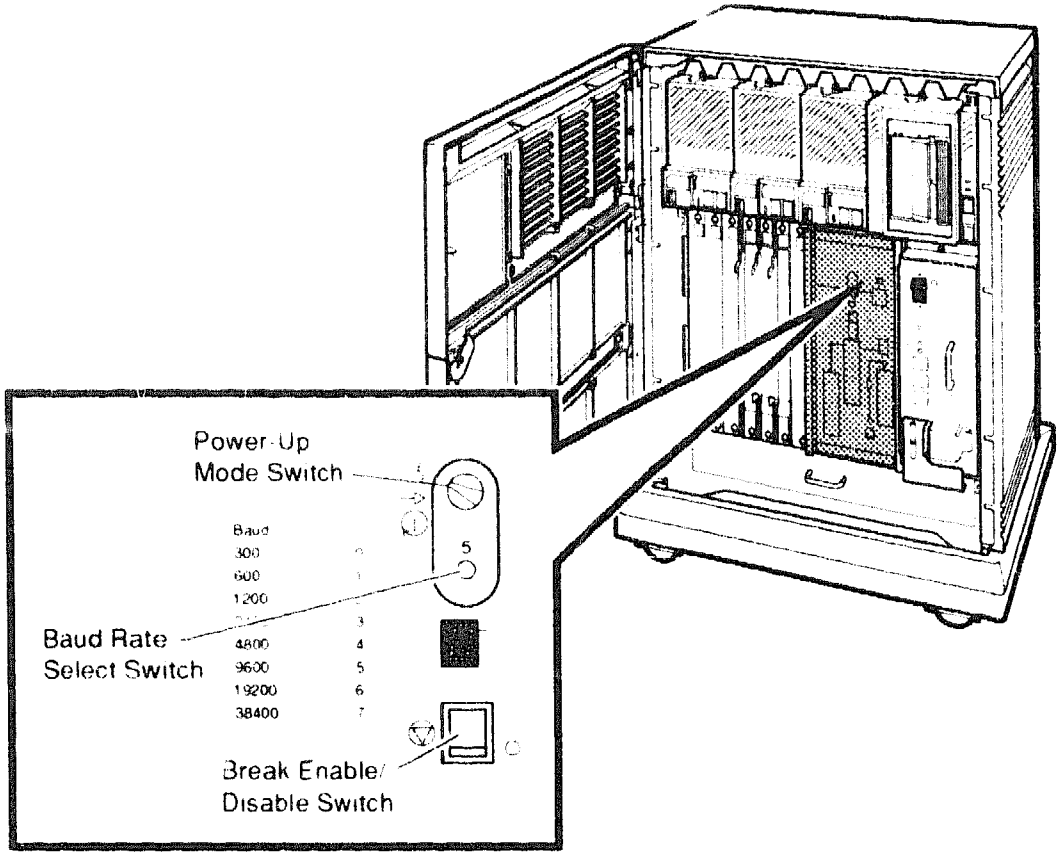
NOTE: *If a bus node ID plug is missing from an ISE, refer to your system Operation manual for corrective action.*

3. Check the setting of the Halt button on the system control panel. It should be out (run position).



MLO-007115

4. Check the settings on the console module:
   - The Power-Up Mode switch should be set to Language Inquiry (uppermost position, indicated by a human profile).
   - The Baud Rate Select switch should be set to the same rate you used for your console terminal.
   - The Break Enable/Disable switch should be set to break enabled (up, indicated by a 1).



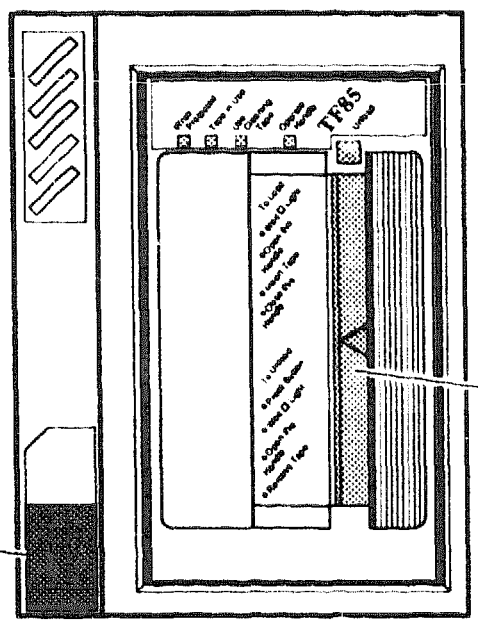
MLO-027116

5. Check the settings on the tape drive:

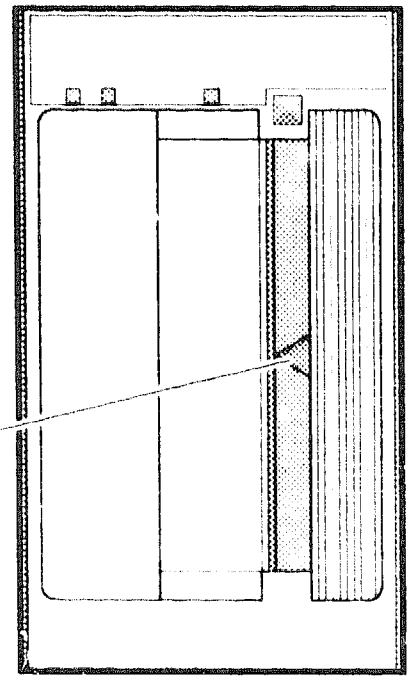
   - If a TF-series tape drive is installed in your system:

     Make sure the Cartridge Insert/Release handle is closed (pushed in).

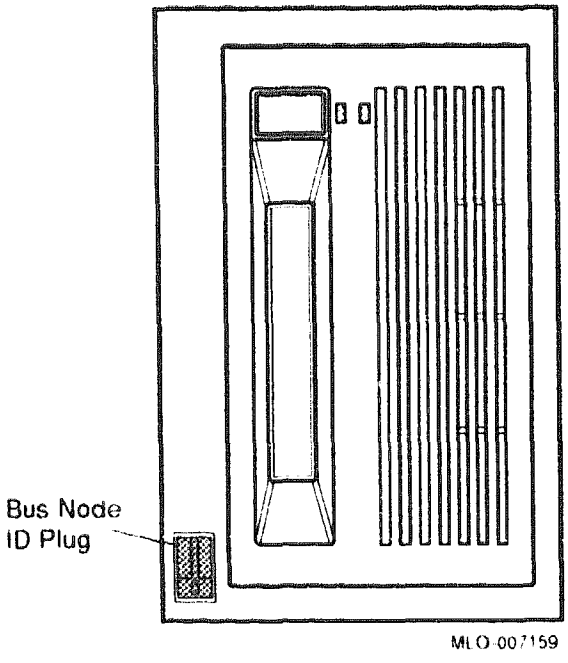
     Verify that a bus node ID plug is inserted into the drive.



- If a TK-series tape drive is installed in your system, make sure the Cartridge Insert/Release handle is closed (pushed in).



- If a TLZ04 tape drive is installed in your system, verify that a bus node ID plug is inserted into the drive.



7 Connect Additional Devices to the System

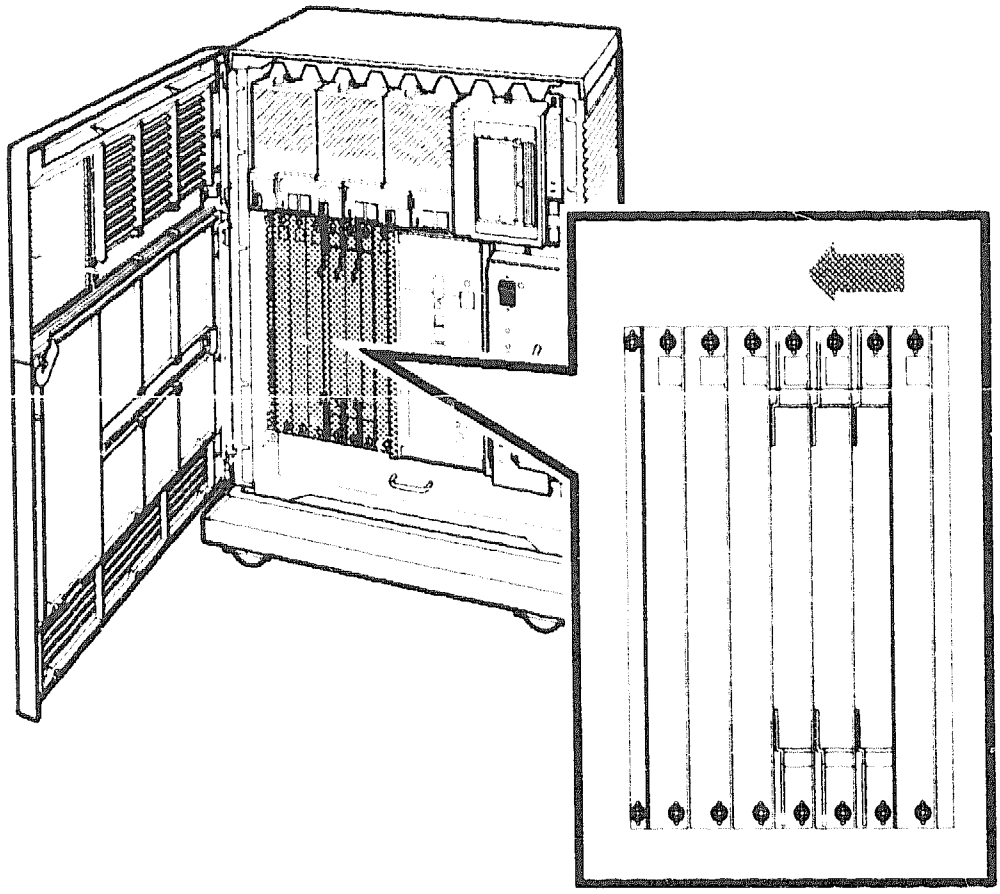
You can connect additional devices at this time, or you can complete the installation (go to Section 8) before connecting the devices.

- If you have devices that must be connected before you start up system software, connect them now.

CAUTION: *To prevent damage to equipment or software, make sure the Power switch on the power supply panel is off (set at 0).*

Make all connections directly to the appropriate system module cover.

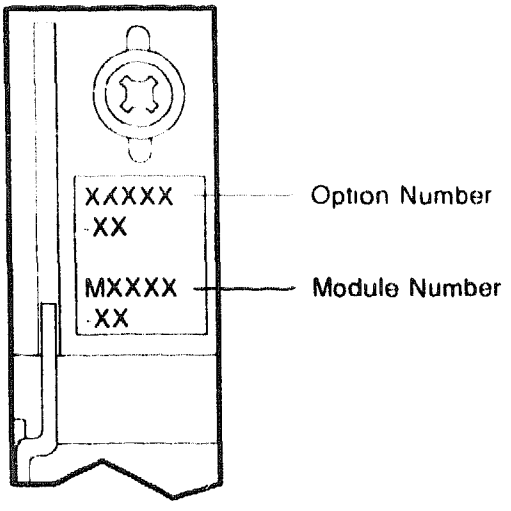
1. Begin with the module at the far right.



MLO-007117

2. As you complete connections for each module, move left to the next module.

Each module cover has an identifying label at the top, which shows the option number and module number.



MLO-007118

The following sections tell you how to connect devices to the modules described in this manual. Connections to other modules are described in the device installation guides.

Section 7.1 — terminals and serial printers (CXA16 or CXB16 module)

Section 7.2 — parallel printers (LPV11 module)

Section 7.3 — synchronous modems (DSV11 module)

Section 7.4 — asynchronous modems (CXY08 module)

Section 7.5 — Ethernet device (H3604 console module)

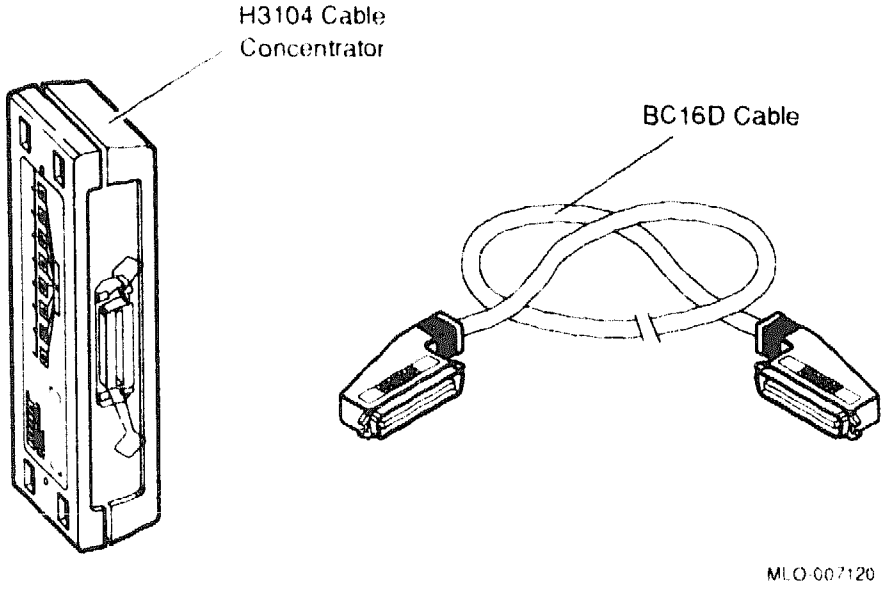
Section 7.6 — Ethernet device (DESQA module)

Section 7.7 — Embedded TLZ04 tape drive (KZQSA module)

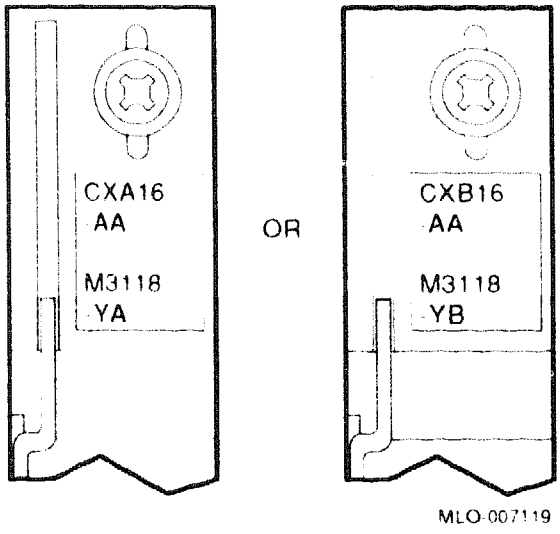
7.1 Connecting Terminals and Serial Printers

You can connect up to 16 terminals and/or serial printers for each CXA16 or CXB16 module installed in your system.

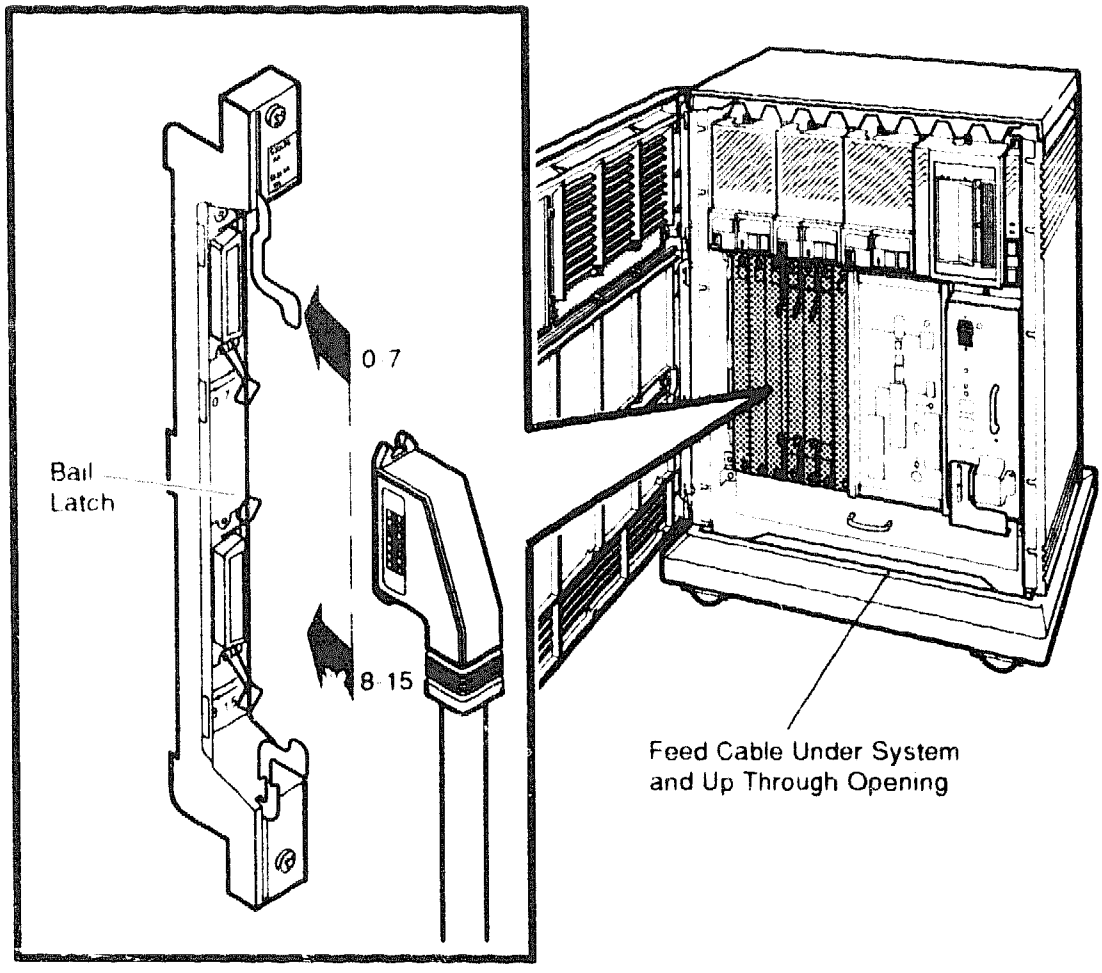
1. Find a cable concentrator and its cable.



2. Find the CXA16 or CXB16 module.

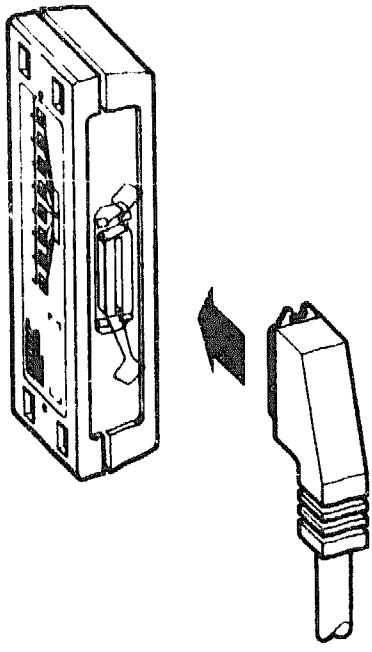


3. Insert the cable into a connector on the module.
   - If you are connecting two cables, connect the first to the connector labeled 8–15 on the module cover.
   - If you are connecting one cable, connect it to the connector labeled 0–7.



Secure the connection by pressing the bail latches until they snap into place.

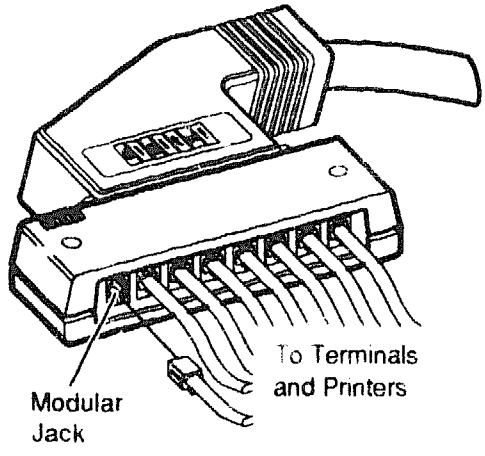
4. Insert the other end of the cable into the cable concentrator.



MLO-007122

Secure the connection by pressing the bail latches until they snap into place.

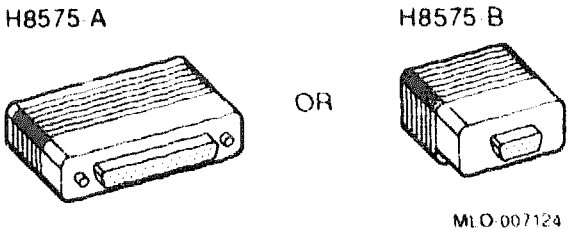
5. Insert each printer and terminal cable into one of the modular jacks on the cable concentrator.



MLO-007123

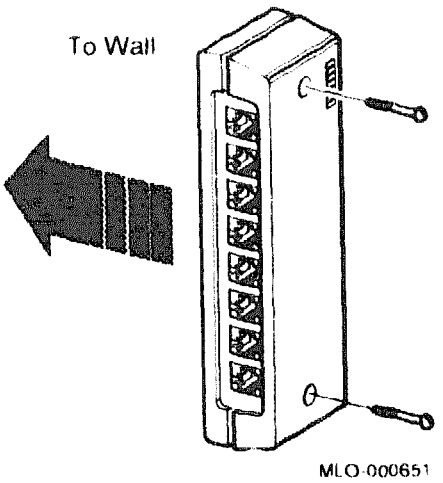
6. Make sure a terminal or printer is connected to the other end of each cable, as described in your terminal or printer documentation.

   If the printer or terminal does not have a modular jack connection, use a passive adapter.



Follow the same procedure for connecting a second BC16D cable to the module, except insert the cable into the connector labeled 0–7.

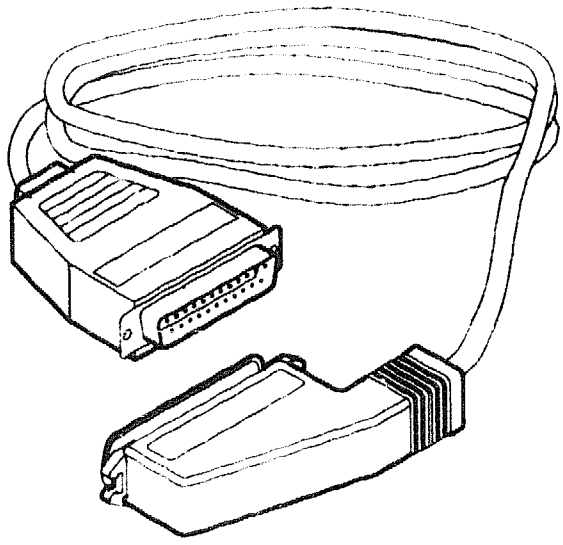
You can mount the cable concentrator on a wall.



7.2 Connecting Parallel Printers

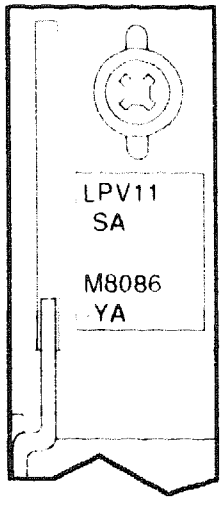
You can connect up to two parallel printers for each LPV11 module installed in your system.

1. Find a BC27L–30 cable.



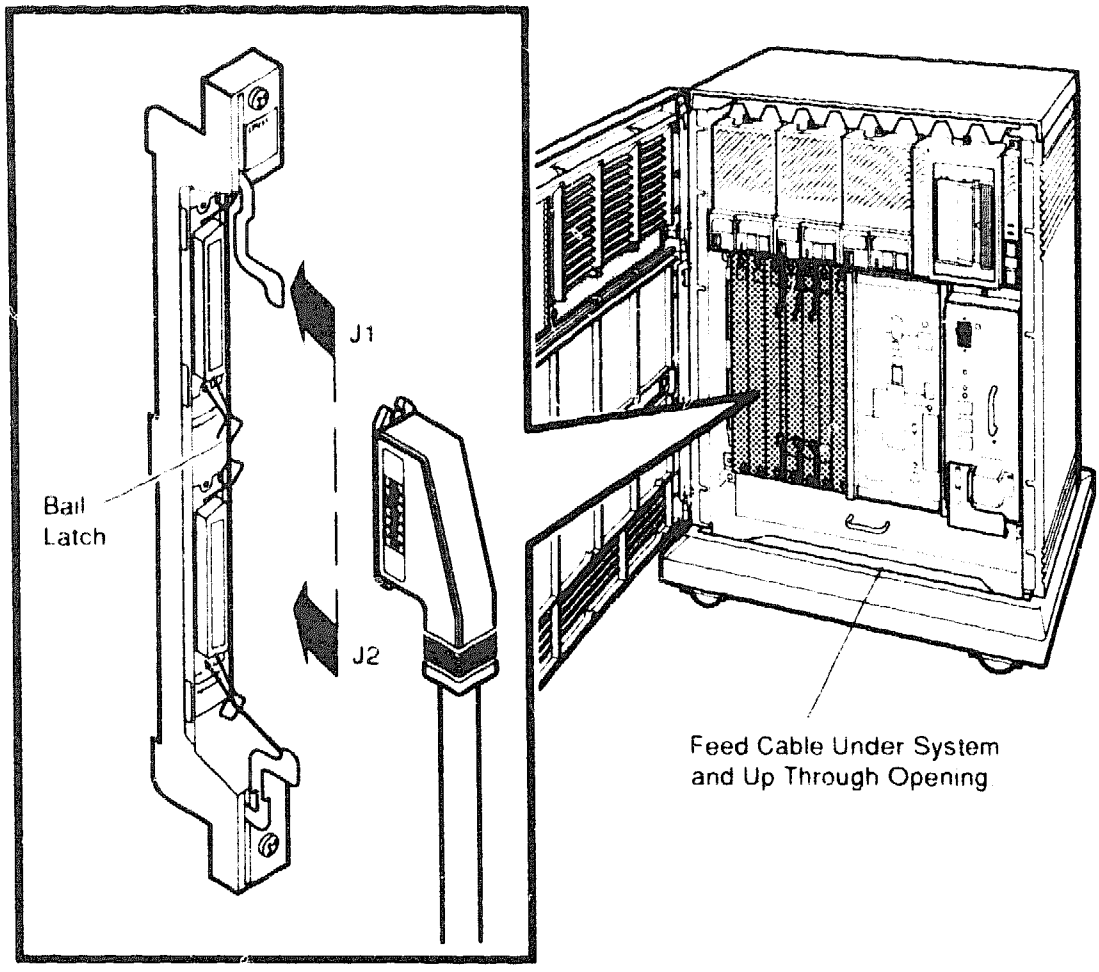
MLO-007126

2. Find the LPV11 module.



MLO 007125

3. Insert one end of the cable into the lower connector labeled J2 on the module.



Secure the connection by pressing the bail latches until they snap into place.

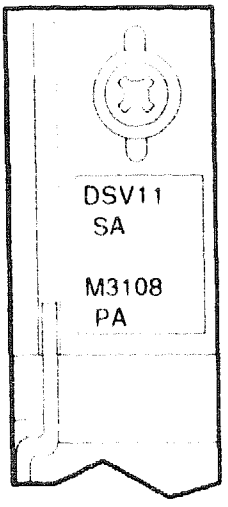
4. Insert the other end of the cable into the printer, as described in your printer documentation.

Follow the same procedure for connecting a second printer to the LPV11 module, except insert the cable into the upper connector labeled J1 on the module cover.

7.3 Connecting Synchronous Modems

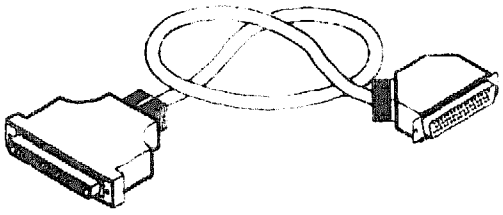
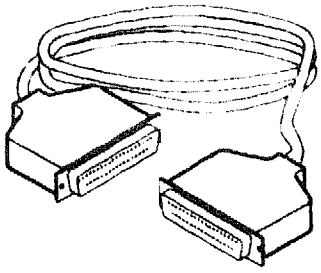
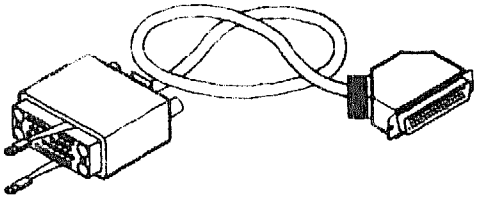
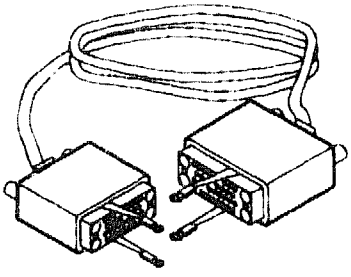
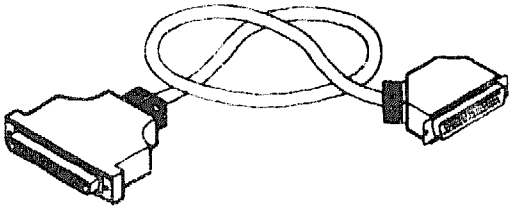
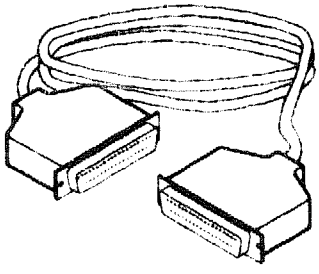
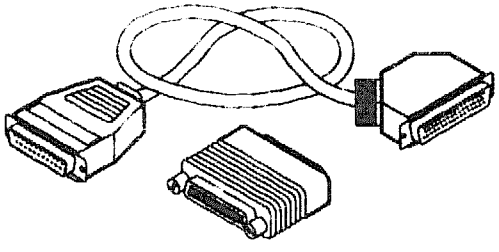
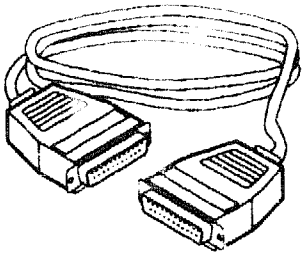
You can connect up to two synchronous modems for each DSV11 module installed in your system.

1. Find the DSV11 module.



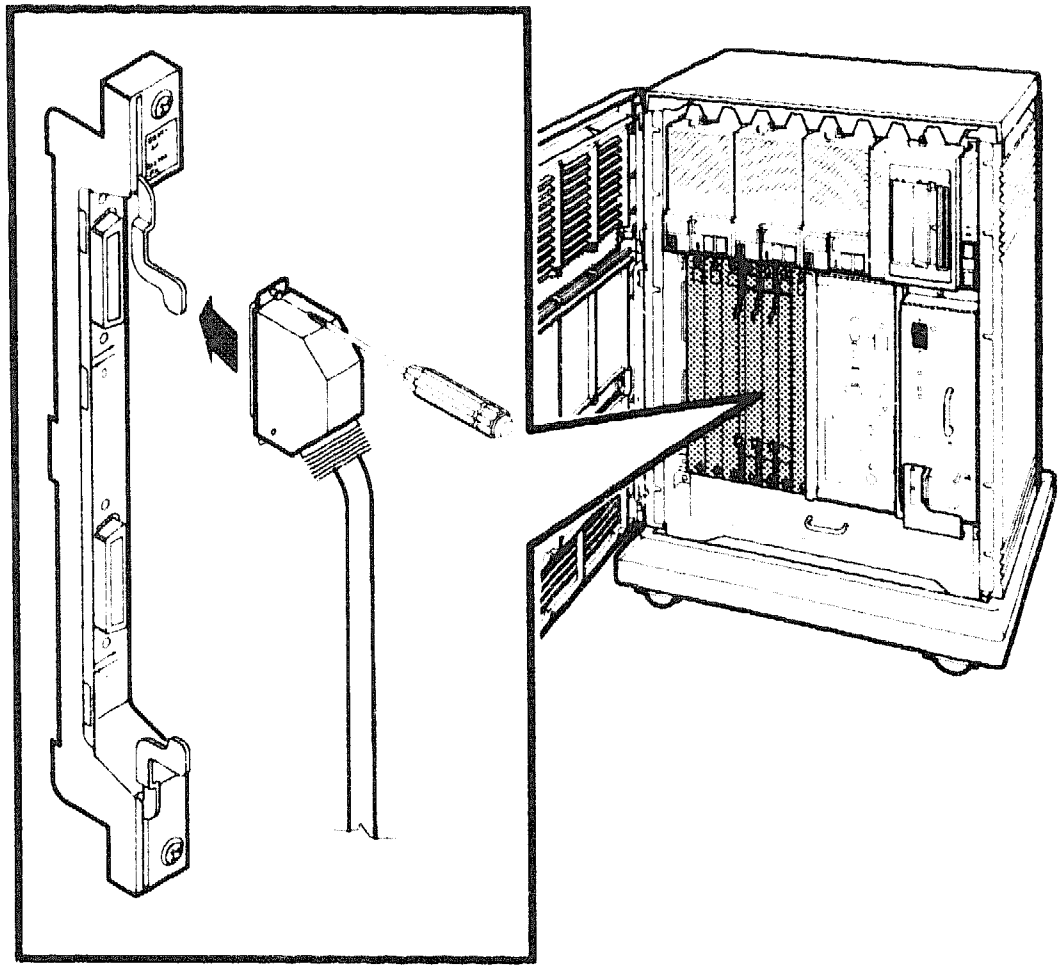
MLO-00/128

2. Find one of the following adapter-extension cable pairs.

Adapter Cables	Extension Cables
BC19E-02	BC55D-25
	
BC19F-02	BC19L-25
	
BC19B-02	BC55D-25
	
BC19D-02	BC22F
	

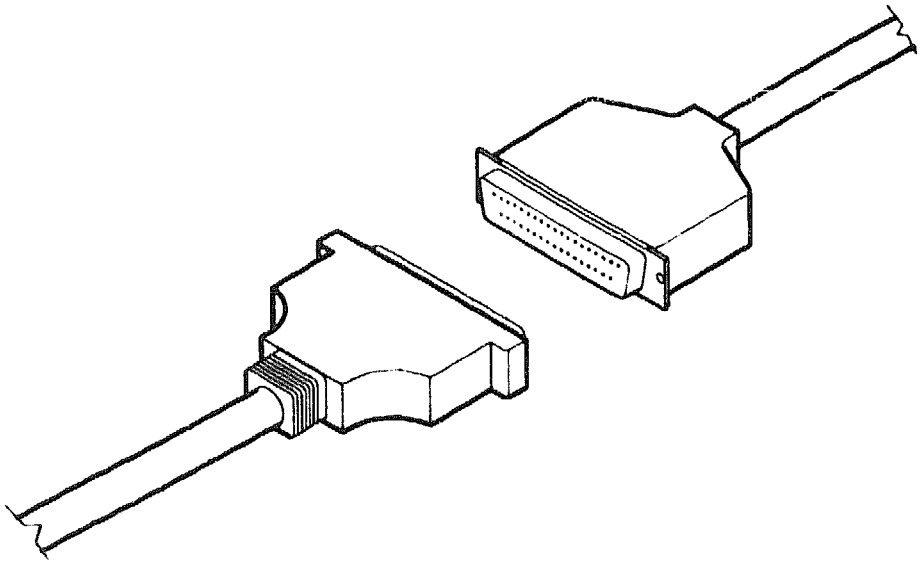
MLO-007129

3. Connect the socket end of the adapter cable to the module.



MLO-007130

4. Connect the extension cable to the other end of the adapter cable.



MLO-007132

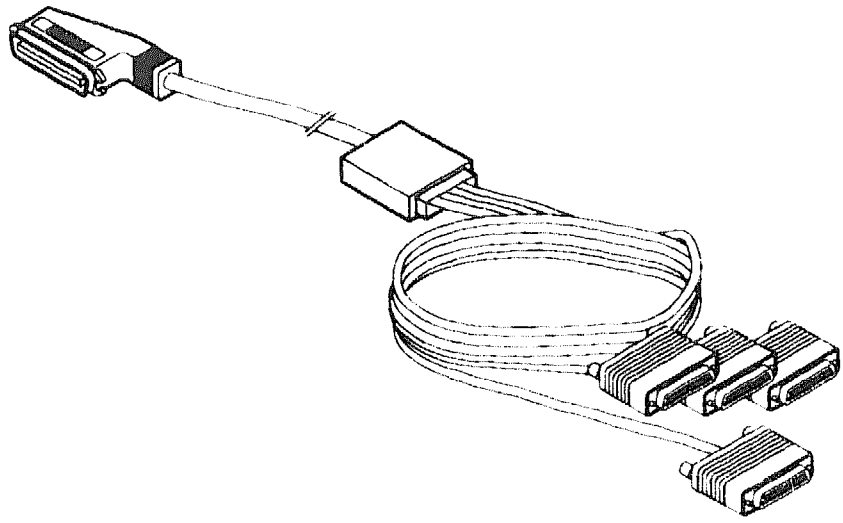
If necessary, you can use 4–40 threaded standoffs and a screwdriver to secure the connection.

5. Connect the other end of the extension cable to the modem, as described in your modem documentation.

7.4 Connecting Asynchronous Modems

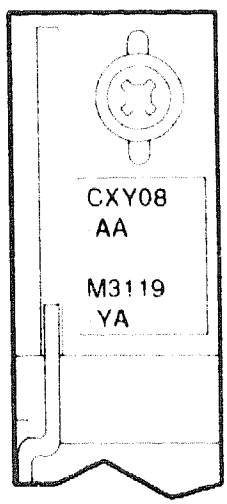
You can connect up to eight asynchronous modems to the CXY08 module.

1. Find a BC19N–12 cable.



MLO-007134

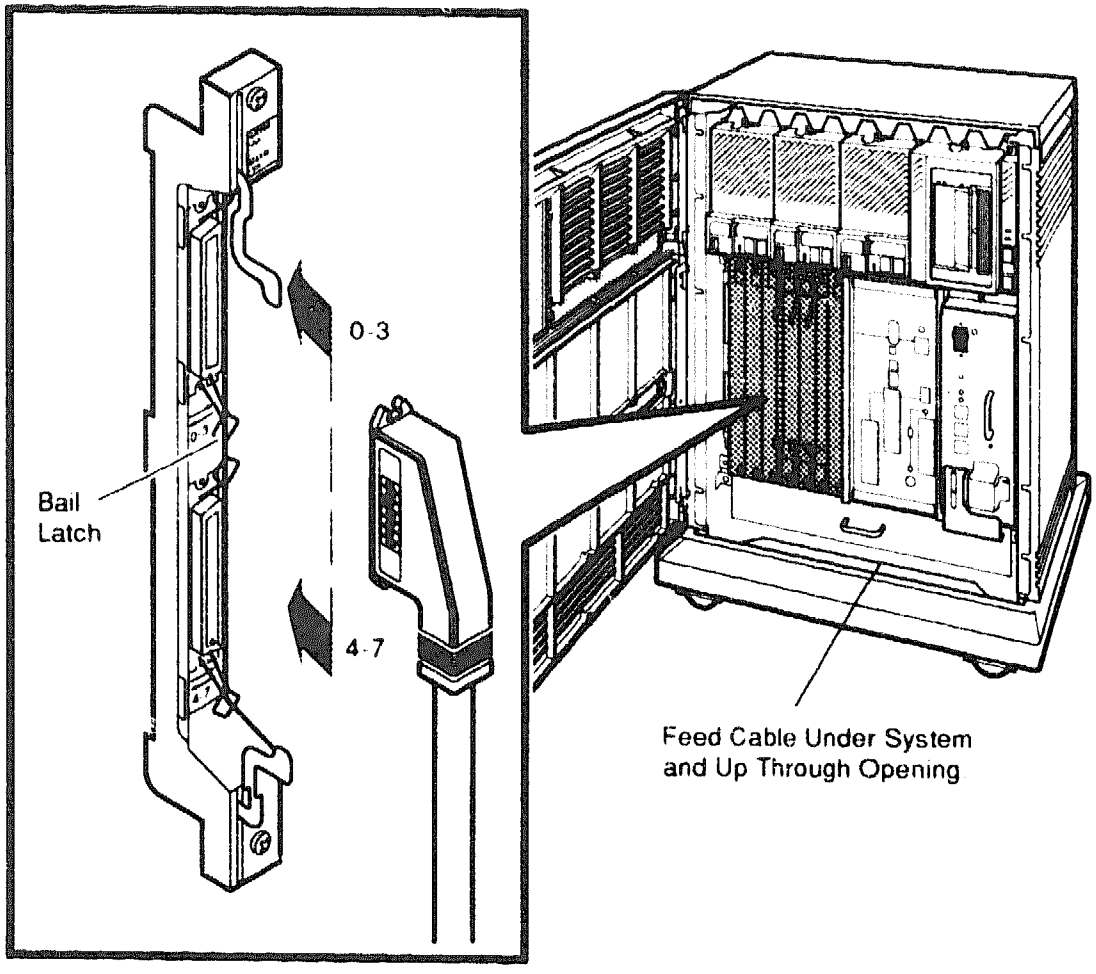
2. Find the CXY08 module.



MLO-007133

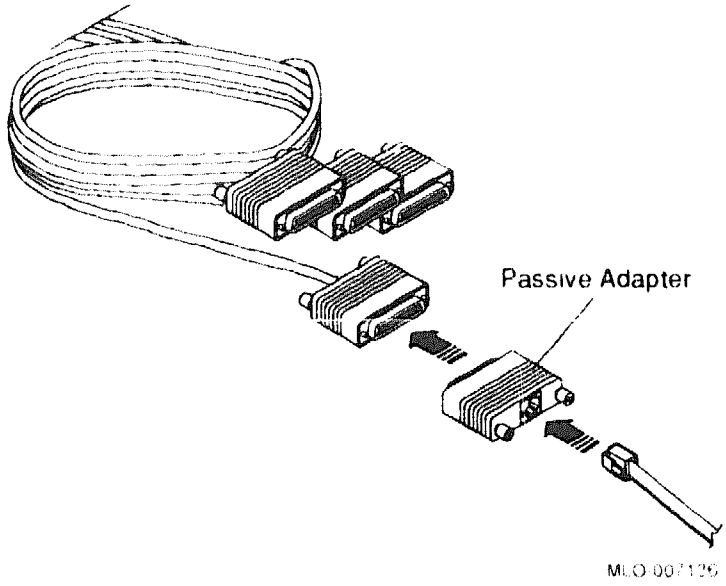
3. Insert the single-connector end of the cable into a connector on the module.

   - If you are connecting two cables, connect the first to the connector labeled 4–7 on the module cover.
   - If you are connecting one cable, connect it to the connector labeled 0–3.



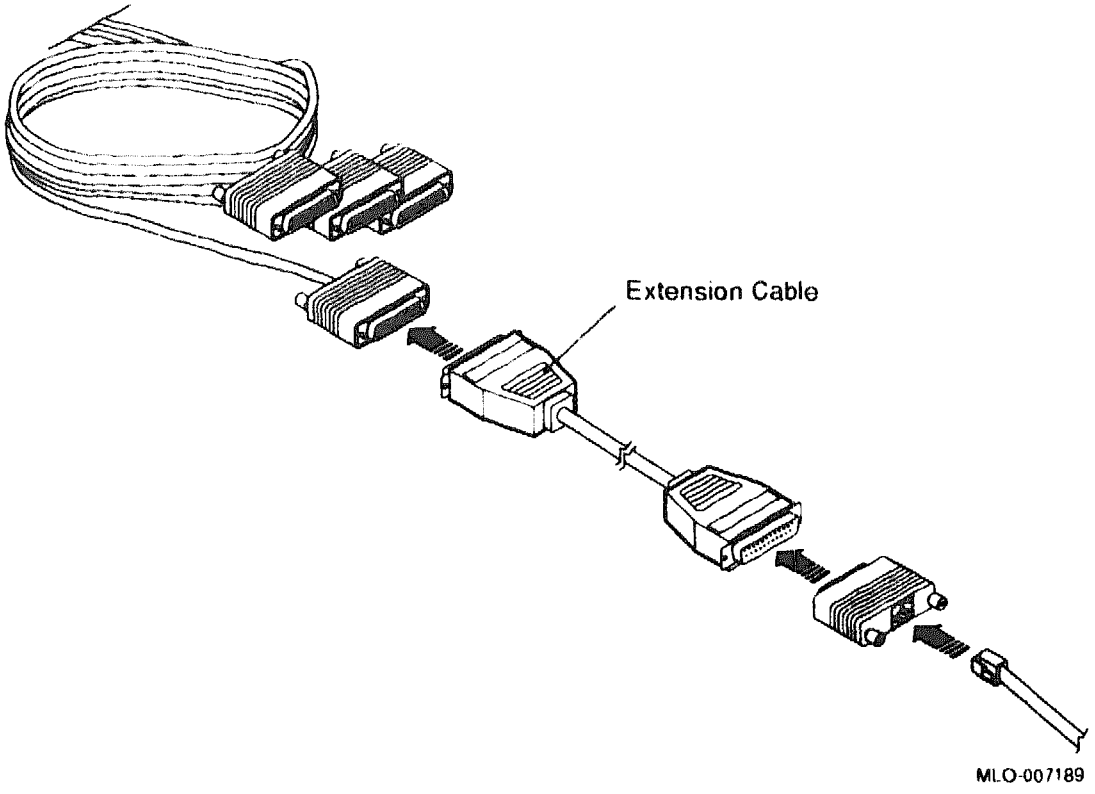
Secure the connection by pressing the bail latches until they snap into place.

4. Attach one to four modem cables to the four connectors on the opposite end of the BC19N–12 cable.



If necessary, you can use 4–40 threaded standoffs and a screwdriver to secure the adapter to the BC19N–12 cable.

If you want to place the modem farther away from the system, attach a BC22F extension cable between the BC19N–12 cable connector and the modem.



If necessary, you can use 4–40 threaded standoffs and a screwdriver to secure the BC19N–12 to BC22F connection and the BC22F to adapter connection.

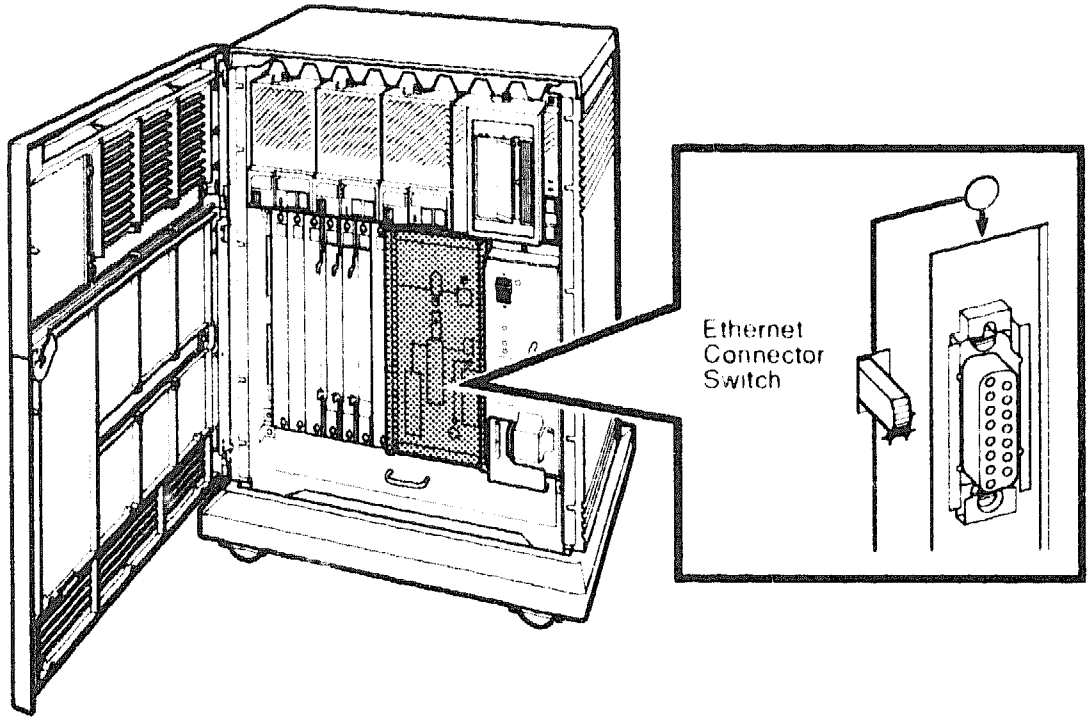
5. Refer to your modem documentation for the location of the modem connector.

To connect a second BC19N–12 cable, repeat the same procedure, except insert the cable into the connector labeled 0–3.

7.5 Connecting to an Ethernet Network at the H3604 Console Module

An Ethernet Connector switch on the console module activates a ThinWire or a standard connector. You must select one.

- To select the ThinWire connector, slide the switch down. Then go to Section 7.5.1.
- To select the standard connector, slide the switch up. Then go to Section 7.5.2.

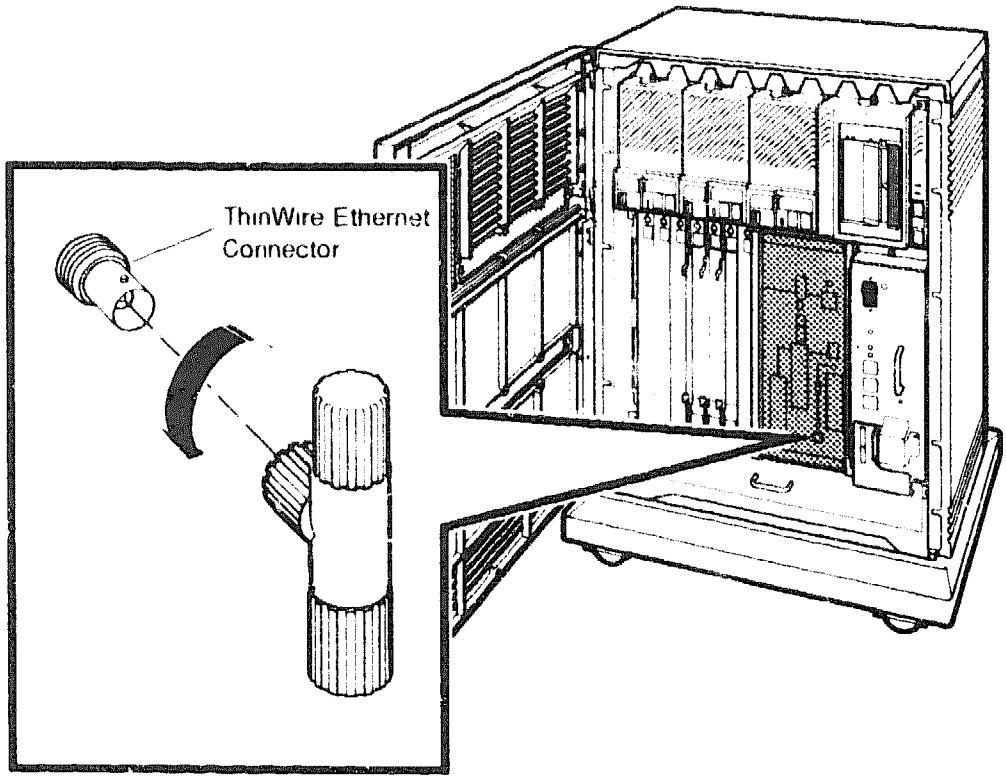


MLO-007183

7.5.1 Making a ThinWire Network Connection

Make sure the Ethernet Connector switch is down.

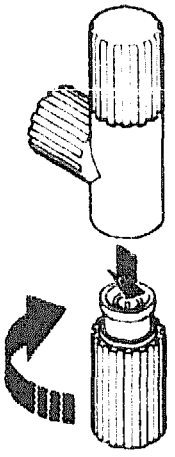
1. Remove the T-connector from the module.



MLO-007138

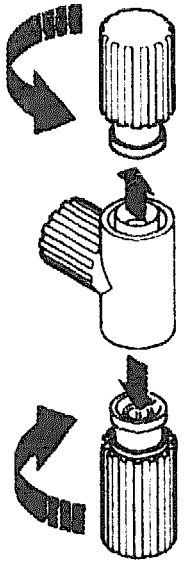
2. Remove one or both terminators from the T-connector.

   - If your system is at the end of a network segment (requires one connection to the network):



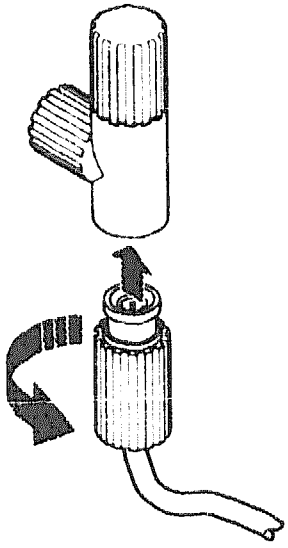
MLO-007184

   - If your system is between two other network devices (requires two connections to the network):



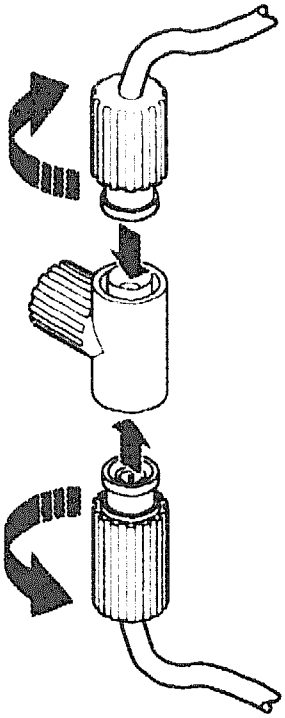
MLO-007139

3. Connect one or two ThinWire cables to the T-connector.
   - If your system requires one connection to the network:



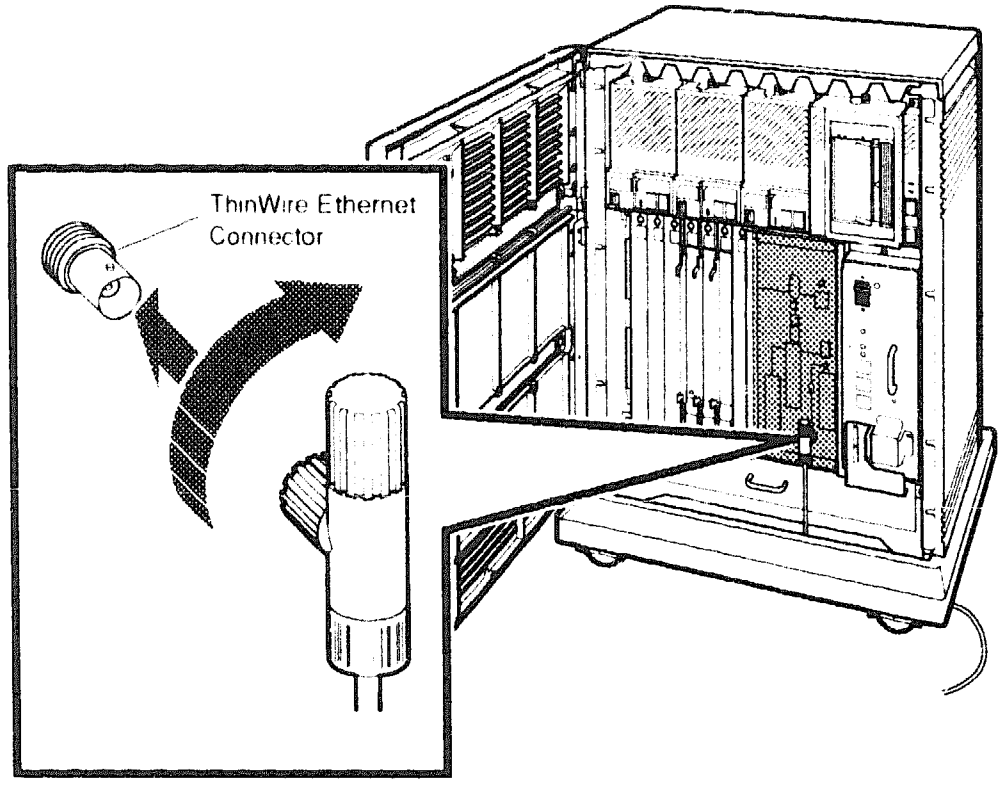
MLO-007140

   - If your system requires two connections to the network:



MLO-007141

4. Insert the T-connector into the ThinWire connector on the module.



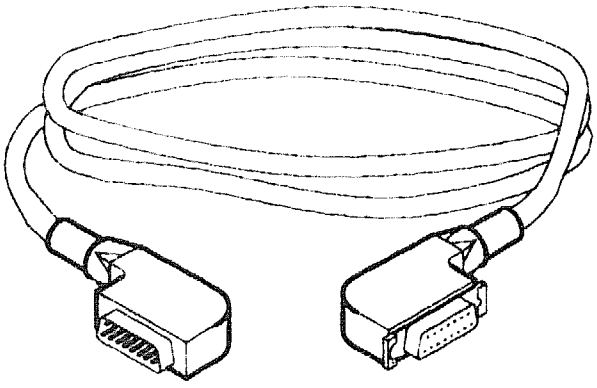
5. Connect the ThinWire cable(s) to one or two of the following ThinWire Ethernet devices, as described in your network documentation.
   - Multiport repeater
   - Singleport repeater
   - Adapter in another system or workstation

NOTE: *Contact your network manager or Digital service representative if you have questions about network configurations.*

7.5.2 Making a Standard Network Connection

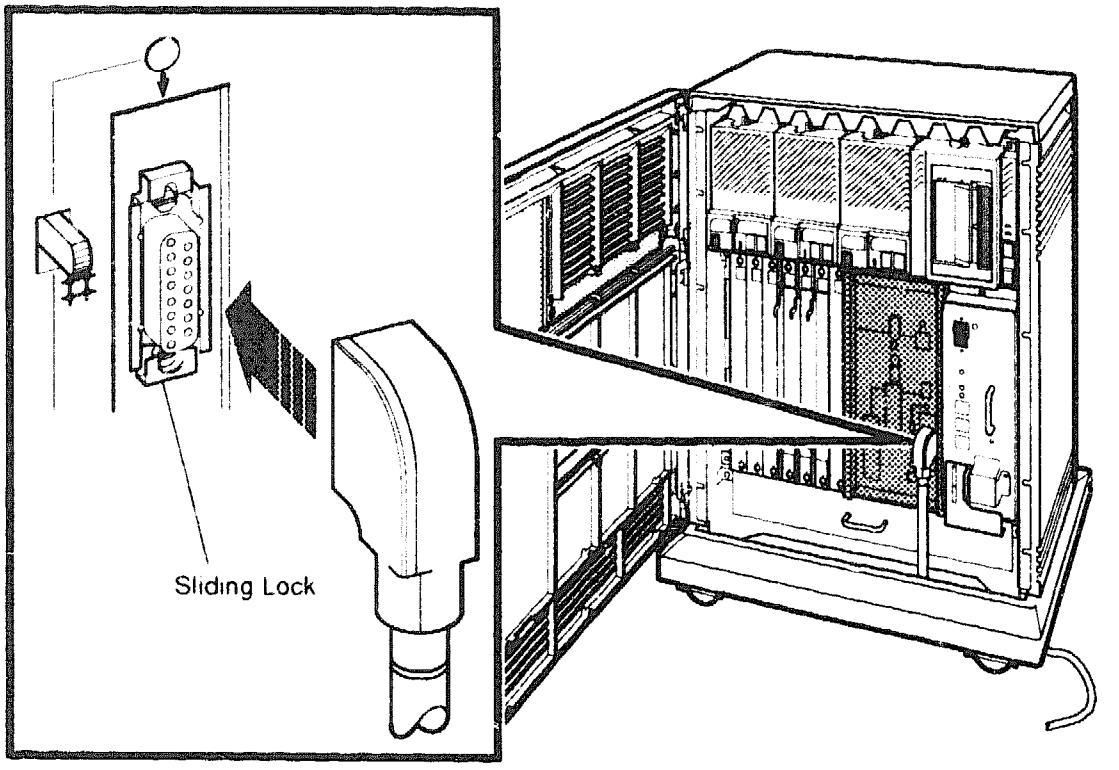
Make sure the Ethernet Connector switch is up.

1. Find the Ethernet transceiver cable.



MLO-007143

2. Make sure the sliding lock on the standard Ethernet connector is in the up position.



MLO-007144

3. Insert the plug end of the cable into the connector.

   Slide the lock down to secure the connection, and make sure the Ethernet Connector switch remains up.

4. Connect the other end of the cable to one of the following devices, as described in your network documentation.

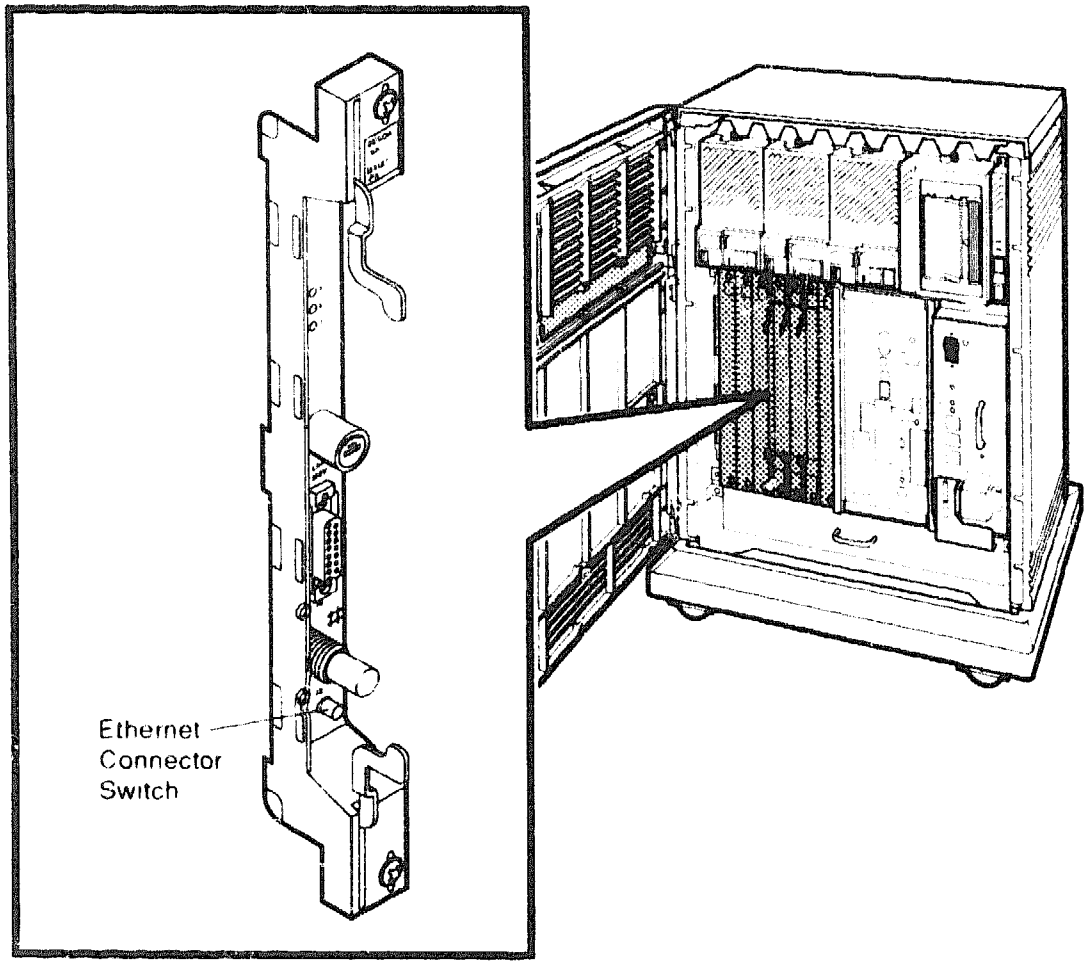
   - Transceiver
   - Interconnect
   - Adapter in another system or workstation

NOTE: *Contact your network manager or Digital service representative if you have questions about network configurations.*

7.6 Connecting to an Ethernet Network at the DESQA Module

An Ethernet Connector switch on the DESQA module activates a ThinWire or a standard connector. You must select one.

- To select the ThinWire connector, set that switch to the out position. Then go to Section 7.6.1.
- To select the standard connector, set that switch to the in position. Then go to Section 7.6.2.

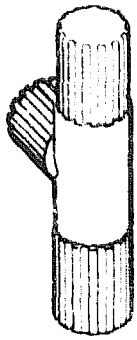


MLO-007145

7.6.1 Making a ThinWire Network Connection

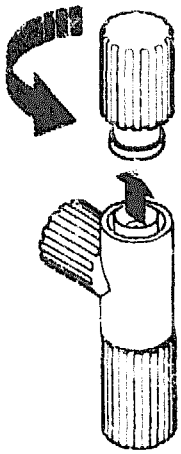
Make sure the Ethernet Connector switch is out.

1. Find the ThinWire T-connector and terminators.



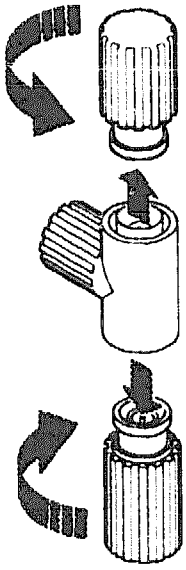
MLO-007167

2. Remove one or both terminators from the T-connector.
   - If your system is at the end of a network segment (requires one connection to the network):



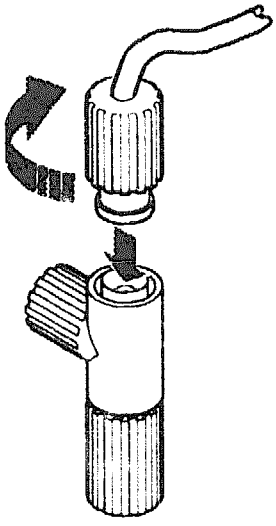
MLO-007185

- If your system is between two other network devices (requires two connections to the network):



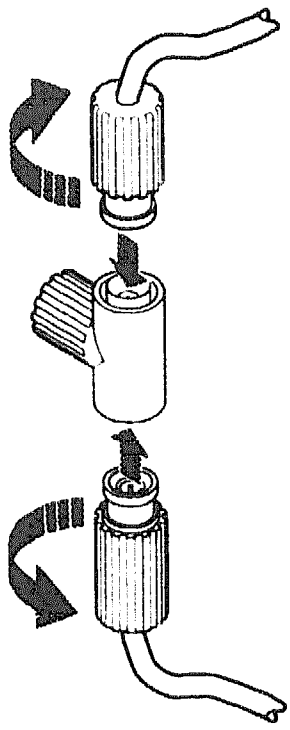
MLO-007139

3. Connect one or two ThinWire cables to the T-connector.
   - If your system requires one connection to the network:



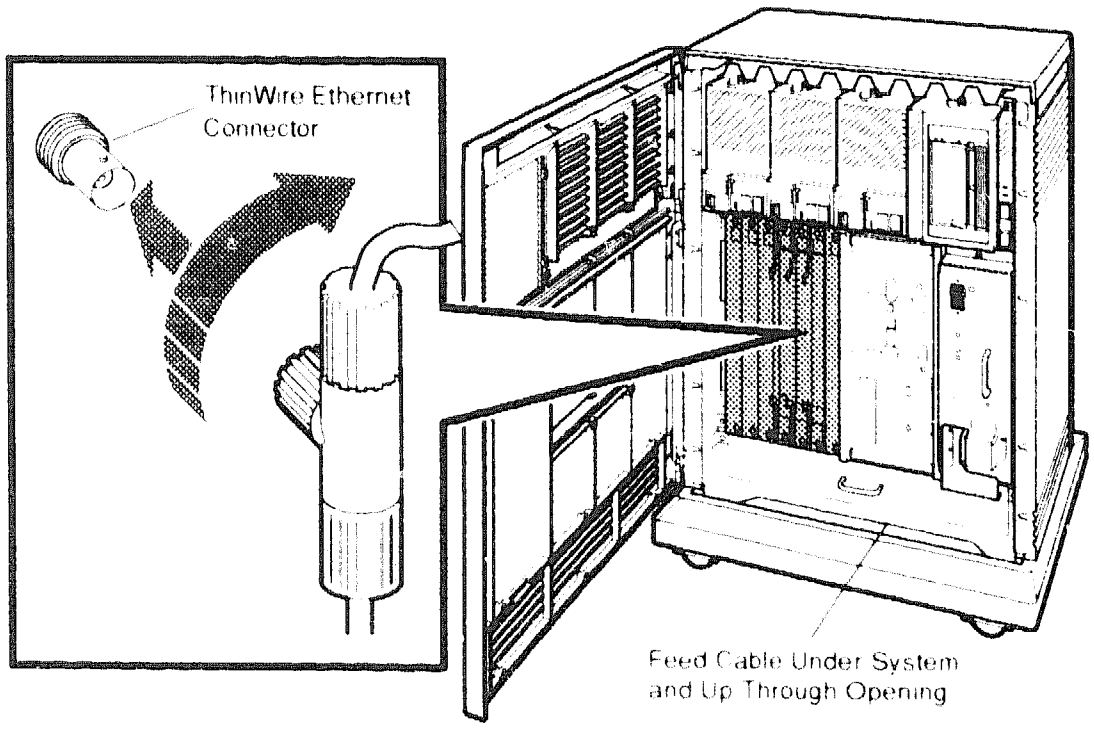
MLO-007146

- If your system requires two connections to the network:

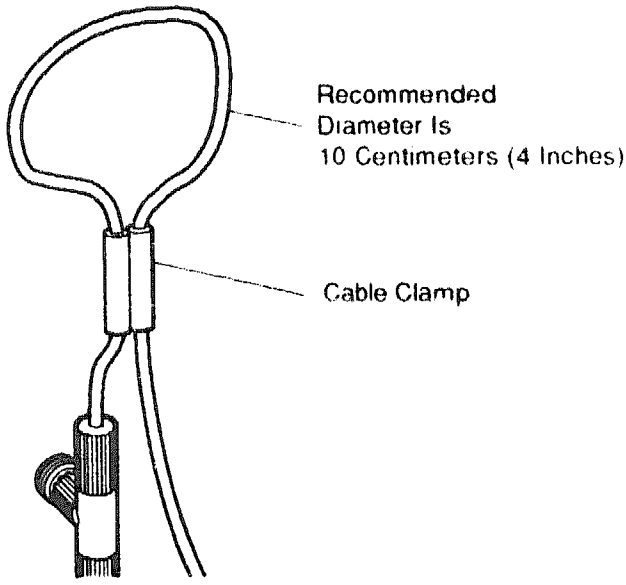


MLO-007141

4. Insert the T-connector into the ThinWire connector on the module.



5. Use the cable clamp shipped with the module to form the upper cable in a loop.



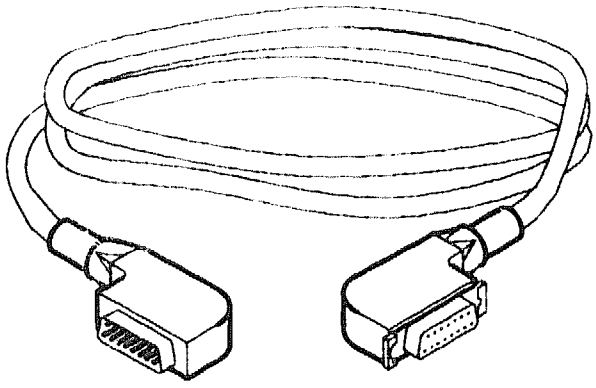
6. Connect the ThinWire cable(s) to one or two of the following ThinWire Ethernet devices, as described in your network documentation.
   - Multiport repeater
   - Singleport repeater
   - Adapter in another system or workstation

NOTE: *Contact your network manager or Digital service representative if you have questions about network configurations.*

7.6.2 Making a Standard Network Connection

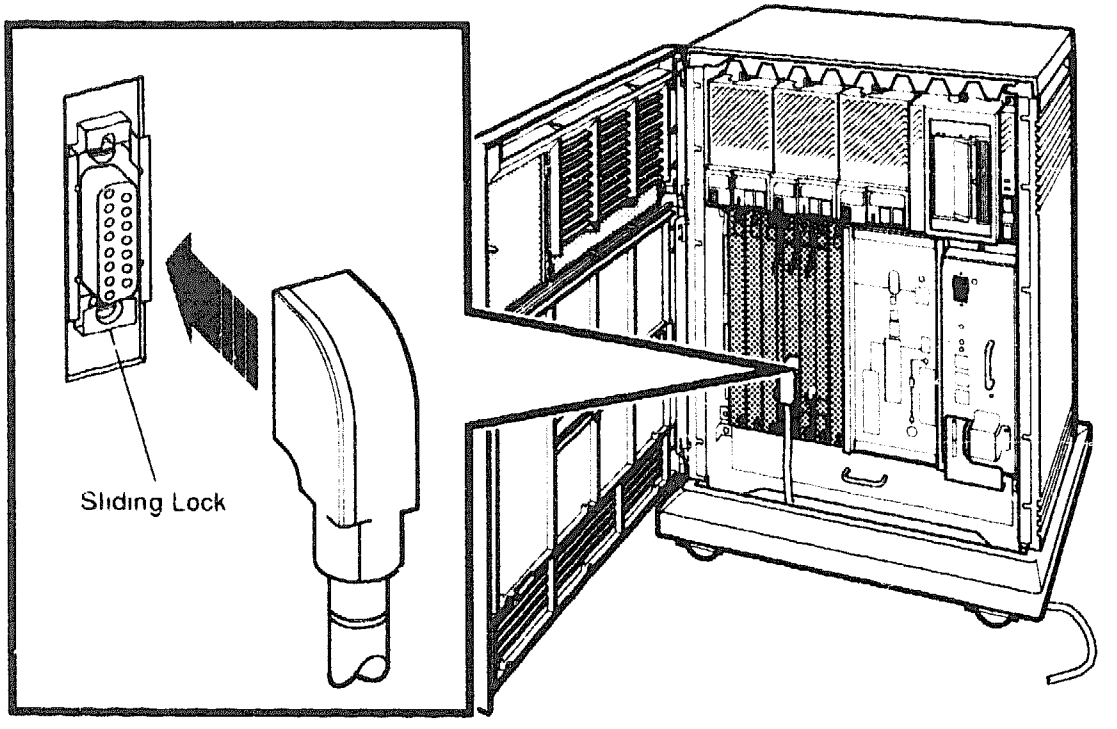
Make sure the Ethernet Connector switch is in.

1. Find the Ethernet transceiver cable.



MLO-007143

2. Make sure the sliding lock on the standard Ethernet connector is in the up position.



MLO-007149

3. Insert the plug end of the cable into the connector.

   Slide the lock down to secure the connection, and make sure the Ethernet Connector switch remains in.

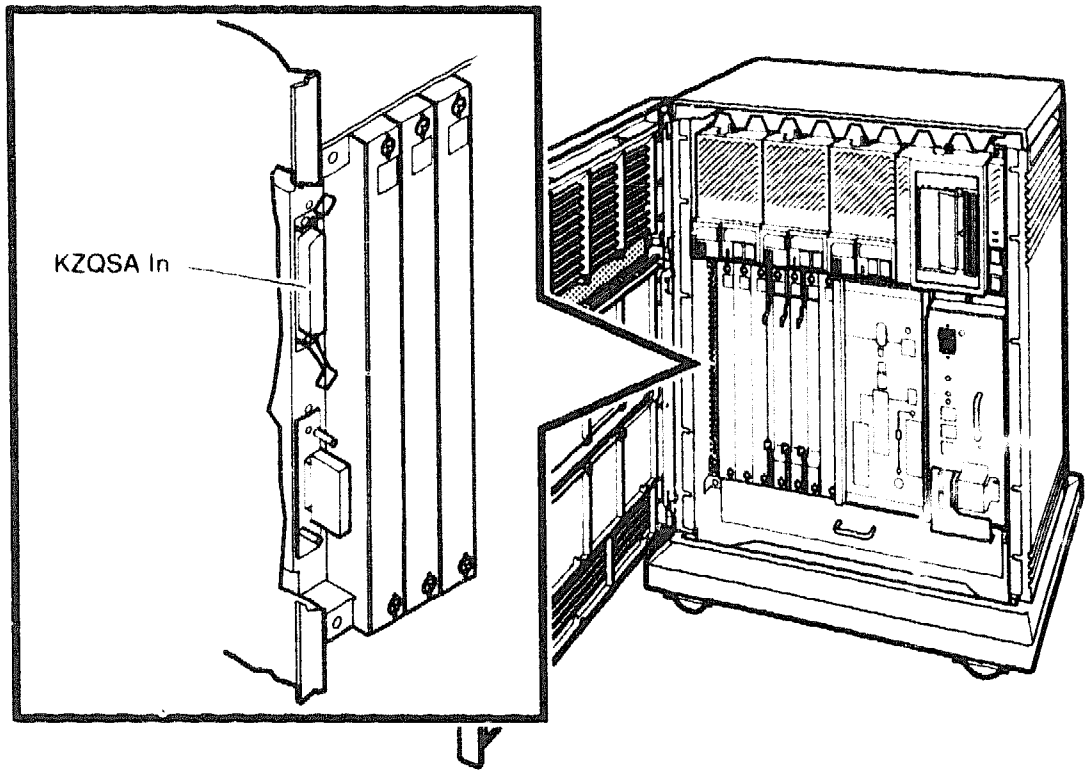
4. Connect the other end of the cable to one of the following devices, as described in your network documentation.

   - Transceiver
   - Interconnect
   - Adapter in another system or workstation

NOTE: *Contact your network manager or Digital service representative if you have questions about network configurations.*

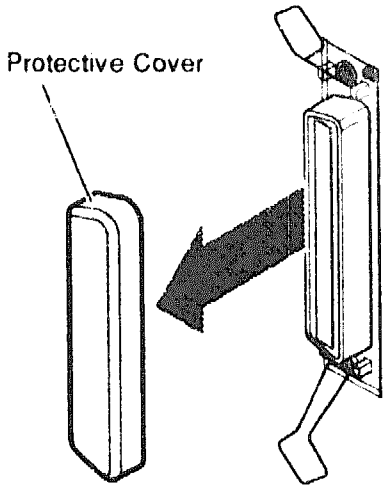
7.7 Connecting an Embedded TLZ04 Tape Drive

1. Find the KZQSA In connector.

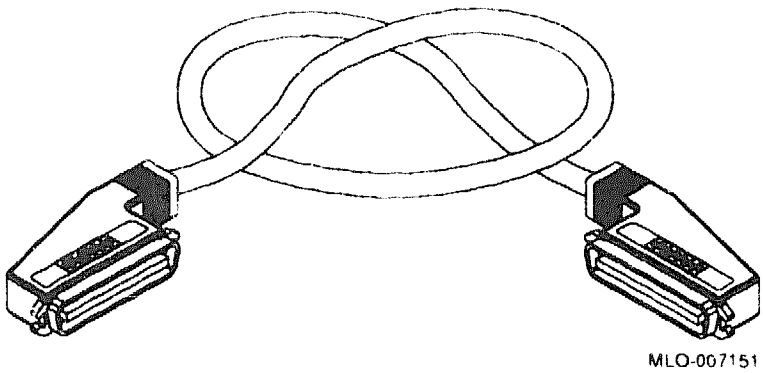


MLO-007150

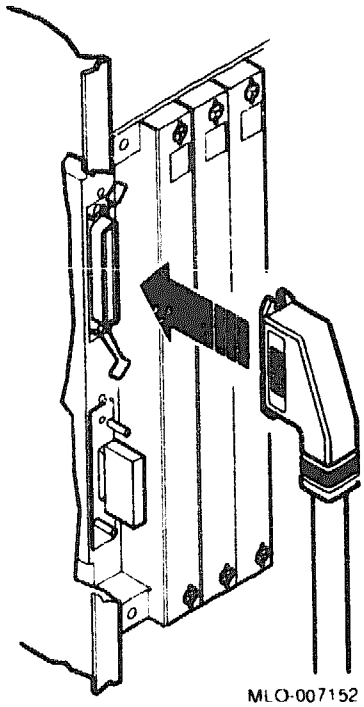
2. Remove the protective cover from that connector.



3. Find the KZQSA internal cable labeled BC06P–2F.



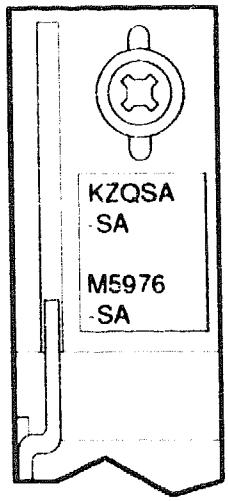
4. Insert one end of that cable into the KZQSA In connector.



MLO-007152

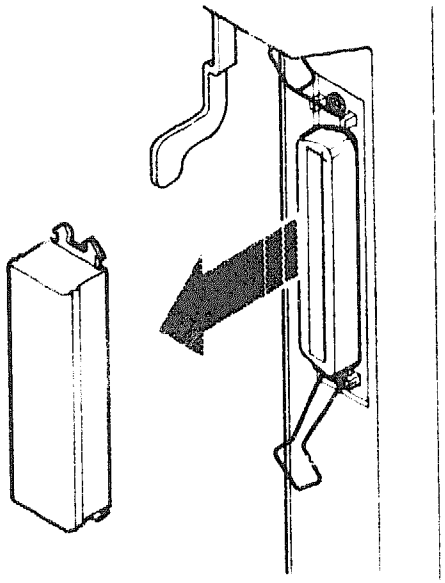
Secure the connection by pressing the bail latches until they snap into place.

5. Find the KZQSA module.



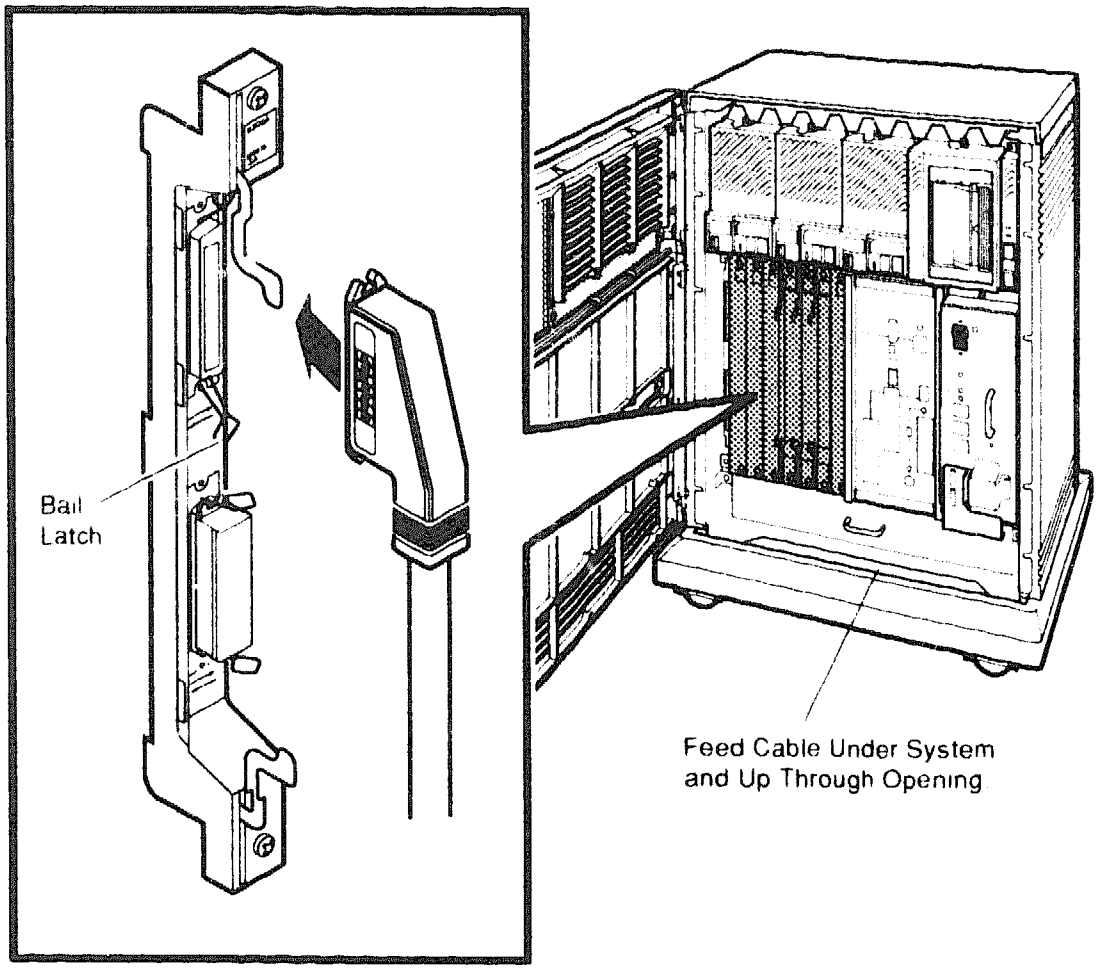
MLO-007153

6. Remove the terminator from the upper connector on that module.



MLO-007179

7. Insert the other end of the cable into the connector on the module.



Secure the connection by pressing the bail latches until they snap into place.

8 Connect an Expander, If Required

If you are not installing a factory-configured expander with your system, go to Section 9.

If you are installing a factory-configured expander with your system:

1. Begin the installation of the expander as described in the manual shipped with the expander. Make sure you connect the expander cables that will also be connected to your system.
2. Return to this manual to connect the expander cables to the applicable system connections described in the following sections.

Expander Cable(s)	Expander	Section
Q bus cables	B400X	8.1
DSSI cable	B400X or R400X	8.2
KZQSA external cable	B400X or R400X	8.3, if TLZ04 drive or KZQSA module is in expander
Power control bus cable	B400X or R400X	8.4
Ground cable	B400X or R400X	8.5

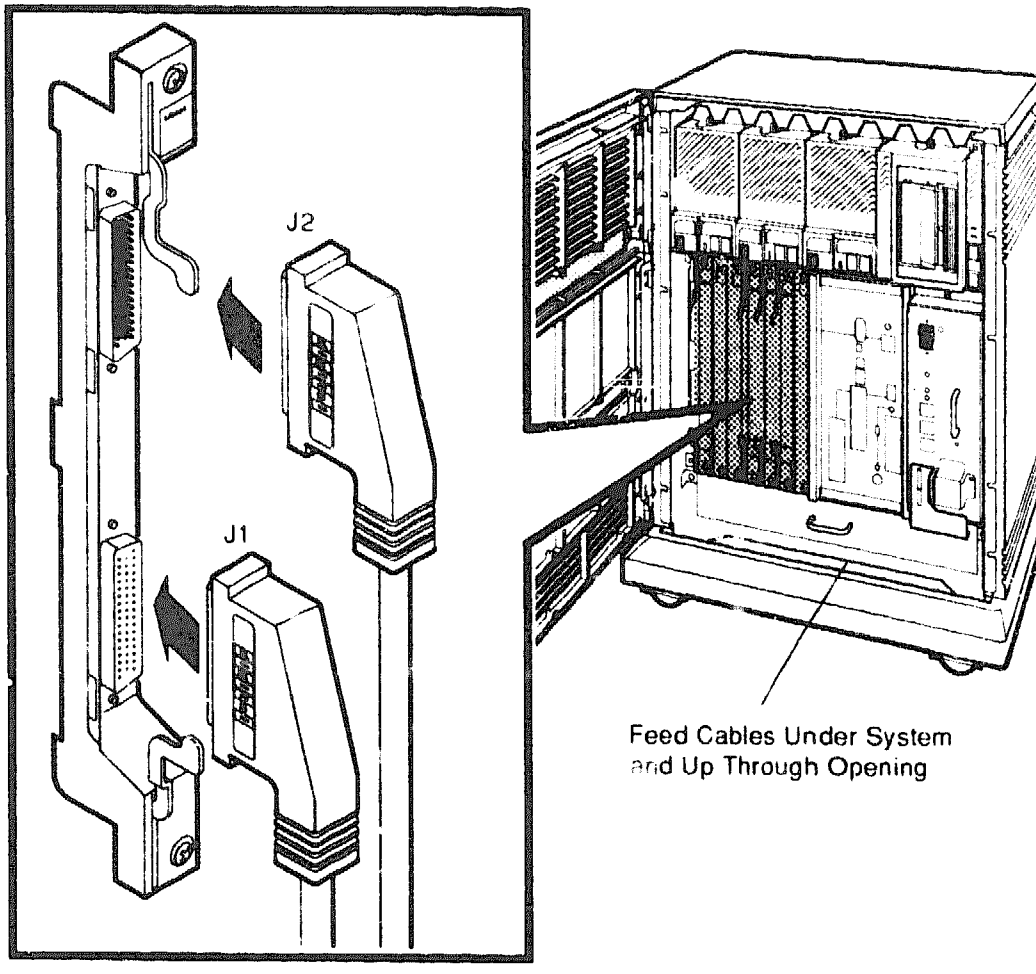
CAUTION: *If you are installing a DSSI configuration, to prevent system performance degradation or data corruption caused by excessive ground offset voltages, connect a ground cable between the expander and your system as described in Section 8.5.*

3. Complete the installation of the expander as described in the expander manual.
4. Complete the installation of your system by completing the procedures remaining in this manual (continue with Section 9).

8.1 Connecting the Q–bus Cables

1. Find the two Q–bus cables labeled BC04V–09. One end of each cable should be connected to the expander.
2. Connect the free ends of those cables to the two Q–bus Out connectors on your system.

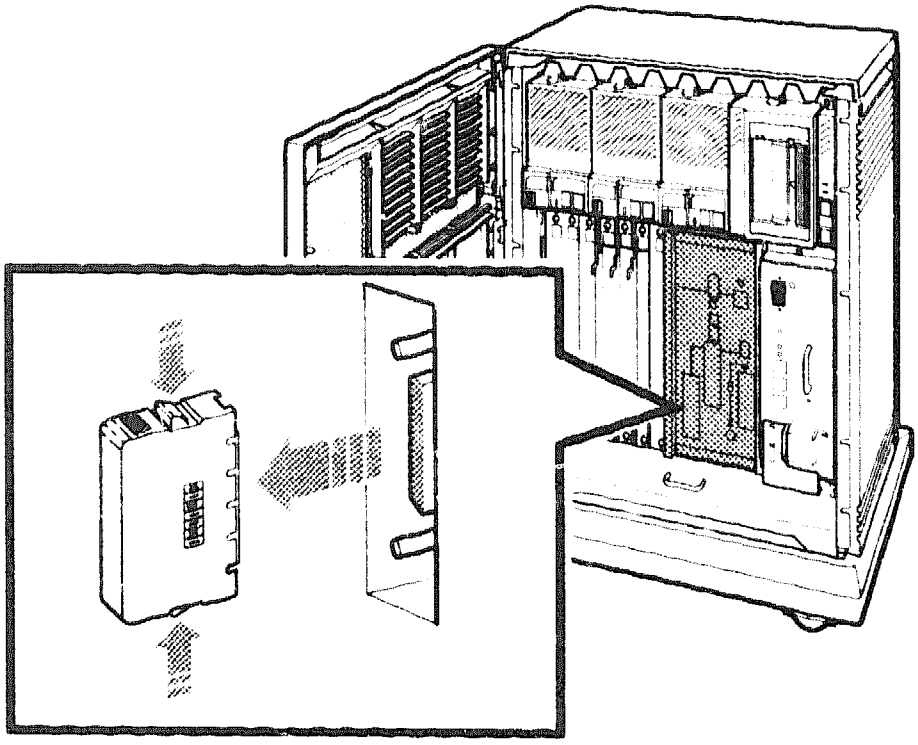
   a. Connect the plug end of one of the cables to connector J1.



   b. Connect the socket end of the other cable to connector J2.

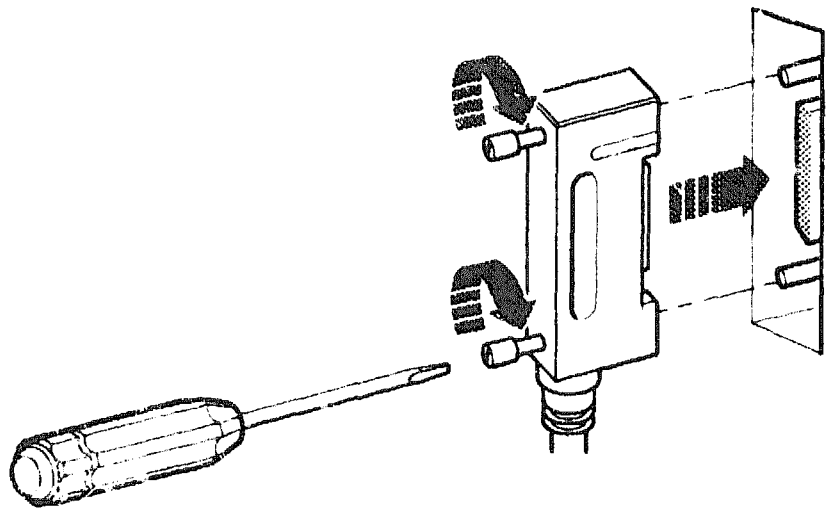
8.2 Connecting the DSSI Cable

1. Find the DSSI cable labeled BC21M–09. One end should be connected to the expander.
2. Remove the terminator from the DSSI In/Out connector labeled X.



MLO-007158

3. Connect the free end of the cable to that connector.

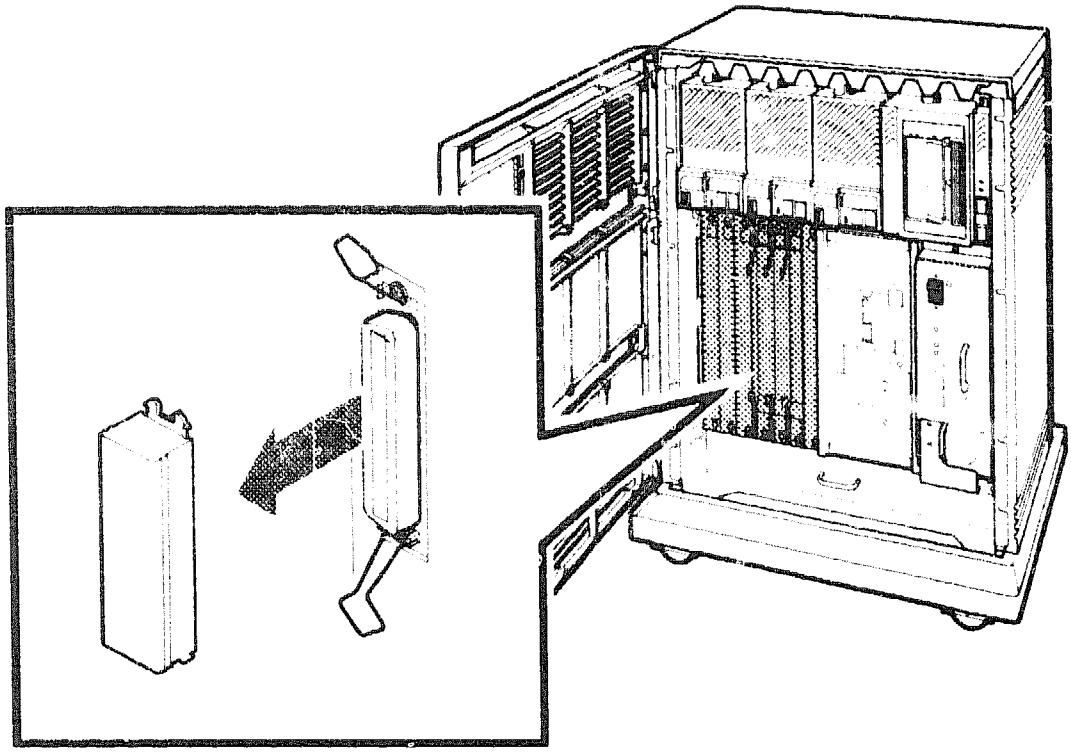


MLO-007160

4. If applicable, install the terminator (removed in step 2) on the expander as shown in the expander installation manual.

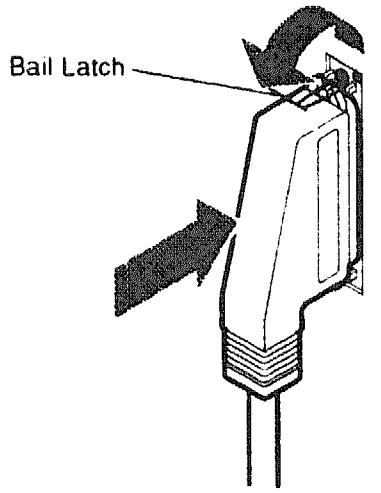
8.3 Connecting the KZQSA External Cable

1. Find the KZQSA external cable labeled BC06P–06. One end should be connected to the expander.
2. Remove the terminator from the lower connector on the KZQSA module.



MLO-007161

3. Connect the free end of the cable to that connector.

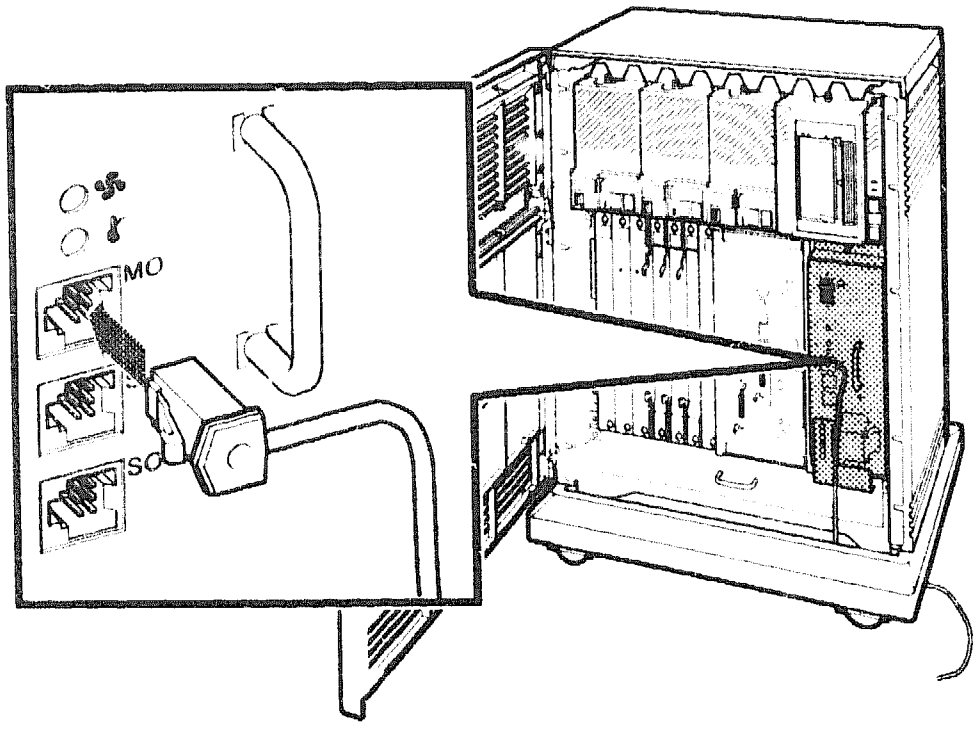


4. If applicable, install the terminator (removed in step 2) on the expander as shown in the expander installation manual.

8.4 Connecting the Power Control Bus Cable

CAUTION: *To maintain system operation, do not use the Power Control Bus cable in a DSSI VAXcluster configuration.*

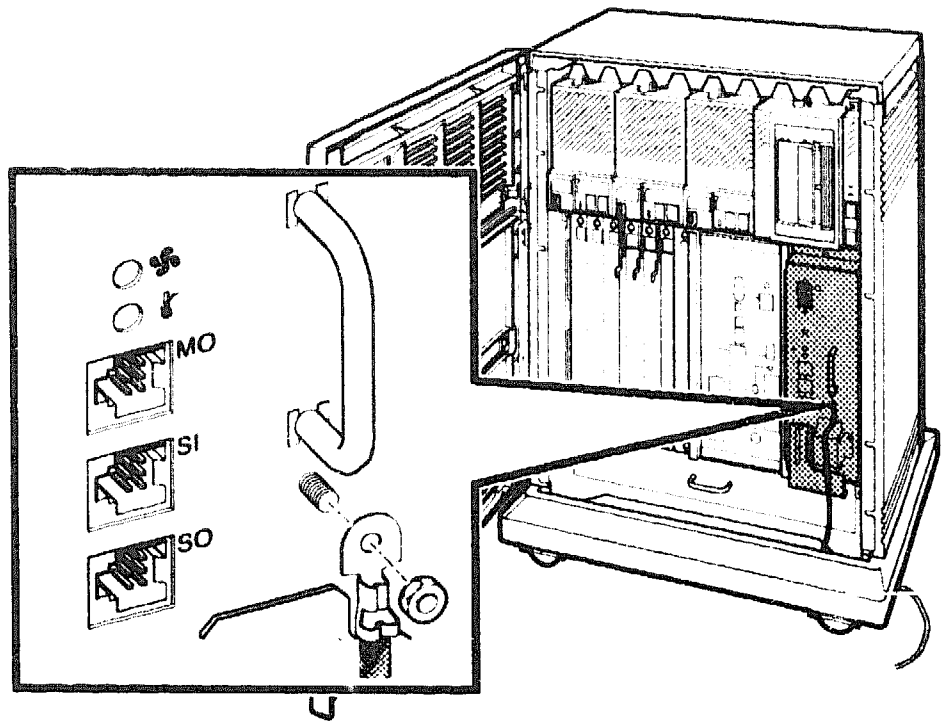
1. Find the Power Control Bus cable labeled 17–02638–01. One end should be connected to the SI connector on the expander.
2. Connect the free end of that cable to the MO connector.



MLO-007163

8.5 Connecting the Ground Cable

1. Find the Ground cable labeled 12–13756–A8. One end should be connected to the expander.
2. Connect the free end of that cable to the Ground Wire Out bolt.



MLO-007164

9 Connect the System Power Cable

CAUTION: *Do not connect your computer system to an IT power system (a power system without a directly grounded neutral conductor). To prevent damage, your system should be plugged into a dedicated (isolated) ground circuit.*

1. Make sure the system Power switch is set to off (0).

2. Make sure all devices connected to your system are turned off.

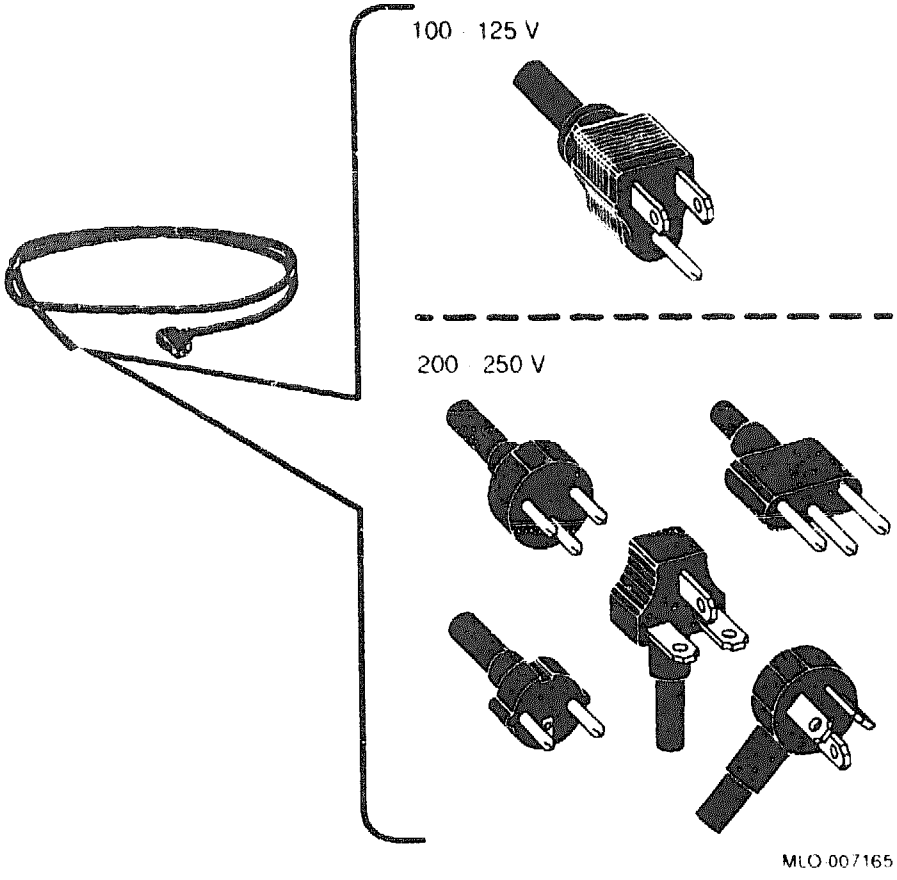
   Printer?

   External modem?

   Console terminal?

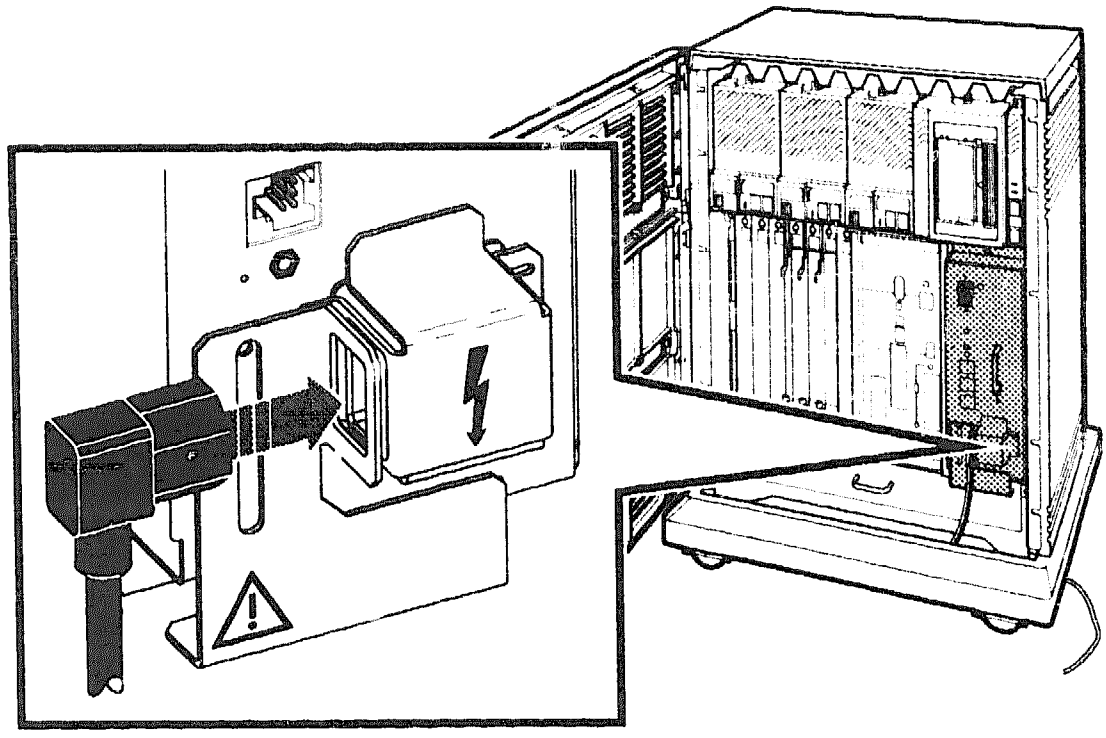
   Expander?

3. Find the power cable shipped with your system.



4. Make sure the plug end of that cable matches your wall outlet or other power source.

5. Insert the socket end of the cable into the power supply connector.



M'.O-007166

6. Insert the plug end of the cable into your wall outlet or other power source.

10 Turn On the System and Select a Language

CAUTION: *Do not operate your system without Digital module covers. They protect the equipment, maintain proper airflow for cooling, and provide EMI-RFI containment that meets international regulatory standards.*

1. Turn on your console terminal.

   Wait until the terminal performs its self-tests successfully.

2. If an expander is connected to your system, turn it on.

   Make sure the AC indicator on the expander power supply glows orange. If a Power Control Bus cable is installed, the expander will not power up until the system is turned on.

3. Turn on your system.

Make sure the AC Present indicator, next to the Power switch, glows orange.

Within a few moments the following language selection menu, or something like it, appears on your console terminal.

NOTE: *If you are using an older terminal that does not support multiple languages, this menu does not appear and the system defaults to English (United States/Canada).*

```
KA6nn-A Vn.n VMB n.n

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

4. Select a language by typing its number and Return.

NOTE: *If you do not select a language within 30 seconds, the system defaults to English (United States/Canada).*

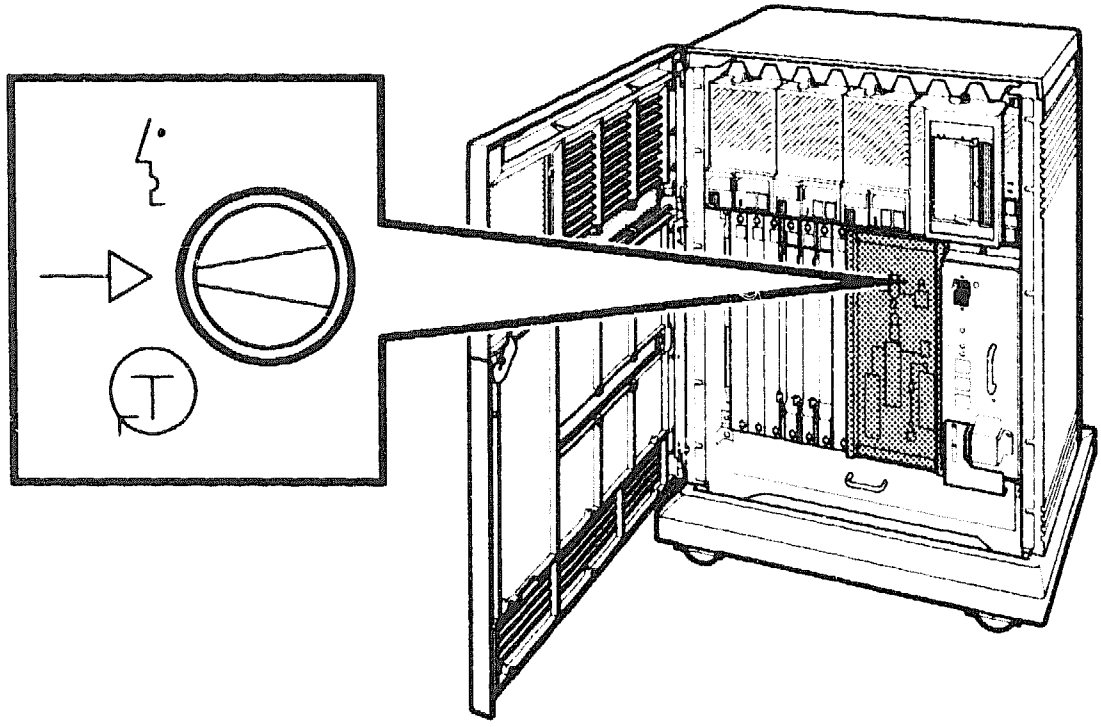
Within a few moments the console terminal displays a series of numbers as the system tests itself. This example shows that display after successful testing.

```
KA6nn-A Vn.n, VMB n.n

Performing normal system tests.
66..65..64..63..62..61..60..59..58..57..56..55..54..53..52..51..
50..49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..
34..33..32..31..30..29..28..27..26..25..24..23..22..21..20..19..
18..17..16..15..14..13..12..11..10..09..08..07..06..05..04..03..
Tests completed.
>>>
```

If the self-tests do not complete successfully, refer to your system *Troubleshooting and Diagnostics* manual to find the source of the problem.

5. If the self-tests complete successfully, save the language you selected by turning the Power-Up Mode switch to Run mode.

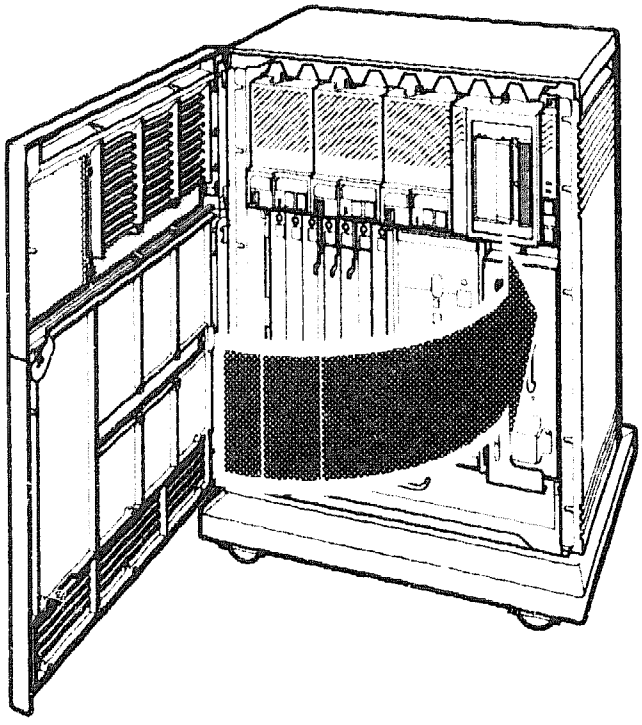


MLO-004264

11 Close the System Doors

NOTE: *If you plan to run diagnostic software immediately following the installation, leave the upper door open. If you plan to start up factory-installed software immediately following the installation, leave both doors open.*

1. Push gently at the top right of the upper door and the bottom right of the lower door.



MLO 004030

2. Turn the key to the middle position (both doors locked) or to the top position (upper door unlocked).

The installation is complete. You can now place the system directly against a wall, if that is where you want it to be.

12 After Installation

1. Read your system *Operation* manual to learn how to use the system. Then make sure the system is turned on and operating normally.

2. If you installed a configuration consisting of two or more enclosures connected by a common DSSI bus, use a voltmeter to make sure the ground offset voltage between any two enclosures does not exceed one of the limits listed below.

	Allowable Ground Offset Voltage	
Total Bus Length	**DC**	**AC (rms)**
Up to 20 meters (65 feet)	200 millivolts	70 millivolts
20 to 25 meters (65 to 82 feet)	40 millivolts	14 millivolts

Total bus length includes all DSSI cable lengths, internal and external. Your *DSSI VAXcluster Installation and Troubleshooting* manual tells you how to calculate internal cable lengths.

To measure the ground offset voltage, connect the voltmeter leads to bare (unpainted) metal on each enclosure. If the voltage exceeds one of the limits, call your Digital service representative.

NOTE: *The ground offset voltage may vary over time, if equipment is added to your system or plugged into your power outlets. Therefore, this measurement does not guarantee that the voltage will remain within acceptable limits.*

3. Run the diagnostic software for your system as described in your system *Troubleshooting and Diagnostics* manual.

4. If you have factory-installed software on your system, see the *VMS Factory Installed Software User Guide* for the startup procedure. Otherwise, install the software that you ordered with your system.

NOTE: *Systems with VMS factory-installed software have a yellow sticker on the front panel of the ISE containing that software.*

Index

17–02638–01 cable, 58
12–13756–A8 cable, 59

A

Additional devices, connecting, 16
After installation, 65
Asynchronous modems, connecting, 29
Attaching
See Connecting *or* Installing

B

BC04V–09 cable, 53
BC06P–06 cable, 56
BC06P–2F cable, 48
BC16D cable, 19
BC19–B cable, 26
BC19–D cable, 26
BC19–E cable, 26
BC19–F cable, 26
BC19L cable, 26
BC19N–12 cable, 29
BC21M–09 cable, 54
BC22F cable, 26
BC27L–30 cable, 23
BC55D cable, 26
Boxes, checking, 2

C

Cable concentrator, 19
Cables
17–02638–01, 58
12–13756–A8, 59
BC04V–09, 53
BC06P–06, 56
BC06P–2F, 48
Cables (cont'd)
BC16D, 19
BC19–B, 26
BC19–D, 26
BC19–E, 26
BC19–F, 26
BC19L, 26
BC19N–12, 29
BC21M–09, 54
BC22F, 26
BC27L–30, 23
BC55D, 26
console terminal, 8
DSSI, 52
DSSI, connecting, 54
Ethernet transceiver, 38, 46
expander, 52
ground, 52
ground, connecting, 59
KZQSA external, 52
KZQSA external, connecting, 56
KZQSA internal, connecting, 48
power control bus, 52
power control bus, connecting, 58
power, system, 60
Q–bus, 52
Q–bus, connecting, 53
system power, 60
system power, connecting, 59
ThinWire Ethernet, 36, 42
transceiver, Ethernet, 38, 46
Cartons, checking, 2
Checking shipment, 2
Closing system doors, 64
Concentrator, cable, 19

Connecting
additional devices, 16
asynchronous modems, 29
console terminal, 8
devices, additional, 16
DSSI cable, 54
Ethernet network, console module, 33
Ethernet network, DESQA module, 40
expander, 52
ground cable, 59
KZQSA external cable, 56
KZQSA internal cable, 48
modems, asynchronous, 29
modems, synchronous, 25
parallel printers, 23
power cable, system, 59
power control bus cable, 58
printers, parallel, 23
printers, serial, 19
Q-bus cables, 53
serial printers, 19
standard Ethernet cable, console module, 38
standard Ethernet cable, DESQA module, 46
synchronous modems, 25
system power cable, 59
terminals and serial printers, 19
ThinWire Ethernet cable, console module, 34
ThinWire Ethernet cable, DESQA module, 41
TLZ04 tape drive, 47
Console
See Console module *or* Console terminal
Console module
connecting Ethernet network, 33
connecting standard Ethernet cable, 38
connecting ThinWire Ethernet cable, 34
setting controls, 13
Console terminal
cable, 8
connecting, 8
installing, 8
setup operations, 8
Control panel
See System, control panel
Controls, setting system, 10
CXA16-AA option, 19
CXB16-AA option, 19
CXY08-AA option, 29

D

DESQA module, connecting
Ethernet network, 40
standard Ethernet cable, 46
ThinWire Ethernet cable, 41
DESQA-SA option, 40
Devices, connecting additional, 16
Doors
closing, 64
opening, 6
DSSI cable, 52
connecting, 54
DSV11-SA option, 25

E

Ethernet cable
See Standard Ethernet cable *or* ThinWire Ethernet cable
Ethernet network, connecting
console module, 33
DESQA module, 40
Ethernet transceiver cable, 38, 46
Expander
cables, 52
connecting, 52

G

Ground cable, 52
connecting, 59

H

H3604 console module
See Console module

I

Installing console terminal, 8
Integrated Storage Elements, setting controls, 11
ISEs
See Integrated Storage Elements

K

KZQSA external cable, 52
connecting, 56
KZQSA internal cable, connecting, 48
KZQSA–SA option, 49

L

Language, selecting, 61
LPV11–SA option, 23

M

M3018 module, 25
M3118–YA module, 19
M3118–YB module, 19
M3119–YA module, 29
M3127–PA module, 40
M5976–SA module, 49
M8086–YA module, 23
Modems
asynchronous, connecting, 29
synchronous, connecting, 25
Module
identification labels, 18
numbers, 18
Modules
See also Options
M3018, 25
M3118–YA, 19
M3118–YB, 19
M3119–YA, 29
Modules (cont'd)
M3127–PA, 40
M5976–SA, 49
M8086–YA, 23
Moving system, 5

N

Network
See Ethernet network

O

Opening system doors, 6
Option numbers, 18
Options
CXA16–AA, 19
CXB16–AA, 19
CXY08–AA, 29
DESQA–SA, 40
DSV11–SA, 25
KZQSA–SA, 49
LPV11–SA, 23

P

Parallel printers, connecting, 23
Positioning system, 5
Postinstallation procedures, 65
Power cable
See System, power cable
Power control bus cable, 52
connecting, 58
Power supply
See System power supply
Preoperational procedures, 65
Preparation, verifying site, 1
Printers
parallel, connecting, 23
serial, connecting, 19

Q

Q–bus cables, 52
connecting, 53

R

RF-series Integrated Storage Elements, setting controls, 11

S

SCP
  See System, control panel
Selecting language, 61
Serial printers, connecting, 19
Setting system controls, 10
  console module, 13
  Integrated Storage Elements, 11
  power supply, 10
  system control panel, 12
  tape drives, 14
Setup operations, console terminal, 8
Shipment, checking, 2
Site preparation, verifying, 1
Standard Ethernet cable, connecting
  console module, 38
  DESQA module, 46
Synchronous modems, connecting, 25
System
  control panel, setting controls, 12
  controls, setting, 10
  doors, closing, 64
  doors, opening, 6
  expander connections, 52
  positioning, 5
  power cable, 60
  power cable, connecting, 59
  power supply, setting controls, 10
  turning on, 61

T

Tape drives
  setting controls, 14
  TF85, setting controls, 14
  TK-series, setting controls, 15
  TLZ04, connecting, 47
Tape drives (cont'd)
  TLZ04, setting controls, 16
Terminal
  See also Console terminal
Terminals and serial printers, connecting, 19
TF85 tape drive, setting controls, 14
ThinWire Ethernet cable, 36, 42
ThinWire Ethernet cable, connecting
  console module, 34
  DESQA module, 41
TK-series tape drive, setting controls, 15
TLZ04 tape drive
  connecting, 47
  setting controls, 16
Transceiver cable, Ethernet, 38, 46
Turning on system and selecting language, 61

V

Verifying site preparation, 1

VAX 4000 Model 400/500/600 Operation

Order Number EK–450AD–OP.004

Digital Equipment Corporation
Maynard, Massachusetts

First Printing, November 1991
Revised, February 1992
Revised, April 1992
Revised, July 1992

The information in this document is subject to change without notice and should not be construed as a commitment by Digital Equipment Corporation.

Digital Equipment Corporation assumes no responsibility for any errors that may appear in this document.

The software, if any, described in this document is furnished under a license and may be used or copied only in accordance with the terms of such license. No responsibility is assumed for the use or reliability of software or equipment that is not supplied by Digital Equipment Corporation or its affiliated companies.

Restricted Rights: Use, duplication or disclosure by the U.S. Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013.

The Reader's Comments form at the end of this document requests your critical evaluation to assist in preparing future documentation.

The following are trademarks of Digital Equipment Corporation: CompacTape, CX, DDCMP, DEC, DECconnect, DECdirect, DECnet, DECscan, DECserver, DECUS, DECwindows, DELNI, DEMPR, DESQA, DESTA, DSRVB, DSSI, IVAX, KDA, KLESI, KRQ50, MicroVAX, MSCP, Q-bus, Q22-bus, RA, RQDX, RV20, SA, SDI, ThinWire, TK, TMSCP, TQK, TS05, TU, VAX, VAX 4000, VAXcluster, VAX DOCUMENT, VAXELN, VAXlab, VAXserver, VMS, VT, and the DIGITAL logo.

FCC NOTICE: The equipment described in this manual generates, uses, and may emit radio frequency. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such radio frequency interference.

Operation of the equipment in a residential area may cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

S1977

This document was prepared using VAX DOCUMENT, Version 2.1

Contents

Preface vii

Chapter 1 System Overview

1.1 Front View and Physical Description 1–1
1.1.1 BA440 Enclosure 1–5
1.1.1.1 Mass Storage Shelf 1–6
1.1.1.2 System Control Panel (SCP) 1–6
1.1.1.3 Card Cage 1–8
1.1.1.4 Console Module 1–10
1.1.1.5 DSSI Bus 0 Connector and KZQSA-In Connector 1–13
1.1.1.6 Power Supply Controls and Indicators 1–14
1.1.1.7 Fans 1–17
1.2 Functional Description 1–17
1.2.1 Base System Components 1–18
1.2.1.1 Central Processing Unit (CPU) 1–18
1.2.1.2 Console Serial Line Unit (SLU) 1–18
1.2.1.3 Main Memory 1–18
1.2.1.4 Network Controller 1–18
1.2.1.5 Embedded DSSI Adapters 1–19
1.2.2 Optional Components 1–19
1.2.2.1 Mass Storage Devices and Controllers 1–19
1.2.2.2 Mass Storage Subsystems 1–20
1.2.2.3 Mass Storage Expanders 1–21
1.2.2.4 Communication Controllers 1–21
1.2.2.5 Real-Time Controllers 1–23
1.2.2.6 Printer Interfaces 1–23
1.2.2.7 Other Available Options 1–23
1.3 DSSI VAXcluster Configuration (VMS Systems Only) 1–24

Chapter 2 Operating the System

2.1 Before You Operate the System 2–1
2.2 Switch Settings 2–1
2.2.1 Normal Operation 2–1
2.2.2 Special Operation 2–2
2.3 Turning On the System 2–4
2.4 Booting the System 2–5
2.4.1 Autobooting the System 2–6
2.4.2 Booting the System from Console Mode 2–10
2.5 Using the System 2–11
2.6 Halting the System 2–11
2.7 Restarting the System 2–12
2.8 Turning Off the System 2–12
2.9 Recovering from an Over Temperature Condition 2–13

Chapter 3 Operating the System Options

3.1 Mass Storage Options 3–1
3.1.1 RF-Series Integrated Storage Elements 3–2
3.1.1.1 RF-Series Controls and Indicators 3–2
3.1.1.2 Write-Protecting an RF-Series ISE 3–4
3.1.1.3 Changing the Bus Node ID Plugs 3–8
3.1.2 TF-Series Tape Drive 3–10
3.1.2.1 Operation of the Drive 3–12
3.1.2.2 Labeling a Tape Cartridge 3–12
3.1.2.3 Write-Protecting a Tape Cartridge 3–13
3.1.2.4 Tape Cartridge Handling and Storage Guidelines 3–16
3.1.2.5 Inserting a Tape Cartridge in TF-Series Drive 3–16
3.1.2.6 Removing a Tape Cartridge 3–18
3.1.2.7 Summary of TF-Series Tape Drive Controls and Indicators 3–20
3.1.2.8 Cleaning the TF-Series Tape 3–21
3.1.3 TK70 Tape Drive 3–22
3.1.3.1 Operation of the Drive 3–23
3.1.3.2 Labeling a Tape Cartridge 3–24
3.1.3.3 Write-Protecting a Tape Cartridge 3–25

3.1.3.4 Tape Cartridge Handling and Storage Guidelines 3–27
3.1.3.5 Inserting a Tape Cartridge 3–27
3.1.3.6 Removing a Tape Cartridge 3–29
3.1.3.7 Summary of TK70 Tape Drive Controls and Indicator Lights 3–31
3.1.4 TLZ04 Tape Drive 3–32
3.1.4.1 Proper Handling of Cassette Tapes 3–34
3.1.4.2 Setting the Write-Protect Tab on the Cassette Tape 3–35
3.1.4.3 Inserting a Cassette Tape into the Drive 3–36
3.1.4.4 System Software 3–37
3.1.4.5 Cleaning the Heads 3–37
3.1.5 Other Available Storage Subsystems 3–39
3.2 Communication Controller Options 3–39
3.2.1 Asynchronous Serial Controllers 3–39
3.2.1.1 Asynchronous Controllers Without Modem Support 3–40
3.2.1.2 Asynchronous Controllers With Modem Support 3–40
3.2.2 Synchronous Controllers 3–41
3.2.3 Network Controllers 3–41
3.3 Real-Time Options 3–42
3.4 Printer Options 3–43
3.5 Adding Options 3–43

Appendix A Related Documentation

Appendix B Programming Parameters for DSSI Devices

B.1 DSSI Device Parameters B–1
B.2 How VMS Uses the DSSI Device Parameters B–3
B.3 Examining and Setting DSSI Device Parameters B–4
B.3.1 Entering the DUP Driver Utility B–7
B.3.2 Setting Allocation Class B–8
B.3.3 Setting Unit Number B–8
B.3.4 Setting Node Name B–11
B.3.5 Setting System ID B–11
B.3.6 Exiting the DUP Server Utility B–12

Appendix C Backup Procedures

C.1 Overview of Standalone BACKUP C–1
C.1.1 Installing Standalone BACKUP on the System Disk C–2
C.1.2 Booting Standalone BACKUP from the System Disk C–2
C.1.3 Installing Standalone BACKUP on a Tape Cartridge C–3
C.1.4 Booting Standalone BACKUP from a Tape Cartridge C–5
C.2 Backing Up the System Disk C–6
C.3 Restoring the System Disk C–9

Glossary

Index

Tables

2–1 Normal Power-Up Indications 2–4
2–2 Device Names 2–9
3–1 RF-Series ISE Controls and Indicators 3–4
3–2 TF-Series Tape Drive Controls 3–20
3–3 TF-Series Tape Drive Indicators 3–21
3–4 TK70 Tape Drive Controls 3–31
3–5 TK70 Tape Drive Indicator Lights 3–31
3–6 TLZ04 Drive Indicators (Normal Conditions) 3–33
3–7 TLZ04 Drive Indicators (Abnormal Conditions) 3–34
C–1 Standalone BACKUP Qualifiers C–7

Preface

This manual tells you how to use your system. It is structured as follows.

- Chapter 1 provides an overview of the system.
- Chapter 2 tells you how to use the system.
- Chapter 3 tells you how to use options installed in the system.
- Appendix A lists related documentation.
- Appendix B tells you how to set and examine DSSI device parameters from console mode.
- Appendix C describes procedures for creating backup files.
- A glossary explains key terms and abbreviations.

The following conventions are used in this manual.

Convention	Meaning
Key	A terminal key used in text and examples. For example, Break indicates that you press the Break key on your terminal keyboard.
Ctrl/C	Hold down the Ctrl key while you press the C key.
BOLD	Your input. For example, `>>>BOOT MIA5` shows that you must enter BOOT MIA5 at the console prompt.
NOTE	Provides general information about the current topic.
CAUTION	Provides information to prevent damage to equipment or software.

Chapter 1
System Overview

Your system components are housed in a BA440 enclosure. It is a free-standing pedestal that can house the:

- Card cage
- System controls
- Central processing unit (CPU) module
- Memory modules
- Console module
- RF-series Integrated Storage Elements (ISEs)
- TF-series, TK70, or TLZ04 tape drive
- Q–bus option modules
- Power supply
- Fans

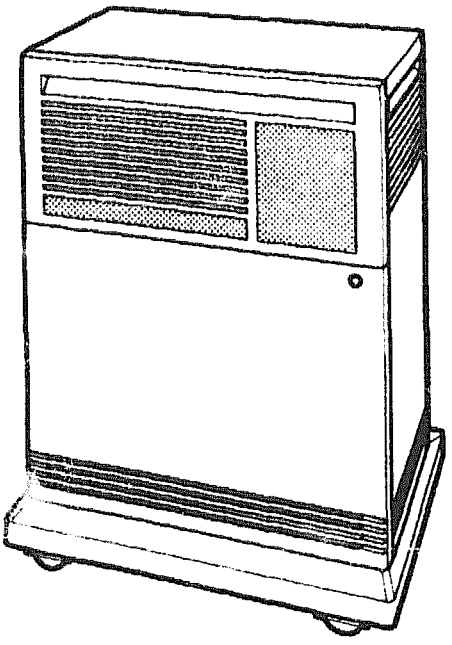
Using the dual-disk RF35, up to seven RF-series ISEs, or up to six RF-series ISEs and a tape drive, can be mounted inside the BA440 enclosure.

This chapter describes the system components and their functions.

Chapter 2 and Chapter 3 tell you how to use the system and its options.

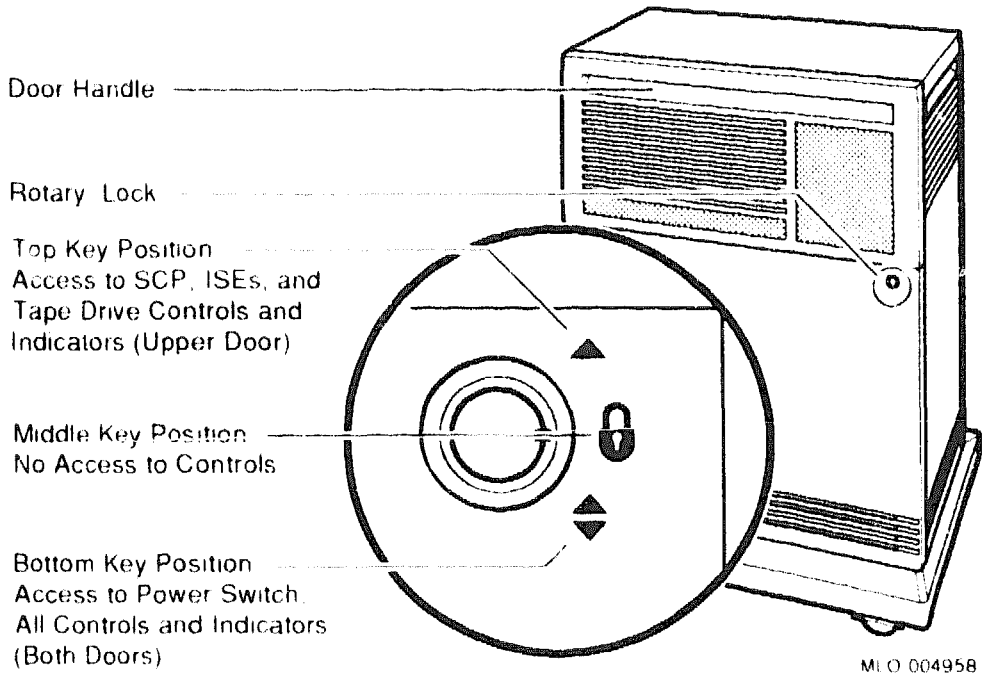
1.1 Front View and Physical Description

The front of your system has a divided door that restricts access to the system controls.



MLO-004032

A three-position rotary lock lets you lock the upper and lower doors, or lock just the lower door. Opening the upper door lets you access the controls for the RF-series Integrated Storage Elements (ISEs), tape drive, and System Control Panel (SCP). Opening both doors lets you access all system controls and cable connections.



Opening and Closing the Doors

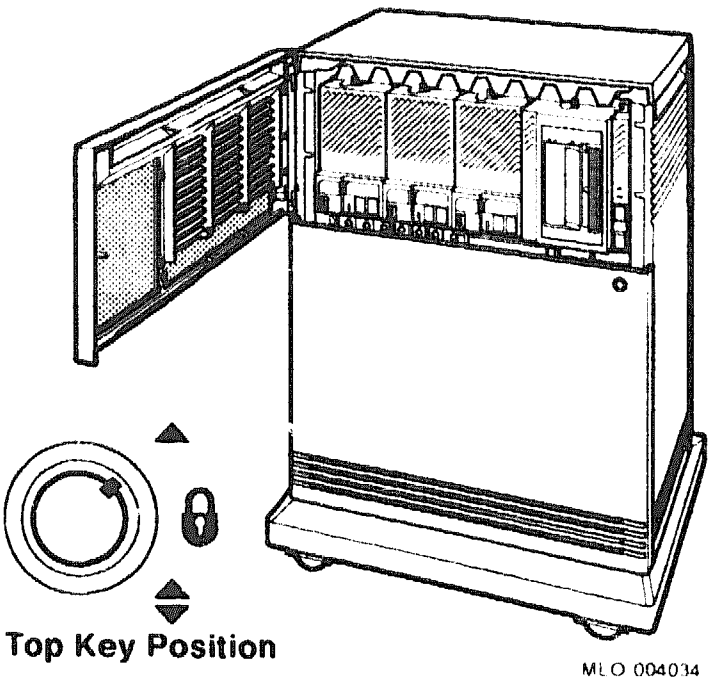
The divided door lets you access the mass storage devices and system control panel (SCP), while restricting access to the Power switch and console module. Open and close the doors as follows.

1. Insert the key in the lock on the front door. Turn the key to the top position to open the upper door, or to the bottom position to open both doors.

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

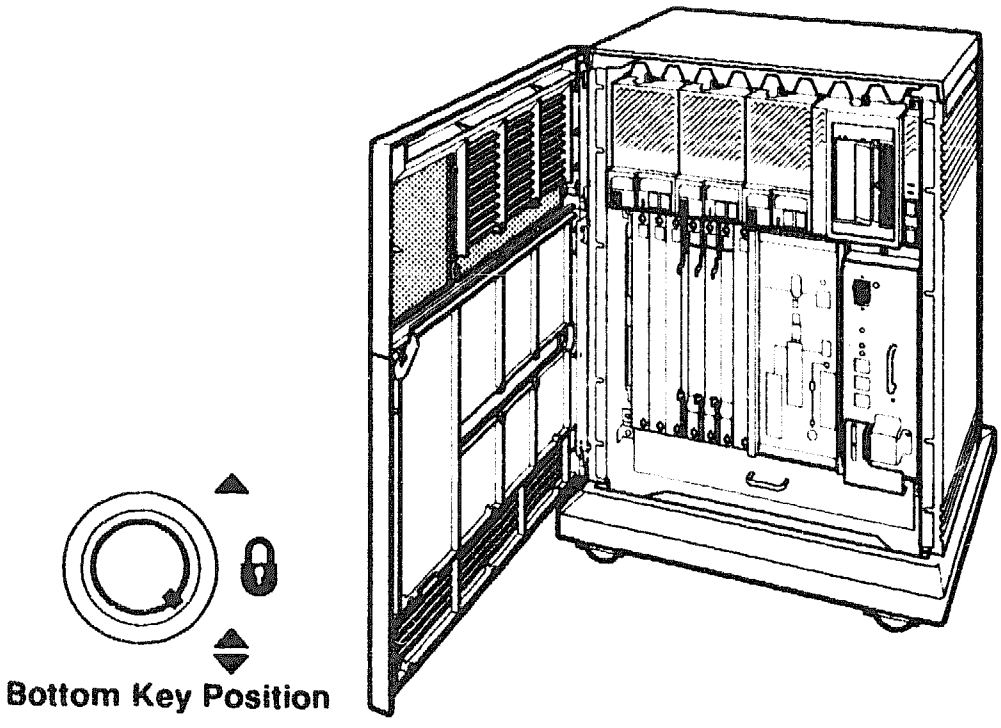
2. Swing the doors open.

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



Top Key Position

MLO 004034



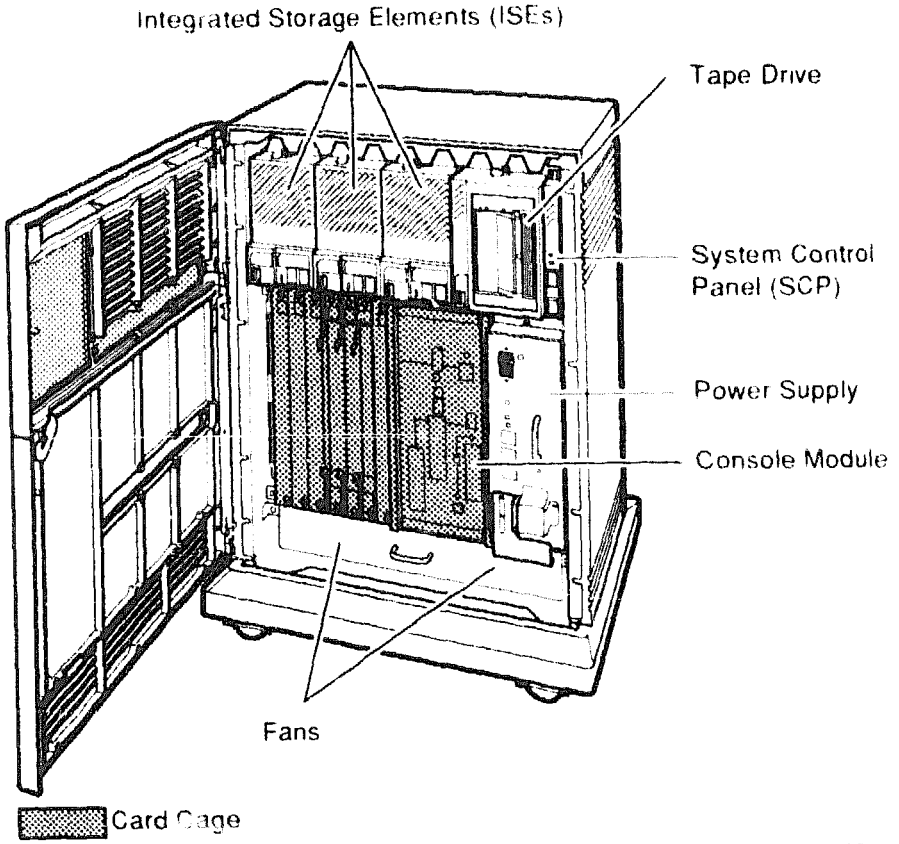
Bottom Key Position

MLO-004035

The next section describes the BA440 enclosure, which is exposed when you open both doors.

1.1.1 BA440 Enclosure

Opening both doors lets you access the components housed in the BA440 enclosure.



The BA440 enclosure can contain the following.

- Mass storage — TF-series, TK70, or TLZ04 tape drive and, using the dual-disk RF35, up to six RF-series ISEs or up to seven RF-series ISEs and no tape drive

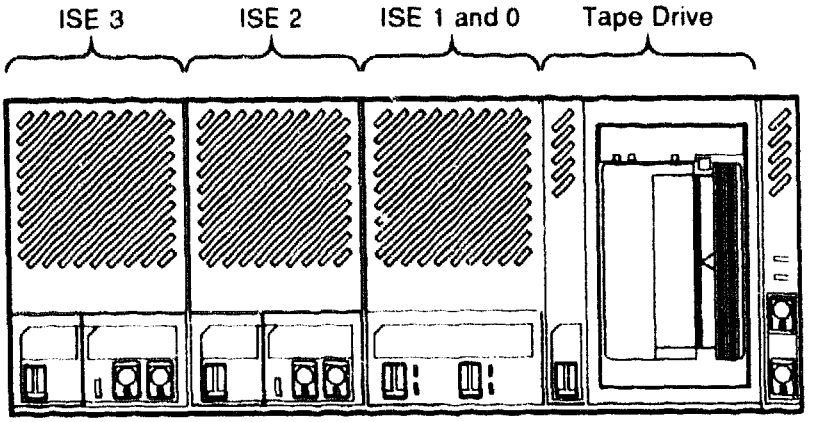
All enclosures contain the following.

- System control panel (SCP)
- Card cage containing modules — CPU and memory
- Console module

- Power supply
- Fans

1.1.1.1 Mass Storage Shelf

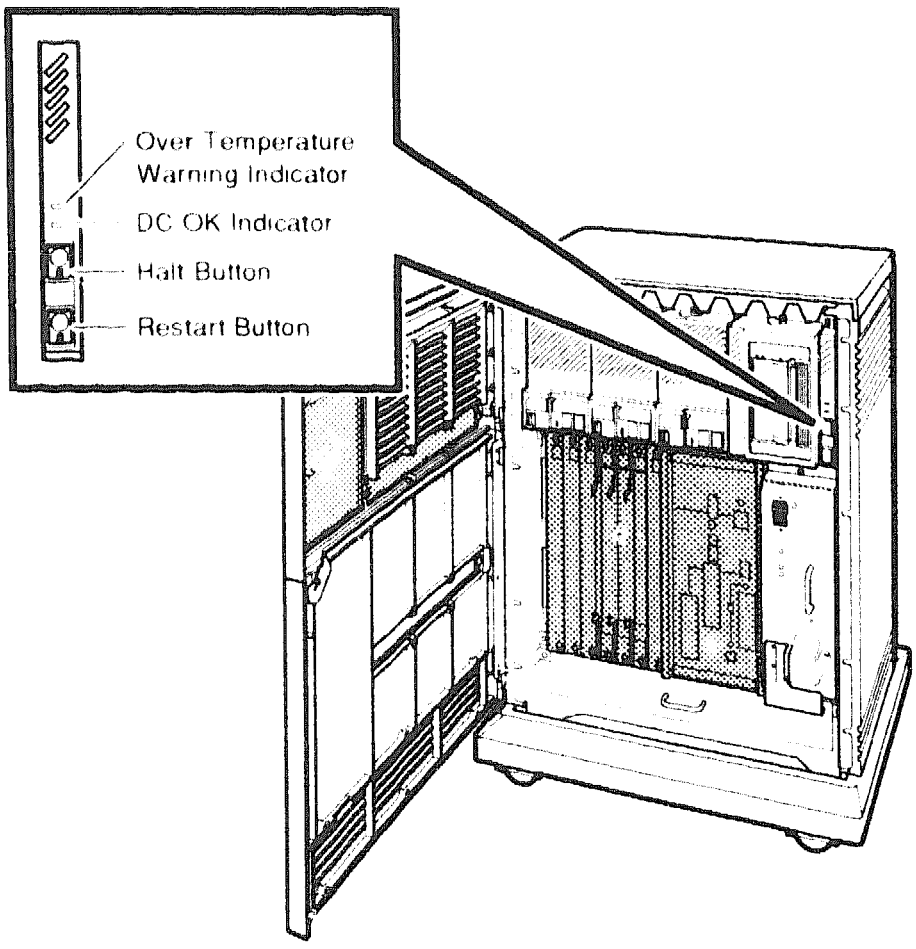
The mass storage shelf extends across the top of the enclosure. It contains a tape drive, and up to six RF-series ISEs (tapeless systems can have up to seven RF-series ISEs). Each ISE has its own controls and indicators.



Instructions for using ISEs and the TF-series, TK70, or TLZ04 tape drive are in Chapter 3.

1.1.1.2 System Control Panel (SCP)

The system control panel is to the right of the storage devices



The SCP controls and indicators function as follows.

Over Temperature Warning Indicator — A red indicator that flashes when the system internal temperature is approaching a level that may cause system components to overheat. In addition to the flashing indicator, an audible alarm provides warning of a possible over temperature condition. If the components continue to heat, the system will automatically shut down to prevent components from being damaged. Section 2.9 provides instruction for turning on the system after a shutdown due to overheat conditions.

DC OK Indicator — A green indicator that shows the power supply voltages are within the correct operating range. If the

indicator is not lit when system power is on, refer to your system *Troubleshooting and Diagnostics* manual.

Halt Button — A two-position button. When you press it, the system halts. A red indicator on the button lights when the button is set to the in position. Before you enter console commands, press the button again to return it to the out position. When the button is returned to the out position, the console mode prompt (>>>) is displayed on the console terminal. Now you can enter console commands. If you inadvertently press the Halt button, type C[Return] to continue. Chapter 2 describes halting your system in more detail.

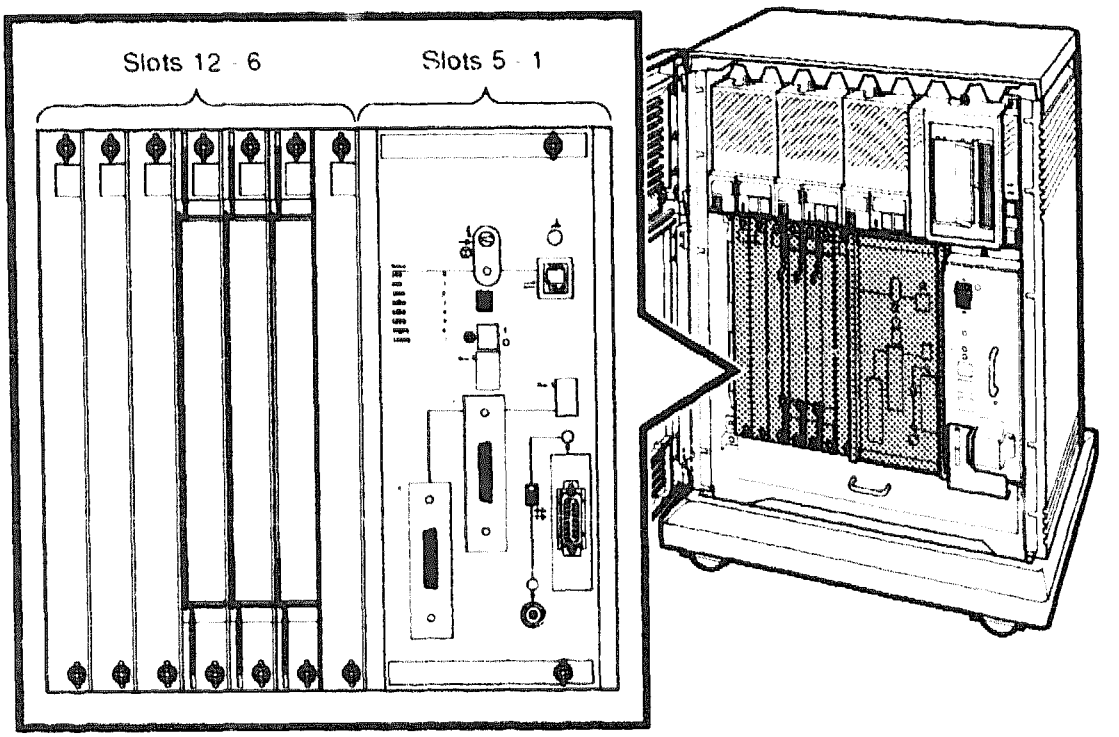
CAUTION: *Pressing the Halt button halts the system regardless of the setting of the Break Enable/Disable switch on the console module.*

Restart Button — It has a green indicator. When you press the button, the system returns to a power-up condition and self-tests are run. If you specified a boot device and if the Break/Enable Disable switch is set to disable, the system will reboot system software. Further instructions on restarting your system are in Chapter 2.

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

1.1.1.3 Card Cage

The modules in your system are mounted in a 12-slot card cage under the mass storage shelf.



Slots 1 through 4 are reserved for memory modules. Slot 5 is reserved for the CPU. A console module with system controls and connectors covers those slots. Slots 6 through 12 are available for Q–bus option modules. The number and type of option modules installed in your system depend on your configuration.

Each Q–bus slot, even an empty one, is protected by a module cover. Together the covers form a shield with a three-fold purpose:

- Protect external devices from electrical interference generated by the system.
- Protect the system from electrical interference generated by external devices.
- Maintain airflow integrity.

CAUTION: *Do not operate your system without Digital-supplied module covers. They are required to protect the equipment and to meet international regulatory standards. Do not substitute other module covers as they may not meet the required specifications.*

Operating your system without the module covers has the following consequences.

- *The system may overheat due to improper air circulation.*
- *The system will not comply with FCC and VDE requirements for electromagnetic shielding and may produce electrical interference that affects other equipment.*
- *The system is susceptible to electrical interference or damage from external sources.*

The design of module covers varies, depending on the type of module installed in each slot.

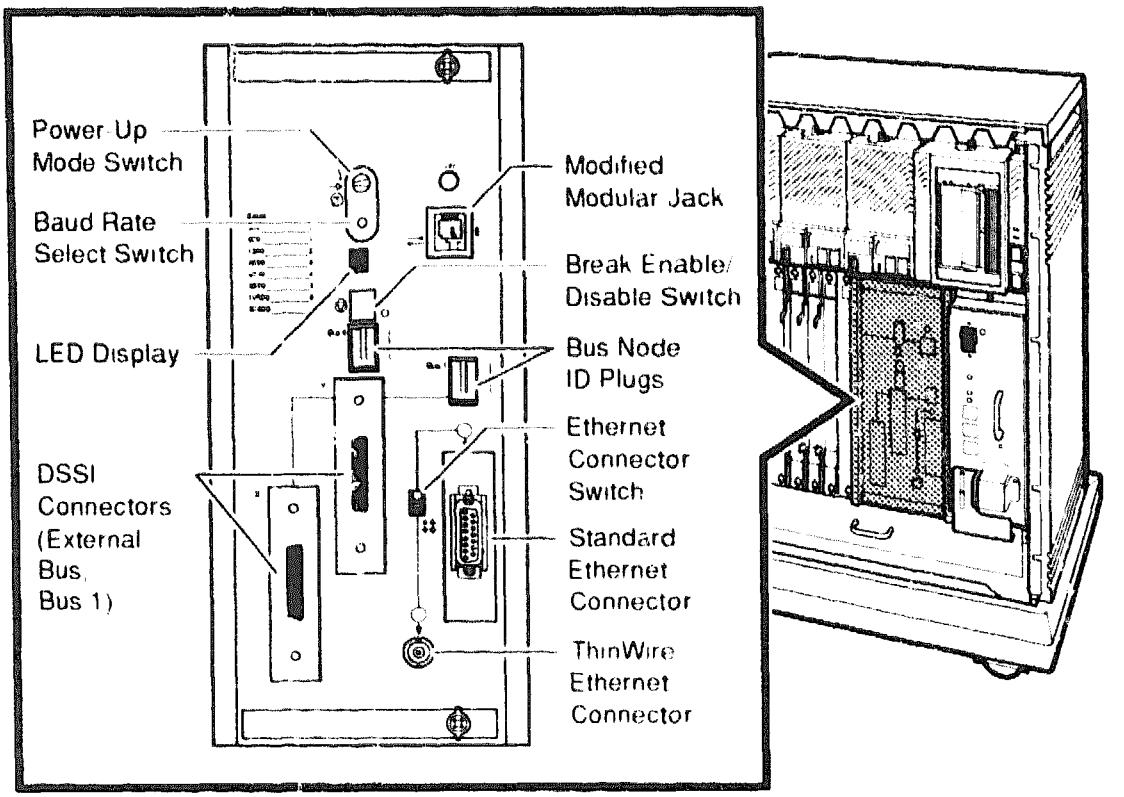
- Modules requiring external cable connections, such as communication controllers, have recessed covers that are riveted directly to the module. The recessed covers provide space for connecting cables.
- Modules requiring no external cable connections, such as mass storage controllers, are covered by flush covers. Empty slots are also covered by flush covers which may be single or double width.

All covers, except those covering empty slots, have a label identifying the module installed in the slot.

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

1.1.1.4 Console Module

Your system can have up to four memory modules. The memory modules occupy the first four slots of the card cage and are followed by the CPU. The memory and CPU modules are behind a console module that covers the first five slots. The console module has several system controls and connectors.



MLO-004038

Power-Up Mode Switch — A three-position rotary switch that determines how your system responds at power-up:

Language Inquiry Mode (the top position, indicated by a profile of a human face) causes your system to display a language selection menu at power-up if your console terminal supports multiple languages. If a default boot device is not selected, this mode displays a list of bootable devices and prompts you to select a device from the list. Once you select a device, your system autoboots from that device each time you turn it on.

Run Mode (the middle position, indicated by an arrow) is the normal operating setting.

Loop Back Test Mode (the bottom position, indicated by a T in a circle) causes your system to run loopback tests on the console serial line at power-up. This setting requires special loopback connectors and is for Digital service use only.

Baud Rate Select Switch — It is used to set the system baud rate to match that of your console terminal. The factory setting is position 5 (9600).

Modified Modular Jack (MMJ) — A connector that provides the connection for your console terminal.

Light-Emitting Diode (LED) Display — It shows the testing sequence during system power-up.

Break Enable/Disable Switch — When it is down (position 0), breaks are disabled. When it is up (position 1), breaks are enabled. When breaks are enabled, pressing Break on your console terminal halts the processor and transfers control to the console program. Using the console command SET CONTROLP, you can specify the control character, Ctrl/P, rather than Break to initiate a break signal.

This switch also controls what happens at power-up. When breaks are disabled, the system attempts to boot software at power-up. When breaks are enabled, the system enters console mode (indicated by the >>> prompt) at power-up.

Using the console command SET HALT REBOOT or SET HALT RESTART_REBOOT, you can set your system to automatically boot software after the system is halted due to pressing Break.

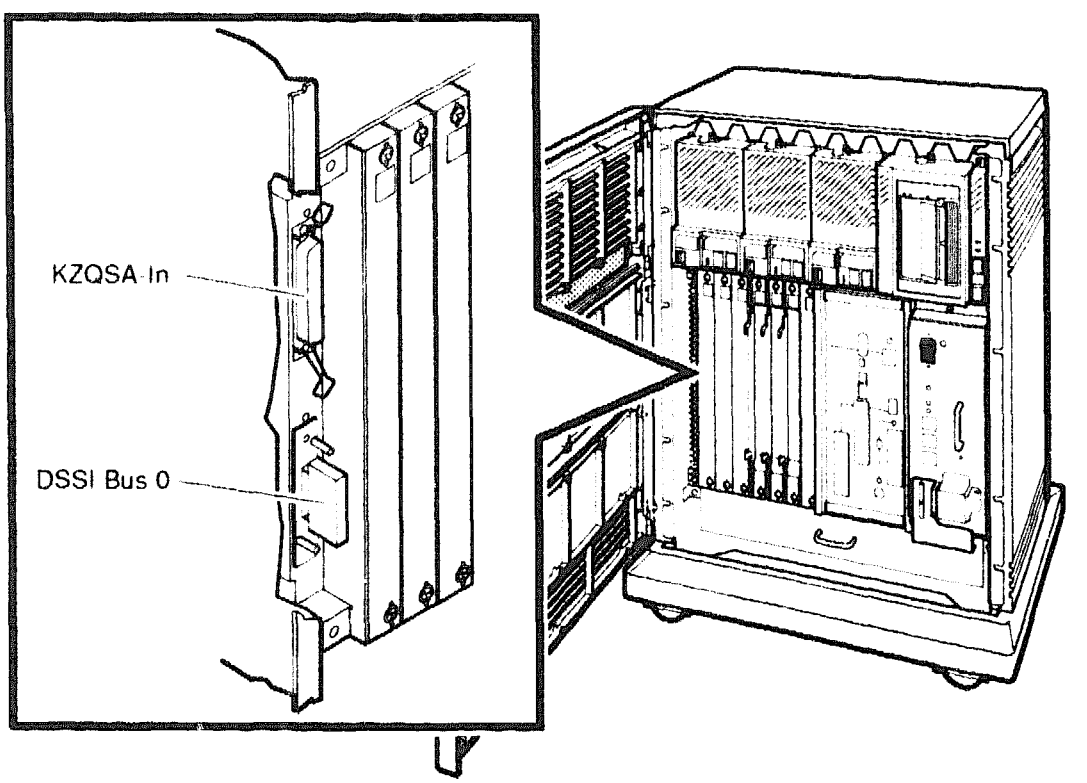
Bus Node ID Plugs — They identify the bus nodes of DSSI adapters in the CPU. Your system has two separate Digital Storage System Interconnect (DSSI) busses. One plug identifies an internal DSSI bus, Bus 0, and the other plug identifies an external DSSI bus, Bus 1. Both plugs are configured at the factory. Refer to Section 3.1.1.3 for rules on changing them.

DSSI Bus 1 Connectors — Labeled X and Y, they let you expand your system by connecting additional mass storage devices to the second DSSI (Digital Storage System Interconnect) bus. You can share the mass storage devices with another system by forming a DSSI VAXcluster configuration, described in Section 1.3.

Ethernet Connectors — There are two connectors: a BNC-type connector for a ThinWire cable and a 15-pin connector for a standard transceiver cable. The Ethernet connector switch lets you select one or the other: To select the standard cable, move the switch up. To select the ThinWire cable, move the switch down. A green indicator light (LED) for each connector indicates which cable is active.

1.1.1.5 DSSI Bus 0 Connector and KZQSA-In Connector

To the left of the card cage is a panel with two connectors: the DSSI Bus 0 connector and the KZQSA-In connector.



MLO 007173

The DSSI Bus 0 connector (and a cable) connects to the DSSI bus any DSSI devices installed in your system. It lets you expand your system by

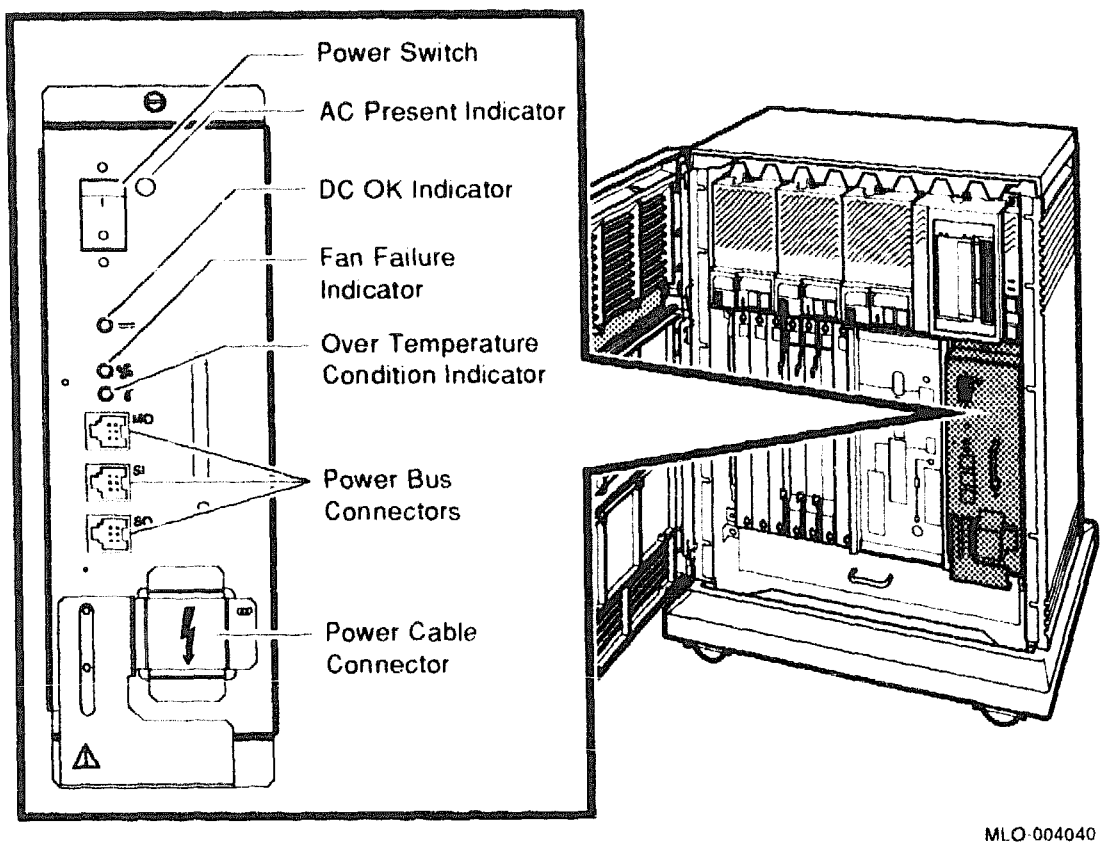
connecting additional mass storage devices to the bus. You can also share mass storage devices with another system by forming a DSSI VAXcluster configuration, described in Section 1.3.

The KZQSA-In connector connects the KZQSA storage adapter to an embedded TLZ04 tape drive. The cable is connected during installation.

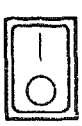
1.1.1.6 Power Supply Controls and Indicators

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

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



MLO-004040



Power Switch — It turns system power on and off. The off position is indicated by a 0; the on position is indicated by a 1.

The Power switch also functions as the system circuit breaker. In the event of a power surge, the breaker trips, causing the Power

switch to return to the off position (0). Turning the system on resets the circuit breaker. If the circuit breaker trips, wait 1 minute before turning the system back on.

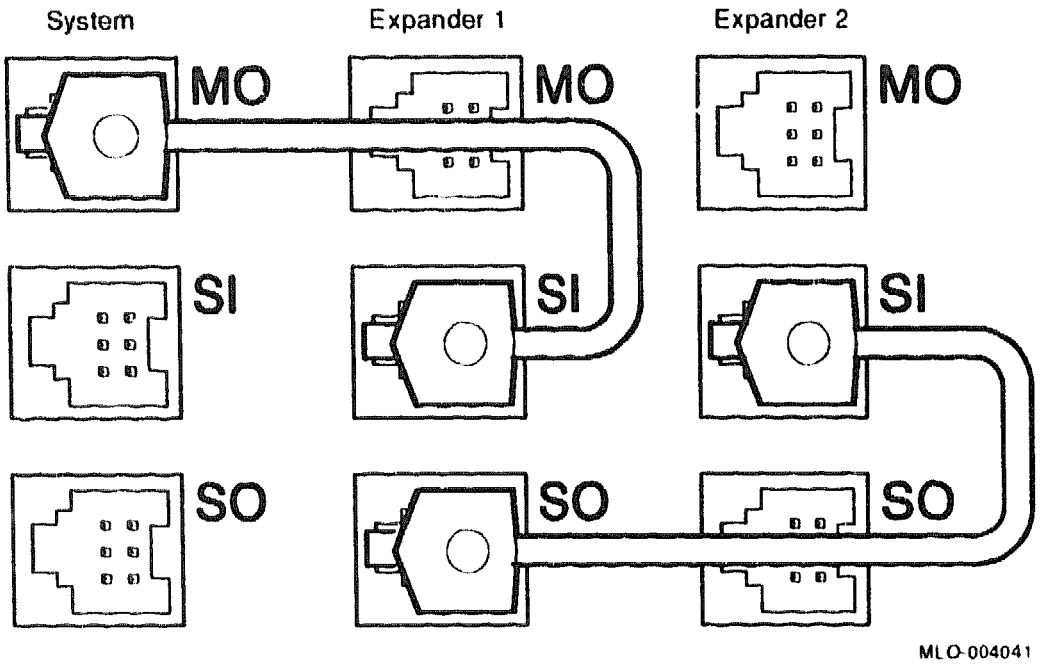
AC Present Indicator — An orange indicator that lights when the Power switch is set to on and voltage is present at the input of the power supply. If the indicator does not light when the Power switch is set to on, refer to your system *Troubleshooting and Diagnostics* manual.

DC OK Indicator — A green indicator that lights when the power supply voltages are within the correct operating range. If the indicator does not light when the Power switch is set to on, refer to your system *Troubleshooting and Diagnostics* manual.

Fan Failure Indicator — An amber indicator that lights if one of the two cooling fans stops working. The power supply automatically shuts down your system as a precautionary measure when a fan failure is detected. Call your Digital service representative if a fan failure occurs.

Over Temperature Condition Indicator — An amber indicator that lights if your system shuts down due to an over temperature condition. Section 2.9 provides instructions on recovering from an over temperature condition.

Power Bus Connectors — They let you configure a Power Bus for systems expanded with the R400X or B400X expander. For a single-system configuration with one or more expanders, the Power Bus lets you turn power on and off through the power supply designated as the main power supply. That way, one Power switch can control power for an entire expanded system.



NOTE: *DSSI VAXcluster systems should not be configured with a Power Bus. Inadvertently shutting off a system defeats the added reliability of a DSSI VAXcluster configuration.*

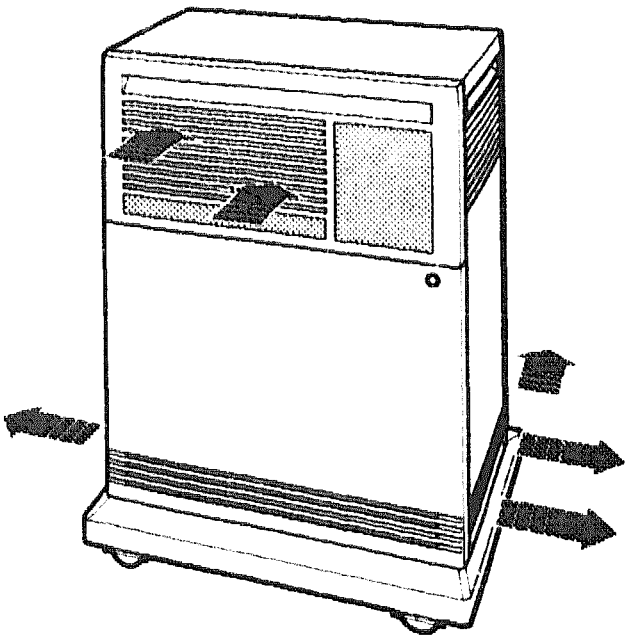
MO The **main out (MO)** connector sends the power control bus signal to an expander. One end of a Power Bus cable is connected here; the other end is connected to the secondary in (SI) connector on the expander power supply.

SI The **secondary in (SI)** connector receives the power control bus signal from the main power supply. In a Power Bus with more than one expander, the power control bus signal is passed along, using the secondary in and out connectors.

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

1.1.1.7 Fans

Two fans located under the card cage draw air in through the top of your system, down through the card cage, and out the bottom.



MLO-004042

The speed of the fans varies, depending on the surrounding room temperature. To reduce the load on the fans, keep your system away from heat sources.

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

1.2 Functional Description

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

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

1.2.1 Base System Components

Base system components include the:

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

1.2.1.1 Central Processing Unit (CPU)

The central processing unit (CPU) controls the execution of all instructions and processes. Its circuits contain the logic, arithmetic, and control functions used by your system.

1.2.1.2 Console Serial Line Unit (SLU)

Your system has a serial line unit connecting the console terminal to the system. The SLU connector (a modified modular jack) is located on the console module. The console serial line lets you communicate with the CPU.

1.2.1.3 Main Memory

Main memory provides the storage area for data and instructions used by the CPU. Your system supports from one to four MS690 memory modules. Each memory module supports 32, 64, or 128 MB of main memory for a total maximum of 512 MB.

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

1.2.1.4 Network Controller

A network controller lets you connect to an Ethernet network. With a network connection and appropriate DECnet software, you can use network services such as mail, access data stored on other systems, perform operations such as editing and printing on remote systems, and share resources such as laser printers.

Your system has an onboard Ethernet controller that is part of the CPU. The system can connect to an Ethernet network through standard Ethernet cable or ThinWire Ethernet cable. Connectors for both types of cables are on the console module.

1.2.1.5 Embedded DSSI Adapters

Your system has two Digital Storage System Interconnect (DSSI) adapters built into the CPU. They provide a path to two separate DSSI busses (0 and 1) through which the CPU can communicate with DSSI devices. Each adapter can support eight nodes, with the adapter and each DSSI storage device counting as one node. Therefore, each adapter can support seven DSSI storage devices.

The adapters also let you link one of the DSSI busses to another system to form a DSSI VAXcluster configuration, described in Section 1.3. When a DSSI bus is extended to a second system, both systems can share up to six DSSI storage devices. When a DSSI bus is extended to a third system, the systems can share up to five DSSI storage devices.

1.2.2 Optional Components

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

- Mass storage devices and controllers
- Mass storage subsystems
- Mass storage expanders
- Communication controllers
- Real-time controllers
- Printer interfaces

1.2.2.1 Mass Storage Devices and Controllers

Mass storage devices record data on magnetic media. The data is not lost when you turn off the system, but it can be altered or erased if you record over the data. Use mass storage devices to store data and software permanently. When the data or software is needed, the CPU copies it from the mass storage device into main memory.

The two primary types of mass storage devices are the integrated storage elements and devices with removable media such as tape cartridges and compact disks.

Integrated Storage Elements (ISEs)

Up to seven RF-series ISEs can be installed in your system (using the dual-disk RF35). An ISE is an intelligent storage device that contains its own controller and server. Special mounting hardware lets the device plug directly into the system backplane.

Devices with Removable Media

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

Mass Storage Controllers and Adapters

All mass storage devices require a controller to control activity between the CPU and the mass storage device. While the controller for a DSSI storage device is built into the device, other storage options require a controller module in your system's card cage. The controller for the TK70 tape drive is the TQK70; the KDA50 is the controller for RA-series disk drives. Each KDA50 controller supports up to four RA-series disk drives.

The KZQSA adapter lets the CPU communicate with the TLZ04 tape drive or RRD-series compact disc drive. Each KZQSA adapter can support up to two drives.

The CPU communicates with DSSI devices through a DSSI adapter, which is built into the CPU. Your system has two DSSI adapters and therefore two separate DSSI busses. Each DSSI buss is capable of supporting seven DSSI devices. A third and fourth DSSI bus can be added to your system by using up to two KFQSA DSSI adapter modules. Each KFQSA adapter can support up to seven DSSI devices.

1.2.2.2 Mass Storage Subsystems

Optional mass storage subsystems are available for your system. They include the:

InfoServer subsystem
RRD42 compact disc subsystem
RV20 optical disk subsystem
TF-series, TSZ07, TS05, and TU81 tape drives
SA600 storage array (with up to eight RA90 disk drives)

If your system includes an optional mass storage subsystem, refer to the user's guide or owner's manual for that subsystem for instructions on how to operate the device.

1.2.2.3 Mass Storage Expanders

You can expand the mass storage and Q–bus capacity of your system by using the following expanders.

- The R400X mass storage expander provides space for up to 7 ISEs, which provides space for up to 13 RF35 disk drives or 12 RF35 disk drives and a tape drive. Using an R400X expander, you can fill both DSSI busses for a total of 14 DSSI devices, with drives in the expander and in the system.
- The B400X expander provides 10 additional Q–bus slots for a system total of 17 Q–bus slots. The B400X also has space for up to four additional RF-series ISEs or up to three ISEs and a tape drive (TF-series, TK70, or TLZ04).

  NOTE: *Using the dual-disk RF35 (available with the R400X and B400X expanders) you can increase the number of ISEs, up to seven per DSSI bus.*

- The R215F expander provides space for up to three RF-series ISEs.
- The B213F expander provides 10 additional Q–bus slots and space for up to three RF-series ISEs and a TK70 tape drive.
- The SF100 storage array pedestal provides space for a TF857 magazine tape subsystem and one SF-series storage array building block.
- The SF200 storage array subsystem provides space for up to two TF857 magazine tape subsystems and up to six SF-series storage array building blocks.

Contact your Digital representative for more information on those and other expander products.

1.2.2.4 Communication Controllers

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

The following types of communication controllers are available.

- Asynchronous serial controllers
- Synchronous serial controllers
- DECservers

- Network controllers

Asynchronous Serial Controllers

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

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

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

  CAUTION: *Printers equipped with a microprocessor (intelligent printers) may require modem control signals to function correctly. Do not attach a printer requiring modem control signals to a controller with no modem support. Check your printer documentation to determine the proper communication interface for your printer.*

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

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

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

Synchronous Serial Controllers

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

DECservers

DECservers are terminal servers (hardware and software) that let you connect multiple terminals or printers to systems in an Ethernet Local Area Network (LAN).

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

Network Controllers

Network controllers let you connect to an Ethernet LAN or other network type. With a network connection and appropriate DECnet software, you can:

- Use network services such as mail.
- Access data stored on other systems.
- Perform operations, such as editing and printing, on remote systems.
- Share resources such as laser printers.

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

1.2.2.5 Real-Time Controllers

Real-time controllers interface with devices that monitor or control external processes, such as laboratory equipment or manufacturing equipment connected to computer systems. Typically, real-time controllers are parallel devices, not serial devices.

1.2.2.6 Printer Interfaces

Some printers require specific interfaces to communicate with a system. For example, the LG01, LG02, LP29, and LP37 printers require the LPV11-SA interface module.

1.2.2.7 Other Available Options

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

1.3 DSSI VAXcluster Configuration (VMS Systems Only)

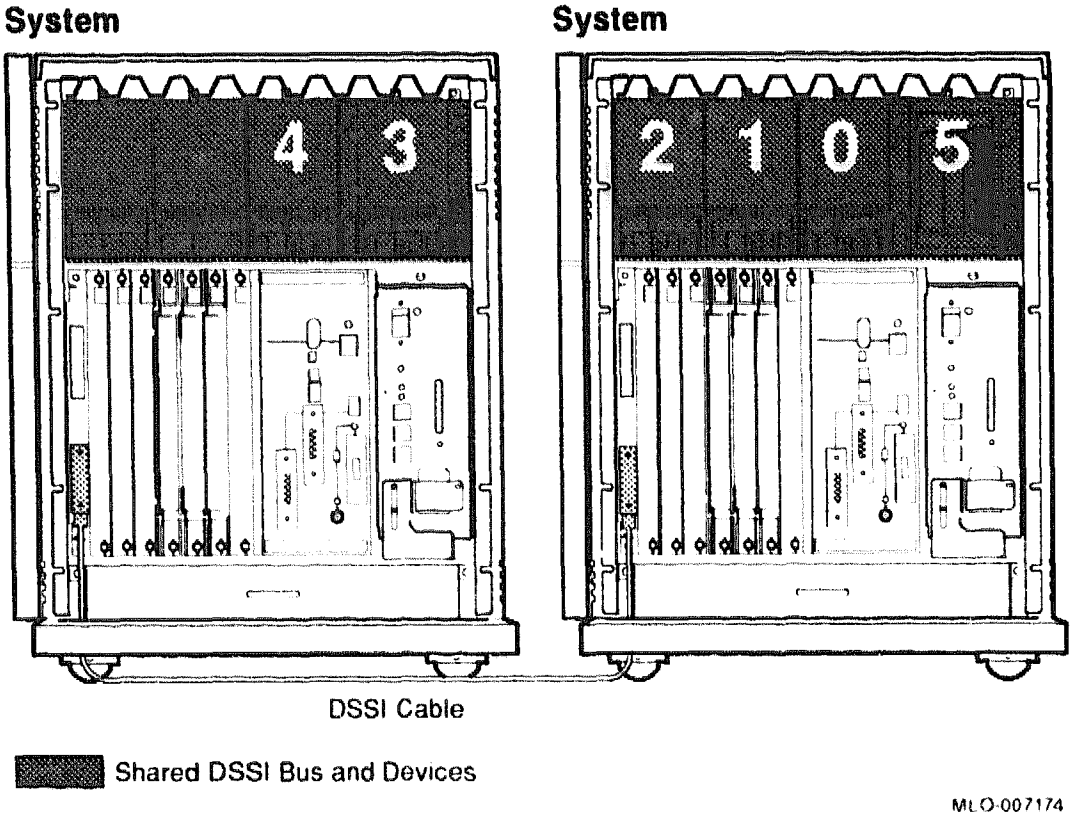
NOTE: *A DSSI VAXcluster configuration is supported only under VMS Version 5.5 or later.*

A DSSI VAXcluster configuration consists of two or more systems configured as a DSSI VAXcluster and sharing their DSSI devices through a Digital Storage System Interconnect (DSSI) bus. Each system can have direct access to any of the devices on the DSSI bus, including a shared system disk.

The simplest DSSI VAXcluster configuration, a two-system configuration, can let one system disk be used as the system disk for both systems. Although the system disk resides in one system, both systems have equal access to it and to any other DSSI storage device in either system.

A DSSI device, such as the RF73, has a built-in DSSI VAXcluster capability that can dynamically serve two or more systems. DSSI adapters, embedded in the system CPU, let you extend a DSSI bus by connecting it to another system.

Using an external DSSI cable, DSSI-based systems can be connected to form a DSSI VAXcluster configuration.



NOTE: *In the sample configuration shown above, the shared bus (Bus 0) is fully configured: 2 DSSI adapters + 6 DSSI storage devices (bus nodes 0–5) = 8 nodes.*

The benefits of a DSSI VAXcluster configuration:

- VAXcluster features such as shared data across systems and satellite nodes.
- Higher system availability — If one of the systems is unavailable due to a system malfunction, the satellites booted through it can continue operating through the other system.

If one system fails, all satellite nodes booted through that system lose connections to the system disk. But each satellite knows that the system disk is available through a second path. So the satellite nodes establish a new connection through the other system and continue operation.

To increase system availability, a second system disk can be added to each boot node. If one system disk fails, the other system disk continues to serve one system and the satellite nodes booted through it. As in

any VAXcluster, a second system disk improves availability but increases system management tasks.

DSSI VAXcluster configurations must be installed by a Digital service representative or licensed self-maintenance customer.

Chapter 2
Operating the System

This chapter tells you how to operate your system, once the software is installed or you complete startup procedures for factory-installed VMS.

2.1 Before You Operate the System

This chapter assumes that your system is properly installed. Installation includes running the diagnostic software (if ordered) and installing the operating system or completing the startup procedures for factory-installed VMS.

Refer to the *VMS Factory Installed Software User Guide*, shipped with your system, for instructions on starting up factory-installed VMS. To install other operating system options or layered products, see the instructions in your system software installation manual or layered product installation manual. Some of the instructions may require you to open the front door of the system to change switch settings on the console module.

2.2 Switch Settings

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

2.2.1 Normal Operation

Switch settings for normal operation are the following.

- The Break Enable/Disable switch on the console module is set to disable (down, position 0). Digital recommends you run the system with breaks disabled to prevent the user from inadvertently halting the system by pressing Break on the console terminal. Halting the system causes all activity to stop.

  With breaks disabled, the system automatically boots system software when powered on.

  NOTE: *You can use the console command SET CONTROLP to specify* Ctrl/P, *rather than* Break, *to initiate a break signal.*

You can use the console command SET HALT REBOOT or SET HALT RESTART_REBOOT to set your system to automatically boot software after the system is halted due to pressing Break.

- The Power-Up Mode switch on the console module is set to Run (indicated by an arrow).
- The Write-Protect button for each RF-series ISE is set to out (not lit). That lets system software write to the storage element.

  NOTE: *RF35 ISEs do not have a Write-Protect button.*

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

  NOTE: *RF35 ISEs do not have a Run / Ready button.*

- The Halt button on the SCP is set to out (not lit).
- For expanded systems using a Power Bus cable to link the R400X or B400X expander, the power switch on the expander power supply remains on (set to 1) at all times. The system power supply sends the power bus signal needed to turn the expander on or off.

2.2.2 Special Operation

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

- If you need the ability to halt the system from the console terminal, for example, when installing system software or performing certain backup tasks, set the Break Enable/Disable switch to enable (up, position 1). That lets you halt the system by pressing Break on the console terminal.

  NOTE: *You can use the console command SET CONTROLP to specify* Ctrl/P, *rather than* Break, *to initiate a break signal.*

  You can use the console command SET HALT REBOOT or SET HALT RESTART_REBOOT to set your system to automatically boot software after the system is halted due to pressing Break.

- If you want data on an ISE to be write-protected, you must set the Write-Protect button to in (lit).

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

RF35 ISEs do not have a Write-Protect button. Refer to Section 3.1.1 for instructions on write-protecting RF35 ISEs.

- If you want to use the Language Selection Menu to select a new language for the console program, before you turn on your system set the Power-Up Mode switch to Language Inquiry Mode (the human profile). When you turn on your system, a language selection menu is displayed, similar to the one shown here.

```
KA6nn-A Vn.n VMB n.n

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

Select a language by typing its number and Return. Save the language you selected by rotating the Power-Up Mode switch to Run Mode, indicated by an arrow. The language selected is saved and automatically used during subsequent reboots of the system.

NOTE: *If you do not select a language within 30 seconds, the system defaults to English (United States/Canada).*

If the Power-Up Mode switch is set to Language Inquiry Mode (indicated by a human profile), the system will prompt for the language at each power-up.

In addition to the Language Selection Menu, your system may issue a list of bootable devices and prompt you to select a device from the list. If that happens, refer to Section 2.4.1 for more information.

If your system is turned off for more than 10 days, the battery unit that saves the system clock and the language selection may run down. If that happens, the Language Selection Menu will be displayed when you turn on the system, regardless of the Power-Up Mode switch setting.

Once the system is booted, reset the system clock as described in your system software manual.

2.3 Turning On the System

Once you set the switches correctly, you are ready to turn on the system:

1. Turn on the console terminal and wait for it to complete its self-tests.
2. Turn on the system by setting the Power switch to 1.

NOTE: *For systems using the R400X or B400X expander linked by a power bus cable, the system Power switch provides the power control bus signal to the expander. Setting that switch to on (1) causes the expander to power up as well. The expander Power switch should always remain in the on (1) position.*

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

Table 2–1: Normal Power-Up Indications

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

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

Every time you turn on your system, it runs a series of self-tests on the CPU and memory.

- Your console terminal first displays a line of information identifying the CPU, the version of the firmware, and the version of VMB, the primary bootstrap program. In the sample screens provided in this chapter, the CPU is identified as a KA6nn-A, and the versions of the firmware and primary bootstrap are indicated as n.n. Your system will display actual version numbers.
- The console terminal then displays a countdown as the system tests itself. When the tests are successful, the system autoboots system software or goes into console mode, as described in Section 2.4.1 and Section 2.4.2.

If your system detects an error during its self-tests, it displays an error summary consisting of several lines of hexadecimal numbers. A Digital service representative can use the error summary to diagnose the problem. Depending on the type of error, one or more error summaries may display on your console terminal. A sample error summary:

```
KA6nn-A  Vn.n  VMB n.n

Performing normal system tests.
66..65..64..63..62..61..60..59..58..57..56..55..54..53..52..51..
50..49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..
34..33..32..31..30..29..28..27..26..25..24..23..22..21..20..19..
18..17..16..15..14..13..12..11..10..09..08..07..

?5F 2 15 FF 0000 0000 02        ; SUBTEST_5F_15, DE_SGEC.LIS

P1=00000000  P2=00000002  P3=5839FF00  P4=00000000  P5=00000000
P6=00000000  P7=00000000  P8=00000000  P9=0000080A P10=00000003
r0=00000054  r1=20084019  r2=00008206  r3=00000000  r4=00004210
r5=00000044  r6=000048DC  r7=20008000  r8=00008000 EPC=FFFF90D6
06..05..04..03..
Normal operation not possible.

>>>
```

If possible, print out the error summary and give it to your Digital service representative. The number following the question mark is the most important information.

2.4 Booting the System

Your system boots in one of two ways:

You can configure the system to autoboot on power-up.
You can manually boot the system from console mode.

The Break Enable/Disable switch setting determines how your system boots.

2.4.1 Autobooting the System

If the Break Enable/Disable switch is set to disable (the normal operating setting), the system runs self-tests and then attempts to load system software.

If the Break Enable/Disable switch is set to enable, and the halt action REBOOT or RESTART_REBOOT was defined by the SET HALT console command, the system attempts to load system software.

Depending on whether or not a boot device was selected, the system loads system software or prompts you to select a boot device.

Loading System Software with Boot Device Selected

If a boot device was selected, the system identifies the boot device and the number 2 displays on your screen. As the system begins booting, the countdown continues from 1 to 0.

This shows a successful power-up and automatic boot when DIA0 was selected as the boot device.

```
KA6nn-A Vn.n, VMB n.n

Performing normal system tests.
66..65..64..63..62..61..60..59..58..57..56..55..54..53..52..51..
50..49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..
34..33..32..31..30..29..28..27..26..25..24..23..22..21..20..19..
18..17..16..15..14..13..12..11..10..09..08..07..06..05..04..03..
Tests completed.
Loading system software.
(BOOT/R5:0 DIA0)

   2..
-DIA0
      1..0..
```

Loading System Software with No Boot Device Selected

If you did not select a boot device and the Break Enable/Disable switch is set to disable, the system runs self-tests and then displays a list of bootable devices. You are prompted to select a boot device from the list, as shown below.

```
KA6nn-A Vn.n VMB n.n
```

```
Performing normal system tests.
66..65..64..63..62..61..60..59..58..57..56..55..54..53..52..51..
50..49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..
34..33..32..31..30..29..28..27..26..25..24..23..22..21..20..19..
18..17..16..15..14..13..12..11..10..09..08..07..06..05..04..03..
Tests completed.
Loading system software.
No default boot device has been specified.
Available devices.
-DIA0 (RF73)
-DIA1 (RF73)
-MIA5 (TF85)
-EZA0 (08-00-2B-06-10-42)
Device? [EZA0]:
```

To select a boot device, enter a device name at the system prompt. After you select a boot device, the system boots from that device. The following example shows a successful power-up when DIA0 is selected as the boot device. The next time the system is turned on, it will autoboot from that device.

```
KA6nn-A Vn.n VMB n.n

Performing normal system tests.
66..65..64..63..62..61..60..59..58..57..56..55..54..53..52..51..
50..49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..
34..33..32..31..30..29..28..27..26..25..24..23..22..21..20..19..
18..17..16..15..14..13..12..11..10..09..08..07..06..05..04..03..
Tests completed.
Loading system software.
No default boot device has been specified.
Available devices.
-DIA0 (RF73)
-DIA1 (RF73)
-MIA5 (TF85)
-EZA0 (08-00-2B-06-10-42)
Device? [EZA0]:DIA0
(BOOT/R5:0 DIA0)

   2..
-DIA0
      1..0..
```

NOTE: *If you do not enter a device name within 30 seconds, the system attempts to boot from Ethernet device EZA0.*

Changing the Boot Device

After you select a boot device, the system autoboots from that device each time you turn it on, until you do one of the following.

- Change the setting of the Break Enable/Disable switch to enable (up, position 1). If you do that, the system does not autoboot but enters console mode after completing self-tests (assuming you did not define a halt action of REBOOT or RESTART_REBOOT by using the SET HALT console command). Refer to Section 2.4.2 for instructions on booting from console mode.
- Change the boot device by using the SET BOOT command.

Using the SET BOOT Command

To tell your system to boot automatically from a specific device or to change the setting of the default boot device, put the system into console mode and at the >>> prompt enter SET BOOT *device-name*. For example,

```
>>>SET BOOT EZA0
```

sets the system default boot device to be the Ethernet controller.

After you select a boot device, your system autoboots from that device each time you turn it on.

Using SET BOOT *device-name,device-name,device-name*, you can specify a string of default boot devices (up to 32 characters with devices separated by commas and no spaces) your system will check for bootable software. The system checks the devices in the order specified and boots from the first that contains bootable software. For example,

```
>>>SET BOOT DUA0,DIA0,MIA5,EZA0
```

tells the system to use DUA0, DIA0, MIA5, and EZA0 as the default boot devices. When the system autoboots, or if the BOOT command is used without specifying a device, the system boots from the first default boot device that contains bootable software.

NOTE: *If you include the Ethernet device EZA0 in a string of boot devices, it should be the last device in the string. The system will continuously attempt to boot from EZA0.*

To find the name of the device from which to boot your system, refer to Table 2–2 or enter the SHOW DEVICE command at the console prompt.

Table 2- . Device Names

Device Type	Controller/Adapter	Device Logical Name
RF-series ISE	Embedded DSSI host adapter (part of CPU)	DImu[1]
	KFQSA DSSI storage adapter	DUcu[2]
TF-series tape drive	Embedded DSSI host adapter (part of CPU)	MImu[1]
TF85 tape drive	KFQSA DSSI storage adapter	MUcu[2]
TK70 tape drive	TQK70	MUcu[3]
TLZ04 tape drive	KZQSA adapter	MKAn
PROM (programmable read-only memory)	MRV11 module	PRAu
Ethernet adapter	On-board (part of CPU)	EZA0
	DESQA Ethernet controller	XQAu
RA-series drives	KDA50	DUcu[2]

[1] m = DSSI bus adapter: A = internal bus (0); B = external bus (1).
u = unit number (device unit numbers must be unique throughout system).
When under operating system control, DIBu devices are recognized as DIAu devices.

[2] c = MSCP controller designator: A = first, B = second, and so on.
u = unit number (device unit numbers must be unique throughout system).

[3] c = TMSCP controller designator: A = first, B = second, and so on.
u = unit number.

This shows a sample list of devices. The system displays the logical device name, preceded by a dash (–), for each device.

```
>>>SHOW DEVICE
DSSI Bus 0 Node 0 (CLYDE)
-DIA0 (RF73)
DSSI Bus 0 Node 1 (BONNIE)
-DIA1 (RF73)
DSSI Bus 0 Node 5 (TFDR1)
-MIA5 (TF85)
DSSI Bus 0 Node 6 (*)
DSSI Bus 1 Node 7 (*)
UQSSP Tape Controller 0 (774500)
-MUA0 (TK70)
SCSI Adaptor 0 (761400), SCSI ID 7
-MKA0 (DEC TLZ04 1991(c)DEC)
```

```
Ethernet Adapter
-EZA0 (08-00-2B-06-10-42)
```

NOTE: *Selecting a default boot device other than Ethernet device EZA0 is not appropriate for diskless and tapeless systems that must boot software over a network.*

For more information about the system booting process, refer to your system *Technical Information* manual.

2.4.2 Booting the System from Console Mode

If the Break Enable/Disable switch is set to enable, your system powers up to console mode (indicated by the >>> prompt) after successfully completing its self-tests (assuming you did not define a halt action of REBOOT or RESTART_REBOOT by using the SET HALT console command).

This shows a successful power-up to console mode.

```
KA6nn-A Vn.n VMB n.n

Performing normal system tests.
66..65..64..63..62..61..60..59..58..57..56..55..54..53..52..51..
50..49..48..47..46..45..44..43..42..41..40..39..38..37..36..35..
34..33..32..31..30..29..28..27..26..25..24..23..22..21..20..19..
18..17..16..15..14..13..12..11..10..09..08..07..06..05..04..03..
Tests completed.
>>>
```

Loading System Software

To load system software from console mode, enter BOOT *device name*. For example,

```
>>>BOOT MIA5
```

tells your system to boot software from a cartridge in the TF85 tape drive.

If you enter the BOOT command without specifying a device, your system attempts to boot from the default boot device or string of devices defined by the SET BOOT command.

Using BOOT *device-name,device-name,device-name*, you can specify a string of boot devices (up to 32 characters with devices separated by commas and no spaces) from which the system will attempt to boot software. Your system checks the devices in the order specified and boots from the first that contains bootable software. For example,

```
>>>BOOT DUA0,DIA0,MIA5,EZA0
```

tells the system to boot from the first device that contains bootable software.

NOTE: *If the Ethernet device EZA0 is included in a string of boot devices, it should be the last device in the string. The system will continuously attempt to boot from EZA0.*

To determine the name of the device from which to boot your system, refer to Table 2–2.

Software manuals may tell you to power up with break enabled and to use the BOOT command.

2.5 Using the System

Once the system software is loaded, the first display of that software appears on your console terminal after a few seconds. That display is described in your system software documentation.

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

Your system software manuals cover:

- Installing software on your system
- Running software to perform tasks
- Making and restoring backup copies of system software or data files
- Accessing devices and utilities in your system

2.6 Halting the System

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

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

You can halt your system in one of two ways:

- Press the Halt button twice, in to halt the system and out to enter console mode.
- If the Break Enable/Disable switch on the console module is set to enable (indicated by 1), press the Break key on the console terminal.

If the Break Enable/Disable switch is not set to enable and you wish to halt the system by pressing Break, change the setting of the Break Enable/Disable switch from disable to enable.

NOTE: *You can use the console command SET CONTROLP to specify* Ctrl/P, *rather than* Break, *to initiate a break signal.*

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

If you are using a system that is part of a VAXcluster, do not halt, restart, or turn off the system without consulting your cluster manager. Any of those actions will interrupt the processes of the entire cluster.

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

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

2.7 Restarting the System

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

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

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

NOTE: *The Halt button must be out (not lit) to restart the system.*

2.8 Turning Off the System

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

After you complete the shutdown procedure, you can turn off your system by setting the Power switch to 0.

NOTE: *For systems with an R400X or B400X expander linked by a power bus cable, just turn off the system. The expander powers down when you set*

the system Power switch to off (0). The orange ac indicator on the expander power supply should remain lit even though the system Power switch is set to off.

2.9 Recovering from an Over Temperature Condition

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

After your system shuts down due to overheating, the Over Temperature Condition indicator on the power supply remains lit. To recover from a shutdown, set the Power switch to off (0) and wait 5 minutes before turning on the system.

To prevent an over temperature condition:

- Make sure your system is away from heat sources.
- Check that the system air vents are not blocked.
- Check that the room temperature is within the limits specified in your system *Site Preparation* manual.

Chapter 3

Operating the System Options

This chapter tells you how to use options that are part of your system or that can be added to your system. The following types of options are covered.

- Mass storage devices and controllers
- Communication controllers
- Real-time controllers
- Printers

3.1 Mass Storage Options

The following mass storage options can be included in your system.

- RF-series Integrated Storage Elements (ISEs)
- TF-series, TK70, or TLZ04 tape drives

NOTE: *The RV20 optical disk subsystem, RRD4x digital disc subsystem, SF-series mass storage array, TF857 tape subsystem, and TSZ07, TSV05 or TU81 tape drive can be added to your system. If your system contains one of those options, refer to the user's guide or owner's manual for instructions on how to operate the option.*

This section tells you how to use the controls for the RF-series ISEs and the TF-series, TK70, and TLZ04 tape drives. For the tape drives, it also tells you how to insert and remove the tape cartridge.

To use any mass storage device, you must properly identify the device to your operating system and use appropriate operating system commands. Refer to your system software documentation for details.

3.1.1 RF-Series Integrated Storage Elements

Using the dual-disk RF35, your system can have up to seven RF-series ISEs or up to six RF-series ISEs and a tape drive. When your system has multiple ISEs, you should separate them according to function. For example, if your system has two ISEs, you may want to use them as follows.

- ISE 0 contains the operating system and applications installed on the system.
- ISE 1 contains work areas for each user with an account on the system.

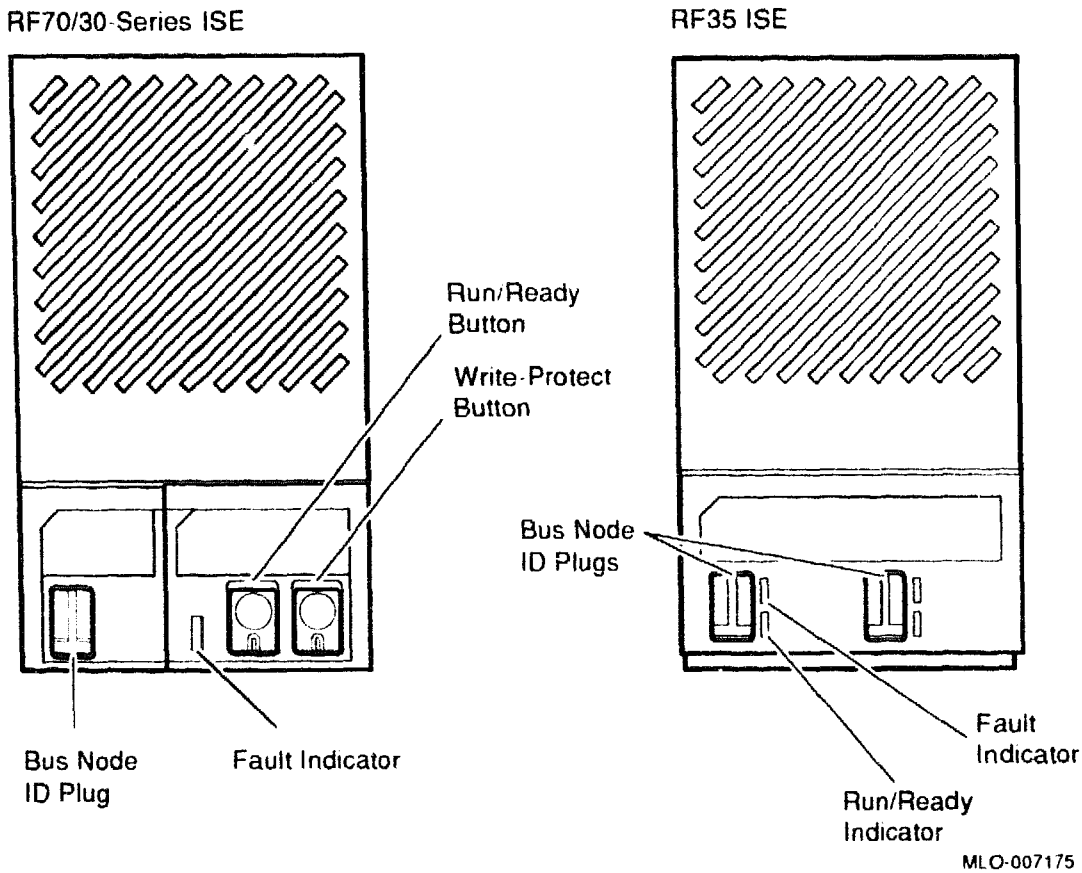
The storage capacities and other specifications for RF-series ISEs are listed in your system *Technical Information* manual.

NOTE: *The RF35 ISE has a dual-disk capability: Two separate ISEs can share the same mass storage cavity and RF35 front panel.*

Refer to Appendix B for information on setting or examining parameters for DSSI devices.

3.1.1.1 RF-Series Controls and Indicators

Each RF-series ISE has controls and indicators on its front panel. To access them, you must open the upper system door (top key position).



NOTE: *If your system has less than the maximum number of ISEs, a blank ISE front panel with no controls or indicators covers the empty ISE cavities. Such panels are required to meet international regulatory standards and airflow requirements.*

If your system has an RF35 with only one disk, one set of controls will have a blank bus node ID plug and its indicators will not light.

Each ISE (with the exception of the RF35) has the following controls and indicators on its front panel.

- Bus node ID plug
- Fault indicator
- Write-Protect button
- Run/Ready button

RF35 ISEs have the following controls and indicators (there are two sets of controls and indicators, as RF35 ISEs can have two disks behind the one panel).

- Bus node ID plug
- Fault indicator
- Run/Ready indicator

Bus node ID plugs identify the bus node number of each ISE to the system, as well as the unit number by default. Bus node numbers are configured at the factory in consecutive order from right to left.

Table 3–1 lists RF-series controls and indicators.

Table 3–1: RF-Series ISE Controls and Indicators

Control	Position	Function
Bus node ID plug	Installed	Identifies bus node ID number (unit number) of ISE to system. ID is factory set to number 0 through 6.
	Not installed	Bus node number undefined. Fault indicator lit.
Fault	Lit	Indicates error condition. Light temporarily on during power-up sequence (normal condition).
	Not lit	Indicates error-free condition in ISE.
Run/Ready	In (lit, green)	ISE on line, available for use. Green light flashes as seek operations are performed.
	Out (not lit)	ISE off line, cannot be accessed. Green light cannot be lit when Run/Ready button is out.
Write-Protect	In (lit, amber)	ISE write-protected. Prevents system software from writing to ISE.
	Out (not lit)	ISE not write-protected. System software can read from or write to ISE.

3.1.1.2 Write-Protecting an RF-Series ISE

You may want to write-protect an ISE containing sensitive data you do not want changed or accidentally erased.

- For all but the RF35, you write-protect an ISE by setting the Write-Protect button to in (lit).
- For the RF35 ISE, which has no Write-Protect button, you set write-protection through VMS commands or through firmware commands in console mode, explained later in this section.

The Write-Protect button controls whether your system can write data to the ISE. Your system can read from the ISE regardless of the setting of that button. When that button is out (not lit), your system can write to the ISE.

Your system disk (the ISE containing system software) and ISEs containing work areas for users should be write-enabled, the normal setting.

Software Write-Protect for RF-Series ISEs

Since the RF35 ISE does not have a Write-Protect button, the software write-protect is the primary method for write-protecting an RF35.

The software write-protect uses the VMS DCL MOUNT command with the /NOWRITE qualifier, as shown below,

```
MOUNT <device_name> <volume_label>/SYSTEM/NOWRITE
```

where <device_name> is the device name, as shown using the VMS DCL command SHOW DEVICE DI, and <volume_label> is the volume label for the device. For example,

```
$ MOUNT $1$DIA1 OMEGA/SYSTEM/NOWRITE
```

software write-protects device 1DIA1.

Dismounting and then remounting the device (without using the /NOWRITE qualifier) write-enables the device.

Use the VMS DCL command SHOW DEVICE DI to check the protection status of the drive. A write-protected drive shows a device status of `Mounted wrtlck`. Refer to your VMS documentation for more information on using the MOUNT utility.

CAUTION: *When you dismount and then mount the device again, it will no longer be write-protected.*

Hardware Write-Protect for RF35 ISEs

The hardware write-protect provides a more permanent write-protection than the software write-protect. Once you hardware write-protect an RF35, it remains write-protected, regardless of the availability of the operating system or if the system is powered-down. Also, a hardware write-protect cannot be removed by using the MOUNT command. In effect, the hardware write-protect provides the same degree of write-protection available for RF-series ISEs that have a Write-Protect button.

You should consider hardware write-protecting an RF35 when:

- You want to write-protect an RF35 ISE when the VMS operating system is not available, such as before running the MicroVAX Diagnostic Monitor.
- You want to ensure that an RF35 remains write-protected, since the hardware write-protect cannot be removed by the VMS MOUNT command and remains in effect even if the operating system is brought down.

You can hardware write-protect an RF35 from VMS or through firmware commands entered at the console prompt (>>>):

1. Access the Diagnostic and Utility Program (DUP) driver for the device you want to write-protect.
   - To access the DUP driver from console mode:
     a. Enter console mode by pressing the Halt button or powering up the system with the Break Enable/Disable switch set to enable (up, position 1).

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

     b. Access the DUP driver by setting host to the device you want to write-protect.

        Use the following command for embedded DSSI.

        ```
        SET HOST/DUP/DSSI/BUS:<bus_number> <node_number> PARAMS
        ```

        where <bus_number> is the DSSI bus number (0 or 1), and <node_number> is the bus node ID (0–6) for the device on the bus. The bus number and node number are listed in the SHOW DSSI display.

        Use the following command for KFQSA-based DSSI.

        ```
        SET HOST/DUP/UQSSP/DISK <controller_number> PARAMS
        ```

        where <controller_number> is the controller number listed in the SHOW UQSSP display for the device on the bus.
   - To access the DUP driver from VMS:
     a. Connect to DUP and load its driver by using the VMS system generation utility (SYSGEN) as shown below.

```
$ MCR SYSGEN
SYSGEN> CONNECT/NOADAPTER FYA0
SYSGEN> EXIT
$
```

b. Access the DUP driver by setting host to the device you want to write-protect.

```
SET HOST/DUP/SERVER=MSCP$DUP/TASK=PARAMS <node_name>
```

where <node_name> is the device node name. It is listed, in parentheses, in the SHOW DEVICE DI display.

2. At the PARAMS> prompt, enter SET WRT_PROT 1 to write-protect the ISE to which you are connected.

NOTE: *To verify that you set host to the intended drive, enter the command LOCATE at the PARAMS> prompt. That command causes the drive's Fault indicator to blink momentarily.*

3. Enter SHOW WRT_PROT to verify that the WRT_PROT parameter is set to 1.

4. Enter WRITE at the PARAMS> prompt to save the device parameter. The change is recorded in nonvolatile memory.

5. Enter EXIT at the PARAMS> prompt to exit DUP.

This is an example of setting a hardware write-protect through firmware.

```
>>>SET HOST/DUP/DSSI/BUS:0 1 PARAMS
Starting DUP server...
Copyright (c) 1992  Digital Equipment Corporation
PARAMS>SET WRT_PROT 1
PARAMS>WRITE
PARAMS>SHOW WRT_PROT
Parameter     Current           Default         Type      Radix
--------- ----------------  ----------------  --------  -----
WRT_PROT                1                 0   Boolean     0/1
PARAMS>EXIT
Exiting...
Stopping DUP server...
>>>
```

This is an example of setting a hardware write-protect through VMS.

```
$ MCR SYSGEN
SYSGEN> CONNECT/NOADAPTER FYA0
SYSGEN> EXIT
$ SET HOST/DUP/SERVER=MSCP$DUP/TASK=PARAMS R35F3C
Starting DUP server...
Copyright (c) 1992  Digital Equipment Corporation
PARAMS>SET WRT_PROT 1
PARAMS>WRITE
PARAMS>SHOW WRT_PROT
Parameter     Current           Default         Type      Radix
--------- ---------------  ---------------  --------  -----
WRT_PROT                1                0   Boolean     0/1
PARAMS>EXIT
Exiting...
Stopping DUP server...
$
```

To remove hardware write-protection, repeat the procedure but set WRT_PROT to 0.

You can verify that the device is write-protected while running VMS:

- If you issue the VMS command SHOW DEVICE DI, a write-protected drive shows a device status of `Mounted wrtlck`.
- If you issue the VMS command SHOW DEVICE/FULL, a write-protected drive is listed as `software write-locked`.

NOTE: *You cannot remove hardware write-protection by using the VMS MOUNT command.*

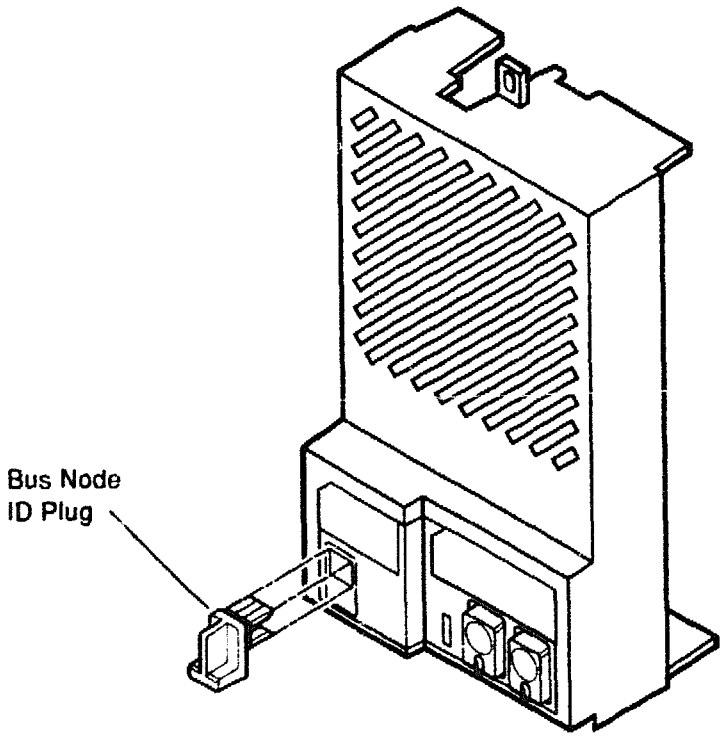
3.1.1.3 Changing the Bus Node ID Plugs

Spare bus node ID plugs are supplied with your system. Use them to renumber your ISEs:

- If you reconfigure your system with an expander
- If you create a DSSI VAXcluster configuration

The ID plugs have prongs on the back that indicate the bus node number (unit number) of the ISE.

- To remove a plug, grasp it firmly and pull straight out.
- To insert a plug, align the two center prongs with the two center slots and press the plug into the slots.



Use these rules for renumbering your storage devices.

- For each DSSI bus, do not duplicate bus node numbers for your storage devices/adapters. For Bus 0, you can have only one device identified as node 0, one device as 1, and so on. For Bus 1 you can have only one device identified as node 0, one device as 1, and so on.
- That rule also applies to DSSI VAXcluster configurations. All DSSI bus node numbers for storage devices and DSSI adapters must be unique in a shared DSSI bus.
- The RF-series ISEs are numbered in increasing order from right to left beginning with zero.
- DSSI adapters use the highest available bus nodes. The next highest available node (usually five) is reserved for a TF-series tape drive.
- If more than one DSSI bus is used and your system is using a nonzero allocation class, assign new MSCP unit numbers for devices on all but one of the DSSI busses. The unit numbers for all DSSI devices connected to a system's associated DSSI busses must be unique. Refer to Appendix B for more information on setting parameters for DSSI devices.

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

3.1.2 TF-Series Tape Drive

The TF-series tape drive is behind the upper door of your system. To use the drive, turn the key to the top position and open the door.

The tape drive holds one removable magnetic tape cartridge.

- The drive can read data written on a CompacTape III, CompacTape II, or CompacTape cartridge.
- The drive cannot write to a CompacTape II or CompacTape cartridge.
- You must use a CompacTape III cartridge to make copies or backups of software or data.

To put it another way:

CompacTape	CompacTape II	CompacTape III
Read	Read	Read/Write

NOTE: *The tape drive can read cartridges recorded by TK-series tape drives, as well as by TZ30 and TZK50 tape drives. Tapes written on a TF-series drive can be read only on that drive.*

You can identify the type of cartridge by its label.

TF-series Tape Drive Controls and Indicators

The tape drive has two primary controls: the cartridge insert/release handle (subsequently referred to as the handle) and the Unload button.

- You use the handle to insert or remove cartridges and lock them in position: Pull the handle open to insert or remove a cartridge. Push the handle closed to lock a cartridge in position and load the tape.
- You use the Unload button to rewind and unload the tape. Rewinding and unloading can also be controlled by software. Refer to your system software manuals for appropriate commands.

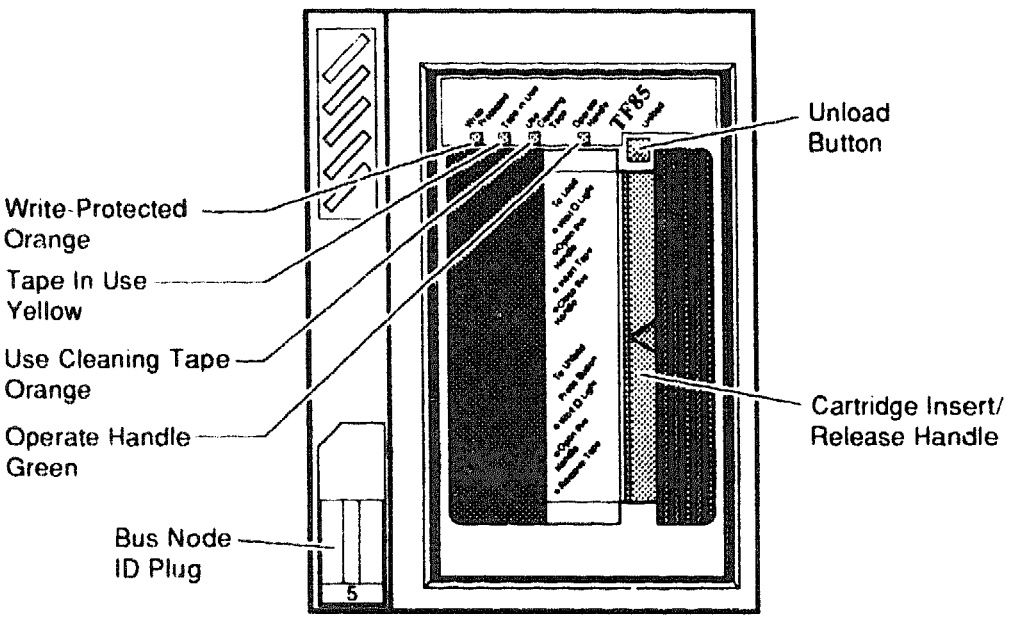
A bus node ID plug on the drive's front panel identifies the bus node number (unit number) of the device to your system.

NOTE: *Refer to Appendix B for information on setting or examining parameters for DSSI devices.*

The drive has four indicator lights that show its status.

- Write Protected (Orange): A steady light means the cartridge is write-protected.
- Tape in Use (Yellow): A steady light means the tape is loaded. A blinking light means the tape is in motion.
- Use Cleaning Tape (Orange): A steady light means the drive needs cleaning.
- Operate Handle (Green): A steady light means you can move the handle to insert or remove tape. A blinking light means a cartridge load fault. You can move the handle when the light is blinking.

All four lights blinking simultaneously indicates a fault condition.



MLO-006543

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

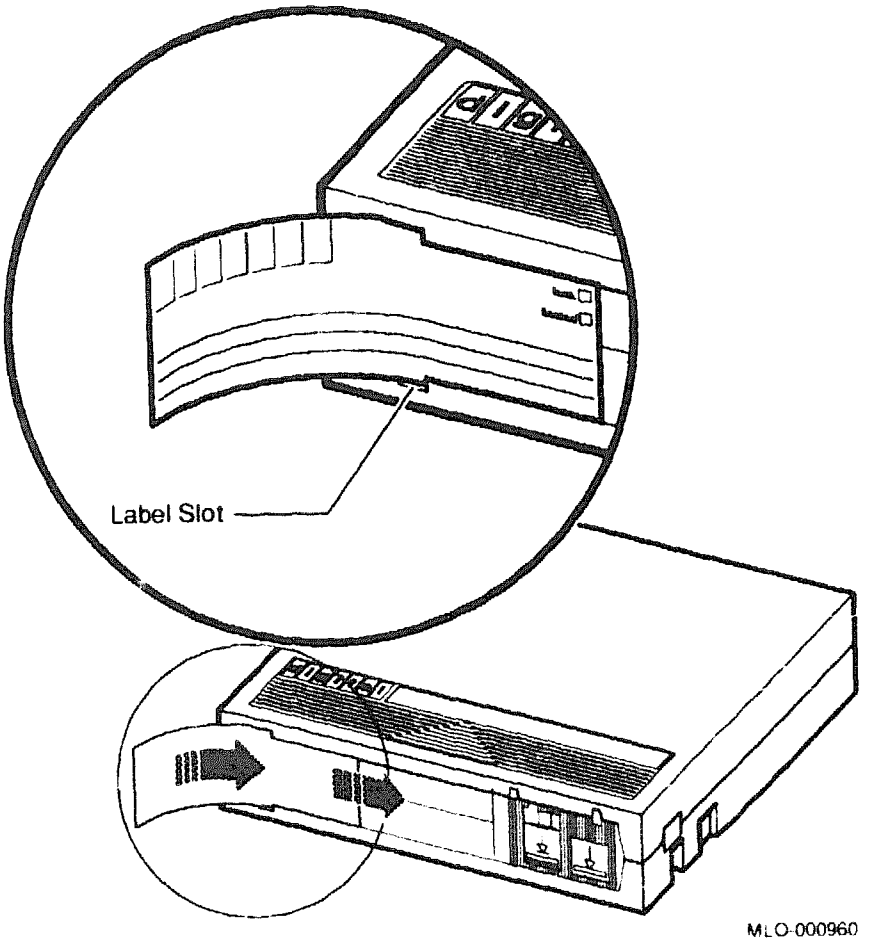
3.1.2.1 Operation of the Drive

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

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

3.1.2.2 Labeling a Tape Cartridge

After recording data in a cartridge, label its contents. A slot for the label is on the front of the cartridge. Write your identification on the label and insert it in the slot.



The label is visible when the tape is in the drive.

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

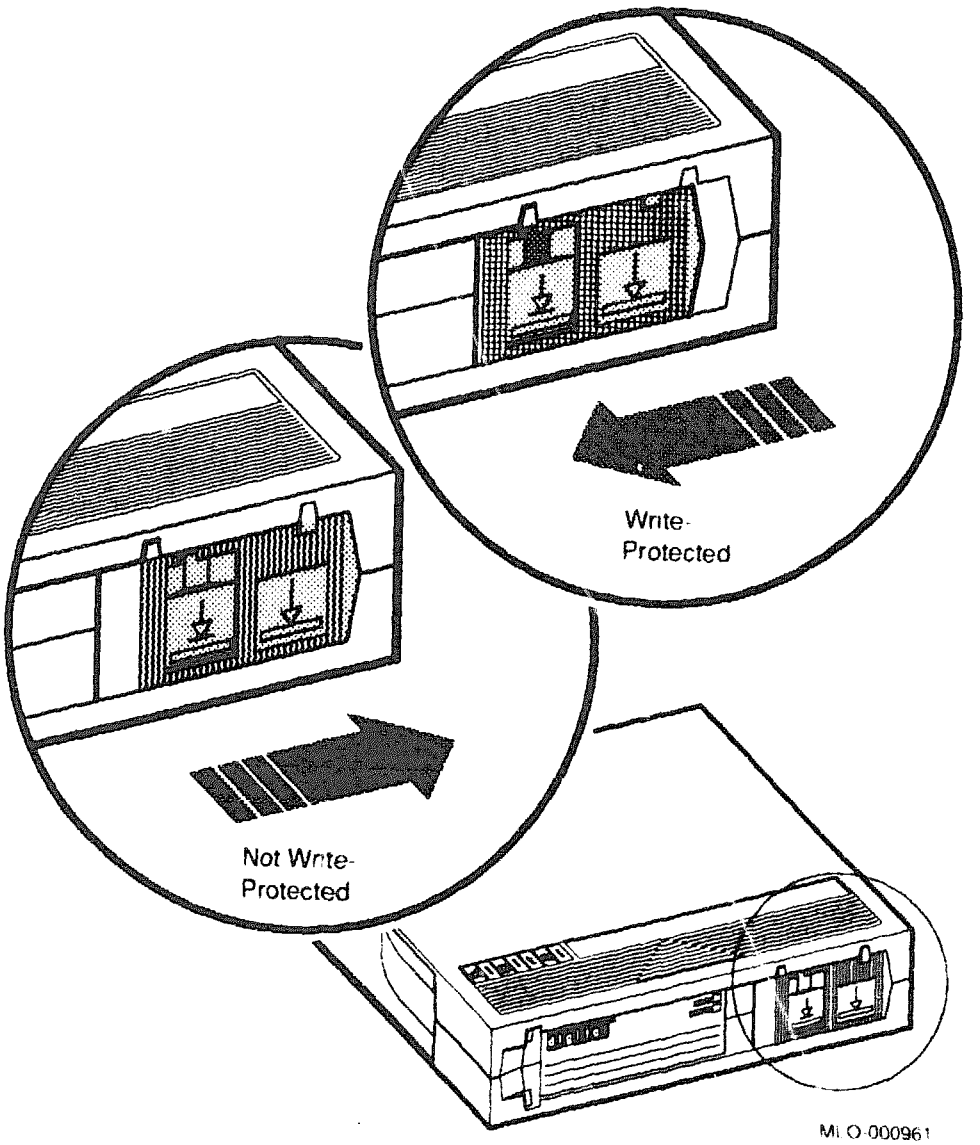
3.1.2.3 Write-Protecting a Tape Cartridge

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

- Set the write-protect switch on the cartridge to the write-protect position.
- Write-protect the cartridge by using operating system commands described in your system software manuals.

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

When you use a tape cartridge to install software, make sure the cartridge is write-protected. Two icons on the switch indicate the write-protect status.



An orange rectangle is visible when the switch is in the write-protect position. If you do not see an orange rectangle, slide the switch toward the label slot.

When you insert a write-protected cartridge into the drive, the orange Write Protected indicator lights. Your system recognizes the tape as being write-protected when:

- The write-protect switch on the cartridge is set to the write-protect position.
- An operating system command write-protected the tape.
- A tape recorded on a TK-series drive is inserted into the drive.

Removing write-protection depends on how the tape was recorded and how it is write-protected.

- You cannot write-enable a tape recorded on a TK50/TK70 drive by moving the write-protect switch on the cartridge or by using software commands.
- The TF-series tape drive always recognizes a tape recorded on a TK50 /TK70 drive as write-protected.

You can remove write-protection on tapes recorded on a TF-series drive as follows.

- If the cartridge is write-protected by the write-protect switch on the cartridge and not by the operating system, moving the switch to the write-enabled position causes the Write Protected indicator light to go out.
- If the cartridge is write-protected by a software command and not by the write-protect switch, removing the operating system restriction causes the Write Protected indicator to go out.
- If the cartridge is write-protected by the write-protect switch and a software command, you must change the switch setting and remove the operating system restriction.

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

3.1.2.4 Tape Cartridge Handling and Storage Guidelines

- Do not touch the exposed surface of the tape.
- Do not drop the tape cartridge. The impact from a fall can damage it.
- Let new tapes stabilize at room temperature for 24 hours before using them.
- Place an identification label only in the label slot on the front of the tape cartridge.
- Store tape cartridges in a dust-free environment.
- Keep tape cartridges away from direct sunlight, heaters, and other sources of heat.
- Store tape cartridges in a stable temperature between 10° and 40°C (50° and 104°F).
- Store tape cartridges where the relative humidity is between 20 and 80 percent.
- Keep tape cartridges away from magnets and equipment that generate magnetic fields, such as motors, transformers, terminals, and audio equipment.
- Keep tape cartridges away from x-ray equipment.

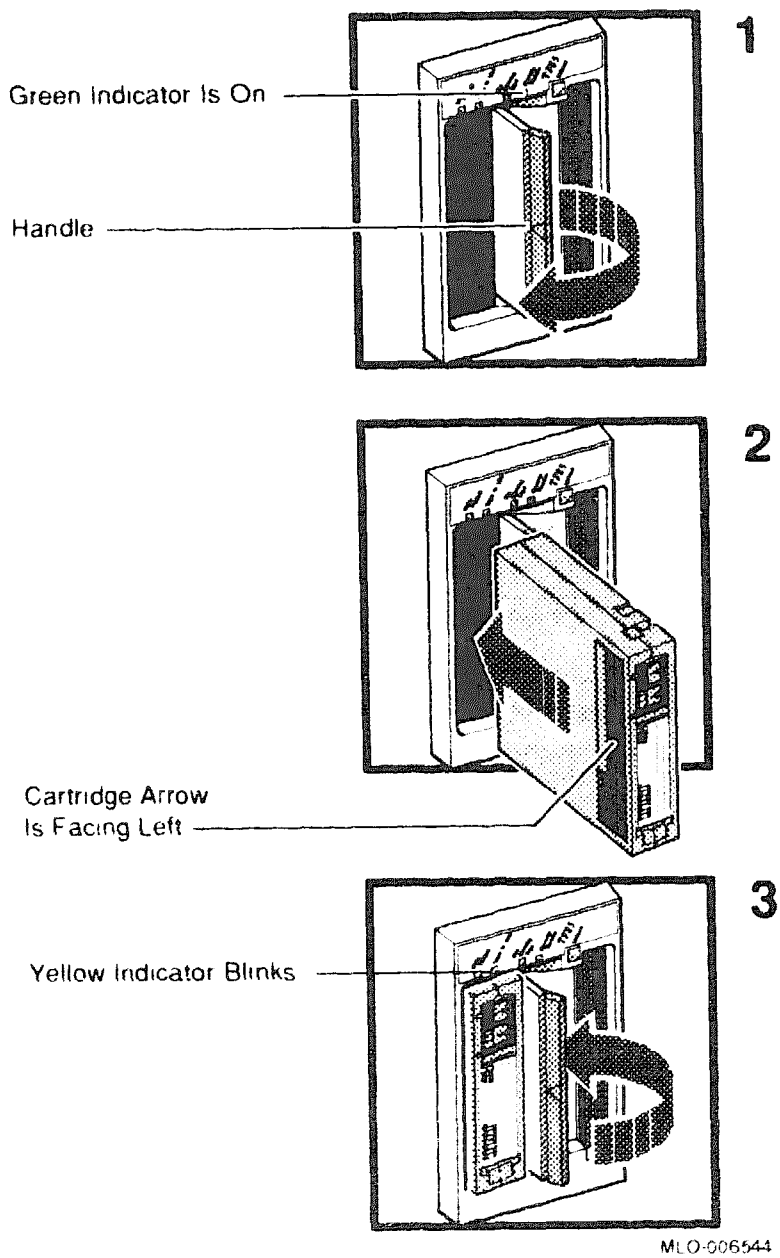
3.1.2.5 Inserting a Tape Cartridge in TF-Series Drive

Before you use the tape drive, make sure your system is turned on. During power-up, the drive runs self-tests that last a few seconds. All four indicator lights come on momentarily, then the yellow (Tape in Use) light blinks during the self-tests. At the end of the tests, the yellow light goes off and the green (Operate Handle) light comes on, accompanied by a short beep. The green light and the beep indicate that you can move the cartridge handle.

CAUTION: *Move the handle only when the green indicator light is on. Moving the handle when the yellow indicator light is on can damage the drive.*

If all four indicators blink rapidly at any time, a fault condition exists. Press the Unload button once. If the fault is cleared, the tape unloads. The yellow indicator blinks during unloading, then the green indicator comes on. If the fault is not cleared, the four indicators continue to flash. Do not attempt to use the drive or to remove the cartridge. Call your Digital service representative.

Use the following procedure to insert a tape cartridge.



1. Pull the drive handle open.
2. Hold the cartridge so the arrow on the cartridge faces left and points toward the drive. Then insert the cartridge into the drive until you feel the cartridge lock in place.
3. Push the drive handle closed.

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

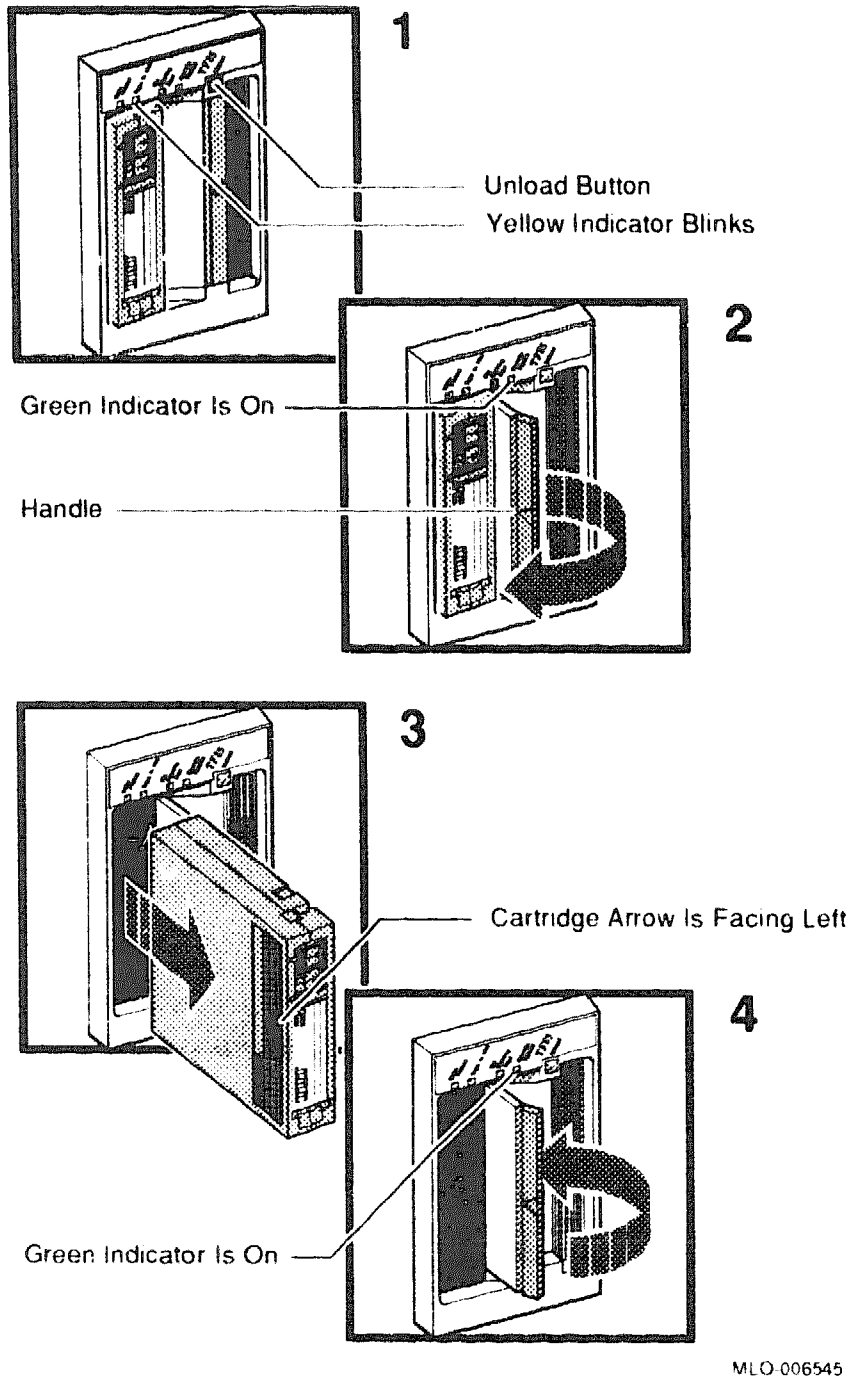
NOTE: *If the green indicator blinks rapidly after you push the handle closed, the drive has detected a cartridge fault. Pull the handle open and remove the cartridge. Use another cartridge.*

Refer to Appendix C for instructions on how to create backup files in a tape cartridge.

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

3.1.2.6 Removing a Tape Cartridge

You must unload a tape before you can remove the cartridge from the tape drive. Use the following procedure.



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

The yellow (Tape in Use) indicator blinks slowly, as the tape rewinds and unloads into the cartridge. That may take up to 90 seconds.

2. After the yellow indicator goes off and the green (Operate Handle) indicator comes on (and you hear a beep), pull the handle open.

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

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

4. Push the handle closed.

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

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

3.1.2.7 Summary of TF-Series Tape Drive Controls and Indicators

Table 3–2 summarizes the tape drive controls.

Table 3–2: TF-Series Tape Drive Controls

Control	Position	Function
Handle	Open	Lets you insert or remove tape after rewind and unload operations are completed.
	Closed	Locks tape in operating position and begins load sequence.
Unload button	Momentary contact switch	Rewinds and unloads tape.
Bus node ID plug	Installed	Identifies bus node ID number (unit number) of drive to system. Factory set to a number 0 through 6. Refer to Section 3.1.1.3 for instructions on changing bus node ID plugs.
	Not Installed	Drive bus node number is undefined. All four indicators light, indicating fault condition.

Table 3–3 describes the meaning of the indicators.

Table 3–3: TF-Series Tape Drive Indicators

Write Protected	Tape in Use	Use Cleaning Tape	Open Handle	Condition
Off	Off	Off	Off	No power to tape drive.
Off	Off	Off	On steadily	Safe to move handle. Power present.
Off	Off	Off	Blinking	Load fault. Cartridge leader may be defective. Pull out handle and remove cartridge. Do not use cartridge.
On/Off	On steadily	Off	Off	Tape loaded but not in motion.
On/Off	Blinking	Off	Off	Tape in motion.
On	On steadily/ blinking	Off	Off	Cartridge write-protected.
Off	Off	On	Off	Drive needs cleaning with CleaningTape III cartridge.
Blinking	Blinking	Blinking	Blinking	Fault occurring. Press Unload button to unload tape. If fault clears, yellow indicator blinks while tape rewinds. After green indicator comes on, you can move handle to remove cartridge. If fault persists, all four lights continue to blink. Do not remove cartridge. Call your Digital service representative.

3.1.2.8 Cleaning the TF-Series Tape

When the Use Cleaning Tape indicator lights, load a CleaningTape III cartridge as you would load a tape cartridge. When the cleaning is finished, the beeper sounds to tell you to unload the cleaning cartridge.

The CleaningTape III cartridge will perform 20 to 24 cleanings. When it expires, the Use Cleaning Tape indicator remains on.

NOTE: *If the Use Cleaning Tape indicator is not lit, the cleaning cartridge will not load.*

3.1.3 TK70 Tape Drive

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

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

You can use the tape drive as an input device to load software or data into your system. The drive can read data in cartridges written by TK50, TK70, TZ30, and TZK50 tape drives. (The TK50 drive records data in a format different from that of the TK70.)

You should use CompacTape II to make copies or backups of software or data. The TK70 drive cannot write to CompacTape or CompacTape II that was written by a TK50 tape drive.

TK70 Tape Drive Controls

The tape drive has two primary controls: the cartridge insert/release handle (subsequently referred to as the handle) and the Unload button. You use the handle to insert or remove cartridges and lock them in position.

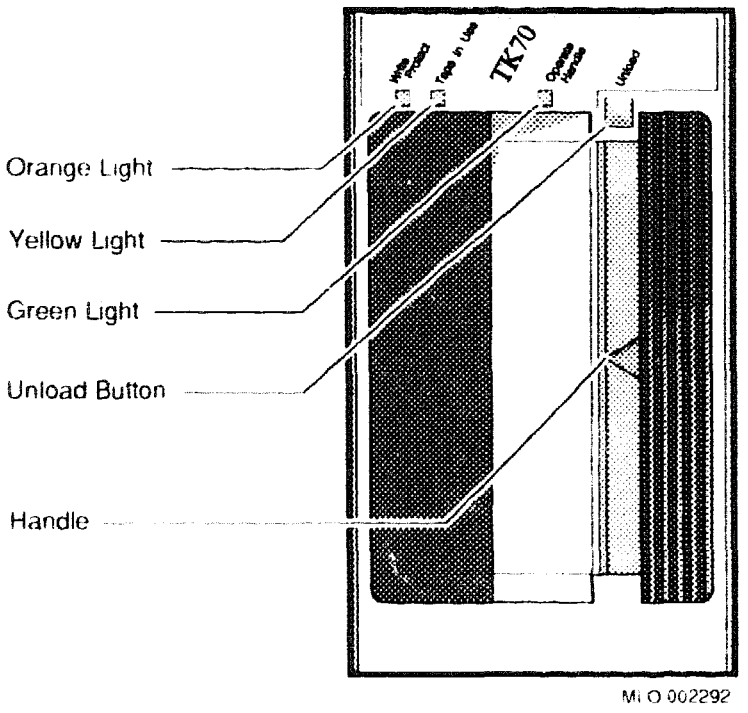
- Pull the handle open to insert or remove a tape cartridge.
- Push the handle closed to lock a tape cartridge in position and load the tape.

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

The drive has three indicator lights that show its status.

- Orange light (Write Protected): A steady light means the cartridge is write-protected.
- Yellow light (Tape in Use): A steady light means the tape is loaded. A blinking light means the tape is in motion.
- Green light (Operate Handle): A steady light means you can move the handle to insert or remove a cartridge. A blinking light means a cartridge load fault. You can move the handle when the light is blinking.

All three lights blinking simultaneously indicates a fault condition.



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

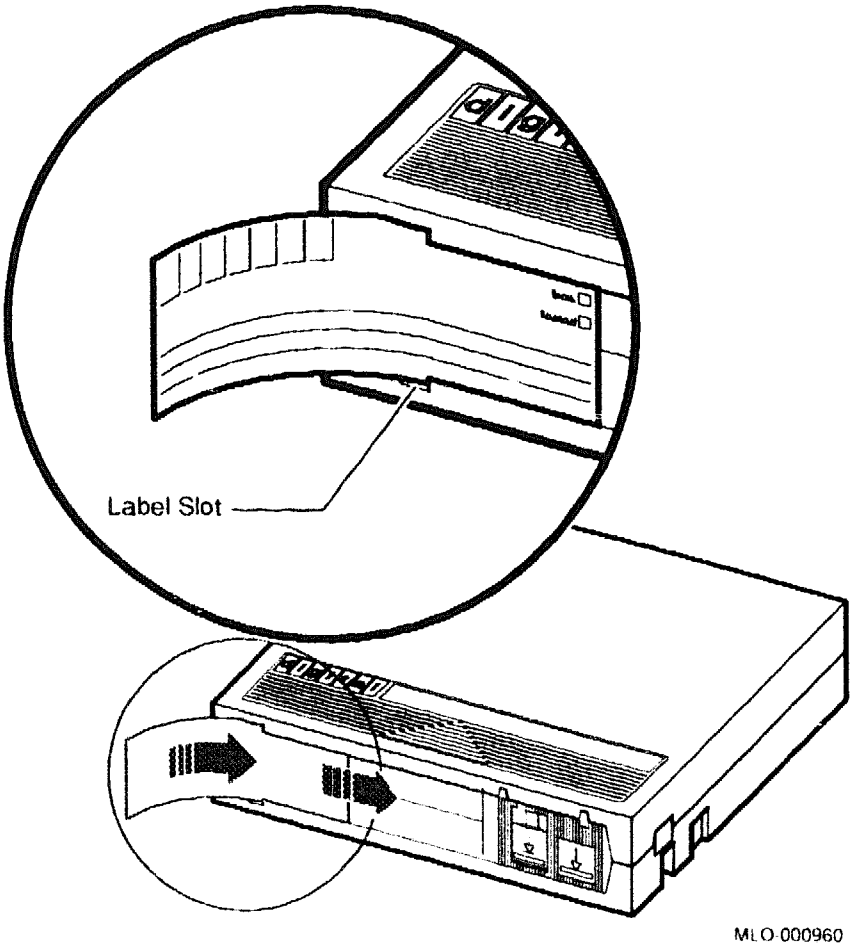
3.1.3.1 Operation of the Drive

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

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

3.1.3.2 Labeling a Tape Cartridge

After recording data in a cartridge, label its contents. A slot for the label is on the front of the cartridge. Write the identification on the label and insert the label in the slot.



The label is visible when the tape is in the drive.

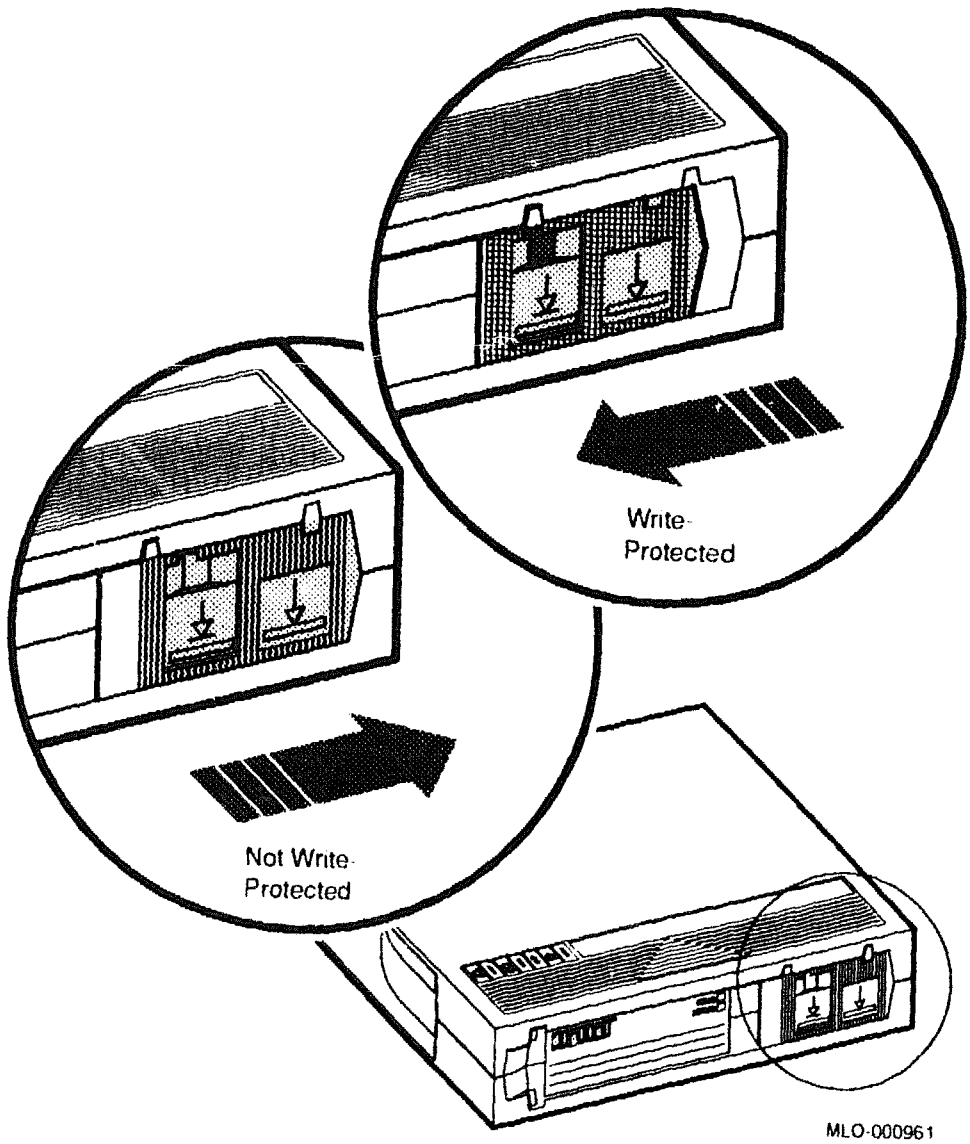
To indicate that the tape was recorded on a TK70 tape drive, check the box labeled 296MB. Use the 95MB box for tapes recorded on a TK50 drive.

CAUTION: *Do not write on the cartridge or attach labels to its top, bottom, or sides.*

3.1.3.3 Write-Protecting a Tape Cartridge

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

- Set the write-protect switch on the cartridge to the write-protect position.
- Use operating system commands described in your system software manuals.



Your system can read information on the tape regardless of the position of the write-protect switch or whether writing is software-disabled. However,

your system cannot write data to the tape when the write-protect switch is set to the write-protect position or when writing is software disabled.

Before installing software, make sure the cartridge is write-protected. Two icons on the switch indicate the write-protect status. An orange rectangle is visible when the switch is in the write-protect position. If you do not see an orange rectangle, slide the switch toward the label slot.

After you insert a write-protected cartridge into the drive, the orange indicator light comes on. Your system recognizes the tape as being write-protected under any one of these conditions.

- The write-protect switch on the cartridge is set to the write-protect position.
- An operating system command write-protected the tape.
- A tape recorded on a TK50 drive is inserted into the drive.

Removing write-protection depends on how the tape was recorded and how it is write-protected.

- You cannot write-enable a tape recorded on a TK50 drive by moving the write-protect switch on the cartridge or by using software commands.
- The TK70 drive recognizes a tape recorded on a TK50 drive as write-protected.

To remove write-protection on tapes recorded on a TK70 drive:

- If the cartridge is write-protected by the write-protect switch on the cartridge and not by a software command, moving the switch to the write-enabled position causes the orange light to go out at the end of the executing command.
- If the cartridge is write-protected by a software command and not by the write-protect switch, removing the operating system restriction causes the orange light to go out.
- If the cartridge is write-protected by the switch on the cartridge and a software command, you must change the switch setting and remove the operating system restriction.

When you use a CompacTape II cartridge to make a backup copy of files:

- Make sure the orange write-protect light on the TK70 drive is off.
- If the light is not off, check for any of the write-protect conditions listed above.

- Change the switch setting and/or operating system restriction as necessary.

Do not begin your operation until the orange light goes off.

3.1.3.4 Tape Cartridge Handling and Storage Guidelines

- Do not touch the exposed surface of the tape.
- Do not drop the cartridge. The impact from a fall can damage it.
- Let new tapes stabilize at room temperature for 24 hours before using them.
- Place an identification label only in the label slot on the front of the cartridge.
- Store cartridges in a dust-free environment.
- Keep cartridges away from direct sunlight, heaters, and other sources of heat.
- Store cartridges in a stable temperature between 10° and 40°C (50° and 104°F).
- Store cartridges where the relative humidity is between 20 and 80 percent.
- Keep cartridges away from magnets and equipment that generate magnetic fields, such as motors, transformers, terminals, and audio equipment.
- Keep cartridges away from x-ray equipment.

3.1.3.5 Inserting a Tape Cartridge

Before you use the tape drive, make sure your system is turned on. During power-up:

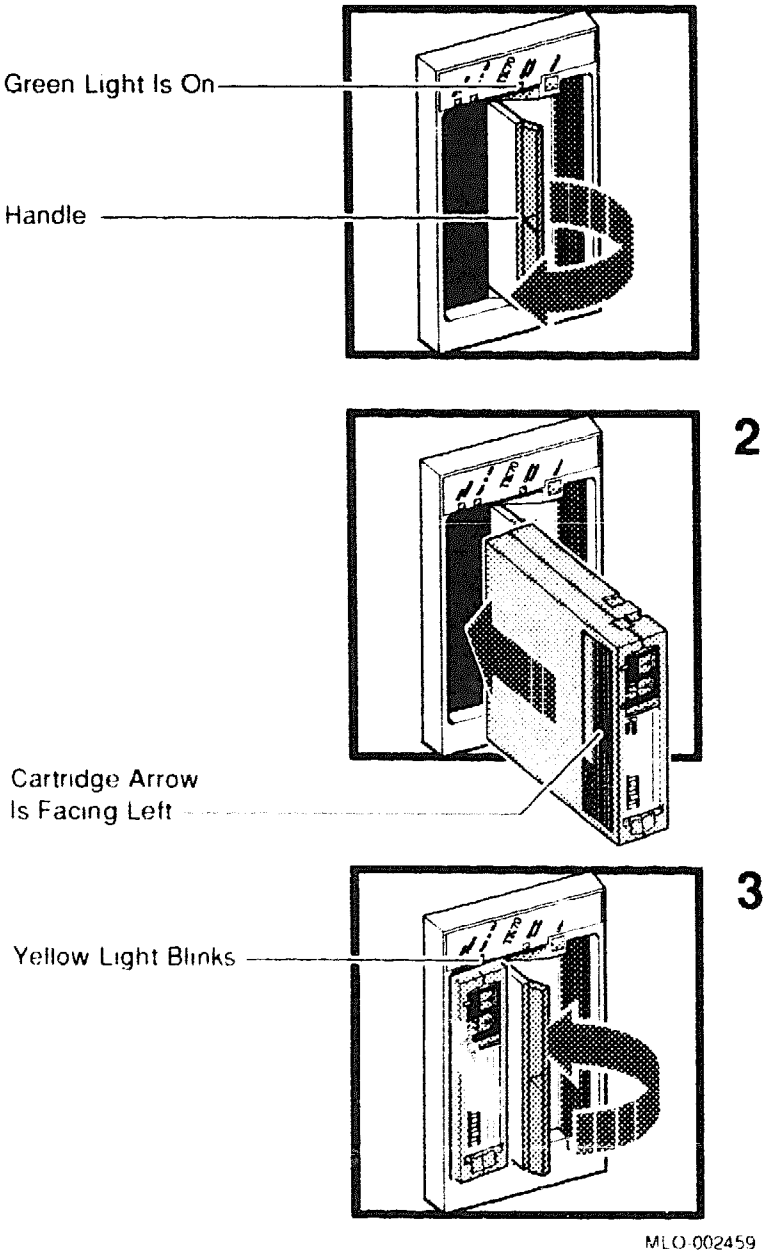
- The TK70 drive runs self-tests that last a few seconds. All three lights (orange, yellow, and green) come on momentarily, then the yellow (Tape in Use) light blinks during the self-tests.
- At the end of the tests, the yellow light goes off and the green (Operate Handle) light comes on, accompanied by a short beep.

The green light and the beep indicate that you can move the cartridge release handle.

CAUTION: *Move the handle only when the green indicator light is on. Moving the handle while the yellow light is on can damage the drive. If*

all three lights blink rapidly at any time, a fault condition exists. Press the Unload button once. If the fault clears, the tape unloads. The yellow light blinks during unloading, then the green light comes on. If the fault does not clear, the three lights continue to flash. Do not use the drive or remove the cartridge. Call your Digital service representative.

Use the following procedure to insert a tape cartridge.



1. Pull the drive handle open.
2. Hold the cartridge so the arrow on the cartridge faces left and points toward the drive. Then insert the cartridge into the drive until you feel the cartridge lock in place.
3. Push the drive handle closed.

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

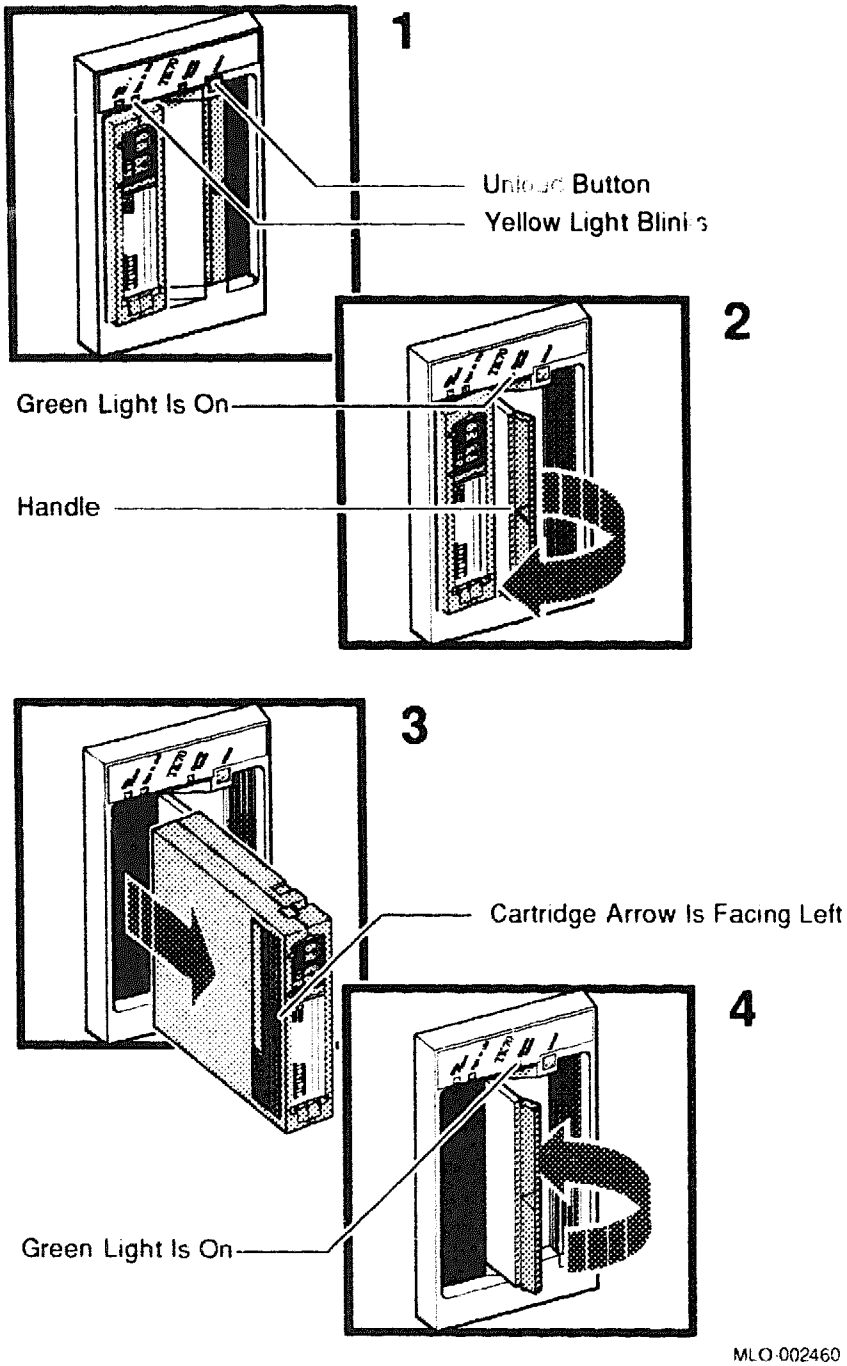
   NOTE: *If the green light blinks rapidly after you push the handle closed, the drive detected a cartridge fault. Pull the handle open and remove the cartridge. Use another cartridge.*

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

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

3.1.3.6 Removing a Tape Cartridge

You must unload a tape before you can remove the cartridge from the tape drive. Use the following procedure.



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

The yellow (Tape in Use) light blinks slowly as the tape rewinds and unloads into the cartridge. That may take up to 90 seconds.

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

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

3. Remove the cartridge and store it in its container.
4. Push the drive handle closed.

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

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

3.1.3.7 Summary of TK70 Tape Drive Controls and Indicator Lights

Table 3–4 summarizes the TK70 tape drive controls.

Table 3–4: TK70 Tape Drive Controls

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

Table 3–5 describes the meaning of the indicator lights.

Table 3–5: TK70 Tape Drive Indicator Lights

Orange	Yellow	Green	Condition
Off	Off	Off	No power to tape drive.
Off	Off	On steadily	Safe to move cartridge release handle. Power present.

Table 3–5 (Cont.): TK70 Tape Drive Indicator Lights

Orange	Yellow	Green	Condition
Off	Off	Blinking	Load fault. Cartridge leader may be defective. Pull out handle and remove cartridge. Do not use cartridge.
On/Off	On steadily	Off	Tape loaded but not in motion.
On/Off	Blinking	Off	Tape in motion.
On	On steadily/ blinking	Off	Cartridge write-protected.
Blinking	Blinking	Blinking	Fault occurring. Press Unload button. If fault clears, yellow light blinks while tape rewinds. After green light comes on, you can move handle to remove cartridge. If fault does not clear, all three lights continue to blink. Do not remove cartridge. Call your Digital service representative.

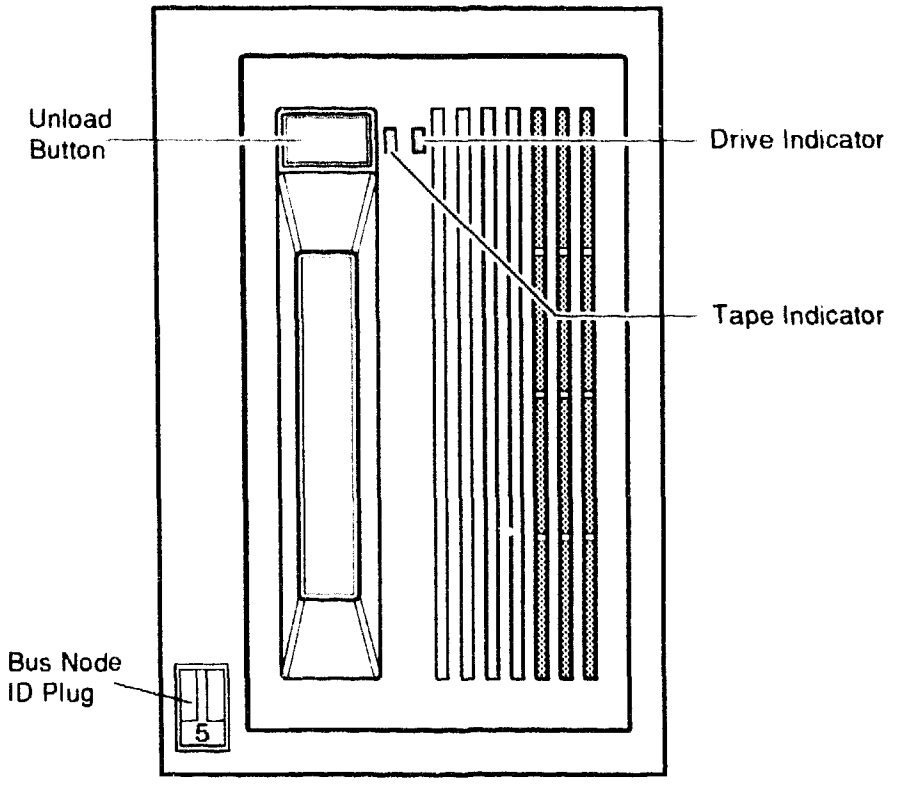
3.1.4 TLZ04 Tape Drive

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

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

The DDS/DAT format lets you back up 1.2 gigabytes of data in approximately 2 hours with no operator intervention. That format has three levels of error correction, which ensures high data integrity.

TLZ04 Tape Drive Controls and Indicators



NOTE: *The bus node ID plug for the TLZ04 tape drive uses the KZQSA-type plug and does not conflict with the bus node ID plugs for DSSI devices.*

Use the Unload button to eject the tape cassette. The Tape and Drive indicators show the status of the TLZ04 and can indicate error conditions.

CAUTION: *Pressing the Unload button during tape operations can halt the drive.*

Table 3–6 describes the TLZ04 drive indicators as they apply to normal operating conditions.

Table 3–6: TLZ04 Drive Indicators (Normal Conditions)

Indicator	Color(s)	Meaning
Tape	—	Indicates status of tape as follows.

Table 3–6 (Cont.): TLZ04 Drive Indicators (Normal Conditions)

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

Table 3–7 describes the TLZ04 drive indicators as they apply to abnormal operating conditions.

Table 3–7: TLZ04 Drive Indicators (Abnormal Conditions)

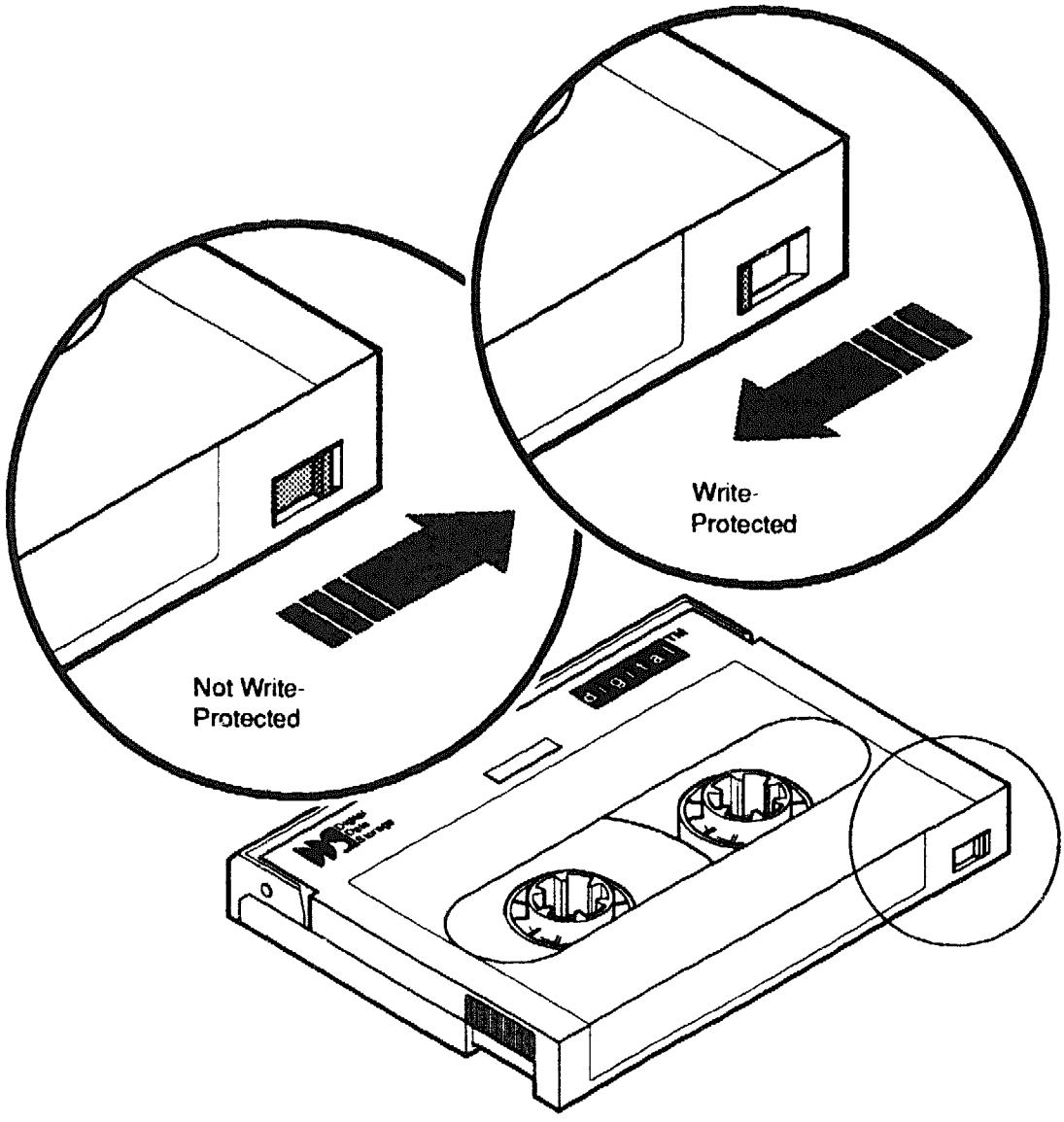
Indicator	Color(s)	Meaning
Tape	Slow flashing green or yellow	Excessive tape errors. Use head cleaning cassette. If failure repeats, use another tape.
	Flashing yellow 1-3 times	Power-up self-test failed.
Drive	Solid yellow	Power-up self-test failed.
Drive and Tape	Solid yellow	High humidity. Adjust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

3.1.4.1 Proper Handling of Cassette Tapes

- Avoid placing the tapes near sources of electromagnetic interference such as terminals and video or X-ray equipment. Emissions from such equipment can erase data on the tape.
- Keep tapes out of direct sunlight and away from heaters and other sources of heat.
- Store tapes (and cleaning cassette) where the room temperatures are between 5°C and 32°C (40°F and 90°F).
- Store tapes in a dust-free environment where the relative humidity is 20% to 60%.

3.1.4.2 Setting the Write-Protect Tab on the Cassette Tape

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



MLO-005329

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

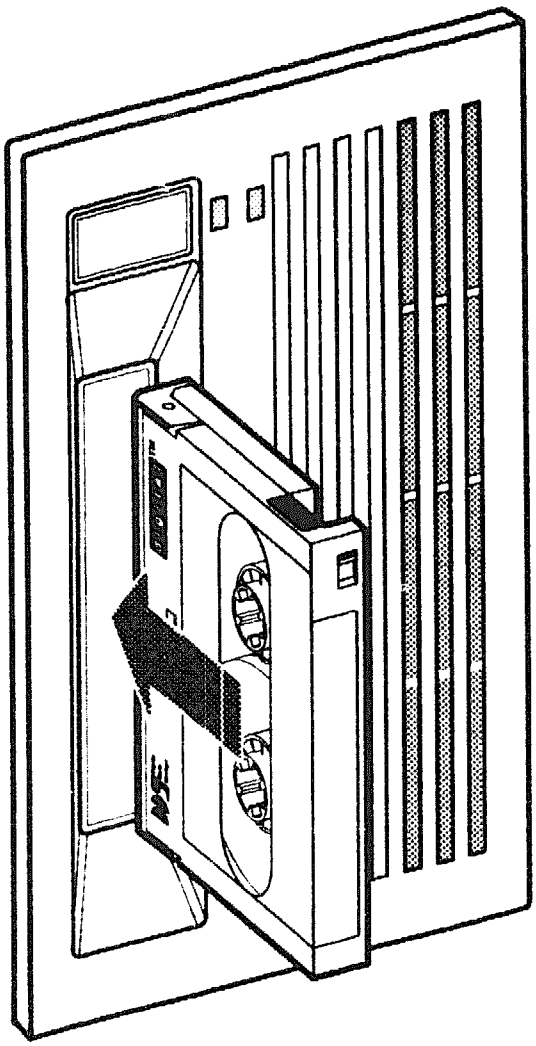
- If you are reading data (copying from tape), set the write-protect tab to write-protected.

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

The write-protect tab position displays in the front panel tape indicator.

3.1.4.3 Inserting a Cassette Tape into the Drive

Insert the TLZ04 cassette tape into the drive with the cassette's write-protect tab at the top.



MLO-005331

3.1.4.4 System Software

System software lets you execute commands to read and write data to and from the cassette tape. Your operating system documentation describes commands that let you:

- Back up data from disk drives to a tape drive
- Copy data from disk to tape or tape to disk

3.1.4.5 Cleaning the Heads

The heads are the components in a drive that magnetically read and write data to and from the medium (in this case, cassette tape).

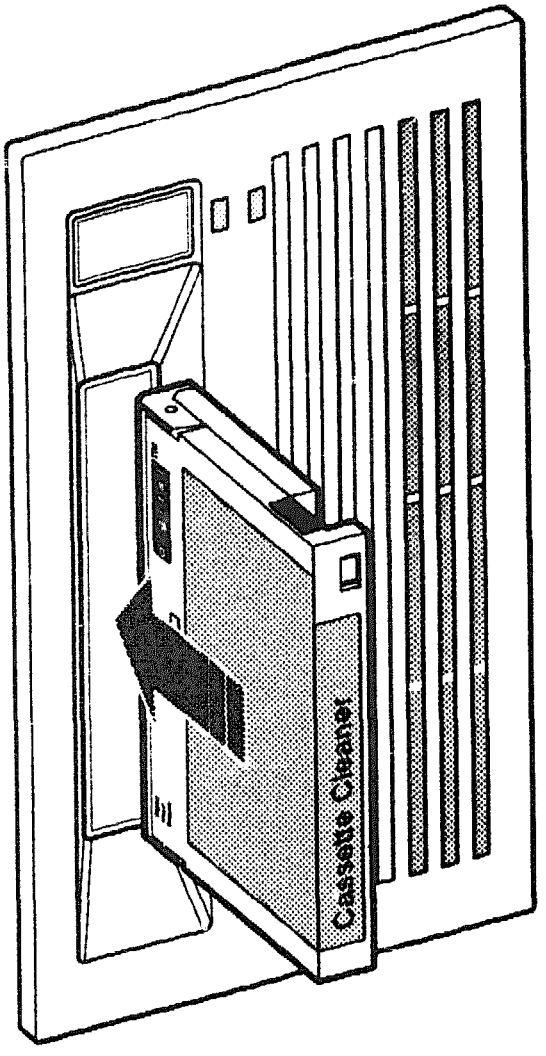
Over 90% of drive-related problems are associated with the medium. Therefore, you should follow the instructions for handling cassette tapes and cleaning the heads of the drive. This section shows you how to clean the TLZ04 heads.

NOTE: *You should perform the head cleaning procedure every 2 weeks or after every 25 hours of drive usage. Under normal conditions, you should not have to exceed that cleaning schedule. If a cassette causes problems, try changing to another cassette.*

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

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

1. Observe that the drive indicator is lit solid green.
2. Insert the head cleaning cassette (part TLZ04–HA) into the drive.



MLO-005332

The drive automatically uses the cassette to clean the heads for about 30 seconds and then ejects the cassette.

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

   Under normal conditions, you can use the head cleaning cassette for about 25 cleanings. If you try to use it more times than it was designed to be used, the drive will eject the cassette in 8 to 10 seconds. No cleaning action will occur.

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

Additional cassettes are available from your Digital sales representative or DECdirect.

3.1.5 Other Available Storage Subsystems

Your system may include one of these mass storage subsystems.

RRD40-series compact disc drive
RV20 optical disk
TSV05, TSZ07, or TU81E tape drive

Refer to your subsystem documentation for instructions on operating the device.

3.2 Communication Controller Options

The following types of communication controllers are available for your system.

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

3.2.1 Asynchronous Serial Controllers

The following asynchronous controllers are available for your system, with or without modem support.

- CXA16—16-line multiplexer, Q–bus controller
- CXB16—16-line multiplexer
- CXY08—8-line multiplexer with modem control, Q–bus controller
- DFA01—2-line controller with integral modems, Q–bus controller
- Digital terminal server

3.2.1.1 Asynchronous Controllers Without Modem Support

Before using any peripheral device connected to a serial communication controller:

- Make sure the device is properly connected to your system.
- Make sure the device is properly installed, plugged into an appropriate power source, and turned on.
- Make sure the device is properly set up.

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

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

3.2.1.2 Asynchronous Controllers With Modem Support

Serial devices with modem support require two modems: one connected to the system and one connected to the remote terminal. Both must be connected to phone lines.

Before using modems with your system:

1. Make sure each modem is connected to the system.
2. Make sure each modem is properly installed and connected to a phone jack.
3. Set the controls on each modem according to instructions in the modem user's guide.

Before using the modem connected to the remote terminal:

1. Make sure the modem is properly installed and connected to a phone jack.
2. Set the controls on the modem according to instructions in the modem user's guide.
3. Check the settings on the terminal attached to the modem.

   Depending on the type of modem and type of lines used, the baud rate can be 1200, 2400, 4800, or 9600. Other settings should be the same as those described in the previous section.

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

3.2.2 Synchronous Controllers

The following synchronous controllers are available for your system.

- DIV32—DEC Integrated Services Digital Network (ISDN) controller
- DPV11—Single-line programmable controller
- DSV11—Dual-line controller

Before using a synchronous controller you must verify the following.

- The system you want to communicate with has an appropriate synchronous controller.

  Synchronous communications require a synchronous controller on the transmitting system and the receiving system.

- The transmitting and receiving systems have supporting software installed.

  Synchronous communications operate under protocols that define how data is interpreted. Two common protocols are X.25 and PSI. Appropriate software is required to interpret the protocol.

3.2.3 Network Controllers

NOTE: *Your system contains an Ethernet controller embedded in the CPU module. You can have two additional Ethernet controllers, DESQA modules, included in your system.*

Before using a network controller:

1. Make sure the Ethernet cable (standard transceiver cable or ThinWire cable) is connected to the console module or optional DESQA module.

   The light next to the connector should be lit, indicating an active connection. If it is not lit, move the Ethernet Connector switch to the proper position.

2. Make sure the Ethernet cable is properly connected to the network.

   A transceiver cable can be connected in one of the following ways.

   - To an H4000 or H4005 transceiver in a traditional Ethernet

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

A ThinWire cable can be connected as follows.

- To a ThinWire Ethernet multiport repeater (DEMPR) or ThinWire single port repeater (DESPR) that can be connected to a larger Ethernet or can serve to connect many systems in a local area network
- To an available connection on a T-connector of other ThinWire node

3. Have the DECnet application installed on your system.
4. Register your node with the network manager so it will be recognized by other systems in the network.

Some software products (for example, Ethernet-based VAXcluster systems) use the Ethernet hardware address of other systems to operate properly.

To find the hardware address of your Ethernet device, use the command SHOW ETHERNET from console mode. The hardware address of your Ethernet device displays on the terminal as shown in the following example.

```
>>>SHOW ETHERNET

EZA0 (08-00-2B-03-50-5C)
```

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

3.3 Real-Time Options

The following real-time options are available for your system.

- DRQ3B—High-speed interface with two unidirectional 16-bit data channels
- DRV1W—General purpose interface with one 16-bit input port, one 16-bit output port
- IEQ11—DMA controller that connects a Q–bus to two independent busses
- IBQ01—DMA controller that connects a Q–bus to RS–485 control
- AAV11–S—Digital-to-analog converter with DMA capability
- ADV11–S—Analog-to-digital converter with DMA capability

- KWV11–S—Programmable clock that can count from one to five frequencies
- AXV11—Input/output circuit board for analog devices
- ADQ32—Analog-to-digital converter with DMA capability

Before using a real-time controller, make sure the devices connected to the controller are properly set up. Refer to the documentation for the real-time device.

3.4 Printer Options

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

Your system has several printer options available. Consult your Digital sales representative for a list of printers and printer interface requirements.

3.5 Adding Options

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

- Power limitations
- Physical space limitations
- Bus limitations (ac/dc loading)

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

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

Appendix A
Related Documentation

Document	Order Number
Hardware Documentation	
KA680/KA690 CPU System Maintenance	EK–454AA–MG
KA680 CPU Module Technical Manual	EK–KA680–TM
RF-Series Integrated Storage Element User Guide	EK–RF72D–UG
DSSI VAXcluster Installation and Troubleshooting	EK–410AA–MG
Software Documentation	
Overview of VMS Documentation	AA–LA95A–TE
VMS Version 5.5 Upgrade and Installation Manual	AA–NG61D–TE
VMS Upgrade and Installation Supplement	AA–LB35B–TE
VMS Factory Installed Software User Guide	EK–A0377–UG
VMS VAXcluster Manual	AA–LA27A–TE
VMS Networking Manual	AA–LA48A–TE
Guide to DECnet–VAX Networking	AA–LA47A–TE
VAX/VMS Backup Utility Reference Manual	AA–Z407B–TE
Guide to VAX/VMS Disk and Magnetic Tape Operations	AI–Y506B–TE
VAX/VMS Mount Utility Reference Manual	AA–Z424A–TE
VAXELN Host System Guide	AA–JG87B–TE
VAXELN Run-Time Facilities Guide	AA–JM81B–TE

Documentation specific to supported options is listed with the option in your system *Technical Information* manual.

Appendix B
Programming Parameters for DSSI Devices

This appendix describes the console mode procedures for setting and examining parameters for DSSI devices.

NOTE: *Before you reprogram DSSI devices, you should have a good understanding of DSSI architecture and VAXcluster software operation. If you do not have that understanding, you should read the VMS manuals listed in Appendix A or call your Digital service representative.*

Two types of DSSI adapters are available for your system: an embedded DSSI adapter, which is part of the CPU, and the KFQSA adapter. The CPU has two embedded DSSI adapters: bus 0 and bus 1.

Each adapter provides a separate DSSI bus that can support up to eight nodes, where the adapter and each DSSI storage devices count as one node, hence each DSSI adpater can support up to seven DSSI storage devices (six DSSI storage devices for a two-system DSSI VAXcluster; five DSSI stroage devices for a three-system DSSI VAXcluster configuration). The adapters make a connection between the CPU and the requested device on their respective DSSI bus. Each DSSI device has its own controller and server that contain the intelligence and logic necessary to control data transfers over the DSSI bus.

B.1 DSSI Device Parameters

Six principal parameters are associated with each DSSI device:

- Bus Node ID
- ALLCLASS
- UNITNUM
- FORCEUNI
- NODENAME
- SYSTEMID

NOTE: *Each of the above parameters, with the exception of the Bus Node ID, are programmed and examined using the console-based Diagnostic and Utility Program (DUP) driver utility. The Bus Node ID is physically determined by the numbered bus node ID plug that inserts into the device's front panel.*

A brief description of each parameter follows.

The Bus Node ID parameter is provided by the bus node ID plug on the device's front panel. Each DSSI bus can support up to eight nodes, 0–7. Each DSSI adapter and each device count as a node. Hence, in a single-system configuration, a DSSI bus can support up to seven devices, bus nodes 0–6 (with node 7 reserved for the adapter); in a two-system DSSI VAXcluster configuration, up to six devices, 0–5 (with nodes 6 and 7 reserved for the adapters); in a three-system DSSI VAXcluster configuration, up to five devices, 0–4 (with nodes 5, 6, and 7 reserved for the adapters). Refer to Chapter 3 for instructions on changing bus node ID plugs.

The ALLCLASS parameter determines the device allocation class. The allocation class is a numeric value from 0 to 255 that is used by the VMS operating system to derive a path-independent name for multiple access paths to the same device. The ALLCLASS firmware parameter corresponds to the VMS SYSGEN parameter ALLOCLASS.

DSSI devices are shipped from the factory with a default allocation class of zero. Each device to be served to a cluster should have a nonzero allocation class that matches the allocation class of the system. Refer to the *VMS VAXcluster* manual for rules for specifying allocation class values.

The UNITNUM parameter determines the unit number of the device. By default, the device unit number is supplied by the bus node ID plug on the device's front panel. Systems with multiple DSSI busses, as described later in this section, require that the default values be replaced with unique unit numbers. To set unit numbers and override the default values, you use the console-based DUP driver utility to supply values to the UNITNUM parameter and to set a value of zero to device parameter FORCEUNI.

The FORCEUNI parameter controls the use of UNITNUM to override the default device unit number supplied by the bus node ID plug. When FORCEUNI is set to a value of zero, the operating system uses the value assigned to the UNITNUM parameter; when FORCEUNI is set to a value of one, the operating system uses the value supplied by the bus node ID plug.

The NODENAME parameter allows each device to have an alphanumeric node name of up to eight characters. DSSI devices are shipped from the

factory with a unique identifier, such as R7CZZC, R7ALUC, and so on. You can provide your own node name.

The SYSTEMID parameter provides a number that uniquely identifies the device to the operating system. That parameter may need to be modified only when replacing a device. Only Digital service representatives and licensed self-maintenance customers should remove devices.

B.2 How VMS Uses the DSSI Device Parameters

This section describes how the operating system uses the parameters to form unique identifiers for each device. Configurations that require you to assign new unit numbers for devices are also described.

With an allocation class of zero, the operating system can use the default parameter values to provide each device with a unique device name. The operating system uses the node name along with the device logical name in the following manner.

NODENAME$DIA*u*

where NODENAME is a unique node name, and *u* is the unit number.

With a nonzero allocation class, the operating system relies on unit number values to create a unique device name. The operating system uses the allocation class along with the device logical name in the following manner.

$ALLCLASS$DIA*u*

where ALLCLASS is the allocation class for the system and devices, and *u* is a unique unit number.

Using mass storage expanders, you can fill multiple DSSI busses: busses 0 and 1 supplied by the CPU, and a third and fourth DSSI bus using the KFQSA adapter. Each bus can have up to seven DSSI mass storage devices (bus nodes 0–6). When more than one bus is being used, and your system is using a nonzero allocation class, you need to assign new unit numbers for storage devices on all but one of the DSSI busses, as the unit numbers for all DSSI storage devices connected to a system's associated DSSI busses must be unique.

The following table illustrates the need to program unit numbers for a system using more than one DSSI bus and a nonzero allocation class. In the case of the nonzero allocation class, the operating system sees three of the ISEs as having duplicate device names, which is an error, as all unit numbers must be unique.

Allocation Class=0	Nonzero Allocation Class (Example: ALLCLASS=1)
R7BUCC$DIA0	1DIA0 * Duplicate 0
R7CZZC$DIA1	1DIA1 * Duplicate 1
R7ALUC$DIA2	1DIA2 * Duplicate 2
R7EB3C$DIA3	1DIA3 * Duplicate 3
TFDR1$MIA5	1MIA5
R7IDFC$DIA0	1DIA0
R7IBZC$DIA1	1DIA1
R7IKJC$DIA2	1DIA2
R7ID3C$DIA3	1DIA3
R7XA4C$DIA4	1DIA4
R7QIYC$DIA5	1DIA5
R7DA4C$DIA6	1DIA6

* Nonzero allocation class examples with an asterisk indicate duplicate device names. For one of the DSSI busses, the unit numbers need to be reprogrammed to avoid this error.

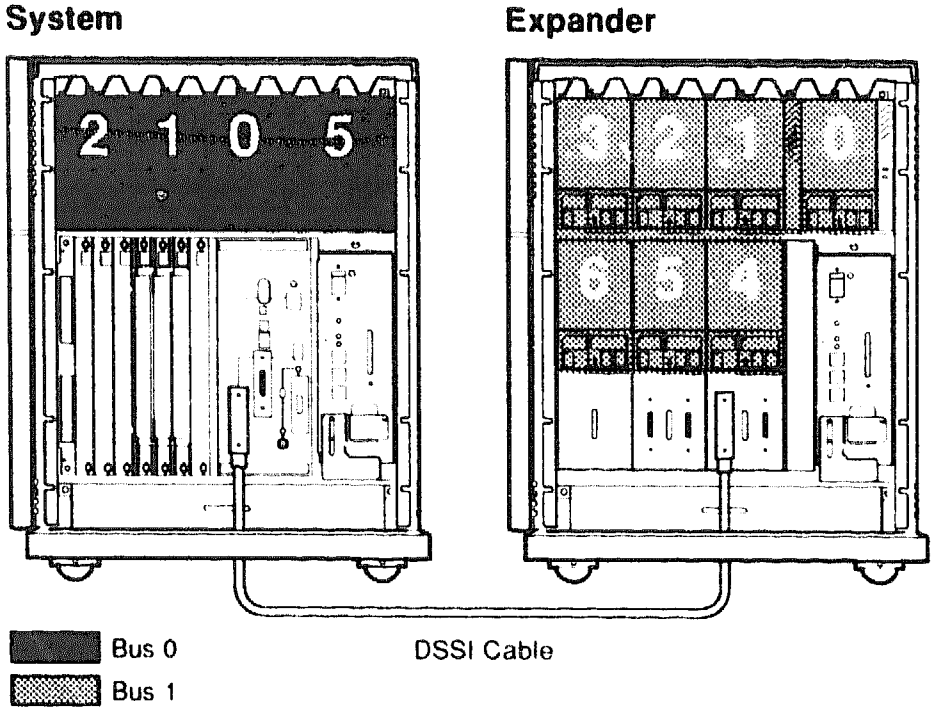
MLO-007176

NOTE: *You should configure your system to have unique unit numbers even if you have a standalone system using an allocation class of zero. That practice will avoid problems with duplicate device names if you later decide to form a cluster.*

B.3 Examining and Setting DSSI Device Parameters

The following instructions describe how to change DSSI parameters, using the DUP driver utility. In the example procedures, the allocation class will be set to 2, the devices for bus 0 (in the system) will be assigned new unit numbers (to avoid the problem of duplicate unit numbers), and the system disk will be assigned a new node name.

The following shows sample DSSI busses and bus node IDs for an expanded system.



NOTE: *Your system need not have the maximum number of devices, as do the examples in this appendix.*

1. Enter the console mode.

   The procedure for programming parameters for DSSI devices from console mode requires that you issue commands to those devices at the console prompt >>>. You may enter the commands in either uppercase or lowercase letters. Unless otherwise instructed, enter each command, then press Return.

   Enter console mode as follows.

   a. Set the Break Enable/Disable switch on the system console module to the enable position (up, position 1).

   b. Set the Power switch for each unit (both hosts for a dual-host system, and any expanders for expanded systems) to on (1).

   Wait for the system to display the console prompt (>>>).

2. To display the DSSI devices on embedded DSSI adapters, enter `SHOW DSSI` at the console prompt. To display the DSSI devices on KFQSA-based DSSI adapters, enter `SHOW UQSSP`.

The firmware displays two lines of information for each device. For embedded DSSI, the firmware displays the following.

- The first line contains the bus number, node number, and node name.
- The second line contains the device name and unit number followed by the device type in parentheses.

For embedded DSSI, the device name consists of the letters DIA*u* or DIB*u* (MIA*u* or MIB*u* for the TF-series tape drive—devices on bus 0 are listed as DIA, devices on bus 1 are listed as DIB—and *u* is a unique unit number. The embedded DSSI host adapter for each bus is identified by an asterisk (*).

The following embedded DSSI display shows a system with four DSSI devices (unit numbers 0–3) and an R400X expander with seven DSSI devices (unit numbers 0–6).

```
>>>SHOW DSSI
DSSI Bus 0 Node 0  (R7ALUC)
-DIA0  (RF73)
DSSI Bus 0 Node 1  (R7EB3C)
-DIA1  (RF73)
DSSI Bus 0 Node 2  (R7EB22)
-DIA2  (RF73)
DSSI Bus 0 Node 5  (TFDR1)
-MIA5  (TF85)
DSSI Bus 0 Node 6  (*)

DSSI Bus 1 Node 0  (SNEEZY)
-DIB0  (RF73)
DSSI Bus 1 Node 1  (DOPEY)
-DIB1  (RF73)
DSSI Bus 1 Node 2  (SLEEPY)
-DIB2  (RF73)
DSSI Bus 1 Node 3  (GRUMPY)
-DIB3  (RF73)
DSSI Bus 1 Node 4  (BASHFUL)
-DIB4  (RF73)
DSSI Bus 1 Node 5  (HAPPY)
-DIB5  (RF73)
DSSI Bus 1 Node 6  (DOC)
-DIB6  (RF73)
DSSI Bus 1 Node 7  (*)
>>>
```

For KFQSA-based DSSI, the firmware displays the following.

- The first line contains the UQSSP disk controller number and device node name.

- The second line contains the device name and unit number followed by the device type in parentheses.

For KFQSA-based DSSI, the device name consists of the letters DU*cu*, where *c* is the controller letter, and *u* is a unique unit number.

This shows a sample KFQSA-based DSSI bus.

```
>>>SHOW UQSSP
UQSSP Disk Controller 0 (772150)
-DUA0 (RF73)
UQSSP Disk Controller 1 (760334)
-DUB1 (RF73)
UQSSP Disk Controller 2 (760340)
-DUC2 (RF73)
UQSSP Disk Controller 3 (760322)
-DUD3 (RF73)
UQSSP Tape Controller 0 (774500)
-MUA0 (TK70)
```

For the examples in this appendix, each device will be assigned an allocation class of 2, and the system disk will be given a new node name. Also, devices DIA0, DIA1, and DIA2; and DUA0, DUB1, DUC2, and DUD3 will be assigned new unit numbers.

NOTE: *The DUP server examples throughout this appendix are for RF-series ISEs. The displays for the TF-series tape drive differ slightly from the RF-series displays.*

B.3.1 Entering the DUP Driver Utility

To examine and change DSSI parameters, you must first activate the DUP driver utility by setting host to the specific device for which you want to modify or examine parameters.

Use the following command for embedded DSSI.

```
SET HOST/DUP/DSSI/BUS:<bus_number> <node_number> PARAMS
```

where <bus_number> is the DSSI bus number (0 or 1), and <node_number> is the bus node ID (0–6) for the device on the bus.

Use the following command for KFQSA-based DSSI.

```
SET HOST/DUP/UQSSP/DISK <controller_number> PARAMS
```

where <controller_number> is the controller number (provided by the SHOW UQSSP display) for the device on the bus.

In the following example, SET HOST/DUP/DSSI/BUS:1 0 PARAMS is entered to start the DUP server for the ISE at node 0 of embedded DSSI bus 1.

```
>>>SET HOST/DUP/DSSI/BUS:1 0 PARAMS
Starting DUP server...
Copyright (c) 1991  Digital Equipment Corporation

PARAMS>
```

In this example, SET HOST/DUP/UQSSP/DISK 0 PARAMS is entered to start the DUP server for the ISE at controller 0 of a KFQSA-based DSSI bus.

```
>>>SET HOST/DUP/UQSSP/DISK 0 PARAMS
Starting DUP server...
Copyright (c) 1991  Digital Equipment Corporation

PARAMS>
```

B.3.2 Setting Allocation Class

After entering the DUP driver utility for a specified device, you can examine and set the allocation class for the device as follows.

1. At the PARAMS> prompt, enter SHOW ALLCLASS to check the allocation class of the ISE to which you are currently connected.
2. Enter SET ALLCLASS 2 (or enter the allocation class you desire).
3. Enter SHOW ALLCLASS to verify the new allocation class.

This example shows the steps for examining and changing the allocation class for a specified device. The allocation class is changed from 0 to 2.

```
PARAMS>SHOW ALLCLASS
Parameter      Current           Default         Type      Radix
---------  ----------------  ----------------  --------  -----
ALLCLASS                 0                 0      Byte     Dec    B

PARAMS>SET ALLCLASS 2
PARAMS>SHOW ALLCLASS

Parameter      Current           Default         Type      Radix
---------  ----------------  ----------------  --------  -----
ALLCLASS                 2                 0      Byte     Dec    B
```

B.3.3 Setting Unit Number

After entering the DUP driver utility for a specified device, you can examine and set the unit number for the device as follows.

1. At the PARAMS> prompt, enter SHOW UNITNUM to check the unit number of the ISE to which you are currently connected.

2. Enter SET UNITNUM 10 (or enter the unit number you desire).
3. Enter SET FORCEUNI 0 to override the default unit number value supplied by the bus node ID plug.
4. Enter SHOW UNITNUM to verify the new unit number.
5. Enter SHOW FORCEUNI to verify that the current value for the FORCEUNI parameter is 0.

   This shows the steps for changing the unit number of a specified device from 0 to 10.

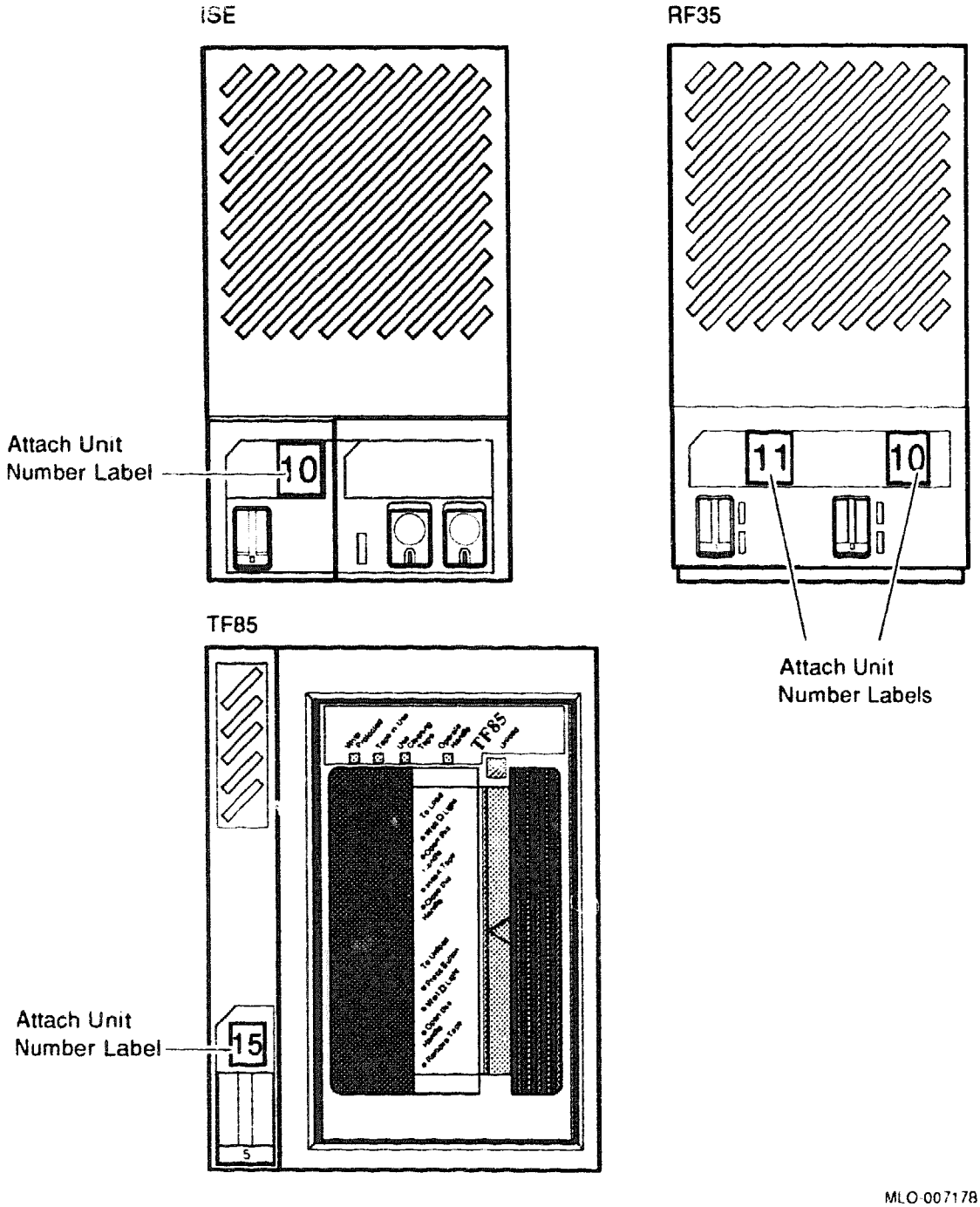
```
PARAMS>SHOW UNITNUM
Parameter      Current          Default          Type      Radix
---------  ----------------  ----------------  --------  -----
UNITNUM                   0                 0      Word     Dec    U

PARAMS>SET UNITNUM 10
PARAMS>SET FORCEUNI 0
PARAMS>SHOW UNITNUM

Parameter      Current          Default          Type      Radix
---------  ----------------  ----------------  --------  -----
UNITNUM                  10                 0      Word     Dec    U

PARAMS>SHOW FORCEUNI
Parameter      Current          Default          Type      Radix
---------  ----------------  ----------------  --------  -----
FORCEUNI                  0                 1   Boolean     0/1    U
```

6. Label the device with its unit number, using the unit number labels shipped with your system.


ISE
RF35
Attach Unit
Number Label
10
11
10
Attach Unit
Number Labels
TF85
TF85
Attach Unit
Number Label
15
5
MLO-007178

B.3.4 Setting Node Name

After entering the DUP driver utility for a specified device, you can examine and set the node name for the device as follows.

1. At the PARAMS> prompt, enter SHOW NODENAME to check the node name of the ISE to which you are currently connected.
2. Enter SET NODENAME SYSDSK (or enter the desired alphanumeric node name of up to eight characters).
3. Enter SHOW NODENAME to verify the new node name.

This shows the steps for changing the node name of a specified device from the factory-supplied name to SYSDSK.

```
PARAMS>SHOW NODENAME
Parameter      Current            Default          Type      Radix
---------  ----------------  ----------------  --------  -----
NODENAME          R7CZZC            RF73         String  Ascii   B

PARAMS>SET NODENAME SYSDSK

PARAMS>SHOW NODENAME

Parameter      Current            Default          Type      Radix
---------  ----------------  ----------------  --------  -----
NODENAME          SYSDSK            RF73         String  Ascii   B
```

B.3.5 Setting System ID

NOTE: *This parameter is modified only when replacing a device. Only Digital service representatives and licensed self-maintenance customers should remove devices. All parameters for the replacement device should be programmed to match those of the original device.*

After entering the DUP driver utility for a specified device, you can examine and set the system ID for the device as follows.

1. At the PARAMS> prompt, enter SHOW SYSTEMID to check the system ID of the device to which you are currently connected.
2. Enter SET SYSTEMID *System ID* (enter the desired serial number-based system ID).
3. Enter SHOW SYSTEMID to verify the new system ID.

This shows the steps for changing the system ID of a specified device from the factory-supplied ID to 1402193310841 (the system ID for the replacement device is programmed to match that of the original).

```
PARAMS>SHOW SYSTEMID
Parameter     Current           Default          Type      Radix
---------  ---------------  ---------------  --------  -----
SYSTEMID     0402193310841     0000000000000  Quadword    Hex   B

PARAMS>SET SYSTEMID 1402193310841

PARAMS>SHOW SYSTEMID

Parameter     Current           Default          Type      Radix
---------  ---------------  ---------------  --------  -----
SYSTEMID     1402193310841     0000000000000  Quadword    Hex   B
```

B.3.6 Exiting the DUP Server Utility

After you have completed setting and examining DSSI device parameters, enter the WRITE command at the PARAMS> prompt to save the device parameters you have changed using the SET command. The changes are recorded to nonvolatile memory.

If you have changed the allocation class or node name of a device, the DUP driver utility will ask you to initialize the controller. Answer Yes (Y) to allow the changes to be recorded and to exit the DUP driver utility.

If you have not changed the allocation class or node name, enter the EXIT command at the PARAMS> prompt to exit the DUP driver utility for the specified device.

This shows the procedure for saving parameter changes. The controller is initialized.

```
PARAMS>WRITE
Changes require controller initialization, ok? [Y/(N)] Y

Stopping DUP server...
>>>
```

NOTE: *You must repeat the procedures in this appendix for each device for which you want to change parameters.*

This example shows the DSSI busses for the embedded DSSI adapters after the unit numbers for the disk devices on bus 0 have been changed from 0, 1, and 2 to 10, 11, and 12. The bus 0 device names are now DIA10, DIA11, and DIA12.

```
>>>SHOW DSSI
DSSI Bus 0 Node 0 (SYSDSK)
-DIA10 (RF73)
DSSI Bus 0 Node 1 (R7EB3C)
-DIA11 (RF73)
DSSI Bus 0 Node 2 (R7EB22)
-DIA12 (RF73)
DSSI Bus 0 Node 5 (TFDR1)
-MIA5 (TF85)
DSSI Bus 0 Node 6 (*)

DSSI Bus 1 Node 0 (SNEEZY)
-DIB0 (RF73)
DSSI Bus 1 Node 1 (DOPEY)
-DIB1 (RF73)
DSSI Bus 1 Node 2 (SLEEPY)
-DIB2 (RF73)
DSSI Bus 1 Node 3 (GRUMPY)
-DIB3 (RF73)
DSSI Bus 1 Node 4 (BASHFUL)
-DIB4 (RF73)
DSSI Bus 1 Node 5 (HAPPY)
-DIB5 (RF73)
DSSI Bus 1 Node 6 (DOC)
-DIB6 (RF73)
DSSI Bus 1 Node 7 (*)
>>>
```

This shows the sample KFQSA-based DSSI bus after the unit numbers have been changed from 0, 1, 2, and 3 to 20, 21, 22, and 23. The device names are now DUA20, DUB21, DUC22, and DUD23.

```
>>>SHOW UQSSP
UQSSP Disk Controller 0 (772150)
-DUA20 (RF73)
UQSSP Disk Controller 1 (760334)
-DUB21 (RF73)
UQSSP Disk Controller 2 (760340)
-DUC22 (RF73)
UQSSP Disk Controller 3 (760322)
-DUD23 (RF73)
UQSSP Tape Controller 0 (774500)
-MUA0 (TK70)
```

Appendix C
Backup Procedures

This appendix describes the following procedures.

- Installing and booting standalone BACKUP on the system disk
- Installing and booting standalone BACKUP on a TK50 tape cartridge
- Backing up and restoring the system disk

C.1 Overview of Standalone BACKUP

The Backup utility lets you create and restore backup copies of files, directories, and user disks. Because the Backup Utility copies only what is on the disk and ignores sections of any open files contained in memory, you should use it to back up user disks, not the system disk. If you use the Backup Utility to back up the system disk, the portions of the files that were in memory and data about files not yet written back to the disk (cache) will not be recorded on the resulting backup copy.

Use standalone BACKUP to make a complete backup of the system disk. Standalone BACKUP is a version of the Backup Utility that runs without the support of the entire VMS operating system. Before you use standalone BACKUP, you must shut down the VMS operating system. The shutdown procedure sends the contents of the caches back to the disk and closes any open files. By shutting down the system and using standalone BACKUP, you can make an exact copy of the system disk.

You can keep standalone BACKUP on the system disk, a TK50 tape cartridge, or any other media the system supports. Digital recommends that you keep standalone BACKUP on the system disk and on a tape cartridge.

Usually you boot standalone BACKUP from the system disk because it saves time. You should, however, keep a copy of standalone BACKUP on a tape cartridge in case the system disk becomes damaged.

C.1.1 Installing Standalone BACKUP on the System Disk

You can install standalone BACKUP in any available root directory on the system disk from [SYS1] to [SYSE]. However, Digital has established [SYSE] as the standard directory for standalone BACKUP.

To install standalone BACKUP in [SYSE] on the system disk, use the following procedure.

1. Log in to the SYSTEM account.
2. Enter the following command.

   ```
   $ @SYS$UPDATE:STABACKIT SYS$SYSDEVICE: Return
   ```

   The procedure places the files in the directories [SYSE.SYSEXE] and [SYSE.SYS$LDR] on the system disk. It lists the files as they are copied. When the procedure finishes, the system displays the following message.

   ```
   The kit is complete.
   ```

3. To boot standalone BACKUP from the system disk, see Section C.1.2.

C.1.2 Booting Standalone BACKUP from the System Disk

To boot standalone BACKUP from the system disk, use the following procedure.

1. If the VMS operating system is not running, go to step 2.

   If the VMS operating system is running, enter the following command to shut down the system.

   ```
   $ @SYS$SYSTEM:SHUTDOWN Return
   ```

   Answer the questions. When the procedure asks if an automatic system reboot should be performed, press Return for No. When the procedure is finished, the system displays the following message.

   ```
   SYSTEM SHUTDOWN COMPLETE - USE CONSOLE TO HALT SYSTEM
   ```

2. Stop the system by pressing the Halt button on the SCP.
3. Enter the BOOT command in the following format.

   ```
   >>>B/E0000000 device_name Return
   ```

   Substitute the device name of the system disk for `device_name`. For example, if the system disk has a device name of DIA0, enter the following.

```
>>>B/E0000000 DIA0 Return
```

4. Standalone BACKUP displays a message similar to the following.

```
VAX/VMS Version V5.5-n Major version id = n Minor version id = n
```

5. A few minutes later the procedure asks for the date and the time. Enter the date and time, using the 24-hour clock format; for example:

```
PLEASE ENTER DATE AND TIME (DD-MMM-YYYY HH:MM)
19-APR-1991 13:00 Return
```

6. The system displays a list of the local devices on your system; for example:

```
Available device MIA5:      device type TF85
Available device DIA0:      device type RF31
      .
      .
      .
```

   Check the list of devices. If the list is incomplete, make sure that all the devices are connected properly to the system. See your system *Installation* manual for details.

7. When standalone BACKUP finishes booting, it displays an identification message followed by the dollar-sign prompt ($):

```
%BACKUP-I-IDENT, stand-alone BACKUP V5.5-n; the date is
  19-APR-1991 13:00:00.00
$
```

To back up the system disk, see Section C.2.

To restore the system disk, see Section C.3.

C.1.3 Installing Standalone BACKUP on a Tape Cartridge

If your system has a tape drive, Digital recommends that you keep standalone BACKUP on a tape cartridge in case the system disk becomes damaged. To install standalone BACKUP on a tape cartridge, use the following procedure.

NOTE: *If you have a tape cartridge distribution kit, you already have standalone BACKUP on a tape cartridge. If the original tape cartridge becomes damaged or if you need to make extra copies, use the procedure in this section.*

1. Obtain a blank tape cartridge. Write the name on the paper label. For example, you would use the name S/A BKUP V5.5–n TK85 to build a Version 5.5–n kit. Insert the label into the label slot.
2. Write-enable the tape cartridge.
3. Insert the tape cartridge labeled S/A BKUP V5.5–n TK85 in the tape cartridge drive.
4. Log in to the SYSTEM account.
5. Enter the following command.

```
$ @SYS$UPDATE:STABACKIT Return
```

6. The system asks for the name of the target device. Enter MIA5; for example:

```
%STABACKIT-I-SYMDEL, all global symbols deleted
Enter the name of the device on which to build the kit:
MIA5 Return
```

7. The system displays the following message.

```
      .
      .
      .
Please place the scratch tape cartridge in drive _MIA50:
This volume will receive the volume label SYSTEM.
Enter "YES" when ready:
```

8. When you are ready to continue, enter Y (for Yes) and press Return.
9. The system displays verification messages informing you that files are being copied.
10. When standalone BACKUP is installed, the system displays a message similar to the following.

```
Ending time   19-APR-1991 13:45:29.90
Starting time 19-APR-1991 13:22:39.05
The kit is complete.
$
```

11. Remove the tape cartridge labeled S/A BKUP V5.5–n TF85 from the tape cartridge drive.
12. Write-protect the tape cartridge and store it in a safe place.

C.1.4 Booting Standalone BACKUP from a Tape Cartridge

If the system disk containing standalone BACKUP should become unusable, you can boot standalone BACKUP from a tape cartridge. Booting standalone BACKUP from a tape cartridge takes approximately 20 minutes. You need a tape cartridge that contains standalone BACKUP (either the distribution tape cartridge or one that you created). To boot standalone BACKUP from a tape cartridge, use the following procedure.

1. If the VMS operating system is not running, go to step 2.

   If the VMS operating system is running, enter the following command to shut down the operating system.

   ```
   $ @SYS$SYSTEM:SHUTDOWN Return
   ```

   Answer the questions. When the procedure asks if an automatic system reboot should be performed, press Return for No. When the procedure is finished, the system displays the following message.

   ```
   SYSTEM SHUTDOWN COMPLETE - USE CONSOLE TO HALT SYSTEM
   ```

2. Stop the system by pressing the Halt button on the SCP.
3. Insert the tape cartridge containing standalone BACKUP in the tape cartridge drive.
4. To boot standalone BACKUP, enter the following command at the console prompt (>>>).

   ```
   >>>B MIA5 Return
   ```

   NOTE: *If your system uses the TLZ04 tape drive, enter the device name MKA0. If your system uses the TF85 tape drive, enter the device name MIA0.*

5. Standalone BACKUP displays a message similar to the following.

   ```
   VAX/VMS Version V5.5--n Major version id=1 Minor version id=0
   ```

6. The procedure asks for the date and the time. Enter the date and time, using the 24-hour clock format; for example:

   ```
   PLEASE ENTER DATE AND TIME (DD-MMM-YYYY HH:MM)
   19-APR-1991 13:00 Return
   ```

7. The system displays a list of the local devices on your system; for example:

```
Available device MIA5:      device type TK85
Available device DIA0:      device type RF31
     .
     .
     .
```

8. When standalone BACKUP finishes booting, it displays an identification message followed by the dollar-sign prompt ($):

```
%BACKUP-I-IDENT, stand-alone BACKUP V5.5--n; the date is
 19-APR-1991 13:00:00.00
$
```

9. Remove the tape cartridge containing standalone BACKUP from the tape cartridge drive.

To back up the system disk, see Section C.2.

To restore the system disk, see Section C.3.

C.2 Backing Up the System Disk

The reasons to back up a system disk are:

- In case a problem occurs during a VMS upgrade or update, or during the installation of other software products. Before you attempt any of these procedures, you should back up the system disk. If a problem occurs, you can restore the backup copy of the system disk.
- To prevent loss of system files if they are deleted accidentally. After you install or upgrade the VMS operating system or any other software products, you should back up the system disk. If a system file is deleted and renders the system disk inoperable, you can restore the backup copy and continue to use the system.
- In case the system disk malfunctions. If you have a backup copy of the VMS operating system, you can restore it to a functioning disk and continue to use the system.
- To eliminate disk fragmentation. It happens when files are not stored contiguously on the disk. Back up the system disk to a tape cartridge, diskettes, or another disk. Then restore the files to the original system disk. The BACKUP command creates a copy on which files are stored contiguously.

Digital recommends that you use standalone BACKUP, which uses a subset of Backup utility qualifiers, to back up and restore the system disk. It is especially important that you understand the functions of the /IMAGE and /PHYSICAL qualifiers to the BACKUP command before using standalone BACKUP. Table C–1 summarizes the standalone BACKUP qualifiers.

Table C–1: Standalone BACKUP Qualifiers

Qualifier	Function
/IMAGE	Allows you to create a functionally equivalent copy of the entire system disk
/PHYSICAL	Copies, saves, restores, or compares the entire system disk in terms of logical blocks, ignoring any file structure

For a complete description of the Backup utility and its qualifiers, see the *VMS Backup Utility Manual.*

To back up the system disk, use the following procedure.

1. Decide whether you want to back up the system to another fixed disk or to a tape cartridge. If you are using a tape cartridge, obtain a scratch tape that you can use for the backup copy. A scratch tape cartridge is a tape cartridge that is either blank or contains files that you no longer need.
2. If you are using a tape cartridge, write-enable it. To write-enable a tape cartridge, slide the write-protect switch away from the tape cartridge label. Insert the tape cartridge in the tape cartridge drive.
3. Determine the device name of the drive holding the system disk and the drive holding the backup disk or tape cartridge. Enter the SHOW DEVICE command at the console prompt (>>>).
4. Boot standalone BACKUP as described in Section C.1.2 or Section C.1.4.
5. Enter the BACKUP command in one of the following formats.

```
$ BACKUP/IMAGE/VERIFY source_drive: target_drive: Return
```

```
$ BACKUP/IMAGE/VERIFY source_drive: target_drive:- Return
-$ saveset.BCK/LABEL=volume_label/REWIND Return
```

where:

- `source_drive` is the location of the files that you want to back up. Use the device name of the drive holding the system disk.
- `target_drive` is the destination. Use the device name of the drive holding the backup disk or tape cartridge.
- `saveset.BCK` is the name of the saveset (the name should reflect the contents of the backup tape and cannot exceed 17 characters in length).

- volume_label is the volume label of the tape cartridge in the tape drive. If the tape has been initialized already, use the same volume label that was assigned by the INITIALIZE command. If the tape has not been initialized, you can assign a volume label at this time. The volume label cannot have more than six characters.

The following example uses the BACKUP command to make a backup disk. You can use a backup disk as the system disk:

```
$ BACKUP/IMAGE/VERIFY DIA0: DIA1 Return
```

The following example uses the BACKUP command to make a backup tape cartridge. The contents of the backup tape cartridge must be restored to a disk before you can use them. For more information, see Section C.3.

```
$ BACKUP/IMAGE/VERIFY DIA0: MIA5:- Return
-$ APR_19_1991.BCK/LABEL=19APRF/REWIND Return
```

6. The system displays the following message.

```
%BACKUP-I-STARTVERIFY, starting verification pass
```

7. If you are backing up the system disk to another disk, proceed to step 8.

   If you are backing up your system disk to a tape cartridge and the contents of the system disk fit on one tape cartridge, remove the backup tape cartridge from the drive. Label the tape COMPLETE SYSTEM BACKUP, number it, and include the date. Proceed to step 8.

   If you are backing up your system disk to a tape cartridge and the system disk contains more data than one tape cartridge can store, the system displays the following messages.

```
%BACKUP-I-RESUME, Resuming operation on volume 2
%BACKUP-I-READYWRITE, Mount volume 2 on _MIA5: for writing
Enter "YES" when ready:
```

   Do the following.

   a. Remove the backup tape cartridge from the drive.

   b. Label the tape COMPLETE SYSTEM BACKUP, number it, and include the date.

   c. Write-protect the tape cartridge.

   d. Write-enable another scratch tape cartridge and insert it in the drive.

e. When you are ready to continue, enter Y (for Yes) and press Return. The procedure displays the following message.

```
%BACKUP-I-STARTVERIFY, starting verification pass
```

Each time the procedure displays a mount request, follow steps a through e.

8. When the procedure is finished, the system displays the following message.

```
%BACKUP-I-PROCDONE, operation completed. Processing finished at
19-APR-1991 15:00:00.00
If you do not want to perform another standalone BACKUP operation,
use the console to halt the system.

If you do not want to perform another standalone BACKUP operation,
ensure the standalone application volume is online and ready.
Enter "YES" to continue:
```

9. Press the Halt button.

10. Reboot the system.

Store the backup tape cartridge in a safe place.

NOTE: *The BACKUP command creates a system disk that includes a Digital-provided set of volume parameters, including a CLUSTER_SIZE (disk access scheme) of value 1. (The CLUSTER_SIZE parameter refers to the way files are stored on the disk, NOT to VAXcluster environments.) You can change most volume parameters later with the SET VOLUME command. However, to change the CLUSTER_SIZE parameter, you must back up the system disk that has been initialized previously with the CLUSTER_SIZE value that you want. To prevent the BACKUP command from reinitializing the target disk, use the /NOINITIALIZE qualifier. For more information about initializing a disk, see the Guide to Maintaining a VMS System. For more information on the BACKUP command, see the VMS Backup Utility Manual.*

C.3 Restoring the System Disk

To restore the system disk from a tape cartridge, use the following procedure.

1. Determine the device names of the drive holding the system disk and the drive holding the backup disk or tape cartridge. Enter the SHOW DEVICE command at the console prompt (>>>).

2. Boot standalone BACKUP as described in Section C.1.2 or Section C.1.4.
3. If you have a backup tape cartridge, make sure it is write protected. Insert it in the drive.
4. Enter the BACKUP command in one of the following formats.

```
$ BACKUP/IMAGE/VERIFY source_drive: target_drive: Return
```

```
$ BACKUP/IMAGE/VERIFY source_drive:- Return
-$ saveset.BCK/SAV/REWIND target_drive: Return
```

where:

- source_drive is the location of the files that you want to restore. Use the device name of the drive holding the backup disk or tape cartridge.
- target_drive is the destination. Use the device name of the drive holding the system disk.
- saveset.BCK is the name of the saveset, if you have a backup tape cartridge.

For example:

```
$ BACKUP/IMAGE/VERIFY DIA0: DIA1: Return
```

The following example uses the BACKUP command to restore the system disk from a backup tape cartridge.

```
$ BACKUP/IMAGE/VERIFY- Return
-$ MIA5:APR_19_1991.BCK/SAV/REWIND DIA0: Return
```

5. The system displays the following message.

```
%BACKUP-I-STARTVERIFY, starting verification pass
```

If you are backing up to a disk or if your saveset fits on one tape, proceed to step 7.

6. If you have more than one backup tape cartridge, the system displays the following message.

```
%BACKUP-I-RESUME, Resuming operation on volume 2
%BACKUP-I-READYWRITE, Mount volume 2 on _MIA5: for reading
Enter "YES" when ready:
```

Remove the backup tape cartridge from the drive. Insert the next backup tape cartridge in the drive, enter Y (for Yes) and press Return. Each time you receive a mount request, repeat this step.

7. When the procedure is finished, the system displays the following message.

```
%BACKUP-I-PROCDONE, operation completed.
Processing finished at 19-APR-1991 15:00:00.00
If you do not want to perform another standalone BACKUP
operation, use the console to halt the system.

If you do not want to perform another standalone BACKUP
operation, ensure the standalone application volume is
online and ready.
Enter "YES" to continue:
```

8. Press the Halt button.
9. Reboot the system.

Glossary

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

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

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

2. A printed circuit board containing the bus.

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

Backup copy
A duplicate copy of data on the ISE that is stored on a tape cartridge.

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

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

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

Boot
To use a bootstrap program to start a computer system.

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

Boot node
The management center for the cluster and its major resource provider.

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

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

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

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

Central processing unit (CPU)
The part of a computer system that controls the interpretation and execution of instructions.

Cluster
A group of computers networked together that share disk storage, application programs, and other computer resources. Also called a VAXcluster.

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

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

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

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

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

CPU
See *Central processing unit.*

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

DAT
Digital audio tape. Used in digital data storage recording technology.

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

DCL
Digital command language. DCL is the standard command interface to the VMS operating system.

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

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

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

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

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

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

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

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

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

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

EIA
Electronic Industries Association.

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

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

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

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

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

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

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

Input/Output (I/O) device
A piece of equipment that accepts data for transmission both to and from a computer. A terminal is an input/output device.

Integrated Storage Element (ISE)
Integrated Storage Elements (ISEs) are intelligent storage devices that contain their own controller and MSCP server.

Interactive
A method of communicating with a computer system. The user enters a command at the keyboard, the system executes the command, and then responds with a message or prompts for another command.

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

I/O
Abbreviation for input/output.

ISE
See *Integrated Storage Element.*

Kbyte
1024 bytes.

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

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

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

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

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

Mbyte
1,048,576 bytes.

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

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

MSCP
Mass Storage Control Protocol

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

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

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

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

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

- Assigning places in memory to programs and data
- Processing requests, scheduling jobs
- Controlling the operation of input and output devices

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

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

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

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

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

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

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

Quorum disk
A quorum disk acts as a virtual node in a system using the quorum scheme. See the *VMS VAXcluster Manual* for further information on quorum disks and the quorum scheme.

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

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

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

ROM
See *Read-only memory*.

Run
1. A single continuous execution of a program.

2. To execute a program.

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

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

Server system
In a VAXcluster, a computer that is used to start the satellite systems and to manage their use of common resources.

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

Software package
A set of related programs that performs a specific task.

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

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

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

System Disk
The disk or ISE that holds VMS factory-installed software.

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

Tailoring
Using the VMSTAILOR program to remove the VMS operating system and DECwindows files that you do not need from the system disk.

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

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

VMS
Digital's proprietary operating system.

Word
A word is 16-bits, or 3-bytes, long.

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

Index

A

Air circulation, 1–17
ALLCLASS, B–2
  setting, B–8
Autobooting system, 2–6

B

Backing up system disk
  using standalone BACKUP, C–7
Backup
  reasons, C–6
  system disk, C–6
BACKUP commands
  backing up, C–7
  restoring system disk, C–10
Base system components
  function, 1–17
BOOT command
  standalone BACKUP on system disk, C–2
  standalone BACKUP on tape cartridge, C–5
  uses, 2–11
Booting system
  autobooting, 2–6
  console mode, 2–10
Booting, console mode, 2–10
Break Enable/Disable switch, 1–12
Bus node ID plugs
  changing, 3–8
  removing, 3–8

C

Card cage
  location, 1–8
  slots, number, 1–8
Cartridge release handle, 3–10, 3–22
Cassette tape
  handling, 3–34
Central processing unit (CPU)
  function, 1–18
Circuit breaker
  function, 1–14
  location, 1–14
  operation, 1–14
CleaningTape III
  using, 3–21
Communication controllers
  asynchronous serial devices, 1–21
  CXA16, 1–22
  CXY08, 1–22
  function, 1–21
  modem support, 3–40
  network controllers, 3–41
  network devices, 1–21
  no modem support, 3–40
  setup, 3–40
  synchronous serial devices, 1–21
  types, 1–21, 3–39
Console module, 1–10
Console terminal connector
  function, 1–12
  location, 1–12
CPU
  See Central processing unit
  location, 1–10
CXA16
  communication controller, 1–22

CXY08
communication controller, 1–22

D

DC OK Indicator
function, 1–7
System Control Panel, 1–7
DC OK light
function, 1–15
power supply, 1–14, 1–15
DELNI
connecting Ethernet cable, 3–41
DESQA
before using, 3–41
Door
front, 1–1, 1–5
DSSI
host adapter, 1–19
DSSI VAXcluster configuration, 1–24
DUP driver utility, B–1, B–2, B–4
entering, B–7
exiting, B–12

E

Enclosure
front, 1–5
Error messages
power-up, 2–4

F

Fans
function, 1–17
location, 1–17
FORCEUNI, B–2
Front door
description, 1–1
opening, 1–3

H

Halt Button
location, 1–8
Halting system
description, 2–11

I

Indicator lights
TF-series tape drive, 3–11
TK70 tape drive, 3–22
Inserting tape cartridge, 3–16, 3–27
Integrated storage element
description, 1–19
Integrated storage elements, 3–3
changing bus node ID plugs, 3–8
controller, 1–20
controls and indicators, 3–4
description, 1–19
function, 1–19
location, 1–6
write-protecting, 3–8

L

Labeling TF-series tape cartridge, 3–12
Labeling TK70 tape cartridge, 3–24
Language Inquiry Mode
setting Power-Up Mode switch, 1–11
LED display
CPU cover panel, 1–12
Loading system software
BOOT command, 2–11
Loading TF-series tape cartridge, 3–12
Loading TK70 tape cartridge, 3–23
Locking door, 1–1
Loop Back Test Mode
setting Power-Up Mode switch, 1–12

M

Main memory, 1–18
Mass storage, 1–19
  controllers, 1–20
  devices, 1–19, 3–10, 3–22
  options, 3–1
  subsystems, 1–20
Mass storage devices
  RF-series ISEs, 3–2
Mass storage shelf
  description, 1–6
Modems
  function, 1–22
  using, 3–40
Module cover
  labels, 1–10
  types, 1–10
Module identification labels, 1–10

N

Network
  communication controllers, 1–18, 1–23
New system
  using, 2–1
NODENAME, B–2
  setting, B–11

O

Opening door, 1–1
Optional devices
  adding, 1–23
Over Temperature Warning indicator
  system, 1–7

P

Power supply
  location, 1–14
  system controls, 1–14
Power-up indicators
  normal, 2–4
Power-Up Mode switch, 1–11
Power-up self-tests
  description, 2–5
Printers
  use, 3–43

Q

Qualifiers
  standalone BACKUP, C–6

R

Removable media
  function, 1–20
Removing tape cartridge, 3–18, 3–29
Restart button
  location, 1–8
Restarting system
  description, 2–12
Restoring system disk
  from disk, C–9
  from tape cartridge, C–9
RF-series integrated storage elements, 3–2
Run Mode
  setting Power-Up Mode switch, 1–11

S

Serial controllers
  modem control support, 1–22
  no modem control support, 1–22
SET BOOT *device name* command
  use, 2–8
SHOW commands, B–5
Shutdown procedure
  turning off system, 2–12
Standalone BACKUP
  booting from system disk, C–2
  booting from tape cartridge, C–5
  installing on system disk, C–2
  installing on tape cartridge, C–3
  overview, C–1
  qualifiers, C–6
  storage media, C–1

Standalone BACKUP (cont'd)
use, C–1
Switch settings, 2–1
normal operation, 2–1
special operation, 2–2
System components
optional, 1–19
System control panel, 1–7
System disk
backing up to disk, C–7
backing up to tape cartridge, C–7
restoring from disk, C–9
restoring from tape cartridge, C–9
SYSTEMID, B–3
setting, B–11

T

Tape cartridge
handling instructions, 3–16, 3–27
inserting, 3–16, 3–27
removing, 3–18, 3–29
storage guidelines, 3–16, 3–27
TF-series tape cartridge
calibration, 3–18
labeling, 3–12
write-protect switch, 3–14
write-protecting, 3–13
TF-series tape drive
access, 3–10
cartridge compatibility, 3–10
cleaning, 3–21
controls, 3–10
indicator lights, 3–11
indicators, summary, 3–20
loading, 3–12
location, 1–6
operation, 3–12
uses, 3–10
TK50/70 tape cartridge
calibration, 3–29
write-protect switch, 3–26
TK70 tape cartridge
labeling, 3–24
write-protecting, 3–25
TK70 tape drive
access, 3–22
controls, 3–22
indicator lights, 3–22
indicator lights, summary, 3–31
loading, 3–23
location, 1–6
operation, 3–23
uses, 3–22
TLZ04 cassette tape
setting write-protect tab, 3–35
write-protect tab, 3–35
TLZ04 cassette tape drive
indicators, 3–33
TLZ04 tape drive
head cleaning, 3–37
head cleaning cassette, 3–37
location, 1–6
Turning off system, 2–12
Turning on system, 2–4
TZL04 Drive indicator, 3–33
TZL04 Tape indicator, 3–33

U

UNITNUM, B–2
setting, B–8
Unload button, 3–10, 3–22
Unloading TF-series tape cartridge, 3–12
Unloading TK70 tape cartridge, 3–23
Using new system, 2–1

W

Write-enabling
RF-series storage element, 3–5
storage element, 3–4
Write-protect switch
TF-series tape cartridge, 3–14
TK50/70 tape cartridge, 3–26

Write-protecting
RF-series storage element, 3–5
RF35 storage element, 3–5
storage element, 3–4
TF-series tape cartridge, 3–13
TK70 tape cartridge, 3–25

VAX 4000 Model 400/500/600 Troubleshooting and Diagnostics

Order Number EK–451AD–TS.004

Digital Equipment Corporation
Maynard, Massachusetts

First Printing, December 1991
Revised, February 1992
Revised, April 1992
Revised, July 1992

The Reader's Comments form at the end of this document requests your critical evaluation to assist in preparing future documentation.

FCC NOTICE: The equipment described in this manual generates, uses, and may emit radio frequency. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such radio frequency interference.

Operation of the equipment in a residential area may cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

S1978

This document was prepared using VAX DOCUMENT, Version 2.1

Contents

Preface v

Chapter 1 Troubleshooting During Power-Up

1.1 Autobooting the System Software 1–1
1.2 Troubleshooting Power-Up Problems 1–1
1.2.1 Problems During Self-Tests 1–1
1.2.2 General Problems During Boot Sequence 1–3
1.2.3 Problems Booting from an RF-Series Integrated Storage Element (ISE) 1–4
1.2.4 Problems Booting from a Tape Drive 1–4

Chapter 2 Troubleshooting During Normal Operation

2.1 System Problems 2–1
2.2 RF-Series Integrated Storage Element (ISE) Problems 2–4
2.3 TF-Series Tape Drive Problems 2–5
2.4 TK50 Tape Drive Problems 2–6
2.5 TK70 Tape Drive Problems 2–7
2.6 TLZ04 Tape Drive Problems 2–8

Chapter 3 Running the MicroVAX Diagnostic Monitor (MDM)

3.1 MDM Limitations 3–1
3.2 Preparing to Run MDM 3–2
3.2.1 Preparing to Run MDM on a Diskless or Tapeless System 3–2
3.2.2 Preparing to Run MDM on an RF-Series Integrated Storage Element (ISE) or Hard Disk 3–3
3.2.3 Preparing to Run MDM on a DSSI VAXcluster 3–3
3.2.3.1 MDM on a DSSI VAXcluster with One TK70 Tape Drive 3–3
3.2.3.2 MDM on a DSSI VAXcluster with Two TK70 Tape Drives 3–4

3.3 Starting MDM 3–5
3.3.1 Tape Drive Instructions 3–6
3.3.1.1 Booting MDM Manually 3–6
3.3.1.2 Booting MDM Automatically 3–7
3.3.2 RRD-Series Disc Instructions 3–8
3.4 MDM Introductory Display 3–9
3.5 Main Menu Options 3–9
3.5.1 Test the System Option 3–9
3.5.2 Display System Configuration and Devices Option 3–11
3.5.3 Display the System Utilities Menu Option 3–13
3.5.3.1 IOADDRES Function 3–13
3.5.3.2 Update Drive Unit Number for RRD-Series Function . . 3–13
3.5.4 Display the Service Menu Option 3–14
3.5.5 Display the Connect/Ignore Menu Option 3–14
3.5.6 Select Single Device Tests Option 3–14
3.6 Exiting MDM 3–16

Appendix A System Controls and Indicators

Appendix B Write-Protecting an RF-Series ISE

B.1 Software Write-Protect For RF-Series ISEs B–1
B.2 Hardware Write-Protect For RF35 ISEs B–2

Index

Figures

A–1 System Control Panel and Power Supply A–2
A–2 RF-Series ISE and Console Module A–3
A–3 TK70 and TK50 Tape Drives A–4
A–4 TF-Series and TLZ04 Tape Drives A–5

Preface

Troubleshooting is the process of isolating and diagnosing problems. When your system does not operate as described in your *Operation* manual, use the information in this manual to isolate and diagnose the problem.

This manual contains three chapters and two appendixes:

- Chapter 1 lists problems you may experience at power-up and provides corrective actions.
- Chapter 2 lists problems you may experience during normal operation and provides corrective actions.
- Chapter 3 tells you how to run the MicroVAX Diagnostic Monitor (MDM), a diagnostic tool you can use to test your system periodically or to isolate a particular problem.
- Appendix A contains illustrations showing the location of your system controls and indicators.
- Appendix B describes how to write-protect your RF-Series ISE.

If the corrective actions suggested in Chapters 1 and 2 do not solve the problem, call your Digital service representative.

The following conventions are used in this manual.

Convention	Meaning
Key	A terminal key used in text and examples. For example, Break indicates that you press the Break key on your terminal keyboard.
Ctrl/C	Hold down the Ctrl key while you press the C key.
NOTE	Provides general information about the current topic.
CAUTION	Provides information to prevent damage to equipment or software.

Chapter 1
Troubleshooting During Power-Up

After you turn on your system, the processor performs a series of self-tests and startup routines. After successful completion of the self-tests, if the Break Enable/Disable switch is set to disable (down), your system autoboots system software.

1.1 Autobooting the System Software

Your system boots automatically (autoboots) from a specified drive after you enter the command SET BOOT device-name from console mode. Your system continues to boot from the specified drive each time it is turned on, until you specify differently by entering the SET BOOT device-name command again. If ac power is lost for several days and all the stored configuration data in the battery back up RAM is lost, you will need to respecify the BOOT device name using the SET BOOT command.

If you do not enter the SET BOOT device-name command, your system boots from the Ethernet port, EZA0.

1.2 Troubleshooting Power-Up Problems

Refer to the descriptions of problems and corrective actions in the following sections. If the action(s) listed do not solve the problem, call your Digital service representative.

1.2.1 Problems During Self-Tests

Problem	Possible Cause	Corrective Action
No response when Power switch turned on; AC Present indicator not lit.	System not plugged in.	Set Power switch to 0. Plug in system. Set Power switch to 1.
	No power at wall outlet.	Use different wall outlet or check circuit breaker controlling power to wall outlet.

Problem	Possible Cause	Corrective Action
	Power switch (circuit breaker) tripped (in position 0).	Wait 1 minute, then set Power switch to position 1. If it trips again, call your Digital service representative.
	Power cable incorrectly installed.	Set Power switch to 0. Check that cable is fully seated in socket. Set Power switch to 1.
AC Present indicator lit; DC OK indicator not lit.	Power Control Bus cable connected to Secondary In (SI) connector on power supply.	Turn on system or expander connected to Power Bus Out (MO) connector on power supply.
	B213F expander not turned on.	Turn on expander.
	Power supply or module failure.	Call your Digital service representative.
System has power; AC Present and DC OK indicators lit; nothing displays on console terminal.	Console terminal off.	Turn on console terminal.
	Console terminal off line.	Put terminal on line as described in terminal document.
	Hold key activated.	Deactivate hold key.
	Console terminal cable incorrectly installed.	Make sure cable is installed properly at both ends.
	Console terminal setup not done correctly.	Reread setup instructions in terminal manual.
	Baud rate of system and terminal do not match.	Set terminal baud rate to match system rate.
	Power-Up Mode switch on console module set to T.	Set that switch to Run (indicated by arrow).
	Terminal defective.	Turn off terminal and turn it on again. If it fails self-tests, call your Digital service representative.
	If printer connected to obtain copy of console interaction, fault in printer.	Turn off printer and turn it on again. If it fails self-tests, call your Digital service representative.
	Problem in CPU.	Call your Digital service representative.

Problem	Possible Cause	Corrective Action
System has power; DC OK indicator lit; nothing displays on console terminal; LED on console module displays E or F.	Problem in CPU.	Call your Digital service representative.
Self-tests halt; error message or error summary displays on console terminal.	System detected error while running self-tests.	Copy number following question mark in error message or summary and call your Digital service representative.
Language Selection Menu does not appear.	Baud rate on console terminal different from baud rate on system.	Check that baud rate on console terminal agrees with system rate.
	Terminal does not support multinational character set (MCS).	Obtain terminal that supports MCS, or use the default language (English). If this is not a problem continue.

1.2.2 General Problems During Boot Sequence

Problem	Possible Cause	Corrective Action
System returns to BOOT prompt after 4 minutes.	Sanity timer enabled on DESQA module.	Disable sanity timer as described in *DESQA Option Installation Guide*.
>>> displays on console terminal.	Break Enable/Disable switch set to enable (up); system in console mode.	To autoboot, set Break Enable/Disable switch on console module to disable (down). Reset system by pressing Restart button on system control panel. To boot manually from console mode, use BOOT device-name command.
>>> displays on console terminal; Break Enable /Disable switch set to disable (down).	User-defined halt action set to HALT.	From console mode, enter SET HALT DEFAULT command.
?54 RETRY displays twice on console terminal.	No bootable medium found.	See actions listed for boot device in subsequent sections.
Countdown does not continue from 2 through 0; Break Enable/Disable switch set to disable (down).	System cannot load software from disk drive, tape drive or Ethernet.	See actions listed for boot device in subsequent sections.

1.2.3 Problems Booting from an RF-Series Integrated Storage Element (ISE)

Problem	Possible Cause	Corrective Action
Countdown continues from 2 through 0; console terminal displays operating system error messages; Write-Protect button in (glows orange). For RF35 ISEs, `Mounted wrtlck` displays when DCL command SHOW DEVICE DI is issued.	System disk write-protected.	Push in and release Write-Protect button to out (unlit) position. Make sure Write-Protect button corresponds to system disk. For RF35, remove Write-Protect per Appendix B.
Countdown continues from 2 through 0; console terminal displays console error messages.	System disk contains no bootable software.	Install system software.
Countdown does not continue from 2 through 0; Break Enable/Disable switch set to disable (down); Run/Ready button out.	System disk off line.	Press Run/Ready button to in position. Press Restart button on system control panel.
Fault indicator lit or blinking.	Problem in controller or ISE.	If Fault indicator stops blinking, system may have corrected itself. Run MDM as described in Chapter 3. If Fault indicator remains lit, call your Digital service representative.
	Bus node ID plug not installed.	Install unique Bus node ID plug

1.2.4 Problems Booting from a Tape Drive

Problem	Possible Cause	Corrective Action
Countdown does not continue from 2 to 0 or system boots from another device (wrong software displays on console terminal).	No tape cartridge in tape drive.	Insert cartridge containing system software into tape drive.
	Fixed disk on line.	Place fixed disk off line.

Problem	Possible Cause	Corrective Action
	Tape not bootable (does not contain bootstrap program).	Use bootable tape to start system software.
	Tape worn or damaged.	Try another tape cartridge.
	Problem in controller or tape drive.	Call your Digital service representative.

Chapter 2
Troubleshooting During Normal Operation

Problems that occur during normal operation of your system may result from a system defect, faulty setting, or incorrect procedure.

The following sections list problems, possible causes, and corrective actions. If the action(s) listed do not solve the problem, call your Digital service representative.

2.1 System Problems

Problem	Possible Cause	Corrective Action
System has power; DC OK indicator lit; nothing displays on console terminal; LED on console module displays E or F.	Problem in CPU.	Call your Digital service representative.
System loses power; AC Present indicator not lit.	System not plugged into wall outlet.	Set Power switch to 0. Plug in system. Set Power switch to 1.
	No power at wall outlet.	Use different wall outlet or check circuit breaker controlling power to wall outlet.
	Power cable incorrectly installed.	Set Power switch to 0. Check that cable is seated in socket. Set Power switch to 1.
System loses power; DC OK indicator not lit.	Power supply failed.	Turn off system and call your Digital service representative.
System loses power; Power switch off (position 0).	Power switch (circuit breaker) tripped.	Wait 1 minute, then set Power switch to 1. If it trips again, call your Digital service representative.

Problem	Possible Cause	Corrective Action
Alarm sounding and Over Temperature Warning indicator flashing.	Systems internal temperature rising and approaching maximum limit.	Make sure that the system air vents are not blocked. Keep system away from heat sources. Check room temperature per your Site Preperation manual.
Over Temperature Condition indicator lit; system loses power; Power switch on (position 1).	System shut down to prevent overheating.	Make sure vents are clear, system is not near heat source, and room temperature is within guidelines in *Site Preparation* manual. Then set Power switch to 0. Wait 5 minutes. Set Power switch to 1. If system shuts down again, call your Digital service representative.
System loses power; Fan Failure indicator lit; Power switch on (position 1).	One or two fans failed.	Call your Digital service representative.
System halts; >>> displayed on console terminal.	Break or Ctrl/P pressed.	Type C and press Return. To prevent recurrences, set Break Enable /Disable switch to disable (down) and press Run/Ready button to restart system. Pressing Restart button reboots system.
Terminal display halts.	Hold Screen key on terminal pressed.	Press Hold Screen key again.
	Terminal data cable disconnected.	Reconnect data cable.
System reboots.	Restart button pressed.	Let rebooting complete. To prevent recurrences, ask your Digital service representative to disable Restart button.
For DSSI configuration: performance degrades, operating system crashes, or `Closed Virtual Circuit` or `Closing Virtual Circuit` displays on console terminal.	Ground offset voltage between enclosures exceeds limit listed in system *Installation* manual.	Make sure site power distribution system does not have any grounding faults listed in system *Site Preparation* manual. Then measure ground offset voltage(s) as described in system *Installation* manual.
		Make sure ground cable connects any two enclosures sharing common DSSI bus.
	Loose or missing DSSI terminators.	Make sure terminators are installed properly.

Problem	Possible Cause	Corrective Action
	Damaged DSSI cable or cable connector.	Replace cable.
	DSSI bus length exceeds limit specified in *DSSI VAXcluster Installation and Troubleshooting* manual.	Call your Digital service representative.
	Non-Digital device connected to DSSI bus.	Call your Digital service representative.

2.2 RF-Series Integrated Storage Element (ISE) Problems

Problem	Possible Cause	Corrective Action
Write error message displayed; Write-Protect button glows orange. For RF35 ISEs, `Mounted wrtlck` displays when DCL command SHOW DEVICE DI is issued.	ISE write-protected.	Press and release Write-Protect button. For RF35, remove Write-Protect per Appendix B.
Fault indicator lit or blinking.	Bus node ID plug not installed.	Install that plug.
	Two or more devices have same node ID on same bus.	Make sure all devices and controllers or adapters on same bus have unique IDs.
	Problem in controller or ISE.	If Fault indicator stops blinking, system may have corrected itself. Run MDM as described in Chapter 3. If Fault indicator remains lit, call your Digital service representative.
Read error message displayed; Run/Ready button out.	ISE not spun up.	Press Run/Ready button to in position. After green indicator lights, ISE is available for use.

2.3 TF-Series Tape Drive Problems

Problem	Possible Cause	Corrective Action
Tape not software write-enabled.	Drive not loaded, or unloaded by software.	Load drive. Ensure that yellow indicator is lit.
	Cartridge has TK50 or TK70 format (drive cannot write to those devices).	Use cartridge with correct format.
	Bad cartridge or improperly written calibration tracks.	Try another cartridge.
	Software operating system error.	Reboot operating system.
	Problem in drive.	Call your Digital service representative.
Does not mount or read /write.	Problem in cartridge.	Try another cartridge.
	Dirty read/write heads.	Use yellow head-cleaning cartridge.
Orange Use Cleaning Tape light lit.	Dirty read/write heads.	Use yellow head-cleaning cartridge.
Four lights blinking.	Failed self-test or detected hard error.	Push Unload button. If lights continue blinking, call your Digital service representative.
Green light on; yellow light not lit.	Cartridge load error.	Try another cartridge. If problem persists, call your Digital service representative.
Cartridge stuck in drive; tape on takeup reel.	Hard drive error.	Press Unload button. If problem persists, call your Digital service representative.
Cartridge does not load.	Mispositioned leader.	Try another cartridge.

2.4 TK50 Tape Drive Problems

Problem	Possible Cause	Corrective Action
Red light blinking; no unusual sounds.	Problem in drive.	Press Load/Unload button four times. If problem persists, do not use drive or remove cartridge. Call your Digital service representative.
Red light blinking; whirring sound.	Tape leader not coupled properly.	Turn off system. Do not remove cartridge. Call your Digital service representative.
Cartridge release handle does not move.	Self-test in progress.	Press Unload button and wait for red light to go out and green light to remain on. Then try again.
	Drive active.	Press Unload button and wait for red light to go out and green light to remain on. Then try again.
Cartridge release handle does not lock.	Cartridge not inserted properly.	Reinsert cartridge. If problem persists, call your Digital service representative.
Cartridge does not unload.	Load/Unload button in load (in) position.	Press button to unload (out) position. Wait for red light to go out and green light to remain on before trying to remove cartridge.
	Load/Unload button not working properly.	Press button to load (in) position, wait a few seconds, then press button to unload (out) position. After red light goes off and green light comes on, move cartridge release handle. If problem persists, call your Digital service representative.
Passes self-test; does not work.	Problem in controller or connection between drive and controller.	Call your Digital service representative.

2.5 TK70 Tape Drive Problems

Problem	Possible Cause	Corrective Action
Green light blinking after tape insertion.	Tape leader defective.	Pull handle open and remove cartridge. Use another cartridge.
Orange, yellow, and green lights blinking.	Problem in drive.	Press Unload button once. If orange and green lights go out and yellow light starts blinking, cartridge is unloading. After green light comes on and you hear beep, remove cartridge. If three lights start blinking after you press Unload button, fault is not cleared. Do not remove cartridge. Call your Digital service representative.
Handle does not move.	Self-test in progress.	Do not move handle while yellow light is on. Press Unload button and wait for orange and yellow lights to go off and green light to remain on. Then try again.
	Drive active.	Do not move handle while yellow light is on. Press Unload button and wait for yellow light to go off and green light to remain on. Then try again.
Handle does not lock.	Cartridge not inserted properly.	Reinsert cartridge. If problem persists, call your Digital service representative.
Cartridge does not unload.	Unload button not working properly.	Unload cartridge with command described in your system software manuals.
Passes self-test; does not work.	Problem in controller or connection between drive and controller.	Call your Digital service representative.

2.6 TLZ04 Tape Drive Problems

Problem	Possible Cause	Corrective Action
Unable to copy to tape; tape indicator yellow.	Cassette write protected.	Set cassette Write-Protect tab to write enable.
Unable to copy to tape; drive indicator green.	No cassette in drive.	Insert cassette into drive.
Unable to copy to or from tape; tape and drive indicators not lit.	Problem in adapter or drive.	Run MDM as described in Chapter 3 and call your Digital service representative.
Unable to copy to or from tape; tape and drive indicators green.	Drive off line.	Get into console mode (>>>) and issue SHOW SCSI command. If device information does not appear, make sure cable and terminator are plugged in.
	Problem in adapter or drive.	Run MDM as described in Chapter 3 and call your Digital service representative.
Excessive tape errors; tape indicator blinking green or yellow.	Dirty read/write heads or worn tape.	Use head cleaning cassette. If problem persists, try another cassette.
Tape and drive indicators yellow.	Excessive humidity.	Adjust room climate.

Chapter 3
Running the MicroVAX Diagnostic Monitor (MDM)

The MicroVAX Diagnostic Monitor (MDM) is an optional software package containing diagnostic tests that isolate and identify faults in your system. MDM also lets you display your system configuration and test how devices work together.

MDM is on tape, in a cartridge labeled MV DIAG CUST TK50. MDM operating instructions begin in Section 3.2.

CAUTION: *If your system is connected to a cluster, notify your cluster manager before halting the system to load MDM.*

You generally run MDM in four situations:

- Before you install software on a new system
- After you add a device to your system
- After you receive an error message or experience a system problem
- When you want to test your system periodically to ensure that all components are operating correctly

3.1 MDM Limitations

MDM tests internal devices in your system, but it performs limited diagnostics.

- MDM reads from each drive and checks each controller, but it does not write to the drives because that could destroy data.

  NOTE: *MDM tests a tape or diskette drive only after the medium (tape or diskette) is inserted into the drive.*

- MDM checks devices on the system as well as the system and interconnects.

- MDM checks terminal interfaces (but not terminals) by means of feedback connectors.

If your devices pass the tests but you still experience problems, call your Digital service representative for further testing.

If you require more complete diagnostic testing, purchase the MicroVAX Maintenance Kit. That kit includes a system maintenance guide and the service diagnostic tests. The MDM version you receive with your system is a subset of the service version.

CAUTION: *Only qualified service personnel should use the service diagnostic tests.*

3.2 Preparing to Run MDM

Running MDM on some systems requires additional or special procedures:

Read Section 3.2.1 if you plan to run MDM on a diskless or tapeless system.

Read Section 3.2.2 if you plan to install MDM on a hard disk or RF-series Integrated Storage Element.

Read Section 3.2.3 if you plan to run MDM on a DSSI VAXcluster.

You can run MDM on an RRD-series disc drive by using the MDM CDROM Kit.

3.2.1 Preparing to Run MDM on a Diskless or Tapeless System

To run MDM on a diskless or tapeless system that is part of a local area network, you must:

- Obtain a MicroVAX Ethernet Server Customer Diagnostics Kit.
- Run MDM using the diagnostics in that kit, labeled MV DIAG ENET CUST.

Refer to the *MicroVAX Diagnostic Monitor Ethernet Server User's Guide* at this time. After you install and downline load MDM, refer again to that manual for instructions on running MDM.

NOTE: *If you have a diskless or tapeless system that is not part of a local area network, you cannot run MDM. To diagnose problems, call your Digital service representative.*

3.2.2 Preparing to Run MDM on an RF-Series Integrated Storage Element (ISE) or Hard Disk

You can install MDM on an RF-series ISE or hard-disk drive by using the MDM Hard Disk Kit. Installation of that kit requires your completion of the Diagnostic Software Installation Acknowledgment. See the *MicroVAX Diagnostic Monitor Hard Disk User's Guide* for licensing requirements and installation instructions.

3.2.3 Preparing to Run MDM on a DSSI VAXcluster

NOTE: *The MDM Hard Disk Kit is required for a two-system DSSI VAXcluster where one host is a tapeless system, and the other uses the TK70 tape drive.*

TF-series tape drives are DSSI devices and can be shared between systems in a DSSI VAXcluster. Both systems in a two-system DSSI VAXcluster can boot MDM from the same drive, However you must run MDM separately from each host.

Before running MDM:

- Your system must be properly configured.
- The Digital Storage Systems Interconnect (DSSI) cable connecting the multiple hosts must be installed.

You must run MDM separately for each host. For TK70 based systems, the procedure to use depends on whether one host is a tapeless system (no tape drive) or each host has its own tape drive.

Use the procedure in Section 3.2.3.1 to prepare to run MDM in a DSSI VAXcluster with one TK70 tape drive.

Use the procedure in Section 3.2.3.2 to prepare to run MDM in a DSSI VAXcluster with a TK70 tape drive in each host.

3.2.3.1 MDM on a DSSI VAXcluster with One TK70 Tape Drive

To run MDM on a DSSI VAXcluster with one TK70 tape drive (one or more tapeless hosts):

- Use the MDM Hard Disk Kit.
- Complete the Diagnostic Software Installation Acknowledgment.
- Install the kit on a hard disk or an RF-series ISE as described in the *MicroVAX Diagnostic Monitor Hard Disk User's Guide*.

After the installation is complete, use the following procedure to run MDM.

1. If software is installed on your system:
   a. Warn all users to log off.
   b. Perform system shutdown as described in your software manuals.
2. Set the Break Enable/Disable switch on the host to be tested to enable (up).
3. Insert a blank tape cartridge into the tape drive and lock it in place.
4. Restart the host to be tested.
5. Enter one of these commands, where u is the unit number of the disk containing the Hard Disk Kit and c is the controller port letter.

   BOOT/100 DIAu (CPU-based DSSI)

   BOOT/100 DUcu (KFQSA adapter or KDA50 controller)

   The system prompts for the boot file name by displaying `Bootfile:`
6. Enter one of these file names.

   [SYS0.SYSEXE]MDMSHA.SYS (CPU-based DSSI)

   [SYS0.SYSEXE]MDM.SYS (KFQSA adapter or KDA50 controller)

   Then press Return to continue booting.
7. Run MDM as described in Section 3.3.
8. After you complete the tests on the first host:
   a. Make sure the Break Enable/Disable switch is set to enable (up) and press the Restart button on that host.
   b. After the countdown completes and the >>> prompt displays, boot MDM from the second system using the procedure described in steps 2 through 6.
   c. Run MDM as you did for the first system.

3.2.3.2 MDM on a DSSI VAXcluster with Two TK70 Tape Drives

To run MDM on a DSSI VAXcluster with two tape drives in each system:

NOTE: *You can also use the MDM Hard Disk Kit as described in the previous section.*

1. If software is installed on your system:
   a. Warn all users to log off.
   b. Perform system shutdown as described in your software manuals.
2. Set the Break Enable/Disable switch on the host to be tested to enable (up).
3. Make sure the Write Protect switch on the tape cartridge containing the MDM diagnostic is in the Write Protect Position.
4. Insert the tape cartridge containing MDM into the tape drive and lock it in place.
5. Restart (turn on) both hosts.
6. After the self-test countdown completes and the >>> prompt displays, enter the command BOOT MUcu, where c is the controller designator and u is the drive unit number, to boot the tape.
7. Run MDM as described in Section 3.3.
8. After you complete the tests on the first host:
   a. Remove the tape cartridge, by following the procedure described in your *Operation* manual, and press the Restart button on that host.
   b. After the self-test countdown completes and the >>> prompt displays, insert the tape cartridge into the tape drive in the second system and lock it in place.
   c. Enter the command BOOT MUcu, where c is the controller designator and u is the drive unit number, to boot the tape.
   d. Run MDM as you did for the first system.

3.3 Starting MDM

You must start MDM differently for different media:

If you are booting MDM from a tape drive, read Section 3.3.1.

If you are booting MDM from an RRD-series disc drive, read Section 3.3.2.

If you are booting MDM from a hard disk or an RF-series ISE, refer to the *MicroVAX Diagnostic Monitor Hard Disk User's Guide*.

CAUTION: *Unless instructed to do so, do not change any settings or manipulate devices while the tests are running. MDM interprets any change of state as an error.*

3.3.1 Tape Drive Instructions

Before you run MDM, be sure you understand the instructions in your *Operation* manual for using the tape drive.

MDM runs the same way whether or not system software is loaded.

- You can boot MDM manually from a TF-series, TK50 or TK70 tape drive (Section 3.3.1.1).
- You can use the autoboot feature to boot MDM only from a TK50 or TK70 tape drive (Section 3.3.1.2).

NOTE: *If your system is part of a local area network (LAN), you can reduce the time required to load MDM by obtaining the MicroVAX Ethernet Server Customer Diagnostics Kit. That kit lets you install MDM on a host system and downline load MDM to other systems that are part of the LAN, using the DECnet / Ethernet network facilities.*

3.3.1.1 Booting MDM Manually

Use this procedure to boot MDM from a TF-series, TK50 or TK70 tape drive.

1. If software is installed on your system:
   a. Warn all users to log off.
   b. Perform system shutdown as described in your software manuals.
2. Make sure the write protect switch on the tape cartridge is in the write-protect position.
3. If your system contains software, write-protect all disk drives and RF-series ISEs.
4. Move the Break Enable/Disable switch to enable (up).
5. Restart the system.
6. After the green light on the tape drive glows steadily (orange and yellow lights go out), insert the tape cartridge containing MDM into the tape drive and lock it in place.

7. Tell your system to load MDM from the tape cartridge:

   For a TK50 or TK70 tape drive, enter the command BOOT MUcu, where c is the controller designator and u is the drive unit number.

   For a TF-series tape drive, enter the command BOOT/100 MImc, where m is the DSSI bus adapter and c is the drive unit number. Then, when your system displays `Bootfile:`, enter [SYS0.SYSEXE]MDM.SYS (the boot file name).

   Loading MDM takes several minutes. A green light on a TK50 drive or a yellow light on a TK70 or TF-series drive blinks while loading occurs. Section 3.4 describes the display you see after loading completes

8. After loading completes, make sure all RF-series ISEs are on line.

3.3.1.2 Booting MDM Automatically

Use this procedure to boot MDM from a TK50 or TK70 tape drive. Do not use this procedure for a TF-series tape drive.

1. If software is installed on your system:
   a. Warn all users to log off.
   b. Perform system shutdown as described in your software manuals.
2. Enter the command SET BOOT MUcu.
3. Make sure the write protect switch on the tape cartridge is in the write-protect position.
4. Remove any removable disks, and place all fixed-disk drives and RF-series ISEs off line.
5. Write-protect all disk drives and RF-series ISEs.
6. Turn off your system.
7. Set the Break Enable/Disable switch to disable (down).
8. Turn on your system.
9. After the green light on the tape drive glows steadily, insert the tape cartridge containing MDM into the drive and lock it in place.

   Loading MDM takes several minutes. A green light on a TK50 drive or a yellow light on a TK70 drive blinks while loading occurs. Section 3.4 describes the display you see after loading completes.

10. After loading completes, make sure all RF-series ISEs are on line.

3.3.2 RRD-Series Disc Instructions

If you are using an RRD-series disc drive connected to a KZQSA adapter or KRQ50 controller, use the following procedure to boot MDM.

1. If software is installed on your system:
   a. Warn all users to log off.
   b. Perform system shutdown as described in your software manuals.
2. Place all hard-disk drives and RF-series ISEs off line.
3. Turn off your system.
4. Set the Break Enable/Disable switch to disable (down).
5. Turn on your system (and the disc drive).
6. Insert the disc caddy into the disc drive:
   a. Remove the disc from its package.
   b. Insert the disc into the caddy (See MDM CDROM booklet.).
   c. Insert the caddy into the drive slot:

      For an RRD40 drive, push the caddy in until it stops. Then withdraw the caddy. The disc remains in the drive.

      For another RRD-series drive, the caddy stays in the drive. Do not remove it.
7. Tell your system to load MDM from the disc:

   For a KZQSA adapter, enter the command BOOT DKxnnn, where x is the adapter designator and nnn is the drive unit number.

   For a KRQ50 controller, enter the command BOOT/100 DUcu, where c is the controller designator and u is the drive unit number. Then, when your system displays `Bootfile:`, enter [SYS0.SYSEXE]MDMCD.SYS (the boot file name).

   Loading MDM takes several minutes. Section 3.4 describes the display you see after loading completes.
8. After loading completes, place all hard disks and RF-series ISEs on line.

3.4 MDM Introductory Display

After MDM is loaded, the introductory display appears. Make sure the date and time in that display are correct.

- If the date and time are correct, press Return to continue.
- If the date and time are not correct, type the correct date and time using the format shown in the display. For example, enter 10–JUN–1991 02:30 and press Return to continue.

The Main Menu appears. Section 3.5 describes the options on that menu.

3.5 Main Menu Options

The Main Menu provides six options as shown below.

```
MAIN  MENU                                Release nnn   Version  xx.xx

 1 - Test the System

 2 - Display System Configuration and Devices

 3 - Display the System Utilities Menu

 4 - Display the Service Menu

 5 - Display the Connect/Ignore Menu

 6 - Select Single Device Tests

Type the number; then press the RETURN key.
```

NOTE: *The MDM release and version numbers are represented by nnn and xx.xx respectively in the displays provided throughout this chapter.*

Select an option by typing its number and Return.

The next six sections describe the options on the Main Menu.

3.5.1 Test the System Option

The Test the System option tests the devices it sees in your system and how they work together. You can select this option at any time without jeopardizing data.

After you select this option, the diagnostics are prepared for testing. If this is the first option you selected, the diagnostics are loaded. Loading takes several minutes. After loading completes, you are prompted to press Return.

After you press Return, an explanation of the testing procedures appears.

When you are ready to begin the test, press Return. Your system displays `Begin Device Tests.`

As each device passes the test, it is listed on your terminal screen.

NOTE: *Because of the similarity of some communication options, MDM sees them as the same device. A CXA16 and CXB16 appear the same to MDM. A generic device name, DH-CX0, is listed for such options, and the last letter in each name shows the difference. For example, DH-CX0A indicates one option, DH-CX0B a second, and so forth.*

If a device fails the test, you receive a failure message which identifies:

The device tested

When the failure occurred

The field-replaceable unit (FRU)

Copy the failure message and report it to your Digital service representative.

This shows an example of an unsuccessful test.

```
BEGIN FUNCTIONAL TEST

     Device                    Result

     SGCA  ................  FAILURE DETECTED

     A failure was detected while testing the

          OPTION: SGCA  Ethernet controller

     The Field Replaceable Unit (FRU) identified is the:

          Ethernet controller
```

If your system has serious problems, the following message appears.

```
All devices disabled, no tests run.
```

Report that message to your Digital service representative.

After a failure message appears, the testing stops.

After all devices pass the first part of the test, the exerciser tests begin. Those tests take about 4 minutes and test how the devices work together. If the devices pass, you receive a success message.

At the end of the tests, press Return to return to the Main Menu.

From the Main Menu you can exit MDM as described in Section 3.6 or you can select one of the other options.

3.5.2 Display System Configuration and Devices Option

The Display System Configuration and Devices option identifies devices recognized by MDM.

After you select this option, the diagnostics are prepared for testing. If this is the first option you selected, the diagnostics are loaded. Loading takes several minutes. After loading completes, you are prompted to press Return.

After you press Return, the configuration is displayed:

```
MAIN  MENU                                  Release nnn   Version  xx.xx

SYSTEM CONFIGURATION AND DEVICES

CPUA ... VAX 4000 CPU
     KA6nn MC=01 FW=3.9
MEMA ...  VAX 4000 memory system
     64 Megabytes. 131072 Pages.
          MS690 ... 32MB memory module
          MS690 ... 32MB memory module
PDIA ... SHAC DSSI Subsystem
     SHAC Ver. 3.6
          RF73 ...  Unit #0, Dssi Disk, Online
          TF85 ...  Unit #1, Dssi Tape, Online
          RF73 ...  Unit #11, Dssi Disk, Online
SGCA ... Second Generation Ethernet Controller
     SGEC V4 08-00-2B-19-60-66
PDIB ... SHAC DSSI Subsystem
     SHAC Ver. 3.6

Press the RETURN key to return to the previous menu. >
```

Up to two lines of information are provided for each device:

One line lists the name of the device and gives a brief description.

A second line may indicate the revision level of the device.

The revision level can refer to hardware or microcode. For example, the KA6nn CPU described above is at revision 3.9 for microcode (MC=01).

Besides the general information listed for each device, more information for specific devices may be given. Some examples:

- CPUA — Type of CPU, presence of a floating-point unit
- MEMA — Total amount of memory in megabytes and pages, number and type of memory modules
- KFQSA — Type of DSSI device and its unit number for each ISE
- KDA50 — Unit number, drive type, controller revision number

- PDIA — DSSI adapter, for Bus 0 embedded in KA6nn CPU
- DESQA — Ethernet station address
- SGCA — On-board Ethernet controller, embedded in KA6nn CPU
- PDIB — DSSI adapter for Bus 1, embedded in KA6nn CPU
- Communication devices — Type of device and whether it has modem control

In addition to showing information about testable device options, MDM displays messages indicating the presence of nontestable system devices. If a device is in your system but is not listed in the System Configuration and Devices display, one of the following two messages can indicate the reason.

```
No Dg xxx ... Diagnostic not loaded
```

MDM displays a `No Dg` (no diagnostic) message for each nontestable Digital device in your system, where xxx indicates the device. For example, if MDM cannot find the TK70 tape drive diagnostic, the message `No Dg TKA` is displayed. TKA indicates that the device is a TK tape drive. Such a message can appear when:

The medium is not installed properly.

The diagnostic is not on the medium.

```
Unknown ... Diagnostic not loaded
```

The `Unknown` (unknown device) message indicates that a device not recognized by MDM is attached to your system. That message appears when:

A device is configured to a nonstandard CSR address.

A Digital device that has no diagnostic is attached to your system. That can occur if a device not supported on your system is attached.

A non-Digital device is attached to your system.

After all devices are listed, you can return to the Main Menu by pressing Return.

From the Main Menu you can exit MDM as described in Section 3.6 or you can select one of the other options.

3.5.3 Display the System Utilities Menu Option

The Display the System Utilities Menu option displays the System Utilities Menu. If system utilities in addition to the IOADDRES function are available on your system, they are listed on that menu.

After you select this option, the diagnostics are prepared for testing. If this is the first option you selected, the diagnostics are loaded. Loading takes several minutes. After loading completes, you are prompted to press Return.

After you press Return, the System Utilities Menu appears:

```
MAIN MENU
SYSTEM UTILITIES

  Utility selections are:

  1 - IOADDRES
  2 - RRAA - Update drive unit number for RRD40 controller A.
  3 - RRAB - Update drive unit number for RRD40 controller B.
```

NOTE: *If your system does not have an RRD-series drive connected to a KRQ50 controller, only one function, IOADDRES, is available.*

Select a function by typing its number and Return.

3.5.3.1 IOADDRES Function

NOTE: *The IOADDRES function is for users of Industrial VAX systems. It is described in the Industrial VAX troubleshooting manual.*

The IOADDRES function gives you a list of standard CSR addresses and interrupt vectors that MDM uses in testing devices. The first available CSR and interrupt vector for configuring devices with a nonstandard address is also given. IOADDRES does not look at devices on the bus; it lists devices supported by Digital Customer Services.

The devices in your system were configured at the factory. Any new devices added to your system should be configured by a Digital service representative.

3.5.3.2 Update Drive Unit Number for RRD-Series Function

The Update Drive Unit Number function lets you update the unit number for an RRD-series disc drive connected to a KRQ50 controller. Refer to the appropriate RRD-series disc drive owner's manual for instructions.

3.5.4 Display the Service Menu Option

The Display the Service Menu option is available only if you purchased the MicroVAX Maintenance Kit. That kit contains service diagnostics and the system maintenance guide.

CAUTION: *Only qualified service personnel should use the MicroVAX Maintenance Kit.*

3.5.5 Display the Connect/Ignore Menu Option

NOTE: *The Connect/Ignore Menu is for users of Industrial VAX systems. Its options are described in the Industrial VAX troubleshooting manual.*

The Display the Connect/Ignore Menu option lets you customize MDM diagnostics. You can load your own diagnostics on a device, as well as load MDM diagnostics on a device with a nonstandard CSR address and interrupt vector.

See the *Industrial VAX Troubleshooting* manual; use this option with caution.

3.5.6 Select Single Device Tests Option

The Select Single Device Tests option lets you run tests for a single device.

- A functional test is performed on the device circuits.
- An exerciser test ensures that the device works properly.

After you select this option, the diagnostics are prepared for testing. If this is the first option you selected, the diagnostics are loaded. Loading takes several minutes. After loading completes, you are prompted to press Return.

After you press Return, a list of the devices in your system is displayed:

```
MAIN  MENU                              Release nnn   Version  xx.xx
SELECT SINGLE DEVICE TEST

Select the device number to be tested.  The functional tests
will be run followed by the exercisers for 4 minutes.

1 - CPUA - VAX 4000 CPU
2 - MEMA - VAX 4000 memory system
3 - PDIA - SHAC DSSI Subsystem
4 - SGCA - Second Generation Ethernet Controller
5 - PDIB Shac DSSI subsystem.
```

```
Type the number; then press the RETURN key,
or type 0 and press the RETURN key to return to the Main Menu. >
```

NOTE: *Because of the similarity of some communication options, MDM sees them as the same device. A CXA16 and CXB16 appear the same to MDM. A generic device name, DH-CX0, is listed for such options, and the last letter in each name shows the difference. For example, DH-CX0A indicates one option, DH-CX0B a second, and so forth.*

Select a device for testing by typing its number and Return.

After you press Return, your system configures the device diagnostics and testing begins. If the device passes the functional test, a message to that effect appears and the exerciser test begins. The exerciser test runs for approximately 4 minutes.

This shows an example of a successful test.

```
BEGIN FUNCTIONAL TEST

     Device                          Result

     CPUA ....................       PASSED

BEGIN EXERCISER TEST

     Results are reported at the end of the testing.

SINGLE DEVICE TEST PASSED
```

If a device fails the test, you receive a failure message which identifies:

- The device tested
- When the failure occurred
- The field-replaceable unit (FRU)

Copy the failure message and report it to your Digital service representative.

This shows an example of an unsuccessful test.

```
BEGIN FUNCTIONAL TEST

     Device                       Result

     SGCA ...................     FAILURE DETECTED

     A failure was detected while testing the

          OPTION: SGCA  Ethernet controller

     The Field Replaceable Unit (FRU) identified is the:

          Ethernet controller
```

After a failure message appears, the testing stops.

Press [Return] to return to the Select Single Device Test menu for more testing.

To exit MDM, press [Break] or the Restart button.

3.6 Exiting MDM

Exit MDM in one of the following ways.

- Press [Break].
- Press and then release the Halt button.
- Press the Restart button.

Remove the tape cartridge as described in your *Operation* manual.

If you ran MDM on a new system, you are ready to install your software. Set the write protect button to write-enable and then follow the instructions in your software manuals.

If you ran MDM on a system containing software, you must reboot that software.

You can reboot your system software in one of two ways:

- At the console mode prompt (>>>), use the command BOOT Dxxx, where Dxxx is the device name of the fixed disk or RF-series ISE containing your system software.

  Use DUxx for an RA-series disk drive, or an RF-series ISE with a KFQSA adapter.

  Use DIxx for an RF-series ISE with a CPU-based DSSI.

  After your system software is loaded, set the Break Enable/Disable switch to disable (down) to avoid halting the system by pressing [Break].

- Set the Break Enable/Disable switch to disable (down) and press the Restart button. That begins the self-test sequence and loads system software.

Appendix A
System Controls and Indicators

The illustrations in this appendix show the controls and indicators on your system:

Figure A–1: System Control Panel and Power Supply

Figure A–2: Integrated Storage Element and Console Module

Figure A–3: TK70 and TK50 Tape Drives

Figure A–4: TF-Series and TLZ04 Tape Drives

Figure A–1: System Control Panel and Power Supply

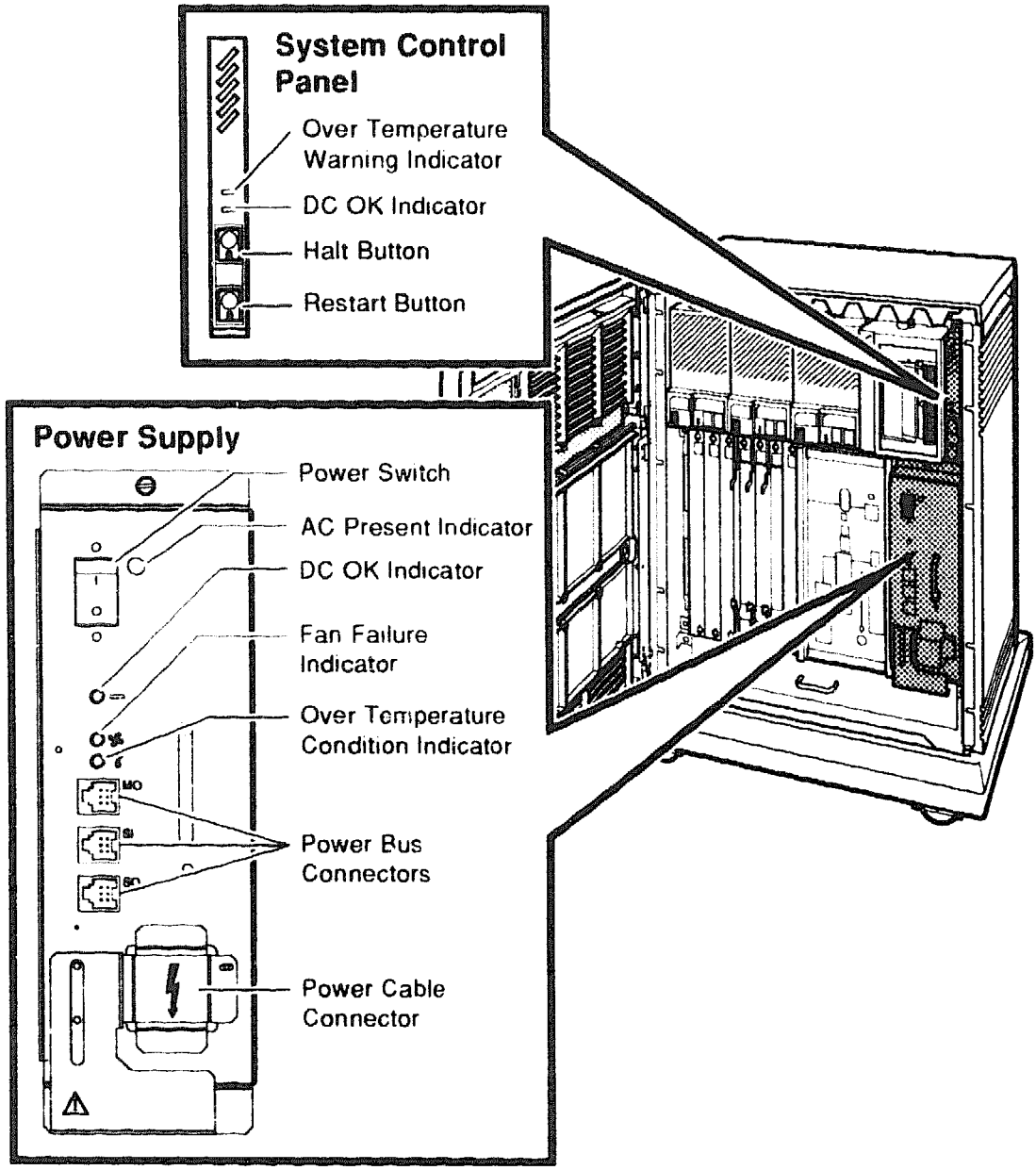
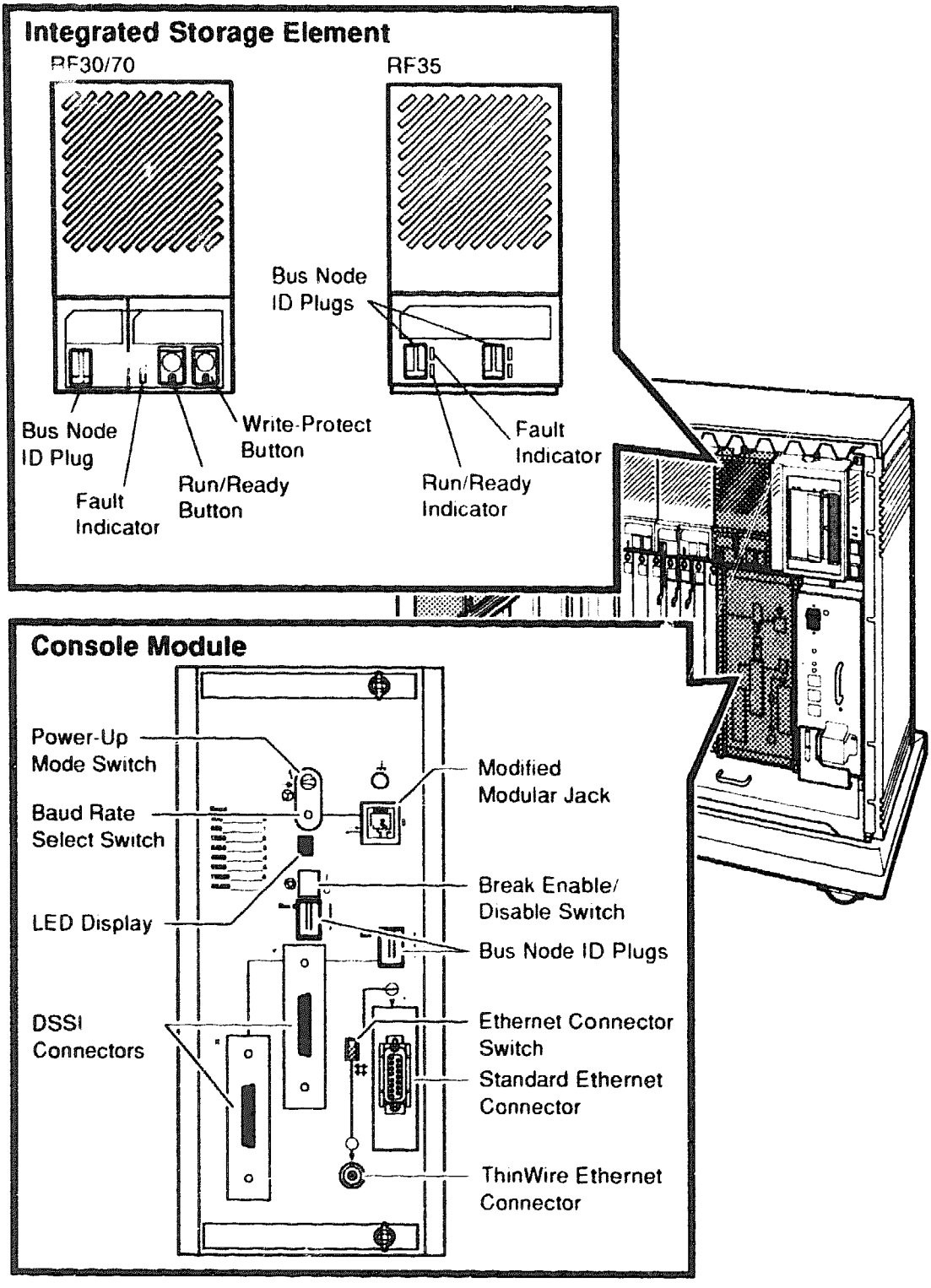


Figure A–2: RF-Series ISE and Console Module



MLO-007703

Figure A–3: TK70 and TK50 Tape Drives

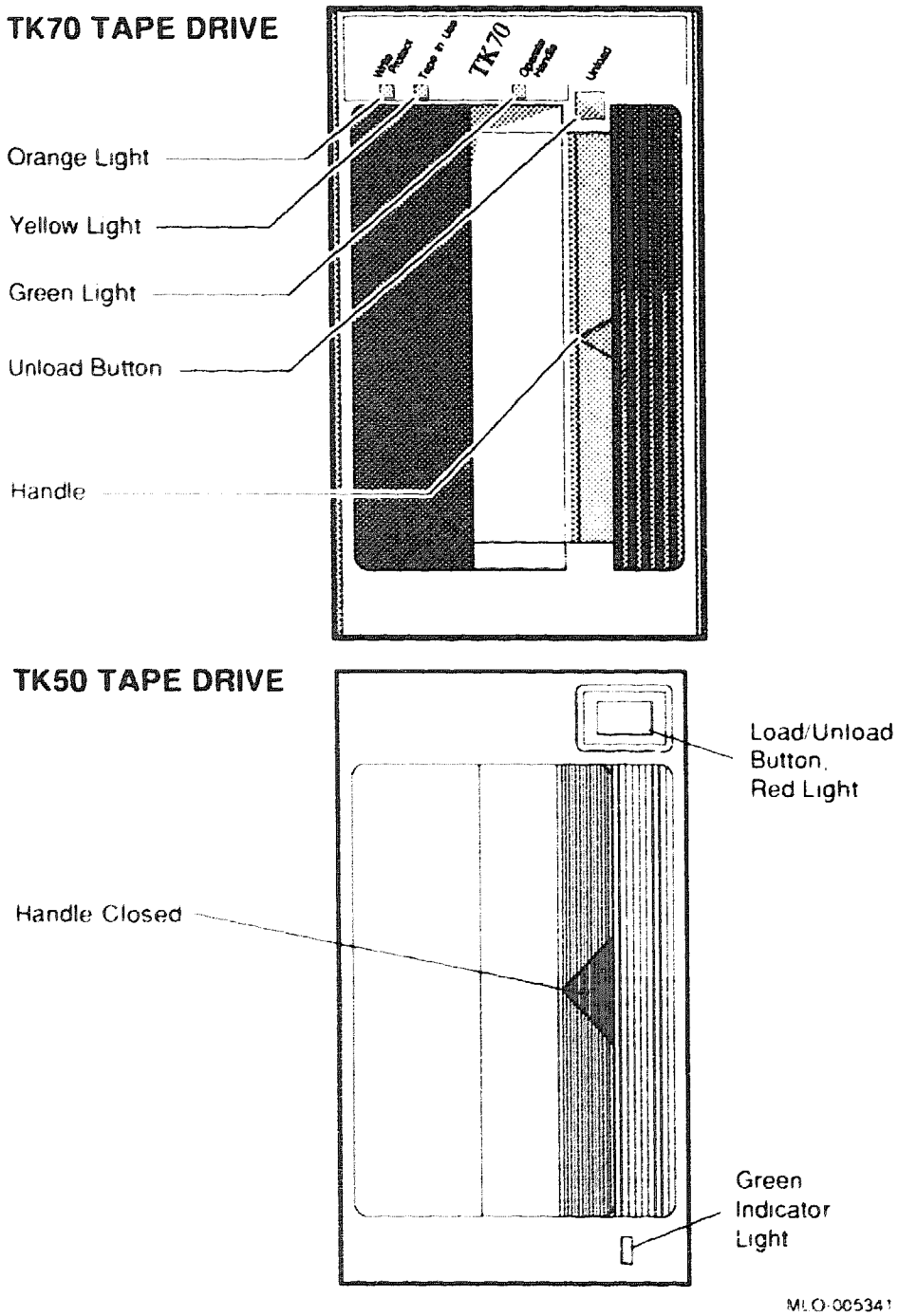
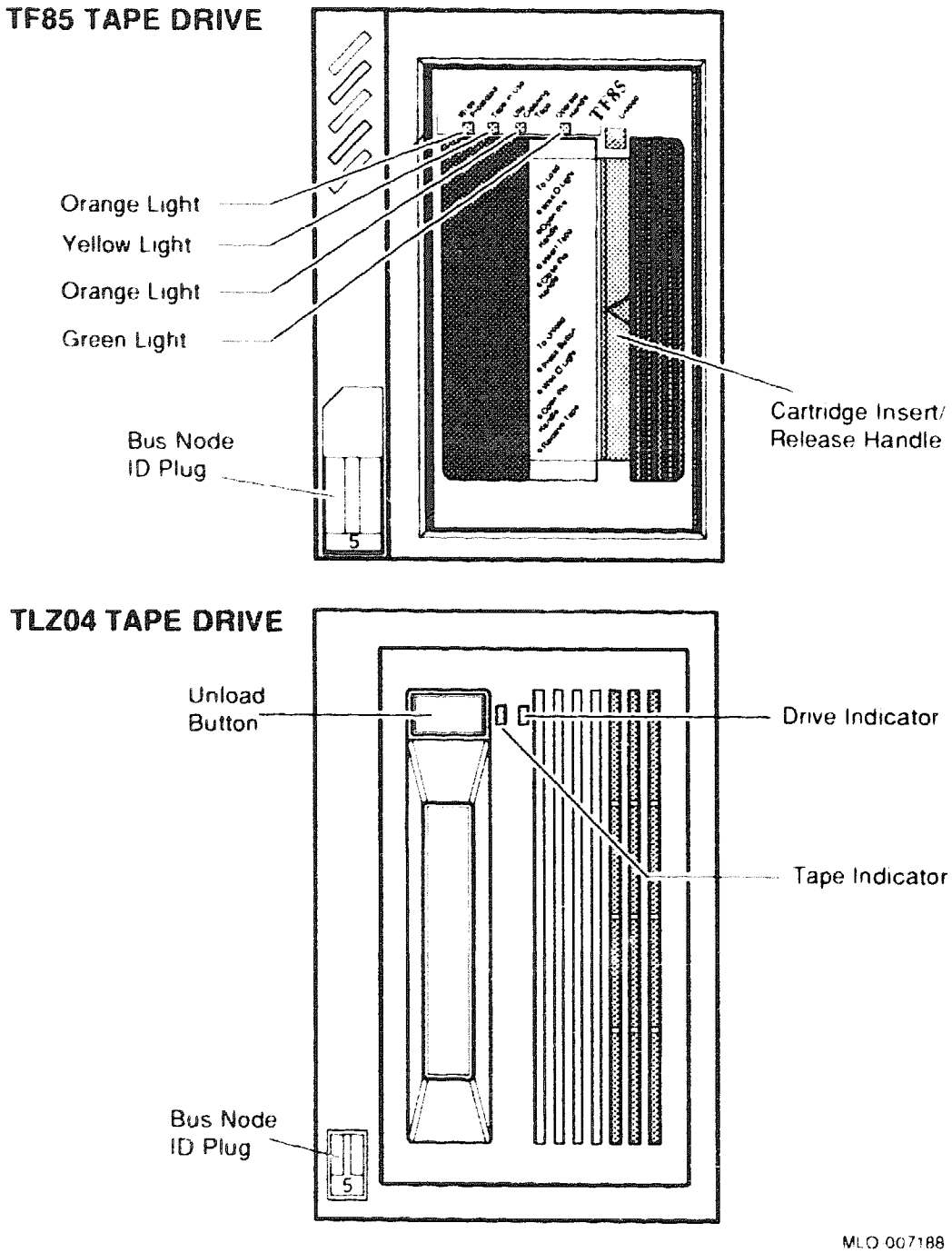


Figure A–4: TF-Series and TLZ04 Tape Drives



Appendix B
Write-Protecting an RF-Series ISE

You may want to write-protect an ISE containing sensitive data you do not want changed or accidentally erased.

For all but the RF35, you write-protect an ISE by setting the Write-Protect button to in (lit). For the RF35 ISE, which has no Write-Protect button, you set write-protection through VMS commands or through firmware commands in console mode, explained later in this section.

The Write-Protect button controls whether the system can write data to the ISE. The system can read from the ISE regardless of the setting of the Write-Protect button. When the Write-Protect button is out (not lit), the system can write to the ISE.

Your system disk (the ISE containing system software) and ISEs containing work areas for users should be write-enabled, the normal operating setting.

B.1 Software Write-Protect For RF-Series ISEs

Since the RF35 does not have a Write-Protect button, the software write-protect is the primary method for write-protecting an RF35.

The software write-protect is available through VMS using the MOUNT utility with the /NOWRITE qualifier.

To software write-protect an ISE, enter the following DCL command from the VMS operating system.

```
MOUNT <device_name> <volume_label>/SYSTEM/NOWRITE
```

where <device_name> is the device name, as shown using the VMS DCL command SHOW DEVICE DI, and <volume_label> is the volume label for the device. For example,

```
$ MOUNT $1$DIA1 OMEGA/SYSTEM/NOWRITE
```

will software write-protect device 1DIA1.

Dismounting, and then remounting the device (without using the /NOWRITE qualifier), will write-enable the device.

Use the VMS DCL command SHOW DEVICE DI to check the protection status of the drive. A write-protected drive will show a device status of `Mounted wrtlck`. Refer to your VMS documentation for more information on using the MOUNT Utility.

CAUTION: *When you dismount then mount the device again, it will no longer be write-protected.*

B.2 Hardware Write-Protect For RF35 ISEs

The hardware write-protect provides a more permanent write-protection than the software write-protect in that once you hardware write-protect an RF35 it remains write-protected regardless of the availability of the operating system or if the system is powered-down. In addition, a hardware write-protect cannot be removed using the MOUNT command. The hardware write-protect simply provides the same degree of write-protection available to RF-series ISEs that have a Write-Protect button.

You should consider hardware write-protecting an RF35 in the following situations.

- If you want to write-protect an RF35 ISE when the VMS operating system is not available, such as before running the MicroVAX Diagnostic Monitor (MDM).
- If you want to ensure that an RF35 remains write-protected, since the hardware write-protect cannot be removed using the VMS command MOUNT and will remain in effect even if the operating system is brought down.

You can hardware write-protect an RF35 from VMS or through firmware commands entered at the console prompt (>>>). Use the following instructions.

1. Access the Diagnostic and Utility Program (DUP) driver for the device you want to write-protect.
   - To access the DUP driver from console mode:
     a. Enter console mode by pressing the Halt Button or powering up the system with the Break Enable/Disable switch set to enable (up, position 1).

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

b. Access the DUP driver by setting host to the specific device you want to write protect.

Use the following command for embedded DSSI.

```
SET HOST/DUP/DSSI/BUS:<bus_number> <node_number> PARAMS
```

where <bus_number> is the DSSI bus number (0 or 1), and <node_number> is the bus node ID (0–6) for the device on the bus (bus number and node number are listed in the SHOW DSSI display).

Use the following command for KFQSA-based DSSI.

```
SET HOST/DUP/UQSSP/DISK <controller_number> PARAMS
```

where <controller_number> is the controller number (listed in the SHOW UQSSP display) for the device on the bus.

- To access the DUP driver from VMS:

a. Connect to the Diagnostic and Utility Program (DUP) and load its driver using the VMS System Generation Utility (SYSGEN) as shown below.

```
$ MCR SYSGEN
SYSGEN> CONNECT/NOADAPTER FYA0
SYSGEN> EXIT
$
```

b. Access the DUP driver by setting host to the specific device you want to write protect. Use the following command.

```
SET HOST/DUP/SERVER=MSCP$DUP/TASK=PARAMS <node_name>
```

where <node_name> is the device node name (the node name, in parenthesis, is listed in the SHOW DEVICE DI display).

2. At the PARAMS> prompt, enter SET WRT_PROT 1 to write-protect the ISE to which you are currently connected.

NOTE: *To verify that you have set host to the intended drive, you can enter the command LOCATE at the PARAMS> prompt. The LOCATE command causes the drive's Fault indicator to blink momentarily.*

3. Enter SHOW WRT_PROT to verify the WRT_PROT parameter is set to 1.

4. After you have completed setting and examining the WRT_PROT device parameter, enter the WRITE command at the PARAMS> prompt to save the device parameter. The change is recorded to nonvolatile memory.

5. Enter the EXIT command at the PARAMS> prompt to exit the DUP driver utility for the specified device.

This is an example of setting a hardware write-protect through firmware.

```
>>>SET HOST/DUP/DSSI/BUS:0 1 PARAMS
Starting DUP server...
Copyright (c) 1992  Digital Equipment Corporation
PARAMS>SET WRT_PROT 1
PARAMS>WRITE
PARAMS>SHOW WRT_PROT
Parameter      Current            Default          Type      Radix
---------  ----------------  ----------------  --------  -----
WRT_PROT                  1                 0   Boolean     0/1
PARAMS>EXIT
Exiting...
Stopping DUP server...
>>>
```

This is an example of setting a hardware write-protect through VMS.

```
$ MCR SYSGEN
SYSGEN> CONNECT/NOADAPTER FYA0
SYSGEN> EXIT
$ SET HOST/DUP/SERVER=MSCP$DUP/TASK=PARAMS R35F3C
Starting DUP server...
Copyright (c) 1992  Digital Equipment Corporation
PARAMS>SET WRT_PROT 1
PARAMS>WRITE
PARAMS>SHOW WRT_PROT
Parameter      Current            Default          Type      Radix
---------  ----------------  ----------------  --------  -----
WRT_PROT                  1                 0   Boolean     0/1
PARAMS>EXIT
Exiting...
Stopping DUP server...
$
```

To remove the hardware write-protection, repeat the above procedure, only set the WRT_PROT value to 0.

You can verify that the device is write-protected while running VMS—when you issue the VMS DCL command SHOW DEVICE DI, a write-protected drive will show a device status of `Mounted wrtlck`. If you issue the VMS command SHOW DEVICE/FULL, a write-protected drive will be listed as `software write-locked`.

NOTE: *You cannot remove hardware write-protection using the VMS MOUNT utility.*

Index

A

Autobooting system software, 1–1

B

Boot sequence power-up problems, 1–3
Booting
  integrated storage element, power-up problems, 1–4
  tape drive, power-up problems, 1–4
Booting MicroVAX Diagnostic Monitor
  See MicroVAX Diagnostic Monitor, starting

C

Caddy, disc
  See RRD-series disc
CDROM
  See RRD-series disc
CDROM Kit, MicroVAX Diagnostic Monitor, 3–2
Compact disc
  See RRD-series disc
Connect/Ignore option, MicroVAX Diagnostic Monitor Main Menu, 3–14
Controls and indicators, system, A–1

D

Diagnostic monitor
  See MicroVAX Diagnostic Monitor
Disc caddy
  See RRD-series disc
Disc, compact
  See RRD-series disc
Diskless or tapeless system
  See System, diskless or tapeless
Display System Configuration and Devices option, MicroVAX Diagnostic Monitor Main Menu, 3–11
Display the Connect/Ignore Menu option, MicroVAX Diagnostic Monitor Main Menu, 3–14
Display the Service Menu option, MicroVAX Diagnostic Monitor Main Menu, 3–14
Display the System Utilities Menu option, MicroVAX Diagnostic Monitor Main Menu, 3–13
DSSI VAXcluster system, preparing to run MicroVAX Diagnostic Monitor, 3–3
DSSI VAXcluster, preparing to run MicroVAX Diagnostic Monitor
  one TK70 tape drive, 3–3
  two tape drives, 3–4

E

Error messages
  All devices disabled, 3–10
  No Dg, 3–12
  Unknown, 3–12
Exiting MicroVAX Diagnostic Monitor, 3–16

H

Hard Disk Kit, MicroVAX Diagnostic Monitor, 3–3
Hard disk, preparing to run MicroVAX Diagnostic Monitor, 3–3

I

Indicators, system, A–1
Integrated storage element
  operation problems, 2–4
  power-up booting problems, 1–4
Introductory display, MicroVAX Diagnostic Monitor, 3–9
IOADDRES function, MicroVAX Diagnostic Monitor System Utilities Menu, 3–13
ISE
  See Integrated storage element

K

KZQSA adapter, booting MicroVAX Diagnostic Monitor, 3–8

L

Leaving MicroVAX Diagnostic Monitor, 3–16
Limitations, MicroVAX Diagnostic Monitor, 3–1

M

Main Menu options, MicroVAX Diagnostic Monitor, 3–9
MDM
  See MicroVAX Diagnostic Monitor
Messages
  See Error messages
MicroVAX Diagnostic Monitor
  booting
    disc drive, 3–8
    KZQSA adapter, 3–8
    RRD-series disc drive, 3–8
  CDROM Kit, 3–2
MicroVAX Diagnostic Monitor (cont'd)
  disc caddy, preparing, 3–8
  Display System Configuration and Devices option, Main Menu, 3–11
  Display the Connect/Ignore Menu option, Main Menu, 3–14
  Display the Service Menu option, Main Menu, 3–14
  Display the System Utilities Menu option, Main Menu, 3–13
  exiting, 3–16
  Hard Disk Kit, 3–3
  introductory display, 3–9
  IOADDRES function, System Utilities Menu, 3–13
  leaving, 3–16
  limitations, 3–1
  Main Menu options, 3–9
  medium, 3–1
  preparing RRD-series disc caddy, 3–8
  preparing to run, 3–2
  preparing to run, diskless or tapeless system, 3–2
  preparing to run, DSSI VAXcluster, 3–3
  preparing to run, DSSI VAXcluster, one TK70 tape drive, 3–3
  preparing to run, DSSI VAXcluster, two tape drives, 3–4
  preparing to run, hard disk, 3–3
  preparing to run, RF-series integrated storage element or hard disk, 3–3
  preparing to run, RRD-series disc, 3–2
  preparing to run, tapeless system, 3–2
  RRD-series disc caddy, preparing, 3–8
  running, 3–1

MicroVAX Diagnostic Monitor (cont'd)
Select Single Device Tests option, Main Menu, 3–14
starting, 3–5
starting, booting TK50/TK70 tape, 3–6
starting, booting TK70 tape automatically, 3–7
starting, booting TK70 tape manually, 3–6
starting, RRD-series disc, 3–8
Test the System option, Main Menu, 3–9
Update Drive Unit Number for RRD40 function, System Utilities Menu 3–13
when to run, 3–1
MicroVAX Ethernet Server Customer Diagnostics Kit, 3–2
Monitor
See MicroVAX Diagnostic Monitor

N

Normal operation problems
See Operation problems
Normal operation, troubleshooting, 2–1

O

Operation problems
integrated storage element, 2–4
system, 2–1
TF-series tape drive, 2–5
TK50 tape drive, 2–6
TK70 tape drive, 2–7
TLZ04 tape drive, 2–8

P

Power-up problems, 1–1
boot sequence, 1–3
booting integrated storage element, 1–4
booting tape drive, 1–4
Power-up problems (cont'd)
integrated storage element, booting, 1–4
self-test, 1–1
tape drive booting, 1–4
troubleshooting, 1–1
Preparing disc caddy, RRD-series disc, 3–8
Preparing to run MicroVAX Diagnostic Monitor
See MicroVAX Diagnostic Monitor, preparing to run
Problems
See Operation problems *or* Power-up problems

R

Rebooting system after running MicroVAX Diagnostic Monitor, 3–16
RF-series integrated storage element
See Integrated storage element
preparing to run MicroVAX Diagnostic Monitor, 3–3
ROM
See RRD-series disc
RRD-series disc
booting MicroVAX Diagnostic Monitor from KZQSA adapter, 3–8
preparing disc caddy, 3–8
preparing to run MicroVAX Diagnostic Monitor, 3–2
starting MicroVAX Diagnostic Monitor, 3–8
Running MicroVAX Diagnostic Monitor, 3–1

S

Select Single Device Tests option, MicroVAX Diagnostic Monitor Main Menu, 3–14

Self-test
power up, 1–1
power-up problems, 1–1
Software
See System, software
Starting MicroVAX Diagnostic Monitor
See MicroVAX Diagnostic Monitor, starting
Storage element
See Integrated storage element
System
controls and indicators, A–1
diskless or tapeless, preparing to run MicroVAX Diagnostic Monitor, 3–2
DSSI VAXcluster, preparing to run MicroVAX Diagnostic Monitor, 3–3
DSSI VAXcluster, preparing to run MicroVAX Diagnostic Monitor, one TK70 tape drive, 3–3
DSSI VAXcluster, preparing to run MicroVAX Diagnostic Monitor, two tape drives, 3–4
indicators, A–1
operation problems, 2–1
software, autobooting, 1–1
tapeless, preparing to run MicroVAX Diagnostic Monitor, 3–2

T

Tape drive
power-up problems, booting, 1–4
TF-series operation problems, 2–5
TK50 operation problems, 2–6
TK70 operation problems, 2–7
TLZ04 operation problems, 2–8
Tapeless system
See System, tapeless
Test the System option, MicroVAX Diagnostic Monitor Main Menu, 3–9
TF-series tape drive operation problems, 2–5
TK50 tape drive
operation problems, 2–6
TK50/TK70 tape, starting MicroVAX Diagnostic Monitor, 3–6
TK70 tape drive
operation problems, 2–7
TLZ04 tape drive operation problems, 2–8
Troubleshooting
MicroVAX Diagnostic Monitor, 3–1
normal operation, 2–1
power up, 1–1
power-up problems, 1–1

U

Update Drive Unit Number for RRD40 function, MicroVAX Diagnostic Monitor System Utilities Menu, 3–13
Utilities menu
See MicroVAX Diagnostic Monitor, Display the System Utilities Menu option

W

Write-enabling
a storage element, B–1
an RF35 storage element, B–1 to B–4
Write-protecting
a storage element, B–1
an RF35 storage element, B–1 to B–4

VAX 4000 Model 400/500/600 Technical Information

Order Number EK–452AD–TI.004

Digital Equipment Corporation
Maynard, Massachusetts

First Printing, December 1991
Revised, February 1992
Revised, April 1992
Revised, July 1992

The Reader's Comments form at the end of this document requests your critical evaluation to assist in preparing future documentation.

FCC NOTICE: The equipment described in this manual generates, uses, and may emit radio frequency. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such radio frequency interference.

Operation of the equipment in a residential area may cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

S1979

This document was prepared using VAX DOCUMENT, Version 2.1

Contents

Preface vii

Chapter 1 Base System Description

1.1 System Overview 1–1
1.2 Firmware Overview 1–2
1.3 Power-Up 1–3
1.4 Console I/O Mode Overview 1–3
1.4.1 Control Characters in Console I/O Mode 1–4
1.4.2 Console I/O Mode Commands 1–6
1.5 Digital Storage Systems Interconnect (DSSI) 1–11
1.6 KA675–AA CPU Specifications 1–12
1.7 KA680–AA CPU Specifications 1–15
1.8 KA690–AA CPU Specifications 1–19
1.9 MS690 Memory Specifications 1–23

Chapter 2 Option Specifications

2.1 Options Overview 2–1
2.1.1 Configuration 2–1
2.2 Mass Storage Options 2–2
2.2.1 KDA50 Controller 2–2
2.2.2 KFQSA Storage Adapter 2–4
2.2.3 KLESI Controller 2–5
2.2.4 KZQSA Storage Adapter 2–5
2.2.5 RA60 Disk Drive 2–6
2.2.6 RA70E Disk Drive 2–7
2.2.7 RA81 Disk Drive 2–8
2.2.8 RA82 Disk Drive 2–10
2.2.9 RA90 Disk Drive 2–11

2.2.10 RA92 Disk Drive 2–12
2.2.11 RF31 Integrated Storage Element (ISE) 2–13
2.2.12 RF31F Integrated Storage Element 2–14
2.2.13 RF35 Integrated Storage Element 2–15
2.2.14 RF71 Integrated Storage Element (ISE) 2–17
2.2.15 RF72 Integrated Storage Element (ISE) 2–18
2.2.16 RF73 Integrated Storage Element (ISE) 2–19
2.2.17 RRD40 Compact-Disc Subsystem 2–21
2.2.18 RRD42 Optical Compact-Disc Subsystem 2–22
2.2.19 TF85 Tape Drive 2–23
2.2.20 TK50 Tape Drive 2–25
2.2.21 TK70 Tape Drive 2–26
2.2.22 TLZ04 Tape Drive 2–28
2.2.23 TSZ07 Tape Drive 2–30
2.2.24 TSV05 Tape Drive 2–32
2.2.25 TSV05 Controller 2–33
2.2.26 TU81–Plus Tape Drive 2–34
2.3 Communication Options 2–35
2.3.1 CXA16 Asynchronous Multiplexer (16 lines) 2–36
2.3.2 CXB16 Asynchronous Multiplexer (16 lines) 2–38
2.3.3 CXY08 Asynchronous Multiplexer (8 Lines) 2–41
2.3.4 DEQRA Token Ring Q-Bus Adapter 2–43
2.3.5 DESQA Ethernet Controller 2–44
2.3.6 DFA01 Asynchronous Controller with Integral Modem . . . 2–45
2.3.7 DPV11 Synchronous Controller 2–47
2.3.8 DSRVB DECserver 200 2–48
2.3.9 DSV11 Synchronous Controller 2–49
2.4 Real-Time Options 2–50
2.4.1 AAV11–S Digital-to-Analog Converter 2–51
2.4.2 ADQ32 Analog-to-Digital Converter 2–52
2.4.3 ADV11–S Analog-to-Digital Converter 2–55
2.4.4 AXV11 Controller 2–57
2.4.5 DIV32 Controller 2–59
2.4.6 DRQ3B Parallel Interface 2–60
2.4.7 DRV1W Parallel Interface 2–61
2.4.8 IBQ01 Controller 2–63

2.4.9 IEQ11 Controller 2–64
2.4.10 KWV11–S Programmable Real-Time Clock 2–65
2.5 Printer Interface 2–68
2.5.1 LPV11–SA Printer Interface 2–68
2.6 Graphics Adapter 2–68
2.6.1 VS30U Graphics Adapter 2–68

Chapter 3 System Expansion

3.1 Planning System Expansion 3–1
3.2 Completing the System Configuration Worksheet 3–2

Index

Tables

1–1 Console I/O Mode Control Characters 1–4
1–2 Console I/O Mode Commands 1–6
1–3 Device Names 1–10
3–1 Power Requirements 3–4

Page vi
is BLANK

Preface

This manual provides a summary of technical information for your system. The manual is organized as follows.

- Chapter 1 describes the base system and lists specifications for the CPUs and the memory modules.
- Chapter 2 describes optional components available for your system and lists their specifications.
- Chapter 3 provides guidelines on how to expand your system.

NOTE: *You will find a glossary in the Operation manual to help with word definitions and acronyms.*

The following conventions are used in this manual.

Convention	Meaning
Key	A terminal key used in text and examples. For example, Break indicates that you press the Break key on your terminal keyboard.
Ctrl/x	Hold down the Ctrl key while you press another key.
BOLD	Your input. For example: >>> **BOOT MIA5** shows that you must enter BOOT MIA5 at the console prompt.
NOTE	Provides general information about the current topic.

Chapter 1
Base System Description

This chapter describes the base system, including the following.

- Power-up self-tests
- Digital Storage Systems Interconnect (DSSI) architecture
- Specifications for the KA6nn–AA CPU, and the MS690–BA/–CA/–DA memory modules.

1.1 System Overview

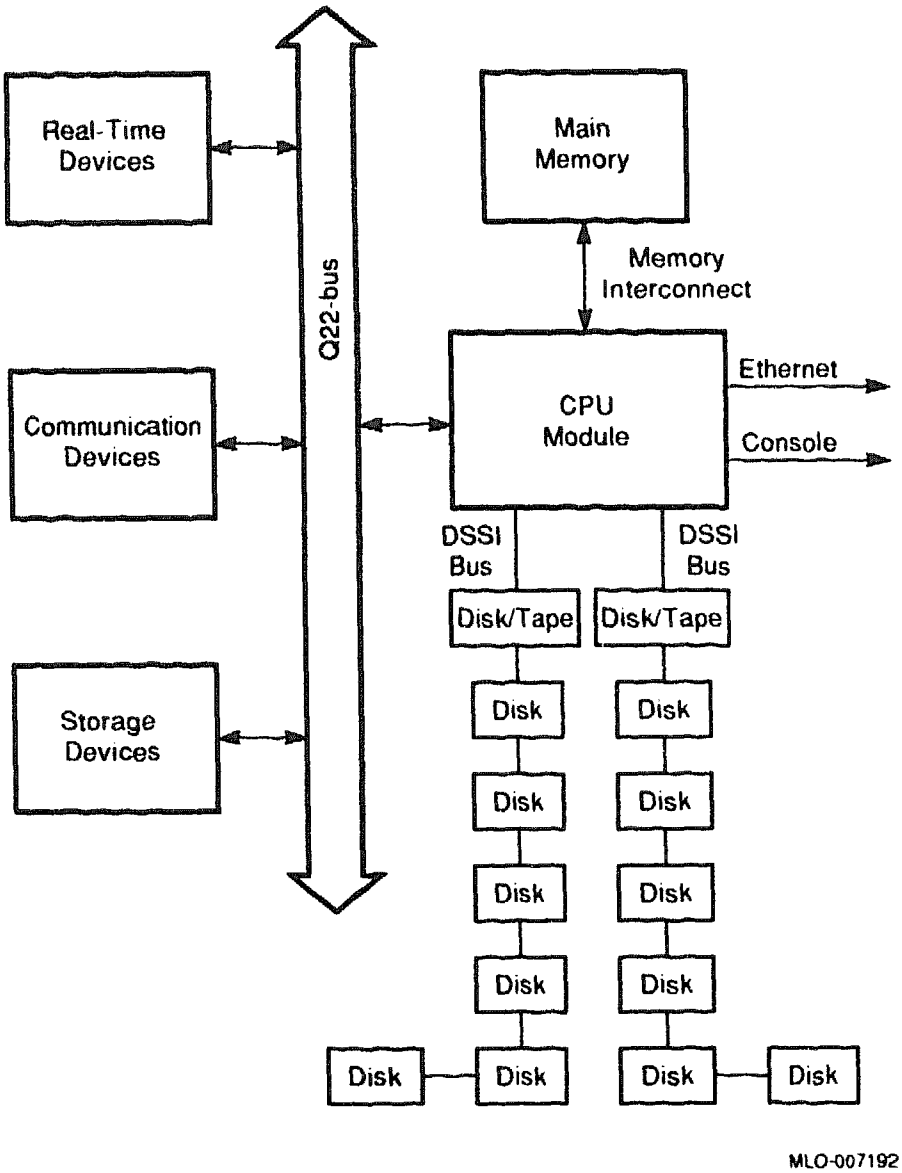
All base system components are housed in a BA440 enclosure, which contains a 12-slot backplane, 7 Q–bus slots; 1 slot reserved for CPU, and 4 slots for memory.

Each base system contains the following.

- A KA6nn–AA (L4002–nA) CPU module, located in slot 5.
- From one to four MS690–BA/–CA/–DA memory modules.

The system operates from the KA6nn CPU firmware, the controls on the console module, and the System Control Panel (SCP). The firmware is described in Section 1.2. Base system operation also integrates Digital Storage Systems Interconnect (DSSI) technology, which is discussed in Section 1.5.

A block diagram of the system:



1.2 Firmware Overview

Four flash-eraseable programmable read-only memory (FEPROM) chips on the KA6nn CPU module contain the firmware. This firmware consists of the following three major programs, which perform the system power-up self-tests and diagnostics.

- A console program
- A set of self-tests for the CPU and memory

- A primary bootstrap program (VMB)

The console program receives control whenever the processor halts. In a processor halt, processor control passes to the console program and instruction execution continues.

Control passes to the firmware under any of the following conditions.

- You turn on the system.
- You press the Restart button.
- You assert the Q22–bus BHALT signal by pressing the Halt button.
- You enter a break when the Break Enable/Disable switch is set to enable.
- A HALT instruction is executed.
- A system error occurs.

1.3 Power-Up

At power-up, the console program determines the console device type and console language, then runs the self-tests for the CPU and memory. You choose the console language when you perform the set-up operations during your console terminal installation procedure.

You determine the type of power-up mode by setting the Power-Up Mode switch on the CPU console module. See your *Operation* manual for the following power-up information.

- Power-up procedures
- Power-Up Mode and Break Enable/Disable switch settings
- Examples of successful power-up sequences
- Boot and autoboot procedures

See your *Troubleshooting and Diagnostics* manual for examples of problems you may encounter during power-up.

1.4 Console I/O Mode Overview

If you set the Break Enable/Disable switch on the console module to enable, the console program enters Console I/O mode after the power-up self-tests are completed successfully. The console program also enters Console I/O mode in response to any external halt condition.

Console I/O mode allows you to control the system by typing commands at the console prompt (>>>). You may enter these commands in either uppercase or lowercase letters. Enter each command, then press Return.

1.4.1 Control Characters in Console I/O Mode

Table 1–1 lists the keypad control characters that have special meaning in Console I/O mode.

Table 1–1: Console I/O Mode Control Characters

Character	Action
Return also <CR>	The carriage return ends a command line. No action is taken on a command until after it is terminated by a carriage return. A null line terminated by a carriage return is treated as a valid, null command. No action is taken, and the console prompts for input. Carriage return is echoed as carriage return, line feed <CR><LF>.
⌫ (rubout)	When you press ⌫ (rubout), the console deletes the previously typed character. The resulting display differs, depending on whether the console is a video or a hardcopy terminal.

For hardcopy terminals, the console echoes a backslash (\) followed by the character being deleted. If you press additional rubouts, the additional deleted characters are echoed. If you type a non-rubout character, the console echoes another backslash, followed by the character typed. The result is to echo the characters deleted, surrounding them with backslashes. For example:

EXAM!;E⌫ (rubout)⌫ (rubout)NE <CR>

The console echoes: EXAMI;E\E\;NE<CR>

The console sees the command line: EXAMINE<CR>

For video terminals, the previous character is erased and the cursor is restored to its previous position.

The console does not delete characters past the beginning of a command line. If you press more rubouts than there are characters on the line, the extra rubouts are ignored. A rubout entered on a blank line is ignored.)

Ctrl/A or F14	Toggles insertion/overstrike mode for command line editing. By default, the console powers up to overstrike mode.
Ctrl/C	Echoes ^C<CR> and aborts processing of a command. Has no effect as part of a binary load data stream. Clears Ctrl/S and re-enables output stopped by Ctrl/O.
Ctrl/D or ←	Moves the cursor one position to the left.

Table 1–1 (Cont.): Console I/O Mode Control Characters

Character	Action
Ctrl/E	Moves the cursor to the end of the line.
Ctrl/F or →	Moves the cursor one position to the right.
Ctrl/B, ↑, or ↓	Recalls the previous commands
Ctrl/H, ← (rubout), or F12	Deletes the previously typed character. Same function as ← (rubout), above.
Ctrl/O	Ignores transmissions to the console until you enter Ctrl/O. Echoes ^O when disabling output, which is not echoed when it re-enables output. Output is re-enabled if the console prints an error message, or if it prompts for a command from the terminal. Output is also enabled by entering Maintenance mode: press Break or enter Ctrl/C.
Ctrl/Q	Resumes output to the console terminal. Not echoed.
Ctrl/R	Echoes <CR><LF>, followed by the current command line. Can be used to improve the readability of a command line that has been heavily edited.
Ctrl/S	Stops output to the console terminal until you enter Ctrl/Q. Not echoed.
Ctrl/U	Echoes ^U<CR>. Entered, but otherwise ignored if typed on an empty line

The console accepts Console I/O mode commands up to 80-characters long. Longer commands produce error messages. The character count does not include rubouts, rubbed-out characters, or the <CR> at the end of the command.

Two or more consecutive spaces and tabs are treated as a single space. Leading and trailing spaces and tabs are ignored. You can place command qualifiers after the command keyword or after any symbol or number in the command.

All numbers (addresses, data, counts) are hexadecimal, but symbolic register names contain decimal register numbers. The hexadecimal digits are 0 through 9, and A through F. You can use uppercase and lowercase letters in hexadecimal numbers (A through F) and commands.

The following symbols are qualifier and argument conventions.

[ ] = an optional qualifier or argument
{} = a required qualifier or argument

1.4.2 Console I/O Mode Commands

Table 1–2 lists and describes the Console I/O mode commands. You can display the list of commands by entering **HELP** at the console prompt (>>>).

Table 1–2: Console I/O Mode Commands

Command	Action
BOOT	Initializes the processor and transfers execution to the VMB.
CONFIGURE	Invokes an interactive mode that permits you to enter Q22–bus device names, then generates a table of Q22–bus I/O page device CSR addresses and interrupt vectors.
CONTINUE	Causes the processor to resume instruction execution at the point where the halt occurred. Does not perform a processor initialization.
DEPOSIT	Deposits data into the address you specify. If you do not specify an address space or data size qualifier, the console uses the last address space and data size used in a DEPOSIT, EXAMINE, MOVE, or SEARCH command.
EXAMINE	Examines the contents of the memory location or register of the address you specify.
FIND	Searches main memory starting at address 0 (zero) for a page-aligned 128-Kbyte segment of good memory, or a restart parameter block (RPB).
HALT	The HALT command has no effect. It is included for compatibility with other VAX consoles.
HELP	Displays the correct syntax for all console commands.
INITIALIZE	Performs a processor initialization.
MOVE	Copies the block of memory starting at the source address to a block beginning at the destination address.
NEXT	Executes the number of macro instructions you specify. If you do not specify a number, 1 (one) is assumed.
REPEAT	Repeatedly displays and executes the command you specify. Press Ctrl/C to stop the command. You can specify any valid console command except the REPEAT command.
SEARCH	Finds all occurrences of a pattern and reports the addresses where the pattern was found. If you include the /NOT qualifier, the command reports all addresses for which the pattern did not match.
SET BFLAG	Sets the default R5 boot flags. The value must be a hexadecimal number of up to eight digits.

Table 1–2 (Cont.): Console I/O Mode Commands

Command	Action
SET BOOT	Sets the default boot device. The value must be a valid device name.
SET CONTROLP	Sets Control-P as the console halt condition, instead of a BREAK.
SET HOST	Connects to the DUP or MAINTENANCE driver on the node or device you specify.
SET LANGUAGE	Sets the console language and keyboard type.
SET HALT	Sets the halt action you define. Acceptable values are the keywords: default, restart, reboot, halt, restart_reboot, or a number in the range 0 to 4 inclusive.
SET RECALL	Sets command recall state to either ENABLED (1) or DISABLED (0).
SHOW BFLAG	Displays the default R5 boot flags.
SHOW BOOT	Displays the default boot device.
SHOW CONTROLP	Shows the current state of Control-P halt recognition, either ENABLED or DISABLED.
SHOW DEVICE	Displays all devices displayed by the SHOW DSSI, SHOW ETHERNET, and SHOW UQSSP commands.
SHOW DSSI	Displays the status of all nodes that can be found on the DSSI bus. For each node on the DSSI bus, the firmware displays the node number, the node name, and the boot name and type of the device, if available. Does not indicate whether the device contains a bootable image.
SHOW ETHERNET	Displays the hardware Ethernet address for all Ethernet adapters that can be found, both on-board and on the Q22–bus.
SHOW LANGUAGE	Displays console language and keyboard type.
SHOW MEMORY	Displays main memory configuration, board by board.
SHOW QBUS	Displays all Q22–bus I/O addresses that respond to an aligned word read, plus vector and device name information. For each address, the console displays the address in the VAX I/O space in hexadecimal, the address as it would appear in the Q22–bus I/O space in octal, and the word that was read in hexadecimal. Also displays the vector that you should set up, and device name or names that could be associated with the CSR.
SHOW RECALL	Displays the current state of command recall, either ENABLED or DISABLED.

Table 1–2 (Cont.): Console I/O Mode Commands

Command	Action
SHOW HALT	Displays the halt action. Keywords include: default, restart, reboot, halt, restart_reboot or a number in the range 0 to 4 inclusive.
SHOW RLV12	Displays all RL01 and RL02 disks that appear on the Q22–bus.
SHOW SCSI	Shows any SCSI devices in the system.
SHOW TRANSLATION	Shows any virtual addresses that map to the specified physical address.
SHOW UQSSP	Displays the status of all disks and tapes that can be found on the Q22–bus that support the UQSSP protocol. For each such disk or tape on the Q22–bus, the firmware displays the controller number, the controller CSR address, and the boot name and type of each device connected to the controller. The command does not indicate whether the device contains a bootable image.
SHOW VERSION	Displays the current firmware version.
START	Starts instruction execution at the address you specify. If you do not give an address, the current program counter is used. If memory mapping is enabled, macro instructions are executed from virtual memory, and the address is treated as a virtual address. Equivalent to a DEPOSIT to PC, followed by a CONTINUE. Does not perform a processor initialization.
TEST	Invokes a diagnostic test program specified by the test number you enter. If you enter a test number of 0 (zero), all tests allowed to be executed from the console terminal are executed. The console accepts an optional list of up to five additional hexadecimal arguments.
UNJAM	Performs an I/O bus reset, by writing a 1 (one) to IPR 55 (decimal).
X	Loads or unloads (that is, writes to memory or reads from memory) the specified number of data bytes through the console serial line (regardless of console type), starting at the specified address. For use by automatic systems communicating with the console.

The following examples show sample displays for the commonly used commands SHOW and SET.

The SET command sets the parameter to the value you specify. The SHOW command displays the console parameter you specify.

```
>>> SHOW QBUS
Scan of Qbus I/O Space
-20001920 (774440) = FF08 DELQA/DESQA
-20001922 (774442) = FF00
-20001924 (774444) = FF2B
-20001926 (774446) = FF08
-20001928 (774450) = FFD7
-2000192A (774452) = FF41
-2000192C (774454) = 0000
-2000192E (774456) = 1030
-20001F40 (777500) = 0020 IPCR

Scan of Qbus Memory Space
>>>
```

For each address, the console displays the address in the VAX I/O space in hexadecimal, the address as it would appear in the Q22–bus I/O space in octal, and the word data that was read in hexadecimal.

```
>>>SHOW DEVICE
DSSI Bus 0 Node 0 (SYSDSK)
-DIA10 (RF31)
DSSI Bus 0 Node 1 (R7EB3C)
-DIA11 (RF31)
DSSI Bus 0 Node 2 (R7EB22)
-DIA12 (RF31)
DSSI Bus 0 Node 5 (TFDR1)
-MIA5 (TF85)
DSSI Bus 0 Node 6 (*)

DSSI Bus 1 Node 0 (SNEEZY)
-DIB0 (RF71)
DSSI Bus 1 Node 1 (DOPEY)
-DIB1 (RF71)
DSSI Bus 1 Node 2 (SLEEPY)
-DIB2 (RF71)
DSSI Bus 1 Node 3 (GRUMPY)
-DIB3 (RF71)
DSSI Bus 1 Node 4 (BASHFUL)
-DIB4 (RF71)
DSSI Bus 1 Node 5 (HAPPY)
-DIB5 (RF71)
DSSI Bus 1 Node 6 (DOC)
-DIB6 (RF71)
DSSI Bus 1 Node 7 (*)
UQSSP Tape Controller 0 (774500)
-MUA0 (TK70)
Ethernet Adapter
-EZA0 (08-00-2B-06-10-42)
```

For each device, the console displays the controller, the node, and the address on the first line, and the device name and option on the second line.

```
>>> SHOW ETHERNET
Ethernet Adapter
-EZA0 (08-00-2B-0B-29-14)

>>> SHOW LANGUAGE
English (United States/Canada)
>>>

>>> SET LANGUAGE 5
>>>
```

In that example, selection 5 is English, chosen from the language selection menu that displays at power-up.

```
>>> SET BOOT MIA5
>>>
```

In that example, entering MIA5 sets the tape drive as the default boot device. Table 1–3 lists all supported device names.

Table 1–3: Device Names

Device Type	Controller/Adapter	Device Logical Name
RF-series ISE	Embedded DSSI host adapter (part of CPU)	DImu[1]
	KFQSA DSSI storage adapter	DUcu[2]
TF-series tape drive	Embedded DSSI host adapter (part of CPU)	MImu[1]
TF85 tape drive	KFQSA DSSI storage adapter	MUcu[2]
TK70 tape drive	TQK70	MUcu[3]
TLZ04 tape drive	KZQSA adapter	MKAn
PROM (programmable read-only memory)	MRV11 module	PRAu

[1] m = DSSI bus adapter (A = internal bus (0); B = external bus (1).)
u = unit number (device unit numbers must be unique throughout the system).
When under operating system control, DIBu devices are recognized as DIAu devices.

[2] c = MSCP controller designator (A = first, B = second, and so on.)
u = unit number (device unit numbers must be unique throughout the system).

[3] c = TMSCP controller designator (A = first, B = second, and so on.)
u = unit number

Table 1–3 (Cont.): Device Names

Device Type	Controller/Adapter	Device Logical Name
Ethernet adapter	On-board (part of CPU)	EZA0
	DESQA Ethernet controller	XQAu
RA-series drives	KDA50	DUcu[2]

[2] c = MSCP controller designator (A = first, B = second, and so on.)
u = unit number (device unit numbers must be unique throughout the system).

1.5 Digital Storage Systems Interconnect (DSSI)

The KA6nn CPU module contains two DSSI bus adapters that are dedicated to the mass storage devices in your system.

The DSSI adapters provide a path to two separate DSSI busses (Bus 0 and Bus 1) through which the CPU can communicate with DSSI devices.

Each DSSI bus has the following characteristics.

- A 4-Mbytes-per-second bandwidth
- Up to eight nodes (one interface and up to seven additional DSSI Devices (RF-series ISEs, TF85s, and adapters))
- Eight data lines
- One parity line
- Eight control lines

DSSI architecture improves system performance as follows.

- The DSSI bus handles all mass storage transactions.
- Mass storage devices can act independently, since each device contains its own controller. Several devices can work simultaneously.

The two DSSI bus interfaces support up to 16 nodes. These 16 nodes include the 2 DSSI interfaces and 14 additional DSSI devices.

An ISE can maintain connection to more than one DSSI interface. That feature allows ISEs to be shared by multiple CPUs in a DSSI VAXcluster configuration.

For more information about DSSI VAXcluster configurations and the advantages of such configurations, see the section on DSSI VAXcluster capability in your system *Operation* manual.

1.6 KA675–AA CPU Specifications

The Model 400 system uses the timesharing KA675–AA CPU (L4002–BA).

Central Processing Unit	
Addressing modes	General register: 8
	Program counter: 4
	Index: 9
Clock rate	250 MHz (16 ns cycle)
Data path width	64 bits
Number of data types	Hardware: 9
	Software emulated: 7
Number of instructions	Hardware: 242
	Microcode assisted: 21
	Software emulated: 41
General purpose registers	16 (32-bit wide)
	Interval timer: 1 (programmable)
	Programmable timers: 2
I/O bus interface	One Q22–bus interface with 8192 entry scatter/gather map
Q–bus backplane termination	240 Ω

Memory Management and Control	
Page size	512 bytes
Virtual address space	4 gigabytes
Physical memory space	512 Mbytes
Number of memory modules	4 maximum

Architecture	
Instruction prefetch buffer size	16 bytes
Primary Cache	

Architecture

Data stored	Instruction stream and data
Write algorithm	Write-through
Size	8 Kbyte
Speed	14 nanoseconds
Associativity	Two-way
Back-up Cache	
Data stored	Instruction stream and data
Write algorithm	Write-back
Size	128 Kbytes
Speed	80 nanoseconds
Associativity	Direct mapped
Translation buffer	
Size	96 entry
Associativity	Fully associative
Q22-bus address translation Q22-bus map cache	
Size	16 entry
Associativity	Fully associative
Q22-bus I/O bus buffer size	
Input	32 bytes
Output	4 bytes
Q22-bus Maximum I/O bandwidth	
Block mode DMA read	2.4 Mbytes/second
Block mode DMA write	3.3 Mbytes/second

Ethernet Port

Supported protocols	Ethernet V2.0 (IEEE 802.3)
Supported media types	Standard or ThinWire
Data path width	1 bit

Ethernet Port

Data rate	10 Mbits/second
Buffer size	
Transmit buffer	128 bytes
Receiver buffer	128 bytes

Digital Storage System Interconnect (DSSI)

Number of DSSI interfaces	2
Maximum number of supported devices	14[1] (7 per DSSI interface)
Data stored	Instruction stream and data
Write algorithm	Write-through
Data path width	8 bits
Maximum bandwidth	4 Mbytes/second
Maximum queue I/O rate	2400/second
Buffer size	
Transmit buffer	256 bytes
Receiver buffer	256 bytes

Console Serial Line

Interface standards	EIA RS–423–A/CCITT V.10 X.26 EIA RS–232–C/CCITT V.28 DEC–423
Data format	1 start bit, 8 data bits, 0 parity bits, 1 stop bit
Baud rates	300; 600; 1200; 2400; 4800; 9600; 19,200; 38,400

Ordering Information

Included as part of base system

[1]Additional DSSI devices are supported via the KFQSA DSSI host adapter.

Configuration Information	
Form factor	Quad height
Power requirements	
CPU module only	+5 Vdc, 2.8 A; +3.3 Vdc, 3.2 A
	+12 Vdc, 0.00 A; −12 Vdc, 0.00 A (24.6 W total)
CPU module, console module, and backplane termination	+5 Vdc, 4.8 A; +3.3 Vdc, 3.2 A
	+12 Vdc, 1.6 A; −12 Vdc, 0.00 A (53.8 W total)
Bus loads	4.0 ac; 1.0 dc

Operating System Support	
VMS	Version 5.5 and later

Diagnostic Support	
MicroVAX Diagnostic Monitor	Release 136 and later
Self-tests	Yes

Related Documentation	
EK–KA675–TM	KA675 CPU Technical Manual
EK–454AA–MG	KA675 CPU System Maintenance

1.7 KA680–AA CPU Specifications

The Model 500 system uses the timesharing KA680–AA CPU (L4002–BA).

Central Processing Unit	
Addressing modes	General register: 8
	Program counter: 4
	Index: 9

Central Processing Unit

Clock rate	286 MHz (14 ns cycle)
Data path width	64 bits
Number of data types	Hardware: 9
	Software emulated: 7
Number of instructions	Hardware: 242
	Microcode assisted: 21
	Software emulated: 41
General purpose registers	16 (32-bit wide)
	Interval timer: 1 (programmable)
	Programmable timers: 2
I/O bus interface	One Q22-bus interface with 8192 entry scatter/gather map
Q-bus backplane termination	240 Ω

Memory Management and Control

Page size	512 bytes
Virtual address space	4 gigabytes
Physical memory space	512 Mbytes
Number of memory modules	4 maximum

Architecture

Instruction prefetch buffer size	16 bytes
Virtual instruction cache	
Data stored	Instruction stream only
Size	2 Koyte
Speed	14 nanoseconds
Associativity	Direct mapped
Primary Cache	
Data stored	Instruction stream and data

Architecture

Write algorithm	Write-through
Size	8 Kbyte
Speed	14 nanoseconds
Associativity	Two-way
Back-up Cache	
Data stored	Instruction stream and data
Write algorithm	Write-back
Size	128 Kbytes
Speed	56 nanoseconds
Associativity	Direct mapped
Translation buffer	
Size	96 entry
Associativity	Fully associative
Q22-bus address translation Q22-bus map cache	
Size	16 entry
Associativity	Fully associative
Q22-bus I/O bus buffer size	
Input	32 bytes
Output	4 bytes
Q22-bus Maximum I/O bandwidth	
Block mode DMA read	2.4 Mbytes/second
Block mode DMA write	3.3 Mbytes/second

Ethernet Port

Supported protocols	Ethernet V2.0 (IEEE 802.3)
Supported media types	Standard or ThinWire
Data path width	1 bit
Data rate	10 Mbits/second

Ethernet Port

Buffer size	
Transmit buffer	128 bytes
Receiver buffer	128 bytes

Digital Storage Systems Interconnect (DSSI)

Number of DSSI interfaces	2
Maximum number of supported devices	14[1] (7 per DSSI interface)
Data stored	Instruction stream and data
Write algorithm	Write-through
Data path width	8 bits
Maximum bandwidth	4 Mbytes/second
Maximum queue I/O rate	2400/second
Buffer size	
Transmit buffer	256 bytes
Receiver buffer	256 bytes

Console Serial Line

Interface standards	EIA RS–423–A/CCITT V.10 X.26 EIA RS–232–C/CCITT V.28 DEC–423
Data format	1 start bit, 8 data bits, 0 parity bits, 1 stop bit
Baud rates	300; 600; 1200; 2400; 4800; 9600; 19,200; 38,400

Ordering Information

Included as part of base system

[1]Additional DSSI devices are supported via the KFQSA DSSI host adapter.

Configuration Information	
Form factor	Quad height
Power requirements	
CPU module only	+5 Vdc, 2.8 A; +3.3 Vdc, 3.2 A
	+12 Vdc, 0.00 A; –12 Vdc, 0.00 A (24.6 W total)
CPU module, console module, and backplane termination	+5 Vdc, 4.8 A; +3.3 Vdc, 3.2 A
	+12 Vdc, 1.6 A; –12 Vdc, 0.00 A (53.8 W total)
Bus loads	4.0 ac; 1.0 dc

Operating System Support	
VMS	Version 5.5 and later

Diagnostic Support	
MicroVAX Diagnostic Monitor	Release 136 and later
Self-tests	Yes

Related Documentation	
EK–KA680–TM	KA680 CPU Technical Manual
EK–454AA–MG	KA680 CPU System Maintenance

1.8 KA690–AA CPU Specifications

The Model 600 system uses the timesharing KA690–AA CPU (L4002–AA).

Central Processing Unit	
Addressing modes	General register: 8
	Program counter: 4
	Index: 9

Central Processing Unit

Clock rate	333 MHz (12 ns cycle)
Data path width	64 bits
Number of data types	Hardware: 9
	Software emulated: 7
Number of instructions	Hardware: 242
	Microcode assisted: 21
	Software emulated: 41
General purpose registers	16 (32-bit wide)
	Interval timer: 1 (programmable)
	Programmable timers: 2
I/O bus interface	One Q22-bus interface with 8192 entry scatter/gather map
Q-bus backplane termination	240 Ω

Memory Management and Control

Page size	512 bytes
Virtual address space	4 gigabytes
Physical memory space	512 Mbytes
Number of memory modules	4 maximum

Architecture

Instruction prefetch buffer size	16 bytes
Virtual instruction cache	
Data stored	Instruction stream only
Size	2 Kbyte
Speed	12 nanoseconds
Associativity	Direct mapped
Primary Cache	
Data stored	Instruction stream and data

Architecture

Write algorithm	Write-through
Size	8 Kbyte
Speed	12 nanoseconds
Associativity	Two-way
Back-up Cache	
Data stored	Instruction stream and data
Write algorithm	Write-back
Size	512 Kbytes
Speed	36 nanoseconds
Associativity	Direct mapped
Translation buffer	
Size	96 entry
Associativity	Fully associative
Q22-bus address translation Q22-bus map cache	
Size	16 entry
Associativity	Fully associative
Q22-bus I/O bus buffer size	
Input	32 bytes
Output	4 bytes
Q22-bus Maximum I/O bandwidth	
Block mode DMA read	2.4 Mbytes/second
Block mode DMA write	3.3 Mbytes/second

Ethernet Port

Supported protocols	Ethernet V2.0 (IEEE 802.3)
Supported media types	Standard or ThinWire
Data path width	1 bit
Data rate	10 Mbits/second

Ethernet Port

Buffer size	
Transmit buffer	128 bytes
Receiver buffer	128 bytes

Digital Storage Systems Interconnect (DSSI)

Number of DSSI interfaces	2
Maximum number of supported devices	14[1] (7 per DSSI interface)
Data stored	Instruction stream and data
Write algorithm	Write-through
Data path width	8 bits
Maximum bandwidth	4 Mbytes/second
Maximum queue I/O rate	2400/second
Buffer size	
Transmit buffer	256 bytes
Receiver buffer	256 bytes

Console Serial Line

Interface standards	EIA RS–423–A/CCITT V.10 X.26 EIA RS–232–C/CCITT V.28 DEC–423
Data format	1 start bit, 8 data bits, 0 parity bits, 1 stop bit
Baud rates	300; 600; 1200; 2400; 4800; 9600; 19,200; 38,400

Ordering Information

Included as part of base system

[1]Additional DSSI devices are supported via the KFQSA DSSI host adapter.

Configuration Information	
Form factor	Quad height
Power requirements	
CPU module only	+5 Vdc, 2.8 A; +3.3 Vdc, 3.2 A
	+12 Vdc, 0.00 A; –12 Vdc, 0.00 A (24.6 W total)
CPU module, console module, and backplane termination	+5 Vdc, 4.8 A; +3.3 Vdc, 3.2 A
	+12 Vdc, 1.6 A; –12 Vdc, 0.00 A (53.8 W total)
Bus loads	4.0 ac; 1.0 dc

Operating System Support	
VMS	Version 5.5 and later

Diagnostic Support	
MicroVAX Diagnostic Monitor	Release 136 and later
Self-tests	Yes

Related Documentation	
EK–KA690–TM	KA690 CPU Technical Manual
EK–454AA–MG	KA600 CPU System Maintenance

1.9 MS690 Memory Specifications

The MS690 memory module provides memory expansion for the KA6nn–AA CPU module. The MS690 modules interface with the CPU through the MS690 local memory interconnect.

You can use up to four MS690 modules in your system.

Operating system support and diagnostic support are the same as for the KA6nn CPU module, as listed in either Section 1.7 or Section 1.8.

Performance

	Memory Cycle Time with KA6nn:
Hexaword Memory Read (32 bytes):	588 ns
Hexaword Memory write	
Hexaword	546 ns
Masked (octaword, Longword)	1050 ns

Performance

Memory data path width	64 bits

Ordering Information

MS690–BA	32-Mbyte field-installed kit
MS690–CA	64-Mbyte field-installed kit
MS690–DA	128-Mbyte field-installed kit

Configuration Information

Form factor	Quad height
Power Requirements	
MS690–BA	+5V; 5.3 A; 26.5 W
MS690–CA	+5V; 4.2 A; 21.0 W
MS690–DA	+5V; 6.4 A; 32.0 W

Chapter 2
Option Specifications

This chapter lists specifications for the options currently supported in your system, grouped as follows.

- Mass storage
- Communications
- Real-time
- Printer
- Graphics

The specifications appear in alphanumerical order within each of the above groups. All weights are approximate.

Some of the options are already installed in your system. If you want to add other options, your Digital sales representative can advise you.

2.1 Options Overview

The option specifications include the following, where applicable.

- Functional information
- Ordering information
- Performance
- Configuration information
- Related documentation

2.1.1 Configuration

Options must be properly configured so that the system recognizes them.

Each option in a system has a device address, commonly referred to as a control and status register (CSR) address, and an interrupt vector that must be set when the option is installed. Options are usually configured by

setting switches or jumpers on modules already configured at the factory or Digital service representatives configure the option when they install it in your system.

Self-maintenance customers can find information on setting CSR addresses and interrupt vectors in the *Microsystems Options* volume of the *Entry Systems Service* kit.

2.2 Mass Storage Options

Your system supports the following mass storage devices.

- Internal to the BA440 enclosure:

  TK-series tape drive
  TF-series tape drive
  TLZ04 tape drive
  RF-series integrated storage element (ISE)

- External to the BA440 enclosure:

  RRD-series compact disk subsystem (tabletop)
  TU81–Plus tape drive
  TSV-series tape drive
  TSZ07 tape drive
  TLZ04 tape drive (tabletop)
  RA-series disk drive
  TF-series tape drive (tabletop)

Four RA-series drives are supported by one KDA50 controller. Up to seven ISEs are supported by one KFQSA.

Using the dual-disk RF35, up to seven ISEs can be installed in your system. The CPU communicates with the ISEs through a Digital Storage Systems Interconnect (DSSI) adapter, which is built into the CPU. Your system has two DSSI adapters, and hence, two separate DSSI busses. Each DSSI bus is capable of supporting seven integrated storage elements.

The system can support two additional adapters (KFQSA, KDA50, KZQSA, and KLESI) provided the system and Q–bus requirements are met.

2.2.1 KDA50 Controller

The KDA50 is an intelligent controller that interfaces with up to four SDI-compatible mass storage devices on the Q22–bus.

Functional Information

Controller protocol	MSCP
Bad block replacement	Software dependent
Supported drives	RA60, RA70, RA81, RA82, RA90
Drives per controller	4
Controllers per system	1 maximum for VMS 5.1 2 maximum for VMS V5.2 and later
Drive interconnect	Transformer-coupled radial

Ordering Information

KDA50–SE	Factory-installed RA-series disk drive controller, controls up to a maximum of four RA-series devices, uses three QBUS slots.
KDA50–SC	Same as –SE but is field-installed.

Performance

Read/Write data transfers	Up to 16-byte block mode DMA
Data buffering	32 Kbytes
Command buffering	20 command and response ring buffers

Configuration Information

Form factor	Two quad height
Power requirements	+5 Vdc, 13.5 A (typocal); +12 Vdc, 0.03 A (typical)
Power consumption	67.86 W
Bus loads	3.0 ac, 0.5 dc

Related Documentation

EK–KDA5Q–UG	KDA50–Q User's Guide

2.2.2 KFQSA Storage Adapter

The KFQSA is an intelligent storage adapter that allows Q22–bus systems to communicate with storage peripherals based on the Digital Storage System Interconnect (DSSI).

Functional Information	
Controller protocol	MSCP: to and from Q22–bus host DSSI: to and from storage devices
Supported devices	RF-series ISEs, also TF85s and other DSSI adapters
Drives per adapter	7
Drive interconnect	Direct
Controllers per system	2 maximum

Ordering Information	
KFQSA–SE	Factory-installed Q-Bus to DSSI adapter, controls up to a maximum of 7 DSSI devices
KFQSA–SG	Same a –SE but is field-installed

Performance	
Peak transfer rate	4 Mbytes/second
Sustained transfer rate	1.5 Mbytes/second
I/O request throughput	190 I/O requests/second (single-sector reads)
Error detection	DSSI bus parity and check character, all transmissions

Configuration Information	
Form factor	Quad height
Power requirements	+5 Vdc, 5.5 A (typical)
Power consumption	27.5 W
Bus loads	4.4 ac; 0.5 dc

Related Documentation	
EK–KFQSA–IN	KFQ Storage Adapter Installation and User Manual

2.2.3 KLESI Controller

The KLESI–SA is a controller that interfaces with the TU81–Plus tape drive on the Q22–bus.

Functional Information	
Controller protocol	TMSCP
Supported drive	TU81–Plus
Drives per adapter	1
Drive interconnect	Direct
Controllers per system	1 maximum

Ordering Information
Included with the TU81–Plus tape drive

Configuration Information	
Form factor	Dual
Power requirements	+5 Vdc, 4.0 A (typical); +12 Vdc, 0.0 A (typical)
Power consumption	20.0 W
Bus loads	0.5 ac; 1.0 dc

Related Documentation	
EK–LESIB–UG	KLESI–B Module User's and Installation Guide

2.2.4 KZQSA Storage Adapter

The KZQSA storage adapter controls the TLZ04 and RRD-series devices on the Q22–bus.

Functional Information	
Adapter protocol	TMSCP
Supported drive	TLZ04, RRD42; two external cables or two devices
Controllers per system	2

Ordering Information	
KZQSA–SA	For external factory-installed TMSCP storage adapters
KZQSA–SF	Same as –SA but is field-installed

Performance Information	
Peak transfer rate	4 Mbytes synchronous
Error detection	Q–bus parity

Configuration Information	
Form factor	Quad height
Power requirements	+5 Vdc, 5.5 A (typical); +12 Vdc, 0.0 A (typical)
Power consumption	27.5 W
Bus loads	4.4 ac; 1.0 dc

Related Documentation	
EK–KZQSA–IN	KZQSA Storage Adapter Installation and User Manual

2.2.5 RA60 Disk Drive

The RA60 is a removable disk drive that provides 205 Mbytes of formatted storage space. Your system supports the RA60 in separate storage expansion enclosures only.

Storage Capacity	
User capacity	205 Mbytes

Storage Capacity	
User capacity (blocks)	400,176

Ordering Information	
RA60–AA	Field-installed RA60 disk drive and cables
RA60–AF	Factory-installed RA60 disk drive and cables
BC26V–06	Interconnect cable with connector block

Performance	
Average seek time	41.67 milliseconds
Average rotational latency	8.33 milliseconds
Average access time	50.30 milliseconds
Peak transfer rate	15.84 Mbits/second

Physical Specifications	
Height	26.52 cm (10.44 inches)
Width	48.26 cm (19 inches)
Depth	85.09 cm (33.75 inches)
Weight	68.95 kg (152 pounds)

Configuration Information	
Form factor	10.5-inches high, full rack width

Related Documentation	
EK–ORA60–UG	RA60 Disk Drive User's Guide

2.2.6 RA70E Disk Drive

The RA70E is a fixed-disk drive that provides 280 Mbytes of formatted storage space. Your system supports the RA70E drives in separate storage expansion enclosures only.

Storage Capacity	
User capacity	280 Mbytes

Ordering Information	
RA70E–SA	Factory-installed RA70E disk drive
RA70E–SF	Same as –SA but is field-installed

Performance	
Average seek time	19.5 milliseconds
Average rotational latency	7.5 milliseconds
Average access time	27.0 milliseconds
Peak transfer rate	1.4 Mbytes/second

Physical Specifications	
Height	26.3 cm (10.38 inches)
Width	44.5 cm (17.5 inches)
Depth	67.3 cm (26.5 inches)
Weight	61.2 kg (135 pounds)
Form factor	5.25-inches high, full rack width

Related Documentation	
EK–ORA70–SV	RA70 Disk Drive Service Manual
EK–ORA70–PS	RA70 Disk Drive Pocket Reference

2.2.7 RA81 Disk Drive

The RA81 is a fixed-disk drive that provides 456 Mbytes of formatted storage space. Your system supports the RA81 drives in separate storage expansion enclosures only.

Storage Capacity

User capacity	456 Mbytes
User capacity (blocks)	891,070

Ordering Information

RA81-HA/-HD	RA81 disk drive (120 V/240 V)
RQA81-AA	Factory-installed RA81 disk drive (120 V) with KDA50 controller and BC26V-06 cable
RQA81-AD	Field-installed RA81 disk drive (240 V) with KDA50 controller and BC26V-6D cable
BC26V-6D	Interconnect cable with connector block

Performance

Average seek time	28.00 milliseconds
Average rotational latency	8.32 milliseconds
Average access time	36.30 milliseconds
Peak transfer rate	17.4 Mbits/second

Physical Specifications

Height	26.3 cm (10.38 inches)
Width	44.5 cm (17.5 inches)
Depth	67.3 cm (26.5 inches)
Form factor	10.5-inches high, full rack width
Weight	61.2 kg (135 pounds)

Related Documentation

EK-ORA81-SV	RA81 Disk Drive Service Guide
EK-ORA81-UG	RA81 Disk Drive User's Guide

2.2.8 RA82 Disk Drive

The RA82 is a fixed-disk drive that provides 623 Mbytes of formatted storage space. Your system supports the RA82 drives in separate storage expansion enclosures only.

Storage Capacity	
User capacity	623 Mbytes
User capacity (blocks)	1,216,660

Ordering Information	
RA82-AA	Factory-installed RA82 disk drive (120 V) with one BC26V-12 cable
RA82-AD	Field-installed RA82 disk drive (240 V) with one BC26V-12 cable
BC26V-06	Interconnect cable with connector block

Performance	
Average seek time	24.00 milliseconds
Average rotational latency	8.33 milliseconds
Average access time	32.33 milliseconds
Peak transfer rate	19.2 Mbits/second

Physical Specifications	
Height	26.3 cm (10.38 inches)
Width	44.5 cm (17.5 inches)
Depth	67.3 cm (26.5 inches)
Weight	61.2 kg (135 pounds)

Configuration Information	
Form factor	10.5-inches high, full rack width

Related Documentation	
EK-ORA82-SV	RA82 Disk Drive Service Guide
EK-ORA82-UG	RA82 Disk Drive User's Guide

2.2.9 RA90 Disk Drive

The RA90 is a fixed-disk drive that provides 1.2 gigabytes of formatted storage space. Your system supports the RA90 drives in separate storage expansion enclosures only.

Storage Capacity	
User capacity	1.2 gigabytes
User capacity (blocks)	2,376,153

Ordering Information	
RA90-NA	RA90 disk drive (120 V)
RA90-ND	RA90 disk drive (240 V)
BC26V-12	Interconnect cable with connector block

Performance	
Average seek time	18.5 milliseconds
Average access time	8.33 milliseconds
Peak transfer rate	22.2 Mbits/second

Physical Specifications	
Height	26.6 cm (10.4 inches)
Width	23.0 cm (8.7 inches)
Depth	68.5 cm (27.0 inches)
Weight	13.6 kg (62 pounds)

Configuration Information	
Form factor	10.5-inches high, full rack width
Power requirements	+5 Vdc, 1.3 A; +12 Vdc, 2.21 A
Power consumption	18.7 W

Related Documentation	
EK-ORA90-SV	RA90 Disk Drive Service Guide
EK-ORA90-UG	RA90 Disk Drive User's Guide

2.2.10 RA92 Disk Drive

The RA92 disk drive provides 1.5 Gbytes of formatted storage space. Your system supports the RA92 only in separate storage expansion enclosures.

Storage Capacity	
User capacity	1.5 gigabytes
User capacity (blocks)	2,940,952

Ordering Information	
RA92-CA/CD	RA92 disk drive (120 V @ 60 Hz; 240 V @ 50 Hz)
BC26J-xx	12-, 25-, 50-, or 80-ft. interconnect cable
BC27V-xx	12-, 15-, 25-, 35-, 50-, or 80-ft. interconnect cable

Performance	
Average seek time	16.5 milliseconds
Single track seek	3.0 milliseconds
Peak transfer rate	22.2 Mbits/second

Physical Specifications	
Height	26.6 cm (10.42 inches)
Width	23.0 cm (8.75 inches)

Physical Specifications	
Depth	60.96 cm (24.0 inches)
Weight	31.8 kg (70 pounds)

Configuration Information	
Form factor	10.5-inches high
Power requirements	+5 Vdc, 1.3 A; +12 Vdc, 2.21 A
Power consumption	18.7 W

Related Documentation	
EK–ORA92–UG–02	RA90/RA92 User's Guide

2.2.11 RF31 Integrated Storage Element (ISE)

The RF31 is a DSSI integrated storage element (ISE) that provides 381 Mbytes of formatted storage space. An ISE is an integrated storage element that is housed in a special mounting bracket for simplified installation and upgrading.

Storage Capacity	
Data storage capacity	381 Mbytes, formatted

Ordering Information	
RF31E–AA	Factory-installed 381 Mbyte half-height ISE
RF31E–AF	Same as –AA but is field-installed

Performance	
Average seek time	14.7 milliseconds
Average access time	23 milliseconds
Average rotational latency	8.33 milliseconds
Peak transfer rate	4.0 Mbytes/second

Physical Specifications	
Height	4.40 cm (1.75 inches)
Width	14.60 cm (5.75 inches)
Depth	20.45 cm (8.25 inches)
Weight	1.81 kg (4.0 pounds)

Configuration Information	
Form factor	Standard 5.25-inch footprint
Power requirements (peak at spin-up)	+5 Vdc, 1.0 A; +12 Vdc, 2.80 A
Power consumption	38.6 W (peak at spin-up)
	18.7 W (seeking)
	12.6 W (idle)

2.2.12 RF31F Integrated Storage Element

The RF31F is a DSSI integrated storage element (ISE) that provides 200 Mbytes of formatted storage space. The RF31F features a code modification to the UVE ROM that makes the RF31F a half-stroke drive.

Storage Capacity	
Data storage capacity	200 Mbytes, formatted

Ordering Information	
RF31F-AA	Factory-installed 200-Mbyte half-height ISE
RF31F-AF	Same as -AA but is field-installed

Performance	
Average seek time	12.3 milliseconds
Average access time	20.6 milliseconds
Average rotational latency	8.37 milliseconds
Peak transfer rate	4.0 Mbytes/second

Performance	
Transfer rate from the media	2.0 Mbytes/second

Physical Specifications	
Height	4.40 cm (1.75 inches)
Width	14.60 cm (5.75 inches)
Depth	20.45 cm (8.25 inches)
Weight	1.81 kg (4.0 pounds)

Configuration Information	
Form factor	Standard 5.25-inch footprint
Power requirements (peak at spin-up)	+5 Vdc, 1.0 A; +12 Vdc, 2.80 A
Power consumption	38.6 W (peak at spin-up)
	18.7 W (seeking)
	12.6 W (idle)

Related Documentation	
EK-RF72D-UG	RF Series Integrated Storage Element User Guide
EK-RF72D-SV	RF Series Integrated Storage Element Service Guide

2.2.13 RF35 Integrated Storage Element

The RF35 is a DSSI integrated storage element (ISE) that provides 852 Mbytes of formatted storage space.

Storage Capacity	
Data storage capacity	852 Mbytes, formatted

Ordering Information

RF35U-AF	Field-installed RF35 maintenance option for upgrading to a RF35E-Ax to a RF352-Ax
RF35E-AA	Factory-installed in the BA400-based systems; single-drive unit
RF35E-AF	Same as -AA but is field-installed
RF352-AA	Factory-installed in the BA400-based systems; dual-drive
RF352-AF	Same as -AA but is field-installed

Performance

Average seek time	9.5 milliseconds
Average access time	15.1 milliseconds
Average rotational latency	5.56 milliseconds
Peak transfer rate	4.0 Mbytes/second
Transfer rate from the media	2.7 Mbytes/second
Buffer size	512K cache

Physical Specifications

Height	4.08 cm (1.63 inches)
Width	10 cm (4.00 inches)
Depth	14.38 cm (5.75 inches)
Weight	0.81 kg (1.8 pounds)

Configuration Information

Form factor	Standard 3.5-inch footprint
Data surfaces	14
Bits per inch	48,300
Tracks per inch	2650
Power requirements	+5 Vdc, 0.71 A; +12 Vdc, 2.29 A (spin-out)
Power consumption	31.1 W (peak at spin-up)

Configuration Information	
	13.8 W (seeking)
	11.3 W (idle)

Related Documentation	
EK–RF72D–UG	RF Series Integrated Storage Element User Guide
EK–RF72D–SV	RF Series Integrated Storage Element Service Guide

2.2.14 RF71 Integrated Storage Element (ISE)

The RF71 is a DSSI integrated storage element (ISE) that provides 400 Mbytes of formatted storage space. An ISE is an integrated storage element that is housed in a special mounting bracket for simplified installation and upgrading.

Storage Capacity	
User capacity	400 Mbytes
User capacity (blocks)	781,440

Ordering Information	
RF71E–AA	Factory-installed 400 Mbyte ISE
RF71E–AF	Same as –AA but is field-installed

Performance	
Average random seek time	19.20 milliseconds
Average rotational latency	8.33 milliseconds
Average access time	34.2 milliseconds
Peak transfer rate	4.0 Mbits/second
Transfer rate from the media	1.5 Mbits/second

Physical Specifications	
Height	7.75 cm (3.05 inches)
Width	14.60 cm (5.75 inches)
Depth	20.75 cm (8.17 inches)
Weight	4.09 kg (9.0 pounds)

Configuration Information	
Form factor	Standard 5.25-in footprint
Power requirements	+5 Vdc, 1.25 A; +12 Vdc, 1.64 A
Power consumption	25.93 W

Related Documentation	
EK–RF71D–IM	RF71 Disk Drive Installation Manual
EK–RF71D–UG	RF71 Disk Drive User's Guide

2.2.15 RF72 Integrated Storage Element (ISE)

The RF72 is a DSSI integrated storage element (ISE) that provides 1.0 Gbytes of formatted storage space. RF-series ISEs are used in DSSI busses (Digital Storage Systems Interconnect). An ISE is a 5.25-inch integrated storage element that is housed in a special mounting bracket for simplified installation and upgrading.

Storage Capacity	
User capacity	1.0 Gbytes

Ordering Information	
RF72E–AA	Factory-installed 1.0 Gbyte ISE
RF72E–AF	Same as –AA but is field-installed

Performance	
Average seek time	13.4 milliseconds

Performance	
Average access time	21.7 milliseconds
Average rotational latency	8.33 milliseconds
Peak transfer rate	4.0 Mbytes/second
Transfer rate from the media	2.0 Mbytes/second

Physical Specifications	
Height	7.75 cm (3.05 inches)
Width	14.60 cm (5.75 inches)
Depth	20.75 cm (8.17 inches)
Weight	4.09 kg (9.0 pounds)

Configuration Information	
Form factor	Standard 5.25-inch high footprint
Power requirements (spin-up)	+5 Vdc, 1.1 A; +12 Vdc, 4.25 A
Power consumption	56.5 W (peak at spin-up)
	28.9 W (seeking)
	17.7 W (idle)

Related Documentation	
EK-RF72D-UG	RF Series Integrated Storage Element User Guide
EK-RF72D-SV	RF Series Integrated Storage Element Service Guide

2.2.16 RF73 Integrated Storage Element (ISE)

The RF73 is a DSSI integrated storage element (ISE) that provides 2.0 Gbytes of formatted storage space. RF-series ISEs are used in DSSI busses (Digital Storage Systems Interconnect). An ISE is an integrated storage element that is housed in a special mounting bracket for simplified installation and upgrading.

Storage Capacity

User capacity	2.0 Gbytes

Ordering Information

RF73E–AA	Factory-installed 2.0 Gbyte ISE
RF73E–AF	Same as –AA but is field-installed

Performance

Average seek time	12.9 milliseconds
Average access time	21.3 milliseconds
Average rotational latency	8.33 milliseconds
Peak transfer rate	4.0 Mbytes/second
Transfer rate from the media	2.2 Mbytes/second

Physical Specifications

Height	8.26 cm (3.25 inches)
Width	14.71 cm (5.79 inches)
Depth	20.85 cm (8.21 inches)
Weight	2.89 kg (6.36 pounds)

Configuration Information

Form factor	Standard 5.25-inch high footprint
Power requirements (spin-up)	+5 Vdc, 1.0 A; +12 Vdc, 4.30 A
Power consumption	56.6 W (peak at spin-up)
	22.9 W (seeking)
	17.0 W (idle)

Related Documentation

EK–RF72D–UG	RF Series Integrated Storage Element User Guide

Related Documentation	
EK-RF72D-SV	RF Series Integrated Storage Element Service Guide

2.2.17 RRD40 Compact-Disc Subsystem

The RRD40 is a CD reader that retrieves data in fixed-length blocks from removable compact-disc media.

Functional Information	
Modes	Idle mode Operation mode: search, normal play
Orientation	Horizontal

Ordering Information	
RRD40-AF	Field-installed tabletop CDROM drive

Performance	
Motor stop time	30% of nominal speed within 30 seconds maximum, 5 seconds typical
Motor start time	90% of nominal speed within 20 seconds maximum, less than 11 seconds typical
Formatted capacity	525 Mbytes with maximum of 600 Mbytes
Average transfer rate	153.6 Kbytes/s, mode 1; 176.4 Kbytes/s, mode 2
Average latency	60 µs maximum inner track; 155 µs outer track
Initialization time	15 seconds maximum to sector zero

Physical Specifications	
Height	27.6 cm (11.02 inches)
Width	8.18 cm (3.27 inches)
Depth	22.7 cm (9.06 inches)
Weight	5.0 kg (11.0 pounds)

Configuration Information	
Power consumption	19.2 W maximum; Play mode: 18 W maximum

Related Documentation	
EK-RRD40-OM	RRD40 Disk Drive Owner's Manual
EK-RRD40-SU	RRD40 MicroVAX Monitor User's Guide Updates

2.2.18 RRD42 Optical Compact-Disc Subsystem

The RRD42 is a 600-Mbyte optical CD reader that retrieves data in fixed-length blocks from removable compact-disc media.

Functional Information	
Interface	Single-ended, asynchronous
	to Q-bus systems through KZQSA storage adapter

Ordering Information	
RRD42-DA	Tabletop model, with power supply
RRD42-FB	Tabletop, 240 V
RRD42-DH	Tabletop, 120 V

Performance	
Seek time, average	400 millisecond, (typical)
Seek time, max full stroke	800 millisecend, (typical)
Rotational speed, innermost track	530 rpm
Rotational speed, outermost track	200 rpm
Start time/Stop time	2.0 second (maximum)
Transfer rate, sustained	150 Kbytes/second
Transfer rate, burst	1.50 Mbytes/second (maximum)

Physical Specifications	
Height	4.15 cm (1.62 inches)
Width	14.60 cm (5.75 inches)
Depth	20.80 cm (8.0 inches)
RRD42–AA	1.30 kg (2.8 pounds)
RRD42–DA	2.9 kg (6.30 pounds)

Configuration Information	
Form factor	Standard 5.25-inch high footprint

Related Documentation	
EK–RRD42–OM	RRD42 Disc Drive Owner's Manual

2.2.19 TF85 Tape Drive

The TF85 is a cartridge tape drive that can store up to 2.6 Gbytes. It is a streaming tape drive with a built-in DSSI (Digital Storage Systems Interconnect) controller, and can be used as a part of a DSSI VAXcluster configuration.

Functional Information	
Recording media	Magnetic, metal-particle tape
Tape dimensions	1.27 cm (0.5 inch) wide, 366 m (1100 feet) long
Mode of operation	Streaming
Recording method	Serpentine
Recording density	42,500 bits/inch
Number of tracks	48
Storage capacity	2.6 Gbytes, formatted
Transfer rate	800 Kbytes/second, formatted

Ordering Information

TF85–BA	2.6-Gbyte cartridge tape subsystem for DSSI-based systems; includes tape drive, DSSI controller, tape cartridge, and head cleaning cartridge
TF85E–JA	Same as –BA but factory-installed embedded BA400-series
TF85E–JF	Same as –BA but field-installed embedded BA400-series
TF85–TA	Same as –BA but tabletop, 120 V

Performance

Tape start time	300 milliseconds maximum
Tape stop time	300 milliseconds maximum
Tape speed	390 cm/second (100 in/second)
Streaming data rate	800 Kbytes/second
Access time	
TF85 mode	3 minutes maximum
TK70/50 mode	60 minutes maximum
Recording technique	Two-track parallel, serpentine
Burst rate on DSSI bus	3.8 Mbytes/second

Physical Specifications

Height	8.25 cm (3.25 inches)
Width	14.60 cm (5.70 inches)
Depth	21.44 cm (8.44 inches)
Weight	15.4 kg (7.0 pounds)

Configuration Information

Form factor	Half-rack, near 5.25-inch footprint
Power requirements	+5 Vdc, 1.8 A (typical); +12 Vdc, 1.0 A (typical)
Power consumption	36.3 W

Related Documentation	
EK–OTF85–OM	TF85 Cartridge Tape Subsystem Owner's Manual
EK–OTK85–RC	TF85 Cartridge Tape Drive Reference Card

2.2.20 TK50 Tape Drive

The TK50 is a streaming-tape drive subsystem that can store up to 95 Mbytes on a tape cartridge for backup data storage.

Functional Information	
Recording media	Magnetic tape
Tape dimensions	1.27 cm (0.5 inch) wide, 182.9 m (600 feet) long
Mode of operation	Streaming
Recording method	Serpentine
Recording density	6667 bits/inch
Number of tracks	22
Storage capacity	94.5 Mbytes formatted

Ordering Information	
TK50E–AA	Factory-installed 95-Mbyte cartridge tape drive
TK50E–AF	Field-installed 95-Mbyte cartridge tape drive
TQK50–SF	Field-installed controller for TK50E–AF
TQK50–SA	Same as –SF but is factory-installed

Performance	
Tape start time	300 milliseconds maximum
Tape speed	2925 cm (75 inches)/second
Streaming data rate	62 Kbytes/second
Access time (from insertion of tape)	60 minutes maximum

Physical Specifications	
Height	8.25 cm (3.25 inches)
Width	14.60 cm (5.70 inches)
Depth	21.44 cm (8.44 inches)
Weight	2.27 kg (5.0 pounds)

Configuration Information	
Form factor	Standard 5.25-inch footprint
Power requirements	+5 Vdc, 1.5 A; +12 Vdc, 2.4 A
Power consumption	36.3 W

Related Documentation	
EK-LEP05-OM	TK50 Tape Drive Subsystem Owner's Manual
EK-OTK50-UG	TK50 Tape Drive Subsystem Users Guide

2.2.21 TK70 Tape Drive

The TK70 is a streaming-tape drive subsystem that can store up to 296 Mbytes on a tape cartridge for backup data storage. The TK70 can read data from cartridges recorded on a TK50 drive, but cannot write data to cartridges recorded on a TK50 drive.

Functional Information	
Recording media	Magnetic tape
Tape dimensions	1.27 cm (0.5 inch) wide, 182.9 m (600 feet) long
Mode of operation	Streaming
Recording method	Serpentine
Recording density	10,000 bits/inch
Number of tracks	48
Storage capacity	296 Mbytes formatted

Ordering Information

TK70E–AA	Factory-installed 296 Mbyte cartridge tape drive
TK70E–AF	Same as –AA but is field-installed
TQK70–SF	Field-installed controller for TK70E–AF
TQK70–SA	Same as –SF but is factory-installed

Performance

Tape start time	325 milliseconds maximum
Tape stop time	200 milliseconds maximum
Tape speed	390 cm/second (100 in/second)
Streaming data rate	125 Kbytes/second
Access time (from insertion of tape)	60 minutes maximum

Physical Specifications

Height	8.25 cm (3.25 inches)
Width	14.60 cm (5.70 inches)
Depth	21.44 cm (8.44 inches)
Weight	2.27 kg (5.0 pounds)

Configuration Information

Form factor	Standard 5.25-inch footprint
Power requirements	+5 Vdc, 1.35 A; +12 Vdc, 2.4 A
Power consumption	35.6 W

Related Documentation

EK–OTK70–OM	TK70 Tape Drive Subsystem Owner's Manual
EK–OTK70–TM	TK70 Tape Drive Subsystem Technical Manual
EK–OTK70–SM	TK70 Tape Drive Subsystem Service Manual

2.2.22 TLZ04 Tape Drive

The TLZ04 is a 1.2-Gbyte cassette (DAT) SCSI tape drive, either tabletop or embedded in your system.

Functional Information	
Recording media	Magnetic tape
Mode of operation	Streaming and start/stop
Storage capacity	1.2 Gbytes formatted
Drive interface	RDAT compatible

Ordering Information	
TLZ04–JA	Factory-installed embedded BA400-series
TLZ04–JF	Field-installed embedded BA400-series
TLZ04–GA	Tabletop including BC06P cable

Performance	
Passes per cassette tape	300
Media	TLZ04–CA cassette tape
Bit density	114 Mbits/square inch
Transfer rate (sustained)	183 Kbytes/second
Recording format	Digital data storage (DDS)
Read/write speed	0.87 cm/second
Peak transfer rate, raw	180 Kbytes/second
Peak transfer rate,user data	170 Kbytes/second
Average file access time	20 seconds
Rewinding time	40 seconds

Physical Specifications	
Height	10.0 cm (3.8 inches), tabletop
	8.2 cm (3.35 inches), embedded

Physical Specifications

Width	32.5 cm (12.7 inches), tabletop
	14.60 cm (5.70 inches), embedded
Depth	28.5 cm (11.2 inches), tabletop
	21.44 cm (8.44 inches), embedded
Weight	7.72 kg (17 pounds), tabletop
	2.20 kg (7.72 pounds), embedded

Data Organization

Recording technology	Helical scan
Recording method	Digital Data Storage (DDS)
Recording density	61,000 bits/inch
Record size	Variable
Maximum capacity	1.2 Gbytes, formatted
Recording medium	60 m x 4 mm

Maintenance

Recommended cartridge cleaning	Every 25 hours

Configuration Information

Form factor	5.25-inch DAT drive
Power requirements	90 to 132 V, 1.6 A; 198.0 to 264 V, 1.0 A
Power consumption (embedded)	15.0 W
Power consumption (tabletop)	50.0 W

Related Documentation

EK–TLZ04–MM	TLZ04 Tape Drive Subsystem Service Manual
EK–BA400–IN	Tape Drive Subsystem Service Manual
EK–TLZ04–OM	TLZ04 Tape Drive Owner's Manual

2.2.23 TSZ07 Tape Drive

The TSZ07 is a 40-Mbyte, high-capacity, streaming, 9-track, reel-to-reel, half-inch magnetic tape drive with dual recording densities. The TSZ07 is available in tabletop, cabinet, or rackmount models, and cannot be mounted inside your system.

Functional Information	
Recording densities	1600 bits/inch or 6250 bits/inch
Mode of operation	Streaming and start/stop
Storage capacity	40 Mbytes with 8-Kbyte blocks, formatted
Number of tracks	9 on 0.5-inch magnetic tape
Drive interface	RDAT compatible

Ordering Information	
TSZ07-AA	Rackmount, specify country kit
TSZ07-BA	Cabinet, 120 V
TSZ07-BB	Cabinet, 240 V
TSZ07-CA	Tabletop, specify country kit

Performance	
Transfer rate	4 Mbytes/second
Load/unload time	55 seconds
Recording speed	100 in/second
Rewinding speed	150 seconds (with 2400 reel)

Physical Specifications	
Tabletop	
Height	26.78 cm (10.50 inches)
Width	50.36 cm (19.75 inches)
Depth	68.85 cm (27.00 inches)
Weight	36.8 kg (81 pounds)

Physical Specifications

Rackmount	
Height	22.32 cm (8.75 inches)
Width	43.35 cm (17.0 inches)
Depth	64.03 cm (25.5 inches)
Weight	31.8 kg (70 pounds)
Cabinet	
Height	101.0 cm (40.0 inches)
Width	56.10 cm (22.0 inches)
Depth	76.50 cm (30.0 inches)
Weight	180.1 kg (238 pounds)

Maintenance

Cleaning cartridge interval	Every 25 hours recommended

Configuration Information

Form factor	5.25-inch DAT drive
Power consumption	385 W, cabinet
	355 W, tabletop
	355 W, rackmount

Related Documentation

EK–TSZ07–IN–002	TSZ07 Installation/Owner's Manual
EK–TSZ07–TM–002	TSZ07 Technical Manual

2.2.24 TSV05 Tape Drive

The TSV05 is a magnetic streaming-tape drive that provides 40.5 Mbytes of backup data storage. The TSV05 reads or writes up to 160 Kbytes per second in standard ANSI format.

Functional Information	
Recording media	Magnetic tape, 26.7 cm (10.5 inches) reel
Tape dimensions	1.27 cm (0.5 inch) wide, 731 m (2400 feet) long
Mode of operation	Streaming
Recording method	Phase encoded (PE)
Recording density	1600 bits/inch
Number of tracks	9
Storage capacity	40 Mbytes formatted

Ordering Information	
TSV05-SE	TSV05 tape drive subsystem

Performance	
Handling	Bidirectional reel-to-reel with compliance arm
Tape velocity	64 or 254 cm/second (25 or 100 in/second)
Maximum data transfer rate	40 or 160 Kbytes/second
Rewind time	2.8 minutes/731 m (2400 feet)

Physical Specifications	
Height	23.0 cm (8.75 inches)
Width	43 cm (17 inches)
Depth	62 cm (24.5 inches)
Weight	36 kg (80 pounds)
Form factor	10.5-in high, full rack width

Related Documentation	
EK–TSV05–UG	TSV05 Tape Transport System User's Guide
EK–TSV05–TM	TSV05 Tape Transport Subsys Tech Manual

2.2.25 TSV05 Controller

The TSV05 tape drive controller interfaces the TSV05 tape drive to the Q22–bus.

Functional Information	
Controller protocol	Controller unique
Supported drive	TSV05
Drives per controller	1
Drive interconnect	Direct

Ordering Information	
TSV05–SB	TSV05 tape drive subsystem
TSV05–SE	TSV05 tape drive subsystem with cabinet

Performance	
Buffer size	3.5 Kbytes

Configuration Information	
Form factor	Quad height
Power requirements	+5 Vdc, 6.5 A (typical); +12 Vdc, 0.0 A (typical)
Power consumption	32.5 W
Bus loads	2.4 ac; 1.0 dc

Related Documentation	
EK–TSV05–UG	TSV05 Tape Transport System User's Guide

2.2.26 TU81–Plus Tape Drive

The TU81–Plus is a reel-to-reel tape drive mounted in a 101.6-cm (40-inches) cabinet. The drive supports two industry-standard recording methods: group coded recording (GCR) and phase encoded (PE).

Storage Capacity	
PE unformatted	45.3 Mbytes
PE formatted	40.0 Mbytes
GCR unformatted	177 Mbytes
GCR formatted	140 Mbytes

Functional Specifications	
Recording media	Magnetic tape
Tape dimensions	1.27 cm (0.5 inch) wide, 731 m (2400 feet) long
Mode of operation	Streaming
Recording methods	Group code recording (GCR)
	Phase encoded (PE)
Recording density	6250 bits/in (GCR)
	1600 bits/in (PE)
Number of tracks	9

Ordering Information	
TU81E-DA	TU81–Plus tape drive, KLESI controller for 120 V
TU81E-DB	TU81–Plus tape drive, KLESI controller for 240 V

Performance	
Handling	Bidirectional reel-to-reel
Tape velocity	
High speed	190.5 cm/second (75 in/second)
Low speed	63.5 cm/second (25 in/second)

Performance	
Channel data transfer rate	
PE high speed	120 Kbytes/second
PE low speed	40 Kbytes/second
GCR high speed	469 Kbytes/second
GCR low speed	156 Kbytes/second
Rewind time (731.5 m (2400 feet) tape on 26.7 cm (10.5 inches) reel)	2.75 minutes maximum

Physical Specifications	
Height	105.8 cm (41.7 inches)
Width	54.6 cm (21.5 inches)
Depth	76.2 cm (30.0 inches)
Weight	139 kg (295 pounds)

Related Documentation	
EK-TU81E-UG	TU81-Plus Tape Subsystem User's Guide

2.3 Communication Options

Your system supports the following communication options.

- CXA16 asynchronous multiplexer (16 lines)
- CXB16 asynchronous multiplexer (16 lines)
- CXY08 asynchronous multiplexer (8 lines)
- DEQRA Token Ring Q-bus adapter
- DESQA Ethernet controller
- DFA01 asynchronous controller with integral modem
- DPV11 synchronous interface
- DSRVB DECserver 200
- DSV11 synchronous controller

Asynchronous Serial Controllers

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

Synchronous Serial Controllers

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

Ethernet Controllers

Ethernet controllers connect your system to an Ethernet network. With a network connection and appropriate DECnet software, you can use all network services.

2.3.1 CXA16 Asynchronous Multiplexer (16 lines)

The CXA16 is an intelligent, preprogrammed serial controller that can operate in either DHV11 or DHU11 mode, depending on the setting of an on-board switch. The module contains 16 multiplexed lines.

Functional Information	
Supported line interfaces	EIA RS-423-A/CCITT V.10 EIA RS-232-D/CCITT V.28 DEC-423
Split-speed operation	All lines
Flow control (XON/XOFF)	All lines
Supported data formats	16 programmable formats (each with 1 start bit) • 5, 6, 7, or 8 data bits, 0 or 1 parity bit, and 1 stop bit • 5 data bits, 0 or 1 parity bit, and 1.5 stop bits • 6, 7, or 8 data bits, 0 or 1 parity bit, and 2 stop bits Parity, if enabled, can be either odd or even.
Modem control	None

Ordering Information

CXA16-AA	CXA16 Factory-installed kit. Includes two 7.6-m (25-feet) BC16D-25 cables, two H3104 cable concentrators, and other accessories required to install the option.
CXA16-AF	Same as -AA but is field-installed.

- BC16D-25 cable—data only, 36-conductor, terminated with 36-pin Amphenol connectors
- H3104 cable concentrator—concentrates eight BC16E cables into one BC16D cable; eight modified modular jacks and one 36-pin Amphenol connector

BC16E-series cable	Office cable—data only, six-conductor, terminated with modified modular plugs • BC16E-10: 3 m (10 feet) • BC16E-25: 7.6 m (25 feet) • BC16E-50: 15.2 m (50 feet)
H8572	Cable extender with modified modular jacks.
H8571-A	25-pin passive adapter[1]
H8571-B	9-pin passive adapter[1]
H3105	Active adapter. Converts EIA RS-232-D signals to DEC-423 signals.

Performance

Transmit data transfers	Single-character transfers or up to 16-char block mode DMA transfers in DHV11 mode. Single-character or two-character transfers, or up to 16-character block mode DMA transfers in DHU11 mode.
Receive data transfers	Single-character transfers in both DHV11 and DHU11 modes.
Transmit buffer size	One character for DHV11 mode transfers 64-character FIFO for DHU11 mode transfers 64-character FIFO for DMA transfers in DHU11 and DHV11 modes

[1]Converts a D-connector to a modified modular jack. Required for connecting terminals and printers to office cables terminated with modified modular plugs.

Performance	
Receive buffer size	256-character FIFO in DHV11 and DHU11 modes
Supported baud rates	16 programmable baud rates: 50; 75; 110; 134.5; 150; 300; 600; 1200; 1800; 2000; 2400; 4800; 7200; 9600; 19,200; 38,400[2]
Throughput at maximum baud rate:	
5 data bits, 0 parity, 1 stop bit	140,000 characters/s (all lines)
7 data bits, 1 parity bit, 1 stop bit	110,000 characters/s (all lines)

Configuration Information	
Form factor	Quad height with integral, recessed cover panel
Power requirements	+5 Vdc, 1.6 A (typical); +12 Vdc, 0.20 A (typical)
Power consumption	10.4 W
Bus loads	3.0 ac; 0.5 dc
Module connectors	2 female, 36-pin Amphenol connectors

Related Documentation	
EK-CAB16-UG	CXA16/CXB16 User's Guide
EK-CAB16-TM	CXA16/CXB16 Technical Manual

[2]38,400 baud rate is not supported by Digital operating systems.

2.3.2 CXB16 Asynchronous Multiplexer (16 lines)

The CXB16 is an intelligent, preprogrammed serial controller that can operate in either DHV11 or DHU11 mode, depending on the setting of an on-board switch. The module contains 16 multiplexed lines.

Functional Information	
Supported line interfaces	EIA RS-422-A/CCITT V.11 X.27
Split-speed operation	All lines
Flow control (XON/XOFF)	All lines

Functional Information

Supported data formats	16 programmable formats (each with 1 start bit) • 5, 6, 7, or 8 data bits, 0 or 1 parity bit, and 1 stop bit • 5 data bits, 0 or 1 parity bit, and 1.5 stop bits • 6, 7, or 8 data bits, 0 or 1 parity bit, and 2 stop bits Parity, if enabled, can be either odd or even.
Modem control	None

Ordering Information

CXB16-AA	Factory-installed module and cable kit. Includes two 7.6-m (25-feet) BC16D-25 cables, two H3104 cable concentrators, and other accessories required to install the option.
CXB16-AF	Same as -AA but is field-installed.

- BC16D-25 cable—data only, 36-conductor, terminated with 36-pin Amphenol male connectors
- H3104 cable concentrator—concentrates eight BC16E cables into one BC16D cable; eight modified modular jacks and one 36-pin Amphenol female connector

BC16E-series cable	Office cable—data only, six-conductor, terminated with modified modular plugs

- BC16E-10: 3 m (10 feet)
- BC16E-25: 7.6 m (25 feet)
- BC16E-50: 15.2 m (50 feet)

H8572	Cable extender. Null modem cable terminated with modified modular jacks.

Performance

Transmit data transfers	Single-character programmed transfers or up to 16-character block mode DMA transfers in DHV11 mode.

Performance

	Single-character or two-character programmed transfers, or up to 16-character block mode DMA transfers in DHU11 mode.
Receive data transfers	Single-character programmed transfers in both DHV11 and DHU11 modes.
Transmit buffer size	One character for programmed transfers in DHV11 mode
	64-character FIFO for programmed transfers in DHU11 mode
	64-character FIFO for DMA transfers in DHU11 and DHV11 modes
Receive buffer size	256-character FIFO in DHV11 and DHU11 modes
Supported baud rates	16 programmable baud rates: 50; 75; 110; 134.5; 150; 300; 600; 1200; 1800; 2000; 2400; 4800; 7200; 9600; 19,200; 38,400[1]
Throughput at maximum baud rate:	
5 data bits, 0 parity bits, 1 stop bit	140,000 characters/second (all lines)
7 data bits, 1 parity bit, 1 stop bit	110,000 characters/second (all lines)

Configuration Information

Form factor	Quad height with integral, recessed cover panel
Power requirements	+5 Vdc, 2.0 A (typical); +12 Vdc, 0.00 A (typical)
Power consumption	10.0 W
Bus loads	3.0 ac; 0.5 dc
Module connectors	2 female, 36-pin Amphenol connectors

Related Documentation

EK-CAB16-UG	CXA16/CXB16 User's Guide
EK-CAB16-TM	CXA16/CXB16 Technical Manual

[1]38,400 baud rate is not supported by Digital operating systems.

2.3.3 CXY08 Asynchronous Multiplexer (8 Lines)

The CXY08 asynchronous multiplexer performs data concentration, real-time processing, and interactive terminal handling. The CXY08 can operate in either DHV11 or DHU11 mode, depending on the setting of an on-board switch. The CXY08 supports full modem control.

Functional Information

Supported line interfaces	EIA RS–423–A/CCITT V.10 EIA RS–232–D/CCITT V.28 DEC–423
Split-speed operation	All lines
Flow control (XON/XOFF)	All lines
Supported data formats	16 programmable formats (each with 1 start bit) • 5, 6, 7, or 8 data bits, 0 or 1 parity bit, and 1 stop bit • 5 data bits, 0 or 1 parity bit, 1.5 stop bits • 6, 7, or 8 data bits, 0 or 1 parity bit, and 2 stop bits Parity, if enabled, can be either odd or even.
Modem control	Full
Supported modems	Bell models 103, 113, 212

Ordering Information

CXY08–AA	Factory-installed CXY08 kit. Includes two 3.7-m (12-feet) BC19N–12 cable assemblies and other accessories required to install the option.
CXY08–AF	Same as –AA but is field-installed.

- BC19N–12 cable assembly—concentrates four 11-conductor cables with 25-pin male D-connectors into one 44-connector cable terminated by a 50-pin male CHAMP connector.)

Performance

Transmit data transfers	Single-character programmed transfers or up to 16-character block mode DMA transfers in DHV11 mode.
	Single-character or two-character programmed transfers, or up to 16-character block mode DMA transfers in DHU11 mode.
Receive data transfers	Single-character programmed transfers in both DHV11 and DHU11 modes.
Transmit buffer size	One character for programmed transfers in DHV11 mode
	64-character FIFO for programmed transfers in DHU11 mode
	64-character FIFO for DMA transfers in DHU11 and DHV11 modes
Receive buffer size	256-character FIFO in DHV11 and DHU11 modes
Supported baud rates	16 programmable baud rates: 50; 75; 110; 134.5; 150; 300; 600; 1200; 1800; 2000; 2400; 4800; 7200; 9600; 19,200; 38,400[1]
Throughput at maximum baud rate:	
5 data bits, 0 parity bits, 1 stop bit	87,771 characters/second (all lines)
7 data bits, 1 parity bit, 1 stop bit	61,440 characters/second (all lines)

Configuration Information

Form factor	Quad height with integral, recessed cover panel
Power requirements	+5 Vdc, 1.64 A (typical); +12 Vdc, 0.395 A (typical)
Power consumption	12.94 W
Bus loads	3.0 ac; 0.5 dc
Module connectors	2 female, 50-pin CHAMP connectors

Related Documentation

EK-CXY08-UG	CXY08 User's Guide
EK-CXY08-TM	CXY08 Technical Manual

[1]38,400 baud rate is not supported by Digital operating systems.

2.3.4 DEQRA Token Ring Q-Bus Adapter

The DEQRA Token Ring Q–bus adapter and its software, TRDRV/VMS, enable Q–bus VAX systems to connect to 4- or 16-Mbits/second Token Ring networks, and act as full function DECnet Phase IV nodes and pathworks for VMS servers.

Functional Information	
Supported protocols	IBM-compatible Token Ring (IEEE 802.5)
Operating system supported	VMS 5.4
	DECTRN Driver VMS 1.0

Ordering Information	
DEQRA–CA	DEQRA module, documentation, and licensed letter
BC29E–15	External console ribbon cable, 15-feet
QL–GVJAP–AA	Software license
BN26P Series	Adapter cable

Performance	
Data transfer rate	4-Mbits and 16-Mbits

Diagnostic Support	
Diagnostic support	Power-up self test
	MDM
	Installation Verification Procedure (IVP)
	DEQRA specific from host

Configuration Information	
Form factor	Quad height
Power requirements	+5 Vdc, 4.0 A; +12 Vdc, 0.1 A
Power consumption	21.2 W

Configuration Information	
Bus loads	2.2 ac; 0.5 dc

Related Documentation	
EK-DEQRA-IN	DEC TRNcontroller 100 Hardware Installation and Debugging
EK-DEQRA-TM	DEC TRNcontroller 100 Hardware Description and Operation
AA-PH7NA-TE	DEC Token Ring Network Device Driver for VMS Installation
AA-PH7PA-TE	DEC Token Ring Network Device Driver for VMS Use and Programming

2.3.5 DESQA Ethernet Controller

The DESQA Ethernet controller provides a high-speed asynchronous connection between a Q22–bus system and a local area network (LAN) based on Ethernet or IEEE 802.3. The DESQA supports either standard or ThinWire Ethernet cabling.

Functional Information	
Supported protocols	Ethernet, IEEE 802.3
	Maintenance Operation Protocol (MOP)

Ordering Information	
DESQA–SA	Factory-installed option
DESQA–SF	Same as –SA but is field-installed
External cable (standard)	BNE3B or BNE3D
External cable (ThinWire)	BC16M

Performance	
Transmit/Receive data transfers	Up to 32-byte block mode DMA
Transmit data transfers	2-Kbyte FIFO for DMA transfers

Performance	
Receive data transfers	4-Kbyte FIFO for DMA transfers
Throughput at maximum rate	10 Mbits/second

Configuration Information	
Form factor	Quad height
Power requirements	+5 Vdc, 2.4 A; +12 Vdc, 0.22 A
Power consumption	14.64 W
Bus loads	2.2 ac; 0.5 dc
Module connectors (standard)	One 15-pin D-type
Module connectors (Thinwire)	T-connector to BNC connector on DESQA

Related Documentation	
EK-DESQA-TM	DESQA Technical Manual

2.3.6 DFA01 Asynchronous Controller with Integral Modem

The DFA01 is an asynchronous serial controller that emulates the DZQ11. It has two lines, each with a DF224-compatible integral modem.

Functional Information	
Supported modulation protocols	Bell 103J
	Bell 212A
	CCITT V.22
	CCITT V.22-BIS
Split-speed operation	Both lines
Flow control (XON/XOFF)	No

Functional Information

Supported data formats	8 programmable formats (each with 1 start bit) • 5, 6, 7, or 8 data bits, 0 or 1 parity bit, and 1 stop bit • 5, 6, 7, or 8 data bits, 0 or 1 parity bit, and 2 stop bits
Modem control	Full

Ordering Information

DFA01-AA	Factory-installed option
DFA01-AF	Same as -AA but is field-installed

Performance

Transmit data transfers	Single-character programmed transfers
Receive data transfers	Single-character programmed transfers
Transmit buffer size	One character for programmed transfers
Receive buffer size	64-character FIFO
Supported baud rates	8 programmable baud rates: 50, 75, 110, 134.5, 150, 300, 1200, 2400[1]
Throughput at maximum baud rate	1200 bytes/second

Configuration Information

Form factor	Quad height with integral, flush cover panel
Power requirements	+5 Vdc, 1.97 A; +12 Vdc, 0.04 A
Power consumption	10.30 W
Bus loads	3.0 ac; 1.0 dc
Module connectors	4 TELCO: 2 modified modular jacks (MMJ) for data lines; 2 modular jacks (MJ) for voice lines

[1]The serial line is capable of baud rates up to 9600 baud. However, because the modem is restricted to speeds of 0–300, 1200, and 2400 baud, all other baud rates are considered illegal and pass meaningless data.

Related Documentation	
EK-DFA01-UG	DFA01 Modem User's Guide
EK-DFA01-IN	DFA01 Modem Installation Guide

2.3.7 DPV11 Synchronous Controller

The DPV11 is a single-line programmable controller that provides local or remote interconnections between systems.

Functional Information	
Supported line interfaces	EIA RS-232-C/CCITT V.28
	EIA RS-423-A
	EIA RS-422-A
Supported protocols	DDCMP, BISYNC, and SDLC
Operating mode	Full or half-duplex
Character size	Program selectable (5–8 bits with character-oriented protocols and 108 bits with bit-oriented protocols)
Modem support	Limited
Supported modems	All Digital modems and the Bell 200 series

Ordering Information	
DPV11-SA	Factory-installed option
DPV11-SF	Field-installed option

Performance	
Transmit/Receive data transfers	Single-byte programmed transfer
Transmit buffer size	2 bytes
Receive buffer size	2 bytes
Data rate	56 Kbits/second

Configuration Information	
Form factor	Dual height
Power requirements	+5 Vdc, 1.2 A (typical); +12 Vdc, 0.3 A (typical)
Power consumption	9.6 W
Bus loads	1.0 ac; 1.0 dc

Related Documentation	
EK-DPV11-UG	DPV11 Synchronous Interface User's Guide
EK-DPV11-TM	DPV11 Technical Manual

2.3.8 DSRVB DECserver 200

The DSRVB DECserver 200 is an 8-line terminal server connecting terminals to a host computer on an Ethernet local area network. Software for the server is downloaded from a host. The server is available in two models: the modem control (MC) model an RS–232–C line interface; the data leads (DL) model has no modem control and a DEC–423 (DECconnect) line interface.

Functional Information	
Supported line interfaces	RS–232–C (MC Model)/DEC–423 (DL Model)
Modem control	Yes (MC Model)/No (DL Model)
Protocols	Asynchronous
Supported terminal devices	VT-, LN-, LA-, and LQ-series devices

Ordering Information, Hardware Only[1]	
DSRVB–AA	8-line DECserver 200/MC, RS–232–C line interface, 120 V. Includes country kit.[2]
DSRVB–BA	8-line DECserver 200/DL, DEC–423 (DECconnect) line interface, 120 V. Includes country kit.
DSRVB–AB	8-line DECserver 200/MC, RS–232–C line interface, 240 V. Requires country kit.

[1]See the *Networks and Communications Buyer's Guide* for appropriate software.

[2]Each country kit includes a power cord, hardware manual, and rack mounting brackets. See the *Networks and Communications Buyer's Guide* for available country kits.

Ordering Information, Hardware Only[1]	
DSRVB-BB	8-line DECserver 200/DL, DEC-423 (DECconnect) line interface, 240 V. Requires country kit.

Performance	
Maximum throughput	8 lines at 19.2 Kbytes/second

Physical Specifications	
Height	11.75 cm (4.63 inches)
Width	48.90 cm (19.25 inches)
Depth	32.07 cm (12.63 inches)
Weight	5.44 kg (12 pounds)

Related Documentation	
AA-HL77B-TK	DSRVB DECserver 200 User's Guide

[1]See the *Networks and Communications Buyer's Guide* for appropriate software.

2.3.9 DSV11 Synchronous Controller

The DSV11 is a two-channel, high-speed, synchronous controller that interfaces Q22-bus backplanes.

Functional Information	
Supported line interfaces	RS-423 RF-422 RS-232/V.24, V.35
Supported protocols	DDCMP HDLC/SDLC BISYNC
Operating mode	Full or half-duplex
Modem support	Full modem control

Ordering Information	
DSV11–SF	Factory-installed kit (first DSV11)
DSV11–SG	Field-installed kit (additional DSV11's)

Performance Information	
Transmit/Receive data transfers	DMA
Data rate, Mbits/second (maximum)	RS–232–C/V.24 = up to 20K RS–423 = 100 Kbits/second RS–422 = 256 Kbits/second V.35 = 48 Kbits/second

Configuration Information	
Form factor	Quad height
Power requirements	+5 Vdc, 5.43 A (typical); +12 Vdc, 0.69 A (typical)
Power consumption	35.43 W
Bus loads	3.9 ac; 1.0 dc

Related Documentation	
EK–DSV11–UG	DSV11–S Communications Option User Guide
EK–DSV11–TD	DSV11 Communications Option Technical Description

2.4 Real-Time Options

Real-time controllers interface devices that monitor processes in environments such as the laboratory or manufacturing. Typically, real-time controllers are parallel devices that transmit more than one bit of information simultaneously.

Your system supports the following real-time options.

- AAV11–S digital-to-analog converter
- ADQ32 analog-to-digital converter
- ADV11–S analog-to-digital converter
- AXV11 controller

- DIV32 controller
- DRQ3B parallel interface
- DRV1W parallel interface
- IBQ01 controller
- IEQ11 controller
- KWV11-S programmable real-time clock

2.4.1 AAV11–S Digital-to-Analog Converter

The AAV11–S is a digital-to-analog converter with DMA capability. The AAV11–S is functionally equivalent to the AAV11–D.

Functional Information

Circuits	Two D/A converter circuits
D/A input	12-bit digital input
Data notation	Binary input notation for unipolar output; offset binary or two's complement input notation for bipolar output.
D/A output	
Voltage	Output voltage range is jumper selectable: ±10 V, ±5 V, or 0 V to +10 V.
Control signals	4-bit digital output for control signals, such as CRT intensity, blank, unblank, and erase
Polarity	Unipolar or bipolar output

Ordering Information

AAV11–SA	Factory-installed option
AAV11–SF	Same as –SA but is field-installed
UDIP–BA[1]	Universal data interface panel mounting box
UDIP–DB	Universal data interface panel (UDIP)
UDIP–TA	Tabletop enclosure

[1] You must order the UDIP mounting box and the UDIP interface when installing a new option.

Performance	
Analog output	
Voltage	±10 V, at 10 mA
	±5 V, at 10 mA
	0 V to 10 V, at 10 mA
Current	10 mA, at 10 V minimum
DC impedance	0.05Ω typical
Linearity (0–10 V)	±1/2 LSB; ±1.2 mV at full-scale range
Differential linearity	±1/2 LSB
Offset error	Adjustable to 0
Offset drift	±15 ppm/at maximum °C
Gain accuracy	Adjustable to zero
Gain drift	±25 ppm/at maximum °C
Settling time	6 µs to 0.1% for a p–p output change of 20 V

Configuration Information	
Form factor	Dual height
Power requirements	+5 Vdc, 2.10 A (typical); +12 Vdc, 0.0 A
Power consumption	10.5 W
Bus loads	2.5 ac; 0.5 dc

Related Documentation	
EK–AV11D–UG	Q-Bus DMA Analog System User's Guide

2.4.2 ADQ32 Analog-to-Digital Converter

The ADQ32 is an analog-to-digital converter with DMA capability.

Functional Information

Input channels	32 single-ended analog input channels or 16 differential analog input channels; single-ended or differential is programmable
Programmable gain	1, 2, 4, or 8; selectable per channel
A/D output	
Resolution	12-bit output data resolution
Data notation	Straight binary (unipolar), two's complement (bipolar)
A/D conversions	Can be started by a program, a real-time clock, or an external trigger
A/D results	Can be received by a programmed I/O transfer or by servicing an interrupt request
Interrupts	Can be enabled and automatically set
Common mode rejection ratio	55 dB at maximum range

Ordering Information

ADQ32–SA	ADQ32 factory-installed kit
ADQ32–SF	ADQ32 field-installed kit
UDIP–BA[1]	Universal data interface panel (UDIP) mounting box
UDIP–AA	Universal data interface panel (UDIP)
UDIP–TA	Tabletop enclosure

Performance

Analog input	
No. of analog inputs	16 channels using differential inputs or 32 channels using single-ended inputs
Input range	0 V to +10 V (unipolar)
	-10 V to +10 V (bipolar)
Input impedance	10 MΩ, minimum
Input bias current	500 nA maximum ON current

[1] You must order the UDIP mounting box and the UDIP interface when installing a new option.

Performance

Input protection	Inputs are current-limited and protected to an overvoltage of ±35 V without damage.
Common mode rejection ratio	55 dB
A/D output	
Data buffer register	16-bit read-only output register
Resolution	12 bits unipolar; 11 bits bipolar plus sign bit
Data notation	Straight binary or two's complement
Sample and hold amplifier	
Aperture uncertainty	1 nanosecond
Aperture delay	50 nanoseconds, maximum with minimum aperture enabled (clock bypass bit set)
Input noise	2 μV p–p
A/D converter performance	
Linearity	
Differential	0.2 to 2 LSB
Integral	1.5 LSB, maximum
Scale drift	15 ppm/C typical
System throughput	
Maximum single channel sample rate	250 KHz
Maximum multichannel rate to ensure ±1/2 LSB accuracy	200 KHz

Configuration Information

Form factor	Quad height
Power requirements	+5 Vdc, 4.45 A (typical)
	+12 Vdc, 0.0 A
Power consumption	22.25 W
Bus loads	2.5 ac
	0.5 dc

Related Documentation

EK–153AA–UG	ADQ32 Analog-to-Digital Converter User's Guide

2.4.3 ADV11–S Analog-to-Digital Converter

The ADV11–S is an analog-to-digital converter with DMA capability. The ADV11–S is functionally equivalent to an ADV11–D.

Functional Information

Input channels	16 single-ended analog input channels or 8 differential analog input channels; SE/DI input is jumper-selectable.
Programmable gain	1, 2, 4, or 8
A/D output	
Resolution	12-bit output data resolution
Data notation	Binary, offset binary, or two's complement
A/D conversions	Can be started by a program, a real-time clock, or an external trigger
A/D results	Can be received by a programmed I/O transfer or by servicing an interrupt request
Interrupts	Can be enabled and automatically set by A/D DONE and/or ERROR bits
Common mode rejection ratio (gain=1)	80 dB at maximum range

Ordering Information

ADV11–SA	Factory-installed option
ADV11–SF	Same as –SA but is field-installed
UDIP–BA[1]	Universal data interface panel mounting box
UDIP–AB	Universal data interface panel for ADV11–S
UDIP–TA	Tabletop enclosure

[1]You must order the UDIP mounting box and the UDIP interface when installing a new option.

Performance

Analog input	
Number of analog inputs	8 channels using differential inputs or 16 channels using single-ended inputs
Input range	0 V to +10 V (unipolar); -10 V to +10 V (bipolar)
Maximum input signal	±10.5 V (signal + common mode voltage)
Input impedance	
Off channels	100 MΩ minimum, 10 pF maximum
On channels	100 MΩ minimum, 100 pF maximum
Power off	1 KΩ in series with a diode
Input bias current	±20 nA at 25°C (77°F) maximum
Input protection	Inputs are current-limited and protected to an overvoltage of ±35 V without damage.
Common mode rejection ratio	80 dB at a range of ±10 V at 60 Hz
A/D output	
Data buffer register	16-bit read-only output register
Resolution	12 bits unipolar; 11 bits bipolar plus sign bit
Data notation	Binary, offset binary, or two's complement
Sample and hold amplifier	
Aperture uncertainty	Less than 10 nanoseconds
Aperture delay	Less than 0.5 µs from start of conversion to signal disconnect
Front end settling	Less than 15 µs to ±0.01% of full-scale value for a peak-to-peak input of 20 V
Input noise	Less than 0.2 mV rms
A/D converter performance	
Linearity	Less than ±1/2 LSB
Stability (temperature coefficient)	±30 ppm at maximum °C (32°F)
Stability (long term)	±0.05% change in 6 months
System accuracy (gain=1)	Input voltage to digitized value to within ±0.03%

Performance	
System throughput	25K channel samples/second

Configuration Information	
Form factor	Dual height
Power requirements	+5 Vdc, 2.0 A (typical); +12 Vdc, 0.0 A
Power consumption	10.0 W
Bus loads	2.3 ac; 0.5 dc

Related Documentation	
EK-AV11O-UG	Q-Bus DMA Analog System User's Guide

2.4.4 AXV11 Controller

The AXV11–S is an input/output circuit board for analog devices. The AXV11–S is functionally equivalent to the AXV11–C.

Functional Information	
Input channels	16 single-ended analog input channels or 8 differential analog input channels; SE/DI jumper is field-selectable.
Programmable gain	1, 2, 4, or 8
A/D output	
Data resolution	12-bit output data resolution
Data notation	Binary, offset binary, or two's complement
Voltage	Output voltage range selection of ±10 V (bipolar) or 0 V to 10 V (unipolar)
A/D conversions	Can be started by a program, an external trigger, or a real-time clock
A/D results	Can be received by a programmed I/O transfer or by servicing an interrupt request
Common mode rejection ratio	80 dB at maximum range
D/A converters (DACs)	

Functional Information

Number of DACs	2
Input (each DAC)	12-bit digital input
Output (each DAC)	Unipolar or bipolar output

Ordering Information

AXV11–SA	Factory-installed option
AXV11–SF	Same as –SA but is field-installed
UDIP–BA[1]	Universal data interface panel mounting box
UDIP–AY	Universal data interface panel (UDIP) for AXV11–S
UDIP–TA	Tabletop enclosure

Performance

A/D converter performance	
Linearity	To within ±1/2 LSB
Stability (temperature coefficient)	±30 ppm at maximum °C (32°F)
Stability (long term)	±0.05% change in 6 months
Conversion time	25 µs from end of front end settling to setting the A/D DONE bit
System throughput	25K channel samples/second
D/A converter specifications	
Number of D/A converters	2
Digital input	12 bits (Binary code is used for unipolar output; offset binary or two's complement code is used for bipolar output.)
Analog output	±10 V (bipolar) or 0 V to +10 V (unipolar)
Output current	±5 mA maximum
Output impedance	0.1 Ω
Differential linearity	To within ±1/2 LSB

[1]You must order the UDIP mounting box and the UDIP interface when installing a new option.

Performance	
Nonlinearity	0.02% of full-scale value
Offset error	Adjustable to 0
Offset drift	±30 ppm at maximum °C (32°F)
Gain accuracy	Adjustable to full-scale value
Gain drift	±30 ppm at maximum °C (32°F)
Settling time	65 µs to 0.1% for a peak-to-peak output change of 20 V
Noise	0.1% full-scale value
Capacitive load capability	0.5 µF

Configuration Information	
Power requirements	+5 Vdc, 2.0 A; +12 Vdc, 0.0 A
Power consumption	10.0 W
Bus loads	1.2 ac; 0.3 dc

Related Documentation	
EK–AXVAA–UG	AXV11/KWV11 Module User's Guide
MP–011291–00	AXV11–C Field Maintenance Print Set

2.4.5 DIV32 Controller

The DIV32 is a quad-height, integrated services digital network (ISDN) communication controller with connection to the Q22–bus backplane.

Functional Information	
Supported line interfaces	RS–423
	RS–422
	RS–232/V.24, V.35
Supported protocols	VAX ISDN
Operating mode	Full- or half-duplex

Ordering Information	
DIV32–SA	Factory-installed option
DIV32–SF	Same as –SA but is field-installed

Performance	
Transmit/Receive data transfers	DMA
Data transfer rate	64 Kbits/second

Configuration Information	
Form factor	Quad height
Power requirements	+5 Vdc, 5.5 A (typical)
Power consumption	27.5 W
Bus loads	3.9 ac; 1.0 dc

Related Documentation	
EK–DIV32–UG	Communications Option User Guide
EK–DIV32–IN	DIV Hardware Installation Guide

2.4.6 DRQ3B Parallel Interface

The DRQ3B is a high-speed parallel interface that provides two independent 16-bit, unidirectional data channels.

Functional Information	
Two unidirectional channels	Each 512-word FIFO
Interrupt vectors	One for both DMA channels
	One for all other interrupts

Ordering Information	
DRQ3B–SA	Factory-installed option
DRQ3B–SF	Same as –SA but is field-installed

Ordering Information

Cables	Connects the DRQ3B to a user device or to another DRQ3B. Order two cables for each DRQ3B module. BC19T–25/–50: 7.6 m (25 feet)/15.2 m (50 feet)

Performance

Throughput rates	Burst: 500 kilowords
	Block: 1.1 megawords
	Extended block mode: 1.1 megawords
	Height speed: 1.4 megawords

Configuration Information

Form factor	Quad height
Power requirements	+ 5 Vdc, 4.5 A; +12 Vdc, 0.0 A
Power consumption	22.5 W
Bus loads	2.0 ac; 0.5 dc
Module connectors	Two 50-pin female IEEE connectors
I/O port data transceivers	Source 16 mA, sink 64 mA

Related Documentation

EK–O47AA–UG	DRQ3B Parallel DMA Input/Output Module User's Guide

2.4.7 DRV1W Parallel Interface

The DRV1W is a general-purpose, parallel interface with one 16-bit input port and one 16-bit output port. The DRV1W supports DMA. The DRV1W–S is functionally equivalent to the DRV11–WA.

Functional Information

Number of lines	Total: 50
	16 data output lines

Functional Information

	16 data input lines
	3 user-definable input status lines
	3 user-definable output control lines
	8 input control lines
	4 output control lines
Line characteristics	
Input data lines	1 TTL unit load each
Input control lines	1 TTL unit load each
Output data lines	10 TTL unit loads each
Output control lines	10 TTL unit loads each
Logic levels	High = logic 1
	Low = logic 0

Ordering Information

DRV1W–SA	Factory-installed option
DRV1W–SF	Same as –SA but is field-installed

Performance

Transfer mode	Up to 2-byte programmed transfers
	Up to 8-byte burst mode DMA transfers and unlimited burst mode DMA transfers (unsupported)
Data transfer rate	Up to 250,000 16-bit words/second in single-cycle mode
	Up to 500,000 16-bit words/second in burst mode

Configuration Information

Form factor	Dual height
Power requirements	+5 Vdc, 1.8 A (typical); +12 Vdc, 0.0 A
Power consumption	9.0 W

Configuration Information	
Bus loads	2.0 ac; 1.0 dc
Module connectors	Two 40-pin connectors

Related Documentation	
EK-DRVWA-UG	DRV11-WA General Purpose DMA User's Guide

2.4.8 IBQ01 Controller

The IBQ01 is a DMA controller that interfaces a Q22–bus system to RS–485 industrial control and measurement devices.

Functional Information	
Communication protocol	Modified SDLC
Supported functions	Single multidrop interconnect
	250 BITBUS compatible devices

Ordering Information	
IBQ01–SA	Factory-installed option
IBQ01–SF	Same as –SA but is field-installed
Cables	User-supplied RS–485 BITBUS standard

Performance	
Transfer mode	Programmed I/O transfers with interrupt DMA data transfer
Data transfer rate	Up to 2.4 Mbits/second at BITBUS length of 30 m
	375 Kbits/second at BITBUS length of 300 m
	62.5 Kbits/second at BITBUS length of 13,200 m

Configuration Information	
Form factor	Quad height

Configuration Information	
Power requirements	+5 Vdc, 5.0 A; +12 Vdc, 0.3 A
Power consumption	28.6 W
Bus loads	4.6 ac; 1.0 dc

Related Documentation	
EK-IBQ01-UG	DECscan BITBUS Controller User's Guide
EK-IBQ01-IN	DECscan BITBUS Controller Installation Manual
EK-IBQ01-TM	DECscan BITBUS Controller Technical Manual
EK-JQ52A-TN	DECscan BITBUS Controller Software Installation

2.4.9 IEQ11 Controller

The IEQ11 option is a DMA controller that interfaces a Q22–bus system to two independent instrument buses (IEC/IEEE).

Functional Information	
Supported interfaces	IEEE–488–1978
	IEC 625–1
Supported interface functions	Automatic source handshake
	Automatic acceptor handshake
	Talker and extended talker (includes serial poll)
	Listener and extended listener
	Service request
	Remote local
	Parallel poll
	Device clear/Device trigger
	Controller

Ordering Information	
IEQ11–SA	Factory-installed option for IEC connection
IEQ11–SF	Same as –SA but is field-installed

Performance	
Transfer mode	Programmed I/O transfers with interrupt DMA data transfers
Data transfer rate	150 Kbytes/s during a DMA block transfer

Configuration Information	
Form factor	Quad height
Power requirements	+5 Vdc, 3.5 A (typical); +12 Vdc, 0.0 A
Power consumption	17.5 W
Bus loads	2.0 ac; 1.0 dc
Module connectors	Standard 24-pin IEEE 488 connector (IEQAA–AC)
	Standard 25-pin IEC 625 connector (IEQ11–AD)

Related Documentation	
EK–IEUQ1–UG	IEU11–A/IEQ11–A User's Guide

2.4.10 KWV11–S Programmable Real-Time Clock

The KWV11–S is a programmable real-time clock that can be programmed to count from one to five crystal-controlled frequencies, from an external frequency or event, or from a 50-Hz or 60-Hz line frequency on the Q22–bus. The board can generate interrupts or can synchronize the processor. The KWV11–S clock is functionally equivalent to the KWV11–C.

Functional Information	
Resolution	16 bits
Frequencies	5 internal crystal frequencies — 1 MHz, 100 kHz, 10 kHz, 1 kHz, and 100 Hz

Functional Information

Schmitt Triggers	2, each with slope and level controls that can be used to start the clock or generate program interrupts
Input	Line frequency input from BEVNT bus (50 or 60 Hz)
Modes	4 programmable modes

Ordering Information

KWV11–SA	Factory-installed option
KWV11–SF	Same as –SA but is field-installed
UDIP–BA[1]	Universal data interface panel mounting box
UDIP–KB	Universal data interface panel for KWV11–S
UDIP–TA	Tabletop enclosure

Performance

Clock	
Crystal oscillator	10-MHz base frequency
Output ranges	1 MHz, 100 kHz, 10 kHz, 1 kHz, and 100 Hz
Oscillator accuracy	0.01%
Other sources	Line frequency or input at Schmitt Trigger
Schmitt-Trigger input signals	
Number of inputs	2
Input range	±30 V (maximum limits)
Triggering range	–12 V to +12 V (adjustable)
Triggering slope	Positive or negative, switch-selectable
Source	User device
Response time	Depends on input waveform and amplitude; for TTL logic levels, typically 600 nanoseconds
Hysteresis	Approximately 0.5 V, positive and negative

[1]You must order the UDIP mounting box and the UDIP interface when installing a new option.

Performance

Characteristics	Single-ended input, 100-KΩ impedance to gnd
Clock output	
Signal	CLK OV L (clock overflow, asserted low)
Output pins	J1 pin 5 and CLK OVFL tab
Function	Time base selection from an internal crystal-controlled frequency, an input at ST1, or a line frequency at BEVNT bus line
Duration	Approximately 500 nanoseconds
Line driver	TTL-compatible, open collector circuit with a 470-Ω pull-up resistor to +5 V
Maximum source current	5 mA when output is high (≥2.4 V), measuring from source through load to ground
Maximum sink current	8 mA when output is low (≤0.8 V), measuring from external source voltage through load to output
Schmitt-Trigger 1 output	
Signal	ST1 OUT L (asserted low)
Output pins	J1 pin 2 and ST1 OUT tab
Function	External time base input or counter. Input frequency is a function of the input signal.
Other characteristics	Same as clock output
Schmitt-Trigger 2 output	
Signal	ST2 OUT L (asserted low)
Output pin	J1 pin 4
Function	Starts counter, sets ST2 flag, and generates an interrupt (if enabled); causes buffer preset register (BPR) to be loaded from counter.
Other characteristics	Same as clock output

Configuration Information

Power requirements	+5 Vdc, 2.2 A (typical); +12 Vdc, 0.013 A (typical)
Power consumption	11.156 W
Bus loads	1.0 ac; 0.3 dc

Related Documentation	
EK-AXVAA-UG	AXV11/KWV11 Module User's Guide

2.5 Printer Interface

2.5.1 LPV11–SA Printer Interface

The LPV11 printer interface controls the flow of data between the Q22–bus and a line printer.

Ordering Information	
LPV11–SA	LPV11 controller module

Configuration Information	
Form factor	Quad height
Power requirements	+5 Vdc, 2.8 A (typical), +12 Vdc, 0.0 A
Power consumption	14.0 W
Bus loads	1.8 ac; 0.5 dc
Module connectors	2 female, 37-pin D subminiature connectors

Related Documentation	
EK-LPV11-OP	LPV11 Printer User's Manual

2.6 Graphics Adapter

2.6.1 VS30U Graphics Adapter

The VS30U is a full-page, high-resolution DMA color video subsystem capable of 8-plane color video memory display. The VS30U allows field upgrade of Q–bus VAXservers to Q–bus workstations. The option includes the 8-plane color graphics module set (VCB02–J) as well as the 19-in color monitor (VR299) and a keyboard, mouse, and cable.

Ordering Information

VS30U	3 modules: base module and two 4-plane modules
VS30U-G3	GPX upgrade for BA213, VR299, 240 V
VS30U-G4	GPX upgrade for BA213, VR299, 240 V SH
VS30U-GA	GPX upgrade for BA213, VR299, 120 V

Configuration Information

Form factor	Quad height
Power requirements	Base module at +5 Vdc, 5.8 A (typical)
	Base module at +12 Vdc, 0.7 A (typical)
	4-plane module at +5 Vdc, 3.4 A (typical)

Chapter 3
System Expansion

This chapter provides guidelines on how to expand your system.

3.1 Planning System Expansion

You must consider the following when you decide to expand your system.

- Can your system accommodate additional supported options?

  You determine that by filling in a worksheet (Section 3.2) with the options currently installed in your system and those you wish to add.

- If your existing system cannot accommodate a particular set of supported options, you might wish to add one of the following expanders, to enable support for the RA-series or RF-series ISEs.

Expander Name	Additional Q22-Bus Slots	Additional Storage Capacity
B213F	10	Up to three RF-series ISEs, and one TK-series tape drive, or four ISE and no tape.
R215F	0	Up to three RF-series ISEs.
B400X	10	Up to four RF-series ISEs, or three ISEs and one TK-series, TLZ04, or TF-series tape drive.
R400X	0	Up to seven RF-series ISEs[1], or six RF-series ISEs with room for one TLZ04 or TF85 tape drive.
SF100	0	One TF857 magazine tape subsystem and up to four RF72 or RF73 ISEs.
SF200	0	Up to two TF857 magazine tape subsystems, and two to 24 RF72 or RF73 ISEs.

[1]RF35 may contain two ISEs.

This chapter does not describe how to configure new options or how to install them in your system. Configuring an option involves assigning a control and status register (CSR) address and an interrupt vector. This is usually done

by means of switches or jumpers on the options themselves. Digital service representatives configure the options when they install them. Your Digital service representative also determines the proper placement of options within your system, according to specific guidelines.

3.2 Completing the System Configuration Worksheet

To determine what options you can add to your system, you must list the options currently installed and their power requirements on the configuration worksheet provided on the next page.

The worksheet is for the BA440 enclosure. All backplane slots and mass storage devices are powered by the H7874 power supply.

Use the worksheets as follows.

1. In the Module column, list all options and mass storage devices currently installed in your system, except the controller for the tape drive. The KA6nn processor module has already been entered.

   Use the label on the cover panel of each slot to identify the module installed in that slot.

2. List each embedded storage device.

3. List the options and mass storage devices you wish to add to your system.

4. If the system includes a TK70 tape drive, list the TQK70 controller last.

5. Fill in the power requirements for each module and each mass storage device. The power requirements for the more common options are listed in Table 3–1; refer to the option descriptions in Chapter 2 for the power requirements of additional options.

6. Add each column and make sure the totals do not exceed the specified limit. As long as the figures are within range, you can probably install the new option(s).

Slot	Module	Current (Amps) [1] +5 Vdc	+12 Vdc	+3.3 Vdc	-12 Vdc	Power (Watts)	Bus Load AC	DC
MEM 1								
MEM 2								
MEM 3								
MEM 4								
CPU [2]	L4002-nA [3]	4 8	1 6	3 2	0 0	53 8	4 0	1 0
Q-bus 1								
Q-bus 2								
Q-bus 3								
Q-bus 4								
Q-bus 5								
Q-bus 6								
Q-bus 7								
Mass Storage:								
Tape							---	---
1								
2								
3								
4								
Total these columns:								
Must not exceed:		60 0 A	22 0 A	15 0 A	3 0 A	584 0 W	31	20

1. Total output power from +3.3 Vdc and +5 Vdc must not exceed 330 watts.

2. Power requirements in this line include CPU module, H3604 console module, and backplane terminator combined.

3. KA680(L4002-BA) or KA690(L4002-AA)

MLO-005361

NOTE: *The worksheets are only guides. Confirm your plan with your Digital sales representative. While certain configurations may be possible, they may not be recommended due to excessive loads on the system or difficulties in arranging bus and cable access to all devices.*

Table 3–1: Power Requirements

		Current (Amps) Max		Power Max	Bus Loads		Operation Mode
Option	**Module**	**+5 V**	**+12 V**	**Watts**	**AC**	**DC**	
AAV11-SA	A1009-PA	2.10	0.00	10.50	2.5	0.5	
ADQ32-SA	A030	4.45	0.00	22.25	2.5	0.5	
ADV11-SA	A1008-PA	2.00	0.00	10.00	2.3	0.5	
AXV11-SA	A026-PA	2.00	0.00	10.00	1.2	0.3	
CXA16-AA	M3118-YA	1.60	0.20	10.40	3.0	0.5	
CXB16-AA	M3118-YB	2.00	0.00	10.00	3.3	0.5	
CXY08-AA	M3119-YA	1.64	0.395	12.94	3.0	0.5	
DESQA-SA	M3127-PA	2.40	0.22	14.64	3.3	0.5	
DFA01-AA	M3121-PA	1.97	0.04	10.30	3.0	1.0	
DIV32-SA	M7571-PA	5.5	0.00	35.4	3.5	1.0	
DPV11-SA	M8020-PA	1.20	0.30	9.60	1.0	1.0	
DRQ3B-SA	M7658-PA	4.50	0.00	22.50	2.0	0.5	
DRV1J-SA	M8049-PA	1.80	0.00	9.00	2.0	1.0	
DRV1W-SA	M7651-PA	1.80	0.00	9.00	2.0	1.0	
DSV11-SA	M3108	5.43	0.69	35.43	3.9	1.0	
H3604[1]	-	1.70	0.50	14.50	-	-	
IBQ01-SA	M3125-PA	5.00	0.30	28.60	4.6	1.0	
IEQ11-SA	M8634-PA	3.50	0.00	17.50	2.0	1.0	
KA680-AA	L4002-BA	4.8	1.6	53.8	4.0	1.0	
KA690-AA	L4002-BA	4.8	1.6	53.8	4.0	1.0	
KDA50-SE	M7164	6.93	0.00	34.65	3.0	0.5	
—	M7165	6.57	0.03	33.21	-	-	
KFQSA-SA/SE	M7769	5.50	0.00	27.50	4.4	0.5	
KLESI-SA/SF	M7740-PA	4.00	0.00	20.00	0.5	1.0	

[1]Also include –12 Vdc @ 0.25 A, 3 W.

Table 3–1 (Cont.): Power Requirements

		Current (Amps) Max		Power Max	Bus Loads		Operation Mode
Option	**Module**	**+5 V**	**+12 V**	**Watts**	**AC**	**DC**	
KRQ50–SA/SF	M7552	2.70	0.00	13.50	2.7	1.0	
KWV11–SA	M4002–PA	2.20	0.013	11.156	1.0	0.3	
KXJ11–SF	M7616	6.0	0.4	46.8	2.0	1.0	
KZQSA–SA	M5976	5.4	0.0	27.0	4.4	0.5	
LPV11–SA	M8086–PA	2.80	0.00	14.00	1.8	0.5	
M9404–PA	M9404	–	0.00	0.0	–	–	
M9405–PA	M9405	–	0.00	0.0	–	–	
MRV11–D	M8578	1.60[2]	0.00	8.00	3.0	0.5	
MS690–BA	L4004–BA	5.03	0.00	26.5	–	–	
MS690–CA	L4004–CA	4.2	0.00	21.0	–	–	
MS690–DA	L4004–DA	6.4	0.00	32.0	–	–	
RF31E–AA/AF	–	1.20	3.03	42.4	N/A	N/A	peak @spin-up
RF35E–AA/AF	–	0.71	0.85	13.7	N/A	N/A	
RF352–AA/AF	–	0.85	2.55	34.9	N/A	N/A	peak @spin-up
RF71E–AA/AF	–	1.25	1.64	25.93	N/A	N/A	
RF72E–AA	–	1.38	4.68	63.0	N/A	N/A	peak @spin-up
RF73E–AA	–	1.20	5.00	66.0	N/A	N/A	peak @spin-up
TF85E–JA/JF	–	1.50	2.40	36.30	N/A	N/A	
TK50E–AA	–	1.50	2.40	36.30	N/A	N/A	
TK70E–AA	–	1.50	2.40	36.30	N/A	N/A	
TLZ04–JA/JF	–	1.5	2.4	36.3	N/A	N/A	
TQK50–SA/SF	M7546	2.9	0.00	14.5	2.8	0.5	
TQK70–SA/SF	M7559	3.50	0.00	17.50	4.3	0.5	
TSV05–SA	M7530	6.50	0.00	32.50	1.5	1.0	
VCB02–A	M7615	4.60	0.10	24.2	3.5	1.0	

[2]Value is for the unpopulated module only.

Table 3–1 (Cont.): Power Requirements

		Current (Amps) Max		Power Max	Bus Loads		Operation Mode
Option	**Module**	**+5 V**	**+12 V**	**Watts**	**AC**	**DC**	
VCB02–B	M7168–00 M7169	8.85	0.47	49.89	3.5	1.0	
VCB02–C	(2) M7168–00 M7169	12.0	0.47	65.64	3.5	1.0	

Index

A

Asynchronous serial controllers
  description of, 2–36

B

BA440 enclosure, 1–1
Base system
  description of, 1–1
Break Enable/Disable switch
  description of enable setting, 1–3

C

Communication options
  supported, list, 2–35
Console commands
  qualifier and argument conventions in Console I/O mode, 1–5
Console I/O mode
  and examples of SET and SHOW commands, 1–8
  console commands, 1–5
  description of, 1–3
Console program, 1–2
  and power-up mode, 1–3
  entering Console I/O mode, 1–3
Control and status register (CSR)
  assigning, 3–1
  description of, 2–1
CSR
  See Control and status register

D

Device abbreviations, 1–10
DHU11 mode
  and CXA16 support, 2–36
  and CXB16 support, 2–38
DHV11 mode
  and CXA16 support, 2–36
  and CXB16 support, 2–38
Digital Storage Systems Interconnect
  See DSSI
DSSI
  description of, 1–11

E

Expanding system, 3–1

F

Firmware
  system control of, 1–3

I

Integrated storage element (ISE)
  and support on DSSI bus, 1–11
  RF-series, description of, 2–13, 2–14, 2–17, 2–18
  RF-series, description of RF35, 2–15
  RF73, description of, 2–19
Interrupt vector
  description of, 2–1

K

KA675–AA modules
  system names, 1–12

KA680–AA modules
system names, 1–15, 1–19

M

Mass storage controllers
See Controllers
Modules
KA6nn–AA CPU, location, 1–1

N

Network controllers
description of, 2–36

P

Power supply
minimum load, 3–6
Power-up self-tests
description of, 1–2

R

Real-time options
supported, list of, 2–50

S

Self-tests
See Power-up self-tests
SET BOOT command, 1–10
SET command
description of, 1–8
SET LANGUAGE command, 1–10
SHOW command
description of, 1–8
SHOW DEVICE display, 1–9
SHOW ETHERNET display, 1–10
SHOW LANGUAGE display, 1–10
SHOW QBUS display, 1–8
Synchronous serial controllers
description of, 2–36

V

VMB
description of, 1–2

VAX 4000
Site Preparation

Order Number EK–387AE–SP.005

Digital Equipment Corporation
Maynard, Massachusetts

First Printing, March 1990
Revised, December 1990
Revised, November 1991
Revised, April 1992
Revised, July 1992

The Reader's Comments form at the end of this document requests your critical evaluation to assist in preparing future documentation.

FCC NOTICE: The equipment described in this manual generates, uses, and may emit radio frequency. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such radio frequency interference.

Operation of the equipment in a residential area may cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

S1980

This document was prepared using VAX DOCUMENT, Version 2.1

Contents

Chapter 1 General Requirements

1.1 System and Expander Enclosure Designations 1–1
1.2 Space Requirements 1–2
1.3 Operating Environment 1–2
1.3.1 Static Electricity 1–3
1.3.2 Temperature and Humidity Ranges 1–3
1.4 Electrical Requirements 1–3
1.4.1 Power Source 1–4
1.4.2 Grounding 1–4
1.5 Acoustics 1–5
1.6 When Your Shipment Arrives 1–5

Chapter 2 Specific Requirements

2.1 Dimensions 2–1
2.1.1 BA430/BA440 Enclosure and B400X/R400X Expander Shipping Carton Dimensions 2–2
2.1.2 BA430/BA440 Enclosure and B400X/R400X Expander Dimensions 2–3
2.1.3 BA215 Enclosure and Shipping Carton Dimensions 2–4
2.1.4 B213F Expander and Shipping Carton Dimensions 2–5
2.2 Heat, Humidity, Electrical Requirements, and Acoustics 2–6
2.2.1 BA430/BA440 Enclosure and R400X Expander Specifications 2–6
2.2.2 BA215 Enclosure Specifications 2–8
2.2.3 BA213 Enclosure Specifications 2–10
2.3 Additional Expander Requirements 2–11

Appendix A Power and Ground Cable Part Numbers

A.1 Power Cables for BA430/BA440 Enclosure Systems and B400X/R400X Expanders A–1

A.2 Power Cables for BA215 Enclosure Systems and R215F Expanders A–2

A.3 Power Cables for B213F Expanders A–2

A.4 Ground Cables A–3

Index

Chapter 1
General Requirements

Read this chapter for general requirements. Then refer to Chapter 2 for the specific requirements of your system. To ensure smooth installation and operation of the system, your site must meet the requirements in both chapters before the arrival of your system shipment.

NOTE: *Digital recommends that a Digital service representative install your system.*

Digital provides a site preparation service. If you want Digital to prepare your site, contact your Digital service or sales representative.

1.1 System and Expander Enclosure Designations

The following table lists the enclosures in which the systems and expanders are shipped. For simplicity, enclosure designations are used throughout this manual rather than the system or expander name.

System or Expander	Enclosure
VAX 4000 Model 200 System (BA430)	BA430
VAX 4000 Model 200 System (BA215)	BA215
VAX 4000 Model 300 System	BA440
VAX 4000 Model 400 System	BA440
VAX 4000 Model 500 System	BA440
VAX 4000 Model 600 System	BA440
B400X Expander	BA430
R400X Expander	R400X
B213F Expander	BA213
R215F Expander	BA215

The physical requirements for your system are determined by its dimensions before and after the shipping carton is removed, space for

doors to swing open, space for peripheral equipment such as printers and terminals, allowances for adequate airflow around the system, and the noise emission level of the system.

1.2 Space Requirements

Before unpacking your equipment, make sure you have enough space to remove the system from its shipping carton. You need 1.5 to 1.8 meters (5 to 6 feet) to the side of the carton to allow room for rolling the system off its shipping ramp. Also make sure you leave enough space around the system so it can be serviced. The dimensions of cartons and enclosures are shown in Chapter 2.

You must leave at least 1 meter (39 inches) of clearance at the front of your system for opening the doors and to access system controls. You must also leave at least 5 centimeters (2 inches) of clearance at the sides and rear for airflow. Since the base of the enclosure is 5 centimeters (2 inches) wider than the cabinet in front and rear, you can place the rear of the system against a wall or table, and the system will have enough room for adequate airflow.

In addition to the space required for your system, you should ensure that you have enough space for any expanders, terminals, printers, mass storage media, printer paper, and other necessary supplies.

If you plan to connect your system to peripheral devices such as printers, terminals, or modems, you will need additional cabling. Cables that connect the system to peripheral devices must be ordered separately.

NOTE: *Cabling from peripheral devices should be in place and labeled before your system is installed.*

When planning cable routing for multiterminal equipment, you should consider factors such as safety, convenience, future expansion, and cost. And there are other factors to consider when cabling a multiterminal system on more than one floor in the same building or in more than one building. Digital offers several cable types for such applications, and Digital service personnel are available to help you plan your installation. Your sales representative can provide more information.

1.3 Operating Environment

Your system is affected by the discharge of static electricity, temperature changes, and humidity. Those conditions can affect the operation and overall dependability of your system.

1.3.1 Static Electricity

Static electricity is a common problem. It can cause system failure and loss of data. The most common source of static buildup is contact between people and carpeting or clothing. Low humidity allows the greatest buildup of static charges.

To minimize static buildup, follow these guidelines.

- Maintain a relative humidity of at least 40 percent.
- Locate your system away from busy office corridors.
- Avoid using carpeting in the computer area. If you must install carpeting, use antistatic carpeting if possible. If regular carpeting is already installed, place a grounded antistatic mat under your system.
- Maintain the antistatic properties of antistatic floors, carpeting, or mats by following the manufacturer's recommendations for cleaning.

1.3.2 Temperature and Humidity Ranges

Your system should be installed in a well-ventilated area where the temperature and humidity ranges listed in Chapter 2 for your system are maintained throughout the year.

Rapid temperature changes may affect system performance. Therefore, do not operate your system near heating or cooling devices, large windows, or doors that open to the outside. Air should contain a minimum of dust and other abrasive contaminants.

Mass storage media and other computer supplies, including paper, should be kept at the same temperature and humidity as that of the computer area.

When calculating the operating temperature in your environment, consider the heat that the system, peripherals, and other equipment generate. See Chapter 2 for the amount of heat dissipated by each system and expander.

1.4 Electrical Requirements

In determining the electrical requirements of your system or expander, consider the following.

- Voltage range
- Power-source phase
- Nominal frequency

- Frequency range
- Steady-state current
- Power consumption

When you are ready to use that information, turn to Chapter 2 and find the electrical requirements for your system.

1.4.1 Power Source

The power source should handle your system and allow for system expansion. Digital recommends a dedicated circuit from the power source for each system and a separate dedicated circuit for each expander. A dedicated ground circuit provides electrical isolation from power surges or electrical noise caused by other electrical equipment. You should not connect any other equipment such as air conditioners, office copiers, or coffee pots to the same circuit as your system or expander.

If you cannot avoid power disturbances, your system will need additional power-conditioning equipment. For more information, contact your Digital sales representative.

Each system shipped within North America includes a 120-Vac power cable. If your system will be shipped outside North America, or if you require a 240-Vac cable, you must order the power cable(s) separately. See the appendix for a list of the countries and their associated power cables.

1.4.2 Grounding

If you will be installing two or more enclosures (system or expander) and if they will be connected by a common DSSI bus, improper grounding can result in voltage potentials, called ground offset voltages, between the enclosures. And if those voltages exceed certain limits, data transmission across the DSSI bus can be disrupted and your system can experience performance degradation or data corruption.

To prevent system performance degradation or data corruption caused by excessive ground offset voltages:

1. Have a qualified electrician check to make sure your site power distribution system meets all local electrical codes.
2. Also have that electrician inspect your entire site power distribution system to make sure it does not have any of these faults.
   a. Outlets do not have power ground connections.
   b. Grounding prong missing from computer equipment power cables.

c. Power outlet neutral connections are actually ground connections.

d. Grounds for the power outlets are not connected to the same power distribution panel.

e. Devices that are not UL or IEC approved are connected to the same circuit breaker as the computer equipment.

If all the requirements in steps 1 and 2 are met, the ground offset voltages should be within acceptable limits for DSSI operation. If any of those requirements cannot be met, after your system is installed and turned on you should check the ground offset voltages as described in the system *Installation* manual.

NOTE: *To ensure proper grounding, you should check the ground offset voltages even if all the requirements in steps 1 and 2 are met.*

1.5 Acoustics

Computer systems generate noise. Higher than acceptable noise levels can adversely affect your work environment. Digital recommends placing your system and B400X, R400X, B213F, and R215F expanders in an open office environment.

1.6 When Your Shipment Arrives

When your system arrives, you should inspect it with a Digital service representative to ensure that the system and all ordered options arrived undamaged.

When you are ready to begin installation, find the Customer Hardware Information Kit (in the system shipping carton) and begin using the *Installation* manual and *Installation Checklist* to install your system.

Chapter 2
Specific Requirements

This chapter lists system dimensions, acceptable temperature and humidity ranges, electrical requirements, and acoustic levels to consider in preparing your site.

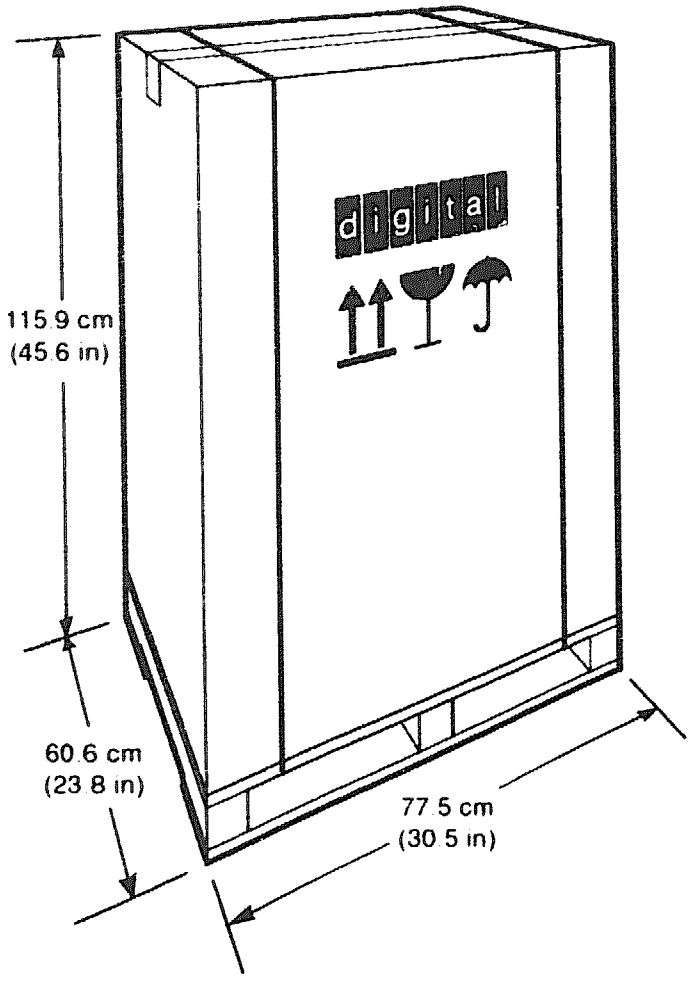
2.1 Dimensions

Your system and B400X, R400X, B213F, and R215F expanders are shown in this section with their shipping carton dimensions and enclosure dimensions.

WARNING: *To prevent injury, at least two people should move system, expander, or terminal cartons.*

- Section 2.1.1 shows the dimensions of the carton used to ship BA430 and BA440 systems and R400X and B400X expanders.
- Section 2.1.2 shows the dimensions of systems and expanders that use the BA430 or BA440 enclosure.
- Section 2.1.3 shows the dimensions of the carton used to ship the Model 200 (BA215) system and the R215F expander, as well as the dimensions of the Model 200 (BA215) system and the R215F expander.
- Section 2.1.4 shows the dimensions of the B213F expander and shipping carton.

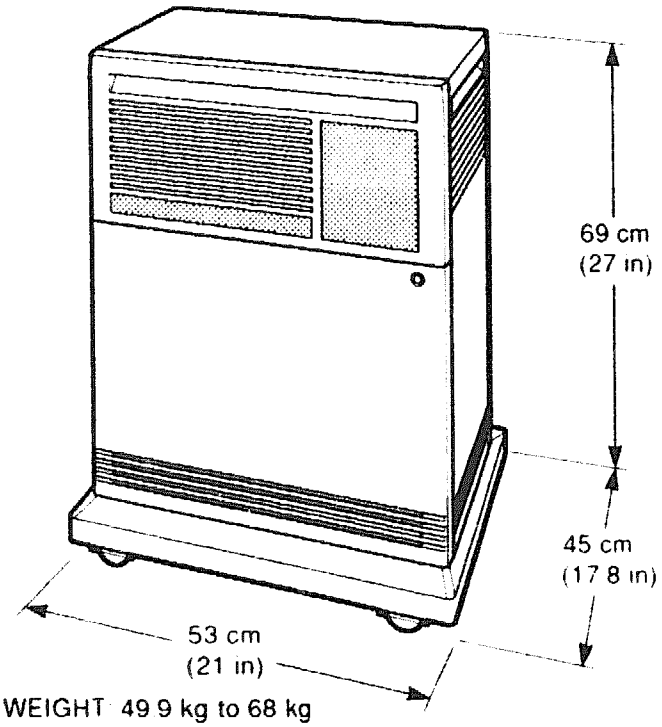
2.1.1 BA430/BA440 Enclosure and B400X/R400X Expande Shipping Carton Dimensions



WEIGHT 63.5 kg to 85.3 kg
(140 lb to 188 lb)

MLO-004189

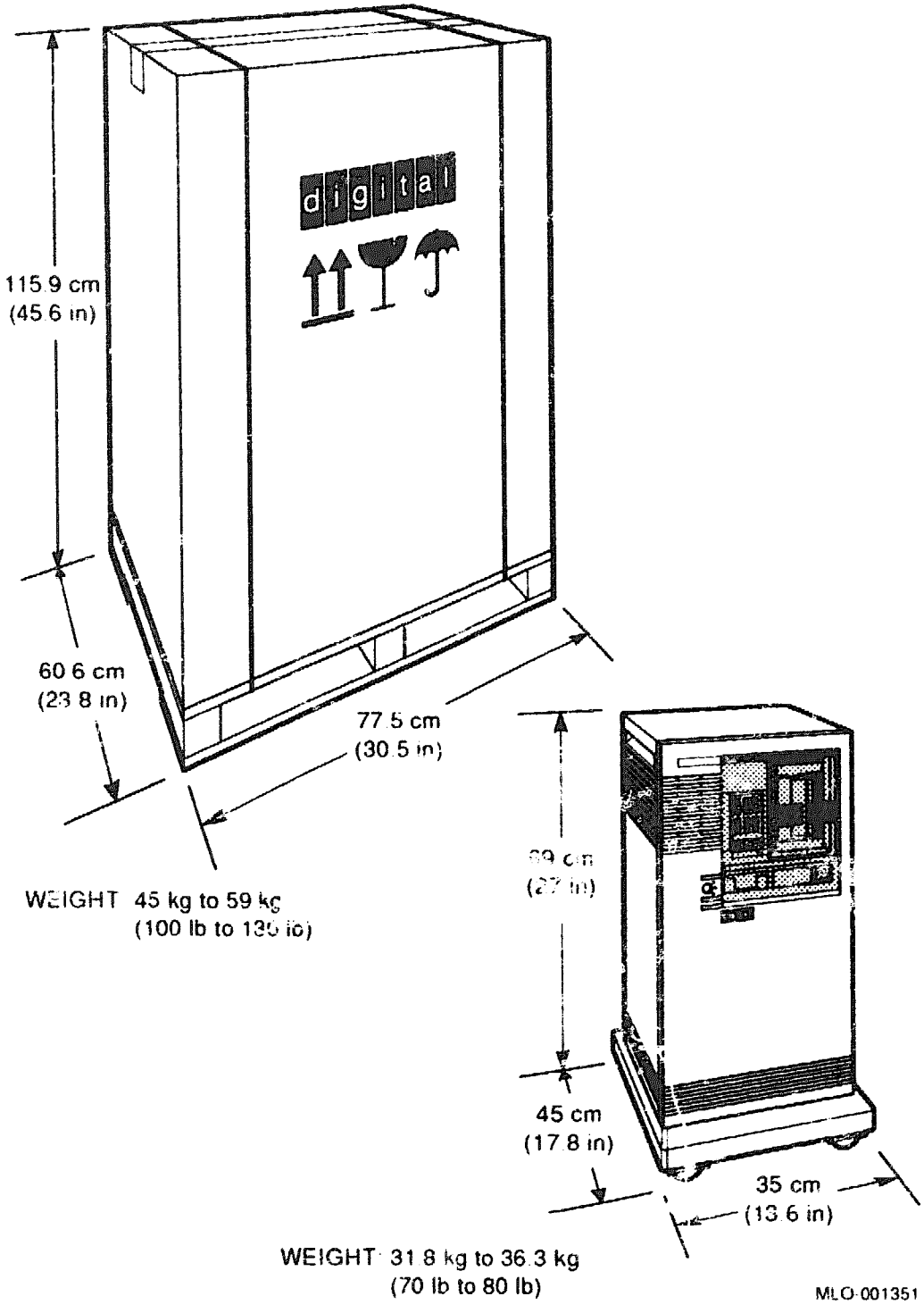
2.1.2 BA430/BA440 Enclosure and B400X/R400X Expander Dimensions



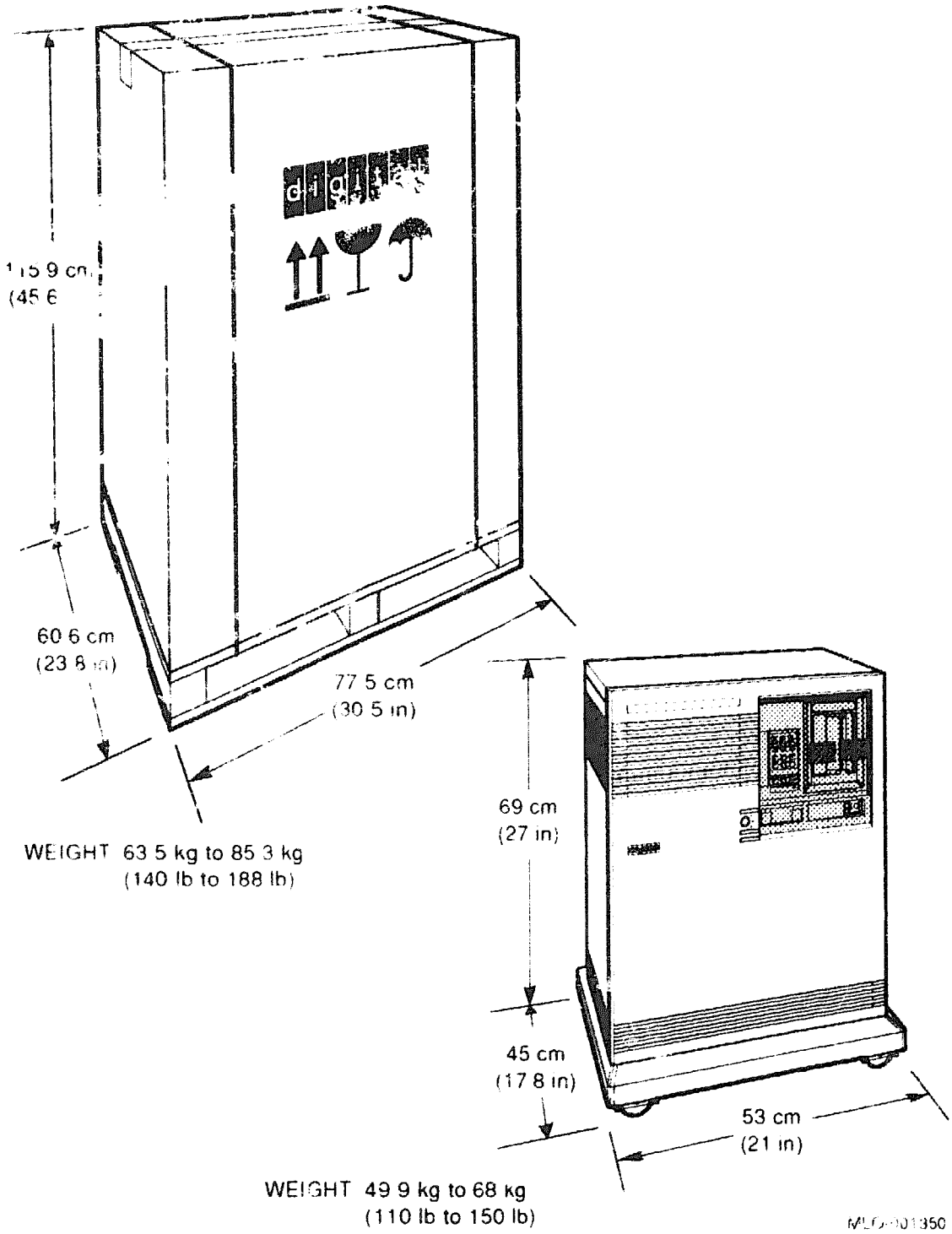
WEIGHT 49 9 kg to 68 kg
(110 lb to 150 lb)

MLO-004190

2.1.3 BA215 Enclosure and Shipping Carton Dimensions



2.1.4 B213F Expander and Shipping Carton Dimensions



2.2 Heat, Humidity, Electrical Requirements, and Acoustics

Systems and expanders operate within or at the values for temperature and humidity, power requirements, and noise levels listed in the following sections.

- Section 2.2.1, BA430/BA440 enclosure and R400X expander specifications
- Section 2.2.2, BA215 enclosure specifications
- Section 2.2.3, BA213 enclosure specifications

2.2.1 BA430/BA440 Enclosure and R400X Expander Specifications

Heat Dissipation, Temperature, and Humidity Ranges

Condition		Measure
Heat dissipation	—	2980 BTU/h
Temperature	Operating:	10°C to 40°C (50°F to 104°F)
	Nonoperating:	–40°C to 66°C (–40°F to 151°F)
Temperature rate of change	Operating:	11°C (20°F) per hour maximum
Relative humidity	Operating:	20% to 80% noncondensing
	Nonoperating:	10% to 90% noncondensing
Maximum altitude	Operating:	2438 meters (8000 feet)
	Nonoperating:	4877 meters (16,000 feet)

NOTE: For operation above sea level, decrease the operating temperature range values by 1.8°C per 1000 meters (1°F per 1000 feet).

Operating Accustic Emission Levels

LNPE (B)	LPA (dB)
6.6	61
Recommended placement:	Office environment

NOTES:

LNPE = Noise power emission level (A-weighted sound power level) measured in bels reference 1 pico-watt

LPA = Sound pressure measured in decibels at 1.0 meter from the front edge of the unit and 1.5 meters above the floor.

Levels may be lower than those shown, depending on the kind and number of mass storage devices in the system.

All data measured in accordance with ANSI S12.10–1985 (American National Standards Institute) and ISO/DIS 7779 (International Standards Organization).

Electrical Requirements

Nominal AC Voltage ⟹	100 to 120 Vac	220 to 240 Vac
Voltage range	90 to 128 Vac	176 to 264 Vac
Power-source phase	Single	Single
Nominal frequency	50 to 60 Hz	50 to 60 Hz
Frequency range	47 to 63 Hz	47 to 63 Hz
Maximum steady-state current at nominal voltage	11.9 A	5.8 A
Maximum steady-state current at minimum voltage	11.9 A	5.8 A
Maximum inrush current	100 A	83 A
Maximum power consumption	850 W	850 W

2.2.2 BA215 Enclosure Specifications

Heat Dissipation, Temperature, and Humidity Ranges

Condition		Measure
Heat dissipation	—	1178 BTU/h
Temperature	Operating:	10°C to 40°C (50°F to 104°F)
	Nonoperating:	–40°C to 66°C (–40°F to 151°F)
Temperature rate of change	Operating:	11°C (19.8°F) per hour maximum
Relative humidity	Operating:	20% to 80% noncondensing
	Nonoperating:	10% to 90% noncondensing
Maximum altitude	Operating:	2438 meters (8000 feet)
	Nonoperating:	4877 meters (16,000 feet)

NOTE: For operation above sea level, decrease the operating temperature range values by 1.8°C per 1000 meters (1°F per 1000 feet).

Operating Acoustic Emission Levels

LNPE (B)	LPA (dB)
6.1	48
Recommended placement:	Office environment

NOTES:

LNPE = Noise power emission level (A-weighted sound power level) measured in bels reference 1 pico-watt

LPA = Sound pressure measured in decibels at 1.0 meter from the front edge of the unit and 1.5 meters above the floor.

Levels may be lower than those shown, depending on the kind and number of mass storage devices in the system.

All data measured in accordance with ANSI S12.10–1985 (American National Standards Institute) and ISO/DIS 7779 (International Standards Organization).

Electrical Requirements

Nominal AC Voltage ⇒	101 Vac	120 Vac	220–240 Vac
Voltage range	88 to 110 Vac	93 to 132 Vac	176 to 264 Vac
Power-source phase	Single	Single	Single

Nominal AC Voltage ⟹	101 Vac	120 Vac	220–240 Vac
Nominal frequency	50 to 60 Hz	50 to 60 Hz	50 to 60 Hz
Frequency range	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz
Maximum steady-state current at nominal voltage	5.2 A	4.4 A	2.4 A
Maximum steady-state current at minimum voltage	8.3A	7.2 A	3.9 A
Maximum inrush current	50 A	50 A	50 A
Startup current (30 seconds) at nominal voltage	7.1 A	5.9 A	3.1 A
Maximum power consumption	340 W	340 W	340 W

2.2.3 BA213 Enclosure Specifications

Heat Dissipation, Temperature, and Humidity Ranges

Condition		Measure
Heat dissipation	—	2304 BTU/h
Temperature	Operating:	10°C to 40°C (50°F to 104°F)
	Nonoperating:	–40°C to 66°C (–40°F to 151°F)
Temperature rate of change	Operating:	11°C (20°F) per hour maximum
Relative humidity	Operating:	20% to 80% noncondensing
	Nonoperating:	10% to 90% noncondensing
Maximum altitude	Operating:	2438 meters (8000 feet)
	Nonoperating:	4877 meters (16,000 feet)

NOTE: For operation above sea level, decrease the operating temperature range values by 1.8°C per 1000 meters (1°F per 1000 feet).

Operating Acoustic Emission Levels

LNPE (B)	LPA (dB)
5.7	42
Recommended placement:	Office environment

NOTES:

LNPE = Noise power emission level (A-weighted sound power level) measured in bels reference 1 pico-watt

LPA = Sound pressure measured in decibels at 1.0 meter from the front edge of the unit and 1.5 meters above the floor.

Levels may be lower than those shown, depending on the kind and number of mass storage devices in the system.

All data measured in accordance with ANSI S12.10–1985 (American National Standards Institute) and ISO/DIS 7779 (International Standards Organization).

Electrical Requirements

Nominal AC Voltage ⟹	101 Vac	120 Vac	220–240 Vac
Voltage range	88 to 110 Vac	93 to 132 Vac	176 to 264 Vac
Power-source phase	Single	Single	Single

Nominal AC Voltage ⇒	101 Vac	120 Vac	220–240 Vac
Nominal frequency	50 to 60 Hz	50 to 60 Hz	50 to 60 Hz
Frequency range	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz
Maximum steady-state current at nominal voltage	10.2 A	8.6 A	4.7 A
Maximum steady-state current at minimum voltage	11.4 A	9.9 A	5.4 A
Maximum inrush current	100 A	100 A	100 A
Maximum power consumption	670 W	670 W	670 W

2.3 Additional Expander Requirements

An expander in your system has the following additional requirements.

- B400X, R400X, B213F, and R215F expanders require dedicated wall outlets.
- B400X, R400X, B213F, and R215F expanders must be installed by a Digital service representative when the system or expander is not part of a factory-configured system.
- When installing a B213F or an R215F expander on a system, an H4010–AA expander cable kit is required.

See the appendix for the required power cables.

Appendix A
Power and Ground Cable Part Numbers

Refer to the sections in this appendix and locate your system. Then order the power cable listed for your country.

Ground cables are listed in Section A.4.

For more information on 240-Vac operation, check with your Digital sales representative.

A.1 Power Cables for BA430/BA440 Enclosure Systems and B400X/R400X Expanders

Part Number	Country
BN20A-2E	United States, Japan, Canada (120 Vac)
BN20B-2E	United States, Japan, Canada (240 Vac)
BN22C-2E	Australia, New Zealand (240 Vac)
BN22D-2E	Central Europe (240 Vac)
BN22E-2E	United Kingdom, Ireland (240 Vac)
BN22F-2E	Switzerland (220 Vac)
BN22H-2E	Denmark (220 Vac)
BN22J-2E	Italy (240 Vac)
BN22K-2E	India (240 Vac)
BN22L-2E	Israel (240 Vac)

NOTE: *A 120-Vac power cable, BN20A-2E, is shipped with each 120-Vac system.*

A.2 Power Cables for BA215 Enclosure Systems and R215F Expanders

Part Number	Country
BN20M-2E	United States (120 Vac)
BN20N-2E	United States, Japan, Canada (240 Vac)
BN19J-2E	Australia, New Zealand (230/240 Vac)
BN03B-2E	Central Europe (240 Vac)
BN19B-2E	United Kingdom, Ireland (240 Vac)
BN19F-2E	Switzerland (220 Vac)
BN19L-2E	Denmark (220 Vac)
BN19T-2E	India (240 Vac)
BN19Y-2E	Israel (240 Vac)
BN19N-2E	Italy (240 Vac)

NOTE: *A 120-Vac power cable, BN20M-2E, is shipped with each 120-Vac system.*

A.3 Power Cables for B213F Expanders

Part Number	Country
BN20A-2E	United States (included with each 120-Vac system)
BN20B-2E	United States, Japan, Canada (240 Vac)
BN20C-2E	Australia, New Zealand (240 Vac)
BN20D-2E	Central Europe (240 Vac)
BN20E-2E	United Kingdom, Ireland (240 Vac)
BN20F-2E	Switzerland (240 Vac)
BN20H-2E	Denmark (240 Vac)
BN20J-2E	Italy (240 Vac)
BN20K-2E	India (240 Vac)
BN20L-2E	Israel (240 Vac)

NOTE: *A 120-Vac power cable, BN20A-2E, is shipped with each 120-Vac system.*

A.4 Ground Cables

Part Number	Description
BC21G–50	15.24 meter (50 foot) #6 grounding strap
BC21G–25	7.62 meter (25 foot) #6 grounding strap

Index

A

Acoustics, 1–5, 2–6
Arrival, shipment, 1–5

B

B213F expander and shipping carton dimensions, 2–5
B213F expander power cables, A–2
B400X/R400X expander dimensions, 2–3
B400X/R400X expander power cables, A–1
B400X/R400X expander shipping carton dimensions, 2–2
BA213 enclosure specifications, 2–10
BA215 enclosure and shipping carton dimensions, 2–4
BA215 enclosure specifications, 2–8
BA215 enclosure system and R215F expander power cables, A–2
BA430/BA440 enclosure and B400X /R400X expander dimensions, 2–3
BA430/BA440 enclosure and B400X /R400X expander shipping carton dimensions, 2–2
BA430/BA440 enclosure and R400X expander specifications, 2–6
BA430/BA440 enclosure system and B400X/R400X expander power cables, A–1

C

Cable part numbers
  ground, A–3
  power and ground, A–1

D

Dimensions, 2–1

E

Electrical requirements, 1–3, 2–6
Electricity, static, 1–3
Enclosure designations, system and expander, 1–1
Environment, operating, 1–2
Expander enclosure designations, 1–1
Expander requirements, 2–11

G

General requirements, 1–1
Ground cable part numbers, A–1, A–3

H

Heat, humidity, electrical requirements, and acoustics, 2–6
Humidity, 2–6
Humidity range, 1–3

O

Operating environment, 1–2

P

Part numbers
  ground cables, A–3
  power and ground cables, A–1

Power cable part numbers, A–1
Power cables
  B213F expanders, A–2
  B400X/R400X expanders, A–1
  BA215 enclosure systems and R215F expanders, A–2
  BA430/BA440 enclosure systems and B400X/R400X expanders, A–1
  R215F expanders, A–2
  R400X expanders, A–1

R

R215F expander power cables, A–2
R400X expander dimensions, 2–3
R400X expander power cables, A–1
R400X expander shipping carton dimensions, 2–2
R400X expander specifications, 2–6
Requirements
  electrical, 1–3, 2–6
  expander, 2–11
  general, 1–1
  space, 1–2
  specific, 2–1

S

Shipment arrival, 1–5
Shipping carton dimensions
  B213F expander, 2–5
  B400X/R400X expander, 2–2
  BA215 enclosure, 2–4
  BA430/BA440 enclosure and B400X/R400X expander, 2–2
Space requirements, 1–2
Specific requirements, 2–1
Static electricity, 1–3
System and expander enclosure designations, 1–1

T

Temperature and humidity ranges, 1–3