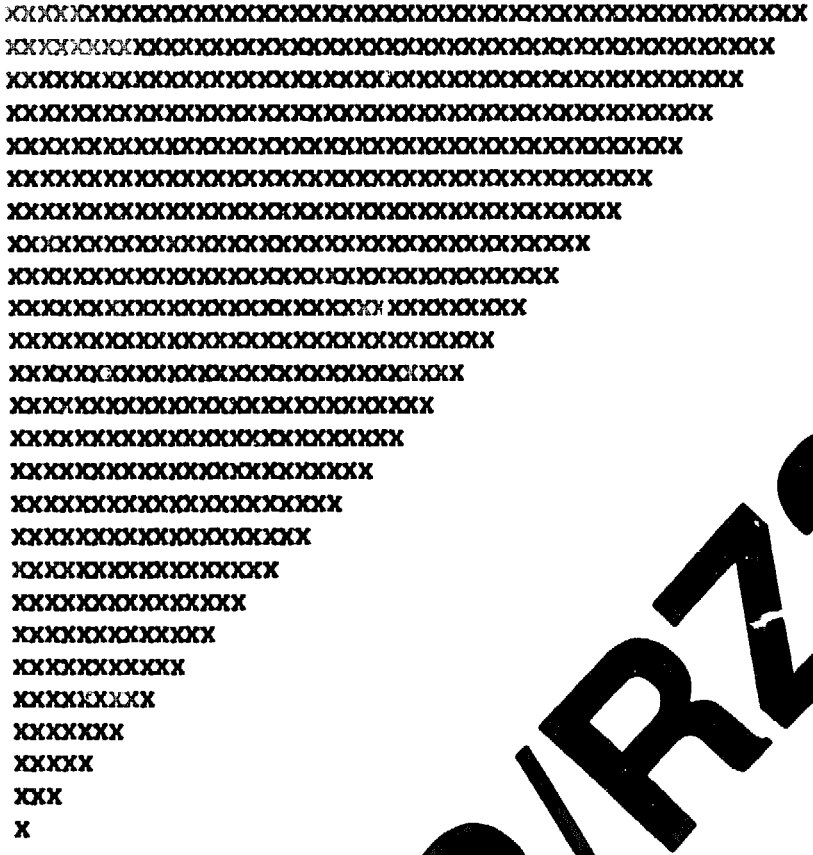
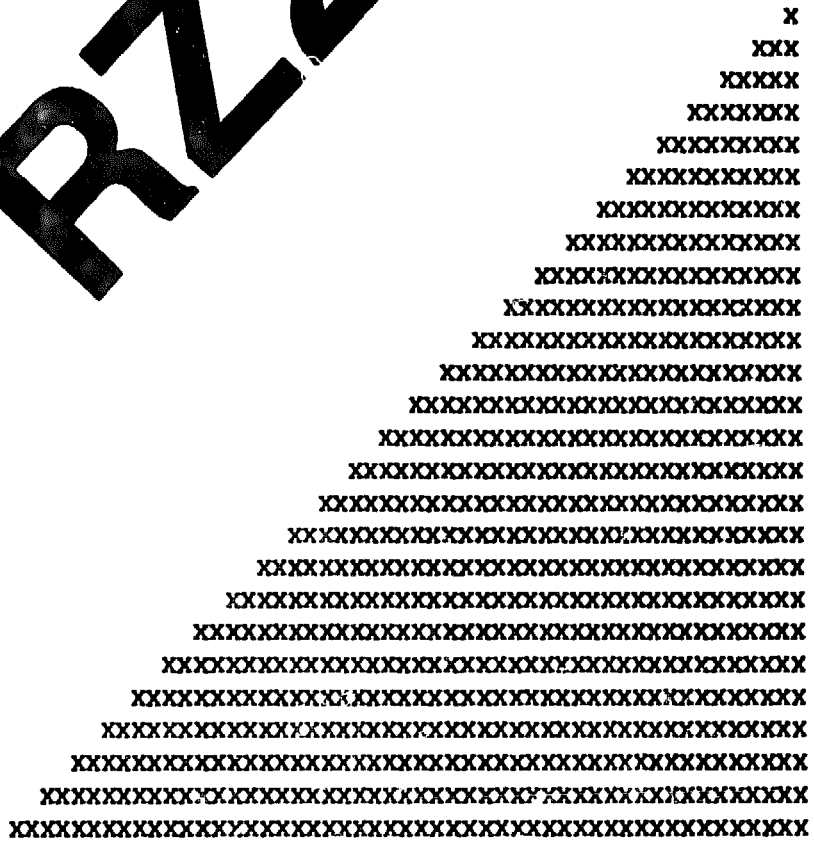


RZ22/RZ23/ RZ24



RZ22, RZ23, and RZ24 Disk Drive Subsystem Service Manual

Order Number EK-RZ234-SV-002

digital equipment corporation
maynard, massachusetts

May, 1990

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About This Manual

This manual provides information and procedures for servicing the RZ22, RZ23, and RZ24 disk drives in a variety of host systems.

Structure of This Manual

Chapter 1, About the RZ22, RZ23, and RZ24 Disk Drives, describes the RZ22, RZ23, and RZ24 disk drives. This chapter also lists the specifications of the drives and how to replace the drive modules.

Chapter 2, Servicing the RZ Disk Drives in a DECstation 2100/3100 System, describes servicing the RZ22, RZ23, and RZ24 disk drives in the DECstation 2100/3100 desktop systems. This chapter briefly describes the DECstation 2100/3100 system, how to troubleshoot the drives, and how to use and interpret the system self-test diagnostics. Finally, it describes, step by step, how to remove the drive from the system enclosure.

Chapter 3, Servicing the RZ22, RZ23 and RZ24 Disk Drives in a VAXstation 3100 System, describes servicing the RZ22, RZ23, and RZ24 disk drives in the VAXstation 3100 desktop systems. This chapter briefly describes the VAXstation 3100 system, how to troubleshoot the drives, and how to use and interpret the system self-test diagnostics. Finally, it describes, step by step, how to remove the drive from the system enclosure.

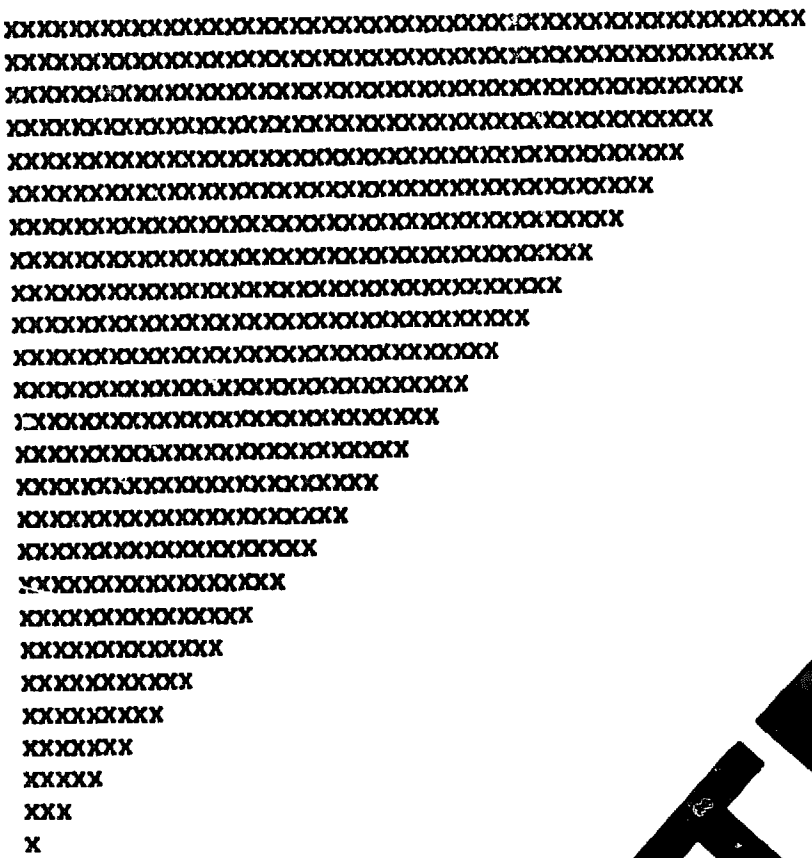
Intended Audience

This manual is intended for Digital Customer Service personnel and self-maintenance customers.

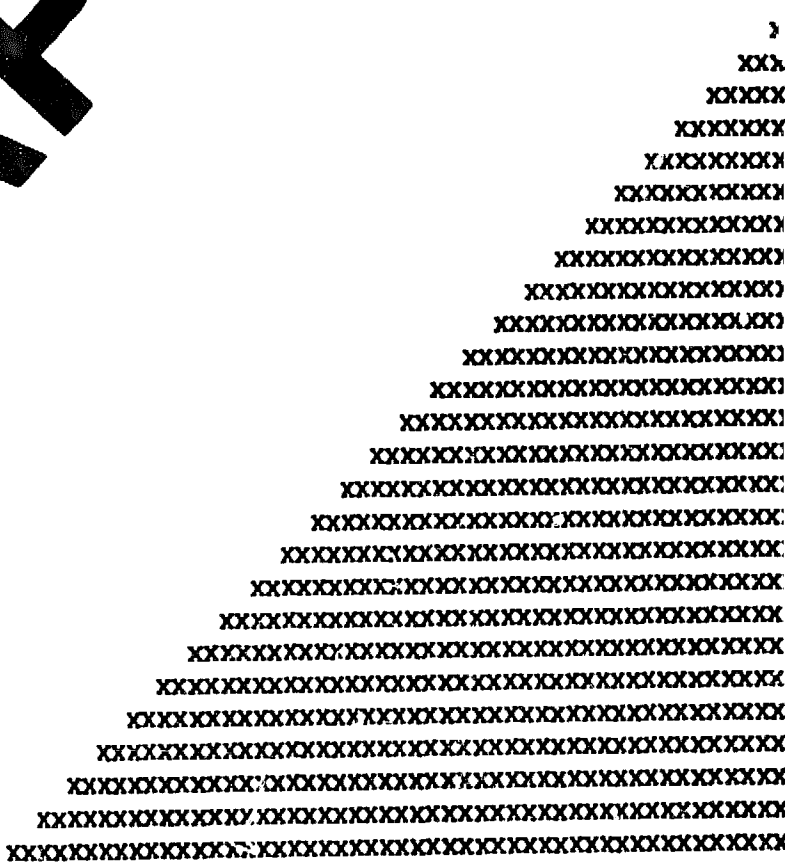
Associated Documents

This manual refers to the following documents:

Title	Order Number
DECstation 3100 Maintenance Guide	EK-291AA-MG
DECstation 2100/3100 Maintenance Guide	EK-291AB-MG
MicroVAX 3100 Maintenance Guide	EK-A0372-MG
VAXstation 3100 Maintenance Guide	EK-285AA-MG



CHAPTER 1



1

About the RZ22, RZ23, and RZ24 Disk Drives

1.1 Introduction

The RZ22, RZ23, and RZ24 hard disk drives are half-height, high-density, 3.5-inch Winchester disk drives for use with low-end desktop and workstation systems to provide random-access data storage/retrieval capability. The RZ22, RZ23, and RZ24 are designed to be mounted horizontally, vertically, and upside-down. The disk drives have small computer system interface (SCSI) ability. The RZ22, RZ23, and RZ24 conform to the common command set (CCS). These random-access rotating memory devices store data in fixed-length blocks on 90 mm thin rigid media disks. The medium contained within the drives are fixed, nonoperator removable hard disks.

The RZ22 and RZ23 disk drives (Figure 1–1) consist of two field replaceable units (FRUs): the entire disk drive and the drive module/frame. The drive module/frame FRU consists of the drive module and frame. The RZ24 disk drive (Figure 1–2) consists of two field replaceable units (FRUs): drive HDA/frame and the drive module.

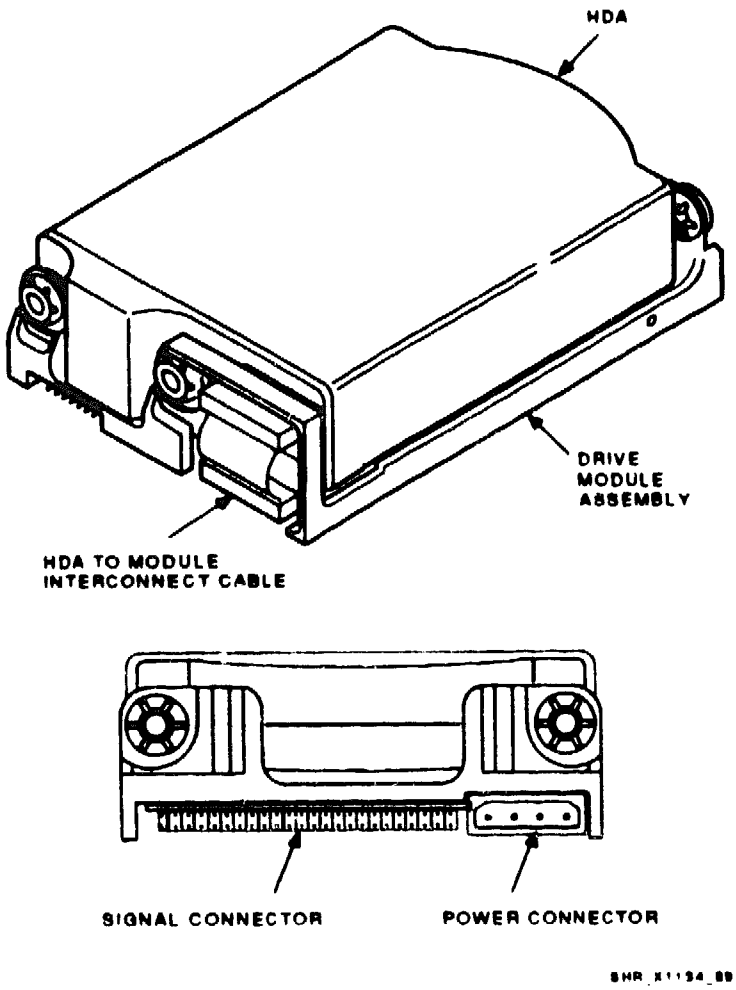


Figure 1–1 RZ22 and RZ23 Disk Drive Subsystems

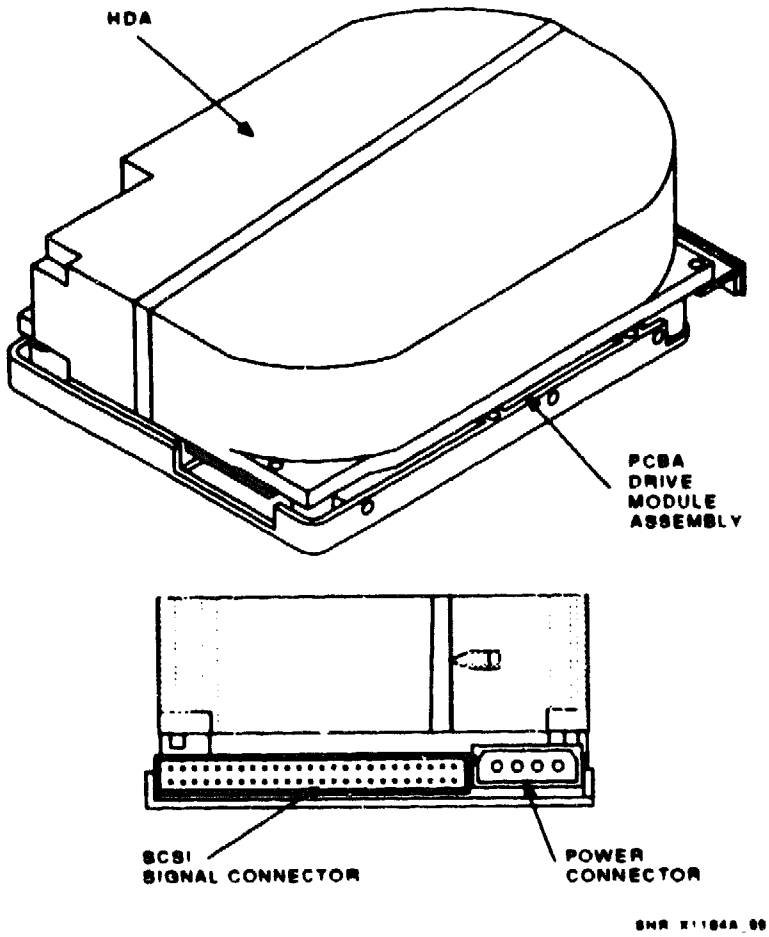


Figure 1–2 RZ24 Disk Drive Subsystem

1.2 Configuration

The SCSI interface must be terminated. The RZ22, RZ23, and RZ24 disk drives are not internally terminated. Therefore, termination must be done within the host system. Refer to the chapters that follow for information concerning the proper termination of the SCSI interface on your particular system.

To configure the drive in the system, set the jumpers as shown in Figures 1–3 and 1–4, and the jumper addresses listed in 1–1.

CAUTION
Make sure that the drive is not internally terminated. The terminating resistors are behind the SCSI port connector. If the terminating resistors are installed on the drive module/frame, remove them by using needlenose pliers.

NOTE
At J4 on Figure 1–3 (lower figure) the drive selected signal is present on J4 pin 1, or the spindle synchronization is present on J4 pin 1. This is for manufacturing use only.

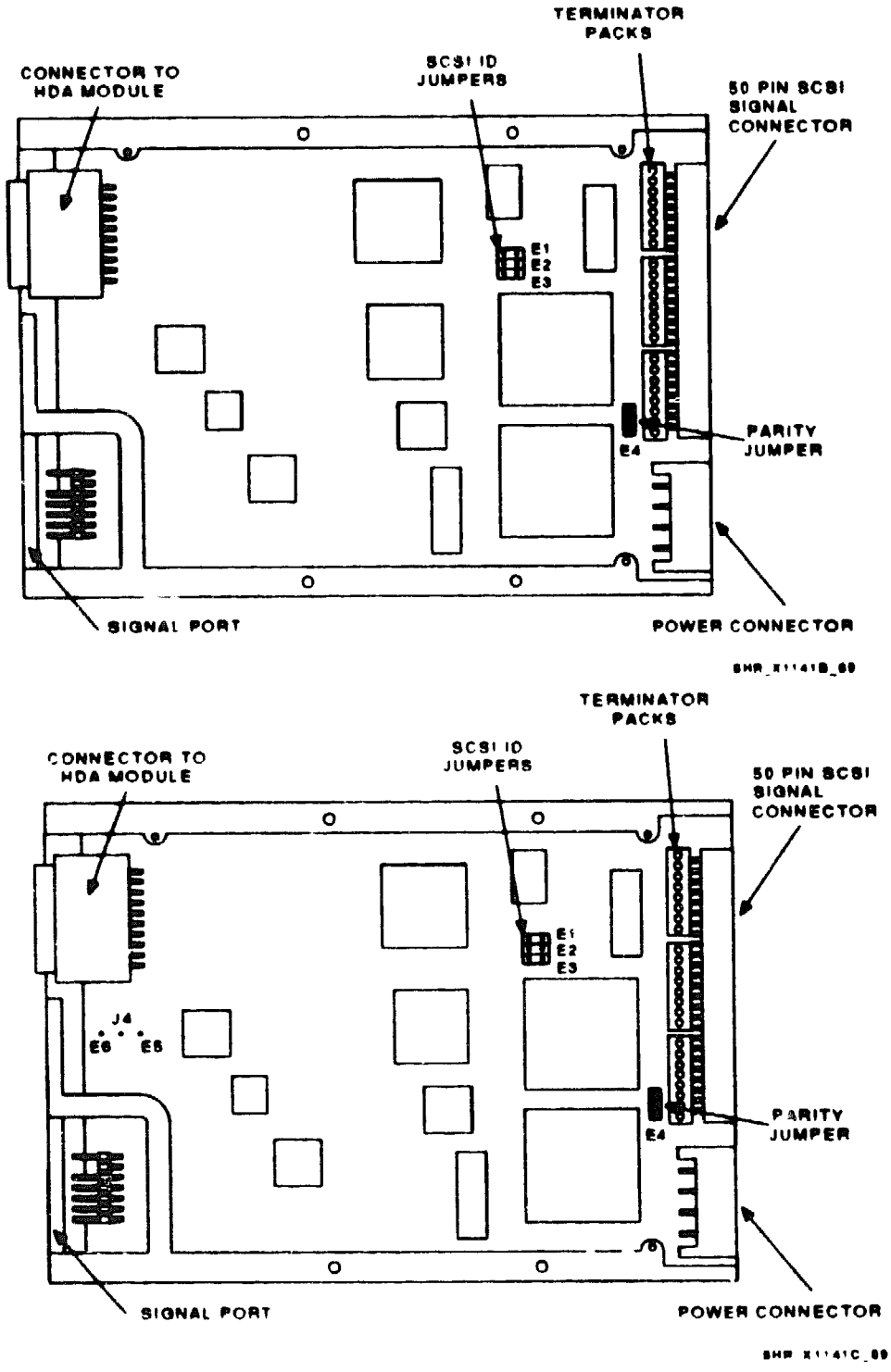


Figure 1–3 RZ22 and RZ23 Jumpers

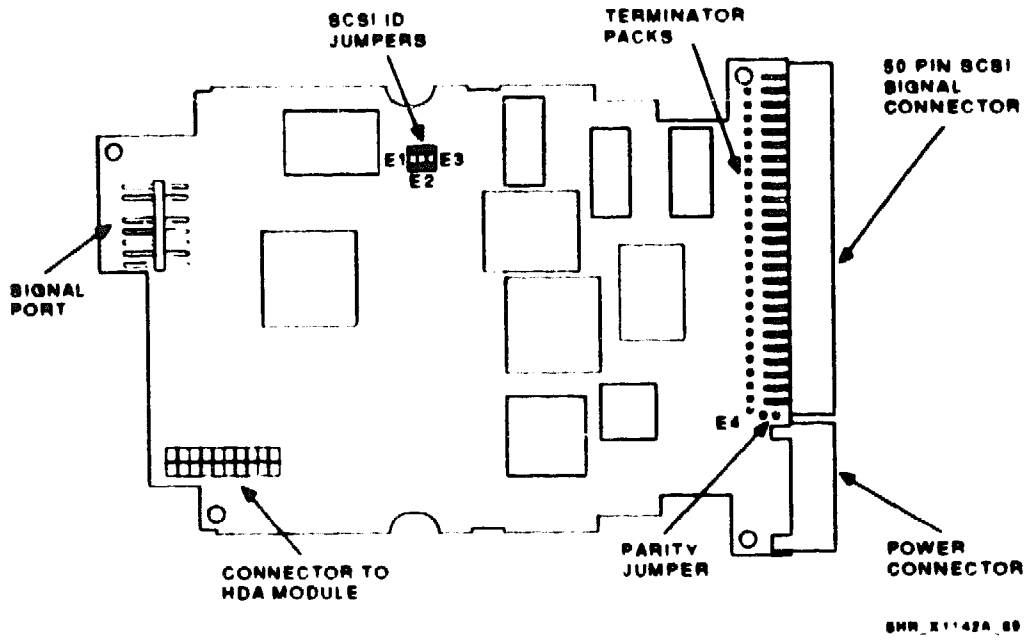


Figure 1–4 RZ24 Jumpers

Table 1–1 RZ22, RZ23, and RZ24 Jumper Settings

SCSI ID	E1	E2	E3	E4
0	Out	Out	Out	Out
1	In	Out	Out	Out
2	Out	In	Out	Out
3	In	In	Out	Out
4	Out	Out	In	Out
5	In	Out	In	Out
6	Out	In	In	Out
7	In	In	In	Out
	E5[1] is Out			E6[1] is In

[1]E5 and E6 are present on RZ22 and RZ23 drive/modules with revision levels BO2 or higher. Manufacturing use only.

1.3 Features

1.3.1 RZ22 and RZ23 Disk Drives Features

The RZ22 and RZ23 hard disk drives have many special features, which are listed below.

- High performance rotary voice coil actuator with embedded servo system
- Two of seven run length limited code
- Internal air filtration system
- Automatic actuator latch against inner stop upon power-down
- Microprocessor controlled diagnostics routine that are automatically executed at startup (drive level power-up self-test)
- Automatic error corrections and retries
- Block size of 512 bytes
- 16-Kbyte data buffer
- Two-piece FRU: RZ option and drive module/frame
- No preventative maintenance
- No need to format in the field

1.3.2 RZ24 Disk Drive Features

The RZ24 hard disk drive has many special features, which are listed below.

- 1:1 interleave
- 64-Kbyte read lookahead buffer
- Embedded servo
- Rotary voice coil actuator
- Thin film heads
- Track skewing
- 48-bit ECC
- Low power consumption
- Two-piece FRU: drive HDA/frame and drive module
- No preventative maintenance
- No need to format in the field

1.4 Specifications

Table 1–2 describes the physical and functional specifications of the RZ22, RZ23, and RZ24 hard disk drives.

Table 1–2 RZ22/23/24 Specifications

	RZ22	RZ23	RZ24
Physical Specifications			
Height	41.28 mm (1.625 in)	41.28 mm (1.625 in)	41.28 mm (1.625 in)
Width	101.60 mm (4.00 in)	101.60 mm (4.00 in)	101.60 mm (4.00 in)
Depth	146.05 mm (5.75 in)	146.05 mm (5.75 in)	146.05 mm (5.75 in)
Weight	0.780 kg (1.72 lb)	0.826 kg (1.82 lb)	0.901 kg (2.00 lb)
Performance Specifications			
Formatted storage capacity			
Per drive (Mbytes)	52	104	209
Per surface (Mbytes)	13	13	26
Bytes per track	16,896	16,896	19,456
Bytes per block	512	512	512
Blocks per track	33	33	38
Blocks per drive	102,432	204,864	409,792
Spare blocks per track	1	1	1
Spare blocks per drive	3,104	6,208	10,944
Transfer rate (to/from media)	1.25 Mbytes/s	1.25 Mbytes/s	1.50 Mbytes/s
Transfer rate (to/from buffer)	1.25 Mbytes/s	1.25 Mbytes/s	4.00 Mbytes/s

Table 1–2 (Cont.) RZ22/23/24 Specifications

	RZ22	RZ23	RZ24
Performance Specifications			
Seek time			
Track to track	≤ 8 ms	≤ 8 ms	≤ 5 ms
Average	≤ 25 ms	≤ 25 ms	≤ 16 ms
Maximum (full stroke)	≤ 45 ms	≤ 45 ms	≤ 35 ms
Average latency	8.4 ms	8.4 ms	8.5 ms
Rotational speed	3,575 r/min (±0.1%)	3,575 r/min (±0.1%)	3,497 r/min (±0.1%)
Start time (maximum)	20 s	20 s	20 s
Stop time (maximum)	20 s	20 s	20 s
Interleave	1:1	1:1	1:1
SCSI Overhead	na	na	1.5 ms
Functional Specifications			
Interface	SCSI	SCSI	SCSI
Recording density (BPI at ID)	23,441	23,441	31,800
Flux density (FCI at ID)	15,627	15,627	21,200
Track density (TPI)	1,150	1,150	1,700
Tracks/surface	776	776	1386
R/W heads	4	8	8
Disks	2	4	4
Time to process ECC (512 bytes)	<100 ms	<100 ms	<100 ms
Maximum Current and Power Consumption			
5 V supply current	0.600 A	0.600 A	0.350 A
12 V supply current	0.325 A	0.325 A	0.400 A
Power dissipation	8.000 W	8.000 W	6.800 W

Table 1–2 (Cont.) RZ22/23/24 Specifications

	RZ22	RZ23	RZ24
Environmental Specifications (for all drives)			
Temperature (operating)	10°C - 55°C (50°F - 131°F)		
Temperature (non-operating)	-40°C - 66°C (-40°F - 151°F)		
Relative humidity (operating)	8% - 80%		
Relative humidity (non-operating)	8% - 95%		
Altitude (operating)	-305 m - 4,572 m (-1,000 ft - 15,000 ft)		
Altitude (non-operating)	-305 m - 12,195 m (-1,000 ft - 40,000 ft)		
Heat dissipation (R/W)	6.8 W (27.36 Btu/h)		
Heat dissipation (Idle)	4.35 W (30.80 Btu/h)		

1.5 Removing and Replacing the Drive Module/Frame

1.5.1 RZ22 and RZ23 Disk Drives

This section describes the procedures for removing the drive module/frame from the HDA (head/disk assembly) and replacing the drive module/frame on the HDA.

CAUTION
Wear an antistatic wrist strap, properly grounded, and use care when handling the drive.

Make sure that the drive is not internally terminated. The terminating resistors are behind the SCSI port connector (refer to Figure 1–3). If the terminating resistors are installed on the drive module/frame, remove them by using needlenose pliers.

To remove the drive module/frame you will need:

- A 1/16-inch hex driver
- A replacement drive module/frame (mounted on a chassis)
- Two 4-40 screws (included with the drive module/frame)

1. Once you have removed the drive from the system enclosure, orient the drive as shown in Figure 1–5.
2. Remove the HDA to the drive interconnect cable at the HDA end, *not* at the drive module/frame end.
3. Remove the two screws using a 1/16-inch hex driver.
4. Hold the drive in your left hand.
5. With your right hand, push the HDA back against the rear grommets. Pull the front of the HDA up and straight out (away from the drive module/frame). Refer to Figure 1–5.

To replace the drive module/frame, reverse the procedure.

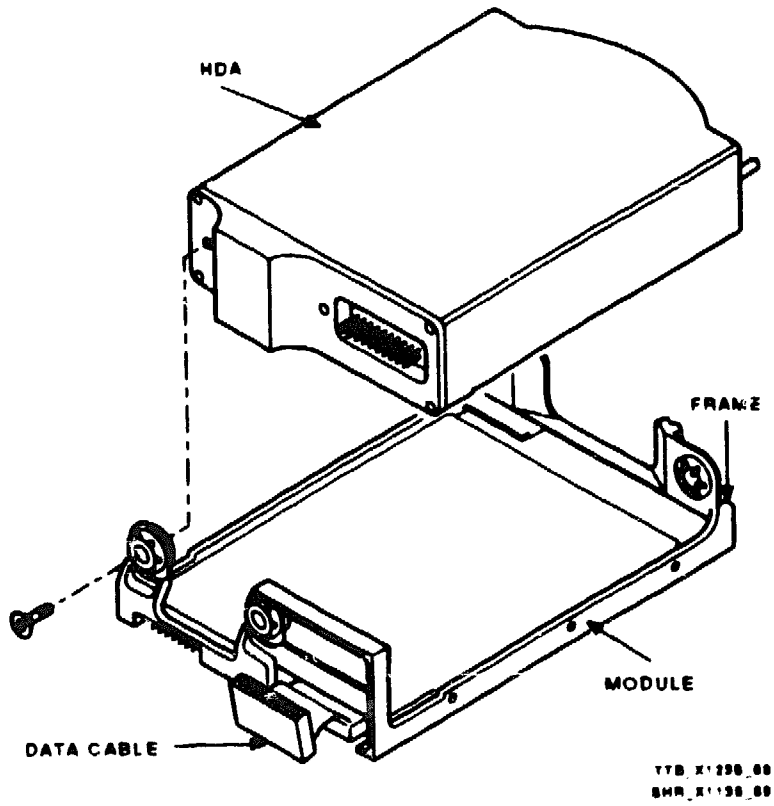


Figure 1–5 Drive Module/Frame Removal

1.5.2 RZ24 Disk Drive

This section describes the procedures for removing the drive module from the HDA/frame (head/disk assembly) and replacing the drive module on the HDA. Figure 1–6 shows the major components of the RZ24 disk drive.

CAUTION
Wear an antistatic wrist strap, properly grounded, and use care when handling the drive.

Make sure that the drive is not internally terminated. The terminating resistors (RP1, RP2, and RP3) are behind the SCSI port connector (Figure 1–4). If the terminating resistors are installed on the drive module, remove them by using needlenose pliers.

To remove the drive module you will need:

- A 7/64-inch hex driver
- A 5/64-inch hex driver
- A replacement drive module

1. Remove the four screws that secure the mounting frame to the drive using a 7/64-inch hex driver.
2. Remove the four screws that secure the drive module to the HDA/frame using a 5/64-inch hex driver.
3. Hold the drive in your left hand.
4. With your right hand, pull the the drive module up and straight out (away from the HDA/frame).

CAUTION
When removing the drive module from the HDA/frame, pull up on the drive module at the end where the interconnect between the drive module and the HDA/frame is located, otherwise damage may occur to the pins on the HDA/frame. Remember to place the fish paper insulator between the HDA and drive module.

Remember to retain the insulator between the HDA and drive module.

To replace the drive module, reverse the procedure.

NOTE
Be sure to set the SCSI ID number on the drive module the same as the original.

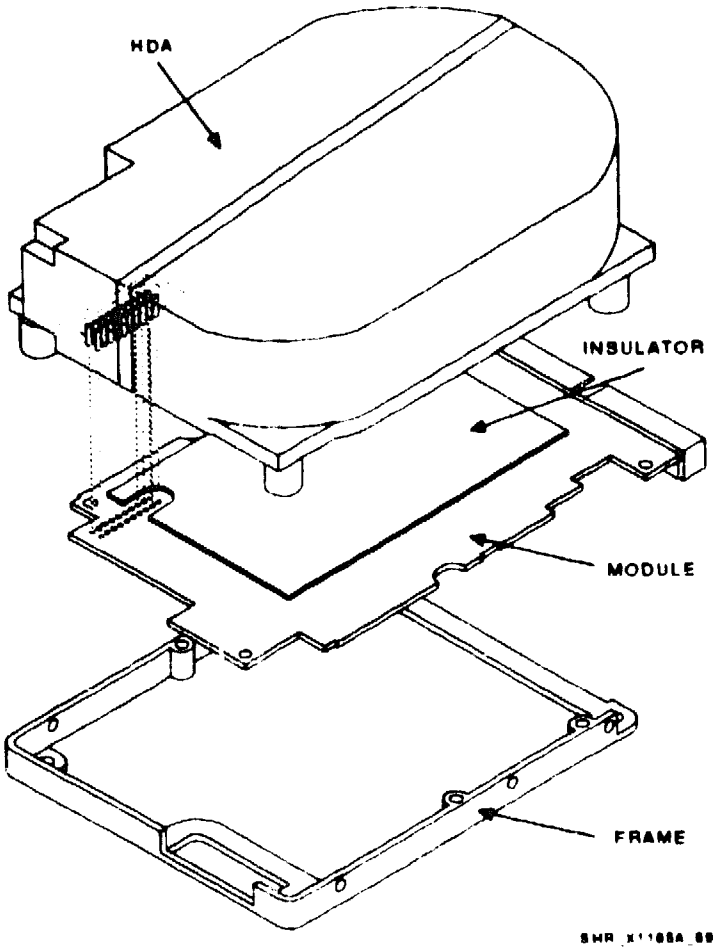
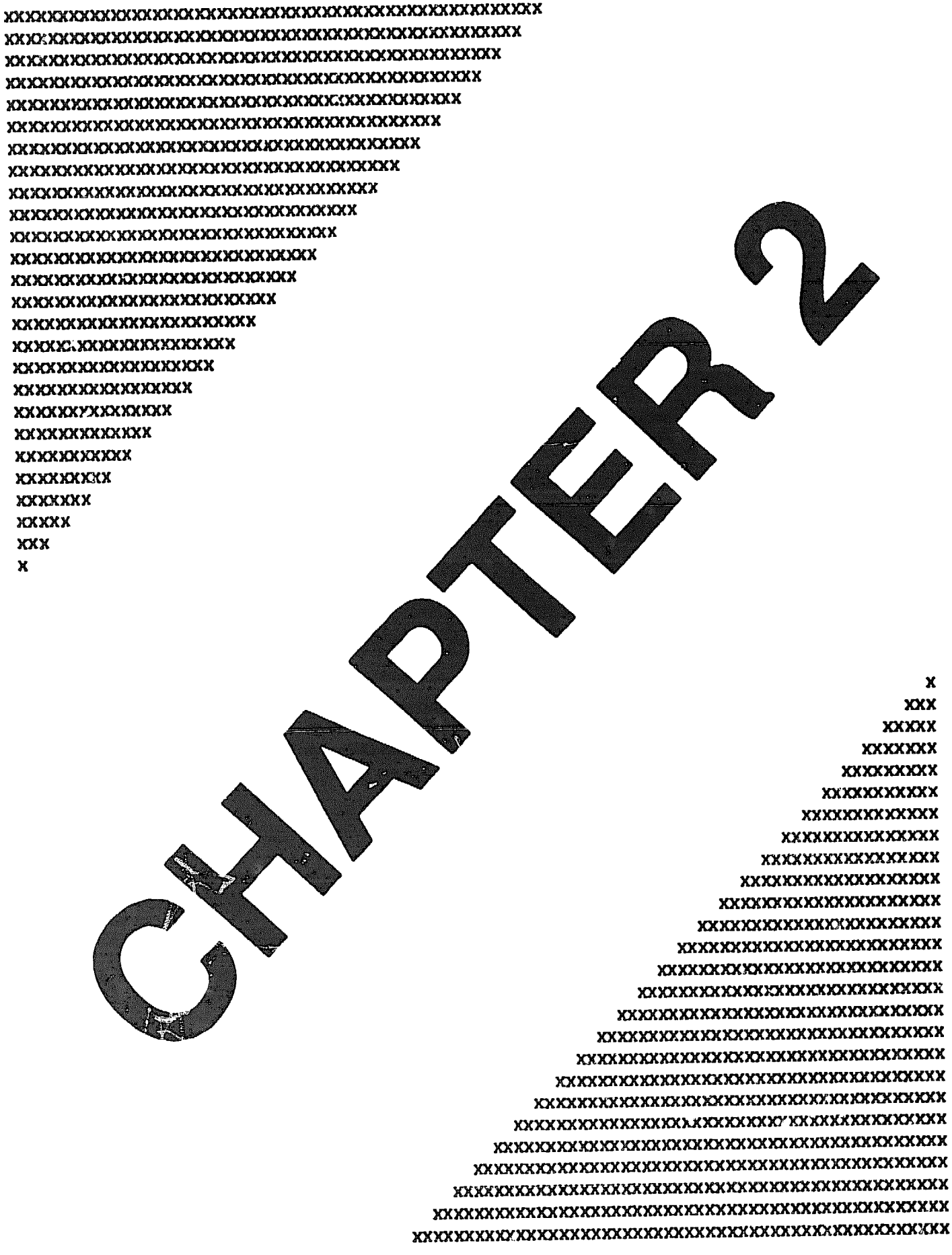


Figure 1–6 RZ24 Disk Drive


CHAPTER 2

2

Servicing the RZ Disk Drives in a DECstation 2100/3100 System

2.1 Introduction

The DECstation 2100/3100 system is a high-performance, desktop ULTRIX workstation based on reduced instruction set computer (RISC) technology. The system is housed in a PM42A enclosure. It has a SCSI bus interface for the RZ22, RZ23, and RZ24 disk drives.

The SCSI port on the back of the system enclosure has a plastic cover. Under the plastic cover is the SCSI terminator. This terminator must be in place if there is no other connection to the SCSI port. If the system is using any external storage devices in expansion boxes (such as an RZ55 disk drive, TK70 tape drive, or RRD40 disc drive), then the terminator must be installed on the SCSI port of the last expansion box in the chain. (The SCSI port on the expansion box is at the rear of the box.)

2.2 Troubleshooting the Drives in the System

To troubleshoot the RZ22, RZ23, and RZ24 disk drives, follow the same basic procedures as for any other disk drive. Check for the type of failures that are common to a faulty disk drive. See Section 2.2.1 for a checklist of items to examine for determining whether the drive is faulty.

The RZ22, RZ23, and RZ24 disk drives depend on the system software diagnostics for troubleshooting. See the *DECstation 2100/3100 Maintenance Guide* for the types of software diagnostics available on the system, and how to run them.

To troubleshoot the RZ22, RZ23, RZ24 disk drives on the SCSI bus and SCSI controller in a DECstation 2100/3100 system, use the following tools:

Checklist (Section 2.2.1)
Flowchart (Section 2.2.2)
Diagnostics (Section 2.3)

The following sections briefly describe troubleshooting procedures. See the system maintenance guide for more detailed system-specific information.

2.2.1 Troubleshooting Checklist

Check the items in the following list to determine if the drive is faulty:

- Make sure the drive is connected (both power and signal cables).
- Make sure there is power to the drive.
- Make sure the drive is correctly configured.
- One of the features of the RZ22, RZ23, and RZ24 disk drives is that field formatting is not necessary. It is possible, however, that the data has been corrupted by the customer. Check to see whether the disk needs to be erased or replaced.
- Check to see whether the drive module/frame was replaced before the entire drive was replaced.

2.2.2 Troubleshooting Flowchart

Figure 2–1 shows the logical procedure for troubleshooting an RZ drive in a DECstation 2100/3100 system. The flowchart uses the ULTRIX operating system and extended self-tests to troubleshoot the drive.

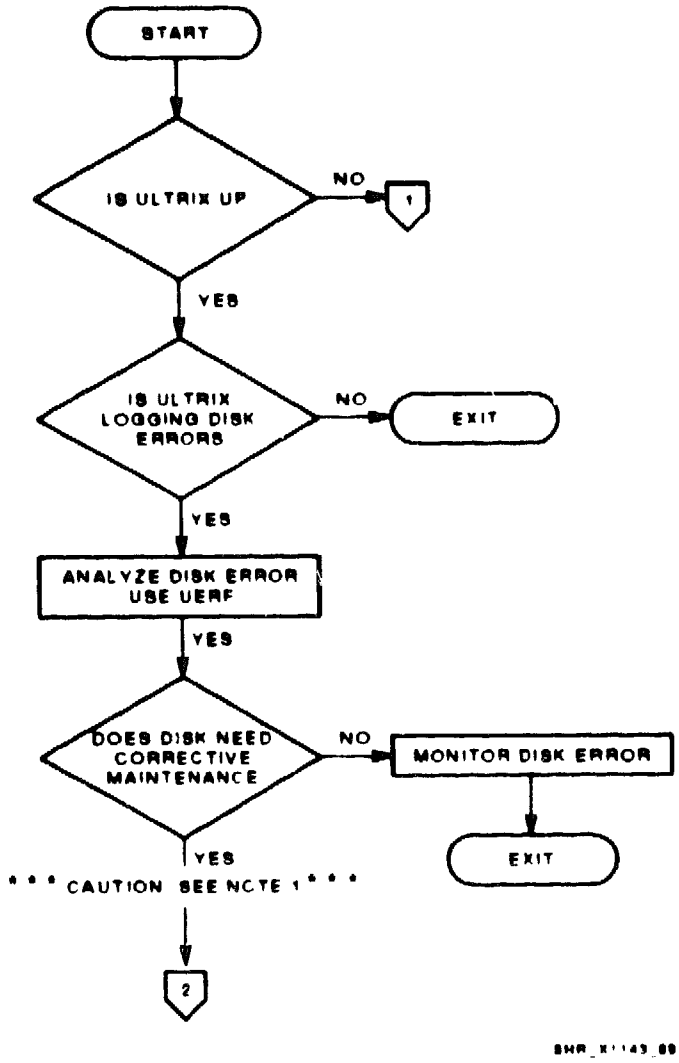
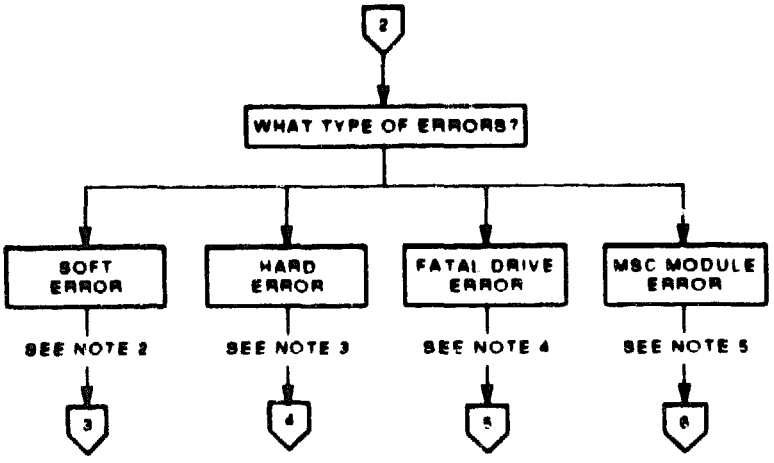


Figure 2–1 (Cont.) DECstation 2100/3100 System: RZ Troubleshooting Flowchart



NOTE 1 BE CERTAIN THERE IS A RECENT BACKUP OF THE DISK BEFORE ATTEMPTING ANY CORRECTIVE MAINTENANCE DIAGNOSTIC MAY ERASE THE DISK

NOTE 2 SOFT ERROR RECOVERABLE ERRORS SUCH AS DATA CHECKS ECC ERRORS

NOTE 3 HARD ERRORS NON RECOVERABLE ERRORS SUCH AS A READ ERROR BAD BLOCK ON THE DISK A BAD FILE BUT THE DRIVE IS OPERATIVE

NOTE 4 A HARD FAULT THE DRIVE IS INOPERATIVE TO THE SYSTEM THE FRU NEEDS TO BE REPLACED

NOTE 5 AN ERROR IN THE MSC MODULE THAT MAY CAUSE INTERMITTENT PROBLEMS TO THE DRIVE DURING A DATA TRANSFER

NOTE 6 LOOPBACK REQUIRED INSTALL SCSI LOOPBACK CONNECTOR IN THE SCSI SYSTEM MODULE CONNECTOR (REFER TO 2 2 3)

SHR_K1144_89

Figure 2–1 (Cont.) DECstation 2100/3100 System: RZ Troubleshooting Flowchart

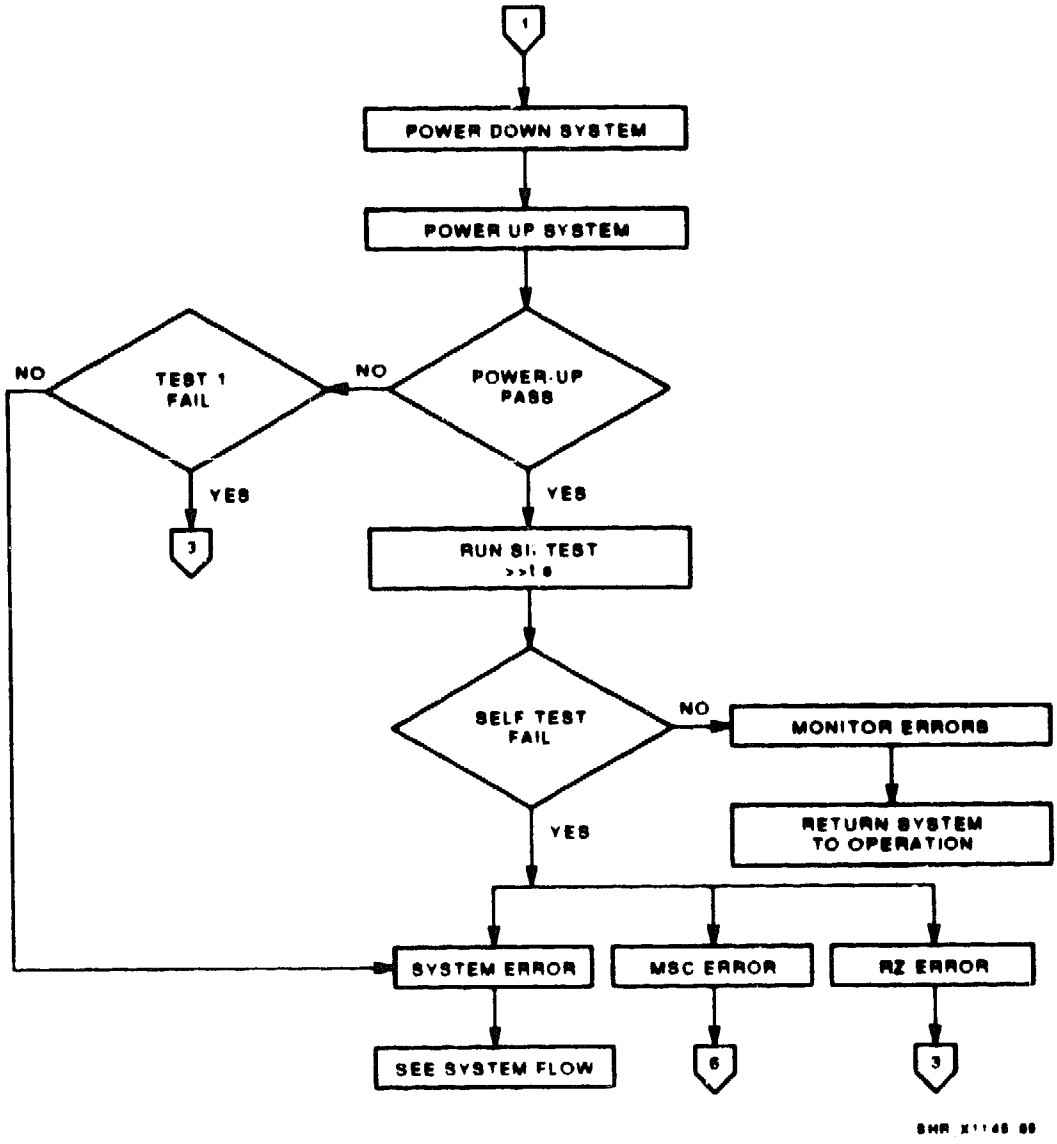
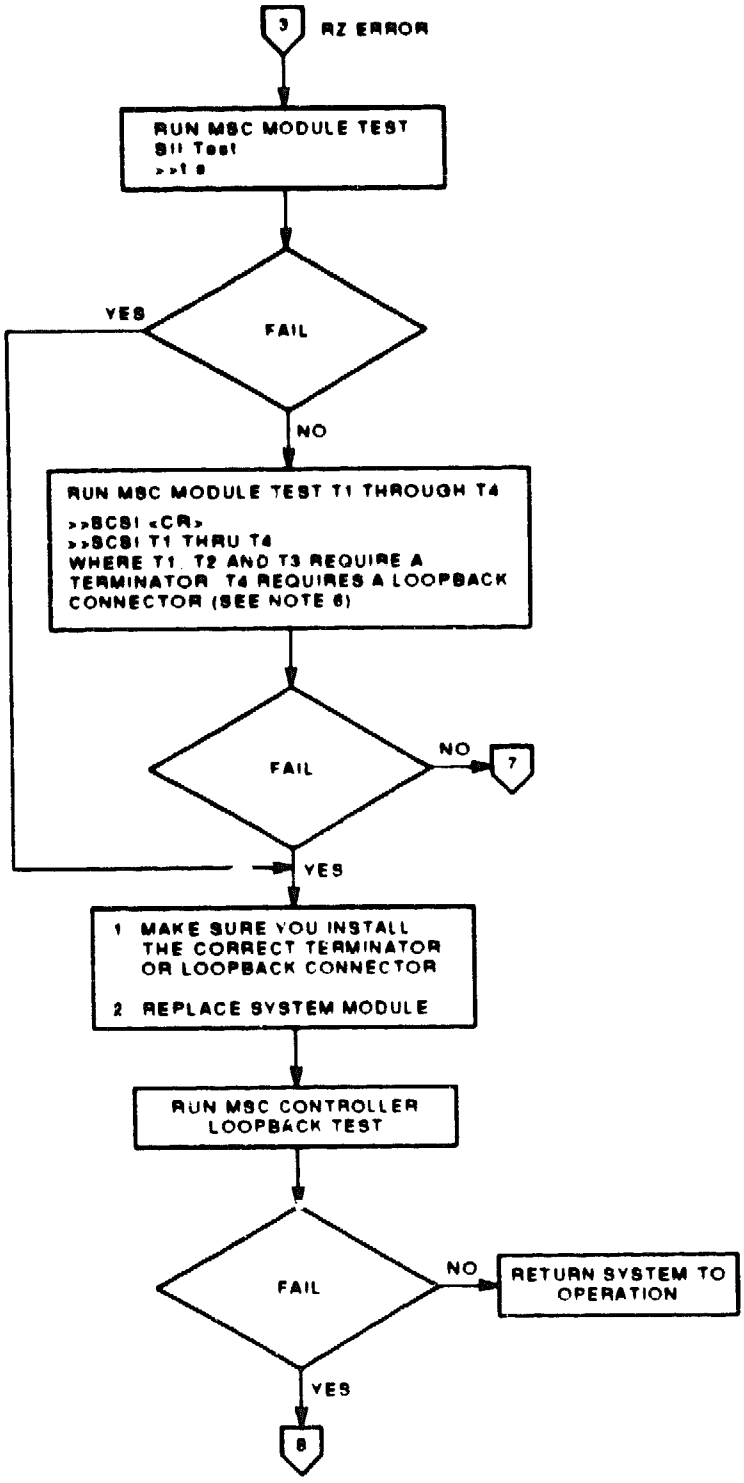


Figure 2–1 (Cont.) DECstation 2100/3100 System: RZ Troubleshooting Flowchart



SHR_X1146 89

Figure 2–1 (Cont.) DECstation 2100/3100 System: RZ Troubleshooting Flowchart

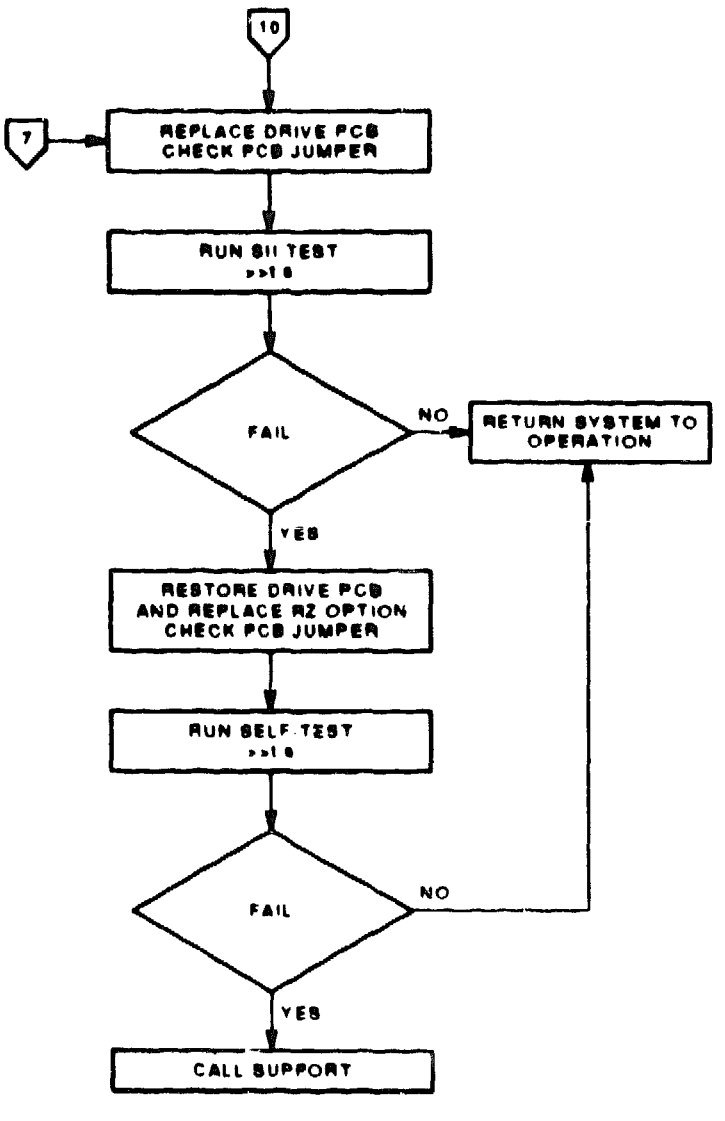


Figure 2–1 (Cont.) DECstation 2100/3100 System: RZ Troubleshooting Flowchart

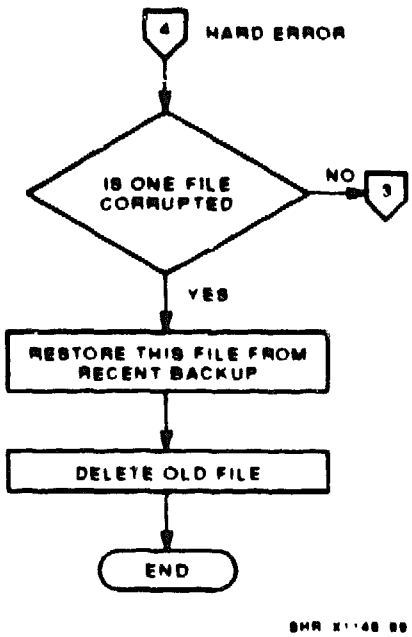


Figure 2–1 (Cont.) DECstation 2100/3100 System: RZ Troubleshooting Flowchart

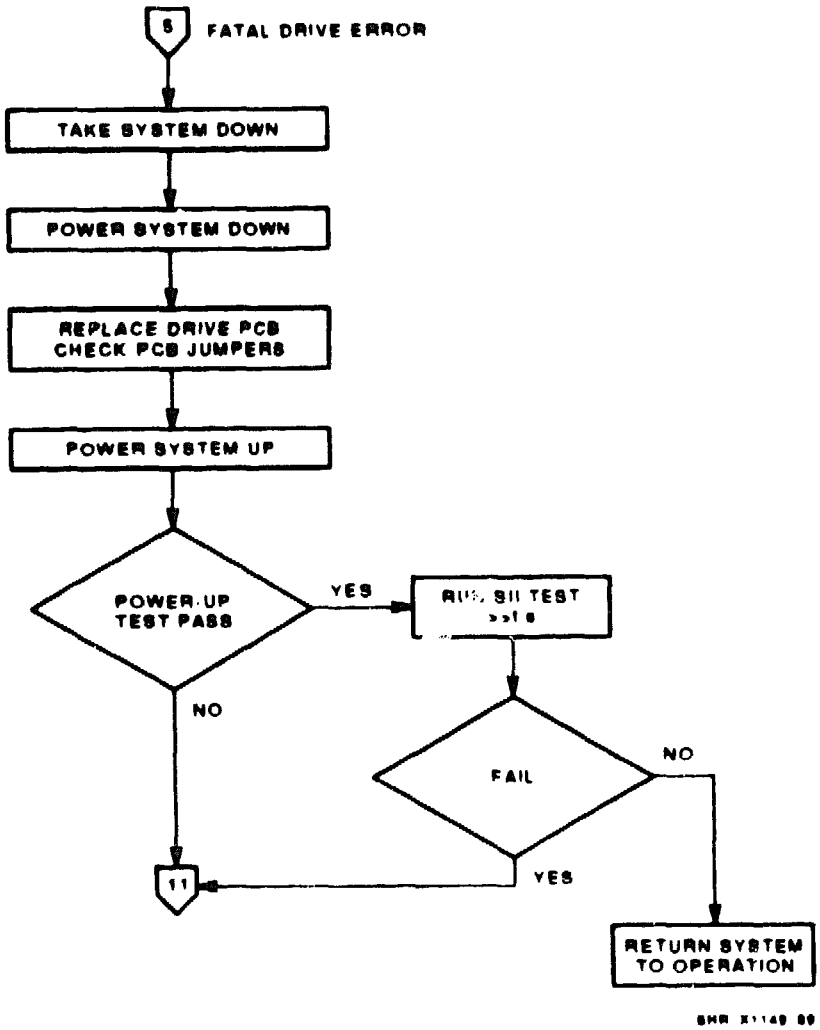


Figure 2–1 (Cont.) DECstation 2100/3100 System: RZ Troubleshooting Flowchart

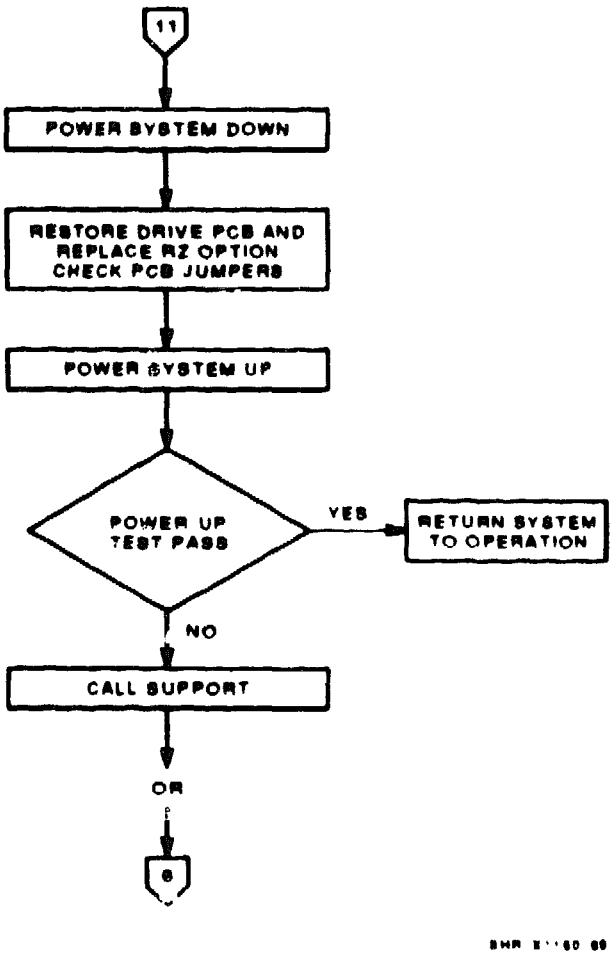


Figure 2–1 (Cont.) DECstation 2100/3100 System: RZ Troubleshooting Flowchart

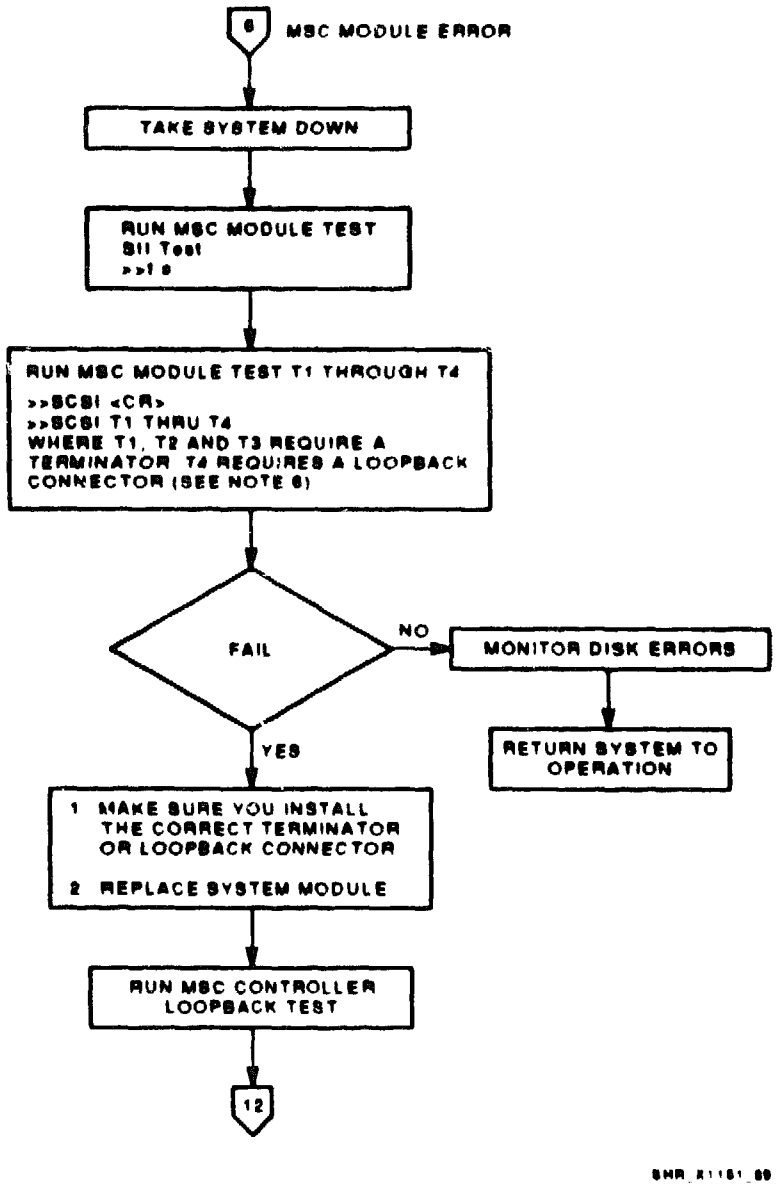


Figure 2–1 (Cont.) DECstation 2100/3100 System: RZ Troubleshooting Flowchart

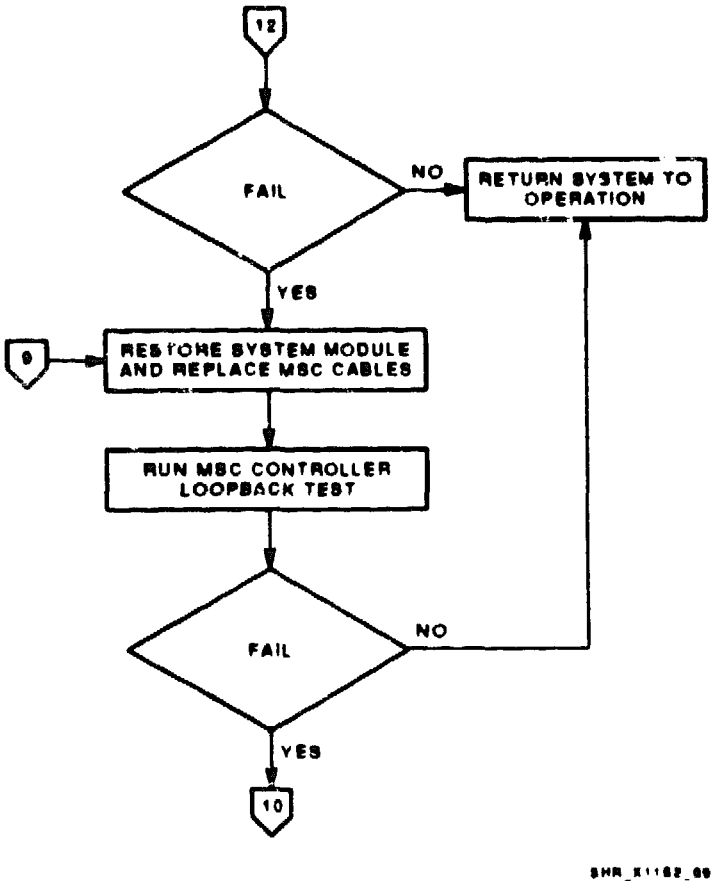


Figure 2–1 DECstation 2100/3100 System: RZ Troubleshooting Flowchart

2.2.3 Installing the Internal SCSI Loopback Connector

When running in the manufacturing mode, install a SCSI loopback connector in the system unit SCSI connector. Perform the following steps.

1. Remove the drive mounting panel (refer to system maintenance guide).
2. Disconnect the SCSI cable from the system board by pushing the SCSI connector latches in the opposite directions.
3. Insert the SCSI loopback connector into the system unit SCSI connector. Make sure the side marked **Side 1** is facing the front of the system unit.

2.3 Using System Diagnostics

This section describes how to run and interpret the diagnostics available for the RZ22, RZ23, and RZ24 disk drives in the DECstation 2100/3100 system:

Power-on self-test (POST)
Self-test
Console extended self-test
SCSI extended self-test

If the system you are testing has intermittent errors, examine the ULTRIX error logs before running extended self-tests. You can use the ULTRIX tools, uerf and netstat, to trace some hardware errors. See the ULTRIX documentation set for details about uerf and netstat. Also see the *ULTRIX-32 Quick Reference Manual* (AA-JF41A-TE).

To shut down the system, log in to the ULTRIX field account or an account that has superuser privileges. Consult the system maintenance guide.

When testing a DECstation 2100/3100 system, you can type the DECstation 2100/3100 console commands from an alternate console through the printer/console port at the back of the system unit. When you use an alternate console, the same text that appears on the DECstation 2100/3100 monitor appears on the alternate console. If using a monitor as an alternate console, you can use either the DECstation 2100/3100 workstation or the alternate console keyboard to type commands.

To connect an alternate monitor or printer to the DECstation 2100/3100 workstation, see the system maintenance guide.

2.3.1 Power-On Self-Test (POST)

The power-on self-test checks each component, subsystem, and connection in the DECstation 2100/3100 system. The system automatically runs POST and displays the console prompt (>>) when you turn on the system.

To turn on the system, push the ON/OFF switch on the system unit to the ON (1) position. The switch is on the rear of the system.

Example 2–1 shows a typical POST display when it successfully completes.

```
KN01  X7.0g

7..6..5..4..3..2..1..0

16Mb.........0

KN01  X7.0g
08-00-2b-0c-4a-93
0x01000000

1) Dansk                              9) Francais (Suisse Romande)
2) Deutsch                           10) Italiano
3) Deutsch (Schweiz)                 11) Nederlands
4) English                           12) Norsk
5) English (British/Irish)           13) Portugues
6) Espanol                           14) Suomi
7) Francais                          15) Svenska
8) Francais (Canadian)               16) Vlaams

(1..16):
```

Example 2–1 Successful POST Display

Each number on the second line of the POST display corresponds to tests for specific hardware components. The third line shows the size of the workstation memory. While the third line is being displayed, the workstation creates a bit map of all bad memory pages that is passed to the operating system.

If the POST completes successfully, the workstation displays the console banner and prompt (Example 2–2).

```
KN01 V6.5
08-00-2b-0c-4a-8b
0x01000000
>>
```

Example 2–2 Sample Console Banner and Prompt

The first line in the console banner indicates the version of the system module. The second line contains the workstation Ethernet address. The third line shows the size of memory in hexadecimal format. The fourth line is the console prompt.

If the POST fails after you turn on the workstation, the power-on self-test halts. All status and error messages are preceded by a number for status and a question mark for errors.

When you see the failure message, do the following:

1. Note the number of the test that failed. The last number displayed on the screen before the failure message appears is the failed test. See Section 2.3.3 to interpret this test.
2. Press the Reset button on the back of the system unit. The POST runs, a failure message appears, and the console banner and prompt appear. Once the console prompt appears, you can run the self-test or type any other console command.

If the POST display does not appear on the monitor, use the status LED display to determine the problem (Section 2.3.6). The status LED display is at the rear of the system near the power cord plug.

2.3.2 Self-Test

The self-test is similar to the POST, except you can run this test anytime you are at the console level. The self-test performs slightly more extensive tests and attempts to put any SCSI devices connected to the workstation on-line. To run the self-test, type (exactly):

```
test -a
```

The display you see is the same as the POST display (Example 2–1). If an error occurs during the hardware tests, the tests stop and the error appears. The workstation then displays the memory size and runs the memory diagnostic that builds the bad memory page map.

When the workstation completes the self-test, the console prompt appears.

NOTE

You can also use the Reset button to run the self-test. If you use the Reset button, the workstation performs the same hardware tests as during POST. However, the workstation does not perform any memory tests and attempts to place recognized SCSI devices on-line.

Note what test failed. When errors occur, testing stops at the test that failed. For example, if the testing stops following the display of test code 5, then test number 5 failed. See Section 2.3.3 for details about interpreting the self-test.

If the monitor is not working, you can observe the status LED display during the self-test. If an error occurs, write down the LED display configuration that appeared. See Section 2.3.6 to determine what component failed.

2.3.3 Interpreting POST and Self-Test Results

This section explains how to interpret the POST and self-test results.

If any test failed during these tests:

1. Check all external connections, cables, and power cords.
2. Make sure the mouse connector is seated correctly, or if the workstation is a server, make sure the mouse loopback connector is installed.

If you cannot locate an external problem, compare the code of the test that failed during the POST or self-test with those described in Table 2–1 and take the appropriate action. See Section 2.3.4 and Section 2.3.5 for instructions about running the extended self-tests.

Table 2–1 POST and Self-Test Codes

Test Code	Component Tested	Action
1	Disk	Run the disk RAM and SII extended self-tests (Section 2.3.4.5) or replace the appropriate FRU.
0	None, test end indicator	None.

2.3.4 Console Extended Self-Tests

Run console extended self-tests to diagnose component and subsystem malfunctions within the system unit. You can run these tests in several different modes, depending on the type of information you want.

In most cases, you use a monitor to run and display extended self-tests. If the monitor is not working, you can observe the status LEDs to get the test results. See Section 2.3.6 for instructions on using the status LEDs instead of the monitor.

2.3.4.1 Preparing for Console Extended Self-Tests

Before running the console extended self-tests:

1. View the menu (test menu) to find the correct commands (Section 2.3.4.2).
2. Select the appropriate test modes (Section 2.3.4.3).
3. Install terminators or loopback connectors for the test mode you are using (Section 2.3.7).

2.3.4.2 Viewing Test Commands

To view a menu listing all valid diagnostic options, type:

```
t ?
```

The workstation displays the menu shown in Example 2–3.

```
t a1 a2
  a  [r]    system test
  b         memory report
  C  [r]    color mask
  c  [r]    cache
  D         dz
  d  [r]    disk ram
  e  [r]    esar
  F  [r]    fpu
  f         video test patterns
      b        blue
      c        color bars
      e        E's
      g        green
      r        red
      w        white
      x        grid
  k         keyboard
  L  [r]    lance
  l  [r]    leds
  M         mode
      d        display modes
      h        toggle halt test on error
      l        toggle loop on error
      m        manufacturer/debug mode
      u        user mode
  m  [r]    main ram
  n  [r]    net ram
  P         mouse
  p  [r]    pcc
```

Example 2–3 (Cont.) Diagnostic Options Menu

```
R  [r]    csr
r  [r]    rtc
s  [r]    sii          <----- SCSI
t  [r]    tlb
V  [r]    vdac
v  [r]    video ram
w  [r]    write buf
```

Example 2–3 Diagnostic Options Menu

2.3.4.3 Selecting a Test Mode

To see the currently set test modes, type:

```
t M d
```

You see a display similar to the one in Example 2–4:

```
usr mod          = User mode
no lp on err     = No loop on error
hlt tst on err = Halt test on error
```

Example 2–4 Test Mode Display

NOTE
The default modes are User, No Loop On Error, and Halt On Error.

To select a test mode, type the following at the console prompt:

```
t M <arg>
```

In the above command, <arg> indicates you must type a specific argument. Arguments are single alphabetic characters. They are separated from the rest of the command line (and any other arguments) with a space character.

The test modes you can select and the arguments you type on the command line are described in Table 2–2.

Table 2–2 Test Modes

Mode Name	Argument	Description
[No]Halt on Error	h	This mode toggles Halt on Error off and on. When set to Halt on Error, the diagnostic test sequence stops as soon as an error is detected and reports the error immediately. The remaining tests in the sequence are not run. Use this mode to save time when you expect an error to occur early in the test sequence. No Halt on Error is the default mode when the workstation is turned on.
[No]Loop on Error	l	This mode toggles Loop on Error on and off. When set to Loop on Error, the diagnostic procedure runs again as soon as an error is detected. This mode is designed for debugging hardware components using an oscilloscope in a manufacturing environment. The default mode, when the workstation is turned on, is No Loop on Error.
Manufacturer/ Debug	m	This mode runs the most detailed check of all the components. Select this mode if the User mode diagnostics fail to isolate a fault. This mode requires a SCSI terminator if a SCSI device is installed. It requires a SCSI loopback connector for SCSI test t4 (Section 2.3.5.9).
User	u	This mode performs a fast check of the workstation. It is a less comprehensive hardware check than that performed in Manufacturer/Debug mode. This mode reports hard, gross errors. This is the default mode when the workstation is turned on.

CAUTION
Some of the tests can destroy data on the customer media.

2.3.4.4 Running Console Extended Self-Tests

To run a console extended self-test, type the appropriate command at the console prompt in the format:

```
t arg1 [arg2]
```

You can run all tests in User or Manufacturer/Debug mode. The examples in this chapter reflect User mode test displays. Manufacturer/Debug tests are more extensive, take longer to complete, and display more detailed information about each test than User mode.

For most tests, you can select the repeat option by typing r as the second argument on the command line. Typing this argument causes the selected test to repeat. To stop a repeating test, press any key.

NOTE
It may take several minutes for the test to halt.

If an error occurs during any console extended self-test, a message similar to the following appears immediately after the test fails:

```
?0d1-00 MSE slf tst
```

When errors occur, check the appropriate field replaceable unit (FRU).

2.3.4.5 SII Test

The SII test checks the SCSI interface to the SCSI bus. This test:

Writes and reads data patterns to the SCSI buffer.
Performs target tests.
Performs initiator tests.
Attempts to place recognized SCSI devices on-line.

To run the SII test, type:

```
t s
```

A display similar to the one shown in Example 2–5 appears.

```
-047-01  SII bfr adr test

-048-01  sii tgt ilpbk
-048-02  tgtst:  STLP <-  4
-048-03  tgtst:  bldg obnd cmd/dta
-048-04  tgtst:  set lpbk md
-048-05  tgtst:  sel + pen
-048-06  tgtst:  id <-  7
-048-07  tgtst:  en dssi md
-048-08  tgtst:  dev 0 sel dev 7
-048-09  tgtst:  dsel
-048-0a  tgtst:  snd cmd[0]
-048-0a  tgtst:  snd cmd[1]
-048-0a  tgtst:  snd cmd[2]
-048-0a  tgtst:  snd cmd[3]
-048-0a  tgtst:  snd cmd[4]
-048-0a  tgtst:  snd cmd[5]
-048-0a  tgtst:  snd cmd[6]
-048-0b  tgtst:  snd dta[0]
-048-0b  tgtst:  snd dta[1]
-048-0b  tgtst:  snd dta[2]
-048-0b  tgtst:  snd dta[3]
-048-0b  tgtst:  snd dta[4]
-048-0b  tgtst:  snd dta[5]
-048-0b  tgtst:  snd dta[6]
-048-0b  tgtst:  snd dta[7]
-048-0b  tgtst:  snd dta[8]
-048-0b  tgtst:  snd dta[9]
-048-0b  tgtst:  snd dta[10]
-048-0c  tgtst:  rcv sts
-048-0d  tgtst:  chk bfr sts
-048-0e  tgtst:  chk cmd blk
-048-0f  tgtst:  chk dta bytes
-048-10  TGSTS:  OK
```

(continued on next page)

Example 2–5 (Cont.) Sample SII Test Display

```
-049-01  sii ini ilpbk tst
-049-02  initst:  bld obnd pkt ad = bb000020
-049-03  initst:  ILP <-  4
-049-04  initst:  set lpbk md
-049-05  initst:  sel + pen
-049-06  initst:  ID <-  7
-049-07  initst:  arb wina
-049-08  initst:  dssi md
-049-09  initst:  BSYa + CDa
-049-0a  initst:  rcv cmd[0]
-049-0a  initst:  rcv cmd[1]
-049-0a  initst:  rcv cmd[2]
-049-0a  initst:  rcv cmd[3]
-049-0a  initst:  rcv cmd[4]
-049-0a  initst:  rcv cmd[5]
-049-0a  initst:  rcv cmd[6]
-049-0b  initst:  ->  dta phse
-049-0c  initst:  rcv dta[0]
-049-0c  initst:  rcv dta[1]
-049-0c  initst:  rcv dta[2]
-049-0c  initst:  rcv dta[3]
-049-0c  initst:  rcv dta[4]
-049-0c  initst:  rcv dta[5]
-049-0c  initst:  rcv dta[6]
-049-0c  initst:  rcv dta[7]
-049-0c  initst:  rcv dta[8]
-049-0c  initst:  rcv dta[9]
-049-0c  initst:  rcv dta[10]
-049-12  initst:  ->  sts phse
-049-0d  initst:  dscon
-049-0e  initst:  chk bfr sts
-049-0f  initst:  chk CSTAT
-049-10  initst: intrd
-049-11  INITST:  OK
```

(continued on next page)

Example 2–5 (Cont.) Sample SII Test Display

```
-04c-01  SCSI scndev
-04b-01  STRT SCSI DEV TSTG
-04b-02  ofl tst u# 2
-04b-04  ofln slftst ok u# 2
-04b-02  ofl tst u# 1
-04b-04  ofln slftst ok u# 1
-04b-02  ofl tst u# 0
-04b-04  ofln slftst ok u# 0
```

Example 2–5 Sample SII Test Display

If an error occurs during this test, make sure you installed the SCSI terminator correctly. Should the problem continue, replace the system module. If replacing the system module does not solve the problem, check the indicated SCSI device. Refer to the device service manual for instructions.

2.3.5 SCSI Extended Self-Tests

Run the SCSI extended self-tests to isolate faults with the SCSI bus, drivers, or connections. This test requires the use of the loopback connector. Table 2–3 lists the SCSI tests you can run and where you can find their descriptions in this manual.

Table 2–3 SCSI Tests

Test	Command	Components Tested	Manual Reference
Canned Disk	scsi cd	Hard disk drive	Section 2.3.5.5
t1	scsi t1	SCSI disk buffer	Section 2.3.5.6
t2	scsi t2	SII function	Section 2.3.5.7
t3	scsi t3	Internal system module function	Section 2.3.5.8
t4	scsi t4	SCSI drivers and connections	Section 2.3.5.9

2.3.5.1 Preparing for SCSI Extended Self-Tests

Before running the SCSI extended self-tests:

1. View the SCSI Storage Device Listing.
2. Select the appropriate test modes (Section 2.3.4.3).
3. Terminate connectors or install loopback connectors, if necessary (Table 2–6).

2.3.5.2 Viewing the Storage Device Listing

To obtain information about the recognized storage devices connected to the SCSI bus, type the following at the console prompt:

```
scsi pb
```

The workstation displays a list of all the recognized SCSI devices and vendor information such as version number and response data format. Example 2–6 shows a typical listing of SCSI storage devices.

```
U[7]
U[6]KN01--SII
U[5]
U[4]
U[3] Dev typ       0 RZ
            RMB                     0x0
            Vrs                     1
            Format                  1 CCS
            Add len                 31
            Vndr                    DEC
            PID                     RZ24     (C) DEC
            Frevlvl                 0618
U[2]
U[1]
U[0]
```

Example 2–6 SCSI Storage Device List

The unit number is the SCSI ID address associated with a specific device. The device type refers to the type of device that has a specific SCSI ID address. The supported device types are as follows:

0 — Hard disk
1 — Magnetic tape
5 — Compact disc drive

2.3.5.3 Running SCSI Extended Self-Tests

All of the SCSI tests perform an inquiry to see what devices are connected to the SCSI bus. If the devices are not in a ready state, the test attempts to put the devices on-line. An error message appears if the test cannot put a device on-line.

In all cases, follow the advice of the error message before proceeding to the suggested action.

2.3.5.4 Using the SCSI Menu

The SCSI menu lists commands to be used for tasks involving the SCSI port and supported devices. Display the SCSI menu by typing:

```
scsi ?
```

Example 2–7 shows the SCSI menu:

```
     HELP menu : try these commands

scsi   a1      a2      a3

       pb                      probe for and setup all units
       rs                      Reset the SCSI bus
       sr                      Dump the scsi status registers
       du                      Dump all scsi registers
       cd      unit    [r]     Read/write test for SCSI hard drive
       ct      unit    [r]     Read/write test for TK50Z tape drive
       cr      unit    [r]     Read only self test for RRD40 ROM disk drv
       fm      unit            Format <UNIT> using default parameters
       iq      unit            Show inquiry response from <UNIT>
       ms      unit            Show mode sense response from <UNIT>
       ry      unit            Show READY status for <UNIT>
       sn      unit            Show request sense response from <UNIT>
       sp      unit            Stop <UNIT>
       sr      unit            Start <UNIT>
       su      unit            Setup unit wait for ready status
       t1      [r]             SII buffer port memory response
       t2      [r]             SII target mode internal loopback test
       t3      [r]             SII initiator mode internal loopback test
       t4      [r]             SII external drive-loopback required !
```

Example 2–7 SCSI Menu

Type SCSI commands at the console prompt. Use the format:

```
scsi arg1 [arg2] [arg3]
```

The second argument is either a unit number or the optional repeat argument (r). To find the unit number of a specific device, use the test -c command or the SCSI command, pb. In the examples in this manual, <UNIT> indicates that you type a number (not the word *unit*). The third argument of the SCSI command line can also be the repeat argument,

depending on the specific command format. Table 2–4 describes the SCSI commands.

Table 2–4 SCSI Commands

Command	Description
pb	This command polls the workstation and lists all the SCSI devices currently recognized by the workstation. The format for this command is: scsi pb.
rs	This command resets the SCSI bus and any peripherals. The format for this command is: scsi rs. (For manufacturing use)
st	This command displays the status of the SII registers. The SII is the LSI chip used by the SCSI bus. The format for this command is: scsi st. (For manufacturing use)
du	This command displays the state of all registers. The format for this command is: scsi du (For manufacturing use)
cd	This command runs the Canned Disk test. The format for this command is: scsi cd <UNIT> [r].
ct	This command runs the Canned Tape test. The format for this command is: scsi ct <UNIT> [r].
cr	This command runs the Canned ROM Disk Drive test. The format for this command is: scsi cr <UNIT> [r]. This test requires a test disk.
fm	This command formats and initializes a specified disk. You are asked to confirm the operation before the initialization takes place. The format for this command is: scsi fm <UNIT>.
iq	This command performs an inquiry about a specified unit. It displays information about the SCSI device (type 0 = hard disk drive, type 1 = magnetic tape drive, type 5 = compact disk drive), the format, additional bytes of data available for a device, and the firmware version. The display is similar to that shown when using the test -c command. The format for this command is: scsi iq <UNIT>.

Table 2–4 (Cont.) SCSI Commands

Command	Description
ms	This command provides detailed information about the attributes of a device. The information this command displays includes the device geometry, whether the device has removable media, drive features, and vendor-supplied data. To interpret data categories and values, see the device specification. The format for this command is: scsi ms <UNIT>. (For manufacturing use)
ry	This command indicates whether a specified device is ready. The format for this command is: scsi ry <UNIT>.
sn	This command is a SCSI request sense command and provides additional information about a SCSI device that fails an extended self-test. Issue this command immediately after the device fails. If you issue another command that performs ar inquiry of the failed device, you may lose the sense data. The information this command displays includes values and error messages for the data categories of sense key and FRU. It also displays vendor-supplied data. To interpret data categories and values, see the ANSI specification for the SCSI bus (document number x3.131-198-x). The format for this command is: scsi sn <UNIT>. (For manufacturing use)
sp	This command stops a specified device. The format for this command is: scsi sp <UNIT>.
sr	This command starts a specified device. The format for this command is: scsi sr <UNIT>.
su	This command checks if the specified device is ready. If the device is not ready, the workstation tries to bring it on-line. If this fails, the workstation displays an error message. The format for this command is: scsi su <UNIT>.
t1	This command runs the SCSI t1 test. The format for this command is: scsi t1 [r].
t2	This command runs the SCSI t2 test. The format for this command is: scsi t2 [r].
t3	This command runs the SCSI t3 test. The format for this command is: scsi t3 [r].
t4	This command runs the SCSI t4 test. The format for this command is: scsi t4 [r].

2.3.5.5 Canned Disk Test

The Canned Disk test performs a full data compare and check. This test:

Writes an 8096-byte block to random locations 100 times.
Reads and verifies each block that it writes.
Verifies communication with the SII.

CAUTION
This test will destroy customer data on media.

To run this test, type:

```
scsi cd <UNIT>
```

You are prompted to confirm that you want to overwrite the disk. To stop the test, type any character at the confirmation prompt. To continue, type:

```
yes
```

A display similar to Example 2–8 appears each time the system completes a write and read pass:

```
Pass      Block      Errors
----      -----      ------
100       37779        0
  ^         ^          ^
  |         |          |
  +-------------------+        Note: This display overwrites itself.
```

Example 2–8 Canned Disk Test Display

Suggested Action

If an error occurs during this test:

1. Make sure you installed the correct terminators and loopback connectors.
2. If step 1 does not solve the problem, check the SCSI cables. Replace them if necessary.
3. If step 2 does not solve the problem, check the hard disk drive.
4. If step 3 does not solve the problem, replace the system module.

2.3.5.6 t1 Test

This test checks the SCSI memory buffer by writing and reading data to the buffer. This test writes an address to that address's location.

NOTE
You do not need a SCSI loopback connector or a SCSI terminator when running this test.

To run this test, type:

```
scsi t1 <UNIT>
```

The <UNIT> is the unit number of the device you are testing. A display similar to Example 2–9 appears on your screen.

```
-047-01  SII bfr adr tst
-047-04  siiatst: 4ptn wrt
-047-02  siiatst: SII bfr tst
-047-03  siiiatst: chk sii buf          0 ?
-047-02  siiatst: SII bfr tst
-047-03  siiiatst: chk sii buf       aaaa ?
-047-02  siiatst: SII bfr tst
-047-03  siiiatst: chk sii buf       5555 ?
-047-02  siiatst: SII bfr tst
-047-03  siiiatst: chk sii buf       ffff ?
```

Example 2–9 t1 Test Display

Suggested Action

If an error occurs during this test:

1. Make sure you installed the correct terminators and loopback connectors.
2. Should the problem continue, replace the system module.

2.3.5.7 t2 Test

This test performs an internal loopback test to ensure that the SII can function as a target on the SCSI bus. This test uses only internal registers.

NOTE
It is recommended that you use a SCSI terminator. You do not need a SCSI loopback connector when running this test.

To run this test, type:

```
scsi t2 <UNIT>
```

The <UNIT> is the unit number of the device you are testing. Example 2–10 is a display similar to the one that appears:

```
-048-01  sii tgt ilpbk
-048-02  tgtst:  STLP <-  4
-048-03  tgtst:  bldg obnd cmd/dta
-048-04  tgtst:  set lpbk md
-048-05  tgtst:  sel + pen
-048-06  tgtst:  id <-  7
-048-07  tgtst:  en dssi md
-048-08  tgtst:  dev 0 sel dev 7
-048-09  tgtst:  dsel
-048-0a  tgtst:  snd cmd[0]
-048-0a  tgtst:  snd cmd[1]
-048-0a  tgtst:  snd cmd[2]
-048-0a  tgtst:  snd cmd[3]
-048-0a  tgtst:  snd cmd[4]
-048-0a  tgtst:  snd cmd[5]
-048-0a  tgtst:  snd cmd[6]
-048-0b  tgtst:  snd dta[0]
-048-0b  tgtst:  snd dta[1]
-048-0b  tgtst:  snd dta[2]
-048-0b  tgtst:  snd dta[3]
-048-0b  tgtst:  snd dta[4]
-048-0b  tgtst:  snd dta[5]
-048-0b  tgtst:  snd dta[6]
-048-0b  tgtst:  snd dta[7]
-048-0b  tgtst:  snd dta[8]
-048-0b  tgtst:  snd dta[9]
-048-0b  tgtst:  snd dta[10]
-048-0c  tgtst:  rcv sts
-048-0d  tgtst:  chk bfr sts
-048-0e  tgtst:  chk cmd blk
-048-0f  tgtst:  chk dta bytes
-048-10  TGST:  OK
```

Example 2–10 t2 Test Display

Suggested Action

If an error occurs during this test:

1. Make sure you installed the correct terminators and loopback connectors.
2. Should the problem continue, replace the system module.

2.3.5.8 t3 Test

This test performs an internal loopback test to ensure that the SII can function as an initiator on the SCSI bus. It requests services from a target (for example, a disk drive). This test uses only internal registers.

NOTE
It is recommended that you use a SCSI terminator. You do not need a SCSI loopback connector when running this test.

To run this test, type:

```
scsi t3 <UNIT>
```

The <UNIT> is the unit number of the device you are testing. A display similar to Example 2–11 appears.

```
-049-01  sii ini ilpbk tst
-049-02  initst:  bld obnd pkt ad = bb000020
-049-03  initst:  ILP <-  4
-049-04  initst:  set lpbk md
-049-05  initst:  sel + pen
-049-06  initst:  ID <-  7
-049-07  initst:  arb wina
```

Example 2–11 (Cont.) t3 Test Display

```
-049-08  initst:  dasi md
-049-09  initst:  BSYa + CDa
-049-0a  initst:  rcv cmd[0]
-049-0a  initst:  rcv cmd[1]
-049-0a  initst:  rcv cmd[2]
-049-0a  initst:  rcv cmd[3]
-049-0a  initst:  rcv cmd[4]
-049-0a  initst:  rcv cmd[5]
-049-0a  initst:  rcv cmd[6]
-049-0b  initst:  ->  dta phse
-049-0c  initst:  rcv dta[0]
-049-0c  initst:  rcv dta[1]
-049-0c  initst:  rcv dta[2]
-049-0c  initst:  rcv dta[3]
-049-0c  initst:  rcv dta[4]
-049-0c  initst:  rcv dta[5]
-049-0c  initst:  rcv dta[6]
-049-0c  initst:  rcv dta[7]
-049-0c  initst:  rcv dta[8]
-049-0c  initst:  rcv dta[9]
-049-0c  initst:  rcv dta[10]
-049-12  initst:  ->  sts phse
-049-0d  initst:  dscon
-049-0e  initst:  chk bfr sts
-049-0f  initst:  chk CSTAT
-049-10  initst:  intrd
-049-11  INITST:  OK
```

Example 2–11 t3 Test Display

Suggested Action

If an error occurs during this test:

1. Make sure you installed the correct terminators and loopback connectors.
2. Should the problem continue, replace the system module.

2.3.5.9 t4 Test

This test performs an external loopback test of the SCSI drivers and cable connections in Manufacturer/Debug mode. You must install a SCSI loopback connector in the SCSI system module connector for this test. Disconnect all SCSI devices.

NOTE
This test automatically sets the mode to Manufacturer/Debug. You do not need to change the test mode manually. After the test completes, the workstation returns to User mode.

To install a SCSI loopback connector in the system unit SCSI connector, you must:

1. Remove the system cover.
2. Disconnect the SCSI cable from the system module by pushing the SCSI connector latches in opposite directions. This releases the SCSI cable from the system module.
3. Insert the SCSI loopback connector into the system unit SCSI connector. Make sure **Side 1** is facing the rear of the system unit. This ensures that the pins on the loopback connector are correctly aligned in the system module SCSI connector.

NOTE
It is possible to insert the connector offset by two pins. Be sure that the connector covers all pins.

To run this test, type:

```
scsi t4 <UNIT>
```

The <UNIT> is the unit number of the device you are testing. A display similar to Example 2–12 appears.

```
-04a-02  sii exdrv lpbk tsts
-04a-01  scsi lpbk chk
?obd-0f  err ext lpbk?  000001ff  00000084
```

Example 2–12 t4 Test Display

"Loopback not found" error message interpretation:

```
?0bd-0f err ext lpbk? xxxx yyyy
```

Where,

```
xxxx = expected data (0x1FF)
yyyy = actual data
```

If the actual data is 0x000, the loopback is installed backwards or otherwise incorrectly installed. If the actual data is nonzero, try another loopback (if available) and compare results. If the error is repeatable, replace the system module.

Suggested Action

If an error occurs during this test:

1. Make sure you installed the correct loopback connectors (depending on where you install the SCSI loopback connector) and you have disconnected all SCSI devices.
2. If step 1 does not solve the problem, check the SCSI cable; replace if necessary.
3. If step 2 does not solve the problem, replace the system module.

2.3.6 Interpreting the Status LED Codes

If your monitor is not working, obtain the results of the POST, self-test, and extended self-tests by observing the LED display on the back of the system unit. The LEDs are arranged in two groups of four and form a binary display.

When you first turn on the workstation, the DECstation 2100/3100 system performs the POST and the LEDs blink accordingly. If an error is detected, the workstation halts on the LED code corresponding to the failed component. Note the configuration of the display.

Use the procedures described in Section 2.3.4 and Section 2.3.5 to run individual extended self-tests. As the DECstation 2100/3100 system performs an extended self-test, the LEDs blink accordingly. If an error is detected, the system halts on the LED code corresponding to the problem. Tests that pass should not cause the LED display to remain on any code for more than 30 seconds.

When using the status LED display instead of a monitor:

1. Terminate appropriate connectors.
2. When using the keyboard, type the appropriate command to run a particular extended self-test.

Use Table 2–5 to determine where the error occurred and what action you should take next.

Table 2–5 Status LED Display Codes

Test	LED Display	Hexadecimal Code	Suggested Action
POST Self-test	1011 1111	bf	1. Run the SII extended self-test (Section 2.3.4.5). 2. Replace the system module.
SII	1011 1101 1011 1110 1011 1111 1101 0011	bd be bf d3	1. Check the following: SCSI cable SCSI device Terminators and loopback connectors 2. Replace the system module.

Legend

1 = LED on
0 = LED off

2.3.7 Installing Terminators and Loopback Connectors

The mode in which you run the diagnostics determines whether you need to install terminators or loopback connectors for the DECstation 2100/3100 connectors. Table 2–6 describes the terminators and loopback connectors used for User and Manufacturer/Debug modes.

Table 2–6 Test Mode Terminators

Test Mode	Terminators/Loopback Connectors
User	This mode requires: • A mouse or mouse loopback connector • A keyboard • A ThinWire Ethernet terminator, ThickWire Ethernet loopback connector, or connection to Ethernet cable. Make sure the Ethernet button is in the correct position. • A SCSI terminator
Manufacturer/Debug	This mode requires: • A keyboard • A mouse loopback connector (except when running the mouse test) • A ThinWire Ethernet terminator, ThickWire loopback connector, or connection to Ethernet cable. Make sure the Ethernet button is in the correct position. • A SCSI terminator if a SCSI device is installed • A SCSI loopback connector for the SCSI t4 test • Serial line loopback connectors for the communications and printer/console ports

See the *DECstation 2100/3100 Installation Guide* for instructions about installing terminators and loopback connectors.

2.4 Removing and Replacing the Drives

This section describes the procedures for removing the RZ22, RZ23, and RZ24 disk drives from the system enclosures. For details not covered in this manual, refer to the system maintenance guide.

2.4.1 Removing and Replacing the Cover

Refer to Figure 2–2 and perform the following steps:

1. Loosen the two screws securing the back panel.
2. Facing the back of the system unit, grip both sides of the cover and slide it away from you to disengage it from the guides.
3. Lift the cover away from the unit and set it aside.

When ready to reassemble the unit, reverse the procedure by first sliding the cover towards the back panel to re-engage the guides.

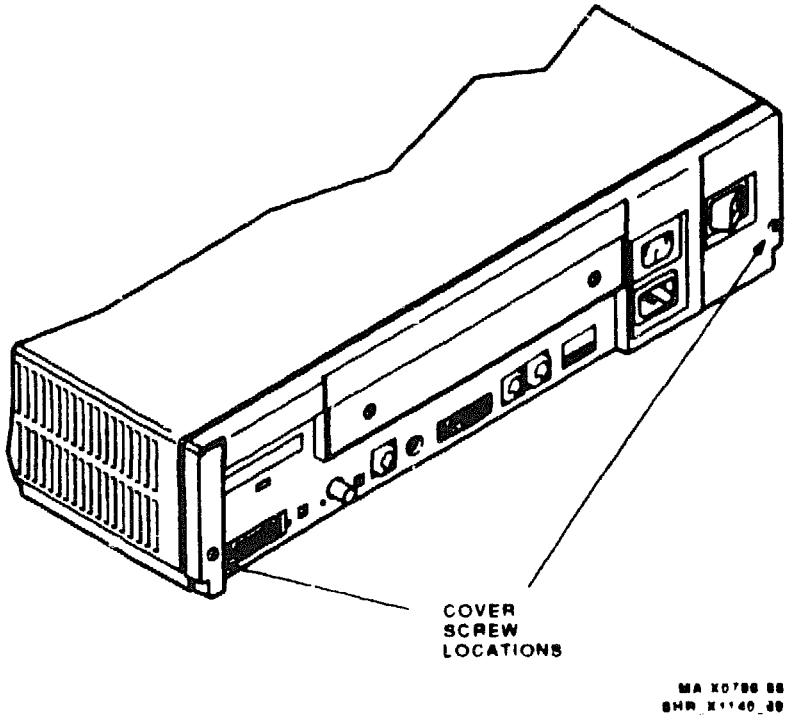


Figure 2–2 Removing the System Unit Cover

2.4.2 Removing the Drive Mounting Panel

Remove the drive mounting panel to replace a D SIM module, a Video SIM module, the system module, or the battery pack. Refer to Figure 2–3 and do the following:

1. Disconnect the drive power cable from the power supply connector by pulling the two connectors in opposite directions.
2. Disconnect the SCSI cable connector(s) from the drive by gently pulling the connector(s) straight out.
3. Unscrew the two captive screws located on the front side of the drive mounting panel, the two captive screws on the back side, and the one captive screw on the power supply assembly.
4. Loosen the three drive-mounting-panel Phillips screws on the side opposite the power supply assembly.
5. Take the assembly out of the unit by grasping it with both hands and sliding it towards the front of the unit, releasing it from the chassis. Lift the assembly and set it aside.

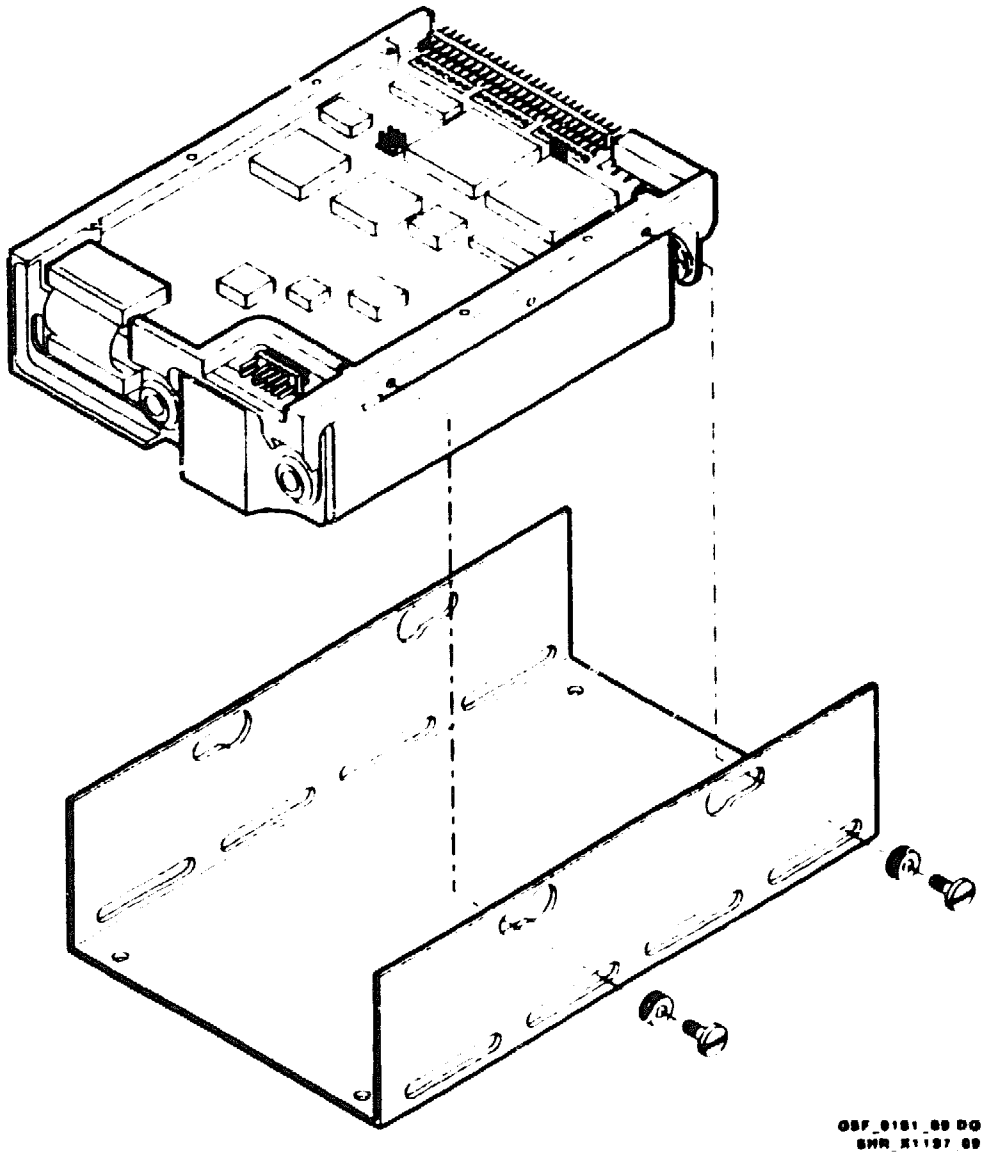


Figure 2–3 Removing the Drive Mounting Panel

2.4.3 Removing the RZ22, RZ23, and RZ24 Disk Drives

Refer to Figure 2–4, and perform the following steps to remove the disk drive.

1. Disconnect the SCSI cable from the drive by gently pulling the connector straight out.
2. Disconnect the drive power cable from the drive.
3. Remove the drive and bracket from the drive mounting panel by using a 5/16-inch socket wrench to unscrew the nuts from the four studs.
4. Lift the drive and bracket off the studs.
5. Remove the four thread screws on either side of the drive.
6. Slide the drive out of the bracket.

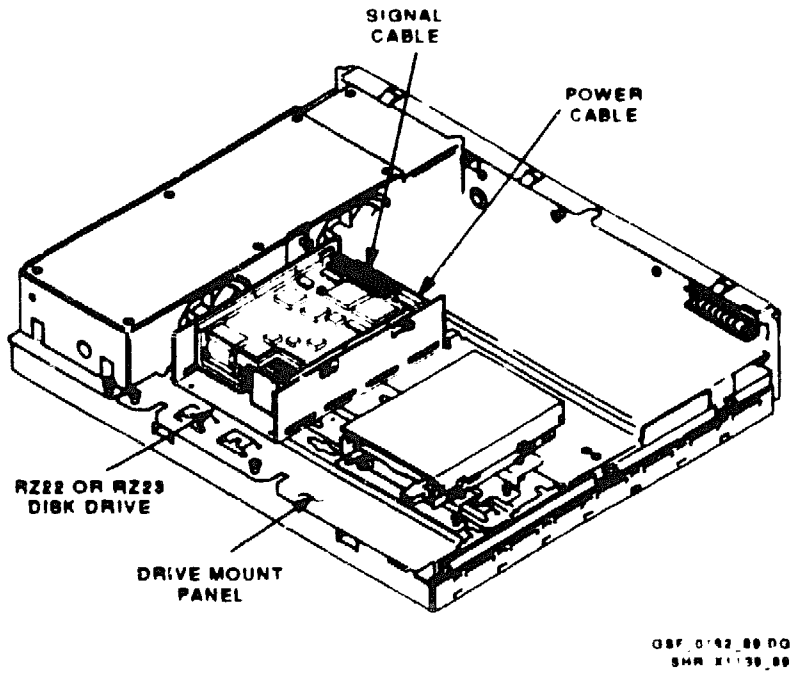


Figure 2–4 Removing the RZ22, RZ23, and RZ24 Disk Drives

2.4.4 Replacing the RZ22, RZ23, and RZ24 Disk Drives

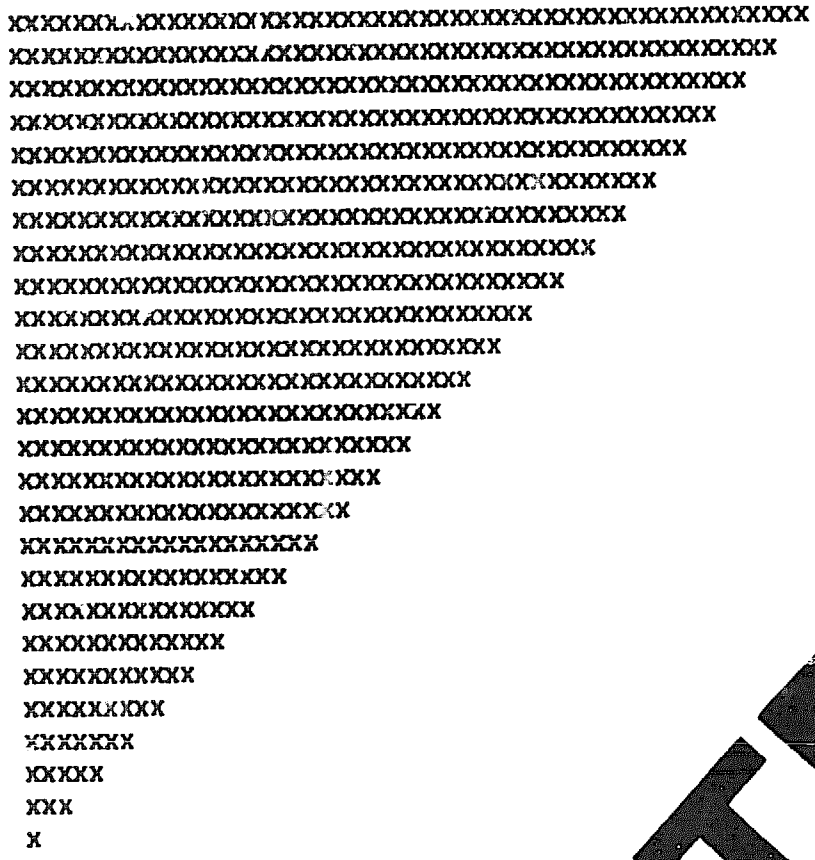
To replace the drive:

1. Place the drive in the bracket.
2. Place the drive and bracket on its side and align the bracket's two screw holes and associated rubber grommets with the corresponding screw holes in the drive.
3. Screw in the two thread screws.
4. Turn the unit over, align the two screw holes and rubber grommets on the other side, and screw in the other two screws.
5. With the drive connectors facing the back of the system unit, align the four bracket holes over the screw studs on the drive mounting panel. Lower the drive and bracket flush with the drive mounting panel.
6. Using a 5/16-inch socket wrench, screw the nuts onto the four studs.
7. Reconnect the drive power cable.
8. Reconnect the SCSI cable to the drive by pushing the SCSI connector into the drive connector so that the This Side Up label is facing up.
9. Verify that the unit select jumpers have the same settings as the original drive. The typical settings are listed in Table 2–7.

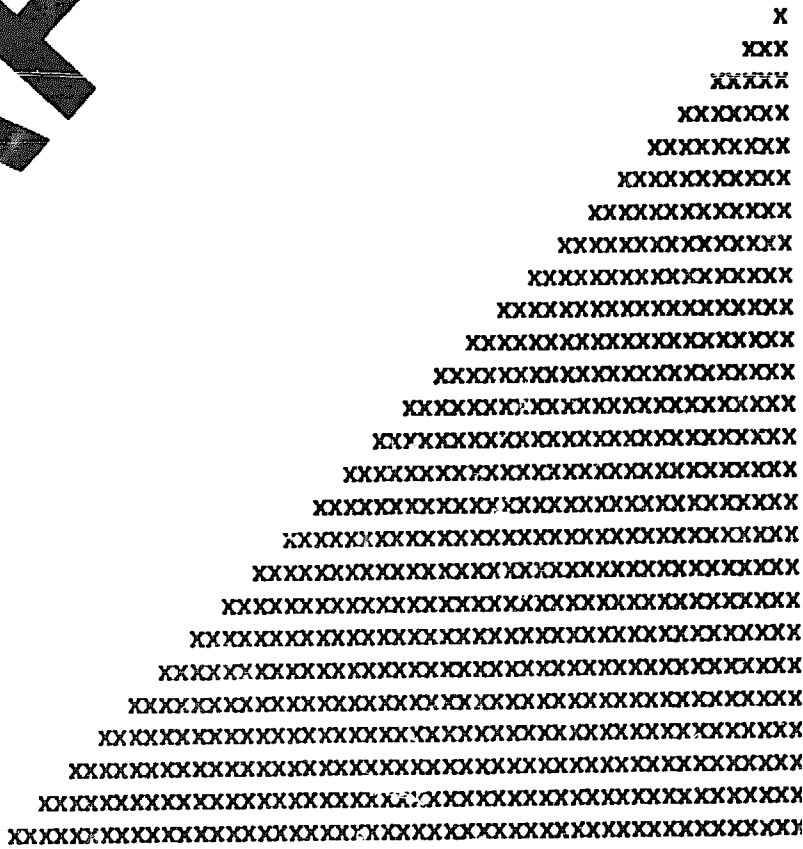
Table 2–7 RZ22, RZ23, and RZ24 Jumper Settings

SCSI ID	E1	E2	E3	E4
0	Out	Out	Out	Out
1	In	Out	Out	Out
2	Out	In	Out	Out
3	In	In	Out	Out
4	Out	Out	In	Out
5	In	Out	In	Out
6	Out	In	In	Out
7	In	In	In	Out
	E5[1] is Out			E6[1] is In

[1]E5 and E6 are present on RZ22 and RZ23 drive/modules with revision levels BO2 or higher. Manufacturing use only.



CHAPTER 3



3

Servicing the RZ22, RZ23 and RZ24 Disk Drives in a VAXstation 3100 System

3.1 Introduction

The VAXstation 3100 has four versions: model 30, model 38, model 40, and model 48. The enclosure used is the xx42A-xx. The VAXstation 3100 enclosure designation is VS42A-xx. Models 30 and 38 can contain two devices: an RX23 diskette drive, and an RZ22, RZ23, or RZ24 disk drive. The RZ22, RZ23, and RZ24 disk drives are devices with a SCSI interface. Models 30 and 38 have only one SCSI interface, and the RX23 needs an extra module to adapt to the SCSI interface. Models 40 and 48 can contain a number of devices. They include the TZ30 tape drive, the RRD40 disc drive, and up to three RZ22, RZ23, or RZ24 disk drives. Models 40 and 48 have two SCSI interfaces — A and B.

The SCSI port on the back of the system enclosure has a plastic cover. Under the plastic cover is the SCSI terminator. This terminator must be in place if there is no other connection to the SCSI port. If the system is using any external storage devices in expansion boxes (such as an RZ55 disk drive, TK70 tape drive or RRD40 disc drive), the terminator must be installed on the SCSI port of the last expansion box in the chain (SCSI port on the expansion box is at the rear of the box).

3.2 Troubleshooting the Drives in the System

To troubleshoot the RZ22, RZ23, and RZ24 disk drives, follow the same basic procedures as for any other disk drive. Check for the type of failures that are common to a faulty disk drive. See Section 3.2.1 for a checklist of items to examine for determining whether the drive is faulty.

The RZ22, RZ23, and RZ24 disk drives are dependent on the system software diagnostics for troubleshooting. Refer to the system maintenance guide for the types of software diagnostics available on the system, and how to run them.

To troubleshoot the RZ22, RZ23, and RZ24 disk drives on the SCSI buses and the SCSI controllers in a VAXstation 3100 (models 30 and 38, or models 40 and 48) system, use the following tools:

- Checklist (Section 3.2.1)
- Flowchart (Figure 3–1)
- Error code listings and interpretations (Section 3.2.3)
- Diagnostics (Section 3.3)

The following sections are brief descriptions of troubleshooting procedures. Refer to the system maintenance guide for more system specific detailed information on the self-test and system exerciser.

3.2.1 Troubleshooting Checklist

The following is a checklist of items that should be examined in order to determine if the drive is faulty.

- Is the drive connected (both power and signal cables)?
- Is there power to the drive?
- Is the drive properly configured?
- One of the features of the RZ22, RZ23 and RZ24 is that no formatting needs to be done in the field. It is possible, however, that the data has been corrupted by the customer. Does the disk need to be erased or replaced?
- Was the drive module/frame replaced before replacing the entire drive?

3.2.2 Troubleshooting Flowchart

Figure 3–1 outlines the process for troubleshooting the drive. The first two pages of the flowchart show the VMS commands SHOW and ANALYZE to find disk drive errors.

The next four pages of the flowchart show the various tests used in the system exerciser to find disk drive errors.

RZ DIAGS (or RZ diagnostics) are software tests that are run on the system to test the disk drive. If a drive needs to be replaced, refer to the procedures in Section 1.5.

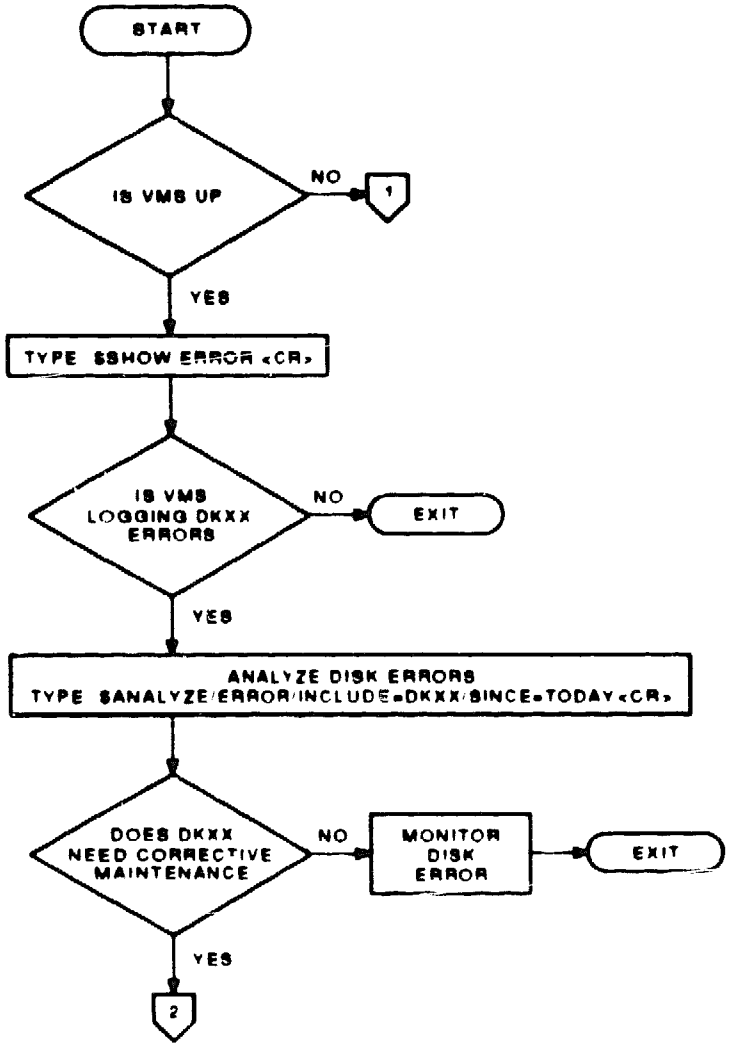
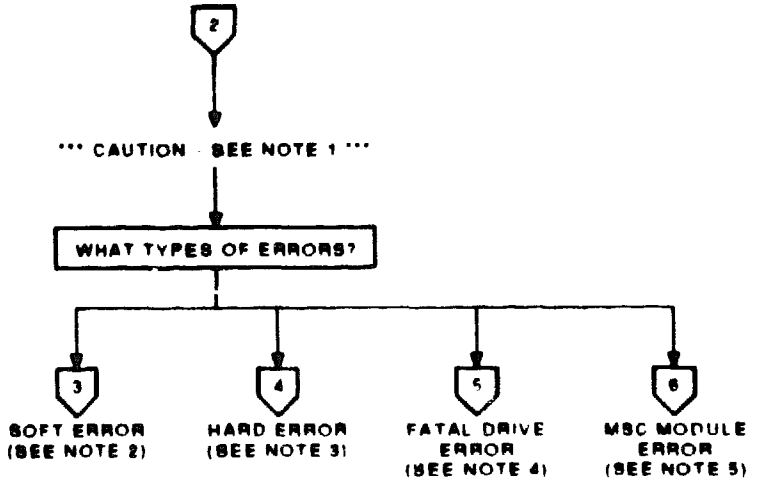


Figure 3–1 (Cont.) Troubleshooting Flowchart



NOTE 1 BE CERTAIN THERE IS A RECENT BACKUP OF THE DISK BEFORE ATTEMPTING ANY CORRECTIVE MAINTENANCE DIAGNOSTIC MAY ERASE THE DISK

NOTE 2 SOFT ERROR RECOVERABLE ERRORS SUCH AS DATA CHECKS ECC ERRORS

NOTE 3 HARD ERRORS NON RECOVERABLE ERRORS SUCH AS A READ ERROR BAD BLOCK ON THE DISK A BAD FILE BUT THE DRIVE IS OPERATIVE

NOTE 4 A HARD FAULT THE DRIVE IS INOPERATIVE TO THE SYSTEM THE FRU NEEDS TO BE REPLACED

NOTE 5 AN ERROR IN THE MSC MODULE THAT MAY CAUSE INTERMITTENT PROBLEMS TO THE DRIVE DURING A DATA TRANSFER

NOTE 6 INSTALL LOOPBACK CONNECTOR IN THE RIGHT MOST MMJ PRINTER PORT TO RUN THE SYSTEM EXERCISER IN THE FIELD SERVICE MODE

Figure 3–1 (Cont.) Troubleshooting Flowchart

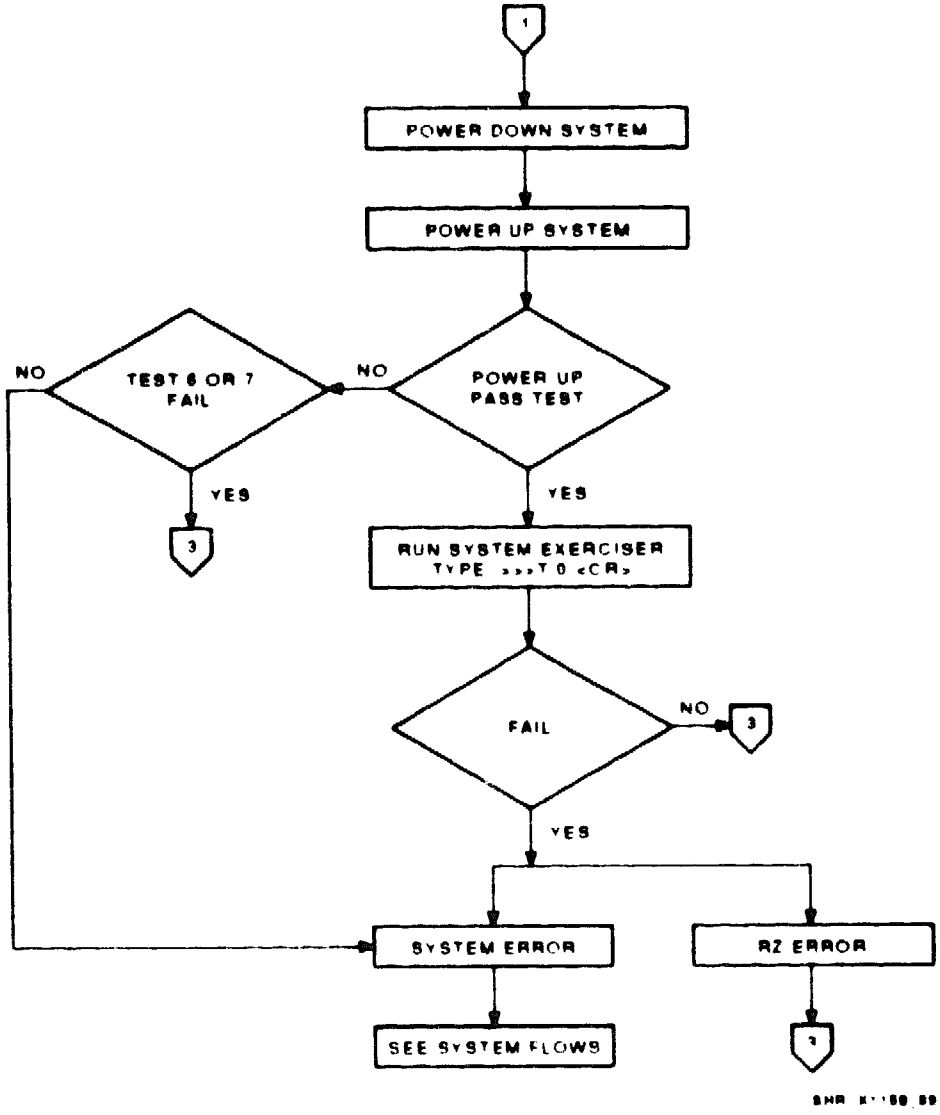


Figure 3–1 (Cont.) Troubleshooting Flowchart

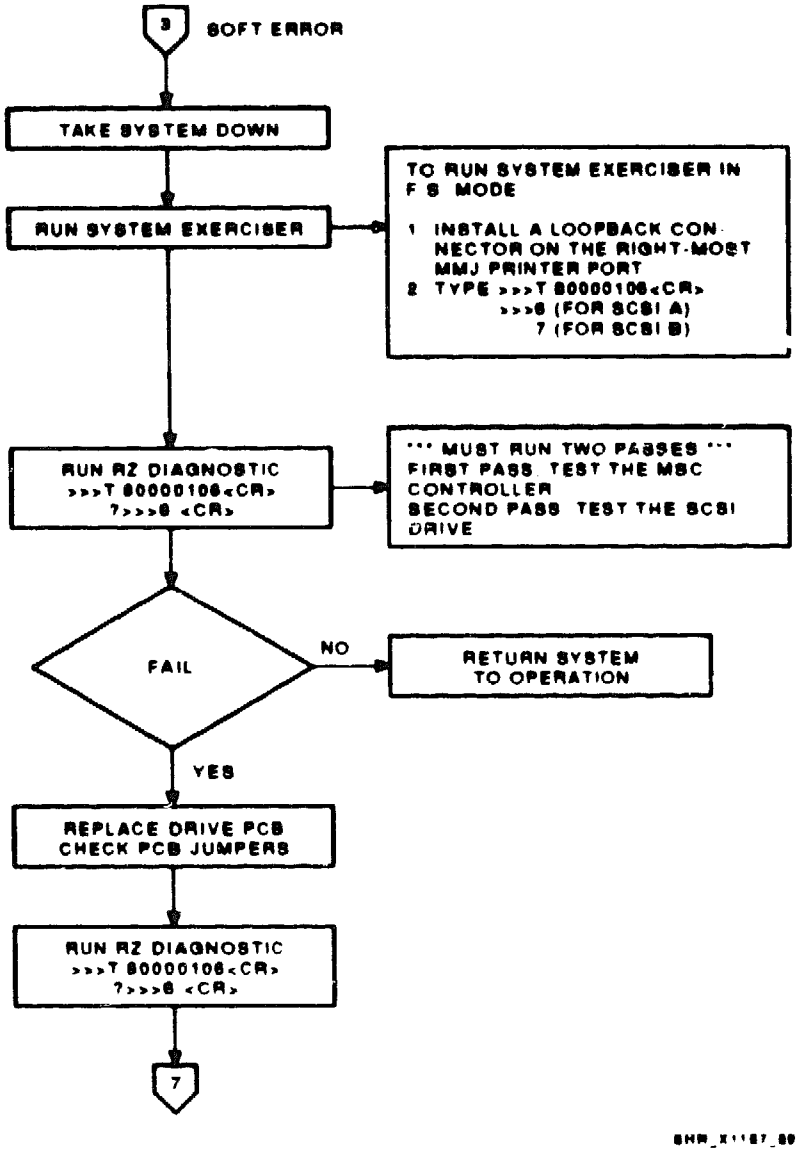


Figure 3–1 (Cont.) Troubleshooting Flowchart

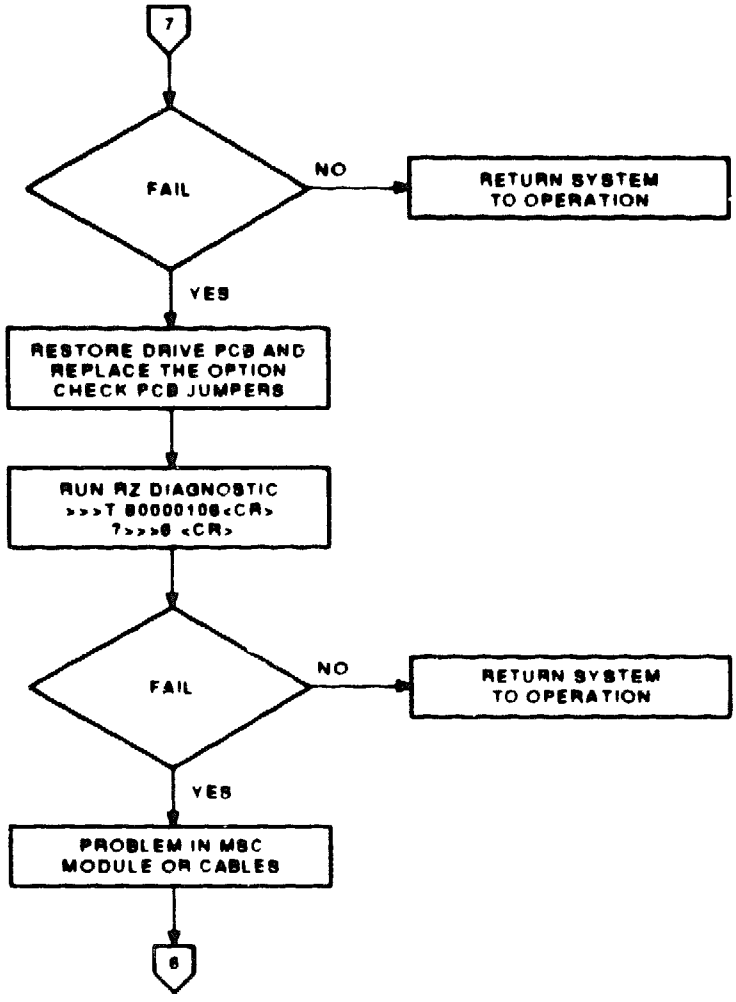


Figure 3–1 (Cont.) Troubleshooting Flowchart

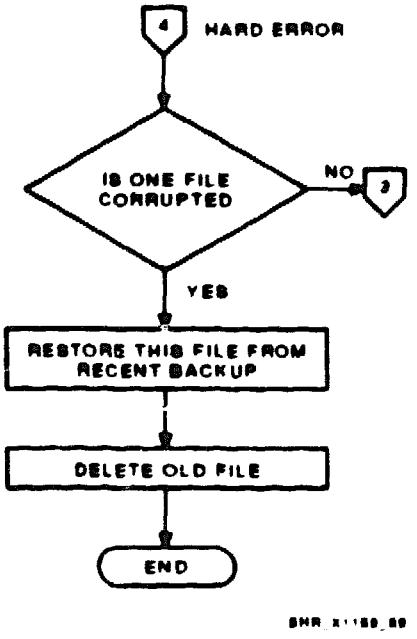


Figure 3–1 (Cont.) Troubleshooting Flowchart

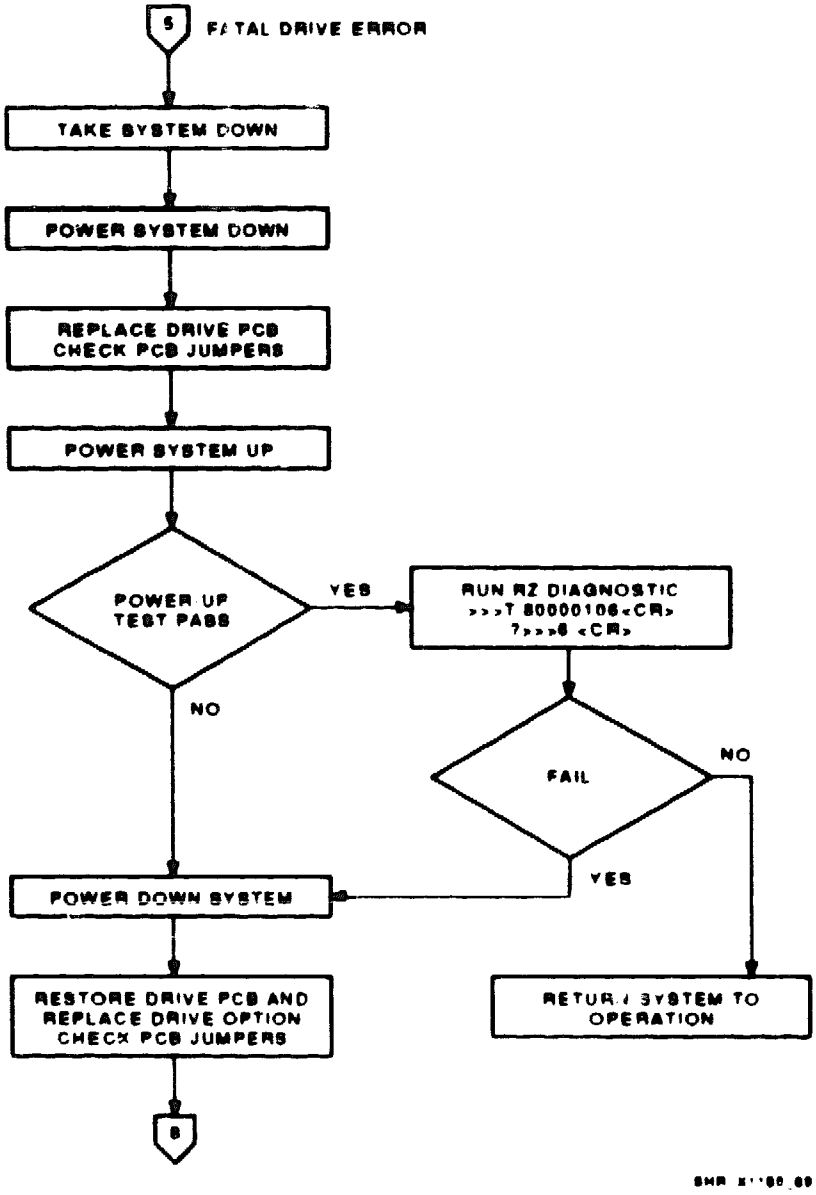


Figure 3–1 (Cont.) Troubleshooting Flowchart

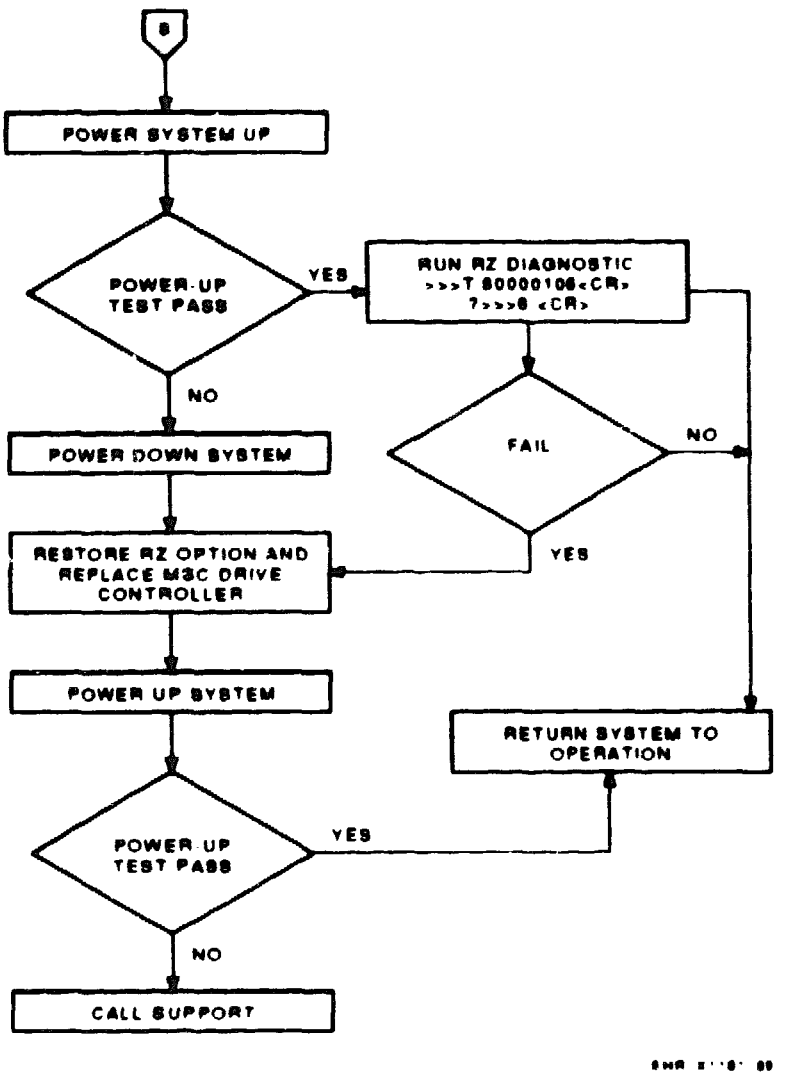


Figure 3–1 (Cont.) Troubleshooting Flowchart

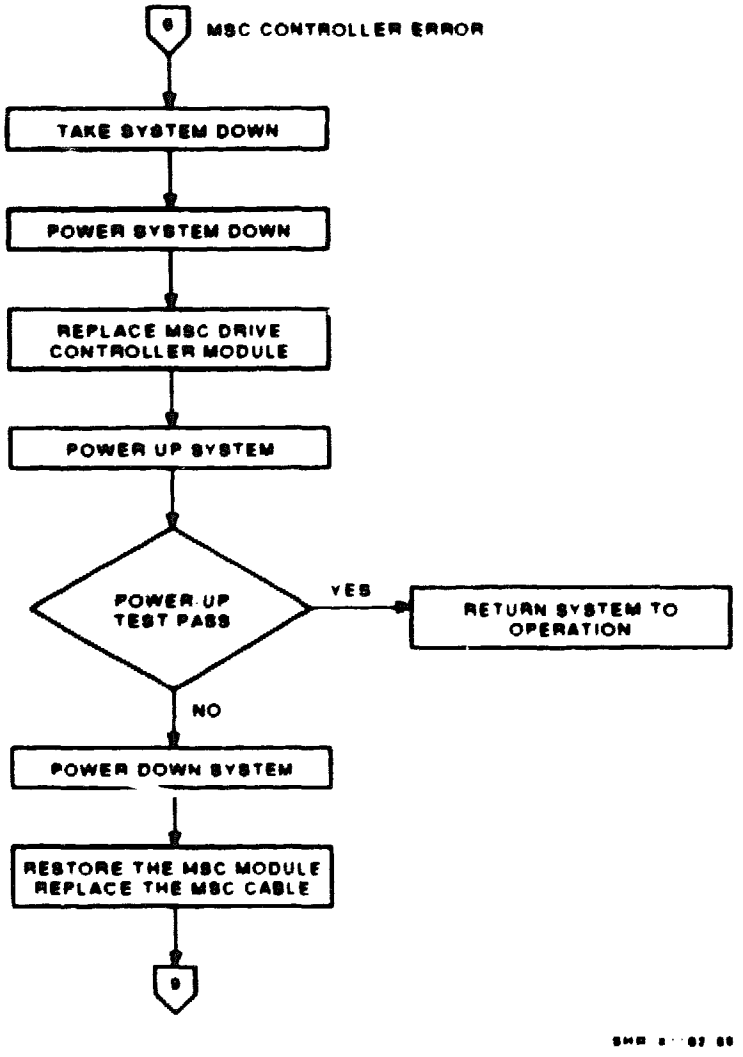


Figure 3–1 (Cont.) Troubleshooting Flowchart

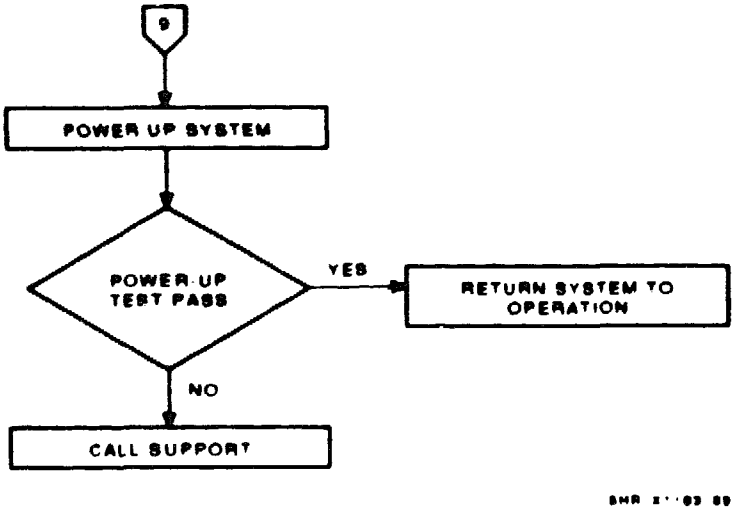


Figure 3–1 Troubleshooting Flowchart

3.2.3 Error Code Listings

Table 3–1 lists the error codes and their definitions for the SCSI controller.

Table 3–1 SCSI Controller Error Codes

Error	Definition
01	No error
02	Data buffer RAM addressing failure
04	Data buffer RAM byte mash failure
06	Data buffer RAM data path failure
10	Error in SCSI controller registers during reset
12	Error in SCSI controller registers after reset
20	Unexpected interrupt after reset, IPL = 1F
22	No interrupt request after reset
24	No interrupt after reset when IPL has been lowered
26	Interrupt request not cleared following ISR (after reset)

Table 3–1 (Cont.) SCSI Controller Error Codes

Error	Definition
28	Multiple interrupts following reset
2A	Unknown interrupt following reset
2C	Wrong interrupt following reset
30	Phase not bus free at start of test
40	First attempt to read SCSI controller register failed
42	SCSI controller register address failed at INI_CMD
44	SCSI controller register address failed at mode
46	SCSI controller register address failed at TAR_CMD
48	SCSI controller register address failed at SCD_CMD
4A	Mode (DMA) found set after being cleared when INI_CMD (BSY) clear
4C	Mode (DMA) found set after being set when INI_CMD (BSY) clear
4E	Mode (DMA) found set after being cleared when INI_CMD (BSY) set
50	Mode (DMA) found clear after being set when INI_CMD (BSY) set
60	Data output to bus with INI_CMD (ENOUT) clear
62	No data to bus with INI_CMD (ENOUT) clear
64	Parity bit CUR_STAT (DBP) did not match data on bus
66	With bus free, data did not match data on bus
68	INI_CMD (SEL) to CUR_STAT (SEL) mismatch
6A	INI_CMD (ACK) to STATUS (ACK) or INI_CMD (ATN) to STATUS (ATN) mismatch
6C	TAR_CMD (REQ or MSG or CD or IO) to CUR_STAT (REQ or MSG or CD or IO) mismatch with mode (TARG) SET
6E	Clearing MODE (TARG) doesn't prevent TAR_CMD bits from appearing on the bus
70	ISR bit with IPL = 1F and INT_MSK (SC) clear
72	Interrupt request INT_REQ (SC) for no reason

Table 3–1 (Cont.) SCSI Controller Error Codes

Error	Definition
74	SCSI bus STATUS (INTREQ) set for no reason
80	SCSI bus busy at start of interrupt test - no test done
82	ISR hit following bus free with IPL = 1F and INT_MSK (SC) clear
84	Interrupt request INT_REQ (SC) not set following bus free
86	SCSI bus STATUS (INTREQ) not set following bus free
88	STATUS (BSYERR) not set after it caused an interrupt
90	SCSI bus busy during interrupt test - no test done
92	ISR hit following bus free with IPL = 1F and INT_MSK (SC) set
94	Interrupt request INT_REQ (SC) not set following bus free
96	SCSI bus STATUS (INTREQ) not set following bus free
98	STATUS (BSYERR) not set following bus free
A0	SCSI bus busy during interrupt test - no test done
A2	Timeout waiting for bus free interrupt
A4	ISR not hit following bus free
A6	Interrupt request INT_REQ (SC) not cleared following ISR after bus free
A8	SCSI STATUS (INTREQ) not set following bus free
AA	Multiple interrupts from bus free
AC	Unknown interrupt from bus free
AE	Wrong interrupt from bus free
B0	SCSI bus busy during interrupt test - no test done
B2	Timeout waiting for parity interrupt
B4	ISR not hit following parity
B6	Interrupt request INT_REQ (SC) not cleared following ISR after parity
B8	SCSI bus STATUS (INTREQ) not set following parity
BA	Multiple interrupts from parity

Table 3–1 (Cont.) SCSI Controller Error Codes

Error	Definition
BC	Unknown interrupt from parity
BE	Wrong interrupt from parity
C0	Phase not bus free before arbitration
C2	INI_CMD (AIP) bit failed to set
C4	Lost arbitration - first check of INI_CMD (LA)
C6	Higher priority device in bus
C8	Lost arbitration - second check of INI_CMD (LA)
D0	Not all selected targets test satisfactorily

3.3 Using System Diagnostics

For detailed information on the diagnostics for the VAXstation 3100, refer to the *VAXstation 3100 Maintenance Guide* (EK-285AA-UG).

Diagnostics available are:

- Power-up test
- Self-test
- System exerciser

  Customer level
  Field Service level

For detailed information on the diagnostic set for the VAXstation 3100 system, see the system maintenance guide.

3.3.1 Power-Up Tests

Power-up tests run each time the system is turned on and consist of a sequence of tests executed for each device installed in the system. They can also be initiated using console test commands. Refer to the system maintenance guide. The test number of each device is listed on the power-up screen display as the device itself is tested. The LEDs on the rear of the system box indicate the status of the power-up testing.

Example 3–1 shows the power-up screen display. Line 1 indicates the CPU name and the ROM version. Line 2 indicates the results of each device test, and Line 3 is a summary of the tests.

```
Line 1   KA42-A  V1.0

Line 2   F   E   D   C   B   A   9   8   7   6   5   4   3   2   1

        Where the following symbols can appear in between each:
        ...  Device tested successfully, or has a soft error
        ??.  Device has a hard error
        _..  Option is not installed, or not tested
        *..  Option installed but its ROM code has not executed

Line 3    xx d  0000   000.0000
           x d  0000   000.0000

        Where xx can be two question marks indicating a hard error,
        and x can be one question mark indicating a soft error or
        status of that device.
```

Example 3–1 Power-Up Tests Screen Display

A double question mark (??) means a hard or fatal error. The device must be replaced before rebooting the system.

An extended summary of the power-up tests is stored in the system configuration table. Refer to the system maintenance guide on how to display and interpret these tables.

3.3.2 Console Mode Tests

To use console mode testing, the system must be halted. The system will halt automatically for tests after power-up testing, for a boot failure, and for a system error. Halt the system manually by pressing the HALT button located to the right of the ThinWire Ethernet port on the back of the system box.

To exit, type BOOT (restarts the system—similar to turning on power) or type CONTINUE (starts the system where halting is present in an operating software).

For further information on console commands and test commands, refer to the system maintenance guide.

3.3.3 Self-Test

The self-test gives a quick status of the SCSI bus controller and the devices on the SCSI bus, including the RZ22, RZ23, and RZ24. The results of the self-test are stored in the configuration table.

Run Test 50 to see these results. The STRG-2 codes contain the results.

An easy way to determine if any errors are detected is to look for question marks in the left column. If there are question marks, then one or more of the drives on the bus are faulty. To determine which device(s) is (are) faulty, examine the status codes of the drives (second line). The address IDs are numbered 0 through 7 from left to right (for example, the RRD40 is located at SCSI address ID 0). A status code of 00000001 indicates no error for the drive (01000001 for a tape drive, and 05000001 for the RRD40).

A code of FFFFFF05 indicates that no drive is installed at this particular address ID, or the drive at this address ID is not powered up, not cabled properly, or is faulty. A code of FFFFFF03 indicates that this address ID is occupied by the SCSI controller (should always be ID 6). Any other codes indicate an error with the drive at that address ID.

If a drive is configured for an address ID that indicates FFFFFF05, check the drive's cabling and power, and retest. If the code is still FFFFFF05 after retesting, replace the drive.

The self-test commands for the VAXstation 3100 systems are:

- Models 30 and 38, SCSI-A, Test #6
- Models 40 and 48, SCSI-A, Test #7
- Models 40 and 48, SCSI-B, Test #6

3.3.4 System Exerciser

To start the system exerciser type Test 0 for customer mode and Test 101, Test 102 or Test 80000106. Then type 6 or 7 at the prompt for Field Service mode. The customer mode system exerciser does not perform reads or writes to the drives. The Field Service mode system exerciser performs a complete read/write test on the tape drive and the disk drives (on reserved diagnostics blocks); performs read on the compact disk drive (if the test disk is loaded); and also performs data transfer tests on all drives.

For Field Service mode to run properly, you must install the loopback connector on the right-most MMJ printer port, load the special-keyed (T 73) tape cartridge into the tape drive, and load the RRD40 test disc before starting the system exerciser.

The first pass of the system exerciser on a SCSI bus tests the SCSI controller, and, if the SCSI controller is operating properly, checks the SCSI bus for the presence of any drives. It does not perform any diagnostics or any data transfer tests on the drives during the first test pass. If the SCSI controller tests bad, an error code is listed in the display and the SCSI bus is not checked for the presence of any drives.

Table 3–2 lists the system exerciser diagnostic tests and their descriptions.

Table 3–2 System Exerciser Diagnostic Tests

Test	Description
T 0	Runs customer level - exercises each device once sequentially, and stops when the slowest device finishes its second pass. It requires no loopback connectors or removable media.
T 101	Runs Field Service level - exercises each device sequentially, then exercises them simultaneously, and stops when the slowest device finishes its second pass. It requires loopback connectors and removable media. **CAUTION** **Do not stop the exerciser before the second pass.**
T 102	Same as T 101, but you can type a CRTL/C to terminate the tests. Once terminated, the result summary can be displayed by pressing RETURN. Type CRTL/C again to stop the result summary display and return to the system prompt. **CAUTION** **Do not stop the exerciser before the second pass; do not press the HALT button. This requires loopback connectors and removable media.**
T 80000106	Individual testing. Runs exerciser diagnostics on individual devices.

To start the system exerciser, type Test 0 for the customer mode or type Test 80000106, then 7 at the prompt for Field Service mode. The customer mode does not perform reads or writes to the RZ22, RZ23, and RZ24 disk drives. The Field Service mode performs complete read/write tests on the disk drives (reserved diagnostic blocks) and also performs data transfer tests to all devices.

For the Field Service mode to run properly, you must install the loopback connector on the right-most MMJ printer port, load the tape cartridge with the special-keyed (T 73) into the TZ30 tape drive, and run the system exerciser.

The first pass of the system exerciser tests the SCSI controller, and, if the SCSI controller is operating properly, checks the SCSI port for the presence of any devices. It does not perform any diagnostics or data transfer tests on these devices during the first pass. If the SCSI controller tests bad, an error code is listed in the display and the SCSI bus is not checked for the presence of any devices. In Field Service mode only, complete data transfer and read/write are not performed on the first pass.

3.3.4.1 SCSI-B Background Information

The SCSI-B bus controller controls up to seven SCSI devices on the SCSI bus including internal and external devices. The RZ22, RZ23, and RZ24 disk drives are internal devices.

Each device on the SCSI bus, including the SCSI bus controller, has its own address ID location. The SCSI bus controller always holds the address ID of 6. The RZ22, RZ23, and RZ24 disk drives (if installed in the system box) normally hold one of the last two address IDs which are 2 and 3. For instance, the first device connected to the SCSI port should hold address ID 3 and the next device should hold address ID 4. If there is not a full configuration of drives in the system box, the remaining address IDs can be used on any device connected to the SCSI port

3.3.4.2 SCSI Address ID Priority

In Models 30 and 38; the RZ22, RZ23, and RZ24 SCSI device address IDs are as follows:

- System disk
- User disk
- Dual disk expansion box

In Models 40 and 48, the RZ22, RZ23, and RZ24 address IDs are as follows:

- **SCSI-A**

  System disk

- **SCSI-B**

  User disk
  Additional disk (SCSI-B bus)
  Dual disk expansion box

(Figures 1–3 and 1–4 show the jumper locations and settings for the RZ22, RZ23, and RZ24 disk drives. Also refer to Table 3–3.)

NOTE

The jumper settings shown are just one possible configuration for the device. However, the address ID of any device can be changed to any one of the valid address IDs (1-7) as long as there are not two devices with the same address ID on the same SCSI bus. Remember that the VAXstation 3100 system has two SCSI buses and each bus operates independently from the other as far as address IDs are concerned.

3.3.4.3 STRG-2 Code Explanation

When running the system exerciser in the Field Service mode with the special-keyed TZ30 tape cartridge installed, the code for the TZ30 is not writeable (2100.0001) during the first pass. However, the second pass shows that the TZ30 is writeable (2300.0001) as long as the cartridge has a good special key on it and the SCSI controller is operating correctly. You must wait for the system exerciser to complete at least two passes on the STRG-2 to determine if the device (in this case, address ID 1) is operating correctly. You must wait for the results of the third pass to see the results of the transfer tests for the device at SCSI address ID 2.

The example below shows the system exerciser display for the STRG-2.

```
6     00A0     STRG-2     2000.0001     2     0  00:03:16.26
                          2300.0001
```

There is one line for the status of the SCSI controller on the mass storage controller (MSC) module and one line for each of the eight devices on the SCSI bus. The status of the SCSI controller is next to the STRG-2 mnemonic (first line) and the status of the SCSI devices is listed under the status of the controller.

An easy way to determine if any errors are detected is to look for question marks in the left column. If there are any question marks on the SCSI controller status line, the SCSI controller is probably faulty and the error code identifies the problem. If there are any question marks on the SCSI device status line, the problem is either the SCSI device (RZ22, RZ23, or RZ24), SCSI bus cables, or the SCSI controller. An error that is listed in the SCSI devices code may be a data transfer error and thus does not isolate the problem to the device itself. It may still be in the SCSI controller. Refer to the following section to decipher the error codes.

3.3.4.4 SCSI Bus Controller

This section includes the STRG-1 SCSI bus controller on the VAXstation 3100 Models 38 and 48 as well as the STRG-2 SCSI bus controller on the other VAXstation 3100 systems. Refer to Tables 3–3 and 3–4.

Controller error code format: **TUVV.XYZ1**. Where

T = drive used during data transfer
U = results of data transfer
VV = error counts (in hexadecimal) during data transfer
X = results of interrupt test
Y = results of register test
Z = results of buffer test

Drive error code format: **JKLL.PRS1**. Where

J = drive number (SCSI address ID 1-7)
K = drive is removable (1), writeable (2), both (3)
LL = error count (in hexadecimal)
P = last command to bus
R = status of drive
S = results of routine test on the drive

Table 3–3 Transfer Test Drive Number (T000.0001)

Code	Drive Used During Transfer Test
F	This code is always shown during first pass
8	No drive available
7	DKx7 or MKx7 - Drive at SCSI address 7
6	DKx6 or MKx6 - Drive at SCSI address 6
5	DKx5 or MKx5 - Drive at SCSI address 5
4	DKx4 or MKx4 - Drive at SCSI address 4
3	DKx3 or MKx3 - Drive at SCSI address 3
2	DKx2 or MKx2 - Drive at SCSI address 2
1	DKx1 or MKx1 - Drive at SCSI address 1

Legend

DK is for disk drive
MK is for tape drive.
The x indicates SCSI bus (A or B) device is on.

Table 3–4 SCSI Bus Controller Error Codes (0U00.XYZ1) (0000.00S1)

Error Codes	Definition
0	Success: no error
1	Controller error: DMA bit will not set in TPC controller mode register. Target command register not valid. Initiator command register not valid. Bus free not valid. Phase match bit in bus and status register not valid.
2	Data path error: data path in longword, word, or byte access failed. Unable to access all data of data buffer. Unable to reach TPC controller, unable to write to mode register.
3	DMA count error: count register not valid. Count not 0 after DMA transfer.
4	Timeout error: no phase match within timeout period.
5	Interrupt error: interrupt not received when expected. An error occurred while testing the system interrupt logic.
6	Unexpected interrupt error: one was received.

Table 3–4 (Cont.) SCSI Bus Controller Error Codes (0U00.XYZ1) (0000.00S1)

Error Codes	Definition
7	Command error: request since command ended without since data. Command terminated with bad device status.
8	Phase error: unexpected phase, or phase change on the SCSI bus.
9	Buffer overflow error: too many bytes read from target.
A	Arbitration error: AIP bit in initiator command register not set during arbitration process or arbitration lost during arbitration process or not won.
B	Target will not set BSY during selection process. Or, the INI_CMD (BSY) bit did not toggle during the register test.
C	Unable to loop data out onto SCSI bus and back in again.
D	Direction and phase of SCSI bus as set by the target and read from the controller are incompatible.
E	SCSI bus will not drop REQ within timeout period or SCSI bus will not assert REQ within timeout period.
F	DMA end bit not verified in bus and status register or DMA data not matching expected data.

Table 3–5 Drive Status Codes (0000.0R01)

Status Codes	Definition
0	Ready: drive is on-line and ready for commands.
2	Off-line: status given to devices that will not respond to selection process, or status given to all devices for initialization.
4	Not ready: status given to devices that are selectable, but return a not ready status during status phase of a command (command tried five times).
6	Diagnostic error: device returned an error status after self-test.
8	Key error: unable to rewrite Field Service key on removable media sequential device.

3.4 Removal and Replacement Procedures

This section describes the procedures for removing the drive from the VAXstation system enclosures. For details not covered in this manual, refer to the system maintenance guide.

NOTE
Remember to label all parts or cables before removing.

3.4.1 Models 38 and 38

1. Turn off the system.
2. Remove the two top cover screws (Figure 3–2).
3. Slide the cover forward and up off the system box.

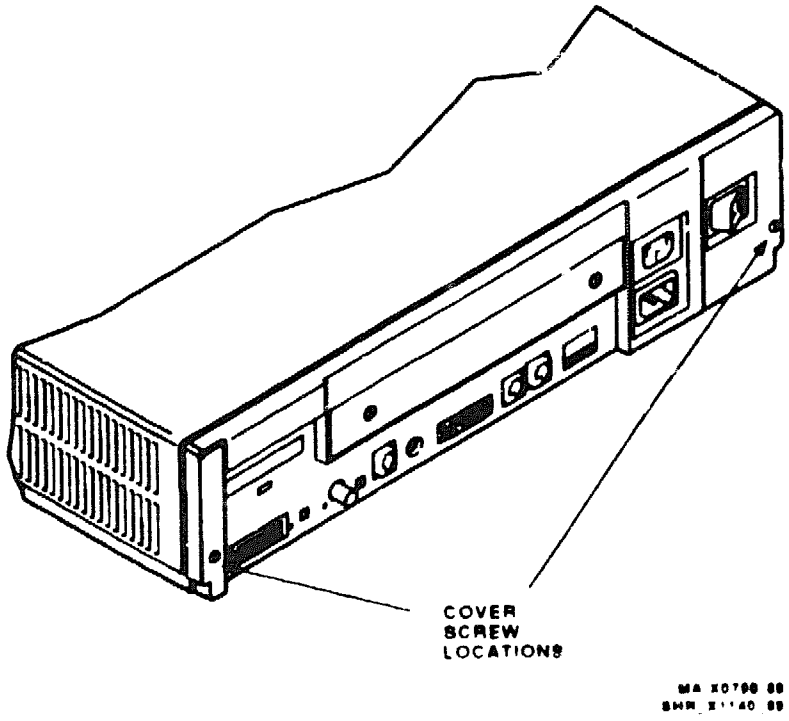


Figure 3–2 Removing the System Box Cover

4. Remove the drive mounting panel (Figure 3–3).
5. Disconnect the drives power and MSC cables.
6. Unscrew the eight screws.
7. Slide the panel forward; lift the panel from the system box and set it aside.
8. To remove the drive (Figure 3–3), turn the drive mounting panel over and remove the four screws from the drive. Support the drive with one hand when removing the last screw.

NOTE
Remember to position any jumpers on the replacement drive to the same configuration as the removed drive. Refer to Figures 1–3 and 1–4.

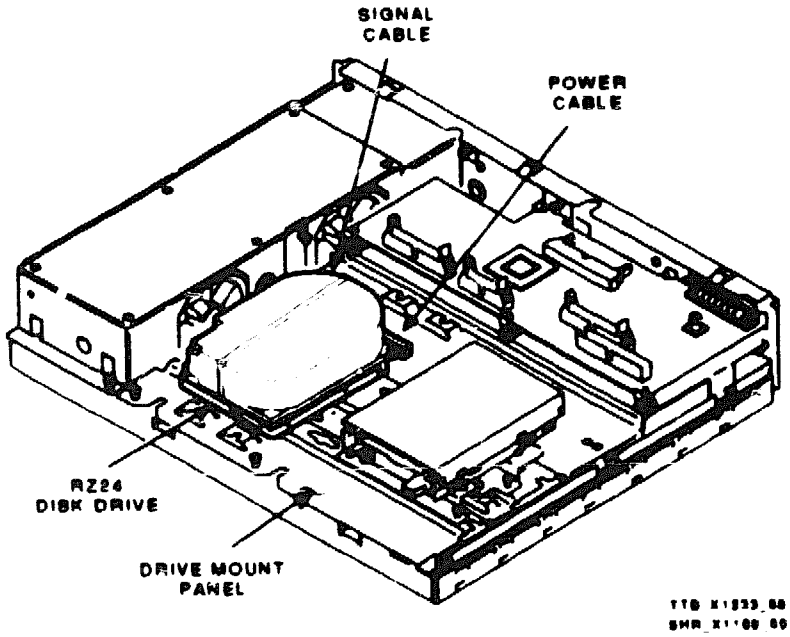


Figure 3–3 Removing the Drive Mounting Panel

To replace the drive onto the drive mounting panel and to return the panel to the system box, reverse the above procedure.

3.4.2 Models 40 and 48

The RZ22 and RZ23 drives attach to the top drive mounting panel and connect to the SCSI buses. One of the drives is the system disk and it connects to the SCSI-A bus. The other two drives are user disks and connect to the SCSI-B bus. You must always replace the RZ22 or RZ23 drive/module frame before replacing the drive option. If replacing the drive module/frame did not fix the fault, you must replace the drive as one FRU since the head/disk assembly (HDA) is not a separate FRU. For the RZ24, replace the drive module and then the drive HDA.

The following procedure describes how to remove the drive from the system, and how to remove and replace the drive module/frame on the RZ22, RZ23, and RZ24 drives.

1. Turn off the system power switch.
2. Remove the two cover screws, refer to Figure 3–4.

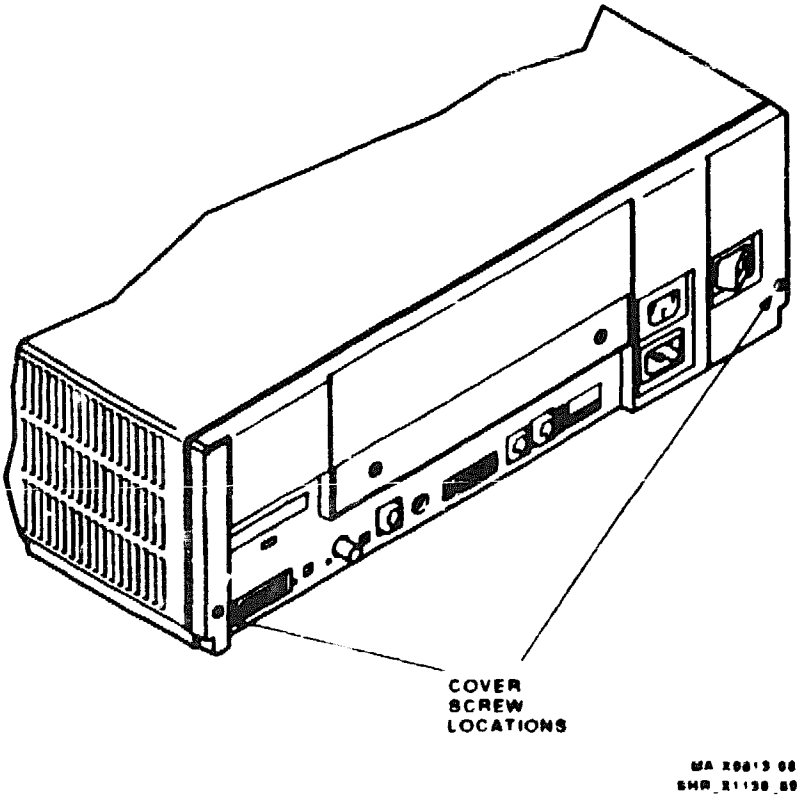


Figure 3–4 Cover Screw Locations

3. Slide the cover forward and up off the system box.

CAUTION
You must note which cables connect to which drive when disconnecting them from the system. Write the type of drive and its position on a piece of tape and wrap the tape around the connector before disconnecting it. This will help you when reinstalling the drives.

4. Disconnect the power cables and the SCSI bus cables from the drives on the top panel as shown in Figure 3–5.

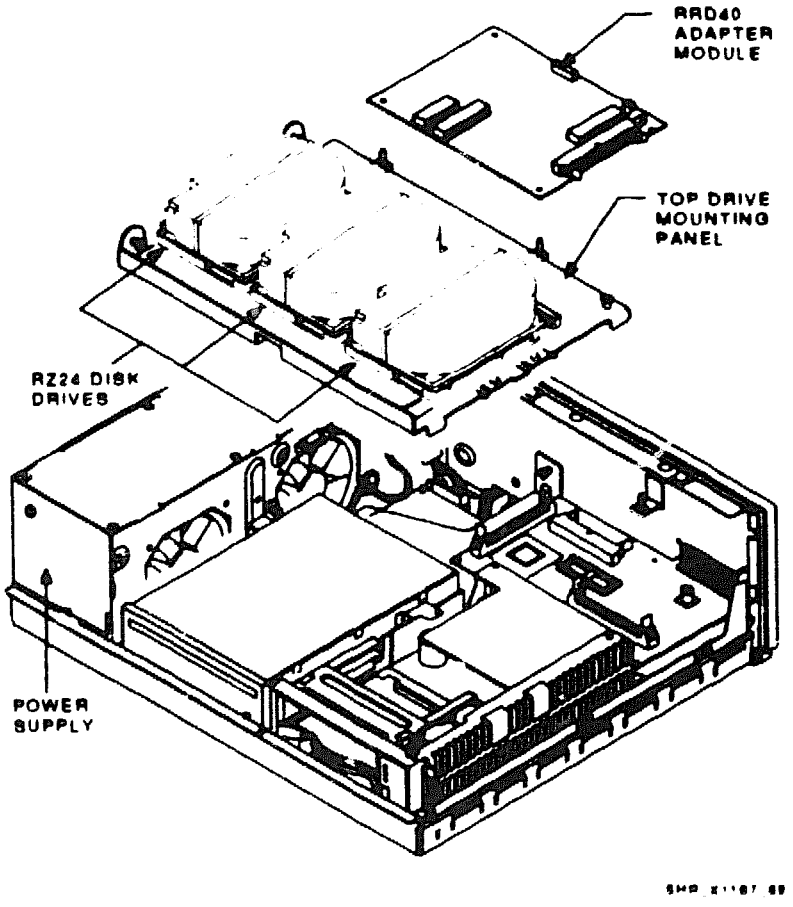
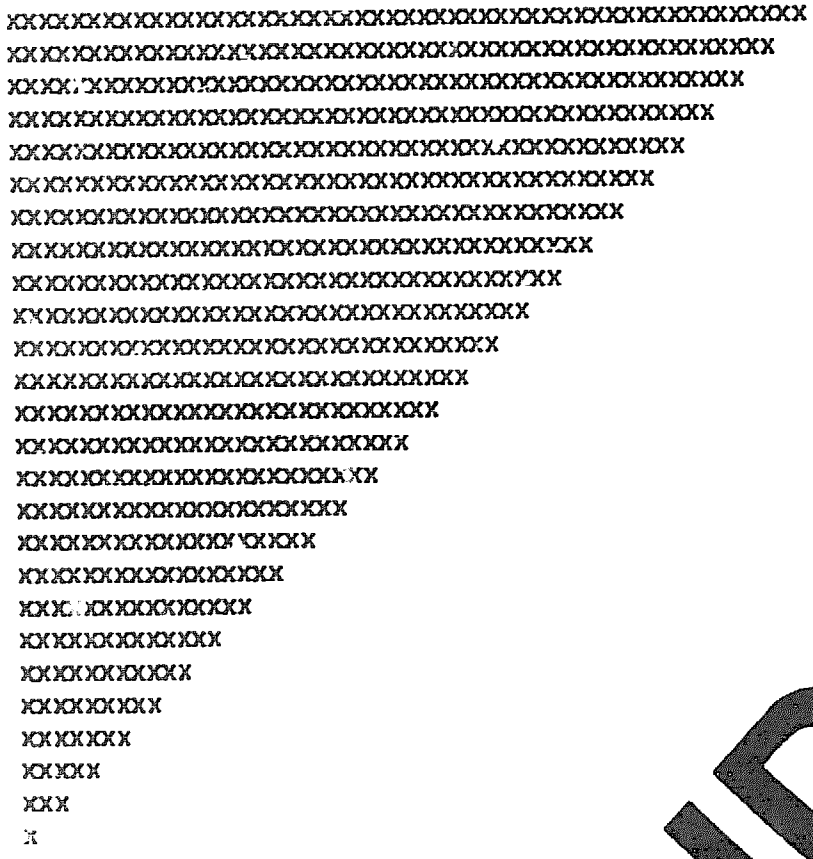


Figure 3–5 Removing the Top Drive Mounting Panel

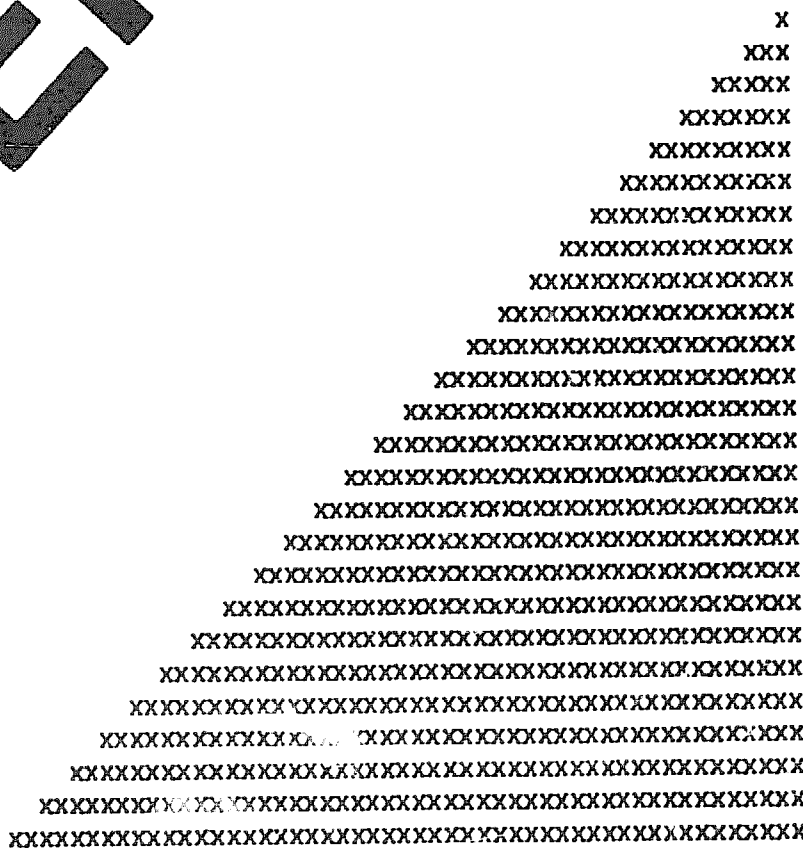
5. Remove the top drive mounting panel. Turn the drive mounting panel over and remove the four screws from the drive. Support the drive with one hand when removing the last screw.
6. Before you remount the drive, position the SCSI ID jumpers. Refer to Figures 1–3 and 1-4.
7. Refer to Section 1.5 for the procedure to replace the drive/module frame.

NOTE

Remember, if you are repairing an RZ24 drive, you must replace the drive/module and then the HDA. You cannot replace the entire drive option.



APPENDIX A



A
Recommended Spares

Table A–1 lists the spares and their part numbers for the RZ22, RZ23 and RZ24 disk drives.

Table A–1 RZ22/23/24 Recommended Spares

Part		Part Number
Drive		RZ22-E RZ23-E
Drive module PCBA	RZ22 RZ23 RZ24	29-27240-01 29-27240-01 29-28144-01
RZ24 HDA		29-28145-01
75 ohm terminator		29-26899-00
SCSI terminator		12-30552-01
External SCSI cable		17-02007-01
MSC (to system) cable		17-BH301-NP
Power cable extension cable		17-01397-01
Power cable extension cable		17-00342-01
MSC module PCB		54-17003-01
MMJ loopback connector		12-25083-01

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