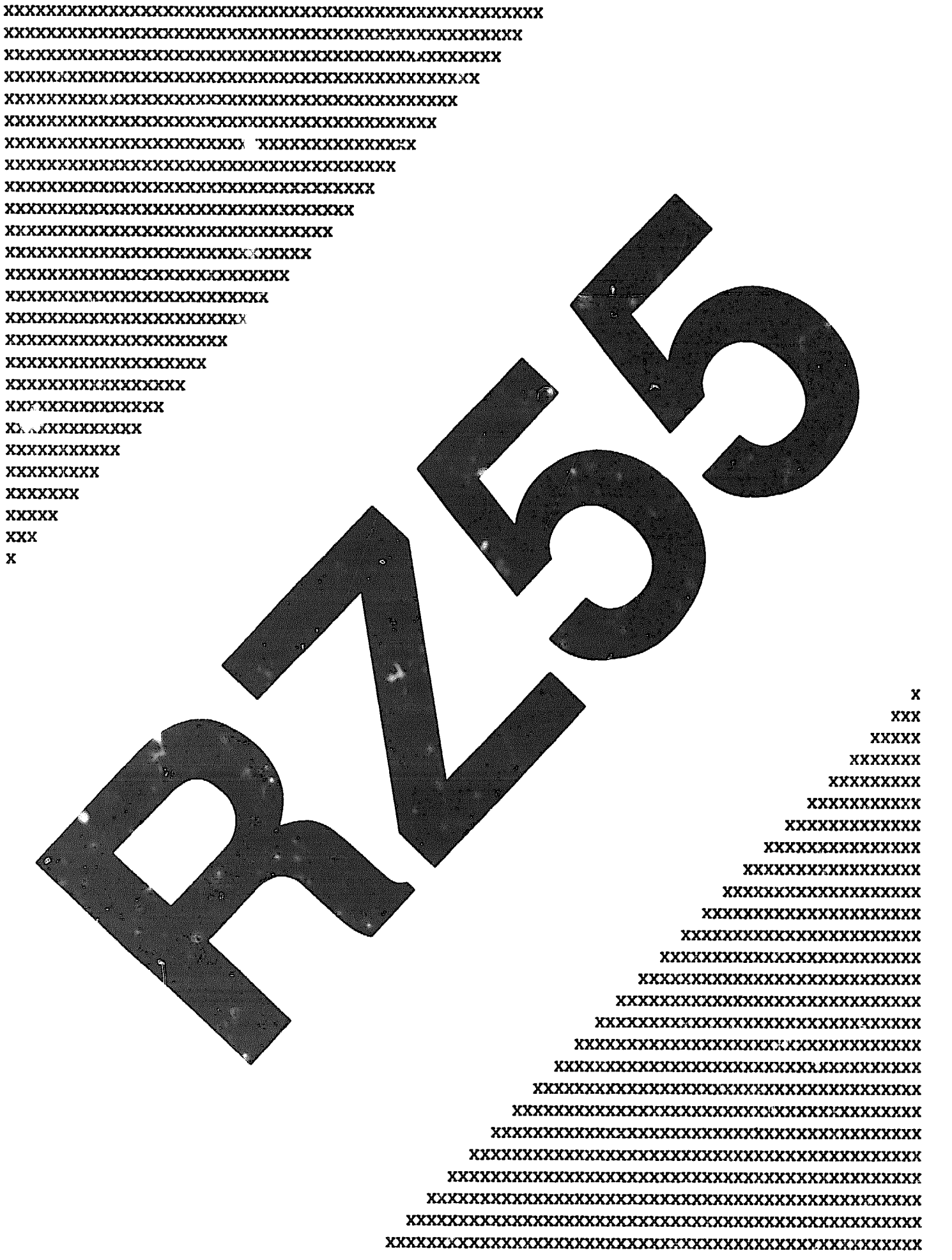

RZ55

RZ55 Disk Drive Subsystem Service Manual

Order Number EK-RZ55D-SV-001

digital equipment corporation
maynard, massachusetts

March, 1989

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 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 on equipment that is not supplied by Digital Equipment Corporation or its affiliated companies.

Copyright ©1989 by Digital Equipment Corporation.

All Rights Reserved.
Printed in U.S.A.

The following are trademarks of Digital Equipment Corporation:

digital™	DIBOL	TK50
DEC	Ethernet	TK70
DEC/CMS	MASSBUS	ULTRIX
DEC/MMS	PDP	UNIBUS
DECnet	PDT	VAX
DECstation	RRD40	VAXcluster
DECsystem-10	RSTS	VAXstation
DECSYSTEM-20	RSX	VMS
DECUS	ThinWire	VT
DECwriter		

Contents

About This Manual vii

1 About the RZ55 Disk Drive

1.1 Introduction 1–1
1.2 Configuration 1–3
1.3 Features 1–4
1.4 Specifications 1–4
1.5 FRU Removal and Replacement 1–6
1.5.1 Drive Bezel 1–6
1.5.2 Drive Module 1–8

2 Servicing the RZ55 Disk Drive in a DECstation 3100 System

2.1 Introduction 2–1
2.2 Troubleshooting the Drive in the System 2–1
2.2.1 Troubleshooting Checklist 2–2
2.2.2 Troubleshooting Flowchart 2–2
2.3 Using System Diagnostics 2–13
2.3.1 Power-On Self-Test (POST) 2–13
2.3.2 Self-Test 2–15
2.3.3 Interpreting POST and Self-Test Results 2–15
2.3.4 Console Extended Self-Tests 2–16
2.3.4.1 Preparing for Console Extended Self-Tests 2–16
2.3.4.2 Viewing Test Commands 2–16
2.3.4.3 Selecting a Test Mode 2–18
2.3.4.4 Running Console Extended Self-Tests 2–20

2.3.4.5 SII Test 2–20
2.3.5 SCSI Extended Self-Tests 2–23
2.3.5.1 Preparing for SCSI Extended Self-Tests 2–23
2.3.5.2 Viewing the Storage Device Listing 2–23
2.3.5.3 Running SCSI Extended Self-Tests 2–24
2.3.5.4 Using the SCSI Menu 2–25
2.3.5.5 Canned Disk Test 2–28
2.3.5.6 t1 Test 2–29
2.3.5.7 t2 Test 2–29
2.3.5.8 t3 Test 2–31
2.3.5.9 t4 Test 2–32
2.3.6 Interpreting the Status LED Codes 2–34
2.3.7 Installing Terminators and Loopback Connectors 2–35
2.4 Removing and Replacing the Drive in the System Expansion Box 2–37

3 Servicing the RZ55 Disk Drive in a VAXstation 3100 System

3.1 Introduction 3–1
3.2 Troubleshooting the Drive in the System 3–1
3.2.1 Troubleshooting Checklist 3–2
3.2.2 Troubleshooting Flowchart 3–3
3.3 Using System Diagnostics 3–12
3.3.1 Power-Up Test 3–13
3.3.2 Console Mode Testing 3–14
3.3.3 Self-Test 3–15
3.3.4 System Exerciser 3–15
3.3.4.1 SCSI Address ID Settings 3–17
3.3.4.2 STRG-1 and STRG-2 Codes 3–18
3.4 Removing and Replacing the Drive in the System Expansion Box 3–22

A Recommended Spares

Index

Examples

2–1 Successful POST Display 2–14
2–2 Sample Console Banner and Prompt 2–14
2–3 Diagnostic Options Menu 2–17
2–4 Test Mode Display 2–18
2–5 Sample SII Test Display 2–21
2–6 SCSI Storage Device List 2–24
2–7 SCSI Menu 2–25
2–8 Canned Disk Test Display 2–28
2–9 t1 Test Display 2–29
2–10 t2 Test Display 2–30
2–11 t3 Test Display 2–31
2–12 t4 Test Display 2–33
3–1 VAXstation 3100 Power-Up Screen Display 3–13
3–2 SHOW DEVICE Display 3–14
3–3 STRG-2 Display 3–18

Figures

1–1 RZ55 Disk Drive 1–2
1–2 RZ55 Drive Module Layout 1–3
1–3 RZ55 Drive Bezel Removal 1–7
1–4 RZ55 Drive Module Removal 1–9
2–1 DECstation 3100 System: RZ Troubleshooting Flowchart . . 2–3
2–2 DECstation 3100 Expansion Box: Cover Removal 2–37
2–3 DECstation 3100 Expansion Box: Shield Removal 2–38
2–4 DECstation 3100 Expansion Box: Drive Mounting Screw Removal 2–39
2–5 DECstation 3100 Expansion Box: SCSI Switch Cable Removal 2–40
2–6 DECstation 3100 Expansion Box: Cable Removal 2–41

2–7 DECstation 3100 Expansion Box: Drive Mounting Bracket Removal 2–42
3–1 VAXstation 3100 System: RZ55 Troubleshooting Flowchart 3–3
3–2 VAXstation 3100 Expansion Box: Cover Removal 3–22
3–3 VAXstation 3100 Expansion Box: Shield Removal 3–23
3–4 VAXstation 3100 Expansion Box: Drive Mounting Screw Removal 3–24
3–5 VAXstation 3100 Expansion Box: SCSI Switch Cable Removal 3–25
3–6 VAXstation 3100 Expansion Box: Cable Removal 3–26
3–7 VAXstation 3100 Expansion Box: Drive Mounting Bracket Removal 3–27

Tables

1–1 RZ55 Specifications 1–4
2–1 POST and Self-Test Codes 2–16
2–2 Test Modes 2–19
2–3 SCSI Tests 2–23
2–4 SCSI Commands 2–26
2–5 Status LED Display Codes 2–35
2–6 Test Mode Terminators 2–36
3–1 System Exerciser Diagnostic Commands 3–16
3–2 Transfer Test Drive Number (T000.0001) 3–19
3–3 SCSI Bus Controller Error Codes (0U00.XYZ1) (0000.00S1) 3–20
3–4 Drive Status Codes (0000.0R01) 3–21
A–1 RZ55 Recommended Spares A–1

About This Manual

The *RZ55 Disk Drive Subsystem Service Manual* provides information and procedures for servicing the RZ55 disk drive in a variety of host systems.

Structure of This Manual

Chapter 1, About the RZ55 Disk Drive, describes the RZ55 disk drive. This chapter also lists the specifications of the drive and how to replace the drive module.

Chapter 2, Servicing the RZ55 Disk Drive in a DECstation 3100 System, describes servicing the RZ55 disk drive in the DECstation 3100 desktop system. This chapter briefly describes the DECstation 3100 system, how to troubleshoot the drive, 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 expansion box.

Chapter 3, Servicing the RZ55 Disk Drive in a VAXstation 3100 System, describes servicing the RZ55 disk drive in the VAXstation 3100 desktop system. This chapter briefly describes the VAXstation 3100 system, how to troubleshoot the drive, 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 expansion box.

Appendix A, Recommended Spares, lists the recommended spares for the RZ55 disk drive.

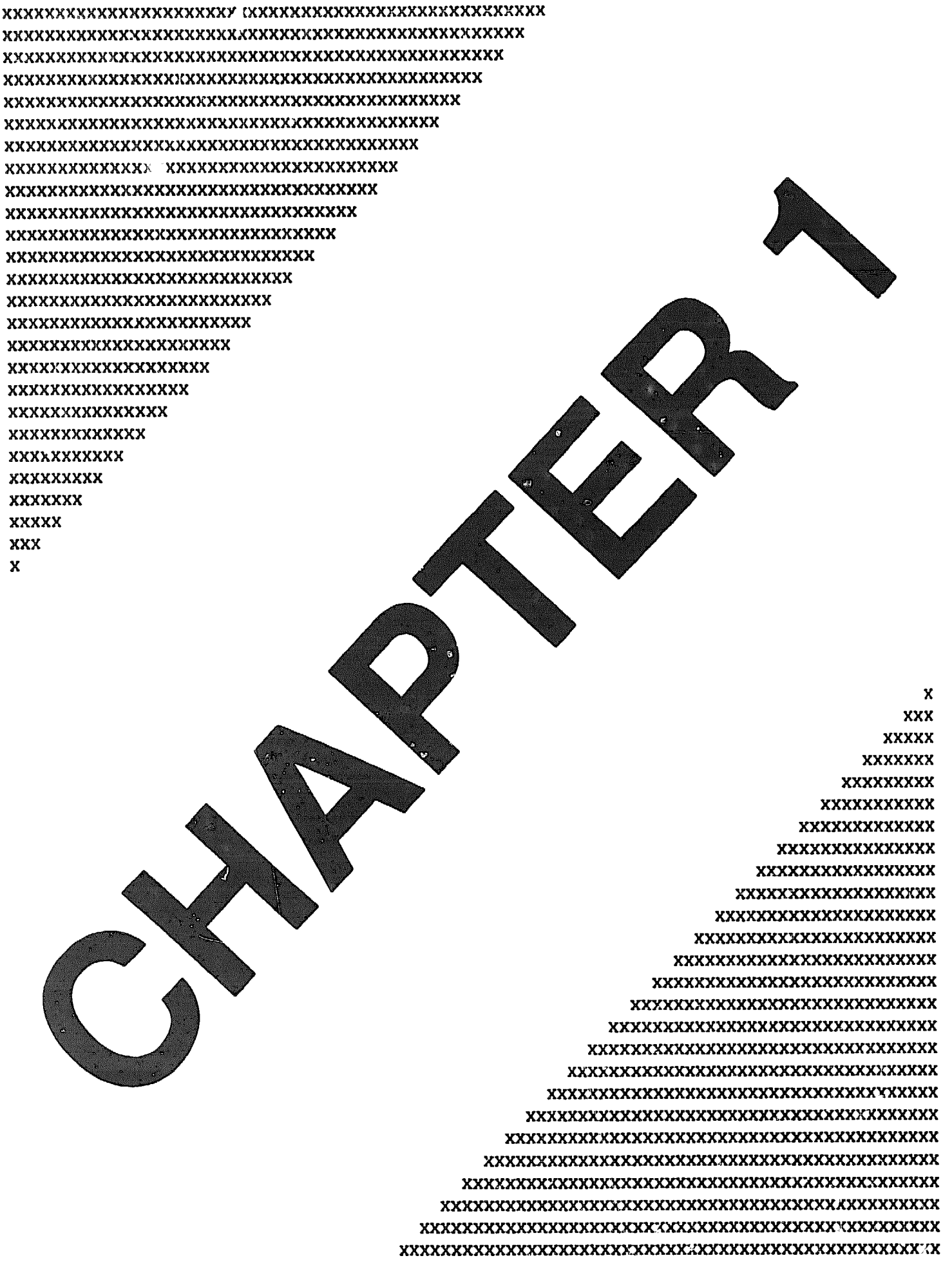
Intended Audience

This manual is intended for Digital Field 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
VAXstation 3100 Maintenance Guide	EK-285AA-MG


CHAPTER 1

1
About the RZ55 Disk Drive

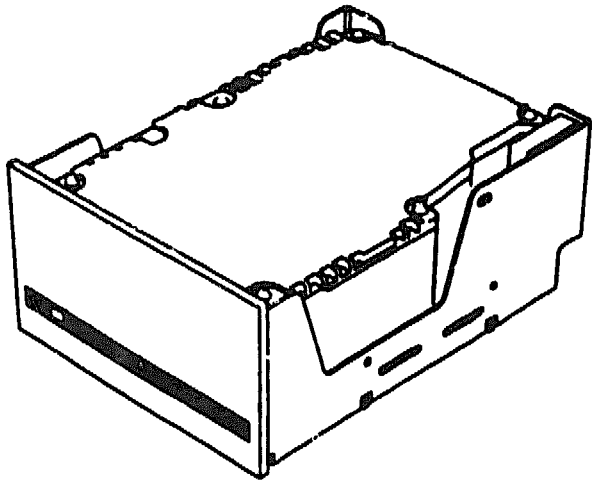
1.1 Introduction

The RZ55 hard disk drive (332 Mbytes) is a high-performance, 5.25-inch drive. It has a small computer system interface (SCSI) that conforms to the common command set (CCS).

The drive is a random access, rotating memory device. It stores data in fixed-length blocks on 130-mm thin film, rigid media disks. The storage medium in the drive is in a fixed, nonremovable head/disk assembly (HDA).

The RZ55 disk drive is for use in Digital products such as low-end desktop and workstation systems to provide the capability of random access data storage and retrieval.

The RZ55 disk drive (Figure 1–1) consists of two field replaceable units (FRUs): the RZ55 option itself and the drive module.



MA-X1047-88

Figure 1–1 RZ55 Disk Drive

1.2 Configuration

The RZ55 disk drive is not internally terminated. The SCSI bus must be terminated. Therefore, termination must be done within the host system itself. Figure 1–2 shows the location of the termination resistors on the RZ55 drive module. See the system chapters that follow for information on the correct termination of the SCSI bus.

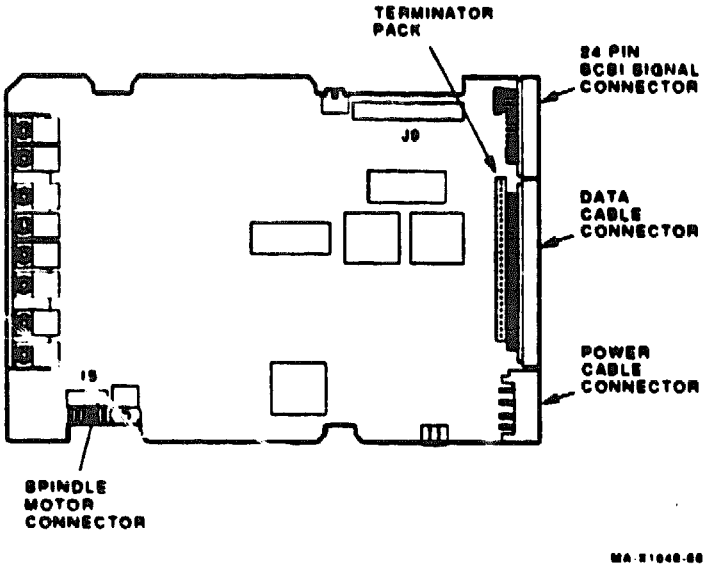


Figure 1–2 RZ55 Drive Module Layout

CAUTION
Make sure the drive is not internally terminated. The terminating resistors are just behind the SCSI port connector (Figure 1–2). If the terminating resistors are installed on the drive module, remove them with needlenose pliers.

1.3 Features

The RZ55 disk drive has the following features:

- Internal air filtration
- 512-byte block
- 64-Kbyte data buffer
- No preventative maintenance
- Factory formatted
- Resident diagnostics for power-on self-test
- Automatic error correction and retries
- High-performance rotary coil actuator with dedicated servo system
- Two-piece FRU: the RZ55 option and the drive module

1.4 Specifications

Table 1–1 lists the physical, functional, performance, and environmental specifications of the RZ55 disk drive.

Table 1–1 RZ55 Specifications

Physical Specifications	
Height	8.26 cm (3.25 in)
Width	14.6 cm (5.75 in)
Depth	20.8 cm (8.20 in)
Weight	3.80 kg (8.40 lb)

Functional Specifications	
Interface	SCSI
Recording density (BPI at ID)	21,231
Flux density (FCI at ID)	14,154
Track density (TPI)	1,075
Tracks per surface (unformatted)	1,224
Read/write heads	15
Disks	8
Time to process ECC (512 bytes)	<100 ms

Table 1–1 (Cont.) RZ55 Specifications

Performance Specifications	
Formatted storage capacity	
Per drive	332.30 Mbytes
Per surface	22.48 Mbytes
Bytes per track	18,432
Blocks per drive	649,040
Blocks per track	36
Bytes per block	512
Spare blocks per cylinder	8
Spare blocks per drive	10,300
Transfer rate (to/from media)	1.25 Mbytes/s
Bus asynchronous	1.50 Mbytes/s
Bus synchronous	4.00 Mbytes/s
Seek time	
Track to track	4 ms maximum
Average	16 ms maximum
Maximum (full stroke)	35 ms maximum
Average latency	8.30 ms
Bus latency	600 µs maximum
Rotational speed	3,600 r/min
Start time (maximum)	20 s
Stop time (maximum)	20 s
Interleave	1:1

Table 1–1 (Cont.) RZ55 Specifications

Environmental Specifications	
Ambient temperature	
Operating	10°C to 55°C (55°F to 131°F)
Nonoperating	-40°C to 66°C (-40°F to 151°F)
Relative humidity	
Operating	8% to 80%
Nonoperating (packaged)	8% to 95%
Altitude	
Operating	-305 m to 4,572 m (-1,000 ft to 15,000 ft)
Nonoperating	-305 m to 12,192 m (-1,000 ft to 40,000 ft)
Heat dissipation	
Operating	28 W (Btu/hr) typical
Random seek mode	32 W (Btu/hr)

1.5 FRU Removal and Replacement

To remove and replace the RZ55 disk drive in the host system expansion box, see the appropriate chapter in this manual or the maintenance guide for that system.

To remove and replace the drive module, perform the procedures in Section 1.5.1 and Section 1.5.2, respectively.

1.5.1 Drive Bezel

Once you have removed the drive from the system expansion box, perform the following procedure to remove the bezel from the drive (Figure 1–3):

CAUTION
Use care when handling the drive. Be sure to wear an antistatic wrist strap and do not touch the exposed face of the drive module.

1. Orient the drive with the module face up, and turn the drive so the bezel is facing away from you.
2. Unplug the LED flex cable from J11.

3. Hold the sides of the bezel with the palms of your hands, with your fingers resting on the front of the bezel. Next, position your thumbs on the back of the bezel above the locking pins.
4. Carefully apply outward pressure to the bezel with your thumbs until the two bezel locking pins clear the holes in the frame. Note that the bezel must flex about 1/8 inch to clear the pins.
5. While the bezel is flexed, slide it upward until movement stops (about 3/8 inch). This frees the upper bezel clips from the upper frame slots.
6. Push the bezel away from the drive. This frees the lower bezel clips from the lower frame slots and releases the bezel.

To replace the bezel on the drive, reverse this procedure.

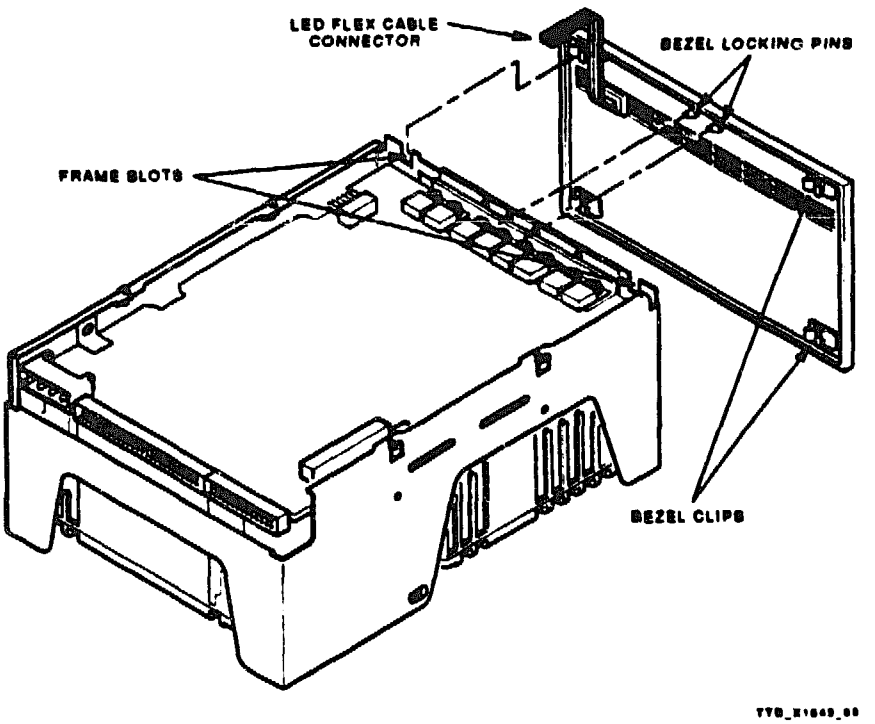


Figure 1–3 RZ55 Drive Bezel Removal

1.5.2 Drive Module

Once you have removed the bezel from the drive, perform the following procedure to remove the drive module (Figure 1–4).

CAUTIONS

Use care when handling the drive. Be sure to wear an antistatic wrist strap and do not touch the exposed face of the drive module.

Make sure the drive is not internally terminated. The terminating resistors are just behind the SCSI port connector (Figure 1–2). If the terminating resistors are installed on the drive module, remove them with needlenose pliers.

1. Remove the screws labeled 1, 2, 3, and 4.
2. Unplug the spindle motor connector at J5.
3. Unplug the preamplifier cable connector at the auxiliary board.

NOTE

When setting the drive back on the work surface, place a support under the drive to protect the loose preamplifier cable and connector.

4. Lift the drive module and the auxiliary board up and out of the drive.
5. Remove the screw and speednut holding the drive module.
6. Unplug the auxiliary board from J9 on the drive module.
7. Exchange the bad module with the replacement module, and check the module configuration.

To replace the drive module, reverse this procedure.

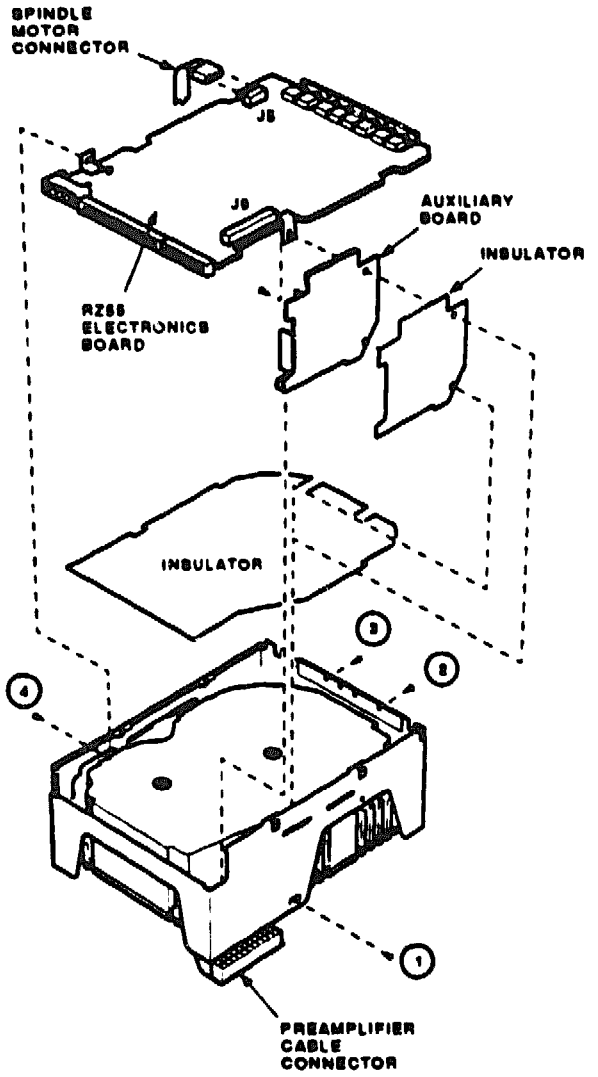
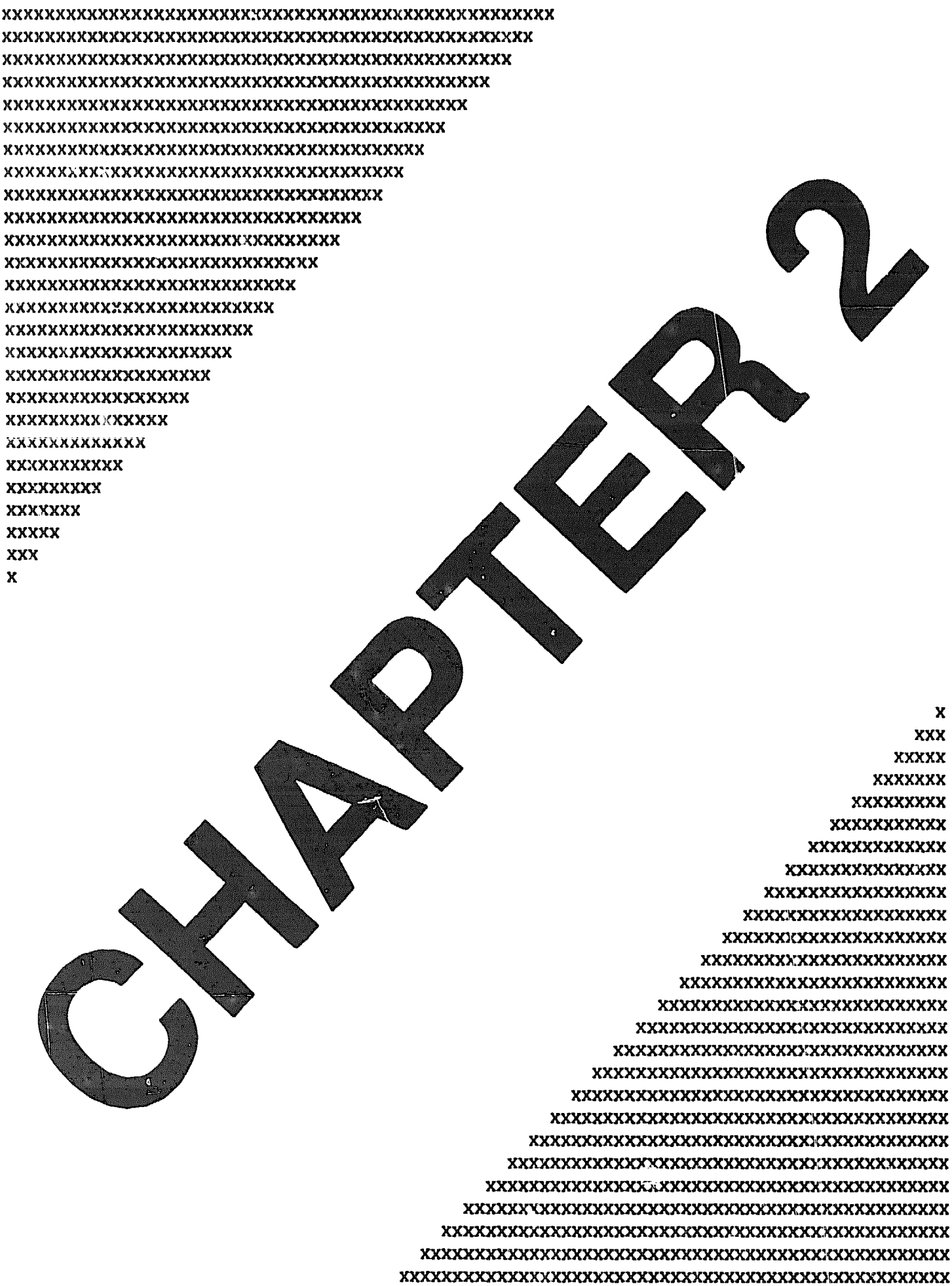


Figure 1–4 RZ55 Drive Module Removal


CHAPTER 2

2
Servicing the RZ55 Disk Drive in a DECstation 3100 System

2.1 Introduction

The DECstation 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 an SCSI bus interface for the RZ55 disk drive.

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 Drive in the System

To troubleshoot the RZ55 disk drive, 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 RZ55 disk drive depends on the system software diagnostics for troubleshooting. See the *DECstation 3100 Maintenance Guide* for the types of software diagnostics available on the system, and how to run them.

To troubleshoot the RZ55 disk drive on the SCSI bus and SCSI controller in a DECstation 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 RZ55 disk drive 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 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 3100 system. The flowchart uses the ULTRIX operating system and extended self-tests to troubleshoot the drive.

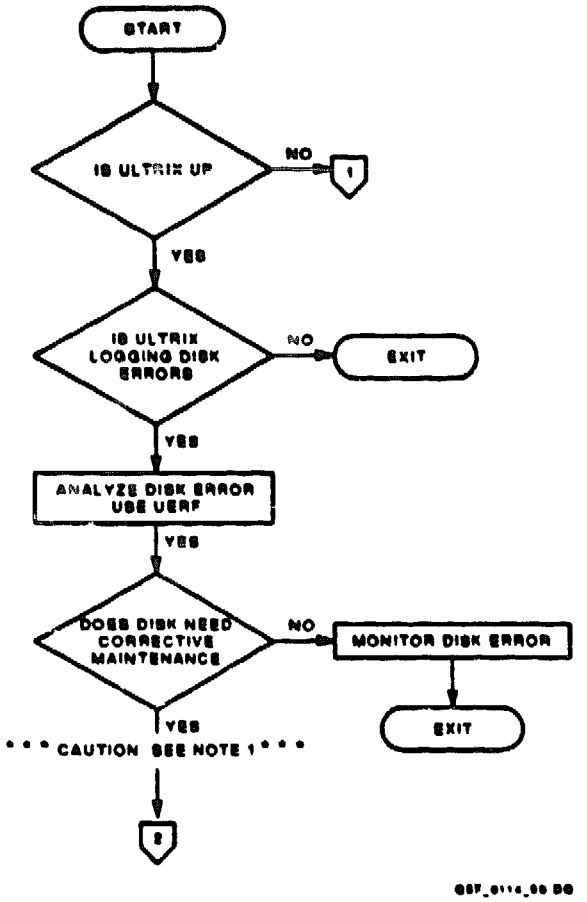
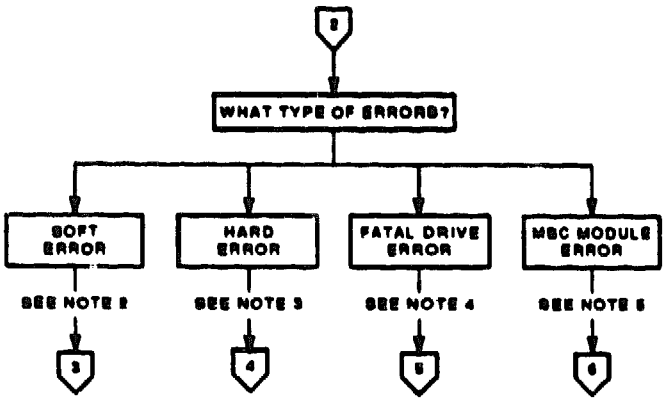


Figure 2–1 (Cont.) DECstation 3100 System: RZ Troubleshooting Flowchart



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

GSF_0116_89.DG

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

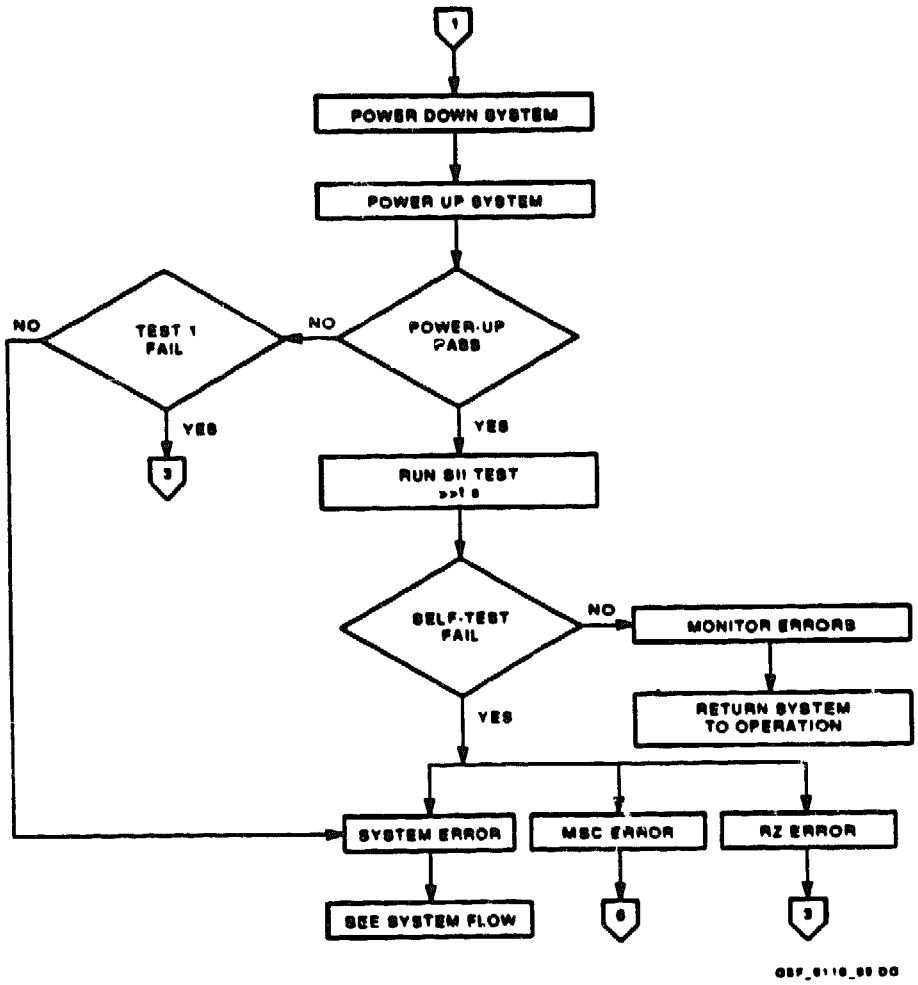


Figure 2–1 (Cont.) DECstation 3100 System: RZ Troubleshooting Flowchart

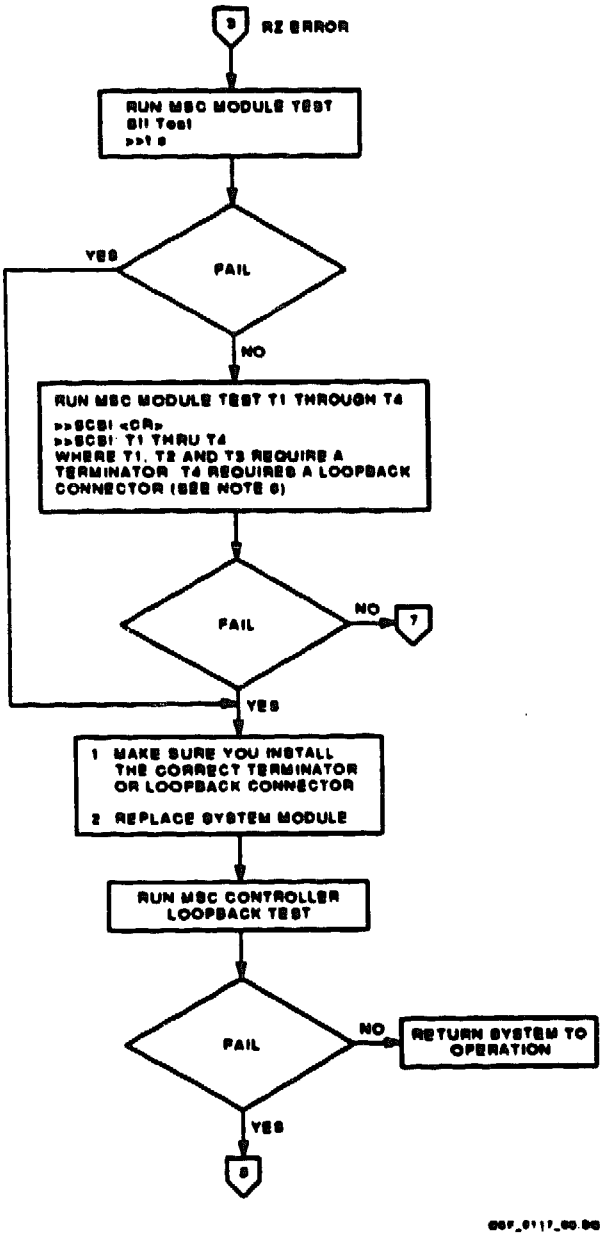


Figure 2–1 (Cont.) DECstation 3100 System: RZ Troubleshooting Flowchart

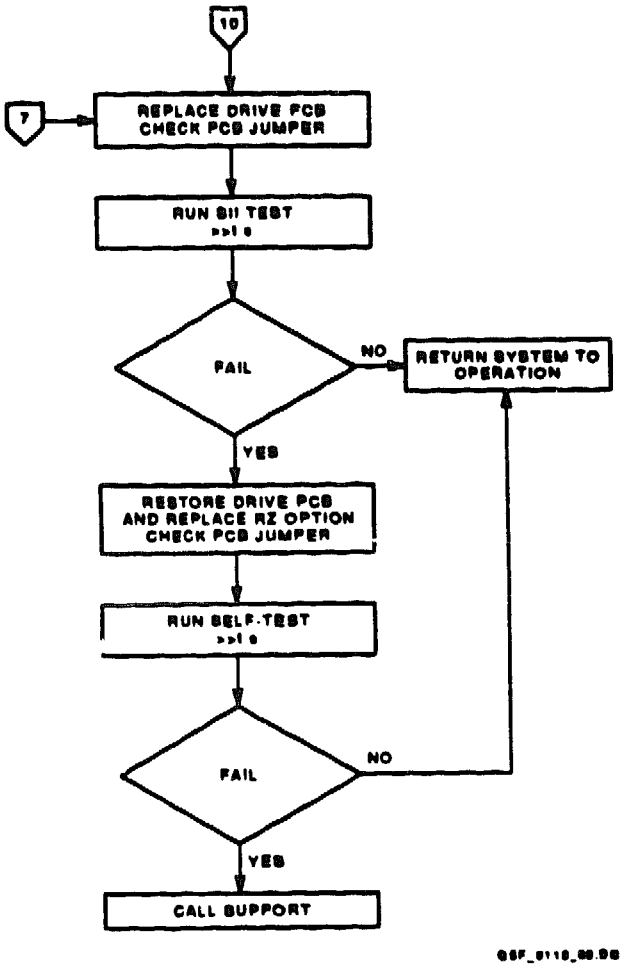


Figure 2–1 (Cont.) DECstation 3100 System: RZ Troubleshooting Flowchart

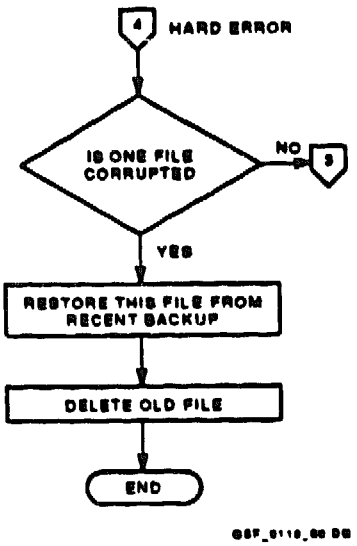


Figure 2–1 (Cont.) DECstation 3100 System: RZ Troubleshooting Flowchart

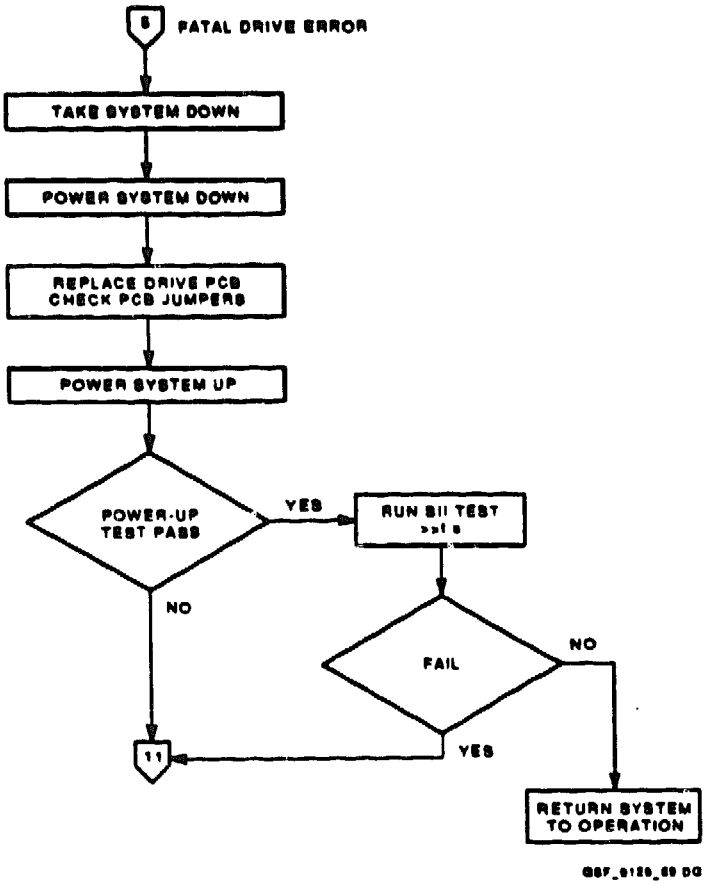


Figure 2–1 (Cont.) DECstation 3100 System: RZ Troubleshooting Flowchart

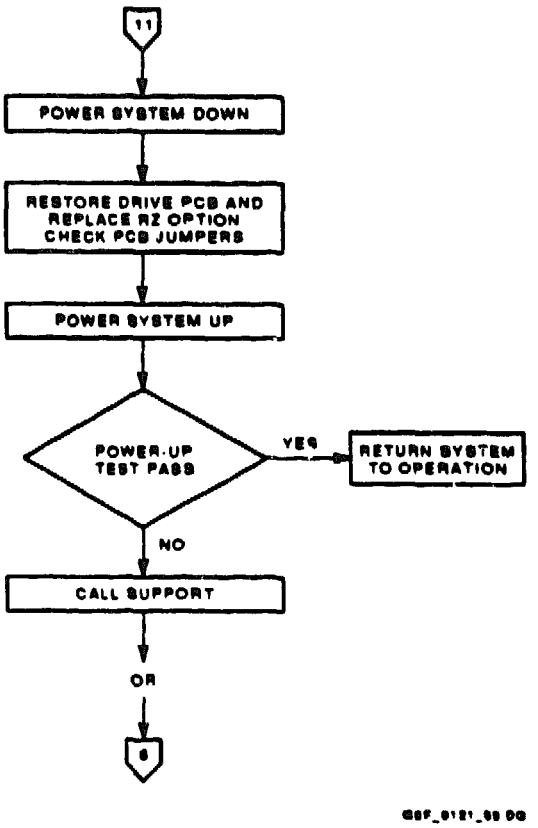
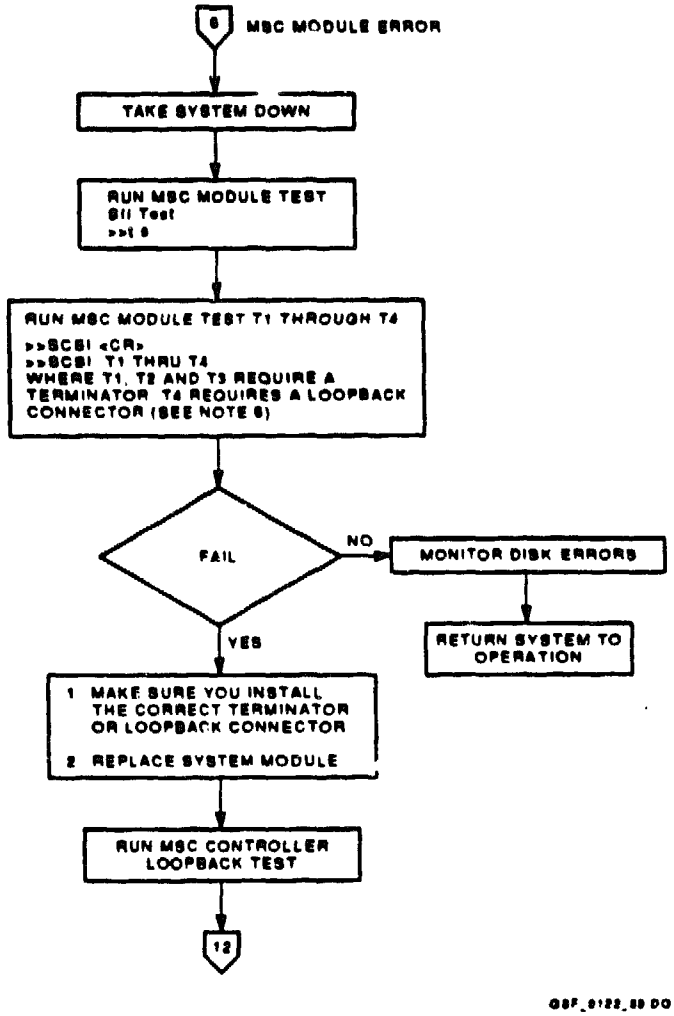


Figure 2–1 (Cont.) DECstation 3100 System: RZ Troubleshooting Flowchart



GSF_0122_89.DG

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

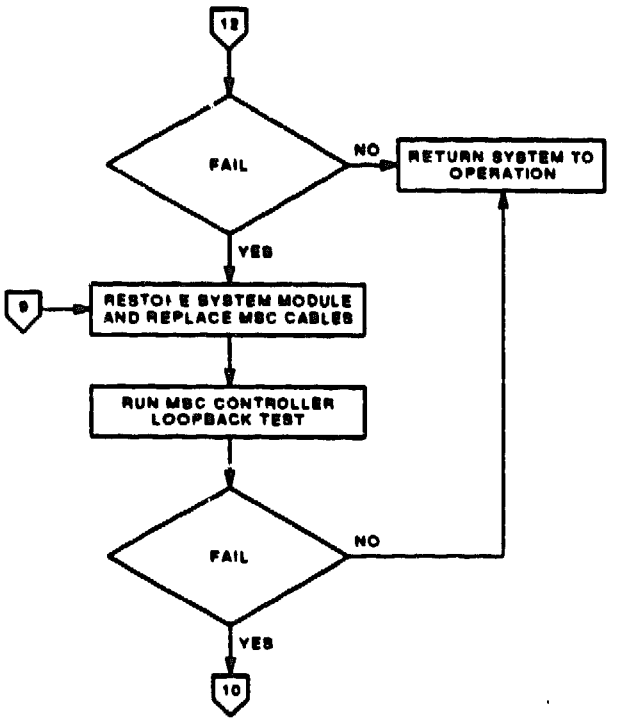


Figure 2–1 DECstation 3100 System: RZ Troubleshooting Flowchart

2.3 Using System Diagnostics

This section describes how to run and interpret the diagnostics that are available to diagnose the RZ55 disk drive in the DECstation 3100 system:

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

If the system you are testing is experiencing 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 3100 system, you can type the DECstation 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 3100 monitor appears on the alternate console. If using a monitor as an alternate console, you can use either the DECstation 3100 workstation or the alternate console keyboard to type commands.

To connect an alternate monitor or printer to the DECstation 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 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  V6.5
7..6..5..4..3..2..1..0
16Mb.........0
>>
```

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. The message FAILURE-RESET TO CONTINUE flashes on the screen.

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 word FAILURE 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 is done 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
  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 modes, type:

```
t M d
```

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

```
user mode
no loop on error
halt test on error
```

Example 2–4 Test Mode Display

NOTE
The default modes are User, No Loop On Error, and Halt Test 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 an SCSI terminator if an SCSI device is installed. It requires an 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:

```
MOUSE ERROR - failed self-test
```

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.

```
  SII buffer address test
  Writing entire buffer with 4 patterns
  SII buffer address testing
  Checking SII buffer for 0
  SII entire buffer testing
  Checking SII buffer for aaaa
  SII entire buffer testing
  Checking SII buffer for 5555
  SII entire buffer testing
  Checking SII buffer for ffff
  SII entire buffer testing
targetTest: setting STLP to 4
targetTest: building out-bound cmd/dat
targetTest: setting loopback mode
targetTest: enabling selections and parity checking
targetTest: setting id to 7
targetTest: enabling dssi mode
targetTest: fudging device 0 select of device 7
targetTest: disasserting select
targetTest: sending cmd[0]
targetTest: sending cmd[1]
targetTest: sending cmd[2]
targetTest: sending cmd[3]
targetTest: sending cmd[4]
targetTest: sending cmd[5]
targetTest: sending cmd[6]
targetTest: sending data[0]
targetTest: sending data[1]
targetTest: sending data[2]
targetTest: sending data[3]
targetTest: sending data[4]
targetTest: sending data[5]
targetTest: sending data[6]
targetTest: sending data[7]
targetTest: sending data[8]
targetTest: sending data[9]
targetTest: sending data[10]
targetTest: receiving status
targetTest: checking buffer status
targetTest: checking data bytes
target test passed
```

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

```
SII initiator mode internal loopback test
initiator test: creating out-bound packet at bb000020
initiator test: setting ILP to 4
initiator test: setting loopback mode
initiator test: enabling selections and parity checking
initiator test: setting ID to 7
initiator test: fudging arb win
initiator test: enabling dssi mode
initiator test: responding to selection w/ BSY and CD
initiator test: receiving cmd[0]
initiator test: receiving cmd[1]
initiator test: receiving cmd[2]
initiator test: receiving cmd[3]
initiator test: receiving cmd[4]
initiator test: receiving cmd[5]
initiator test: receiving cmd[6]
initiator test: changing to data phase
initiator test: receiving data[0]
initiator test: receiving data[1]
initiator test: receiving data[2]
initiator test: receiving data[3]
initiator test: receiving data[4]
initiator test: receiving data[5]
initiator test: receiving data[6]
initiator test: receiving data[7]
initiator test: receiving data[8]
initiator test: receiving data[9]
initiator test: receiving data[10]
initiator test: changing to status phase
initiator test: disconnecting
initiator test: checking buffer status
initiator test: checking CSTAT

initiator test: clearing interrupt
initiator test passed
Starting scan for SCSI devices
Starting SCSI device testing
Executing self-test on unit 1
Self-test on unit 1 passes
```

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.

```
Unit[7]
Unit[6]KN01--SII
Unit[5]
Unit[4]
Unit[3] Device type  0 DISK
          RMB                       0x0
          Version                   1
          Response data format      1 CCS
          Additional length         31
          Vendor                    DEC
          Product identification    RZ55     (C) DEC
          Firmware revision level   0618
Unit[2]
Unit[1]
Unit[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
       st                      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-loopack 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>.
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>.

Table 2–4 (Cont.) SCSI Commands

Command	Description
sn	This command is an SCSI request sense command and provides additional information about an SCSI device that fails an extended self-test. Issue this command immediately after the device fails. If you issue another command that performs an 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 a 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 an SCSI loopback connector or an 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.

```
SII buffer address test
Writing entire buffer with 4 patterns
SII buffer address testing
Checking SII buffer for 0
SII entire buffer testing
Checking SII buffer for aaaa
SII entire buffer testing
Checking SII buffer for 5555
SII entire buffer testing
Checking SII buffer for ffff
SII entire buffer testing
```

Example 2–9 t1 Test Display

Suggested Action

If an error occurs during this test:

1. Make sure you installed the correct terminators or 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 an SCSI terminator. You do not need an 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:

```
targetTest: setting STLP to 4
targetTest: building out-bound cmd/data
targetTest: setting loopback mode
targetTest: enabling selections and parity checking
targetTest: setting id to 7
targetTest: enabling dssi mode
targetTest: fudging device 0 select of device 7
targetTest: disasserting select
targetTest: sending cmd[0]
targetTest: sending cmd[1]
targetTest: sending cmd[2]
targetTest: sending cmd[3]
targetTest: sending cmd[4]
targetTest: sending cmd[5]
targetTest: sending cmd[6]
targetTest: sending data[0]
targetTest: sending data[1]
targetTest: sending data[2]
targetTest: sending data[3]
targetTest: sending data[4]
targetTest: sending data[5]
targetTest: sending data[6]
targetTest: sending data[7]
targetTest: sending data[8]
targetTest: sending data[9]
targetTest: sending data[10]
targetTest: receiving status
targetTest: checking buffer status
targetTest: checking data bytes
target test passed
```

Example 2–10 t2 Test Display

Suggested Action

If an error occurs during this test:

1. Make sure you installed the correct terminators or 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 an SCSI terminator. You do not need an 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.

```
SII initiator mode internal loopback test
initiator test: creating out-bound packet at bb000020
initiator test: setting ILP to 4
initiator test: setting loopback mode
initiator test: enabling selections and parity checking
initiator test: setting ID to 7
initiator test: fudging arb win
initiator test: enabling dssi mode
initiator test: responding to selection w/ BSY and CD
initiator test: receiving cmd[0]
initiator test: receiving cmd[1]
initiator test: receiving cmd[2]
initiator test: receiving cmd[3]
initiator test: receiving cmd[4]
initiator test: receiving cmd[5]
initiator test: receiving cmd[6]
initiator test: changing to data phase
initiator test: receiving data[0]
initiator test: receiving data[1]
initiator test: receiving data[2]
initiator test: receiving data[3]
initiator test: receiving data[4]
initiator test: receiving data[5]
initiator test: receiving data[6]
initiator test: receiving data[7]
initiator test: receiving data[8]
initiator test: receiving data[9]
initiator test: receiving data[10]
```

Example 2–11 (Cont.) t3 Test Display

```
initiator test: changing to status phase
initiator test: disconnecting
initiator test: checking buffer status
initiator test: checking CSTAT
initiator test: clearing interrupt
initiator test passed
```

Example 2–11 t3 Test Display

Suggested Action

If an error occurs during this test:

1. Make sure you installed the correct terminators or 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 an 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 an 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.

```
SII external drive loopback test
checking for presence of SCSI port loopback
walking ones thru SC1 -> sdb loop
killing ext loopback mode between tests
disabling ext drivers between tests
 rezeroing sdb and SC1 regs
data path to SC1 loopback passes
testing ext drv for control signals
 enabling initiator drivers
 enabling target drivers
 enabling arbitration drivers
passes external drive test
```

Example 2–12 t4 Test Display

Interpret the "Loopback not found" error message as follows:

```
error message: external loopback not found xxxx yyyy
```

where xxxx is the expected data (0x1FF), and yyyy is the 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 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 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 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 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.) • An 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.) • An SCSI terminator if an SCSI device is installed • An SCSI loopback connector for the SCSI t4 test • Serial line loopback connectors for the communications and printer/console ports

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

2.4 Removing and Replacing the Drive in the System Expansion Box

Perform the following procedure to remove and replace the RZ55 disk drive in the DECstation 3100 expansion box (BA40). For details not covered in this manual, see the maintenance guide for the DECstation 3100 system.

1. Shut off the power to the expansion box and unplug the expansion box. Next, disconnect the SCSI port cable.
2. Unscrew the four cover screws and remove the expansion box cover (Figure 2–2).

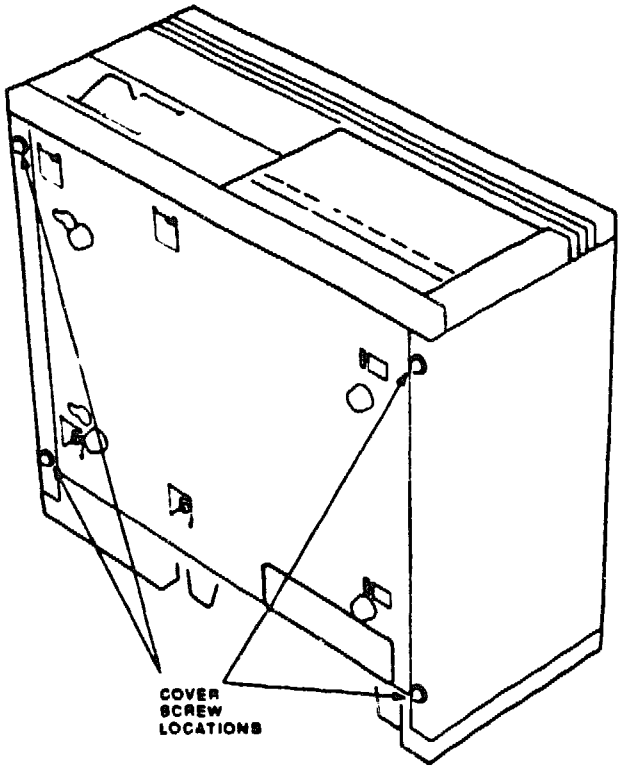


Figure 2–2 DECstation 3100 Expansion Box: Cover Removal

3. Remove the three screws that hold the shield to the main chassis (Figure 2–3) and lift the shield up and off.

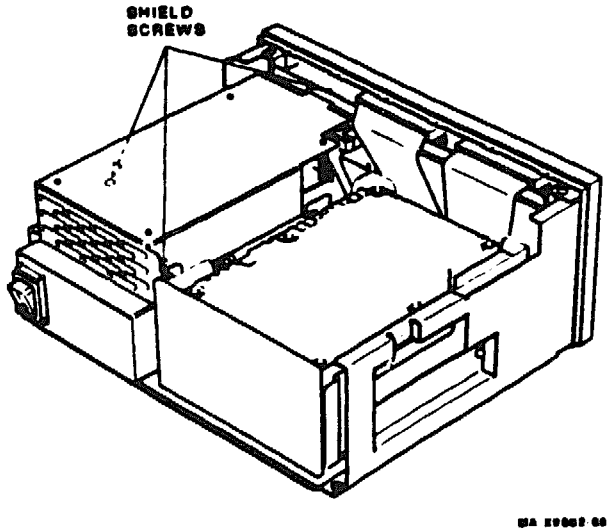


Figure 2–3 DECstation 3100 Expansion Box: Shield Removal

4. **Remove the three drive mounting screws (Figure 2–4).**

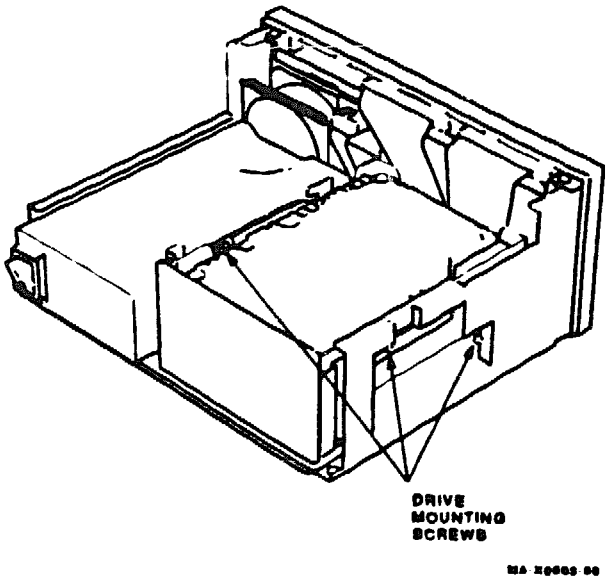


Figure 2–4 DECstation 3100 Expansion Box: Drive Mounting Screw Removal

5. **Remove the SCSI switch cable from the SCSI switch board (Figure 2–5).**

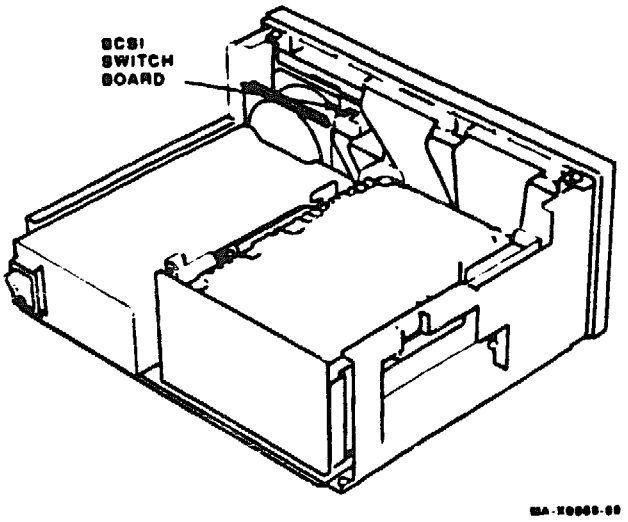


Figure 2–5 DECstation 3100 Expansion Box: SCSI Switch Cable Removal

6. Slide the drive halfway out of the expansion box and disconnect the power cable, data cable, and SCSI switch cable from the back of the drive. Then remove the drive (Figure 2–6).

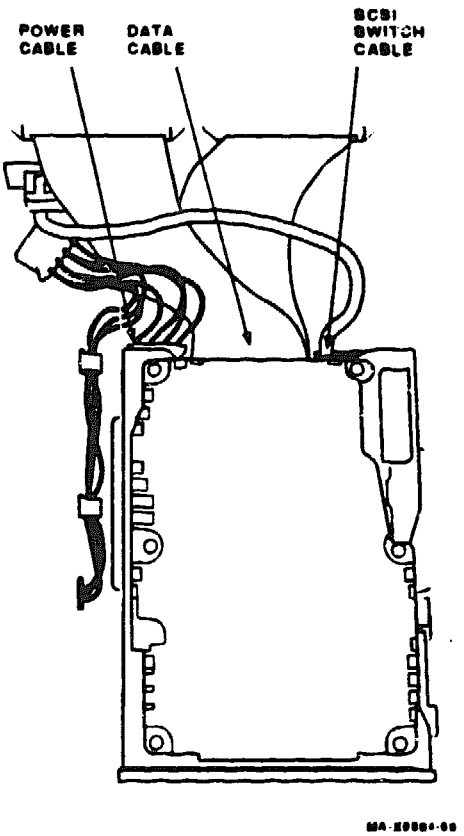


Figure 2–6 DECstation 3100 Expansion Box: Cable Removal

7. Once the drive is free from the expansion box, remove the mounting bracket screws (Figure 2–7) and remove the mounting brackets.

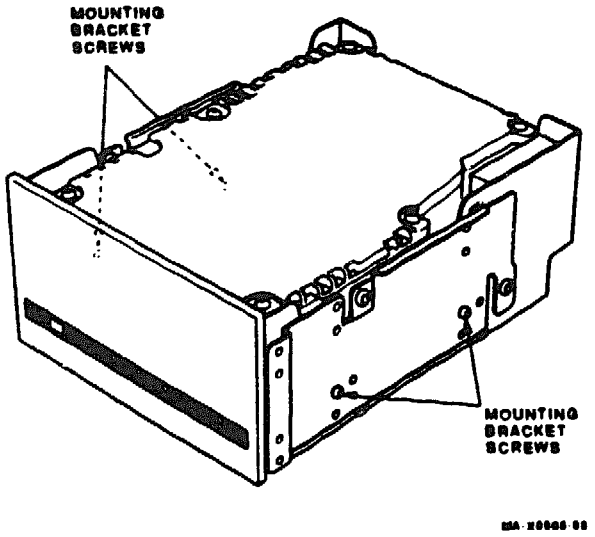
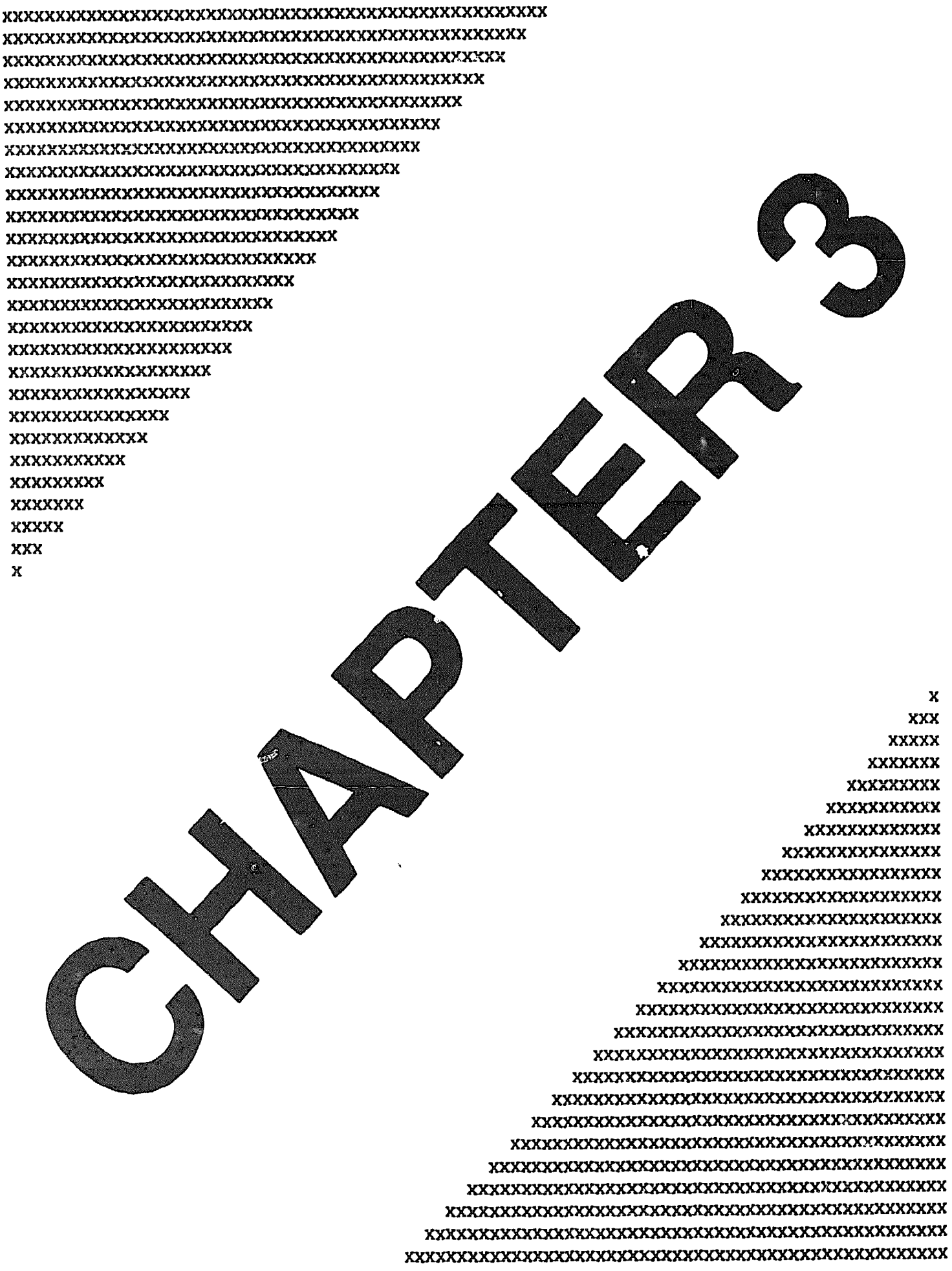


Figure 2–7 DECstation 3100 Expansion Box: Drive Mounting Bracket Removal

To replace the drive in the expansion box, install the mounting brackets removed in step 7 on the replacement drive (Figure 2–7) and reverse this procedure.

To continue FRU removal and replacement for the RZ55 disk drive, see Section 1.5 for the drive bezel and drive module procedures.


CHAPTER 3

3
Servicing the RZ55 Disk Drive in a VAXstation 3100 System

3.1 Introduction

The VAXstation 3100 has two versions: model 30 and model 40. Model 30 has only one SCSI interface and can support three external devices: one RZ55 disk drive, one TK50 tape drive, and one RRD40 optical disc drive. Model 40 has two SCSI interfaces (A and B) and can support four external devices: up to two RZ55 disk drives, one TK50 tape drive, and one RRD40 optical disc drive.

The VAXstation 3100 system is housed in a VS42A enclosure. The RZ55 disk drive (or drives) along with the other drives mentioned are in a BA40 expansion box, in a daisy-chain configuration.

The SCSI port on the back of the system enclosure has a plastic cover over it. 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 (SCSI port on the expansion box is at the rear of the box).

3.2 Troubleshooting the Drive in the System

To troubleshoot the RZ55 disk drive, follow the same basic procedures as for any other disk drive. Check or look for the type of failures that are common to faulty disk drives. See Section 3.2.1 for a checklist of items to examine for determining whether the drive is faulty.

The RZ55 disk drive depends on the system software diagnostics for troubleshooting. See the *VAXstation 3100 Maintenance Guide* for the types of software diagnostics available on the system, and how to run them.

To troubleshoot the RZ55 disk drive on the SCSI bus and the SCSI controller in VAXstation 3100 systems, use the following tools:

Checklist (Section 3.2.1)
Flowchart (Section 3.2.2)
Diagnostics (Section 3.3)

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

3.2.1 Troubleshooting Checklist

Before performing RZ55 removal procedures, check the items in the following list to determine if the drive is faulty:

- Make sure the expansion box has power and is switched on.
- Check the SCSI termination on the expansion box.
- Make sure the SCSI port cable is correctly connected to the SCSI port and to the back of the expansion box.
- Run the self-test and system exerciser.
- If the problem returns, unplug the SCSI port cable and run the self-test (Test 6). If a status code other than **FFFFFF05** appears for the RZ55 drive, then replace the mass storage controller (MSC) module.
- If the status code is **FFFFFF05**, check the address ID on the expansion box for the correct setting.
- If the address ID is set correctly, make sure the power supply in the expansion box is operating correctly.
- If the power supply is good, then replace the RZ55 drive module first, then the entire drive.

3.2.2 Troubleshooting Flowchart

Figure 3–1 outlines the process for troubleshooting the RZ55 drive itself. *RZ DIAGS*, or RZ diagnostics, are software tests that run on the system to test the drive.

The flowchart first uses the VMS operating system to troubleshoot the drive. By using the SHOW and ANALYZE commands, you can look for disk drive errors. Then the flowchart uses the VAXstation 3100 system exerciser. By using various tests, you can again look for disk drive errors.

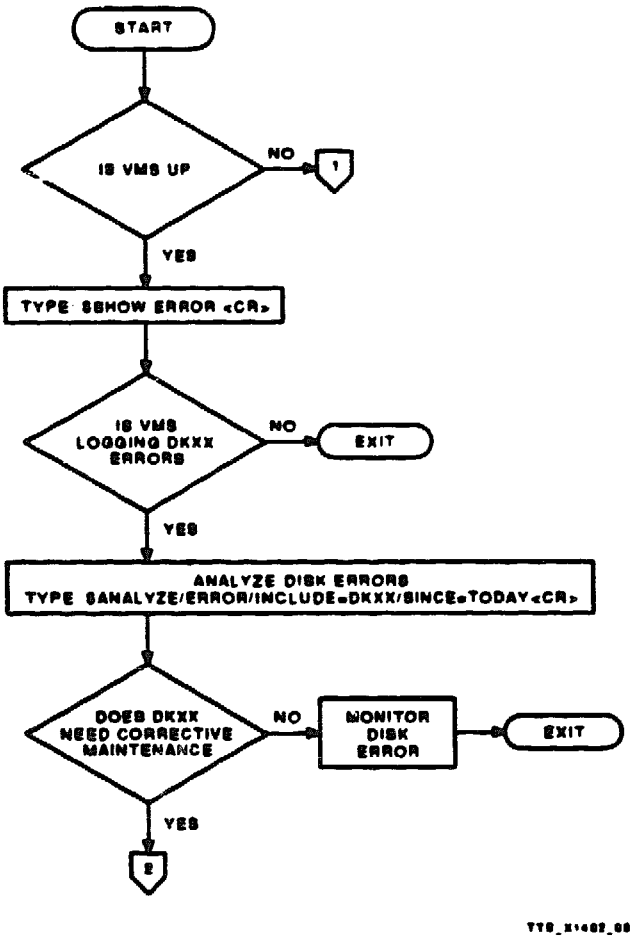
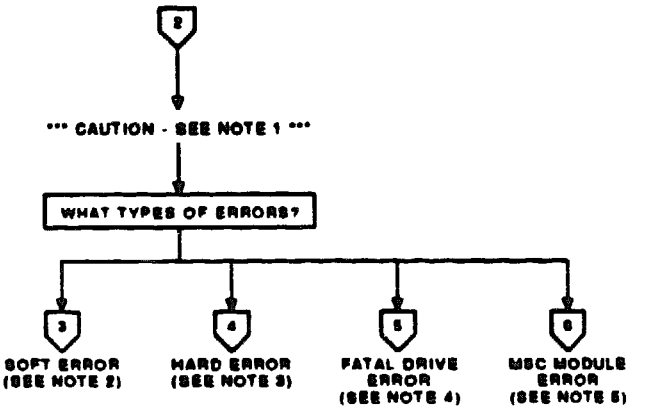


Figure 3–1 (Cont.) VAXstation 3100 System: RZ55 Troubleshooting Flowchart



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

TVS_E1488_88

Figure 3–1 (Cont.) VAXstation 3100 System: RZ55 Troubleshooting Flowchart

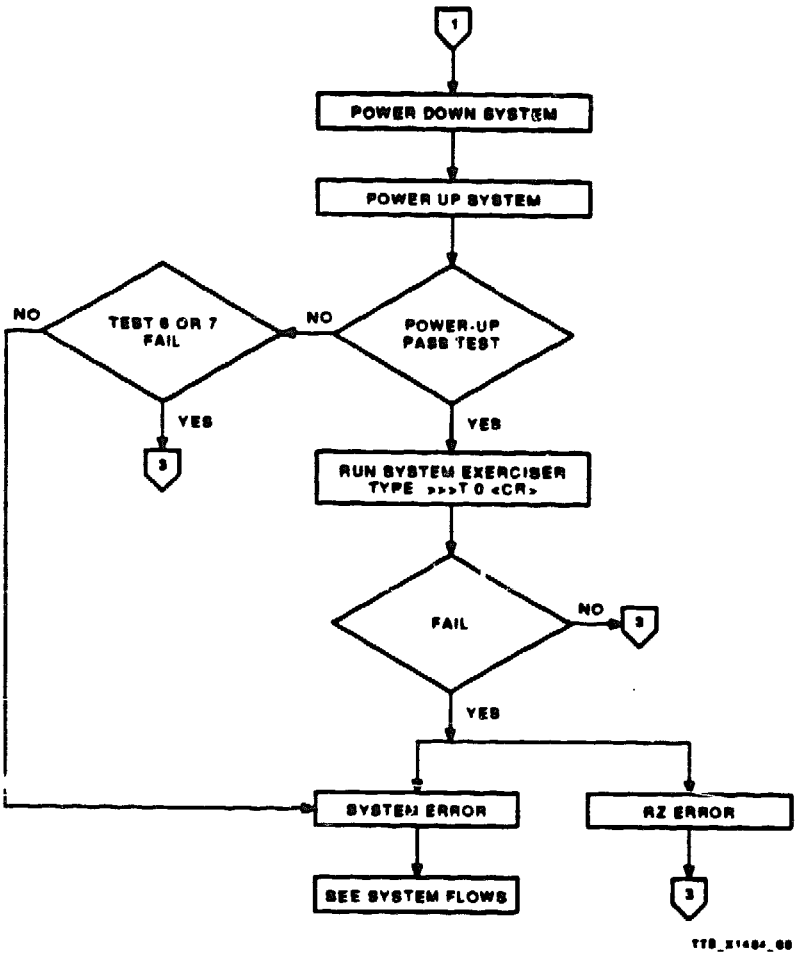


Figure 3–1 (Cont.) VAXstation 3100 System: RZ55 Troubleshooting Flowchart

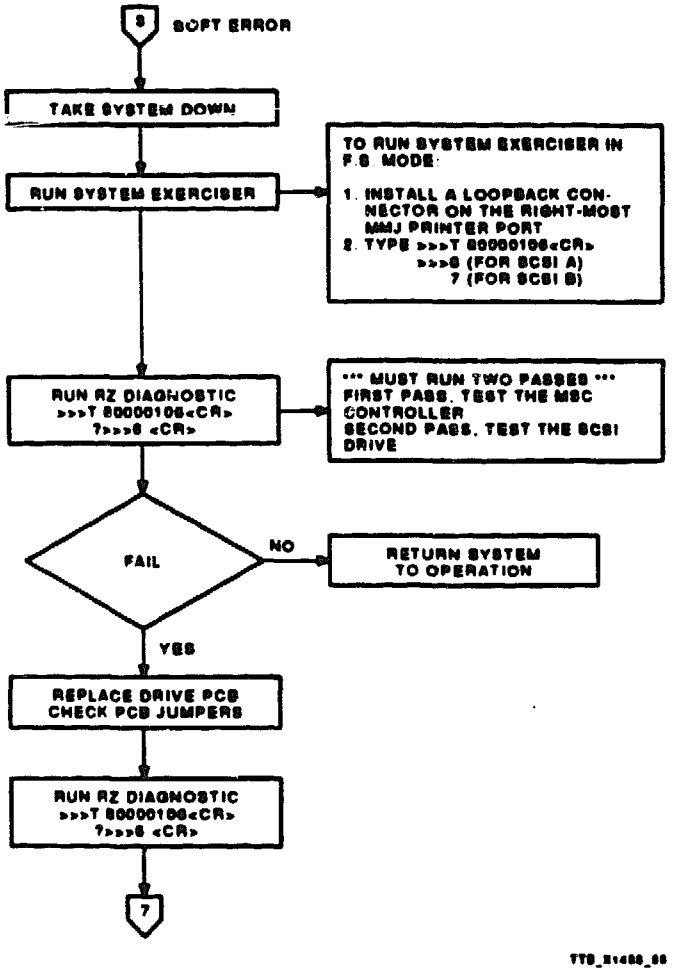
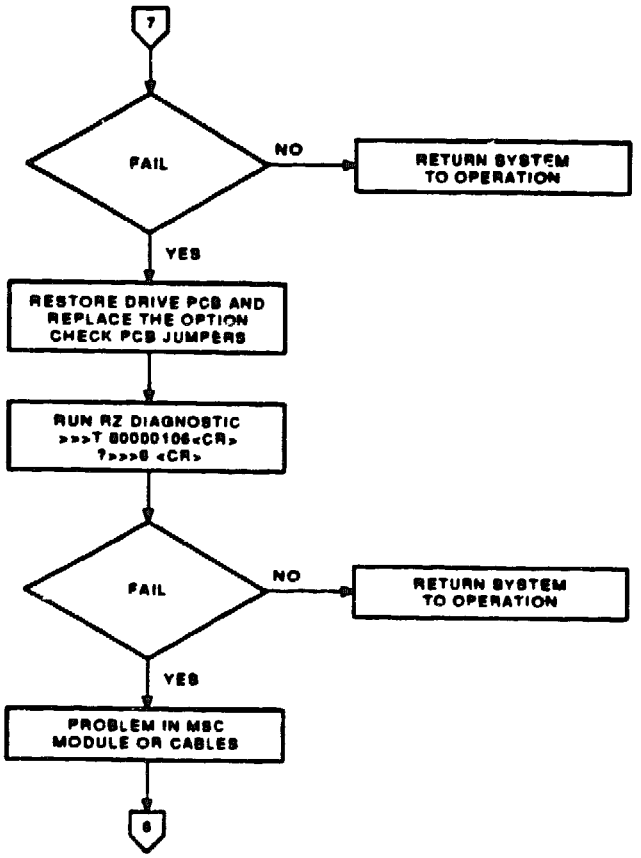


Figure 3–1 (Cont.) VAXstation 3100 System: RZ55 Troubleshooting Flowchart



TTS_X1488_88

Figure 3–1 (Cont.) VAXstation 3100 System: RZ55 Troubleshooting Flowchart

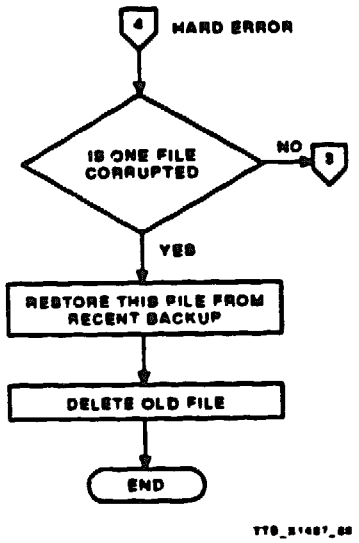


Figure 3–1 (Cont.) VAXstation 3100 System: RZ55 Troubleshooting Flowchart

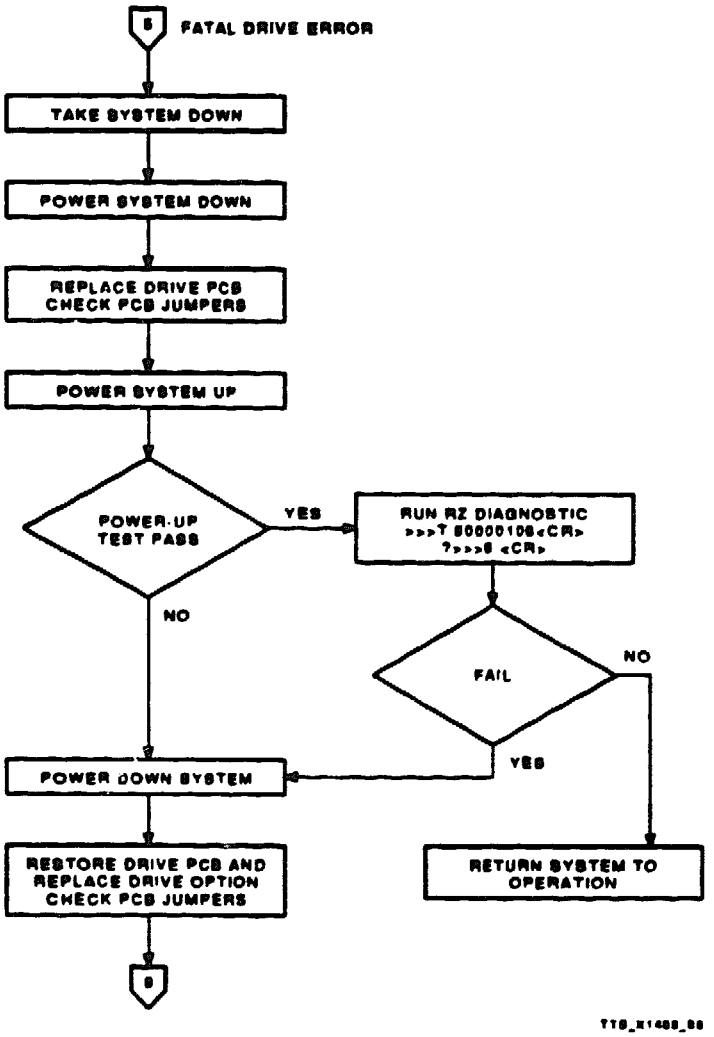


Figure 3–1 (Cont.) VAXstation 3100 System: RZ55 Troubleshooting Flowchart

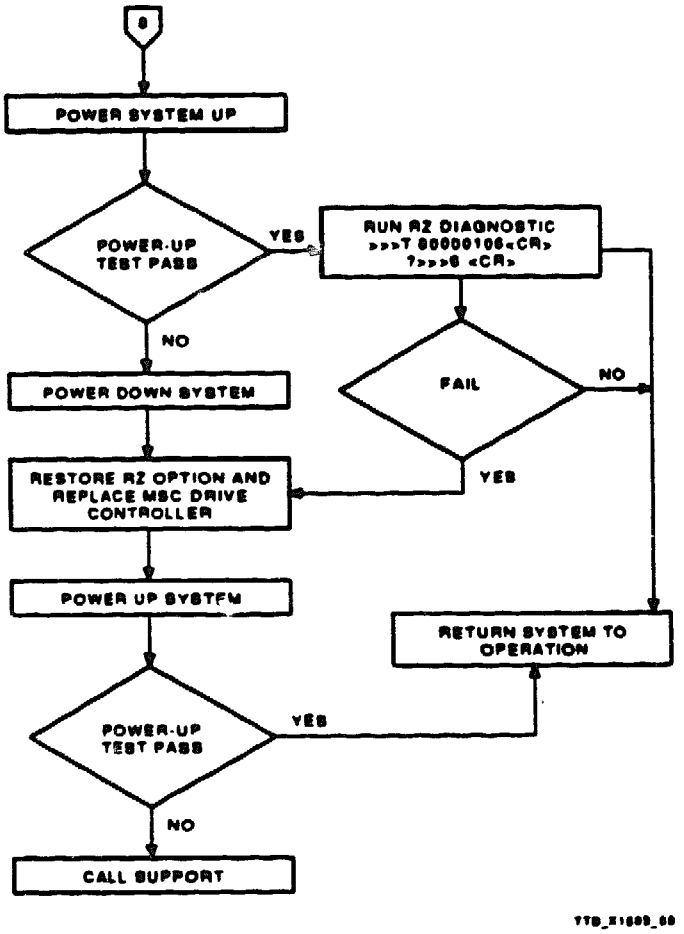


Figure 3–1 (Cont.) VAXstation 3100 System: RZ55 Troubleshooting Flowchart

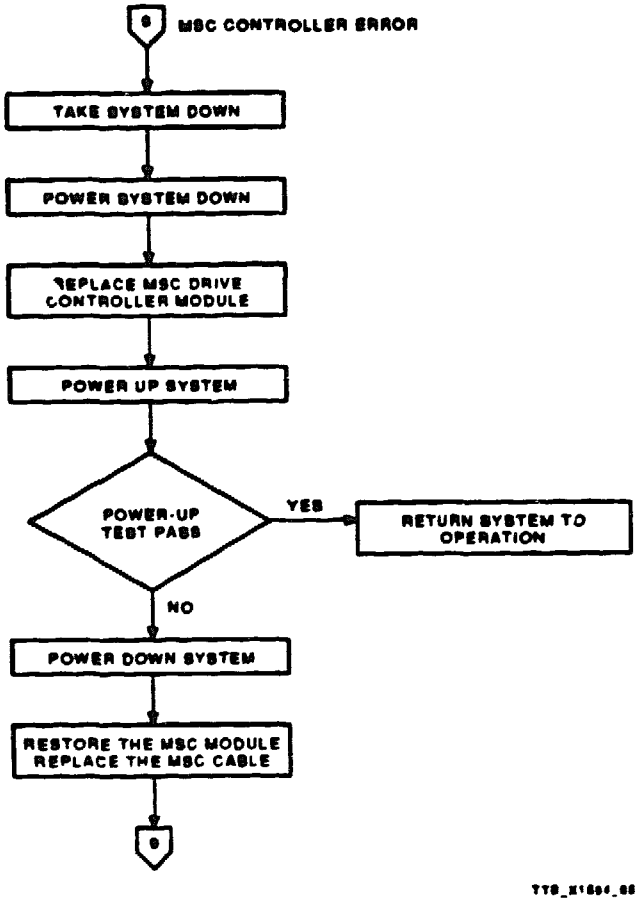


Figure 3–1 (Cont.) VAXstation 3100 System: RZ55 Troubleshooting Flowchart

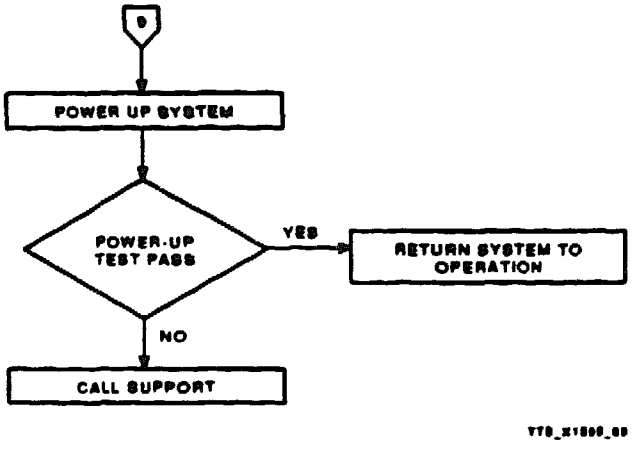


Figure 3–1 VAXstation 3100 System: RZ55 Troubleshooting Flowchart

3.3 Using System Diagnostics

The diagnostics available in a VAXstation 3100 system are as follows:

- 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 Test

The power-up test runs each time the system is turned on and consists of a sequence of tests executed for each device installed in the system. The power-up test can also be initiated by using console test commands. (See 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 back of the system enclosure indicate the status of power-up testing.

Example 3–1 shows an example of the power-up screen display. The first line indicates the CPU name and the ROM version. The second line indicates the results of each device test. The third line 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 after each symbol:
       ...  Device tested successfully, or has a soft error
       ??.  Device has a hard error
       _..  Option in 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 VAXstation 3100 Power-Up Screen Display

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

An extended summary of the power-up test is stored in the system configuration table. See the system maintenance guide to display these tables and interpret them.

Type SHOW DEVICE to get a listing of the devices connected to the VAXstation 3100 system (Example 3–2).

```
>>> SHOW DEVICE
ESA0      ES0    08-00-2B-02-CF-A4

DUA2      RX2                DISK                RM        RX23

DKA400    RZ4    A/4/0/00    DISK    xxxxxxxx    FX        RZ23
MKA500    TZ5    A/5/0/00    TAPE    ........    FM
Host ID           A/6         INITR

DKB000    RZ0    B/0/0/00    RODISK  xxxxxxxx    RM  WP    RRD40
DKB200    RZ2    B/2/0/00    DISK    xxxxxxxx    FX        RZ55
Host ID           B/6         INITR

>>>
```

Example 3–2 SHOW DEVICE Display

Example 3–2 lists ESA0 as the Ethernet device and displays the Ethernet address of the system. The display lists DUA2 as the RX23 diskette drive (model 30 system only) and displays that DUA2 is a disk (DISK) and has removable media (RM). The SCSI buses are listed next. For the model 30 system, only one SCSI bus (SCSI-A) appears on the display because model 30 contains only one SCSI bus. DKA400 is the RZ23 drive at address ID 4 on the SCSI-A bus with a fixed disk (FX). MKA500 is the TZ30 tape drive that is removable (RM) at address ID 5 on the SCSI-A bus. HostID is the address ID of the SCSI-A controller (ID 6). DKB000 is the RRD40 disc drive at address ID 0 on the SCSI-B bus. This drive has a read-only disk (RODISK), removable media (RM), and is write-protected (WP). DKB200 is the RZ55 expansion box at address ID 2 on the SCSI-B bus. The second HostID is the address ID of the SCSI-B controller (ID 6).

If the system does not contain a full configuration of drives internally, additional expansion boxes can be connected to the SCSI port using the SCSI address ID of the internal drive that is not installed.

3.3.2 Console Mode Testing

For console mode testing, the system must be halted. The system halts automatically after power-up testing for a boot failure, or if there is a system error. You can halt the system manually by pressing the HALT button (to the right of the ThinWire Ethernet port on the back of the system enclosure).

To exit, type BOOT (to restart the system in a fashion similar to turning on power) or type CONTINUE (to start the system where it halted in the operating software).

For further information on console commands and test commands, see 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 RZ55 disk drive. The results of the self-test are stored in the configuration table.

Enter Test 50 to see these results. The STRG-2 codes contain the results Section 3.3.4.2.

A code of 0000.4001 indicates that the SCSI bus controller has no errors and that either no devices are connected to the SCSI bus, or the devices are not powered-up connected.

See the system maintenance guide for more detailed information on the self-test.

3.3.4 System Exerciser

The system exerciser simulates a worst-case test on each device, checks how the device operates under these conditions, and generates a screen display as the exerciser runs. Any errors found are displayed in the exerciser screen display, where a single question mark (?) indicates a soft error, a double question mark (??) indicates a hard error, and no question mark indicates that the device has successfully passed the test. The exerciser runs in two modes:

Customer level
Field Service level

The Field Service level requires a maintenance kit containing a loopback connector and removable media (a diskette and/or a tape cartridge). You must initialize the diskette from the maintenance kit with a special diagnostic key. (See the system maintenance guide.)

Table 3–1 lists the system exerciser diagnostic commands.

Table 3–1 System Exerciser Diagnostic Commands

Test	Description
T 0	Runs customer level. Exercises each device once sequentially, and stops when the slowest device finishes its second pass. Requires no loopback connectors or removable media.
T 101	Runs Field Service level. Exercises each device sequentially, then simultaneously, and stops when the slowest devices finishes its second pass. Requires loopback connectors and removable media. NOTE **Do not stop the exerciser before the second pass.**
T 102	Same as T 101, but you can enter a CRTL/C to terminate the tests. Once terminated, you can display the result summary by entering a RETURN. Enter a second CRTL/C to stop the result summary display and return to the system prompt. Requires loopback connectors and removable media. NOTE **Do not stop the exerciser before the second pass, and do not press the HALT button.**
T 80000106	Individual testing. Runs exerciser diagnostics on individual devices.

Start the system exerciser by entering Test 0 for customer mode or Test 80000106 then 7 at the prompt for Field Service mode. Customer mode does not perform reads or writes to the RZ55 disk drive. Field Service mode performs complete read/write tests on the disk drives (reserved diagnostic blocks) and data transfer tests to all devices. For the Field Service mode to run correctly, you must install the loopback connector on the right-most MMJ printer port, load the tape cartridge with the special-key (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 correctly, 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.

See the system maintenance guide for further information on the system exerciser.

3.3.4.1 SCSI Address ID Settings

The SCSI-B bus controller controls up to seven SCSI devices on the SCSI bus, including internal and external devices. The RZ55 disk drive is an external device.

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 0. The RZ55 disk drive usually holds one of the last three address IDs, which are 5, 6, and 7. 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 enclosure, the remaining address IDs can be used on any device connected to the SCSI port.

In a model 30 VAXstation 3100 system, the RZ55 address IDs are as follows (SCSI-A):

Expansion box 1, ID = 1
Expansion box 2, ID = 2

In a model 40 VAXstation 3100 system, the RZ55 address IDs are as follows (SCSI-B):

Expansion box 1, ID = 1
Expansion box 2, ID = 2

Figure 1–2 shows the jumper locations for the RZ55 disk drive.

CAUTION

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 through 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.

Also, the jumpers on the RZ55 drive are factory set and should not be changed for use in the expansion box. Configuration of the RZ55 drive to the system is done by a DIP switch on the back of the expansion box (Section 1.2).

3.3.4.2 STRG-1 and STRG-2 Codes

This section discusses the codes for the STRG-1 SCSI bus controller on the VAXstation 3100 as well as the STRG-2 SCSI bus controller on model 30 and model 40 systems.

When the system exerciser is running in Field Service mode with the special-key TZ30 tape cartridge installed, the code for the TZ30 tape drive 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 see if the device (address ID 1 in this case) 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.

Example 3–3 shows the system exerciser display for the STRG-2.

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

Example 3–3 STRG-2 Display

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 under the status of the controller.

An easy way to determine if any errors are detected is to look for any question marks in the left column. If there are any question marks on the SCSI controller's status line, the SCSI controller is probably faulty and the error code identifies the problem. If there are any questions marks on the SCSI device status line, the problem is either the SCSI device (RZ55 drive), the SCSI bus cables, or the SCSI controller. An error that is listed in the SCSI devices code may be a data transfer error and, therefore, does not isolate the problem to the device itself. It may still be in the SCSI controller.

To decipher the system exerciser codes, see Table 3–2, Table 3–3, and Table 3–4.

Interpret controller error code format as follows:

TUVVXYZ1

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

Interpret drive error code format as follows:

JKLLPRS1

J = Drive number (SCSI address ID 1 through 7)
K = Drive is readable (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 3–2 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 = Disk drive
MK = Tape
x = SCSI bus (A or B) that device is on

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

Error Code	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 & 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.
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.

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

Error Code	Definition
F	DMA End bit not verified in Bus & Status register or DMA data not matching expected data.

Table 3–4 Drive Status Codes (0000.0R01)

Status Code	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 Removing and Replacing the Drive in the System Expansion Box

Perform the following procedure to remove and replace the RZ55 disk drive in the VAXstation 3100 expansion box (BA40). For details not covered in this manual, see the maintenance guide for the VAXstation 3100 system.

1. Shut off the power to the expansion box and unplug the expansion box Next, disconnect the SCSI port cable.
2. Unscrew the four cover screws and remove the expansion box cover (Figure 3–2).

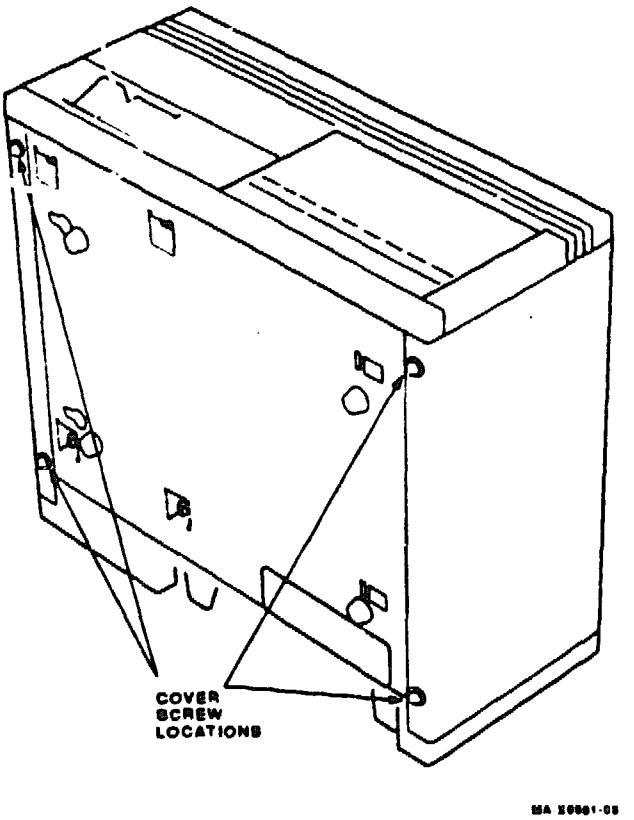


Figure 3–2 VAXstation 3100 Expansion Box: Cover Removal

3. Remove the three screws that hold the shield to the main chassis (Figure 3–3) and lift the shield up and off.

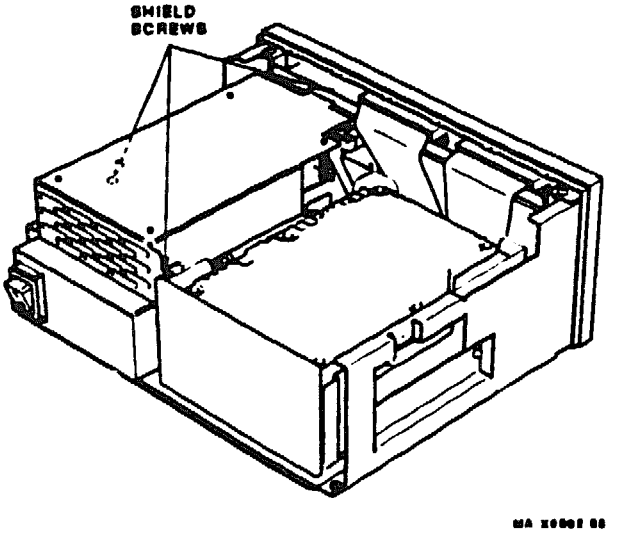


Figure 3–3 VAXstation 3100 Expansion Box: Shield Removal

4. Remove the three drive mounting screws (Figure 3–4).

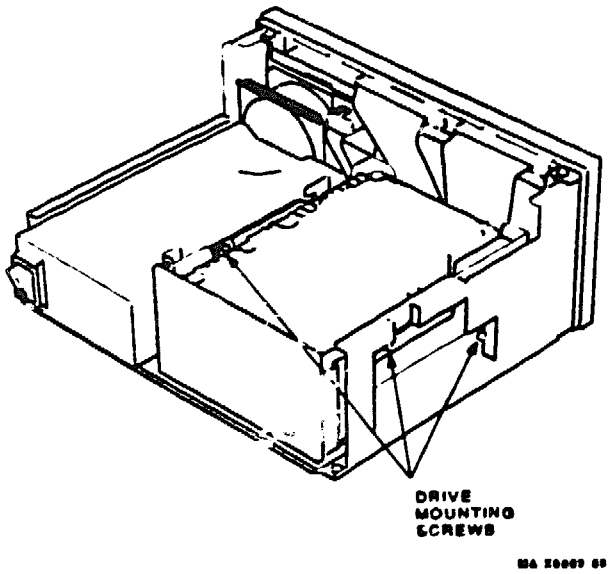


Figure 3–4 VAXstation 3100 Expansion Box: Drive Mounting Screw Removal

5. **Remove the SCSI switch cable from the SCSI switch board (Figure 3–5).**

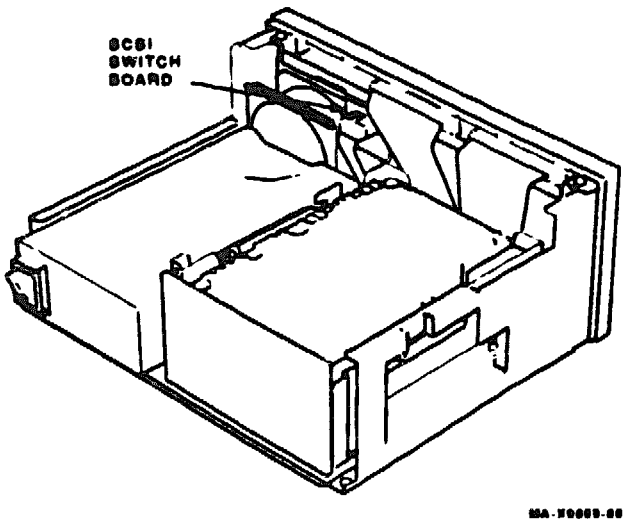


Figure 3–5 VAXstation 3100 Expansion Box: SCSI Switch Cable Removal

6. Slide the drive halfway out of the expansion box and disconnect the power cable, data cable, and SCSI switch cable from the back of the drive. Then remove the drive (Figure 3–6).

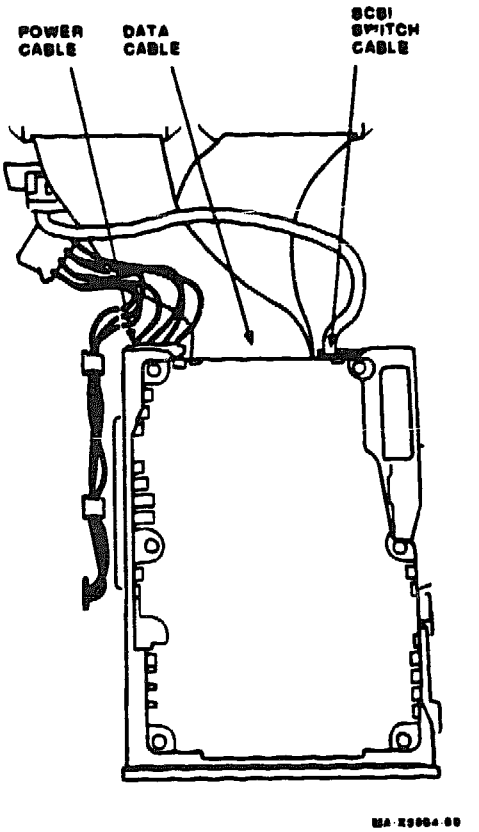


Figure 3–6 VAXstation 3100 Expansion Box: Cable Removal

7. Once the drive is free from the expansion box, remove the mounting bracket screws (Figure 3–7) and remove the mounting brackets.

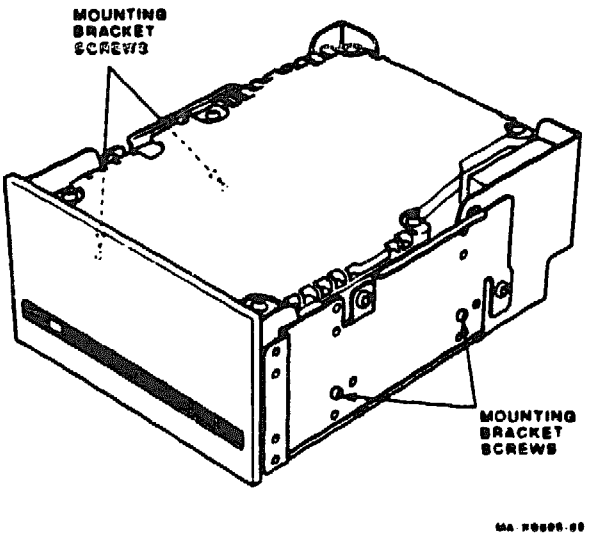


Figure 3–7 VAXstation 3100 Expansion Box: Drive Mounting Bracket Removal

To replace the drive in the expansion box, install the mounting brackets removed in step 7 on the replacement drive (Figure 2–7) and reverse this procedure.

To continue FRU removal and replacement for the RZ55 disk drive, see Section 1.5 for the drive bezel and drive module procedures.

APPENDIX A

A
Recommended Spares

Table A–1 lists the spares and their part numbers for the RZ55 disk drive.

Table A–1 RZ55 Recommended Spares

Part	Part Number
Drive	RZ55-E
Drive module	29-27347-01

INDEX

Index

C

Canned disk test (cd), 2–28
Common command set (CCS), 1–1
Configuring the RZ55 disk drive, 1–3
Console extended self-tests, 2–16 to 2–22
  DECstation 3100 system, 2–13
  diagnostics options menu, 2–17
  preparing for, 2–16
  running, 2–20
  selecting test modes, 2–18
  SII test s, 2–20
  viewing test commands, 2–16

D

DECstation 3100 system, 2–1 to 2–36
  console extended self-tests, 2–16
  ON/OFF switch, 2–13
  power-on self-test (POST), 2–13
  Reset button, 2–14
  RZ55 removal and replacement, 2–37
  RZ55 troubleshooting, 2–1
  SCSI extended self-tests, 2–23
  self-test, 2–15
  status LED codes, 2–34
  system diagnostics, 2–13
  troubleshooting checklist, 2–2
  troubleshooting flowchart, 2–2
Diagnostic aids
Diagnostic aids (cont'd.)
  connecting to an alternate console, 2–13
  netstat, 2–13
  uerf, 2–13
Diagnostics options menu, 2–17
Drive bezel removal, 1–6
Drive module removal, 1–9

E

Extended self-tests, 2–16 to 2–33
  interpreting status LED codes, 2–34
  running without a monitor, 2–34

H

HDA
  See Head/disk assembly
Head/disk assembly, 1–1

L

Loopback connectors
  DECstation 3100 system, 2–35
  VAXstation 3100 system, 3–16

P

Part numbers, A–1
Power-on self-test (POST), 2–13 to 2–16
  codes, 2–16

Power-on self-test (POST) (cont'd.)
DECstation 3100 system, 2–13
display, 2–14
interpreting results, 2–15
running, 2–13
Power-up test, 3–13 to 3–14
VAXstation 3100 system, 3–12

R

Reduced instruction set computer (RISC), 2–1
RZ55 drive module, 1–3
RZ55 features, 1–4
RZ55 removal and replacement procedures, 1–6
RZ55 specifications, 1–4

S

s (SII test), 2–20
SCSI commands, 2–26
SCSI extended self-tests, 2–23 to 2–33
canned disk (cd), 2–28
DECstation 3100 system, 2–13
preparing for, 2–23
running, 2–24
t1 test, 2–29
t2 test, 2–29
t3 test, 2–31
t4 test, 2–32
viewing storage device listing, 2–23
SCSI interface, 1–1
SCSI menu, 2–25 to 2–27
using, 2–25
Self-test, 2–15 to 2–16, 3–15
codes, 2–16
DECstation 3100 system, 2–13
interpreting results, 2–15
interpreting status LED display, 2–34
running, 2–15
Self-test (cont'd.)
status LED display codes, 2–34
VAXstation 3100 system, 3–12
SHOW DEVICE
display, 3–14
utility, 3–13
STRG-1, 3–18
STRG-2, 3–18
System diagnostics
DECstation 3100 system, 2–13
VAXstation 3100 system, 3–12
System exerciser, 3–15 to 3–16
VAXstation 3100 system, 3–12

T

t1 test, 2–29
t2 test, 2–29
t3 test, 2–31
t4 test, 2–32
Terminating connectors, 2–35
Test modes, 2–18
Troubleshooting checklist
DECstation 3100 system, 2–2
VAXstation 3100 system, 3–2
Troubleshooting flowchart
DECstation 3100 system, 2–2
VAXstation 3100 system, 3–3
Troubleshooting the RZ55 disk drive
DECstation 3100 system, 2–1
VAXstation 3100 system, 3–1

V

VAXstation 3100 system, 3–1 to 3–21
address IDs, 3–17
console mode testing, 3–14
power-up test, 3–13
RZ55 removal and replacement, 3–22
RZ55 troubleshooting, 3–1
self-test, 3–15
system diagnostics, 3–12