EK-ORV20-SV-001

RV20
Optical Disk Subsystem

Service Guide

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Optical Disk Subsystem

Service Guide

Prepared by Educational Services
of Digital Equipment Corporation

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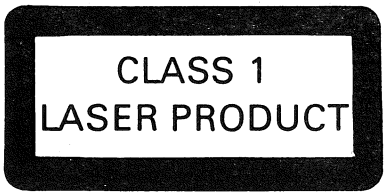

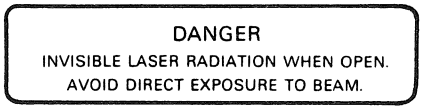

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Chapter 1
Introduction

1.1 Product Description

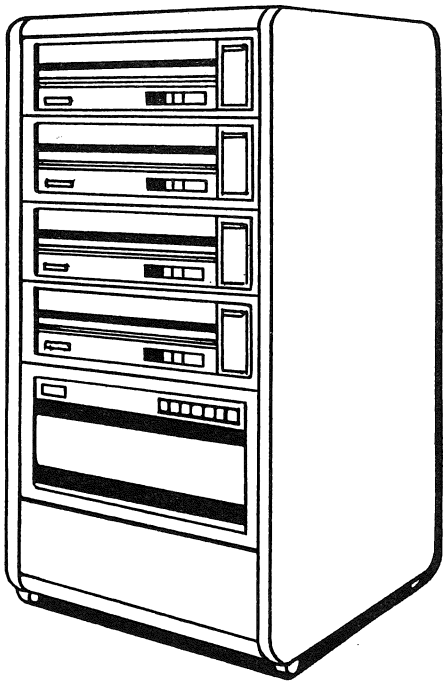
The RV20 optical disk drive is a random-access mass storage device using removable media. The RV20 is a Write-Once Read-Many (WORM) drive that uses a laser system to write and read data. Each RV20 disk cartridge can store up to one gigabyte of information per side.

The RV20 drive uses its own internal bus, the ISI bus. The ISI bus can support up to four drives in a subsystem (one master with three daisy-chained slaves). Each drive in a subsystem must have a unique ISI address (control module number), 0 to 3.

1.2 Subsystem Description

The RV20 subsystem is contained in an H9643 cabinet. All drives in the subsystem are powered through an 874 power controller also contained in the H9643. The power controller connects to site power. The H9643 may also contain an RA- series disk drive that is independent of the RV20 subsystem. Figure 1-1 shows the H9643 cabinet with four RV20s and an RA- series disk drive installed.

Figure 1-1 RV20 Subsystem



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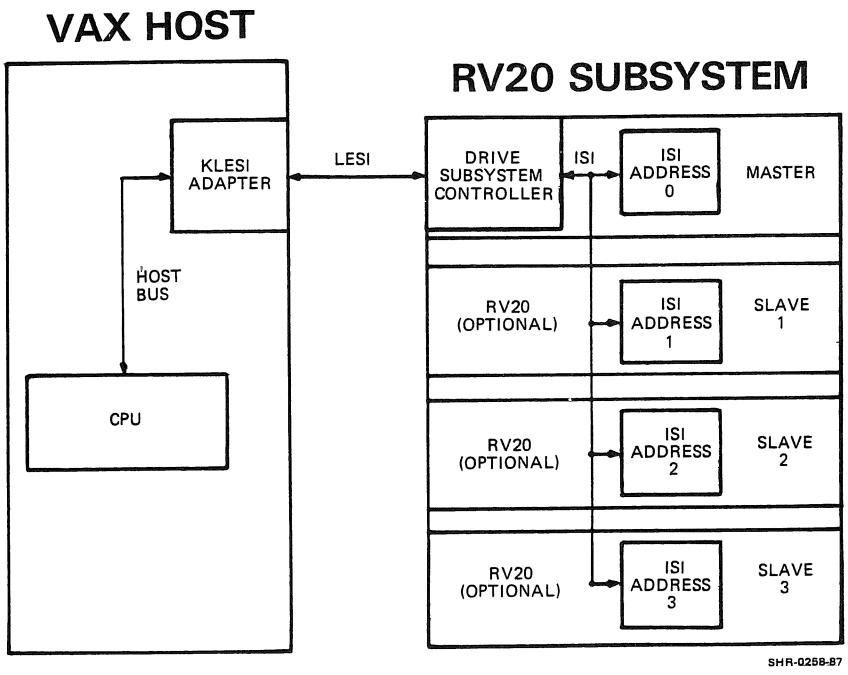
The RV20 subsystem consists of up to four RV20s cabled in a daisy-chain configuration. A subsystem can be any combination from the minimum configuration of one master drive to a maximum configuration of four RV20s (one master drive with three slave drives daisy-chained off of the master). A master drive contains a drive subsystem controller module that is the interface between the ISI bus and LESI. The H9643 can also hold four master RV20 drives (four separate subsystems). The LESI data leaves the drive subsystem controller in the master and enters a KLESI adapter module in the BI- or Q-Bus host system. Figure 1-2 is a block diagram of a four-drive RV20 subsystem (one master with three slaves).

Figure 1-2 RV20 Subsystem Block Diagram



1.3 Field Replaceable Units

The subsystem Field Replaceable Units (FRUs) are listed in Table 1-1.

Table 1-1 Field Replaceable Units

Part Number	Part Name
T1014	KLESI-B adapter module
M7740	KLESI-Q adapter module
BC17Y-XX	LESI interface cable
29-26800	ISI interface cable
29-26458-00	ISI terminator assembly
29-26450-00	Rear panel ground strap E2
29-26454-00	Filter grill
29-26448-00	Air filter
29-26452-00	Start/Stop switch (operator panel)
29-26453-00	Write Protect switch (operator panel)
29-26438-00	Operator panel PCA
29-26434-00	Maintenance panel
29-26430-00	Power supply
29-26460-00	Card rack backplane
29-26459-00	Drive subsystem controller
29-26429-00	ECC PCA
29-26427-00	ISI PCA
29-26435-00	Servo/drive control (S/DC) PCA
29-26439-00	Modulator demodulator synchronizer (MDS) PCA
29-26428-00	Read/write control (R/WC) PCA
29-26437-00	Servo systems PCA
29-26436-00	Error signal generator (ESG) PCA
29-26455-00	Fan assembly
29-26425-00	Spindle
29-26424-00	Spindle pulley belt
29-26476-00	Spindle grounding brush
29-26440-00	Spindle bearing
29-26431-00	Spindle motor assembly
29-26449-00	Spindle brake
29-26457-00	Baseplate terminator PCA
29-26426-00	Carriage
29-26432-00	Tachometer sensor
29-26433-00	Guardband sensor
29-26456-00	Interlock solenoid
29-26469-00	Carriage lock solenoid

1.4 Diagnostics

The subsystem can be tested through the host or an individual drive can be taken off-line and tested.

The subsystem is tested using two types of host diagnostics, listed next and described in detail in Chapter 2.

- Level III diagnostics that are run through the host supervisors (VAX Diagnostic Supervisor on BI systems and MicroVAX Diagnostic Monitor on MicroVAX systems).
- Level IIR Data Reliability Diagnostics (BI-based host systems only)

These diagnostics isolate problems to a simple corrective action or to one of two failed items: an RV20 drive or the communication path to the host.

The drive subsystem controller has a set of basic self-tests that are implemented on power-up. Test results are shown in the series of LED indicators on the board. This power-up sequence is described in Chapter 2.

When an RV20 drive is isolated as the failed item, a failure code and subfailure code (when one applies) are also called out by the diagnostic. These codes correspond to the codes listed in Chapter 3 of this guide. Chapter 3 outlines specific corrective actions to take to correct problems in an RV20 drive.

1.5 Tools and Equipment

There are no special tools or equipment needed to repair the RV20 subsystem, but be sure you have a static kit.

You cannot use customer media to run some of the tests. You will need a dedicated diagnostic test disk to run the Level III tests on the subsystem. Chapter 2 gives instructions on how to create a dedicated diagnostic test disk from a blank disk. If you are running tests on a multidrive subsystem, it is recommended that you have one test disk for each drive in the subsystem.

1.6 Related Documentation

Table 1-2 lists documentation related to the RV20 subsystem.

Table 1-2 Related Documentation

Manual	Part Number	Description
RV20 Optical Disk Subsystem Owner's Manual	EK-ORV20-OM	Customer document that explains the basic operations of the RV20 drive. Instructions are given in this manual for loading, unloading, and write-protecting disks. This manual also contains basic maintenance and testing information.
RV20 Optical Disk Subsystem Installation Guide	EK-ORV20-IN	Contains instructions for installing an RV20 subsystem at a customer site from unpacking through verification. This manual also contains basic power-up confidence checks on the system, as well as instructions for installing an add-on RV20 to an existing subsystem.

1.7 Drive Operation

The front, maintenance, and rear panels of the RV20 drive are shown in Figures 1-3, 1-4, and 1-5. The following paragraphs describe the panels.

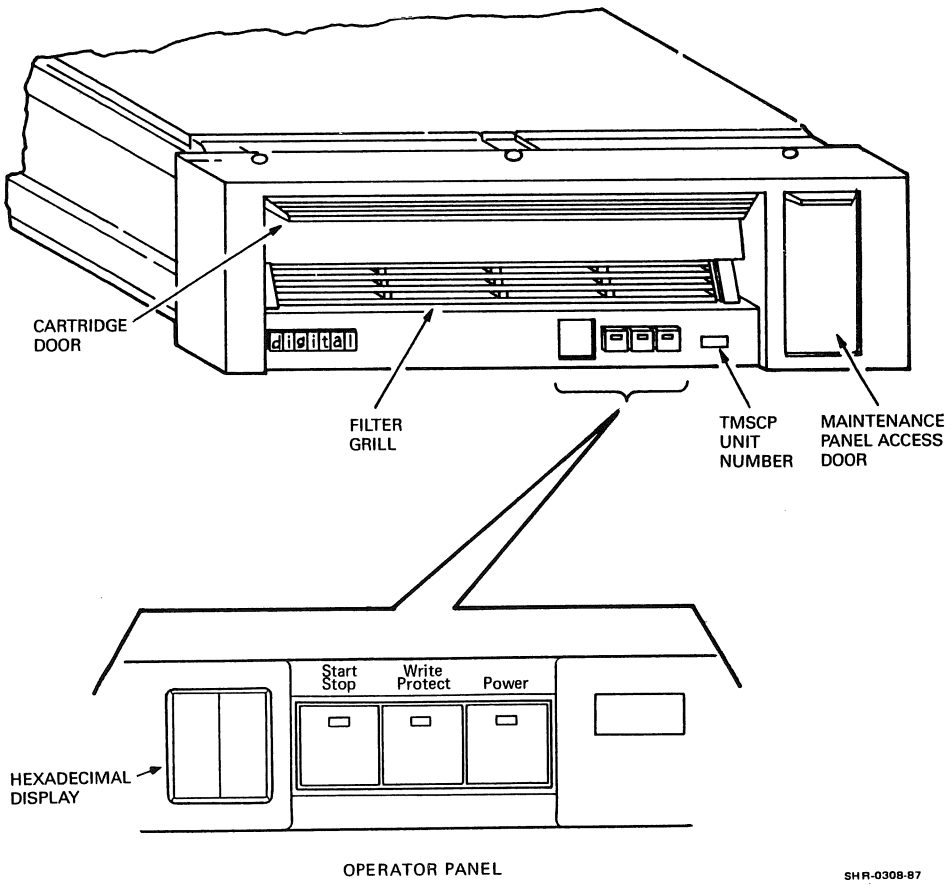
1.7.1 Front Panel

The front panel (Figure 1-3) consists of the cartridge door, the filter grill, the operator panel and the maintenance panel. These are described next.

Cartridge door — When opened, allows for a disk to be inserted into the drive. When closed, protects internal parts of the drive from exposure to dust and dirt.

Filter grill — Houses the air filter, which protects the internal components of the drive from excessive dust and dirt. The filter should be inspected regularly, cleaned as needed, and replaced when frayed or damaged.

Figure 1-3 RV20 Front Panel



Operator panel — The operator panel consists of a hexadecimal display, Start/Stop-Ready switch/indicator, Write Protect switch/indicator, and Power indicator/address plug. Table 1-3 lists these controls and indicators and describes their functions.

TMSCP unit number — This recessed area on the front panel is for the numbered labels that correspond to the TMSCP unit number you assign during installation.

Maintenance panel access door — Allows access to the maintenance panel, which is shown in Figure 1-4. Table 1-4 describes all the switches and indicators on the maintenance panel.

Table 1-3 Operator Panel Controls and Indicators

Switch/Indicator	Type/Color	Action
Hexadecimal display	2 red LEDs	This display gives a 2-digit hexadecimal status code. When a failure is detected during normal operation, FA is displayed and the drive stops functioning. During a diagnostic session, this display flashes test results.
Start/Stop switch	2 position pushbutton	Pressing this switch in (the Start position) will cause the spindle motor to spin the disk up to speed. When this switch is in the Start position, pressing this switch out (the Stop position) will cause the spindle motor to spin the disk down.
Ready indicator	Green LED (located on the Start/Stop switch)	When on, indicates that the spindle motor is up to speed. When flashing, indicates spindle is in the process of spin-up or spin-down. When off, indicates that spindle motor is off.

Table 1-3 Operator Panel Controls and Indicators (Cont)

Switch/Indicator	Type/Color	Action
Write Protect Switch	2 position pushbutton	Pressing this switch will prevent any writing to the disk inside the RV20.
Write Protect Indicator	Yellow LED (located on the Write Protect switch)	When on, indicates that the disk inside the RV20 is write protected. This indicator will be on regardless of which of the two methods of write protecting a disk has been used (host command, Write Protect switch, or with the Write Protect tab on the disk cartridge).
Power indicator	Green LED (located on the address plug)	This light is on when power is present inside the drive.
Address plug	Switchcap	Labelled on top with control module (CM) number. The front bezel must be removed to see the CM number that a drive has been assigned.

1.7.2 Maintenance Panel

The maintenance panel (Figure 1-4) is located behind the maintenance panel access door on the front panel. It contains a two-digit hexadecimal display and the controls and indicators described in Table 1-4.

The hexadecimal display is used to display data input to the drive. This data includes test options, test numbers, test parameters, and memory locations. The display goes blank while you press the ENTER key, indicating the drive has received the input data. When appropriate, the drive outputs data (on the display) in reply to the inputs. If an invalid test number is input, the display flashes three times and FF is displayed in the operator panel hexadecimal display.

During diagnostic testing, two-digit (hexadecimal) test and subtest numbers display. Diagnostic testing is described in more detail in Chapter 3.

Figure 1-4 RV20 Maintenance Panel

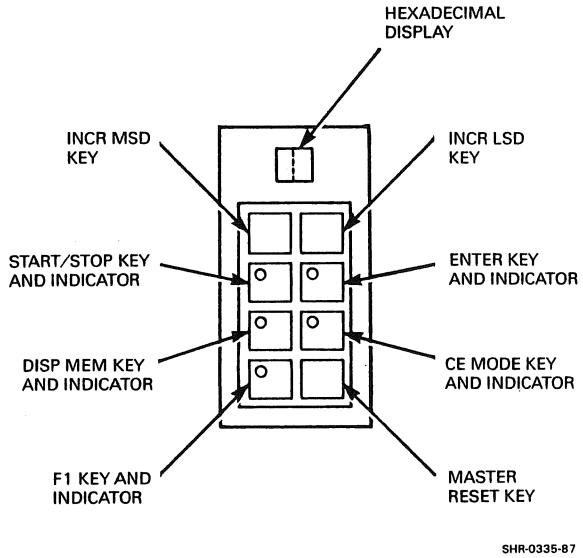


Table 1-4 Maintenance Panel Controls and Indicators

Control/Indicator	Description	Purpose	Comment
Hexadecimal display	LED	Displays data inputs and outputs	Blanks while you press the ENTER key.
INCR MSD key	Membrane key	Increments most significant digit of the hexadecimal display.	The data input is represented as a hexadecimal value from 0 to F. It is displayed as the left or most significant digit in the 2-digit hexadecimal display.
			Stepped or continuous key pressing cycles the digit from 0 to F, restarting at 0 once F is reached.
INCR LSD key	Membrane key	Increments least significant digit of the hexadecimal display.	The data input is represented as a hexadecimal value from 0 to F. It is displayed as the right or least significant digit in the 2-digit hexadecimal display.
			Stepped or continuous key pressing cycles the digit from 0 to F, restarting at 0 once F is reached.

Table 1-4 Maintenance Panel Controls and Indicators (Cont)

Control/Indicator	Description	Purpose	Comment
START/STOP key	Membrane key	When in Idle mode, pressing this key begins execution of a diagnostic test or validates an option.	
		When in Run mode, pressing this key stops execution of the diagnostic test currently running.	
		When in Stopped mode, pressing this key restarts the test or subtest.	
START/STOP indicator	LED	Illuminates to indicate the START/STOP key has been pressed.	Located in the START/STOP key. Flashes while a test or subtest executes.
ENTER key	Membrane key	This key causes the firmware to save the data byte currently displayed on the maintenance panel.	Selecting a test in Stopped mode terminates the current test and places the subsystem in Idle mode.
		Pressing this key exits Stopped mode and enters Idle mode, allowing selection of a test or option.	The new test number replaces the last test number entered.

Table 1-4 Maintenance Panel Controls and Indicators (Cont)

Control/Indicator	Description	Purpose	Comment
ENTER indicator	LED	Blanks while the ENTER key is pressed.	Located in the ENTER key.
DISP MEM key	Membrane key	When in Idle mode, pressing this key enters the Display mode. This allows a memory or parameter location to be displayed and/or modified.	When in Display mode after a memory location or parameter is displayed, pressing the key returns the drive to Idle mode.
		When in Stopped mode, pressing this key enters Display mode.	When in Display mode, pressing the key returns the drive to Stopped mode.
DISP MEM indicator	LED	Illuminates when DISP MEM key has been pressed.	Located in the DISP MEM key.
CE MODE key	Membrane key	When in Normal mode, pressing this key enters the CE mode.	All maintenance panel functions except master reset are enabled or disabled via the CE mode key.

Table 1-4 Maintenance Panel Controls and Indicators (Cont)

Control/Indicator	Description	Purpose	Comment
CE MODE indicator	LED	Illuminates to indicate the RV20 is in CE mode.	Located in the CE mode key. Upon entry of CE mode, all maintenance panel indicators illuminate while the hexadecimal display cycles through 00, 11, 22, ... FF. This is followed by a similar check of the operator panel hexadecimal display.
F1 key	Membrane key	If you run a diagnostic in Stopped or Idle mode and an error is encountered, pressing this key displays subfailure codes on the operator panel. When in Display mode, pressing this key displays the most significant byte of the current memory address on the operator panel.	

Table 1-4 Maintenance Panel Controls and Indicators (Cont)

Control/Indicator	Description	Purpose	Comment
F1 indicator	LED	Illuminates when the F1 key has been pressed.	Located in the F1 key.
Master Reset key	Membrane key	Pressing this key causes the RV20 to go through a power-up reset sequence.	This key can be used anytime, regardless of current operations.

1.7.3 Rear Panel

The rear panel (Figure 1-5) consists of the following.

Circuit breaker (CB1) — CB1 is used to apply power to the RV20. This breaker will trip in the event of a serious current or voltage problem.

AC input connector (J20) — This connects the power cord to the 874 power controller.

Ground strap (E2) — All RV20 drives must be fitted with a ground strap.

LESI connector (J61) — This connects the master drive to the KLESI adapter in the host via the BC17Y-XX LESI interconnect cable.

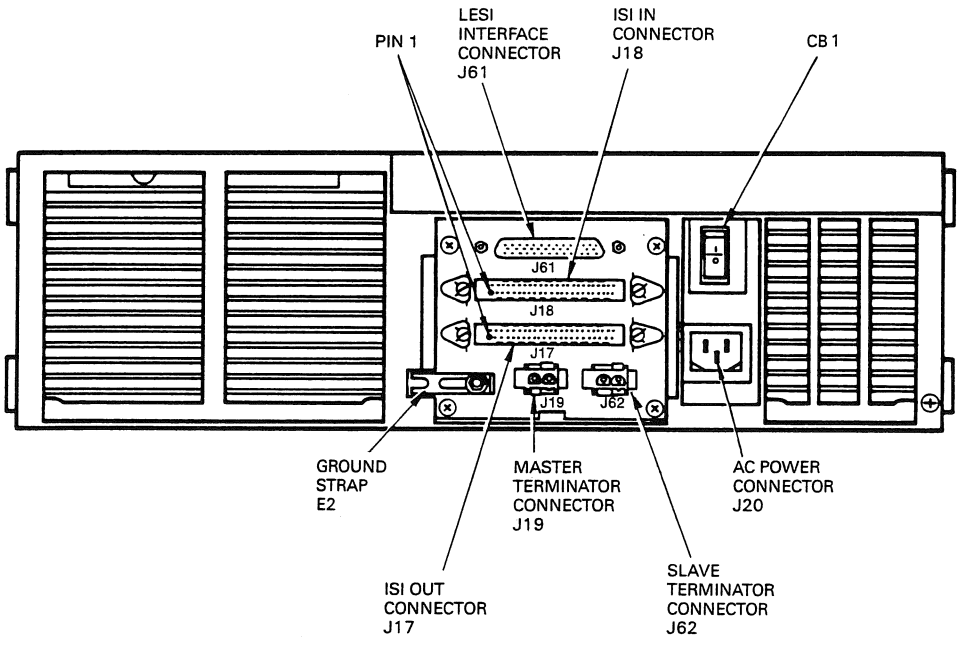
ISI IN connector (J18) — In the RV20 master drive, this connector terminates at J19. In a daisy-chain configuration, the ISI interface cable connects from the previous drive to this connector.

ISI OUT connector (J17) — In a daisy-chain configuration, the ISI interface cable connects from this connector out to the next drive. This connector must be terminated at J62 when it is the last slave in a daisy-chain configuration or on a one-drive subsystem.

Master terminator connector (J19) — A terminator assembly must be installed in J19 (from J18) for the master RV20 in a subsystem (including a subsystem that consists of one drive).

Slave terminator connector (J62) — A terminator assembly must be installed in J62 (from J17) for the last slave drive in an RV20 subsystem (this includes a subsystem that consists of one drive).

Figure 1-5 RV20 Rear Panel



Chapter 2
Subsystem Testing

2.1 General

This chapter gives instructions on how to run tests on the RV20 subsystem.

Paragraphs 2.2 and 2.3 give instructions on running Level III diagnostics through the VAX Diagnostic Supervisor (VDS) and MicroVAX Diagnostic Monitor (MDM). The Level III diagnostics are run in standalone mode; the system must be taken off-line to run them. These tests detect errors and specify one of the following failed items.

- An RV20 drive
- The communication path to the host

When an RV20 drive is isolated as the failed item, a failure code and subfailure code (when one applies) are also called out by the diagnostic. These codes correspond to the codes listed in Chapter 3 of this guide. Chapter 3 outlines specific corrective actions to take to correct problems in a RV20 drive.

Paragraph 2.4 gives instructions on running the extensive Level IIR Data Reliability diagnostics for BI systems. These data reliability diagnostics can only be run in user mode.

Paragraph 2.5 gives instructions on running the on-line Level II DUP tests and Paragraph 2.6 gives information on VMS error logs. Paragraph 2.7 describes the power-up test the drive subsystem controller module performs when a master RV20 is powered up.

2.2 Running Level III Diagnostics Through VDS

On BI-based systems, the Level III diagnostics are run through VDS. Level III diagnostics can only be run in standalone mode. The system must be taken off-line to run Level III diagnostics.

2.2.1 Equipment

To run Level III diagnostics, EVRVA must be available in the Field Service account or on a loadable device.

You must also use your own test disk to test drives; never use customer media for testing. A test disk can be created from a blank disk with test 32. Make sure that the drive to be tested has a test disk installed and the Start/Stop switch is pressed in.

2.2.2 HELP

Help is available throughout VDS. Typing HELP will display a list of topics that have on-line help. Typing HELP followed by the desired topic or command will display information about that topic.

Additional information can be obtained from the host system documentation and also the *VAX Diagnostic Supervisor User's Guide* (EK-VXDSU-UG).

2.2.3 Bringing VDS Up and Loading EVRVA

Begin the test session by running the Diagnostic Supervisor. Entry into the Diagnostic Supervisor is indicated by the DS> prompt.

Load the Level III diagnostics with the following command and press the RETURN key (<CR>).

```
DS> LOAD EVRVA <CR>
DS>
```

When the diagnostics are loaded, the DS> prompt comes up.

2.2.4 ATTACH and SELECT

The ATTACH command is used to specify a device on the system under test. A device cannot be accessed by VDS unless it has first been ATTACHed.

Before the RV20 can be tested, its type, location, and characteristics must be ATTACHed. The subsystem is connected to the drive subsystem controller in the master RV20. The master connects to the KLESI-B adapter in the host, which is connected to the processor. The complete path from processor to device must be established with two ATTACH sequences before testing can begin.

To ATTACH the subsystem, use the following standard ATTACH sequence for all VDS diagnostic packages.

```
ATTACH DEVICE_TYPE DEVICE_LINK DEVICE_NAME BI NODE #
```

The ATTACH sequence can be entered on one line or you will be prompted for each parameter in the command.

Example:

```
DS> ATTACH DWBLA HUB BLAO 4 <CR>
DS>
```

or

```
DS> ATTACH <CR>
Device Type? DWBLA <CR>
Device Link? HUB <CR>
Device Name? BLAO <CR>
BI NODE # (HEX)? 4 <CR>
DS>
```

The first ATTACH sequence is successful when the DS> prompt reappears without any error messages. The next ATTACH sequence has the following format.

```
ATTACH DEVICE_TYPE DEVICE_NAME DEVICE CSR_ADDRESS VECTOR BR
```

Because the subsystem has been ATTACHed with the first ATTACH command string, the supervisor now recognizes the DEVICE_TYPE as RV20. The DEVICE is the logical name of the controller (MUXX). Further, you must know the CSR and vector addresses, as well as the BR level because they are also part of the command string.

Here is an example of the second ATTACH sequence. Remember, the addresses are probably different for your subsystem.

```
DS> ATTACH RV20 BLA0 MUA0 774500 300 5 <CR>
DS>
```

The second ATTACH sequence is successful when the DS> prompt reappears without any error messages.

The next step is to SELECT the drive subsystem controller.

```
DS> SELECT MUA0 <CR>
DS>
```

2.2.5 Running the Tests

When the controller is SELECTed, you can SELECT and SET the test parameters you want to use in this testing session.

The tests only run on drives that have disks installed and spinning. (This is the case if the Ready indicator, located on the drive's Start/Stop switch, is on.) When a set of tests is running on a multidrive subsystem, a test runs on each drive before the next test is performed.

> **CAUTION**
> **Never use customer media when running Level III tests. Use a scratch disk or a dedicated test disk.**

There are 32 Level III tests. Table 2-1 lists the tests and the duration of each one. There are two sets of tests: functional tests (1 to 19) and utility tests (20 to 32). The complete functional test set takes about twenty minutes per drive to run.

Some of the utility tests are not actually tests. Utility test 22, for example, forces a statistical report to be printed out after the current tests are complete. The complete set of utilities and utility tests takes between 5 and 6 hours per drive to run.

Paragraph 2.2.6 gives descriptions of all the tests, what they do, and any equipment or user input needed for the tests to run.

The following are some of the more common commands used in VDS.

SHOW TESTS — This command lists all the RV20 tests. Table 2-1 lists the RV20 tests and gives the duration of each (per drive in the subsystem).

SET TRACE — Traces the test and output status of each test as it runs.

START — Runs the tests.

The complete functional test set is the default testing mode. To run the complete functional test set (tests 1 to 19), type START without any qualifiers.

```
DS> START <CR>
```

To run a specific functional test, type START followed by the test number. For example, to run test 10, type the following.

```
DS> START/TEST=10:10 <CR>
```

To run a series of tests in sequence, type the starting and the ending test numbers in the test number field of the string. For example, to run tests 6 through 15, type the following.

```
DS> START/TEST=06:15 <CR>
```

To run utility tests (tests 20 to 32), the section qualifier must be used with the START command. The START command must be in the following format.

```
START/SECTION:UTILITY/TEST=nn:nn
```

If no /TEST qualifier is given in the command, the entire utility test set will run. To run all the utility tests, type the following.

```
DS> START/SECTION:UTILITY <CR>
```

To run a specific utility test, include the test number in the string. For example, to run utility test 20, use the following command.

```
DS> START/SECTION:UTILITY/TEST=20:20 <CR>
```

To run a series of utility tests in sequence, type the starting and the ending test numbers in the test number field of the string. For example, to run utility tests 25 through 32, type the following.

```
DS> START/SECTION:UTILITY/TEST=25:32 <CR>
```

To run a test or series of tests a specified number of times, use the PASSES qualifier with the START command. For example, to run utility tests 25 through 32 three times, type the following.

```
DS>START/SECTION:UTILITY/TEST 25:32/PASSES=3 <CR>
```

Table 2-1 Level III Tests

Test Number (VDS)	Test Number (MDM)	Test Name	Test Duration
		Functional Tests	
1	1	Register existence	1-4 seconds
2	2	Power-up initialization	1-4 seconds
3	3	Steps 1-4 initialization	1-4 seconds
4	4	Diagnostic SA wrap	1-4 seconds
5	5	Vector and BR level	1-4 seconds
6	6	Purge and poll	1-4 seconds
7	7	Small ring buffer initialization	1-4 seconds
8	8	Large ring buffer initialization	1-4 seconds
9	9	Get DUST status	1-4 seconds
10	10	CPU/server bus data	1-4 seconds
11	11	Internal drive microdiagnostic	8 minutes per drive
12	12	Drive spin-up	1 minute per drive
13	13	Drive spin-down	1 minute per drive
14	14	Illegal command and function	1 minute per drive
15	15	Basic seek	2 minutes per drive
16	16	Serpentine/pump seek	4 minutes per drive
17	17*	Basic read	2 minutes per drive
18	18*	Basic write	2 minutes per drive
19	19	CPU/drive bus data	1 minute per drive

Table 2-1 Level III Tests (Cont)

Test Number (VDS)	Test Number (MDM)	Test Name	Test Duration
		Utility Tests	
20	1	Enable RV20 firmware error logs	< 10 seconds
21	2	Update serial RAM revision level	< 10 seconds
22	3	Force diagnostic statistical report	< 10 seconds
23	4	Seek reliability	45 minutes per drive
24	5	Short data reliability	5 minutes per drive
25	6	Read data reliability	2 hours per drive
26	7	Data reliability spin-down/spin-up	5 minutes per drive
27	8	Write data reliability	2 hours per drive
28	9	Disk allocation utility	2 minutes per drive
29	10	Drive power margins	20 minutes
30	11	Update drive revision levels	< 10 seconds
31	12	Write protect	10 seconds
32	13	Initialize diagnostic test disk	2 minutes

* MDM exerciser tests

2.2.6 Test Descriptions

Functional Test 1 — Register Existence

This test first checks for the existence of the address of the IP and SA registers for the subsystem.

If these register addresses are nonexistent, the subsystem will be dropped from testing and the error reported.

Functional Test 2 — Power-Up Initialization

This test initiates and reports the results of the drive subsystem controller Level A diagnostics.

The following types of testing are performed by the Level A microdiagnostics:

EEPROM — This test checksums and verifies the integrity of the EPROM in the drive controller.

MPU — This test verifies basic functionality of the MPU.

RAM — This tests and verifies the integrity of the RAM.

TIMERS — The two internal programmable timers are tested and verified to be operational.

Functional Test 3 — Steps 1-4 Initialization

Steps 1, 2, 3, and 4 of the initialization sequence are performed and all bits are checked in the SA register to make sure the steps were completed correctly and there were no errors.

Functional Test 4 — Diagnostic SA Wrap

The drive subsystem controller is initialized in Diagnostic Wrap mode. Then the test floats a 1 bit through the SA register to make sure it echoes properly. This process is then repeated, floating a 0 bit through the SA register.

Functional Test 5 — Vector and BR Level

The initialization sequence is started with the interrupt enable bit set to verify the subsystem's vector and BR level. The priority level of the interrupt request is also verified.

Failure of the drive subsystem controller to vector properly will cause this test to fail. Possible reasons for an incorrect interrupt include incorrect hardware configuration, broken hardware, and operator error (hardware attach performed incorrectly). A completed interrupt at the wrong BR level will be reported.

Functional Test 6 — Purge and Poll

This test performs the first three steps of the initialization sequence. When the host responds to the step 3 transition it writes a 1 bit to bit 15 of the SA register, thereby requesting the execution of purge and poll testing. The host then waits for the SA register to transition to 0, simulating a "purge completed" host action. Then the host writes the SA register to 0 and reads the IP register to simulate a "start polling" command from the host to the port. This must be completed by the host within 100 milliseconds. The test is complete when the drive controller announces the transition to step 4 in the SA register.

Functional Test 7 — Small Ring Buffer Initialization, Steps 1-4

The drive subsystem controller is initialized without interrupts and using the smallest ring buffer. This is the first time that the initialization sequence is carried out to completion. Initialization with the smallest ring buffer selected minimizes the host memory area with which the drive subsystem controller must be able to communicate and verifies basic TMSCP communications between the host and the controller. The smallest possible ring buffer is a buffer of two 32-bit slots.

Functional Test 8 — Large Ring Buffer Initialization

With interrupts disabled, the initialization sequence is executed with the largest possible ring buffer selected. The largest possible ring buffer is a buffer with 256 32-bit slots.

A failure to complete the initialization sequence without error will be reported.

Functional Test 9 — Get DUST Status

The Get DUST status test requests and tests the DUST status of each subsystem under test for the following two specific cases.

- No modifiers set
- Illegal modifier set

DUST status is received from the subsystem under test after the program issues the GET DUST STATUS command available in DUP. The response packet received from the subsystem is tested against a known good mask. If the expected and received packets do not match (excluding variable bits, which will be discounted), an error is reported. When no modifiers are set, the subsystem should return successful status. When modifiers are set, the subsystem should return bad status and also indicate which byte of the command packet is incorrect (A01).

Functional Test 10 — CPU/Server Bus Data

This test transfers data from the host to the drive subsystem controller, and then the data is transferred by the controller back to the host. The data is compared by the host to ensure its integrity. The goals of this test are to verify correct DUP server operation and the integrity of the data path from the host to the controller. The transfer length varies between one word and one kbyte and utilizes multiple host buffers to emulate normal bus transfers. This test passes if all data compares correctly and there are no errors during the command/response exchanges.

Functional Test 11 — Internal Drive Microdiagnostic

This test initiates and verifies correct operation of the drive microdiagnostics. This test is used to verify the correct operation of the RV20 drive. It runs all RV20 CE mode diagnostics except the 4X tests. Chapter 3 gives details on the drive's tests and the various error codes.

This test calls out only the drive itself as a failed unit. It also calls out primary and secondary (if applicable) failure codes. These codes correspond to the SAM codes given in Chapter 3. Chapter 3 also lists corrective actions (usually FRU replacements) to get the drive working again. This test passes if the drive's internal microdiagnostics complete without error.

Functional Test 12 — Drive Spin-Up

This test verifies that the SPINUP command is operational. It passes if the drive unit spins up properly with no errors.

Functional Test 13 — Drive Spin-Down

This test verifies that the SPINDOWN command is operational. It passes if the drive unit spins down properly with no errors.

Functional Test 14 — Illegal Command and Function

This test issues all illegal drive ISI commands and verifies that the controller will respond with an "illegal command" response. It passes if the illegal command is reported with the correct illegal command response packet.

Functional Test 15 — Basic Seek

This test will seek to the last physical sector on the disk and then return to track 0. That last physical sector address is then halved. A seek to the new sector address is then done, followed by a return to track 0. This continues until the sector address is less than 5. This test then starts at track 0 and performs 200 two-track seeks. This test makes sure that the drive is capable of performing a basic set of seek operations.

Functional Test 16 — Serpentine/Pump Seek

This test performs a serpentine seek pattern on the disk. It is used to verify that the drive is capable of performing a complex set of seek operations. This test passes only if all seeks are completed with no errors.

Functional Test 17 — Basic Read (Non-blank Disk Required)

This test reads and verifies data from the first 16 sectors after BOT. If a diagnostic test disk is used, known data patterns will be read, allowing for data comparisons. If a nondiagnostic test disk is used, data will be read and stored in a buffer. Another read will be performed and the data read will be compared against the data in the buffer. This test verifies that the drive can read data consistently.

Functional Test 18 — Write Data (Diagnostic Test Disk Required)

This test will write one sector of each of 16 data patterns at the end of any previously written data. The test will then read verify that the data is correct. This test passes when all data is written to and read from correctly.

Functional Test 19 — CPU/Drive Bus Data

This test transfers data given by the host to the RV20 drive subsystem controller's data buffer, and then reads the data back to the host. The host software verifies that the data transferred is correct. This test utilizes multiple buffers and emulates normal transfers from the drive to the host.

Utility Test 20 (Utility Test 1 in MDM) — Enable RV20 Firmware Error Logs

This is not a test, but an instruction to enable the firmware error logs to be printed out during the test session.

Utility Test 21 (Utility Test 2 in MDM) — Update Serial RAM Revision Level

This utility reads and updates the controller revision level in the controller serial RAM. The program reads and displays the current controller revision level for the operator, and then prompts the operator for the new controller revision to be written into the controller serial RAM. Both values are in decimal. <Ctrl/C> can be used at any time to exit this utility.

Utility Test 22 (Utility Test 3 in MDM) — Force Diagnostic Statistical Report

This is not a test but a command to force a statistical report after the current testing session ends. The statistical report contains information pertaining to the performance of the drive during the tests. This report also calls out the failed FRU in the event of a failed test.

Utility Test 23 (Utility Test 4 in MDM) — Seek Reliability

This tests the drive to the specified seek error rate by issuing 10^5 seek commands. It is used to verify that the drive has no errors in 10^5 seeks. This test passes only if no errors are detected in 10^5 seeks.

Utility Test 24 — Short Data Reliability (Non-blank Disk Required)

This test reads known diagnostic data patterns on the test disk for a five-minute period of time. If sufficient tracks have not been written on the test disk, the test starts over at BOT and continues testing until approximately five minutes have elapsed. This test verifies that the drive can read data properly. It can also run on a nontest disk by reading a sector of data twice and comparing the two buffers returned. Data compares are performed as much as possible, but the test tries to keep the drive streaming. This test passes if no hard errors are detected. The read reliability rate is not calculated by this test.

Utility Test 25 — Read Data Reliability (Non-blank Disk Required)

This test reads known diagnostic data patterns on the test disk. If sufficient tracks have not been written on the test disk, the test starts over at BOT and continues testing. The complete test takes approximately 30 minutes per drive and keeps a statistical error log. To have confidence that the read error rate has been met, this test must be run for five passes. This test passes if no hard data or functional errors occur. If one of these errors does occur, then the test is aborted. This test takes significantly longer (possibly twice as long) if the diagnostic disk is not used.

NOTE
When invoked individually, this test can be used to perform extensive drive compatibility testing by swapping the disk cartridge with a disk cartridge written in another drive.

Utility Test 26 (Utility Test 7 in MDM) — Data Reliability Spin-down/Spin-up (Non-blank Disk Required)

This test performs a read data reliability test (similar to test 25) for a random period of time. Next, the drive is spun down. After a period of not more than seven seconds, the drive is spun back up. This cycle repeats for approximately five minutes. This test verifies that data reliability is not affected by the constant spin-up and spin-down of the drive motor. It passes only if there are no hard data errors, compare errors, or errors of any other type.

Utility Test 27 — Write Data Reliability (Test Disk Required)

This test verifies the write reliability of not more than 2.3% of the available sectors. The drive's direct read during write capability verifies that the data is written correctly. The data patterns written are diagnostic data patterns. This test must be specifically invoked and should only be executed if the write error reliability of the drive is in question. Each pass of this test fills a large portion of the free sectors. This test passes if there are no hard data or functional errors. To have confidence that the write error rate has been met, this test should be run for five passes.

Utility Test 28 (Utility Test 9 in MDM) — Disk Allocation Utility (Non-blank Disk Required)

This test reads the entire disk and indicates the number of retired blocks and the amount of usable space available on the disk. It does not perform data compares of the data on the disk. The test time is dependent on the amount of data on the disk. This test passes only if there are no hard data errors, or errors of any other type.

Utility Test 29 (Utility Test 10 in MDM) — Drive Power Margins (Test Disk Required)

This utility allows the operator to do a test of the subsystem's voltage margining capability. This utility tests the subsystem by running the drive's internal microdiagnostics (test 11) using +/- 5% offsets to the power supply voltages (+5, -5, +12, -12). This test verifies that the drive's power margining is within specifications. It passes when the unit completes it without error.

Utility Test 30 (Utility Test 11 in MDM) — Update Drive Revision Levels

This utility reads/updates the drive's top revision level and reads the drive's serial number. This utility does not run by default.

Utility Test 31 (Utility Test 12 in MDM) — Write Protect (Test Disk Required)

This test verifies the write protect functionality of the disk cartridge and disk drive switch. This test is not run as part of the basic test sequence and must be specifically invoked due to the manual intervention required for setting the write protect conditions. It passes only if the drive cannot be written to when write protect is enabled, and can be written when write protect is disabled.

Utility Test 32 (Utility Test 13 in MDM) — Initialize Diagnostic Test Disk (Blank Disk Required)

This test creates a diagnostic test disk from a blank disk. If the disk is not blank, you are prompted as to whether you wish to create a diagnostic test disk. Once a test disk is created, any data previously on the disk is lost. The test creates a test disk by formatting the disk using the ANSI tape format, writing 1000 sectors of data patterns on the disk.

If an error code of 1B (hex) was returned during a previous read test, this test must be run to reformat the disk. Once this test is run, the disk will always be a diagnostic test disk.

2.2.7 Error Reporting

If an error report is requested when setting up the tests, four numbers are called out in an error report. They are the message field, error class, error code, and the procedure where the error occurred (the "where"). The where information has to do with TMSCP protocol, which is proprietary information of Digital Equipment Corporation. The other three numbers are given in the following tables: Table 2-2, Message Fields; Table 2-3, Error Classes; and Table 2-4, Error Codes.

Table 2-2 Message Fields*

Field	Meaning
Bit 7	Set if diagnostic test is being aborted.
Bit 6	Set if command causing error is a TMSCP command.
Bit 5	Set if command causing error is an ISI command.
Bits 0-4:	
0000 0000	Diagnostic test exit status is normal. Command was completed successfully with no error logs.
0000 0001	Diagnostic test has completed successfully.
0000 0010	Packet contains only an error log (no error code or error class in report).
0000 0011	Packet contains only the error code.
0000 0100	Packet contains the end message information from a TMSCP command.
0000 0101	Packet contains the end message information from an ISI command.

Table 2-2 Message Fields* (Cont)

Field	Meaning
0000 0110	An expected error was found.
0000 0111	Unexpected message from controller and/or drive unit.
0000 1000	Diagnostic abort is pending.
0000 1001	Diagnostics were unable to send to host.
0000 1010	Write protect information is provided.
0000 1011	Disk capacity information is provided.
0001 0000	Diagnostic test not available.
0001 0001	Results of the internal drive microdiagnostics.
0001 0010	The illegal command given to the drive was not handled properly.
0001 0011	The packet contains byte compare error information.
0001 0100	The test is ready to receive data from the host.
0001 1111	The packet contains test data.

* The diagnostic prints these values in hex.

Table 2-3 Error Classes

Class	Meaning
00	No error
01	Seek error
02	Drive error
03	Drive status
04	Data error
05	Status error
06	Last fail error
07	Unexpected error number
08	System service error
0A	Controller error
0B	Formatter error
0C	Host buffer access error
0D	Serious exception
0E	Tape transfer error

Table 2-4 Error Codes

Code	Meaning
01	Invalid I/O channel was specified
02	Invalid interrupt type
03	Invalid service
04	Invalid number of seconds specified
05	Buffer pointer was a null pointer
06	Task name was invalid
07	Task is already created
08	Device being opened is an unknown device
09	Device specified is already allocated
0A	Item code for information about an I/O device was invalid
10	Data buffer pointer was lost
11	Data buffer counter is bad
12	Host packet was not present when expected
13	An invalid command number was given
14	There was no room to store a reference to a local data buffer
15	No data buffer in the DB information block left
16	Command information was lost
17	Data pattern numbers do not agree
18	An illegal pattern number was specified
19	A sector read error occurred
1A	The drive was in the wrong position for the read
1B	Invalid data pattern format (Run Initialize Diagnostic Test Disk utility to reformat disk.)
1C	Diagnostic code bug
20	Requested drive is unavailable
21	Fatal drive error occurred
22	Unit is spun up
23	Unit has a volume mounted
24	Unit is write protected
25	Unit has a duplicate unit number
26	Start/Stop switch is out
27	Write Protect switch is in
28	Unit has a blank disk mounted (a blank disk should not be mounted)
29	Unit does not have a blank disk mounted (a blank disk should be mounted)
2A	Unit does not have a diagnostic disk mounted
2B	Unable to send to host

Table 2-4 Error Codes (Cont)

Code	Meaning
2C	Unit has a fault condition
2D	Unit does not have a blank or diagnostic disk mounted (a blank or diagnostic disk should be mounted)
2E	Unit does not exist
40	Drive is still connected
41	Duplicate TMSCP unit number
42	Drive is already on-line
43	Drive is still on-line
44	EOT encountered
45	Drive is still on-line — unload ignored
50	Unit is unknown
51	No volume
52	Unit is inoperative
53	Unit is disabled
60	Unit is hardware write protected
61	Unit is software write protected
62	Unit is data safety write protected
70	Long gap encountered
71	Unrecoverable read error
72	Post field detected
73	Overwrite attempted
74	Soft write error
75	Soft read error
76	Recoverable hard read error
77	ECC read error
78	Unrecoverable read error
79	Secondary revector control table used
7A	Secondary replacement area used
7B	Bad media limits found
7C	End of media found
80	Unknown host buffer
81	Odd transfer address
82	Odd byte count
83	Nonexistent host memory
84	Parity error
85	Invalid page table entry
86	Compare modified read or write error

Table 2-4 Error Codes (Cont)

Code	Meaning
90	Controller code bug
91	Drive has available status
92	Unrecognized error log event code
93	Unrecognized error log format code
94	Inconsistent internal control structure
95	LESI parity error from LESI adapter to drive subsystem controller
96	LESI parity error from drive subsystem controller to LESI adapter
97	Drive subsystem controller memory error
A0	Drive command timeout
A1	Controller-determined transfer error
A2	Position error
A3	Drive detected error
A4	Controller-determined protocol error
A5	Drive failed initialization
A6	Drive ignored initialization
A7	Drive clock dropout
A8	Controller detected state parity error
A9	Drive seek retry applied
AA	Soft seek error
B0	Not a tape format
B1	No secondary revector control table
B2	Secondary revector control table is full
B3	No secondary replacement area
B4	Secondary replacement area is full
C0	Invalid message length
D0	Invalid command
D1	Command aborted
D2	Compare error
D3	BOT encountered
D4	Tape mark encountered
D5	Record data truncated
D6	Position lost
D7	Serious exception
D8	LEOT detected
D9	Message from internal diagnostic
DA	Formatter error

The following are two examples of error reports generated by the diagnostics.

The first example calls out the error that occurred and then names the drive that failed (Drive 2). The report begins with the name of the test that failed (Test 11: Internal Drive Microdiagnostic Test) and also includes a message field (Message: 11).

Table 2-2 lists the message fields in binary code. When you convert 11 hex to binary, the result is 0001 0001. Table 2-2 defines this field as "Results of the internal drive microdiagnostics."

In this example, both primary and secondary fault codes were generated after the message field (7B and 01, respectively). These codes correspond to the SAM failure and subfailure codes described in Chapter 3 of this guide.

```
Test 11: Internal Drive Microdiagnostic Test

System Service error occurred on RV20 subsystem
All values are printed in Hexadecimal
Port (drive) being tested is: 02
Message:     11        Primary Fault Code:          7B
Secondary Fault Code: 01

Bytes in Error:          0000        Soft Seek Errors:         0000
Seek Retry Applied:      0000        Soft Write Errors:        0002
Hard Seek Errors:        0000        Recov Soft Read Errors:   0000
Recov Hard Read Errors:  0000        Nonrecov Read Errors:     0000
Data Error Count:        0000        Other Drive Errors:       0002
ECC Error Count:         0002        Retry Count:              0000
Kbytes read:             000007F0    Kbytes Written:           00000C67
Sectors Addressed:       0000F001C   1 x 10_5 Seeks:           0000
1 x 10_9 Writes:         0000        1 x 10_9 Reads:           0000
```

The next example calls out the error that occurred and then names the drive that failed (Drive 2). The report begins with the name of the test that failed (Test 29: Drive Power Margins Test) and also calls out message field, error class, error code, and "where" information relative to the error that caused the test to fail.

In this example, message field 88 is called out, indicating that the diagnostic aborted (Table 2-2). Error class 02 is called out, indicating that a drive error caused the problem (Table 2-3). And error code 2A is called out, indicating that a diagnostic test disk was not mounted in the drive (Table 2-4). In this case, you would insert a test disk in the drive and run the test again.

```
Test 29: Drive Power Margins Test

System Service error occurred on RV20 subsystem
All values are printed in Hexadecimal
Port (drive) being tested is: 02
Message:      88        Error class:                  02
Error Code:   2A        Where:                        XX

Bytes in Error:           0000        Soft Seek Errors:          0000
Seek Retry Applied:       0000        Soft Write Errors:         0002
Hard Seek Errors:         0000        Recov Soft Read Errors:    0000
Recov Hard Read Errors:   0000        Nonrecov Read Errors:      0000
Data Error Count:         0000        Other Drive Errors:        0002
ECC Error Count:          0002        Retry Count:               0000
Kbytes read:              000007F0    Kbytes Written:            00000C67
Sectors Addressed:        0000F001C   1 x 10_5 Seeks:            0000
1 x 10_9 Writes:          0000        1 x 10_9 Reads:            0000
```

2.3 Running Level III Diagnostics Through MDM

On the MicroVAX, the Level III diagnostics are run through MDM. The system must be taken off-line to run MDM.

2.3.1 Equipment

To run the RV20 diagnostics under MDM, you need the version of MDM that contains the RV20 diagnostics.

You must also use your own test disk to test drives; never use customer media for testing. A test disk can be created with test 13. Make sure that the drive being tested has a test disk installed and the Start/Stop switch is pressed in.

2.3.2 HELP

Help is available throughout MDM. Type HELP at the MDM>> prompt and a summary of all available commands is displayed on the screen. Additional information can be obtained from the host system documentation and the *MicroVAX Diagnostic Monitor User's Guide* (AA-FM7AA). A sample HELP screen follows.

2.3.3 Bringing MDM Up

To start the tests, you must first boot MDM. Once MDM is booted, the disclaimer screen appears.

```
      MicroVAX Maintenance System - Version 2.xx

              CONFIDENTIAL DIAGNOSTIC SOFTWARE
                       PROPERTY OF
               DIGITAL EQUIPMENT CORPORATION

      Use Authorized Only Pursuant to a Valid Right-to-use License

      Copyright (c) 1986
      Digital Equipment Corporation

      The current date and time is: 4-MAY-1987 14:04:56.88

      Press the RETURN key to continue,
      or enter the new date and time; then press the RETURN key.

        [DD-MMM-YYYY HH:MM]:

MDM>> HELP
CLEAR CPU_DISPLAY                 - Set the CPU display to 0.
CLEAR ERROR_LOG                   - Clear the error logs.
CONFIGURE                         - Configure the system.

CONNECT csr FILE_NAME file_name VECTOR vector BR_LEVEL br_level
                                  - Assign a diagnostic to a CSR.

CONTINUE                          - Proceed from MDM CTRL-C>>.
DISABLE                           - Disable selected diagnostics.
DISABLE ALL                       - Disable all the diagnostics.
DISABLE diagnostic_name           - Disable the execution of a diagnostic.
DISABLE diagnostic_number         - Disable the diagnostics indexed by the
                                    number.
ENABLE                            - Enable selected diagnostics.
ENABLE ALL                        - Enable all the diagnostics.
ENABLE diagnostic_name            - Enable the execution of a diagnostic.
ENABLE diagnostic_number          - Enable the diagnostics indexed by the
                                    number.
EXIT                              - Exit from MDM.
HALT                              - Stop diagnostic execution with cleanup.
IGNORE csr                        - Don't load a diagnostic for CSR.
RESTART                           - Return to the main menu.
SELECT                            - Select the following diagnostic.
SELECT diagnostic_name            - Select the indicated diagnostic.
SELECT diagnostic_number          - Select the diagnostics indexed by the
                                    number.
```

```
SELECT NEXT                        - Select the following diagnostic.
SET BELL OFF                       - Disable bell on diagnostic error.
    BELL ON                        - Enable bell on diagnostic error.
    CLOCK DD-MMM-YYYY HH:MM        - Set the system clock.
    DETAILED_MESSAGE OFF           - Disable the display of detailed messages.
    DETAILED_MESSAGE ON            - Enable the display of detailed messages.
    ERROR CONTINUE                 - Set continue on error.
    ERROR HALT                     - Set halt on error.
    MODE SERVICE                   - Set the testing mode to service.
         VERIFY                    - Set the testing mode to verify.
    PASSES number                  - Set the number of passes.
    PROGRESS BRIEF                 - Enable brief progress messages.
    PROGRESS FULL                  - Enable full progress messages.
    PROGRESS OFF                   - Disable progress messages.
    SECTION EXERCISER              - Set the test section to exerciser.
            FUNCTIONAL             - Set the test section to functional.
            UTILITY                - Set the test section to utility.
    TEST ALL                       - Enable all tests that match section and
                                       mode.
         test_range                - Enable tests in test_range, for example,
                                       1, 3-5.
    TIME DDDD HH:MM:SS.CC          - Set the total execution time.
SHOW BUS                           - Show the active CSRs on the bus.
     CLOCK                         - Show the current date and time.
     CONFIGURATION BRIEF           - Show the system configuration.
                   FULL            - Show the full system configuration.
     DEFAULT                       - Show the current settings.
     DEVICE                        - Show the device's CSR, vector, and BR
                                       level.
     DEVICE FRU                    - Show the device's FRUs.
     DEVICE TESTS                  - Show the functional and exerciser tests.
     DEVICE UNITS                  - Show the device's units.
     DEVICE UTILITIES              - Show the utility tests.
     DISCLAIMER                    - Show the disclaimer message.
     ERRORS                        - Show the accumulated errors.
     MEMORY                        - Show the system memory usage.
START                              - Start the selected diagnostic.
START ALL                          - Start all the enabled diagnostics.
START diagnostic_name              - Start the indicated diagnostic.
START diagnostic_number            - Start the diagnostic indexed by the
                                       number.

UNITS diagnostic ENABLE ulist  - Enable or Disable unit testing.
UNITS diagnostic DISABLE ulist - ulist: 0, 1, 2 or 3-5 etc.
```

Input the date and time at the disclaimer screen. The display echoes the date and time you typed in and then asks if you want to enter menu mode.

Enter Menu mode by typing 1 and pressing the RETURN key. Proceed to Paragraph 2.3.4 for details on Menu mode.

If you don't want to enter menu mode, press the 2 key and RETURN. The following screen is displayed.

```
The current date and time is: 4-MAY-1987 14:05:02.18

   Do you want to enter the menu mode?

         1 - Yes
         2 - No

   Type the number; then press the RETURN key. > 2

   CAUTION: You are about to enter command line mode
   There are no menus once you enter this mode.
   Refer to the MDM User's Guide for detailed instructions.

   To return to the menu mode from command line mode
   type "RESTART" and press the RETURN key, or reboot the system.

   Type 2 and press the RETURN key to proceed,
   or type 1 and press the RETURN key to enter menu mode. > 2

 MDM>>
```

Press 2 and RETURN to enter command line mode, where tests can be set up and run. The MDM>> prompt is displayed, signifying that you are in the MicroVAX diagnostic monitor.

At the MDM>> prompt, type CONFIGURE and then press RETURN. When the configure is done, another MDM>> prompt comes up. At that prompt, select the RV20 you want to test and then press RETURN.

```
MDM>> CONFIGURE <CR>
MDM>> SELECT RV20A <CR>
MDM>>
```

When the MDM>> prompt displays again, you may begin testing the RV20 subsystem. Proceed to Paragraph 2.3.5.

2.3.4 Menu Mode

If you choose to enter menu mode, the Main Menu is displayed.

```
MAIN MENU

    1 - Test the system

    2 - Display System Configuration and Devices

    3 - Display the System Utilities Menu

    4 - Display the Service Menu

    5 - Exit MicroVAX Maintenance System
```

Option 1 performs basic Verify mode testing (no write operations) on the RV20 subsystem as well as the other selected devices on the system.

Option 2 displays the current system configuration and lists the devices the CPU recognizes on the system. This allows you to quickly check the system. If a device physically present on the system is not listed on the system configuration and devices display, then there is a problem.

Option 4 selects the Service Menu. This is the option to select when you want to run RV20 diagnostics.

```
MAIN MENU
SERVICE MENU

   CAUTION: This menu is intended for use by qualified service
   personnel only. Misuse of the commands could destroy data.

   1 - Set test and message parameters

   2 - Exercise system continuously

   3 - Display the device menu

   4 - Enter system commands

Type the number; then press the RETURN key,
or type 0 and press the RETURN key to return to the Main Menu. >
```

If you choose option 1, the basic testing parameters currently SELECTed will be displayed. You may SET new parameters at this screen.

If you choose option 2, you will run the Service mode tests. These tests perform write operations on the diagnostic test disk. If you wish to run the Service mode tests without overwriting data on the diagnostic test disk, press in the Write Protect switch on the front panel of the RV20 being tested. Another way to write protect the diagnostic test disk is to turn the Write Protect tab on the disk to the WRITE PROTECT position.

Option 4 takes you out of Menu mode and brings you into Line mode, where you will be at the MDM>> prompt.

Option 3 brings you to the Device Menu, where you can select an RV20 controller from the devices available on the system. When an RV20 controller has been selected, you can run specific tests and series of tests.

2.3.5 Running the Tests

In Line mode, once the RV20 subsystem is SELECTed, you may SELECT and SET the test parameters you want to use in this testing session.

The tests only run on drives that have disks installed and spinning. (This is the case if the Ready indicator, located on the drive's Start/Stop switch, is on.) When a set of tests is running on a multidrive subsystem, a test runs on each drive before the next test is performed.

CAUTION
Never use customer media when running Level III tests. Use a scratch disk or a dedicated test disk.

There are 32 Level III tests. Table 2-1 lists the tests and the duration of each one. There are two sets of tests: functional tests (1 to 19) and utility tests (20 to 32). The complete functional test set takes about twenty minutes per drive to run.

Some of the utility tests are not actually tests. Utility test 19, for example, forces a statistical report to be printed out after the current tests are complete. The complete set of utilities and utility tests takes between 5 and 6 hours per drive to run.

Paragraph 2.2.6 gives descriptions of all the tests, what they do, and any equipment or user input needed for the tests to run.

The following are some of the more common commands used in MDM. (Typing HELP will display all the available commands.)

SET DETAILED MESSAGE OFF — This command gives a brief message if a test fails (in either mode).

SET DETAILED MESSAGE ON — This comand causes a detailed error report to display on the screen when a test fails.

SET PROGRESS OFF — This command does NOT give a progress report on the screen.

SET PROGRESS BRIEF — This command gives a screen message at successful completion of a test (full number of passes). For example, if you run test number 5 ten times, the screen displays a message after the tenth pass of the test.

SET PROGRESS FULL — This command gives a screen message at each run ("pass") of each test (regardless of whether the test passes or fails). If a test fails, a detailed error report is given.

SET MODE VERIFY — This command selects Verify mode (functional tests 1 to 11). See Table 2-1 for test names. These tests take five to six minutes per drive to run.

SET MODE SERVICE — This command selects Service mode (tests 1 through 19). These tests take about 16 minutes per drive to run.

SET SECTION FUNCTIONAL — This command selects functional tests 1 through 19. Verify mode runs tests 1 to 11; Service mode runs all 19 tests.

SET SECTION UTILITY — This command selects utility tests 20 through 32. These are extensive tests that take between seven and eight hours per drive to run. Refer to Paragraph 2.2.6 for more information on the utilities.

SET SECTION EXERCISER — If in Verify mode, this command selects only one test, the basic read test. If in Service mode, this command selects only two tests, the basic read test and the basic write test. The exerciser is used at the same time as other devices on the system. For example, if you have a TK50 tape drive in your system, the exerciser can run an RV20 basic read test while also running a TK50 basic read/write test.

SET TEST ALL — This command runs all tests in the mode and section selected. For example, in the functional section, Verify mode runs tests 1 to 11 and Service mode runs tests 12 to 19.

SET TEST NN — This command runs a specific test or a specific series of tests.

SET TEST 2 — runs test 2
SET TEST 2-4 — runs tests 2, 3, and 4
SET TEST 2,4-6,8 — runs tests 2, 4, 5, 6, and 8

SET PASSES NN — This command runs tests a specified number of times. For example, the command SET PASSES 10 runs each test that is set to run 10 times.

SHOW CONFIGURATION — This command shows the number of RV20 controllers being tested.

SHOW DEFAULT — This command shows the current selected testing parameters.

2.3.6 Error Reporting

If an error report is requested when setting up the tests, the codes given in the error report define and isolate problems. Refer to Paragraph 2.2.7.

2.4 Running Level IIR Data Reliability Diagnostics Through VDS

In BI-based systems, extensive Level IIR data reliability diagnostics are run through VDS. The Level IIRs can be run in user mode. The system does not have to be taken off-line to run these diagnostics.

2.4.1 Equipment

To run the Level IIR diagnostics, EVRVB must be available in the Field Service account or on a loadable device.

Unlike other RV20 diagnostics, you can use customer media for the Level IIR tests. Running these tests can isolate a problem to the customer media (refer to the description of Test 1 in Section 2.4.6.)

2.4.2 HELP

Help is available for all the Level IIR tests. Typing HELP will display an extensive file (EVRVB.HLP) that details ATTACH sequences, device names, commands, and event flags.

Additional information can be obtained from the host system documentation and the *VAX Diagnostic Supervisor User's Guide* (EK-VXDSU-UG).

2.4.3 Bringing VDS Up and Loading EVRVB

Begin the test session by running the Diagnostic Supervisor. Entry into the Diagnostic Supervisor is indicated by the DS> prompt.

Load the Level IIR diagnostics with the following command and press the RETURN key (<CR>).

```
DS> LOAD EVRVB <CR>
DS>
```

When the diagnostics are loaded, the DS> prompt comes up.

2.4.4 ATTACH and SELECT

The ATTACH command is used to specify a device on the system under test. A device cannot be accessed by VDS unless it had first been ATTACHed.

Before the RV20 can be tested, its type, location, and characteristics must be ATTACHed. The subsystem is connected to the drive subsystem controller in the master RV20. The master connects to the KLESI-B adapter in the host, which is connected to the processor. The complete path from processor to device must be established with two ATTACH sequences before testing can begin.

To ATTACH the subsystem with the standard ATTACH sequence for all VDS diagnostic packages, use the following format.

```
ATTACH DEVICE_TYPE DEVICE_LINK DEVICE_NAME BI NODE #
```

The ATTACH sequence can be entered on one line or you will be prompted for each parameter in the command.

Example:

```
DS> ATTACH DWBLA HUB BLA0 4 <CR>
DS>
```

or

```
DS> ATTACH <CR>
Device Type? DWBLA <CR>
Device Link? HUB <CR>
Device Name? BLA0 <CR>
BI NODE # (HEX)? 4 <CR>
DS>
```

The first ATTACH sequence is successful when the DS> prompt reappears without any error messages. The next ATTACH sequence has the following format.

```
ATTACH DEVICE_TYPE DEVICE_NAME DEVICE CSR_ADDRESS VECTOR BR
```

Because the subsystem has been ATTACHed with the first ATTACH command string, the supervisor now recognizes the DEVICE_TYPE as RV20. The DEVICE is the logical name of the controller (MUXX). Further, you must know the CSR and vector addresses, as well as the BR level, because they are also part of the command string.

Here is an example of the second ATTACH sequence. Remember, the addresses are probably different for your subsystem.

```
DS> ATTACH RV20 BLA0 MUA0 774500 300 5 <CR>
DS>
```

The second ATTACH sequence is successful when the DS> prompt reappears without any error messages.

The next step is to SELECT the drive subsystem controller.

```
DS> SELECT MUA0 <CR>
DS>
```

2.4.5 Running the Tests

When the controller is SELECTed, you can SELECT and SET the test parameters for this test session. Paragraph 2.4.6 describes the tests, and Paragraph 2.4.7 contains information on the event flags that can be set with EVRVB.

The tests only run on drives that have disks installed and spinning. (This is the case if the Ready indicator, located on the drive's Start/Stop switch, is on.) When tests are running on a multidrive subsystem, a test runs on each drive before the next test is performed.

2.4.6 Test Descriptions

EVRVB consists of three tests: Test 1 — Basic Functional Test, Test 2 — Basic Read Test, and Test 3 — Multiunit Test. The complete test set takes roughly 60 minutes per drive to run.

Test 1 — Basic Functional Test

This test performs a quick verification of read operations. It should be used to verify the integrity of customer media. It executes ONLINE with the Clear Serious Exception Modifier set, then sets the unit characteristics, and resets any residual errors. The order of operations is as follows.

- Rewinds to BOT
- Spaces forward to LEOT, determining file numbers
- Rewinds and reads records of the first file, determining record count
- Repositions by record, and ensures correct position by reading record counts (This sequence spaces over a few records in each direction, then reads the next subsequent record to check the unit's honesty.)
- Spaces forward to the next file, reads records of the file, and determines record count
- Reverses one file, then spaces forward and rereads records of the file, comparing against the last read
- Rewinds to BOT
- Spaces forward to LEOT
- Rewinds to BOT

Test 2 — Basic Read Test

This test performs a rewind, and then reads until EOT, LEOT, or fatal error is encountered. It keeps track of the number of records per file read, and the total bytes read. If a fatal error is encountered, a message is reported, the unit is repositioned to BOT, and is prevented from executing further read operations. This test is a streaming type of operation. Data compares are performed during the test according to the event flags set by the user.

Test 3 — Multiunit Test (Version 1.1 and later)

This test exercises up to four available drives at a time in a sequential "round robin" manner. The test executes like Test 2, and can test all drives simultaneously.

2.4.7 Event Flags

The following event flags can be set while under Diagnostic Supervisor control. To set an event flag, type

```
SET EVENT FLAGS
```

followed by one of the numbers defined below.

Event Flag Definitions

EF#4 — enables host program data compares on all read operations from the diagnostic disk.

EF#5 — inhibits all data compares.

EF#6 — inhibits autodrop. This flag prohibits the program from dropping any unit that has exceeded the specified failure rate. When this flag is reset, the program drops any units that have exceeded the specified failure rate.

EF#7 — inhibits autoadd. This flag inhibits the program from picking up units that were dropped from testing during a previous test cycle. When set, and the program drops a unit due to an excessive failure rate, the unit will stay deselected until the operator changes the event flag or restarts the program. If reset, the program will attempt to pick up all units previously dropped at the start of a new pass of the test cycle.

2.4.8 Error Reporting

When an an error occurs, a detailed error report prints out. A sample error report follows.

```
ERROR MESSAGES FORMAT

******** EVRVB RV20 LEVEL 2R DIAGNOSTIC -- 1.0 ********
Pass 1, test 2, subtest 0, error 3, 18-JAN-1988 8:07:26.28
Soft error while testing MUA0:
UNIT FAILED TO CORRECTLY EXECUTE A COMMAND
FAILING COMMAND: READ
DETECTING PROCESS: VMS
PREVIOUS COMMAND: READ
BYTE/ACTION COUNT: 32767, 1 RECORDS/FILE
LAST RECORD COMPLETE 91, CURRENT FILE NUMBER: 5
Item Count Complete: 2048


            !EXTENDED ERROR REPORT:
            !PACKET DATA AS CONTAINED WITHIN THE "P6" BUFFER
            !CONTENTS: 48 BYTES - COMMAND PACKET
            !CONTENTS: 48 BYTES - END PACKET RESPONSE

** Packet Sent **
       0000003F       !COMMAND REFERENCE NUMBER (LW)
       00000001       !RESERVED(W)  |  UNIT NUMBER(W)
       00000021       !MODIFIERS(W)  | RESERVED(B)   | OPCODE(B)
       00001000       !BYTE COUNT (LW)
       00023FE0       !BUFFER DESCRIPTOR(LW)
       00000000       !BUFFER DESCRIPTOR(LW)
       00000000       !BUFFER DESCRIPTOR(LW)

** Packet Received **
       0000003F       !COMMAND REFERENCE NUMBER(LW)
       00000001       !RESERVED(W)  |  UNIT NUMBER(W)
       000B1008       !STATUS(W)  |  FLAGS(B)  |  ENDCODE(B)
       00001000       !BYTE COUNT  (HOST BYTE COUNT) (LW)
       00000000       !BYTE COUNT (TAPE RECORD) (LW)
       0000001F       !POSITION (OBJECT COUNT) (LW)
```

NOTE
Field information is clustered into 3 unique data types: (LW) = 32 bits, (W) = 16 bits, (B) = 8 bits. All packet data is in hex. The data contained within a packet is not "indexed" for specific definition. Byte 6, for example, is not "keyed" into a specific ASCII message. Instead, when extended error message information is requested, the user is required to understand the meaning of each field produced in the display.

2.5 Running Level 2R DUP Tests Through VDS

On BI-based systems, the Level 2R Diagnostic Utility Protocol (DUP) on-line diagnostic package runs under VMS and the VAX Diagnostic Supervisor (VDS). It interfaces to the subsystem by way of the VMS DUP FYDRIVER. The package can be run in user mode, so an RV20 suspected of failure can be taken off-line and tested without taking the entire subsystem off-line.

2.5.1 Equipment

To run Level 2R DUP diagnostics, EVRVC must be available in the Field Service account or on a loadable device.

You should also have a dedicated diagnostic test disk in the drive you are testing, although this is not a requirement for running these tests. If desired, a dedicated diagnostic test disk can be created with Level 2R DUP test 21. If a diagnostic test disk is not used, some of the tests cannot run. Refer to the test descriptions given in Paragraph 2.2.6.

2.5.2 HELP

HELP is available throughout VDS. Typing HELP will display a list of topics that have on-line help. Typing HELP followed by the desired topic or command will display information about that topic.

Additional information can be obtained from the host system documentation and also the *VAX Diagnostic Supervisor User's Guide* (EK-VXDSU-UG).

2.5.3 Bringing VDS Up and Loading EVRVC

Begin the test session by running the Diagnostic Supervisor. Entry into the supervisor is indicated by the DS> prompt.

Load the Level 2R DUP diagnostic package with the following command and press the RETURN key (<CR>).

```
DS> LOAD EVRVC <CR>
DS>
```

When the diagnostics are loaded, the DS> prompt comes up.

2.5.4 ATTACH and SELECT

The standard ATTACH and SELECT sequences are used to bring the Level 2R DUP tests on-line. Refer to Paragraph 2.2.4 for the ATTACH and SELECT command sequences.

2.5.5 Running the Tests

The Level 2R DUP diagnostic package consists of 22 tests. The test names and their durations are listed in Table 2-5. All the Level 2R DUP tests are also part of the Level III tests described earlier in this chapter. Table 2-5 contains a column that references the corresponding Level III test number from Table 2-1. This cross reference column is provided so that you can locate test descriptions in Paragraph 2.2.6.

Table 2-5 Level 2R DUP Tests

Level II DUP Test	Level III Test	Test Name	Test Duration
		Service Tests	
1*	9	Get DUST status	1-4 seconds
2*	10	CPU/server bus data	1-4 seconds
3*	11	Internal drive microdiagnostic	8 minutes per drive
4*	12	Drive spin-up	1 minute per drive
5*	13	Drive spin-down	1 minute per drive
6*	14	Illegal command and function	1 minute per drive
7*	15	Basic seek	2 minutes per drive
8*	16	Serpentine/pump seek	4 minutes per drive
9*	17	Basic read	2 minutes per drive
10	18	Basic write	2 minutes per drive
11*	19	CPU/drive bus data	1 minute per drive
12*	23	Seek reliability	45 minutes per drive
13*	24	Short data reliability	5 minutes per drive
14	25	Read data reliability	2 hours per drive
15*	26	Data reliability spin-down/spin-up	15 minutes per drive
		Utility Tests	
16	27	Write data reliability	2 hours per drive
17	28	Disk allocation utility	2 minutes per drive
18	29	Drive power margins	20 minutes
19	30	Update drive revision levels	< 10 seconds
20	31	Write protect	10 seconds
21	32	Initialize diagnostic test disk	2 minutes
22	22	Force diagnostic statistical report	< 10 seconds

* Default tests

There are three groups of Level 2R DUP tests: Default, Service, and Utility. Default tests are the tests that are run if no specific test number is given in the START (or RUN) command. The Default tests are tests 1 to 9 and tests 11, 12, 13, and 15 (see Table 2-5). The Service tests consist of tests 1 through 15 (all the Default tests as well as tests 10 and 14). The Utility tests are tests 16 through 22. These tests are usually run individually and sometimes require operator intervention. Refer to Table 2-5 for test durations and Paragraph 2.2.6 for test descriptions.

The commands used to run the Level 2R DUP tests are the same ones used to run any tests under VDS. Refer to Paragraph 2.2.5 for examples.

2.5.6 Error Reporting

If an error report is requested when setting up the tests, the codes given in the error report define and isolate problems. Refer to Paragraph 2.2.7.

2.6 VMS Error Logs

Whenever the host system detects an RV20 subsystem failure, error codes are generated by the VMS error logger. The error log report calls out a format code and an event code. Table 2-6 lists all the format and event codes generated for the RV20 subsystem.

To get a printout of the error log for a failed drive in an RV20 subsystem, use the ANALYZE/ERROR_LOG command and include the device name of the drive that failed.

Example:

```
ANALYZE/ERROR_LOG/INCLUDE=MUA0
```

Remember that this is merely one example of the ANALYZE command. There are many qualifiers that can be used with this command. More information can be obtained by typing HELP at the system prompt. Refer also to the *VAX/VMS Error Log Utility Reference Manual.*

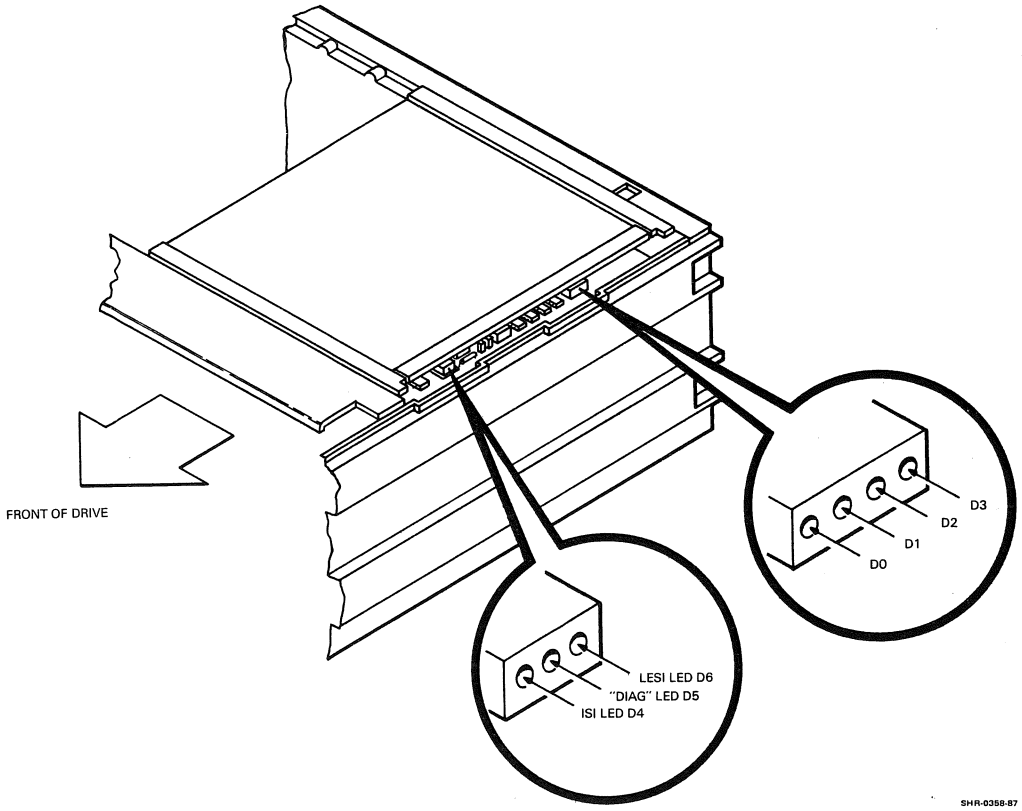
Table 2-6 VMS Error Log Format/Event Codes

Format Code	Event Code	Description
0	006A	Inconsistent internal control structure (drive subsystem controller microcode bug)
0	00AA	LESI parity error (LESI adapter to drive subsystem controller)
0	00CA	LESI parity error (drive subsystem controller to LESI adapter)
0	012A	Drive subsystem controller memory error
1	0007	Compare modified read or write failure
1	0069	Nonexistent host memory error
1	0089	Host memory parity error
5	00E8	Unrecoverable read or write error
5	0108	One-symbol recoverable ECC error
5	0128	Two-symbol recoverable ECC error
5	0148	Three-symbol recoverable ECC error
5	0168	Four-symbol recoverable ECC error
5	0188	Five-symbol recoverable ECC error
5	01A8	Six-symbol recoverable ECC error
5	01C8	Seven-symbol recoverable ECC error
5	01E8	Eight-symbol recoverable ECC error
5	0208	Nine-symbol recoverable ECC error
5	0228	Ten-symbol recoverable ECC error
5	0308	Overwrite attempted
5	002B	Command timeout
5	004B	Controller detected transmission error
5	006B	Positioner error
5	00AB	Drive clock dropout
5	00EB	Drive detected error
5	010B	Controller detected state parity error
5	014B	Controller detected protocol error
5	016B	Drive failed initialization
5	018B	Drive ignored initialization
5	0103	Unit off-line — disabled due to invalid characteristic

2.7 Power-Up Testing the Drive Subsystem Controller

The drive subsystem controller module has a set of power-up tests that run whenever power is applied to the master drive in an RV20 subsystem. The results of the tests are indicated by seven LEDs located on the module. These LEDs are numbered D0 through D6. Figure 2-1 shows the location of the LEDs on the drive subsystem controller.

Figure 2-1 Drive Subsystem Controller LEDs



The seven LEDs are divided into a group of three test LEDs (D4 to D6) and another group of four communications LEDs (D0 to D3). After all the power-up tests run (or when a failure occurs in one of the tests), the three test LEDs are updated as described below. Then communication with the drives in the subsystem is attempted and the communication LEDs are updated.

D6 — LESI LED

As with all seven LEDs, on power-up, D6 lights up. The drive subsystem controller checks for the presence of the KLESI adapter. The adapter is assumed to be present if the CIP (Cable In Place) signal is asserted. If the CIP signal is not asserted, D6 is extinguished. If CIP is asserted, a handshake test is done. When the handshake test passes, D6 is extinguished.

It is important to remember the limitations of D6. D6 is extinguished if the test passes, but it is also extinguished if the CIP signal is not present. The meaning of this extinguished LED should not be misinterpreted to mean the test definitely passed. If the LED stays on, however, you can be sure that the CIP signal is present and the LESI handshake test did indeed fail.

D5 — "DIAG" LED

As with all seven LEDs, on power-up, D5 lights up. Upon successful completion of the Level A microdiagnostics that do not require driving the ISI bus, D5 is extinguished.

D4 — ISI Bus LED

As with all seven LEDs, on power-up, D4 lights up. After the power-up microdiagnostics pass, the remaining microdiagnostics run. These tests drive the data and control lines on the ISI bus. When these tests pass, D4 is extinguished.

D0 to D3 — Communications LEDs

The four yellow communication LEDs correspond to the Control Module (CM) number (0 to 3) that each of the drives in the subsystem has been assigned.

The master RV20 is always CM 0. The first slave in the daisy-chain is always CM 1, the second slave in the chain is always CM 2 and the third slave is always CM 3. The CM number for each drive is stamped on top of the Power indicator/address plug on the RV20 front panel.

On power-up, all four of these LEDs light up. After successful completion of the Level A microdiagnostics, communication is attempted with each of the drives in the subsystem. As communication is established with each drive, the corresponding LED (D0 to D3) is extinguished. If all four LEDs stay on, it may be due to a faulty drive, Level A microdiagnostics failure, or a fatal error encountered by the drive subsystem controller.

2.7.1 Performing the Test

Make sure that the entire subsystem is cabled properly, including the cabling to the host from J61 on the master drive. Make sure that all the slave drives are powered up and have passed their internal power up/self-tests. The test is executed by powering up the master RV20.

WARNING
Don't forget to extend the cabinet's stabilizer leg before pulling the drive from the cabinet

1. Pull the master RV20 out of the cabinet to expose the top cover.
2. Remove the rear piece of the top cover on the RV20 master drive. Locate the drive subsystem controller module in the card cage (top PCA). Locate the seven LEDs on the outer edge of the PCA (Figure 2-1).
3. Begin the test by powering up the master drive.
4. Observe the three test LEDs.

All three test LEDs light up, and then the Level A microdiagnostics run. At the end of the microdiagnostics, all three test LEDs extinguish. If any of the three LEDs stays on, this indicates a test failure. (Refer to the descriptions of each LED above.)

A flashing sequence follows, indicating the results at the end of the Level A microdiagnostics. If all three LEDs extinguish and no flashing sequence occurs, it is likely that the drive subsystem controller encountered a fatal error. Refer to Paragraph 2.7.2 to determine the problem.

If only D5 flashes, this indicates that no CIP signal is present. This could be because the LESI cable from J61 to the host is not connected. It could also be because there is no LESI adapter in the host, a bad LESI adapter is in the host, or the LESI cable is bad.

If only D5 and D6 flash, this indicates that the CIP signal is present, and the potential for establishing communication with the host exists.

If all three LEDs flash successively, this indicates that the Level A microdiagnostics passed and communication with the host has been established.

5. Observe the four communications LEDs. The LEDs corresponding to the CM number of each drive in the subsystem extinguish. If the Level A microdiagnostics do not pass, this communication is never established and all four of these LEDs stay on.

2.7.2 Controller Fatal Error Indication

The LEDs are set to a unique state if the drive subsystem controller encounters a fatal error. Possible causes of a fatal error include the following.

- Power fail interrupt in the controller (the system still has power)
- Lost communication with the LESI adapter
- U/Q port fatal error

When a fatal error occurs, the seven LEDs are set to the following state.

- 3 test LEDs (D4, D5, and D6) — Off
- 4 communications LEDs — On

Chapter 3
RV20 Drive Off-Line Testing

3.1 General

This chapter describes how to detect, isolate and correct RV20 drive problems. It explains in detail how to run standalone tests on a single RV20 optical disk drive. The goal of these tests is to isolate a problem to the Field Replaceable Unit (FRU).

The Structured Analysis Method, or SAM, is used to test RV20 drives and correct errors. This chapter contains SAM procedures to help you detect and correct basic power-up problems (Paragraph 3.3). It tells you how to run automatic self-tests (Paragraph 3.4), and how to enter CE mode (Paragraph 3.5). Paragraph 3.6 gives instructions on how to run CE mode tests from the RV20 maintenance panel. Paragraph 3.7 explains, through the use of tables and matrices, how to correct problems using the SAM error codes generated by the drive.

3.2 Tests

Table 3-1 lists all the RV20 standalone tests. The tests are listed with the test numbers corresponding to each of three possible modes.

Standalone tests can be run three ways: in automatic self-test mode, CE mode, and from the host. Instructions for running automatic self-tests and CE mode tests are given in this chapter. Instructions for running tests from the host are given in Chapter 2 of this manual.

In addition to the standalone tests, there is also a set of 23 tests that are run on every power-up or master reset of the drive. These power-up reset diagnostics verify that the reporting mechanisms in the drive (including the operator and maintenance panel displays) are working properly. These tests also verify

that all the timers are functional and that both the RAM and ROM can be addressed. Error codes 01—2D are generated due to failure of any of these tests.

The standalone tests are divided into 6 groups: 2X (20-series tests), 3X (30-series tests), 4X (40-series tests), 5X (50-series tests), 6X (60-series tests), and 7X (70-series tests).

The 2X, 3X, and 4X tests check the individual units of the RV20 (common memory, ECC, parity and ISI and SIA interfaces).

The 5X tests verify functionality of the drive control and servo control processors, their immediate support hardware, and their communications paths.

The 6X tests verify the functionality of the hardware required to bring the drive to its "Ready" state. These tests ensure that all the servo loops that need to be closed are indeed working properly. These tests check the tracking and focus circuitry, and laser power and spindle motor functions.

The 7X tests bring everything together and perform basic seeks and header reading.

To perform the full test set, the RV20 must be in CE mode (see cautionary note at Paragraph 3.5). In addition, the following must be done.

- In a master RV20, the drive subsystem controller module must be removed for the 4X test to run (see Paragraph 4.4.2).
- Terminators must be installed in the J17 and J62 terminator connectors in the rear of the unit, regardless of the master/slave configuration of the drive.
- A disk must be inserted into the drive (in order for 6X and 7X tests to run).

When a CE mode test fails, a failure code is displayed. The failure code corresponds to a list that gives specific corrective actions (FRUs that need replacing or procedures that have to be performed). Paragraph 3.7 contains this list. The corrective actions are listed by highest probability of the cause of failure.

After each corrective action, all the CE mode tests must be run again to see if the problem was solved. It is very important that all the tests be run again. The tests build on each other and running one specific test can sometimes cause false error codes.

Table 3-1 RV20 Tests

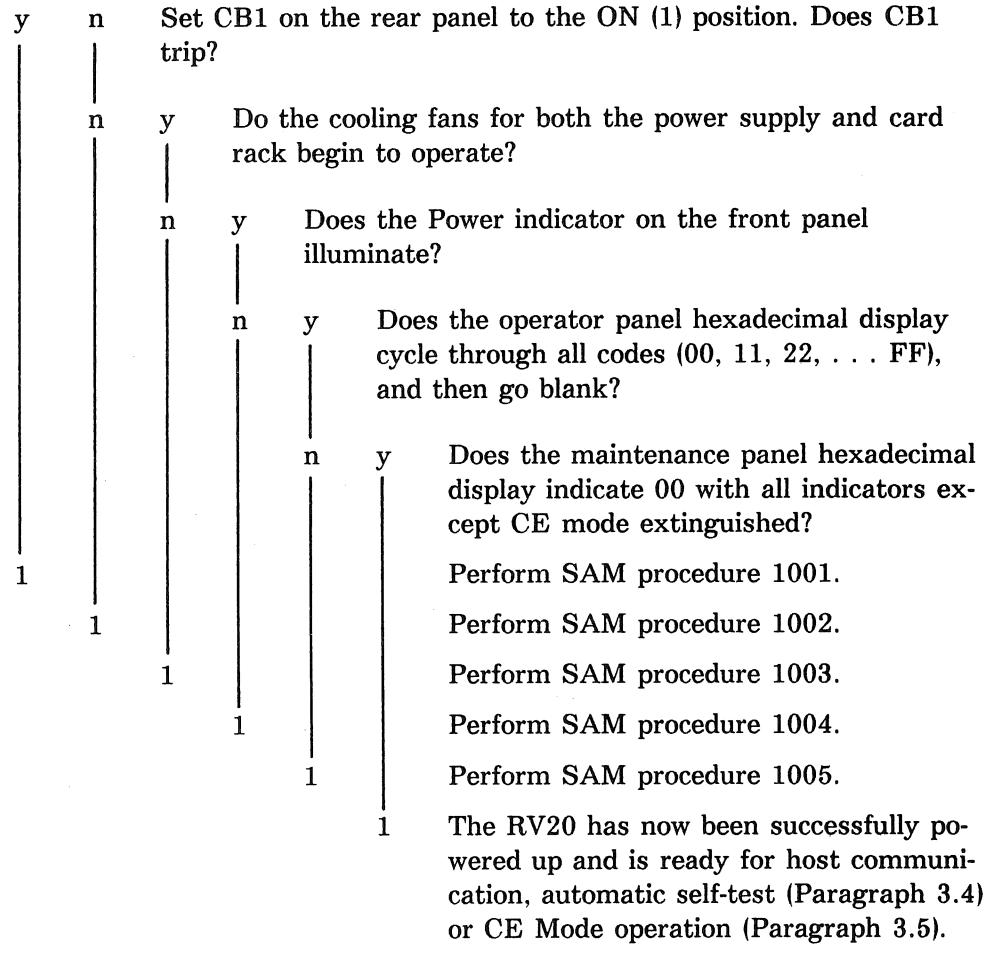
Self-Test	CE Mode Test	Host Test	Test Name	Description
	1X	—	—	Runs all tests (See Paragraph 3.6.1)
	20	—	—	Runs all 2X tests
11	21	72-1	SWTCHSUB	2K ROM and 2K RAM addressing test
12	22	72-2	ROMSUBTST	Checksum test for Z80 program memory
13	23	72-3	COMEMSUB	Destructive RAM test on 64K COMEM
14	24	72-4	PARITYSUB	COMEM and SIA parity test
—	25	72-5	RAM2KSUB	2K RAM test
—	26	72-6	MEM-REF	COMEM refresh test
—	27	72-7		Unsolicited interrupts test
	30	—	—	Runs all 3X tests
15	31	73-1	ECC-TSTDF	Data field ECC test
16	32	73-2	ECC-TSTVA	Vector address field ECC test
17	33	73-3	ECC-TSTPF	Post field ECC test
	40	—	—	Runs all 4X tests
—	41	74-1	UNITIDSUB	ISI unit ID test
—	42	74-2	ISIRSTSUB	ISI reset circuitry test
—	43	74-3	ISIPARSUB	ISI parity test
—	44	74-4	FUNCTSUB	ISI function word test
—	45	74-5	ATTENSUB	ISI attention test
—	46	74-6	DMARYTSUB	ISI DMA write test
—	47	74-7	DMAREDSUB	ISI DMA read test
—	48	74-8	INTERSUB	DMA interrupt test
—	49	74-9	PAUSESUB	ISI pause test
—	4A	74-A	ZROFILSUB	ISI zero fill test
	50	—	—	Runs all 5X tests
18	51	75-1	UPNOLO	Z80 dual port RAM test
19	52	75-2	UPLOECHO	Z80/8039 dual port RAM test
1A	53	75-3	LOBUSSUB	8039/8031 8-bit bus communications test
1B	54	75-4	LOECHOSUB	8039/8031 dual port RAM test
1C	55	75-5	LOTYMSUB	8039/8031 internal timers test

Table 3-1 RV20 Tests (Cont)

Self-Test	CE Mode Test	Host Test	Test Name	Description
1D	56	75-6	DPRWPCHK	Z80 lockout of dual port RAM test
1E	57	75-7	ROMCHKSUB	8031 ROM checksum test
1F	58	75-8	SKBYTESUB	Seek error data test
20	59	75-9	DCPTYMOUT	8039 watchdog timer test
21	5A	75-A	SCPTYMOUT	8031 watchdog timer test
22	5B	75-B	LSYNCINIT	Line sync monitor/60 Hz test
23	5C	75-C	CKDRDWREG	MDS DRDW register test
24	5D	75-D	TSTSIAPAR	SIA and ECC bus parity test
	60	—	—	Runs all 6X tests
25	61	76-1	BRAKESUB	Spindle down test
26	62	76-2	TIMEUPSUB	Spindle up test
27	63	76-3	PWRCTLSUB	Power control loop test
28	64	76-4	FOCUSSUB	Focus loop test
29	65	76-5	NULFSMSUB	FSM nulling test
2A	66	76-6	CORTRKSUB	Coarse tracking loop test
2B	67	76-7	FYNTRKSUB	Fine tracking loop test
2C	68	76-8	INTRPTSUB	Lower deck interrupt signal test
—	69	76-9		Interrupt speed test
2D	6A	76-A	RHIT-SUB	Reading header signal test
2E	6B	76-B	QUADSUB	Quadsum test
2F	6C	76-C	CARLOCSUB	Carriage lock test
30	6D	76-D	GARBNDSUB	Guard band sensor test
31	6E	76-E	LGWRAPSUB	MDS long wrap test
	70	—	—	Runs all 7X tests
32	71	77-1	JPBACKSUB	Jumpback test
33	72	77-2	NOJPBKSUB	No jumpback seek test
34	73	77-3	OCILSKSUB	Oscillating seek test
35	74	77-4	SEC-TEST	Sector interrupt test
36	75	77-5	LOWPARSUB	SDC/MDS parity test
37	76	77-6	SHWRAPSUB	MDS short wrap test
—	A1	55		Load/modify EEPROM data
—	—	56		Read EEPROM data
—	A2	—		Initialize EEPROM

3.3 Power-Up Procedure (SAM 1000)

ASSUMPTION: The proper ac power cable has been installed, connecting the RV20 subsystem to a live site power outlet. The Start/Stop switch on the operator panel is in the STOP position. A data cartridge is not installed.



3.3.1 AC Power Problem Isolation (SAM 1001)

ASSUMPTION: Conditions assumed for SAM procedure 1000 are true. CB1 trips on power-up.

- y → 1
- n → Set CB1 to the OFF (0) position. Remove connector P15 from the power supply. Reset CB1 to the ON (1) position. Does CB1 trip?
  - n → 1
  - y → Set CB1 to the OFF (0) position. Reinstall P15 at power supply. Remove power connector from the card rack cooling fan. Reset CB1 to the ON (1) position. Does CB1 trip?
    - n → 1
    - y → Set CB1 to the OFF (0) position. Remove P16 at the power supply. Reset CB1 to the ON (1) position. Does CB1 trip?
      - 1 → Set CB1 to the OFF (0) position. Check the power wiring to the card rack cooling fan for short circuits between conductors or from conductors to chassis ground. Repair/replace as necessary. Reinstall all connectors and perform SAM procedure 1000.
      - 2 → Set CB1 to the OFF (0) position. Reinstall P16 at the power supply and the power connector on the card rack cooling fan. Replace the S/DC PCA and perform SAM procedure 1000.
      - 3 → Set CB1 to the OFF (0) position. Check power wiring from P15 to the baseplate (refer to Figure 5 in the Removal and Replacement section) for short circuits between conductors or to the chassis ground. Repair/replace as necessary. Reinstall all connectors and perform SAM procedure 1000.

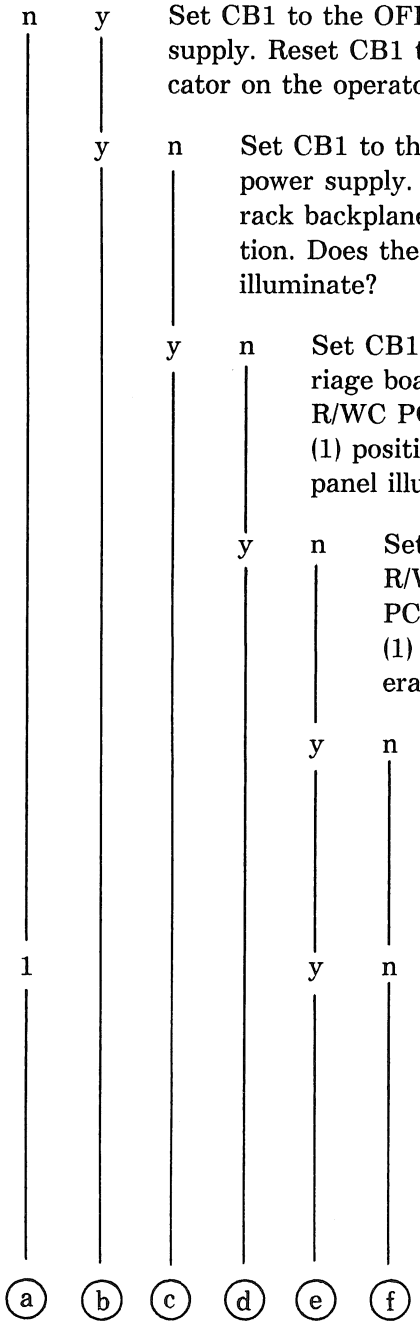
3.3.2 AC Power Distribution Problem Isolation (SAM 1002)

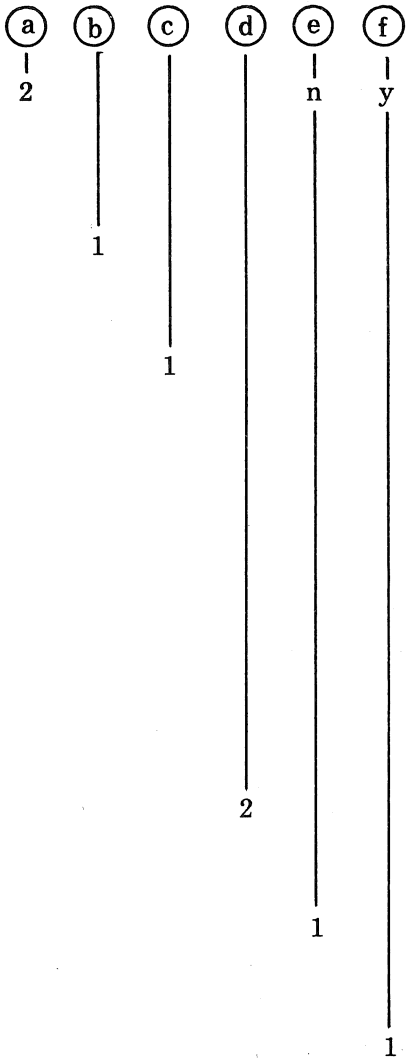
ASSUMPTION: Conditions assumed for SAM procedure 1000 are true. Cooling fans for the power supply and/or card rack do not operate when the RV20 is powered up.

y	n		Are both cooling fans inoperative?
|	|		
|	y	n	Is the power supply fan inoperative?
|	|	|	
|	|	y	Is the card rack fan inoperative?
|	|	|	
1	1	3	Set CB1 to the OFF (0) position. Replace the power supply, making sure that the new power supply is set for the correct site power. Perform SAM procedure 1000.
		1	Set CB1 to the OFF (0) position. Check and repair/replace the power connection to the card rack cooling fan. Perform SAM procedure 1000.
		2	Set CB1 to the OFF (0) position. Replace the card rack cooling fan. Perform SAM procedure 1000.

3.3.3 DC Power Problem Isolation (SAM 1003)

ASSUMPTION: Conditions assumed for SAM procedure 1000 are true. DC power does not come up when RV20 is powered up.





Set CB1 to the OFF (0) position. Disconnect the ac power cable. Remove and replace the power supply. Perform SAM procedure 1000.

Set CB1 to the OFF (0) position. Remove and replace the carriage. Perform SAM procedure 1000.

Set CB1 to the OFF (0) position. Replace the R/WC PCA. Perform SAM procedure 1000.

Set CB1 to the OFF (0) position. The ESG PCA contains the overtemperature sensing circuitry. If the temperature at the card rack exceeds 70oC ± 3oC, this circuitry shuts off dc power. If overtemperature appears to be causing loss of dc power, correct the condition and perform SAM procedure 1000.

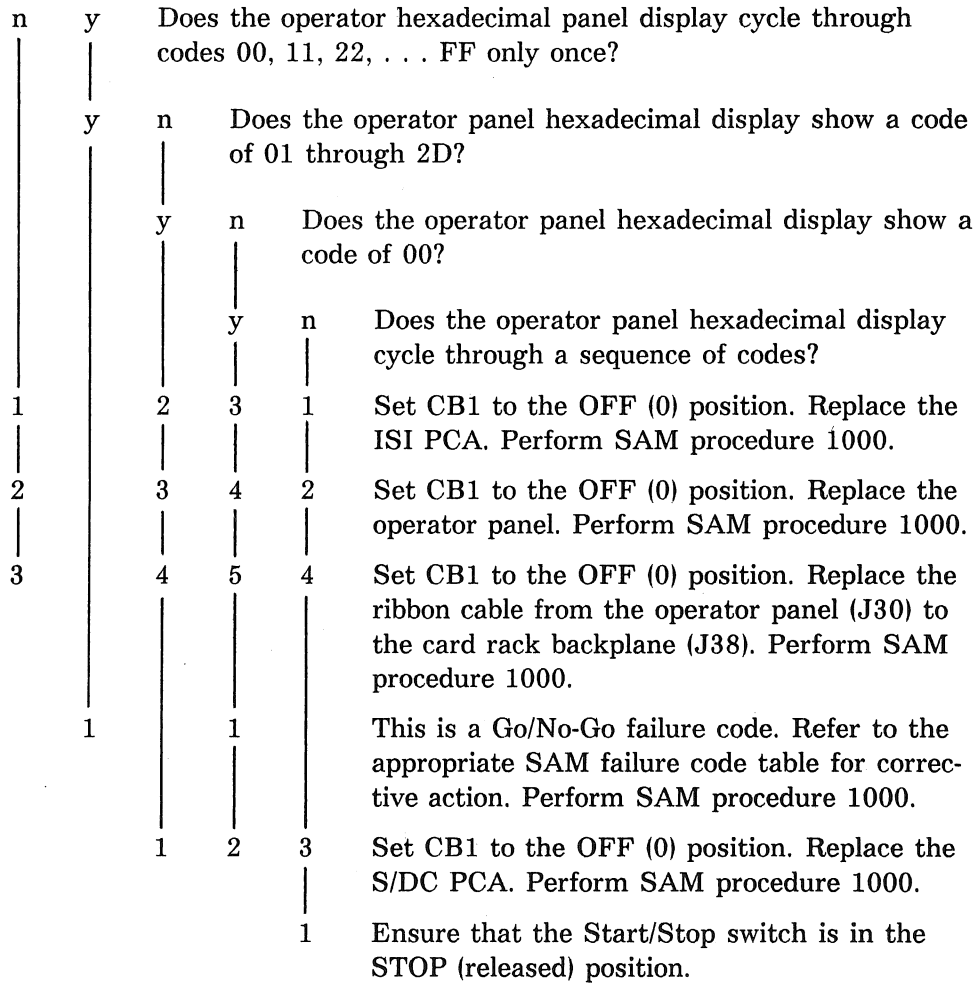
Set CB1 to the OFF (0) position. Replace the ESG PCA. Perform SAM procedure 1000.

Set CB1 to the OFF (0) position. Replace the S/DC PCA. Perform SAM procedure 1000.

Set CB1 to the OFF (0) position. Remove P16 at the power supply and P10 at the card rack. Check for and repair any damage to mating connections. Replace the ribbon cables. Perform SAM procedure 1000.

3.3.4 Operator Panel Initialization Problem Isolation (SAM 1004)

ASSUMPTION: Conditions assumed for SAM procedure 1000 are true. Operator panel hexadecimal display does not cycle through correct power-up sequence.



3.3.5 Maintenance Panel Initialization Problem Isolation (SAM 1005)

ASSUMPTION: Conditions assumed for SAM procedure 1000 are true. The maintenance panel hexadecimal display does not show a code of 00 with all indicators except CE mode extinguished after power-up sequence.

Is the maintenance panel hexadecimal display blank?

- y
- n — Does the maintenance panel hexadecimal display show a code other than 00?
  - y
  - n — Are any or all of the maintenance panel indicators, except CE Mode, illuminated?
    - 1 — Set CB1 to the OFF (0) position. Replace the ICI controller PCA. Perform SAM procedure 1000.
    - 2 — Set CB1 to the OFF (0) position. Replace the maintenance panel. Perform SAM procedure 1000.
    - 3 — Set CB1 to the OFF (0) position. Replace the ribbon cable from the maintenance panel (J40) to the card rack backplane (J39). Perform SAM procedure 1000.
    - 1 — Make sure the Start/Stop switch on the operator panel is in the STOP (released) position.
    - 2 — Set CB1 to the OFF (0) position. Replace the S/DC PCA. Perform SAM procedure 1000.
    - 3 — Set CB1 to the OFF (0) position. Replace the ECC PCA. Perform SAM procedure 1000.
    - 1 — This implies normal conditions. The maintenance panel hexadecimal display shows a code of 00 and all indicators, except CE mode, are extinguished. Perform SAM procedure 1000.
  - 1 — Set CB1 to the OFF (0) position. Replace the ICI controller PCA. Perform SAM procedure 1000.
  - 2 — Set CB1 to the OFF (0) position. Replace the maintenance panel. Perform SAM procedure 1000.
  - 3 — Set CB1 to the OFF (0) position. Replace the ribbon cable from the maintenance panel (J40) to the card rack backplane (J39). Perform SAM procedure 1000.
  - 4 — Make sure the Start/Stop switch on the operator panel is in the STOP (released) position.
  - 5 — Set CB1 to the OFF (0) position. Replace the S/DC PCA. Perform SAM procedure 1000.

3.4 Entering Automatic Self-Test Mode (SAM 1006)

ASSUMPTION: The RV20 power-up or reset sequence has completed normally: operator panel Power indicators are illuminated, the operator panel hexadecimal display is blank, the maintenance panel hexadecimal display shows a code of 00, and all maintenance panel key indicators are extinguished.

- **n** — Insert a data cartridge and press the operator panel Start/Stop switch to the START position. Does the maintenance panel hexadecimal display begin to display test numbers (11, 12, 13, etc.)?
- **y** — Does the operator panel continuously flash a sequence of three 2-character codes followed by a blank?
  - **n** — Do the maintenance and operator panel hexadecimal displays blank, and does the Ready indicator (in the operator panel Start/Stop switch) illuminate after 3 to 4 minutes?
    - **n**
      - **1** — Replace the ISI PCA.
      - **2** — Replace the S/DC PCA.
    - **y**
      - **1** — Replace the R/WC PCA.
      - **2** — Replace the MDS PCA.
      - **3** — Replace the operator panel.
      - **4** — Replace the maintenance panel.
      - **5** — Replace the ribbon cable from the operator panel (J30) to the card rack backplane (J38).
      - **6** — Replace the ribbon cable that leads from the maintenance panel (J40) to the card rack backplane (J39).
      - **7** — This is a self-test failure. The three codes are: (1) test number, (2) failure code, and (3) subfailure code. Refer to the appropriate SAM failure code table for corrective action.
      - **8** — This indicates normal completion of automatic self-tests. The RV20 is spun up and ready for host communication.
  - **1**
- **1**

3.5 Entering CE Mode (SAM 1007)

ASSUMPTION: The RV20 power-up sequence has completed normally: the operator panel Power indicators are illuminated, the operator panel Start/Stop switch is in the STOP (released) position, the unit is spun down, and the operator panel Start/Stop indicator is extinguished.

- Press and release the CE mode key on the maintenance panel. Does the CE mode indicator illuminate?
  - n → 1
  - y → Do all maintenance panel key indicators illuminate, while the maintenance panel hexadecimal display steps through codes 00, 11, 22, . . . FF? Then, do the display and all the indicators except CE mode extinguish?
    - n → 2
    - y → Does the operator panel hexadecimal display cycle through codes 00, 11, 22, . . . FF, and then display 00?
      - n → 3
      - y → Does the maintenance panel hexadecimal display show a code of 14?
        - n → 4
        - y → 5

1. Make sure the Start/Stop switch on the operator panel is in the STOP (released) position, the unit is spun down, and the operator panel Start/Stop indicator is extinguished.
2. Replace the ISI PCA.
3. Replace the maintenance panel.
4. Replace the S/DC PCA.
5. Replace the operator panel.
6. Replace the ribbon cable that leads from the maintenance panel (J40) to the card rack backplane (J39).
7. Replace the ribbon cable from the operator panel (J30) to the card rack backplane (J38).

Replace the MDS PCA.

Replace the R/WC PCA.

At this point, entry into CE mode is complete. The RV20 is in Idle mode and under control of the maintenance panel. Proceed to Paragraph 3.6.

3.6 Diagnostic Test Procedure

1. Perform SAM procedure 1000, as described in Paragraph 3.3.
2. To place the RV20 in the CE mode, perform SAM procedure 1007, as described in Paragraph 3.5.

   At this point, the RV20 is in Idle mode and is under the control of the maintenance panel.

   NOTE
   To ensure that the host does not access the external interface bus during 4X CE test operation, disconnect the external interface cable to the host prior to performing CE mode tests. In a master RV20, the drive subsystem controller must be removed in order to run 4X tests.

   NOTE
   To run 6X and 7X tests, a data cartridge must be installed in the RV20 and the Start/Stop switch on the operator panel must be pressed to the START position.

   To run the indicated test, proceed to step 3.

   To select or change a test or option, refer to Paragraph 3.6.1.

   To change input parameters, refer to Paragraph 3.6.2.

   To change a testing option, refer to Paragraph 3.6.3.

   To perform the test to read/modify data in the EEPROM, proceed to Paragraph 3.6.4.

3. To run the test indicated, press the maintenance panel START/STOP key. The Start/Stop indicator flashes and the maintenance panel shows the current test number.

   If an illegal test number is selected, the maintenance panel flashes and FF is displayed on the operator panel.

   If failures occur, the operator panel displays the failure codes. Successful completion is indicated by 00 on the operator panel.

4. To temporarily halt a testing session, press and hold the START/STOP key. When the test that is currently running concludes, the testing session halts. The Start/Stop indicator extinguishes, and the operation is then in Stopped mode.

5. To resume testing after a test session has been halted, press the START/STOP key again. The Start/Stop indicator flashes and the testing session resumes where it was halted.

3.6.1 Changing a Test or Option

Make sure you have performed steps 1 and 2 from Paragraph 3.6 before beginning the procedures in this section.

1. To select or change a test or an option, use the INCR MSD and INCR LSD keys to enter the number of the desired test in the hexadecimal display. Refer to Table 3-1 for a list of the available tests.

   Test selection is accomplished by setting the MSD to the desired test group, and setting the LSD to the desired test number. To run test 25, set 2 as the MSD and 5 as the LSD. If you want to run an entire set (2X, 3X, 4X), set 0 as the LSD. For example, if you set 20, then all 2X tests will run. If you set 30, then all 3X tests will run. Test select codes of 1X are options that run all the CE mode tests sequentially. The 1X options are as follows.

Code	Option
10/11	Run all tests (excluding CE mode tests A1 and A2). Stop on first failure or on completion of one pass.
12	Run all tests (excluding CE mode tests A1 and A2) using current voltage margin parameter. Run until first failure.
13	Run all tests (excluding CE mode tests A1 and A2). Increment voltage margin parameter. Run until first failure.
14	Same as 10/11, except do not stop on one-time failures.
15	Same as 12, except do not stop on one-time failures.
16	Same as 13, except do not stop on one-time failures.

2. To enter the test selected, press the ENTER key. The hexadecimal display goes blank while the ENTER key is pressed. When the key is released, the new test number is displayed.

3. To run the test selected, press the START/STOP key. The Start/Stop indicator flashes and the maintenance panel shows the current test number.

   If an illegal test number is selected, the maintenance panel flashes and FF is displayed on the operator panel.

   If failures occur, the operator panel displays the failure codes. Successful completion is indicated by 00 on the operator panel.

3.6.2 Changing Input Parameters

Make sure you have performed steps 1 and 2 from Paragraph 3.6 before beginning the procedures in this section.

To change input parameters, proceed as follows.

1. Press the DISP MEM key until the Disp Mem indicator lights up, and a memory display option code is displayed.

2. Use the INCR MSD and INCR LSD keys to set the maintenance panel hexadecimal display to the desired code. Memory display option codes are as follows.

Code	Option
00	Lower half of common memory/2K RAM
01	Lower half of common memory/2K hidden ROM
02	Upper half of common memory/2K RAM
03	Upper half of common memory/2K hidden ROM
04	ECC parameters
05	Voltage margin parameters
06	CE test parameters

3. Press the ENTER key. The next two maintenance panel displays show the upper and lower bytes of the selected memory address.

4. For memory display options 00, 01, 02, and 03:

   a. Use the INCR MSD and INCR LSD keys to set the display to the upper byte of the address.

   b. Press ENTER.

c. Use the INCR MSD and INCR LSD keys to set the display to the lower byte of the address.

d. Press ENTER.

5. For memory display options 04, 05, and 06, enter the default memory address by pressing ENTER twice.

   The maintenance panel displays the contents of the selected memory address. The operator panel displays the lower byte of the selected memory address.

6. To display the upper byte of the selected memory address on the operator panel, press the F1 key.

7. To step the maintenance and operator panel displays to the next memory location in sequence, press ENTER. Each time ENTER is pressed, the displays step to the next location.

8. To change the ECC, voltage margin, or CE testing options:

   a. Use the INCR MSD and INCR LSD keys to set the display to the new value.

      ECC:

      first = sector buffer number (1 through 44)

      second = number of bytes/code word to be altered

      Voltage Margin:

      first = voltage margin control (refer to the *RV20 Technical Manual* (EK-0RV20-TM).

      CE Testing Options:

      first = test repetition count

      second = pass count

      third = fail count

      fourth = run option

      Refer to Paragraph 3.6.3 for specific information about testing options.

   b. After setting the display to each new value, press ENTER.

9. After displaying or altering the selected memory address, press the DISP MEM key until the Disp Mem indicator extinguishes.

Refer to Paragraph 3.6, step 3, for information about running tests.

3.6.3 Selecting a Testing Option

1. To select a testing option while in Idle mode, use the INCR MSD and INCR LSD keys to enter the number of the desired option in the hexadecimal display. (Refer to Paragraph 3.6.1 for more specific instructions on modifying the testing options.)

   The following is a list of available testing options.

Code	Option
00	Loop Until FC = 1 or PC = TRC. The test is executed repeatedly until fail count (FC) equals 1 or pass count (PC) equals test repetition count (TRC).
01	Loop Until FC = TRC or PC = 1. The test is executed until the FC equals the TRC, or the PC equals 1.
02	Loop Until FC = TRC or PC = 255 Decimal. The test is executed repeatedly until the FC equals the TRC or the PC equals 255.
03	Loop Until PC = TRC or FC = 255 Decimal. The test is executed repeatedly until the PC equals the TRC or the FC equals 255.
04	Loop Forever Until FC = 1. Test execution stops on detection of the first failure. As long as no failures are detected, the test is executed endlessly.
05	Loop Forever and Ignore Errors. The test is executed endlessly, regardless of failures detected.

2. To enter the test option, press the ENTER key, then the START/STOP key. If an invalid option number is selected, the maintenance panel hexadecimal display flashes FF.

   Once an option is entered, all tests executed use that option until it is changed.

Refer to Paragraph 3.6, step 3, for information about running tests.

3.6.4 Performing the Test to Read/Modify Data in the EEPROM

There are two tests on the EEPROM: A1 and A2. These tests have to be run from the maintenance panel and are not run under the Run All Tests options listed in Paragraph 3.6.1. Test A1 allows you to access the EEPROM and read and/or modify data. Test A2 is a test that tries to restore some basic numbers in the EEPROM in the event that the EEPROM is completely inaccessible.

To start the test, proceed as follows. (These instructions assume that you are in CE mode from Paragraph 3.6, steps 1 and 2.)

1. Enter a test number (A1 or A2) on the maintenance panel hexadecimal display with the INCR LSD and INCR MSD keys. Press ENTER.
2. For test A1, start the test by pressing the maintenance panel START/STOP key. If a 9D, 9E, or 9F appears on the operator panel, this indicates that a problem exists with the EEPROM. You will not be able to access the EEPROM until the problem is corrected or test A2 is run. Try to run test A2 by entering A2 on the maintenance panel hexadecimal display (see 1., above). If error codes still appear, follow the corrective procedures in Paragraph 3.7 for the specific error code displayed.
3. If a 00 appears on the maintenance panel hexadecimal display, you will access the default address in the EEPROM if you press the ENTER key on the maintenance panel. Go to step 6 to exit the test.
4. If 00 is the first address of the EEPROM that is to be read/modified, press the ENTER key. If 00 is not the desired address, then enter the desired address with the INCR LSD and INCR MSD keys. When the desired address appears on the maintenance panel, press the ENTER key.

   The address you select appears on the operator panel display and the contents of that location appears in the maintenance panel display.

5. To change the contents of the memory address, use the INCR LSD and INCR MSD keys to enter the new contents value. When the new contents value appears in the maintenance panel display, press ENTER. The new value is then stored in local RAM.

   If no change to the contents of the memory address is desired, press the ENTER key. When the ENTER key is pressed, the next successive address appears on the operator panel display and the contents of that address appears in the maintenance panel display.

   Only addresses 00H through 23H are accessible. The assigned addresses follow.

Address	Contents
00	TMCSP unit number (in hex)
01	00
02	Hardware revision (8-bit binary)
03—05	00
06	Model code (8-bit binary)
07	00
08	N1, N0 (BCD) of 8-digit serial number
09	N3, N2 (BCD) of 8-digit serial number
0A	N5, N4 (BCD) of 8-digit serial number
0B	N7, N6 (BCD) of 8-digit serial number
0C	LSD of 2-digit (alpha) site code (ASCII)
0D	MSD of 2-digit (alpha) site code (ASCII)
0E—1F	Unused
20	LSB of operating parameter mode
21	MSB of operating parameter mode
22	LSB of attention delay parameter
23	MSB of attention delay parameter

   If you try to access an address out of the 00 to 23 range (or if you try to input an illegal value in 20H to 23H), then the maintenance panel display flashes a value three times.

6. To exit the test (and store the new data), press the START/STOP key or the CE MODE key on the maintenance panel. This writes the new data that was entered/modified into the EEPROM.

   To quit the test without saving the changes, press the MASTER RESET key on the maintenance panel.

3.7 Failure Analysis

The SAM failure and subfailure codes provide a structured system of corrective actions to resolve functional problems within the RV20.

There are 135 SAM failure codes that can be generated by the drive. Each code is listed in a chart with the corrective action (in specific order) that should be taken. Table 3-2 contains a brief description of all the error codes. The table also lists the tests that can cause each of the failure codes. Additionally, the table lists the tables or paragraphs in this chapter that describe the action to be performed to correct the problem. Most of these corrective actions are removal and replacement of FRUs.

After doing any corrective action called out in this section, you must run all the CE mode tests (except the A1 and A2 tests) again to see if that procedure solved the problem. If not, go on to the next procedure. After each corrective action, replace the original part and run all the CE mode tests again.

> **CAUTION**
> **It is very important that you run ALL the CE mode tests after doing a corrective procedure. The RV20 CE mode tests all build on each other and running a test at random can generate erroneous error codes.**

Of the 135 codes, 116 are simple procedures. These codes are given in Table 3-3. When these failure codes appear, there are no subfailure codes or additional steps to perform before FRU removal and replacement begins. The left column of the table contains the corrective actions and the paragraph reference in this book. The failure code is located on the top row. The column under the failure code gives the order of corrective actions to be performed.

The remaining 19 codes are described in the following separate paragraphs. These sections give details on actions to take to correct the problem. These 19 codes require additional steps before simple corrective actions can be taken. Most of these involve specific subfailure codes that further isolate the problem in order to get to a simple corrective procedure. Some of the 19 codes have tables of subfailure codes similar to Table 3-3. The 19 codes are as follows.

07, 0B, 0C, 42, 43, 4F, 79, 7A, 7B, 7E, 80, 81, 90, 9D, C0, C1, C2, C3, C4

Table 3-2 Failure/Subfailure Codes

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
01	SETROMTST	Table 3-3	Power-up/reset diagnostics	Failure of firmware controlled switch to select 2K hidden ROM.
02	CHKSUMTST	Table 3-3	Power-up/reset diagnostics	Incorrect checksum in the internal controller ROM.
03	SETRAMTST	Table 3-3	Power-up/reset diagnostics	Failure to select internal controller 2K ROM.
04	CHKRAMTST	Table 3-3	Power-up/reset diagnostics	"Stuck" bits in the internal controller RAM or incorrect addressing to the RAM.
05	LWHRDCORE	Table 3-3	Power-up/reset diagnostics	Dual port RAM error when the drive went through internal controller initialization.
06	LWHRDCORE	Table 3-3	Power-up/reset diagnostics	Device fault present in the drive when the internal controller went through initialization checks.
07	LWHRDCORE	Paragraph 3.7.1	Power-up/reset diagnostics	Failure in the basic communications test between the internal controller and the drive.
08	LWHRDCORE	Table 3-3	Power-up/reset diagnostics	MDS PCA failed to generate simulated sector interrupt pulses during power-up initialization.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
09	LWHRDCORE	Table 3-3	Power-up/reset diagnostics	Servo control microprocessor (8031) ROM integrity test failed during power-up initialization.
0A	POLTYMTST	Table 3-3	Power-up/reset diagnostics	Failure of the counter timer circuit on the ICI PCA.
0B	CHKTYMTST	Paragraph 3.7.1	Power-up/reset diagnostics	Failure of the counter timer circuit on the ICI PCA.
0C		Paragraph 3.7.1		Drive took more than six seconds to communicate with the internal controller after initialization.
0D		Table 3-3	Power-up/reset diagnostics	Bad controller parity at power-up/reset.
0E		Table 3-3	Power-up/reset diagnostics	Failure of the Z80 to properly address COMEM.
0F		Table 3-3	Power-up/reset diagnostics	Failure of the ECC PCA to identify itself.
11		Table 3-3	Power-up/reset diagnostics	ECC PCA generating unsolicited interrupts.
12		Table 3-3	Power-up/reset diagnostics	Z80 unable to write to a single address in 2K RAM.
13		Table 3-3	Power-up/reset diagnostics	S/DC PCA generating unsolicited interrupts.
14		Table 3-3	Power-up/reset diagnostics	Z80 encountered program logic that erroneously invoked a restart 38 command.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
16		Table 3-3	Power-up/reset diagnostics	Failure of high/low COMEM select logic.
17		Table 3-3	Power-up/reset diagnostics	Z80 unable to write to a single address in COMEM.
18		Table 3-3	Power-up/reset diagnostics	Bad ECC or SIA bus parity.
20		Table 3-3	Power-up/reset diagnostics	Read laser fault present at power-up/reset.
21		Table 3-3	Power-up/reset diagnostics	Write laser fault present at power-up/reset.
22		Table 3-3	Power-up/reset diagnostics	Quad sum fault present at power-up/reset.
23		Table 3-3	Power-up/reset diagnostics	Verify header fault present at power-up/ reset.
24		Table 3-3	Power-up/reset diagnostics	Seek fault present at power-up/reset.
25		Table 3-3	Power-up/reset diagnostics	Data sync fault present at power-up/reset.
26		Table 3-3	Power-up/reset diagnostics	Wobble fault present at power-up/reset.
27		Table 3-3	Power-up/reset diagnostics	PLL fault present at power-up/reset.
28		Table 3-3	Power-up/reset diagnostics	Focus fault present at power-up/reset.
29		Table 3-3	Power-up/reset diagnostics	Line sync fault present at power-up/reset.
2A		Table 3-3	Power-up/reset diagnostics	Motor speed fault present at power-up/reset.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
2B		Table 3-3	Power-up/reset diagnostics	MPU timeout fault present at power-up/ reset.
2C		Table 3-3	Power-up/reset diagnostics	MPU self-test fault present at power-up/ reset.
2D		Table 3-3	Power-up/reset diagnostics	Tracking fault in the drive.
30	TSTSETROM	Table 3-3	21, 22	Failure of the ROM/RAM switch logic to select program ROM.
31	TSTSETRAM	Table 3-3	21	Failure of the ROM/RAM switch logic to select program RAM.
32	TSTSETCOM	Table 3-3	21	Failure of the high/low common memory page select logic.
33	SEC-TEST	Table 3-3	74	S/DC PCA not interrupting the ISI or interrupts are irregular.
34	READTST	Table 3-3	48, 49	DMA read logic failure.
35	TSTCHKSUM	Table 3-3	22	Failure to read correct program ROM data.
36	CHKZROFIL	Table 3-3	4A	DMA zero fill logic not functioning properly.
37	BINARYCNT	Table 3-3	23, 31—33, 47—49	Failure to verify memory test pattern.
38	FILLZERO	Table 3-3	23	Failure to fill memory with 0s.
39	WALKONE	Table 3-3	23	"Stuck" bits in memory.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
3A	FILLONE	Table 3-3	23	Failure to fill memory with 1s.
3B	WALKZERO	Table 3-3	23	"Stuck" bits in memory.
3C	ONEZERO	Table 3-3	23	Failure to write byte "stripes" in opposite areas of memory.
3D	CHECKER	Table 3-3	23	Failure to write a pattern to memory in which no two adjacent cells are the same.
3E	CHECKALT	Table 3-3	23	Failure to verify a previously written alternating pattern in memory.
3F	BINARYCHK	Table 3-3	23, 31—33, 41	Failure to validate data and address range of memory.
40	PARITYCNT	Table 3-3	40	Failure of parity check on write to common memory.
41	PARITYCHK	Table 3-3	24	Failure of parity check on read from common memory.
42	Subfailure code 01	Paragraph 3.7.2	75	Failure of the MDS PCA to long wrap data from COMEM.
42	Subfailure code 02	Paragraph 3.7.2	—	Communication breakdown between internal controller and drive during long wrap test.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
42	Subfailure code 03	Paragraph 3.7.2	75	MDS PCA not generating two BOS pulses within 10 milliseconds with the PLL Reset switch closed.
43	Subfailure code 01	Paragraph 3.7.3	76	Failure of interleave table logic on MDS PCA.
43	Subfailure code 02	Paragraph 3.7.3	—	Communication breakdown between internal controller and drive during short wrap test.
43	Subfailure code 03	Paragraph 3.7.3	76	No sector interrupts occurring.
43	Subfailure codes 20—2D	Paragraph 3.7.3	—	Refer to Code 7A, subfailure codes 20—2D.
44	ZRO_COMEM	Table 3-3	31	Bit is stuck to 1 or 0 in a CE selected or default data field buffer in common memory.
45	PARBYTS2F	Table 3-3	31	Bit is stuck to 1 or 0 in a CE selected or default ECC buffer in common memory.
46	CHECK_DF	Table 3-3	31	ECC PCA returned a good data status, but did not actually correct the data.
47	WRTLSROFF	Table 3-3	75	Drive electronics failed to software write protect the drive.
48	COMEMSUB	Table 3-3	23	Internal controller failed to pass the common memory subtest due to parity.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
49	COMEMSUB	Table 3-3	23	Internal controller failed to pass the common memory subtest due to parity.
4C	COMEMSUB	Table 3-3	31	Improper addressing of COMEM by the Z80.
4D	COMEMSUB	Table 3-3	26	Memory refresh function not refreshing COMEM.
4E	TSTSIAPAR	Table 3-3	5E	Parity on the SIA bus or no forced parity being reported.
4F	UNSOL_IN	Paragraph 3.7.4	27	Unsolicited interrupts in the drive.
50	TSTUIDBUS	Table 3-3	41	"Stuck" bits in the ISI bus or a failure of the device address switch register to produce valid numbers.
51	TSTBADID	Table 3-3	41	Drive responding to the incorrect unit ID.
52	TSTGOODID	Table 3-3	41, 44	Failure to respond to the proper unit ID.
53	TSTBSRID	Table 3-3	41, 45	Failure of the bit significant response after successful unit selection.
54	TSTBUSIDFL	Table 3-3	41	ISI bus not idle when it should be.
55	TSTUNITID	Table 3-3	41, 44—49	Failure of the ICI interface logic response to unit select.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
56	TSTICIPLO	Table 3-3	43	Unit selection when an ISI bus parity error is present on bits 0—7.
57	TSTICIPHI	Table 3-3	43	Unit selection when an ISI bus parity error is present on bits 8—15.
58	SETFUNWRD	Table 3-3	44, 46—49	Failure of the function word request logic to be set after receipt of a function word.
59	SETDMARYT	Table 3-3	46	Failure to properly set up for a DMA write operation.
5A	TSTDMARYT	Table 3-3	46	Failure of DMA write.
5B	TSTICIRST	Table 3-3	42	Failure of the ICI reset circuitry.
5C	TSTWRDCTR	Table 3-3	46, 47	Failure of the DMA word counter logic.
5D	SETDMARED	Table 3-3	47—49	Failure to set up properly for a DMA read operation.
5E	TSTDMARED	Table 3-3	47—49	Data transfer failure from common memory to the ISI bus during a DMA read.
5F	TSTUPUID	Table 3-3	43	Failure of the ISI unit select circuitry.
60	SETPAUTST	Table 3-3	49	Failure to acknowledge function word or failure to enable pause.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
61	TSTPAUSET	Table 3-3	49	Failure to set pause on the last DMA of a previously verified block of data.
62	TSTPAUSET	Table 3-3	49	Failure of the ISI logic to clear pause.
63	SETFUNACK	Table 3-3	44	Erroneous readback of a previously written function word.
64	TSTFUNWRD	Table 3-3	44	Erroneous readback of a previously written function word.
65	TSTFUNREQ	Table 3-3	44	Failure of a function word write to set a function word request.
66	TSTWRCLR	Table 3-3	44	Failure to clear function word request.
67	SETATTN	Table 3-3	45	Failure to set ATTENTION.
68	CLEARATTN	Table 3-3	45	Failure to clear ATTENTION.
69	TSTATTNID	Table 3-3	45	Failure to set proper ATTENTION bit.
6A	SETDMAZRO	Table 3-3	4A	ICI fails to properly set up for a DMA write operation.
6B	TSTZROFIL	Table 3-3	4A	ICI fails to properly set up for a DMA write operation.
6C	TEST-0061	Table 3-3	41	Failure of ICI reset circuitry.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
6E	FILLCOMEM	Table 3-3	44	MPU is unable to write pattern to common memory.
70	TSTLODECK	Table 3-3	51—5F, 61—6D 71—77	Failure to put the drive into diagnostic mode.
71	CMDLODECK	Table 3-3	51—5E, 61—6D 71—77	Failure to accept a diagnostic command.
72	CLRFLGREG	Table 3-3	51	Failure to clear the dual port RAM flag registers.
73	TSTFLGREG	Table 3-3	51, 52	Failure of flag register bit operations.
74	TSTPADDRS	Table 3-3	51, 52	Port addressing failure on data in ports 12—1F (hex) of the dual port RAM.
75	WALK1PORT	Table 3-3	51	Data mismatches in ports 12—1F (hex) in the dual port RAM.
76	ECHO1FLAG	Table 3-3	52	Failure during the echo test of a dual port RAM flag register.
77	ECHO1PORT	Table 3-3	52	Failure during dual port RAM echo test.
78	TSTDPRWP	Table 3-3	56	Failure of dual port RAM write protect circuit.
79	CHKBADPAR	Paragraph 3.7.4	5C	Servo/drive control parity error, or an MDS PCA parity error.
7A	Subfailure code 01	Paragraph 3.7.5	5C	Parity circuitry failure on S/DC PCA.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7A	Subfailure code 02	Paragraph 3.7.5	5C	Internal controller parity error.
7A	Subfailure code 03	Paragraph 3.7.5	5C	Failure of 8039 to clear S/DC parity error.
7A	Subfailure code 04	Paragraph 3.7.5	5C	Failure of 8039 to respond to a report error.
7A	Subfailure code 20	Paragraph 3.7.5	5C	Read laser fault.
7A	Subfailure code 21	Paragraph 3.7.5	5C	Write laser fault.
7A	Subfailure code 22	Paragraph 3.7.5	—	Quad sum fault.
7A	Subfailure code 23	Paragraph 3.7.5	—	Verify header fault.
7A	Subfailure code 24	Paragraph 3.7.5	—	Seek fault.
7A	Subfailure code 25	Paragraph 3.7.5	—	Data sync fault.
7A	Subfailure code 26	Paragraph 3.7.5	—	Wobble fault.
7A	Subfailure code 27	Paragraph 3.7.5	—	PLL fault.
7A	Subfailure code 28	Paragraph 3.7.5	—	Focus fault.
7A	Subfailure code 29	Paragraph 3.7.5	—	Line sync fault.
7A	Subfailure code 2A	Paragraph 3.7.5	—	Motor speed fault.
7A	Subfailure code 2B	Paragraph 3.7.5	—	MPU timeout fault.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7A	Subfailure code 2C	Paragraph 3.7.5	—	MPU self-test fault.
7A	Subfailure code 2D	Paragraph 3.7.5	—	Tracking fault.
7B	Subfailure code 01	Paragraph 3.7.6	5C	Parity circuitry error on the MDS PCA.
7B	Subfailure code 02	Paragraph 3.7.6	5C	Parity error on the ISI PCA.
7B	Subfailure code 03	Paragraph 3.7.6	5C	Failure of 8039 to accept clear errors command.
7B	Subfailure code 04	Paragraph 3.7.6	5C	Failure of 8039 to accept report errors command.
7B	Subfailure code 05	Paragraph 3.7.6	5C	BOS circuitry failure on MDS PCA.
7B	Subfailure code 06	Paragraph 3.7.6	5C	Sector interrupt.
7C		Table 3-3	5D	Failure of the DRDW threshold register on the MDS PCA.
7D	CLRLODECK	Table 3-3	51, 52	Drive reset failure.
7E	ENDLODECK	Paragraph 3.7.5	51—5E, 61—6E 71—77	Drive diagnostic subtest failure.
7E	Subfailure code 2	Table 3-4	51—5E, 61—6E 71—77	Failure of 8039 to write/read to the dual port RAM.
7E	Subfailure code 03	Table 3-4	51—5E, 61—6E 71—77	Failure of 8031 to write/read to the dual port RAM.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7E	Subfailure code 04	Table 3-4	51—5E, 61—6E 71—77	Failure in dual port RAM switch logic.
7E	Subfailure code 05	Table 3-4	51—5E, 61—6E 71—77	Failure in 8031/8039 8-bit communications bus.
7E	Subfailure code 06	Table 3-4	51—5E, 61—6E 71—77	Failure of 8039 internal timer.
7E	Subfailure code 07	Table 3-4	51—5E, 61—6E 71—77	Failure of 8031 internal timers.
7E	Subfailure code 08	Table 3-4	51—5E, 61—6E 71—77	Failure of 8039 internal RAM.
7E	Subfailure code 09	Table 3-4	51—5E, 61—6E 71—77	Failure of 8031 internal RAM.
7E	Subfailure code 0A	Table 3-4	51—5E, 61—6E 71—77	Failure of 8031 program memory checksum.
7E	Subfailure code 0B	Table 3-4	51—5E, 61—6E 71—77	Failure of 8039 watchdog timer.
7E	Subfailure code 0C	Table 3-4	51—5E, 61—6E 71—77	Failure of 8031 watchdog timer.
7E	Subfailure codes 0D—0F, 10, 11	Table 3-4	51—5E, 61—6E 71—77	8031-to-8039 communications breakdown.
7E	Subfailure codes 12,13	Table 3-4	51—5E, 61—6E 71—77	Dual port RAM failure: bits stuck on 1 or 0.
7E	Subfailure code 20	Table 3-4	51—5E, 61—6E 71—77	Improper laser read current low status at power control loop reset.
7E	Subfailure code 21	Table 3-4	51—5E, 61—6E 71—77	Improper laser write current low status at power control loop reset.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7E	Subfailure code 22	Table 3-4	51—5E, 61—6E 71—77	Improper laser read power status at power control loop reset.
7E	Subfailure code 23	Table 3-4	51—5E, 61—6E 71—77	Improper laser write power status at power control loop reset.
7E	Subfailure code 24	Table 3-4	51—5E, 61—6E 71—77	Improper laser dying status at power control loop reset.
7E	Subfailure code 25	Table 3-4	51—5E, 61—6E 71—77	Improper state of diagnostic retract status after focus retract for 500 milliseconds.
7E	Subfailure code 26	Table 3-4	51—5E, 61—6E 71—77	Improper laser read current low status at power control loop initialization.
7E	Subfailure code 27	Table 3-4	51—5E, 61—6E 71—77	Improper laser write current low status at power control loop initialization.
7E	Subfailure code 28	Table 3-4	51—5E, 61—6E 71—77	Improper laser read power low status at power control loop initialization.
7E	Subfailure code 29	Table 3-4	51—5E, 61—6E 71—77	Improper laser write power control loop initialization.
7E	Subfailure code 2A	Table 3-4	51—5E, 61—6E 71—77	Improper laser dying status at power control loop initialization.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7E	Subfailure code 40	Table 3-4	51—5E, 61—6E 71—77	Improper diagnostic retract status during the focus loop test. Status said focus never retracted.
7E	Subfailure code 41	Table 3-4	51—5E, 61—6E 71—77	Improper diagnostic retract status during the focus loop test. Status said focus was not in equilibrium.
7E	Subfailure code 42	Table 3-4	51—5E, 61—6E 71—77	Improper diagnostic retract status during the focus loop test. Status said focus never fully ramped to upper limit of travel.
7E	Subfailure code 43	Table 3-4	51—5E, 61—6E 71—77	Drive did not capture focus during the focus loop test.
7E	Subfailure code 44	Table 3-4	51—5E, 61—6E 71—77	Improper diagnostic S-curve in status during the focus loop test. Status said focus signal did not have full sine wave.
7E	Subfailure code 45	Table 3-4	51—5E, 61—6E 71—77	Improper diagnostic S-curve out status during the focus loop test. Status said focus signal did not have full sine wave.
7E	Subfailure code 46	Table 3-4	51—5E, 61—6E 71—77	Failure of carriage to retract.
7E	Subfailure code 47	Table 3-4	51—5E, 61—6E 71—77	Improper diagnostic S-curve in status during focus loop test. Status not correct with focus at retract.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7E	Subfailure code 48	Table 3-4	51—5E, 61—6E 71—77	Improper diagnostic S-curve out status during focus loop test. Status not correct with focus at retract.
7E	Subfailure code 49	Table 3-4	51—5E, 61—6E 71—77	Improper laser read power during the focus loop test. Status said the laser shut off during the test.
7E	Subfailure code 4A	Table 3-4	51—5E, 61—6E 71—77	Improper diagnostic S-curve in status during focus loop test. Status did not toggle during ramp up of focus.
7E	Subfailure code 4B	Table 3-4	51—5E, 61—6E 71—77	Improper diagnostic S-curve out status during focus loop test. Status did not toggle during ramp up of focus.
7E	Subfailure code 4C	Table 3-4	51—5E, 61—6E 71—77	Improper focus status during the focus loop test. Status not bad before focus was initialized/captured.
7E	Subfailure code 4D	Table 3-4	51—5E, 61—6E 71—77	Improper latched focus on the SDC during the focus loop test. Status did not match focus status.
7E	Subfailure code 60	Table 3-4	51—5E, 61—6E 71—77	Improper wobble status. Wobble is good when it should be bad.
7E	Subfailure code 61	Table 3-4	51—5E, 61—6E 71—77	Improper wobble status. Wobble is bad when it should be good.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7E	Subfailure code 62	Table 3-4	51—5E, 61—6E 71—77	Bad interrupt signal from the MDS to the SDC. Interrupt signal is too long.
7E	Subfailure code 63	Table 3-4	51—5E, 61—6E 71—77	No interrupt signal from the MDS to the SDC. Interrupt of 8039 did not occur.
7E	Subfailure code 64	Table 3-4	51—5E, 61—6E 71—77	No interrupt signal from the MDS to the SDC. No interrupt signal within 10 milliseconds.
7E	Subfailure code 70	Table 3-4	51—5E, 61—6E 71—77	Quadsum low status is not bad when it should be.
7E	Subfailure code 71	Table 3-4	51—5E, 61—6E 71—77	Quadsum low status is not good when it should be.
7E	Subfailure code 72	Table 3-4	51—5E, 61—6E 71—77	Quadsum high status is not good when it should be.
7E	Subfailure code 73	Table 3-4	51—5E, 61—6E 71—77	Line sync never initialized.
7E	Subfailure code 74	Table 3-4	51—5E, 61—6E 71—77	No 50/60 Hz signal from the power supply and line sync never initialized.
7E	Subfailure code 75	Table 3-4	51—5E, 61—6E 71—77	Improper read current low status with bad quadsum low status. Status not true when it should be.
7E	Subfailure code 7E	Table 3-4	51—5E, 61—6E 71—77	Lower deck not responding to the upper deck for a diagnostic command.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7E	Subfailure code 80	Table 3-4	51—5E, 61—6E 71—77	Motor spin down time exceeds 3 seconds.
7E	Subfailure code 81	Table 3-4	51—5E, 61—6E 71—77	Motor speed greater than 3% above normal.
7E	Subfailure code 82	Table 3-4	51—5E, 61—6E 71—77	Motor speed is slower than 3% below normal.
7E	Subfailure code 83	Table 3-4	51—5E, 61—6E 71—77	Defective or blocked tachsensor slot on the spindle motor.
7E	Subfailure code 90	Table 3-4	51—5E, 61—6E 71—77	Bad "coarse status true" with the FSM nulled.
7E	Subfailure code 91	Table 3-4	51—5E, 61—6E 71—77	Bad diagnostic position-in signal. Signal did not change states with the FSM driven in a positive and negative direction after the FSM was nulled.
7E	Subfailure code 92	Table 3-4	51—5E, 61—6E 71—77	Bad diagnostic coarse status. Signal did not change states with the FSM driven in a positive and negative direction after the FSM was nulled and the coarse loop enabled.
7E	Subfailure code 93	Table 3-4	51—5E, 61—6E 71—77	Bad diagnostic push-pull-in signal. Signal did not change states with the FSM driven in a positive and negative direction after the FSM was nulled and the coarse and fine loops were enabled.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7E	Subfailure code 94	Table 3-4	51—5E, 61—6E 71—77	Bad diagnostic push-pull-out signal. Signal did not change states with the FSM driven in a positive and negative direction after AGC, the FSM was nulled and the coarse and fine loops were enabled.
7E	Subfailure code 95	Table 3-4	51—5E, 61—6E 71—77	Bad tracking polarity status. Signal did not change states with the FSM driven in a positive and negative direction after the FSM was nulled and the coarse and fine loops were enabled.
7E	Subfailure code 96	Table 3-4	51—5E, 61—6E 71—77	Bad track crossing status. Signal did not change states with the FSM driven in a positive and negative direction after AGC, the FSM was nulled and the coarse and fine loops were enabled.
7E	Subfailure code 97	Table 3-4	51—5E, 61—6E 71—77	Bad position LED status.
7E	Subfailure code 98	Table 3-4	51—5E, 61—6E 71—77	Bad diagnostic tracking status. Status did not come true with the coarse and fine loops closed.
7E	Subfailure code 9A	Table 3-4	51—5E, 61—6E 71—77	Bad carriage lock assembly.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7E	Subfailure code 9B	Table 3-4	51—5E, 61—6E 71—77	Tracking would not initialize.
7E	Subfailure code 9C	Table 3-4	51-5E, 61-6E 71-77	"Off track status" not bad with tracking disabled.
7E	Subfailure code B0	Table 3-4	51—5E, 61—6E 71—77	Retract sensor did not change states during a seek out from the home position.
7E	Subfailure code B1	Table 3-4	51—5E, 61—6E 71—77	8031 failed to read headers during a seek. No reading headers signal.
7E	Subfailure code B2	Table 3-4	51—5E, 61—6E 71—77	Failure with data sync during a seek by the 8031. Reading header signal, but no data sync.
7E	Subfailure code B3	Table 3-4	51—5E, 61—6E 71—77	8031 did not get access to the dual port RAM during a seek and, therefore, could not read headers.
7E	Subfailure code B4	Table 3-4	51—5E, 61—6E 71—77	Failure in reading headers by the 8031 during a seek. No matching headers.
7E	Subfailure code B5	Table 3-4	51—5E, 61—6E 71—77	Failure in track crossings during a seek by 8031. 8031 lost track crossings.
7E	Subfailure code B6	Table 3-4	51—5E, 61—6E 71—77	Failure in tracking after a seek by the 8031. 8031 could not capture tracking after a seek.
7E	Subfailure code B9	Table 3-4	51—5E, 61—6E 71—77	8031 unable to complete a seek after maximum retries applied.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7E	Subfailure code BA	Table 3-4	51—5E, 61—6E 71—77	No increment track signal on the SDC.
7E	Subfailure code BC	Table 3-4	51—5E, 61—6E 71—77	No sequential sectors read by 8031 during a seek.
7E	Subfailure code C0	Table 3-4	51—5E, 61—6E 71—77	Bad reading header signal during the reading header/increment track signal test.
7E	Subfailure code C1	Table 3-4	51—5E, 61—6E 71—77	Phase-lock loop (PLL) status was good when it should be bad.
7E	Subfailure code C2	Table 3-4	51—5E, 61—6E 71—77	Bad data sync status when it should be good.
7E	Subfailure code C3	Table 3-4	51—5E, 61—6E 71—77	Sync lost status was bad when it should be good.
7E	Subfailure code C4	Table 3-4	51—5E, 61—6E 71—77	Good data sync status when it should be bad.
7E	Subfailure code C5	Table 3-4	51—5E, 61—6E 71—77	Sync lost status was good when it should be bad.
7E	Subfailure code C6	Table 3-4	51—5E, 61—6E 71—77	Phase-lock loop (PLL) status was bad when it should be good.
7E	Subfailure code C1	Table 3-4	51—5E, 61—6E 71—77	Phase-lock loop (PLL) status was good when it should be bad.
7E	Subfailure code C2	Table 3-4	51—5E, 61—6E 71—77	Bad data sync status when it should be good.
7E	Subfailure code C3	Table 3-4	51—5E, 61—6E 71—77	Sync lost status was bad when it should be good.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
7E	Subfailure code C4	Table 3-4	51—5E, 61—6E 71—77	Good data sync status when it should be bad.
7E	Subfailure code C5	Table 3-4	51—5E, 61—6E 71—77	Sync lost status was good when it should be bad.
7E	Subfailure code C6	Table 3-4	51—5E, 61—6E 71—77	Phase-lock loop (PLL) status was bad when it should be good.
80	CHECKCART	Paragraph 3.7.9	61—6E, 71—77	Data cartridge not inserted in the drive.
81	CHECKCART	Paragraph 3.7.10	61—6E, 71—77	Start/Stop switch on the operator panel is not depressed to the Start position.
90	SET-UPECC	Paragraph 3.7.11	31—33	ECC data buffer number exceeds 48 (decimal).
91	IDENT-ECC	Table 3-3	31, 32	Improper response from the ECC PCA.
92	ENCODE-DF	Table 3-3	31	Failure to encode the user data field.
93	DECODE-DF	Table 3-3	31	Failure to decode the user data field.
94	ENCODE-VA	Table 3-3	32	Failure to encode the vector address field.
95	DECODE-VA	Table 3-3	32	Failure to decode the vector address field.
96	ENCODE-PF	Table 3-3	33	Failure to encode the postfield.
97	DECODE-PF	Table 3-3	33	Failure to decode the postfield.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
98	KILL-DF	Table 3-3	31	Failure of the ECC PCA to correct an erroneous user data field.
99	KILL-VA	Table 3-3	32	ECC PCA failed to correct an erroneous vector address.
9A	KILL-PF	Table 3-3	33	ECC PCA failed to correct an erroneous postfield.
9C	CHKDMAWRT	Table 3-3	46	Addressing failure after DMA write.
9D	KILL-VA	Paragraph 3.7.12	A1, A2	
9D	Subfailure code 01	Paragraph 3.7.12		Bad controller parity.
9D	Subfailure code 02	Paragraph 3.7.12		Bad EEPROM parity.
9E	EERAMTEST	Table 3-3	A1, A2	Failure in volatile RAM of EEPROM.
9F	EECHKSUM	Table 3-3	A1, A2	Failure of EEPROM checksum.
C0	SPINUP	Table 3-5	7X	Drive not READY within five and one half seconds of a spinup command.
C0	Subfailure code 01	Table 3-5	—	No cartridge present status.
C0	Subfailure code 02	Table 3-5	—	Start/Stop switch not pressed in.
C0	Subfailure code 03	Table 3-5	—	No device fault or device error occurred, yet drive is not READY.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
C0	Subfailure code 04	Table 3-5	—	Power supply over-temperature condition.
C0	Subfailure code 06	Table 3-5	—	Card cage overtemperature condition.
C0	Subfailure codes 20—2D	Table 3-5		Refer to code 7A, sub-failure codes 20—2D.
C0	Subfailure codes B1—BC	Table 3-5	—	Refer to code 7E, sub-failure codes B1—BC.
C1	Subfailure code 01	Paragraph 3.7.14	—	Failure of 8039 to accept spindown command.
C1	Subfailure code 02	Paragraph 3.7.14	—	No device error occurred, yet drive did not spin down within five seconds.
C1	Subfailure code 03	Paragraph 3.7.14	—	Excess error recovery in the drive.
C2	NO-JUMPBK	Paragraph 3.7.15	72	Jumpbacks occurring when they are disabled, or drive is unable to spiral across media.
C2	Subfailure code 01	Paragraph 3.7.15	—	Failure of 8039 to respond to a disable jumpbacks command.
C2	Subfailure code 02	Paragraph 3.7.15	—	Failure of 8039 to acknowledge a disable jumpbacks command.
C2	Subfailure code 03	Paragraph 3.7.15	—	Excess error recovery in the drive.
C2	Subfailure code 04	Paragraph 3.7.15	—	Seek to track 1000 aborted, 8039 busy.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
C2	Subfailure code 05	Paragraph 3.7.15	—	Seek to track 1000 not initiated after seek command accepted by the 8039.
C2	Subfailure code 06	Paragraph 3.7.15	—	No on-track status after seek was initiated.
C2	Subfailure code 07	Paragraph 3.7.15	—	Drive not spiraling across 10 tracks within 150 milliseconds.
C2	Subfailure code 0A	Paragraph 3.7.15	—	Seek error, no seek byte status available.
C2	Subfailure code 0B	Paragraph 3.7.15	—	8039 does not respond to a clear errors command.
C2	Subfailure codes 20—2D	Paragraph 3.7.15		Refer to code 7A, subfailure codes 20—2D.
C2	Subfailure codes B1—BC	Paragraph 3.7.15		Refer to code 7E, subfailure codes B1—BC.
C3	JUMPBK-TST	Paragraph 3.7.16	72	Failure of jumpbacks when they are enabled.
C3	Subfailure code 01	Paragraph 3.7.16	—	Failure of 8039 to respond to an enable jumpbacks command.
C3	Subfailure code 02	Paragraph 3.7.16	—	Excess error recovery in the drive.
C3	Subfailure code 03	Paragraph 3.7.16	—	Seek to track 1000 aborted, 8039 busy.
C3	Subfailure code 04	Paragraph 3.7.16	—	Seek to track 1000 not initiated after seek command accepted by the 8039.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
C3	Subfailure code 05	Paragraph 3.7.16	—	No on-track status after seek was initiated.
C3	Subfailure code 06	Paragraph 3.7.16	—	Drive not spiraling across 10 tracks within 150 milliseconds
C3	Subfailure code 07	Paragraph 3.7.16	—	Good on-track status when it should be bad.
C3	Subfailure code 08	Paragraph 3.7.16	—	Seek to track 0 not successful.
C3	Subfailure code 09	Paragraph 3.7.16	—	Jumpback not occurring, no device fault or error.
C3	Subfailure code 0A	Paragraph 3.7.16	—	Seek error, no seek byte status available.
C3	Subfailure code 0B	Paragraph 3.7.16	—	8039 does not respond to a clear errors command.
C3	Subfailure code 0C	Paragraph 3.7.16	—	Power supply over-temperature condition.
C3	Subfailure code 0D	Paragraph 3.7.16	—	Card cage over-temperature condition.
C3	Subfailure codes 20—2D	Paragraph 3.7.16		Refer to code 7A, subfailure codes 20—2D.
C3	Subfailure codes B1—BC	Paragraph 3.7.16		Refer to code 7E, subfailure codes B1—BC.
C4	OCIL-SEEK	Paragraph 3.7.17	72	Failure to perform seeks within a specified time.
C4	Subfailure code 01	Paragraph 3.7.17	—	Failure of 8039 to respond to an enable jumpbacks command.

Table 3-2 Failure/Subfailure Codes (Cont)

Fail. Code	Mnemonic (or Subfail. Code)	Maint. Reference	CE Mode Tests That Failed	Description
C4	Subfailure code 02	Paragraph 3.7.17	—	Failure of 8039 to respond to a report errors command.
C4	Subfailure code 03	Paragraph 3.7.17	—	Excess error recovery in the drive.
C4	Subfailure code 04	Paragraph 3.7.17	—	Seek to track 1000 aborted, 8039 busy.
C4	Subfailure code 05	Paragraph 3.7.17	—	Seek not initiated after seek command accepted by the 8039.
C4	Subfailure code 06	Paragraph 3.7.17	—	No on-track status after seek was initiated.
C4	Subfailure code 07	Paragraph 3.7.17	—	Drive unable to perform a series of two-track seeks.
C4	Subfailure code 08	Paragraph 3.7.17	—	Drive unable to perform a series of hundred-track seeks.
C4	Subfailure code 0A	Paragraph 3.7.17	—	Seek error, no seek byte status available.
C4	Subfailure code 0B	Paragraph 3.7.17	—	8039 does not respond to a clear errors command.
C4	Subfailure codes 20—2D	Paragraph 3.7.17		Refer to code 7A, subfailure codes 20—2D.
C4	Subfailure codes B1—BC	Paragraph 3.7.17		Refer to code 7E, subfailure codes B1—BC.

Table 3-3 SAM Failure Codes

SAM FAILURE CODE -->	01-04	05,06	07*	08	09	0A,0B*	0C*	0D	0E, 11	0F, 12	13	14,16, 17	18	20	21	22	23	24	25
Replace the ISI PCA.	1	2	2	3	2	1	2	1	2	2	2	1	2						
Replace the ECC PCA.								2	1	1		2	1						
Verify that all card rack backplane cables are properly installed/seated at both ends.		3	4					3	3	3	4	3	4	2	3	2	3	5	3
Replace the card rack backplane.		4	5	5				4	4	4	5	4	5						
Replace the S/DC PCA.		1	1	2	1		1				1		3	1	1	1	2	3	2
Replace the MDS PCA.			3	1							3				2		1	4	1
Replace the R/WC PCA.				4										3	4	3	4	6	4
Replace the guard band sensor.							3												
Replace the baseplate terminator PCA.							4												
Replace the carriage.														4	5	4		7	5
Replace the ESG PCA.																		2	
Replace the Servo Systems PCA.																		1	
Replace the power supply to backplane power supply control cable.																			
Replace the power supply.																			
Replace the tachometer.																			
Replace the spindle brake assembly (if applicable).																			
Inspect spindle belt. If OK, replace the spindle motor assembly.																			

Table 3-3 SAM Failure Codes (Cont)

SAM FAILURE CODE -->	26	27	28	29	2A	2B	2C	2D	30	31	32	33	34	35	36	37-39, 3A-3F	40	41,44-46	47	48	49
Replace the ISI PCA.									1	1	1	2	1	1	2	2	2	2	2	2	2
Replace the ECC PCA.											2		2		3	1	1	1		1	1
Verify that all card rack backplane cables are properly installed/seated at both ends.	4	3	4	2	5	2	2	5				4	3		4	3	5	3	3	3	3
Replace the card rack backplane.												5	4		5	4	6	4	4	4	4
Replace the S/DC PCA.	3	2	3	1	4	1	1	3				1					4		1		
Replace the MDS PCA.	2	1						4				3					3				
Replace the R/WC PCA.	5	4						6													
Replace the guard band sensor.																					
Replace the baseplate terminator PCA.					1																
Replace the carriage.			5					7													
Replace the ESG PCA.	1		2					2													
Replace the Servo Systems PCA.			1					1													
Replace the power supply to backplane power supply control cable.				3																	
Replace the power supply.				4	7	3															
Replace the tachometer.					2																
Replace the spindle brake assembly (if applicable).					3																
Inspect spindle belt. If OK, replace the spindle motor assembly.					6																
Verify that terminators are installed and that the ISI bus cable is disconnected. In the master RV20, remove the drive subsystem controller.															1						

Table 3-3 SAM Failure Codes (Cont)

SAM FAILURE CODE -->	4C	4D	4E	5A-5D, 50-59	5E	5F,60,61	62,64	63,65-68	69	6A,6B	6C,6E	6D
Replace the ISI PCA.	1	2	2	2	2	2	2	2	2	2	2	2
Replace the ECC PCA.	2	1	1		3							
Verify that all card rack backplane cables are properly installed/seated at both ends.	3	3	3	3	4	3	3	3	3		3	3
Replace the card rack backplane.	4	4	4	4	5	4	4	4	4			
Replace the S/DC PCA.												
Replace the MDS PCA.												
Replace the R/WC PCA.												
Replace the guard band sensor.												
Replace the baseplate terminator PCA.												
Replace the carriage.												
Replace the ESG PCA.												
Replace the Servo Systems PCA.												
Replace the power supply to backplane power supply control cable.												
Replace the power supply.												
Replace the tachometer.												
Replace the spindle brake assembly (if applicable).												
Inspect spindle belt. If OK, replace the spindle motor assembly.												
Verify that terminators are installed and that the ISI bus cable is disconnected. In the master RV20, remove the drive subsystem controller.				1	1	1	1	1	1	1	1	1

Table 3-3 SAM Failure Codes (Cont)

SAM FAILURE CODE -->	70	71	72-78	7C	7D	91-99,9A	9C	9E,9F
Replace the ISI PCA.	1		2		2	2	1	2
Replace the ECC PCA.						1	2	
Verify that all card rack backplane cables are properly installed/seated at both ends.	3	2	3	2	3	3	3	3
Replace the card rack backplane.	4	3	4	3	4	4	4	
Replace the S/DC PCA.	2	1	1		1			
Replace the MDS PCA.				1				
RepLace the R/WC PCA.								
Replace the guard band sensor.								
Replace the baseplate terminator PCA.								
Replace the carriage.								
Replace the ESG PCA.								1
Replace the Servo Systems PCA.								
Replace the power supply to backplane power supply control cable.								
Replace the power supply.								
Replace the tachometer.								
Replace the spindle brake assembly (if applicable).								
Inspect spindle belt. If OK, replace the spindle motor assembly.								

* Refer to Paragraph 3.7.1 before beginning these procedures.

Table 3-4 SAM Failure Code 7E, Subfailure Codes

SAM FAILURE CODE 7E, SUBFAILURE CODE -->	02-09,0A-0F, 10, 12, 13	11	20-24, 26-29, 2A	25	40-42	43	44	45,48	46	47,4A	4B	4C	4D	49	60	61
Replace the ESG PCA.							1	1		1	1	2				2
Verify that all card rack backplane cables are properly installed/seated at both ends.	1	1	2	3	3	4	2	3	4	2	3	4		2	3	5
Replace the carriage.			4	4	4	5	4			4		6		4		6
Replace the Servo Systems PCA.				1	1	1	3	2	1		2	1				3
Replace the S/DC PCA.	2	2	3	2	2	2			3	3		3	1		2	
Replace the R/WC PCA.			1			3						5		3		4
Replace the ISI PCA.																
Replace the MDS PCA.															1	1
Try a new data cartidge.														1		
Replace carriage lock solenoid.																
Replace the guard band sensor.									2							
Inspect spindle belt. If OK, replace the spindle motor assembly.																
Replace the baseplate terminator PCA.																
Replace the power supply.																
Replace the tachometer sensor.																
Replace the spindle brake assembly (if applicable).																

Table 3-4 SAM Failure Code 7E, Subfailure Codes (Cont)

SAM FAILURE CODE 7E, SUBFAILURE CODE -->	62-64	70	71,72, 75	73	74	7E	80	81	82	83	90	91	92	93	94, 95	96	97
Replace the ESG PCA.											1	1	1	1	1	1	
Verify that all card rack backplane cables are properly installed/seated at both ends.	3	3	3	2		2	1				4	2	2	2	2	2	3
Replace the carriage.		4	4								5	5	5	5			4
Replace the Servo Systems PCA.		1	1								2	4	4	4			
Replace the S/DC PCA.	2	2		1		1	4	3	3		3	3	3	3	3	3	2
Replace the R/WC PCA.			2														1
Replace the ISI PCA.						3											
Replace the MDS PCA.	1																
Try a new data cartridge.																	
Replace carriage lock solenoid.													2				
Replace the guard band sensor.																	
Replace the spindle motor assembly.								2	2								
Replace the baseplate terminator PCA.							3	1	1	3							
Replace the power supply.				3	1		5	4	4								
Replace the tachometer sensor.										2							
Replace the spindle brake assembly (if applicable).							2										
Check and clean any tachsensor slots on the tachometer.										1							

Table 3-4 SAM Failure Code 7E, Subfailure Codes (Cont)

SAM FAILURE CODE 7E, SUBFAILURE CODE -->	98	9A	9B	9C	B0	B1,B2, B4	B3,BA	B5	B6	B9	BC	C0	C1, C6	C2, C3	C4, C5
Replace the ESG PCA.			2					1	1	2	3				
Verify that all card rack backplane cables are properly installed/seated at both ends.	3	3	4	3		4		4	3	5	5	4	3	4	3
Replace the carriage.	4		5					5	4				4	5	
Replace the Servo Systems PCA.	1		1	1	7			2	2	3	4				
Replace the S/DC PCA.	2	2	3	2	6	3	1	3				1	2	3	2
Replace the R/WC PCA.						2				1	1	3	1	2	
Replace ISI PCA.															
Replace the MDS PCA.						1				4	2	2		1	1
Try a new data cartridge.															
Replace carriage lock solenoid.		1			3										
Replace the guard band sensor.					5										
Inspect spindle belt. If OK, replace the spindle motor assembly.															
Replace the baseplate terminator PCA.					4										
Replace the power supply.															
Replace the tachometer sensor.															
Replace the spindle brake assembly (if applicable).															
Verify that connectors on baseplate terminator PCA and card rack backplane are properly installed.					1										
Verify that the guard band sensor is properly mounted and that mounting screws are tight.					2										

Table 3-5 SAM Failure Code C0, Subfailure Codes

SAM FAILURE CODE C0, SUBFAILURE CODE -->	01	02	03	04	06	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D
Replace data cartridge.	1																		
Replace the baseplate terminator PCA.	2		4													1			
Verify that Start/ Stop switch is in START position.		1																	
Replace the S/DC PCA.		2	1	2	3	1	1	1	2	3	2	3	2	2	1	4	1	1	3
Verify that inter-connect cable is properly installed from operator panel to J38 on backplane.		3																	
Replace operator panel.		4																	
Replace the ESG PCA.			2		2														
Replace the spindle brake assembly (when applicable).			3													3			
Inspect spindle belt. If OK, replace the spindle motor assembly.			5													6			
Verify that all card rack backplane cables are properly installed/ seated at both ends.						2	3	2	3	5	3	4	3	4	2	5	2	2	5
Replace the R/WC PCA.						3	4	3	4	6	4	5	4						6
Replace the carriage.						4	5	4		7	5			5					7
Replace the MDS PCA.							2		1	4	1	2	1						4
Replace the Servo Systems PCA.										1				1					1
Replace the ESG PCA.										2		1		2					2
Replace power supply.				1											4	7	3		
Replace power supply to backplane power supply control cable.															3				
Replace the tachometer.																2			
Replace fan assembly.					1														

3.7.1 SAM Failure Codes 07, 0B, and 0C

When SAM failure code 07, 0B, or 0C is displayed, the problem is that the carriage is failing to find the home position. Proceed as follows.

1. Remove the top cover and the disc.
2. Power down the drive and wait 30 seconds. Note that the carriage is in the home position.
3. Power the drive up again and observe the carriage. The carriage should move to the rear (about one-half inch) and then return back to the home position. It should remain there, locked by the solenoid.

   If any of the following occur, power down the drive and proceed to steps 4 through 8.

   a. The carriage makes a high pitched sound while moving to the home position.

   b. The carriage moves to the home position more than once.

   c. The carriage doesn't move at all.

If a, b, or c did not occur, then proceed directly to step 9.

4. Check to make sure the carriage is not rubbing against the guard band sensor, the solenoid, or the magnet. Check to make sure the carriage rails are not damaged and are free from dirt.
5. Check to make sure that the carriage isn't stuck to the rubber bumper.
6. Check all connections on the baseplate terminator PCA.
7. Power up the drive again. If steps 4 to 6 do not correct the problem, replace the guard band sensor as described in Chapter 4.
8. If step 7 doesn't solve the problem, replace the baseplate terminator PCA as described in Chapter 4.
9. If step 8 doesn't solve the problem, proceed with the corrective actions given in Table 3-3 for the specific failure code (07, 0B, or 0C).

3.7.2 SAM Failure Code 42

When SAM failure code 42 is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There can be subfailure codes of 01, 02, or 03.

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. The corrective actions that need to be performed for each of the two subfailure codes are listed below.

After performing a corrective action for a subfailure code, always run all the tests again to see if that procedure solved the problem. If the problem still exists, perform the next procedure.

SUBFAILURE CODE 01

1. Replace the MDS PCA as described in Chapter 4.
2. Replace the ECC PCA as described in Chapter 4.
3. Replace the ISI PCA as described in Chapter 4.
4. Replace the R/WC PCA as described in Chapter 4.
5. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
6. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODE 02

1. Replace the S/DC PCA as described in Chapter 4.
2. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
3. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODE 03

1. Replace the MDS PCA as described in Chapter 4.
2. Replace the S/DC PCA as described in Chapter 4.
3. Replace the R/WC PCA as described in Chapter 4.
4. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
5. Replace the card rack backplane as described in Chapter 4.

3.7.3 SAM Failure Code 43

When SAM failure code 43 is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are 17 possible subfailure codes for code 43. They are as follows.

01, 02, 03, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A, 2B, 2C, 2D

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. The corrective actions that need to be performed for each of the subfailure codes are listed below.

After performing a corrective action for a subfailure code, always run all the tests again to see if that procedure solved the problem. If the problem still exists, perform the next procedure.

SUBFAILURE CODE 01

1. Replace the MDS PCA as described in Chapter 4.
2. Replace the ECC PCA as described in Chapter 4.
3. Replace the ISI PCA as described in Chapter 4.
4. Replace the R/WC PCA as described in Chapter 4.
5. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
6. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODE 02

1. Replace the S/DC PCA as described in Chapter 4.
2. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
3. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODE 03

1. Replace the MDS PCA as described in Chapter 4.
2. Replace the S/DC PCA as described in Chapter 4.
3. Replace the ISI PCA as described in Chapter 4.
4. Replace the R/WC PCA as described in Chapter 4.
5. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
6. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODES 20 — 2D

These subfailure codes correspond to the subfailure codes for SAM failure code C0 that are listed in Table 3-5. Refer to Table 3-5 for the proper corrective actions for these subfailure codes.

For example, the corrective action for SAM code 43, subfailure code 23, is the same as for SAM code C0, subfailure code 23.

3.7.4 SAM Failure Code 4F

When SAM failure code 4F is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are 16 possible subfailure codes for code 4F. They are as follows.

01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B, 0C, 0D, 0E, 0F, 20

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. The subfailure codes are listed below, followed by the actions that need to be taken to correct the problem.

After performing a procedure for a subfailure code, always repeat all the tests to see if that procedure solved the problem. If the problem still exists, perform the next procedure.

SUBFAILURE CODES 01, 02, 0F, and 20

1. Replace the ISI controller PCA as described in Chapter 4.
2. Verify that all the card rack backplane cables are properly installed and seated at both ends.
3. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODES 03 — 0E

1. Replace the ECC PCA as described in Chapter 4.
2. Verify that all the card rack backplane cables are properly installed and seated at both ends.
3. Replace the card rack backplane as described in Chapter 4.

3.7.5 SAM Failure Code 79

When SAM failure code 79 is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken.

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed.

1. If subfailure codes 01, 02, or 03 are displayed while pressing F1, then proceed to steps 2 through 5. If a subfailure code other than 01, 02, or 03 appears while pressing F1, then replace the MDS PCA as described in Chapter 4.
2. Replace the S/DC PCA as described in Chapter 4. After the PCA has been replaced, run all the tests again. If subfailure code 01, 02, or 03 is still present, proceed to step 3.
3. Replace the MDS PCA as described in Chapter 4. After the PCA has been replaced, run all the tests again. If subfailure code 01, 02, or 03 is still present, proceed to step 4.
4. Verify that all the card rack backplane cables are properly installed and are seated at both ends. Then run all the tests again. If a subfailure code is still present, proceed to step 5.
5. Replace the card rack backplane as described in Chapter 4.

3.7.6 SAM Failure Code 7A

When SAM failure code 7A is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are 18 possible subfailure codes for code 7A. They are as follows.

01, 02, 03, 04, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A, 2B, 2C, 2D

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. The corrective actions that need to be performed for each of the subfailure codes are listed below.

After performing a corrective action for a subfailure code, always run all the tests again to see if that procedure solved the problem. If the problem still exists, perform the next procedure.

SUBFAILURE CODES 01, 03, and 04

1. Replace the S/DC PCA as described in Chapter 4.
2. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
3. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODE 02

1. Replace the ISI PCA as described in Chapter 4.
2. Replace the S/DC PCA as described in Chapter 4.
3. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
4. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODES 20 — 2D

These subfailure codes correspond to the subfailure codes for SAM failure code C0 that are listed in Table 3-5. Refer to Table 3-5 for the proper corrective actions for these subfailure codes.

For example, the corrective action for SAM code 7A, subfailure code 23, is the same as for SAM code C0, subfailure code 23.

3.7.7 SAM Failure Code 7B

When SAM failure code 7B is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are 20 possible subfailure codes for code 7B. They are as follows.

01, 02, 03, 04, 05, 06, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A, 2B, 2C, 2D

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. The corrective actions that need to be performed for each of the subfailure codes are listed below.

After performing a corrective action for a subfailure code, always run all the tests again to see if that procedure solved the problem. If the problem still exists, perform the next procedure.

SUBFAILURE CODE 01

1. Replace the MDS PCA as described in Chapter 4.
2. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
3. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODE 02

1. Replace the ISI PCA as described in Chapter 4.
2. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
3. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODES 03 and 04

1. Replace the S/DC PCA as described in Chapter 4.
2. Replace the ISI PCA as described in Chapter 4.
3. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
4. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODES 05 and 06

1. Replace the MDS PCA as described in Chapter 4.
2. Replace the S/DC PCA as described in Chapter 4.
3. Replace the ISI PCA as described in Chapter 4.
4. Verify that all the card rack backplane cables are properly installed and are seated at both ends.
5. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODES 20 — 2D

These subfailure codes correspond to the subfailure codes for SAM failure code C0 that are listed in Table 3-5. Refer to Table 3-5 for the proper corrective action for these subfailure codes.

For example, the corrective action for SAM code 7B, subfailure code 23, is the same as for SAM code C0, subfailure code 23.

3.7.8 SAM Failure Code 7E

When SAM failure code 7E is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are 91 different subfailure codes for SAM failure code 7E. They are listed in Table 3-4.

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. Each of the subfailure codes is listed in Table 3-4 with the actions that need to be taken to correct the problem.

After you perform a procedure in Table 3-4, always repeat all the tests to see if that procedure solved the problem. If the problem still exists, go on to the next procedure for that failure code in Table 3-4.

3.7.9 SAM Failure Code 80

When SAM failure code 80 is displayed, the problem may be that there is no data cartridge in the drive. If this is the case, insert a data cartridge into the drive and run all the tests again. If failure code 80 comes up again, proceed to step 1.

1. Replace the S/DC PCA as described in Chapter 4. After the PCA has been replaced, run all the tests again. If failure code 80 appears again, proceed to step 2.
2. Replace the ISI controller PCA as described in Chapter 4. After the PCA has been replaced, run all the tests again. If failure code 80 appears again, proceed to step 3.
3. Verify that all the card rack backplane cables are properly installed and seated at both ends. Then run all the tests again. If failure code 80 appears again, proceed to step 4.
4. Replace the baseplate terminator PCA as described in Chapter 4. After the PCA has been replaced, run all the tests again. If failure code 80 appears again, proceed to step 5.
5. Replace the operator panel as described in Chapter 4. After replacing the operator panel, run all the tests again. If failure code 80 appears again, proceed to step 6.
6. Replace the card rack backplane as described in Chapter 4.

3.7.10 SAM Failure Code 81

When SAM failure code 81 is displayed, the problem may be that the Start/Stop switch on the front panel is not in the START position. If this is the case, put the switch into the START position and run all the tests again. If failure code 81 appears again, proceed to step 1.

1. Replace the S/DC PCA as described in Chapter 4. After the PCA has been replaced, run all the tests again. If failure code 81 appears again, proceed to step 2.
2. Replace the ISI PCA as described in Chapter 4. After the PCA has been replaced, run all the tests again. If failure code 81 appears again, proceed to step 3.
3. Verify that all the card rack backplane cables are properly installed and seated at both ends. Then run all the tests again. If failure code 81 appears again, proceed to step 4.
4. Replace the operator panel as described in Chapter 4. After replacing the operator panel, run all the tests again. If failure code 81 appears again, proceed to step 5.
5. Replace the card rack backplane as described in Chapter 4.

3.7.11 SAM Failure Code 90

When SAM failure code 90 is displayed, the problem may be that the proper ECC parameter has not been entered.

Use the instructions in Paragraph 3.6.2 to access the ECC parameters section of memory. The second memory location in the ECC area is the "Number of Bytes/codewords to be altered." This number should be 30 hexadecimal (48 decimal) or less. If the memory contains a number larger than 30, reset it to 30. After resetting the ECC parameter, run all CE mode tests again. If SAM failure code 90 appears again, proceed as follows.

1. Replace the ECC PCA as described in Chapter 4. After the PCA has been replaced, run all the tests again. If failure code 90 appears again, proceed to step 2.
2. Replace the ISI PCA as described in Chapter 4. After the PCA has been replaced, run all the tests again. If failure code 90 appears again, proceed to step 3.

3. Verify that all the card rack backplane cables are properly installed and seated at both ends. Then run all the tests again. If failure code 90 appears again, proceed to step 4.
4. Replace the card rack backplane as described in Chapter 4.

3.7.12 SAM Failure Code 9D

When SAM failure code 9D is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are two subfailure codes for SAM failure code 9D: 01 and 02.

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display as long as F1 is pressed. The subfailure codes are listed below, followed by the actions that need to be taken to correct the problem.

After performing a procedure for a subfailure code, always repeat all the tests to see if that procedure solved the problem. If the problem still exists, perform the next procedure.

SUBFAILURE CODE 01

1. Replace the ISI PCA as described in Chapter 4.
2. Verify that all card rack backplane cables are properly installed and seated at both ends.
3. Replace the ESG PCA as described in Chapter 4.

SUBFAILURE CODE 02

1. Replace the ESG PCA as described in Chapter 4.
2. Verify that all card rack backplane cables are properly installed and seated at both ends.
3. Replace the ISI PCA as described in Chapter 4.

3.7.13 SAM Failure Code C0

When SAM failure code C0 is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are 19 different subfailure codes for SAM failure code C0. They are listed in Table 3-5.

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. Each of the subfailure codes is listed in Table 3-5 with the actions that need to be taken to correct the problem.

After you perform a procedure in Table 3-5, always repeat all the tests to see if that procedure solved the problem. If the problem still exists, go on to the next procedure for that failure code in Table 3-5.

3.7.14 SAM Failure Code C1

When SAM failure code C1 is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are 3 subfailure codes for SAM failure code C1: 01, 02, and 03.

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. The subfailure codes are listed below, followed by the actions that need to be taken to correct the problem.

After performing a procedure for a subfailure code, always repeat all the tests to see if that procedure solved the problem. If the problem still exists, perform the next procedure.

SUBFAILURE CODE 01

1. Replace the S/DC PCA as described in Chapter 4.
2. Replace the ISI PCA as described in Chapter 4.
3. Verify that all card rack backplane cables are properly installed and seated at both ends.

SUBFAILURE CODE 02

1. If your RV20 is equipped with a spindle brake, replace the spindle brake assembly.
2. Verify that all card rack backplane cables are properly installed and seated at both ends.
3. Replace the baseplate terminator PCA as described in Chapter 4.
4. Replace the S/DC PCA as described in Chapter 4.

SUBFAILURE CODE 03

1. Replace the ESG PCA as described in Chapter 4.
2. Replace the Servo Systems PCA as described in Chapter 4.
3. Replace the R/WC PCA as described in Chapter 4.
4. Replace the MDS PCA as described in Chapter 4.
5. Replace the S/DC PCA as described in Chapter 4.
6. Verify that all card rack backplane cables are properly installed and seated at both ends.

3.7.15 SAM Failure Code C2

When SAM failure code C2 is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are 32 subfailure codes for SAM failure code C1. They are as follows.

01, 02, 03, 04, 05, 06, 07, 0A, 0B, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A, 2B, 2C, 2D, B1, B2, B3, B4, B5, B6, B9, BA, BC

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. The subfailure codes are listed below, followed by the actions that need to be taken to correct the problem.

After performing a procedure for a subfailure code, always repeat all the tests to see if that procedure solved the problem. If the problem still exists, perform the next procedure.

SUBFAILURE CODES 01, 02, 04, 05, 06, and 0B

1. Replace the S/DC PCA as described in Chapter 4.
2. Replace the ISI PCA as described in Chapter 4.
3. Verify that all card rack backplane cables are properly installed and seated at both ends.

SUBFAILURE CODES 03, 07, and 0A

1. Replace the ESG PCA as described in Chapter 4.
2. Replace the Servo Systems PCA as described in Chapter 4.
3. Replace the R/WC PCA as described in Chapter 4.
4. Replace the MDS PCA as described in Chapter 4.
5. Replace the S/DC PCA as described in Chapter 4.
6. Verify that all card rack backplane cables are properly installed and seated at both ends.

SUBFAILURE CODE 06

1. Replace the S/DC PCA as described in Chapter 4.
2. Verify that all card rack backplane cables are properly installed and seated at both ends.
3. Replace the ESG PCA as described in Chapter 4.
4. Replace the Servo Systems PCA as described in Chapter 4.
5. Replace the R/WC PCA as described in Chapter 4.
6. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODES 20 — 2D

These subfailure codes correspond to the subfailure codes for SAM failure code C0 that are listed in Table 3-5. Refer to Table 3-5 for the proper corrective actions for these subfailure codes.

For example, the corrective action for SAM code C2, subfailure code 23, is the same as for SAM code C0, subfailure code 23.

SUBFAILURE CODES B1, B2, B3, B4, B5, B6, B9, and BC

These subfailure codes correspond to the subfailure codes for SAM failure code 7E that are listed in Table 3-4. Refer to Table 3-4 for the proper corrective actions for these subfailure codes.

For example, the corrective action for SAM code C2, subfailure code B3, is the same as for SAM code 7E, subfailure code B3.

3.7.16 SAM Failure Code C3

When SAM failure code C3 is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are 36 subfailure codes for SAM failure code C3. They are as follows.

01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B, 0C, 0D, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A, 2B, 2C, 2D, B1, B2, B3, B4, B5, B6, B9, BA, BC

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. The subfailure codes are listed next, followed by the actions that need to be taken to correct the problem.

After performing a procedure for a subfailure code, always repeat all the tests to see if that procedure solved the problem. If the problem still exists, perform the next procedure.

SUBFAILURE CODES 01, 03, and 0B

1. Replace the S/DC PCA as described in Chapter 4.
2. Replace the ISI PCA as described in Chapter 4.
3. Verify that all card rack backplane cables are properly installed and seated at both ends.
4. Replace the card rack backplane.

SUBFAILURE CODES 02, 08, and 0A

1. Replace the ESG PCA as described in Chapter 4.
2. Replace the Servo Systems PCA as described in Chapter 4.
3. Replace the R/WC PCA as described in Chapter 4.
4. Replace the MDS PCA as described in Chapter 4.
5. Replace the S/DC PCA as described in Chapter 4.
6. Verify that all card rack backplane cables are properly installed and seated at both ends.
7. Replace the card rack backplane.

SUBFAILURE CODES 04, 05, 07, and 09

1. Replace the S/DC PCA as described in Chapter 4.
2. Verify that all card rack backplane cables are properly installed and seated at both ends.
3. Replace the ESG PCA as described in Chapter 4.
4. Replace the R/WC PCA as described in Chapter 4.
5. Replace the card rack backplane.

SUBFAILURE CODE 06

1. Replace the MDS PCA as described in Chapter 4.
2. Replace the R/WC PCA as described in Chapter 4.
3. Replace the S/DC PCA as described in Chapter 4.
4. Verify that all card rack backplane cables are properly installed and seated at both ends.
5. Replace the card rack backplane.

SUBFAILURE CODE 0C

1. Replace the power supply as described in Chapter 4.
2. Replace the S/DC PCA as described in Chapter 4.

SUBFAILURE CODE 0D

1. Verify that the fan is operating. If it is not, replace the fan assembly as described in Chapter 4. If the fan is operating, go on to step 2.
2. Replace the ESG PCA as described in Chapter 4.
3. Replace the S/DC PCA as described in Chapter 4.

SUBFAILURE CODES 20 — 2D

These subfailure codes correspond to the subfailure codes for SAM failure code C0 that are listed in Table 3-5. Refer to Table 3-5 for the proper corrective actions for these subfailure codes.

For example, the corrective action for SAM code C3, subfailure code 23, is the same as for SAM code C0, subfailure code 23.

SUBFAILURE CODES B1, B2, B3, B4, B5, B6, B9, and BC

These subfailure codes correspond to the subfailure codes for SAM failure code 7E that are listed in Table 3-4. Refer to Table 3-4 for the proper corrective actions for these subfailure codes.

For example, the corrective action for SAM code C3, subfailure code B3, is the same as for SAM code 7E, subfailure code B3.

3.7.17 SAM Failure Code C4

When SAM failure code C4 is displayed, there is an accompanying subfailure code. The subfailure code determines what corrective actions have to be taken. There are 33 subfailure codes for SAM failure code C4. They are as follows.

01, 02, 03, 04, 05, 06, 07, 08, 0A, 0B, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A, 2B, 2C, 2D, B1, B2, B3, B4, B5, B6, B9, BA, BC

To find the subfailure code, gain access to the maintenance panel on the front of the drive and press F1. The subfailure code appears on the operator panel hexadecimal display while F1 is pressed. The subfailure codes are listed below, followed by the actions that need to be taken to correct the problem.

After performing a procedure for a subfailure code, always repeat all the tests to see if that procedure solved the problem. If the problem still exists, perform the next procedure.

SUBFAILURE CODES 01, 02, 04, and 0B

1. Replace the S/DC PCA as described in Chapter 4.
2. Replace the ISI PCA as described in Chapter 4.
3. Verify that all card rack backplane cables are properly installed and seated at both ends.

SUBFAILURE CODES 03, 07, 08, and 0A

1. Replace the ESG PCA as described in Chapter 4.
2. Replace the Servo Systems PCA as described in Chapter 4.
3. Replace the R/WC PCA as described in Chapter 4.
4. Replace the MDS PCA as described in Chapter 4.
5. Replace the S/DC PCA as described in Chapter 4.
6. Verify that all card rack backplane cables are properly installed and seated at both ends.
7. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODES 05, and 06

1. Replace the S/DC PCA as described in Chapter 4.
2. Verify that all card rack backplane cables are properly installed and seated at both ends.
3. Replace the ESG PCA as described in Chapter 4.
4. Replace the R/WC PCA as described in Chapter 4.
5. Replace the card rack backplane as described in Chapter 4.

SUBFAILURE CODES 20 — 2D

These subfailure codes correspond to the subfailure codes for SAM failure code C0 that are listed in Table 3-5. Refer to Table 3-5 for the proper corrective actions for these subfailure codes.

For example, the corrective action for SAM code C4, subfailure code 23, is the same as for SAM code C0, subfailure code 23.

SUBFAILURE CODES B1, B2, B3, B4, B5, B6, B9, BA, and BC

These subfailure codes correspond to the subfailure codes for SAM failure code 7E that are listed in Table 3-4. Refer to Table 3-4 for the proper corrective actions for these subfailure codes.

For example, the corrective action for SAM code C4, subfailure code B3, is the same as for SAM code 7E, subfailure code B3.

Chapter 4
Removal and Replacement

4.1 General

This chapter gives removal and replacement procedures for all major assemblies in the RV20 drive. Paragraph 4.2 contains information about the organization of this chapter. The rest of the chapter deals with the removal and replacement procedures.

4.2 Chapter Organization

The removal and replacement procedures are set up as follows.

Paragraph 4.3 contains external parts removal and replacement information. The following external parts are included.

- Top cover
- Filter grill and filter
- Maintenance panel
- Front bezel
- Operator panel

Paragraphs 4.4 and 4.5 both contain internal parts removal and replacement information. Paragraph 4.4 covers the following internal rear parts.

- Power supply
- Card rack backplane
- Card rack
- Printed circuit assemblies

Paragraph 4.5 contains internal front parts removal and replacement information. Many of the procedures involve removal of other assemblies as well. The following internal front parts are covered.

- Fan assembly
- Spindle assembly
- Spindle grounding brush
- Spindle brake
- Carriage assembly
- Guardband sensor
- Carriage lock solenoid
- Baseplate*
- Spindle pulley belt
- Spindle motor/cable assembly
- Baseplate terminator PCA
- Tachometer sensor
- Interlock solenoid

4.3 Removal and Replacement — External Parts

This paragraph gives removal and replacement procedures for the external assemblies.

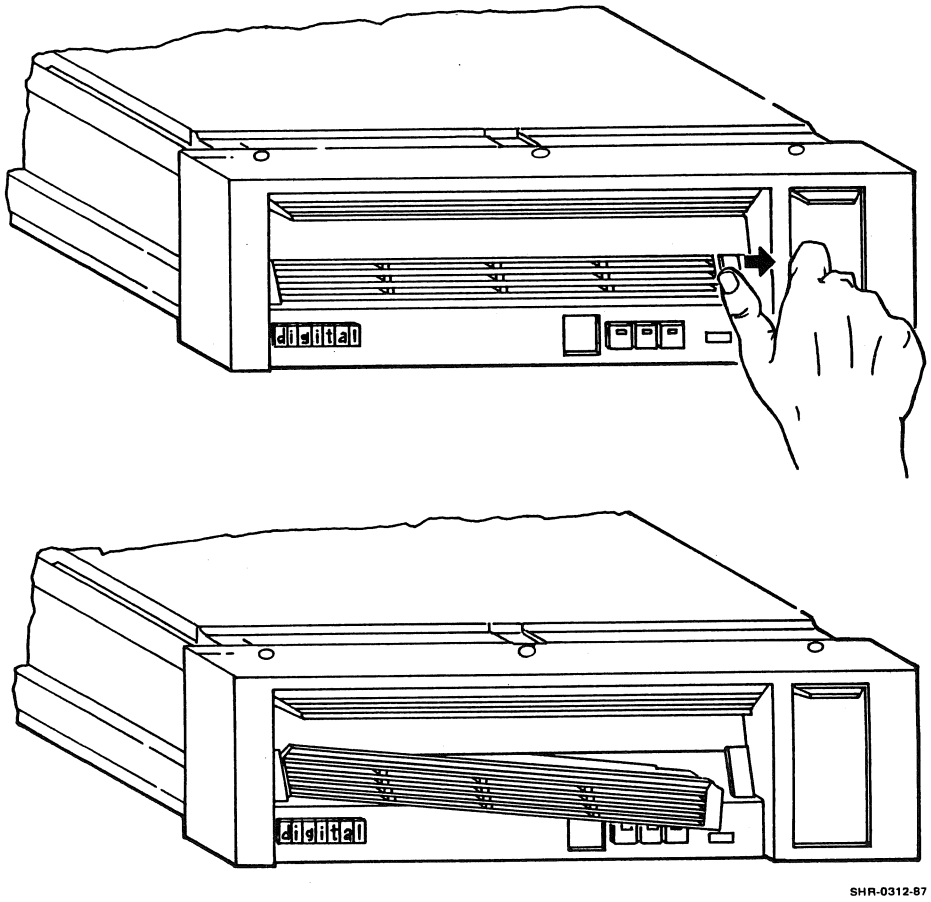
4.3.1 Filter Grill and Filter Removal and Replacement

To remove the filter grill/filter assembly, proceed as follows.

1. Make sure all power is removed from the system (CB1 on the rear panel is in the OFF position).
2. On the right side of the front panel, push the grill latch to the right so the grill comes out about one-half inch (Figure 4-1).
3. Unlatch the filter grill, swinging it out to the left, and remove it (Figure 4-1).
4. The filter lies inside the filter grill. Replace it if necessary.

* The baseplate is not a field replaceable item. Many of the internal front parts require removal of the baseplate, however, so the baseplate removal and replacement is included in Paragraph 4.5.

Figure 4-1 Filter Grill Removal



To replace the filter grill/filter assembly proceed as follows.

1. Place the filter inside the filter grill so it lies flat.
2. On the left side of the front panel, insert the filter grill. Secure the grill on the right side by snapping it into place (Figure 4-1). The grill only goes in one way; it should snap in easily. If you are not sure if the grill is in properly, power up the drive and check to make sure the cartridge door can open and close without obstruction from the grill.

4.3.2 Front Bezel Removal and Replacement

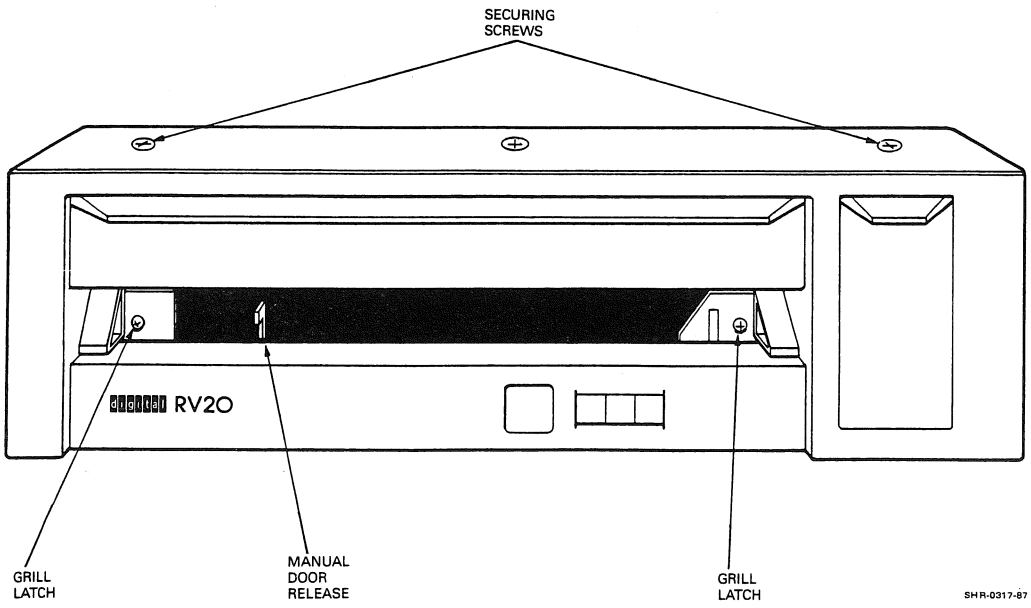
To remove the front bezel, proceed as follows.

1. Make sure all power is removed from the system (CB1 is in the OFF position).
2. Remove the filter grill as described in Paragraph 4.3.1.

WARNING
Make sure that the H9643 stabilizer leg is extended before pulling the RV20 out from the cabinet. Failure to extend the stabilizer leg will cause the H9643 cabinet to tip forward when the RV20 is pulled out. Never extend more than one RV20 drive at a time.

3. Release the ESD bracket at the rear of the drive. Then pull the RV20 out from the H9643 cabinet. Now remove the three securing screws on the top of the bezel (Figure 4-2).
4. Remove the two screws holding the grill latches to the RV20 frame (Figure 4-2).
5. Slip the bezel off the RV20 frame.

Figure 4-2 Front Bezel Removal



To replace the front bezel, proceed as follows.

1. Slip the bezel onto the front of the RV20. Line up the screw holes on the top of the bezel.
2. Replace the two grill latches just below the cartridge door (Figure 4-2).
3. Replace the three securing screws on the top of the bezel (Figure 4-2).
4. Install the filter grill on the front of the drive.

4.3.3 Top Cover Removal and Replacement

The top cover is made up of two pieces that fit together. To remove the top cover, proceed as follows.

WARNING
Make sure that the H9643 stabilizer leg is extended before pulling the RV20 out from the cabinet. Failure to extend the stabilizer leg will cause the H9643 cabinet to tip forward when the RV20 is pulled out. Never extend more than one RV20 drive at a time.

1. Remove the two screws securing the rear piece of the top cover to the frame of the RV20.
2. Lift the back piece of the top cover up and off the frame.
3. To remove the front piece of the top cover, you must remove the front bezel as described in Paragraph 4.3.2.
4. Working from the front, slide the front piece of the top cover back, and lift it up and out.

To replace the top cover, proceed as follows.

1. Replace the front piece of the top cover first. Insert it so that it catches on the side rails and slide it forward into place.
2. Replace the front bezel as described in Paragraph 4.3.2.
3. Replace the rear piece of the top cover. First, mate it with the front piece. Lay the rear piece down so that the allen screw holes in the rear line up.
4. Secure the rear cover with two screws.

4.3.4 Operator Panel Removal and Replacement

To remove the operator panel, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Make sure all power is removed from the system (CB1 is in the OFF position).
2. Remove the top cover and front bezel as described in Paragraph 4.3.3.
3. Remove the two operator panel holding screws and the operator panel.
4. Disconnect P30 from the operator panel. Make note of the cable orientation.

To replace the operator panel, proceed as follows.

1. Connect P30 to the operator panel. Be careful to position the cable correctly. When looking at the cable from the front, the red stripe should be to the right.
2. Place the operator panel into the front chassis and secure it with two screws.
3. Replace the top cover and front bezel as described in Paragraph 4.3.3.

4.3.5 Maintenance Panel Removal and Replacement

To remove the maintenance panel, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Make sure all power is removed from the system (CB1 is in the OFF position and the power cord is removed from its power outlet).
2. Remove the top cover and front bezel as described in Paragraph 4.3.3.
3. Remove the two maintenance panel holding screws and the maintenance panel.
4. Disconnect P40 from the maintenance panel. Make note of the cable orientation.

To replace the maintenance panel, proceed as follows.

1. Connect P40 to the maintenance panel. Be careful to position the cable correctly. When looking at the cable from the front, the red stripe should be closest to the top of the drive.
2. Place the maintenance panel into the front chassis and secure it with two screws.
3. Replace the top cover and front bezel as described in Paragraph 4.3.3.

4.4 Removal and Replacement — Internal Rear Parts

This paragraph gives removal and replacement procedures for the internal rear parts. These parts are shown in Figure 4-3.

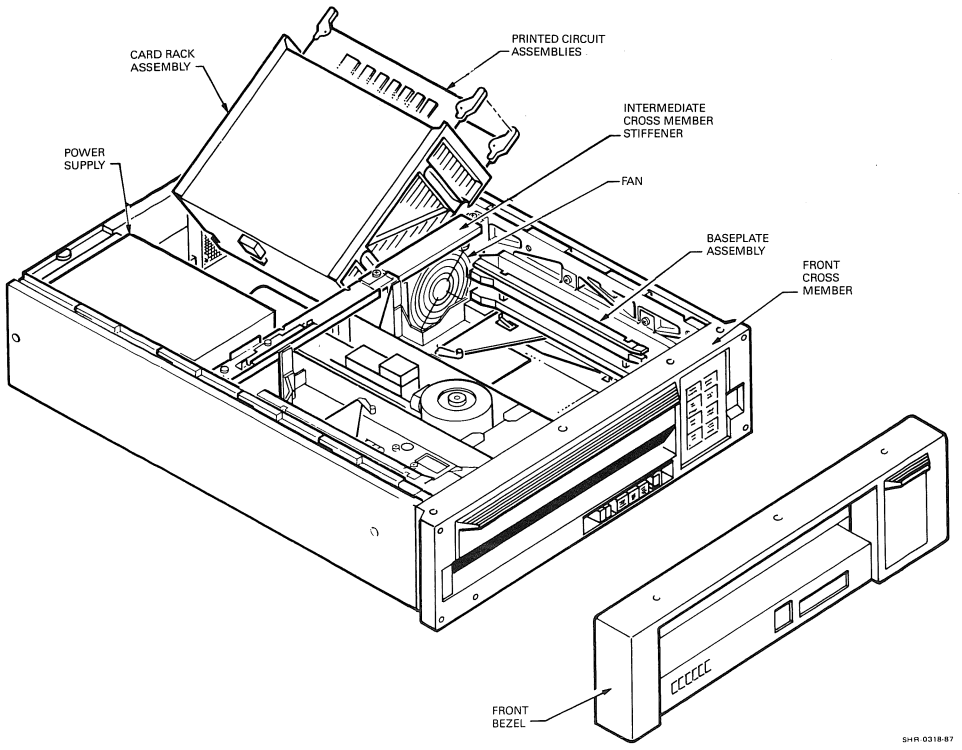
4.4.1 Power Supply Removal and Replacement

To remove the power supply, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

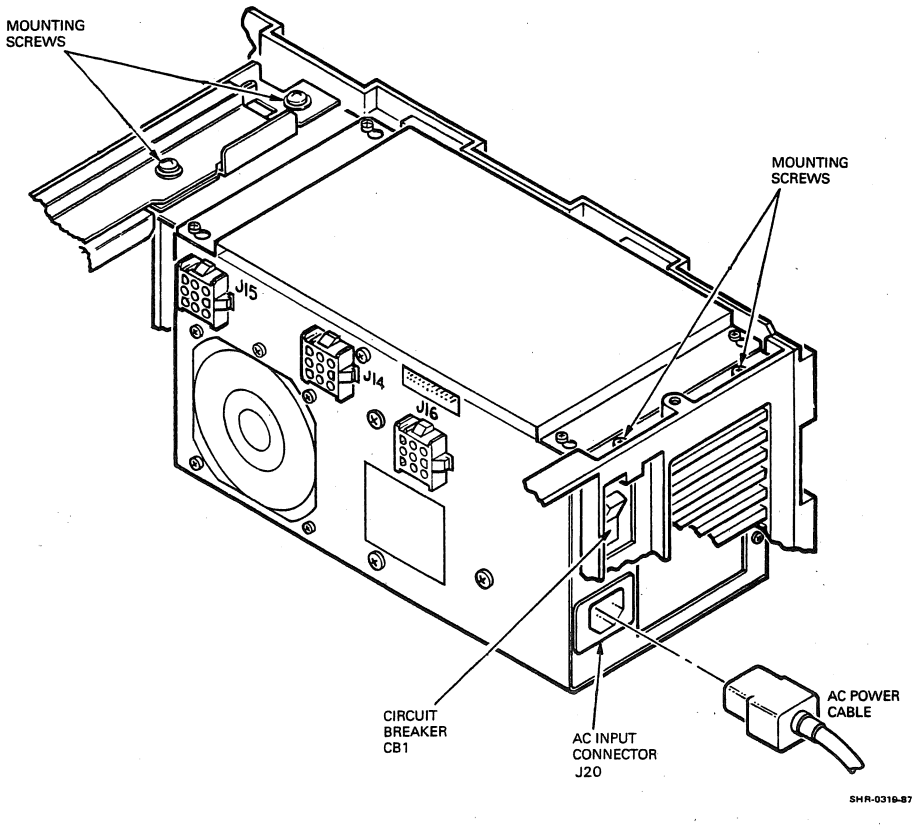
WARNING
Hazardous voltages are present in the power supply. The capacitors in the power supply must have time to discharge before any work is attempted. The RV20 must be powered down for at least five full minutes before these removal procedures are attempted.

Figure 4-3 RV20 Internal Parts Locations



1. Make sure all power is removed from the system (CB1 is in the OFF position). Remove the power cord from ac input connector J20 on the rear of the RV20 (see Figure 4-4).
2. Remove the top cover as described in Paragraph 4.3.3. Remember to extend the H9643 cabinet stabilizer leg before attempting to slide the RV20 out.
3. Disconnect P14, P15, and P16 on the side of the power supply. P14 and P15 are identical, so make sure you know which one is which when you replace the power supply. Note the orientation of P16. P16 is not keyed. It is very important that P16 is replaced properly.
4. Remove the four power supply mounting screws and hardware from the top of the power supply (Figure 4-4).

Figure 4-4 Power Supply Removal



5. Remove the remaining two screws that secure the cross-member stiffener (Figure 4-3), and remove the stiffener. Make note of the stiffener orientation.

6. Grasp the power supply on both ends. You may have to shift the entire supply slightly toward the front of the drive to get a good hold on it. When you have a good hold on the power supply, lift it straight up out of the drive.

To replace the power supply, proceed as follows.

1. Place the power supply in position inside the RV20. Line up the mounting holes in the power supply with the mounting holes on the chassis.

2. Put the cross-member stiffener in place. Make sure the cable to J15 is positioned correctly inside the stiffener.

3. Secure the power supply to the chassis with the mounting hardware and four screws. Remember to secure the ground strap.

4. Secure the cross-member stiffener to the cross member with two screws.

5. Connect P14 and P15 to the power supply.

6. Orient P16 properly and install it in the power supply.

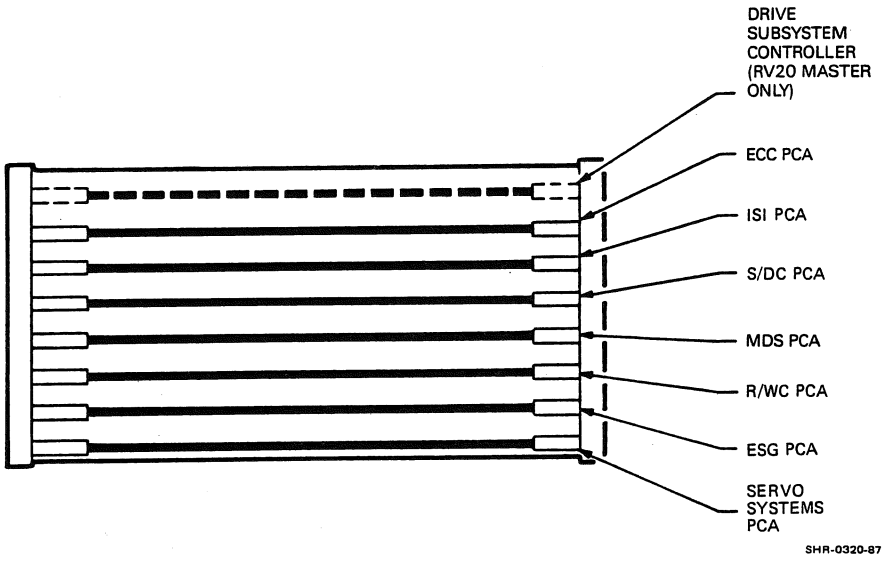
7. Replace the top cover as described in Paragraph 4.3.3.

4.4.2 PCA Removal and Replacement

The procedure is the same for removal and replacement of all printed circuit assemblies in the card cage. Figure 4-5 shows the position of each PCA in the backplane. There are eight slots in the card rack. The top slot is for the RV20 drive subsystem controller PCA. This PCA is in RV20 master drives only. The top slot is unused in RV20 slave drives. The remaining seven slots contain the following seven PCAs (in top-to-bottom order).

- Error correction and common memory interface (ECC) PCA
- ISI PCA
- Servo/drive control (S/DC) PCA
- Modulator demodulator synchronizer (MDS) PCA
- Read/write control (R/WC) PCA
- Error signal generator (ESG) PCA
- Servo systems PCA

Figure 4-5 Card Rack Slot Assignments



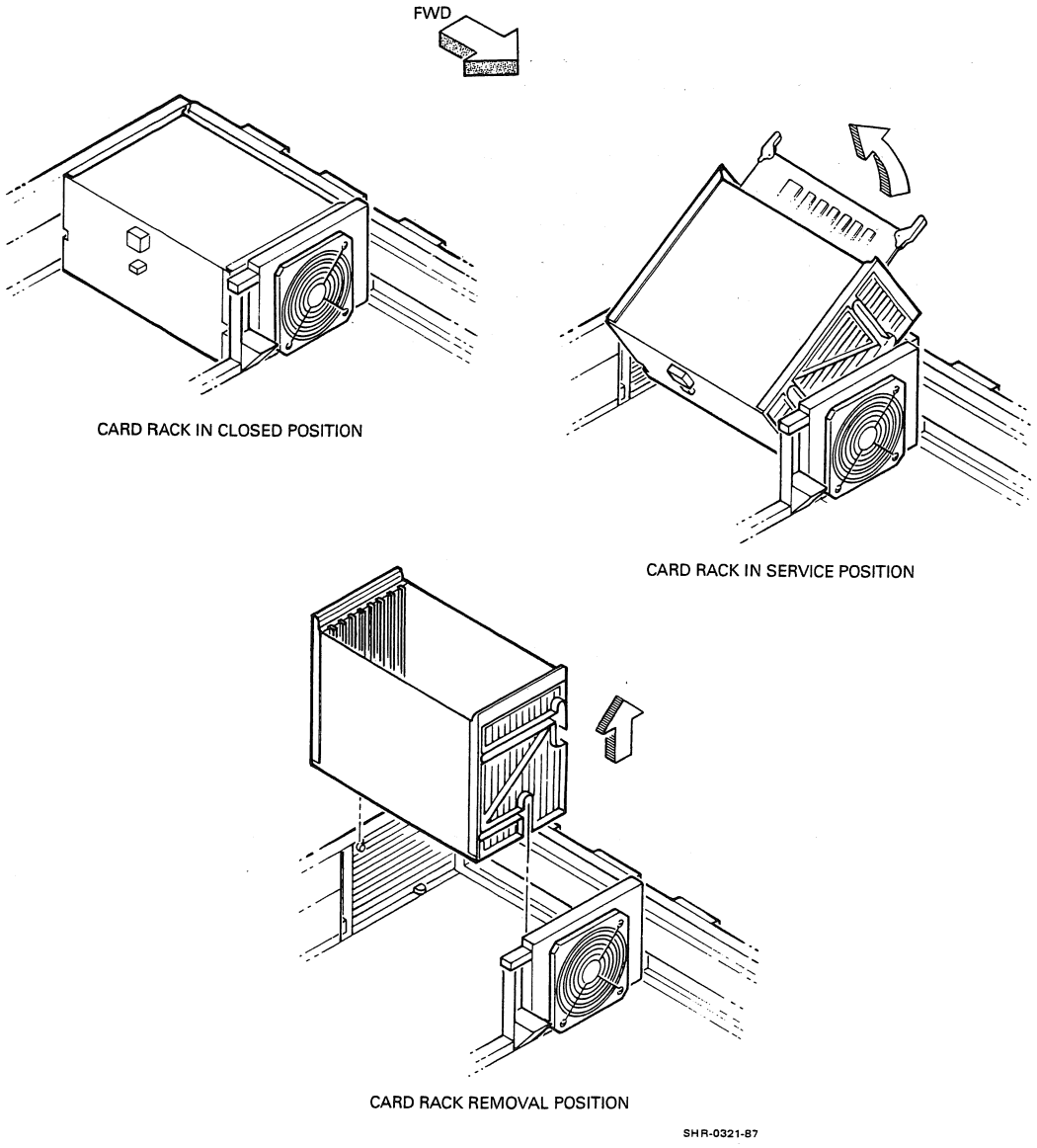
To remove a PCA from the card rack, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Make sure all power is removed from the system (CB1 is in the OFF position).
2. Remove the top cover as described in Paragraph 4.3.3. Remember to extend the H9643 cabinet stabilizer leg before attempting to slide the RV20 out.

3. Lift the card rack up from the chassis and place it in the service position shown in Figure 4-6.

Figure 4-6 Card Rack Service and Removal



4. Remove the PCA mounting brackets on both sides of the card rack (Figure 4-7).

5. Release the injector tabs on either side of the desired module by pulling up (use Figure 4-3 as a guide, if necessary).

6. Carefully slide the module out of the card rack and place on a non-conductive surface.

To replace a PCA in the card rack, proceed as follows.

1. Slide the module into its slot along the card guides on either side of the card rack.

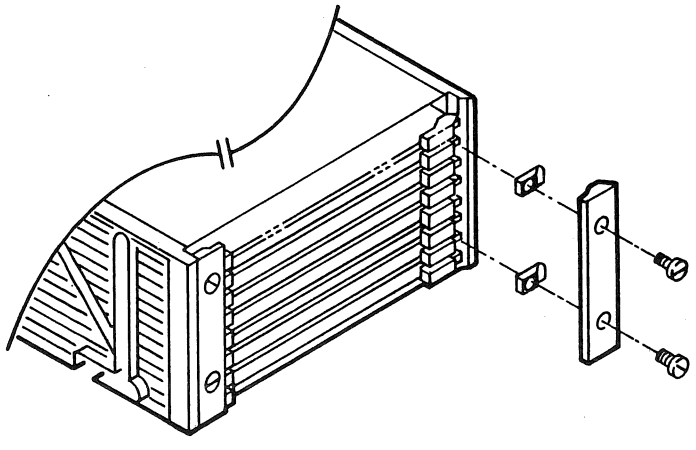
2. Engage the injector tabs on either side of the module by pushing down.

3. Replace the PCA mounting brackets on both sides of the card rack (Figure 4-7) and secure with four screws.

4. Seat the card rack back into its closed position. To accomplish this, lift the card rack up slightly from its service position, straighten it out, and slide the rack down so it is flush with the chassis (Figure 4-6).

5. Replace the top cover as described in Paragraph 4.3.3.

Figure 4-7 PCA Mounting Brackets



4.4.3. Card Rack Removal and Replacement

To remove the card rack, proceed as follows.

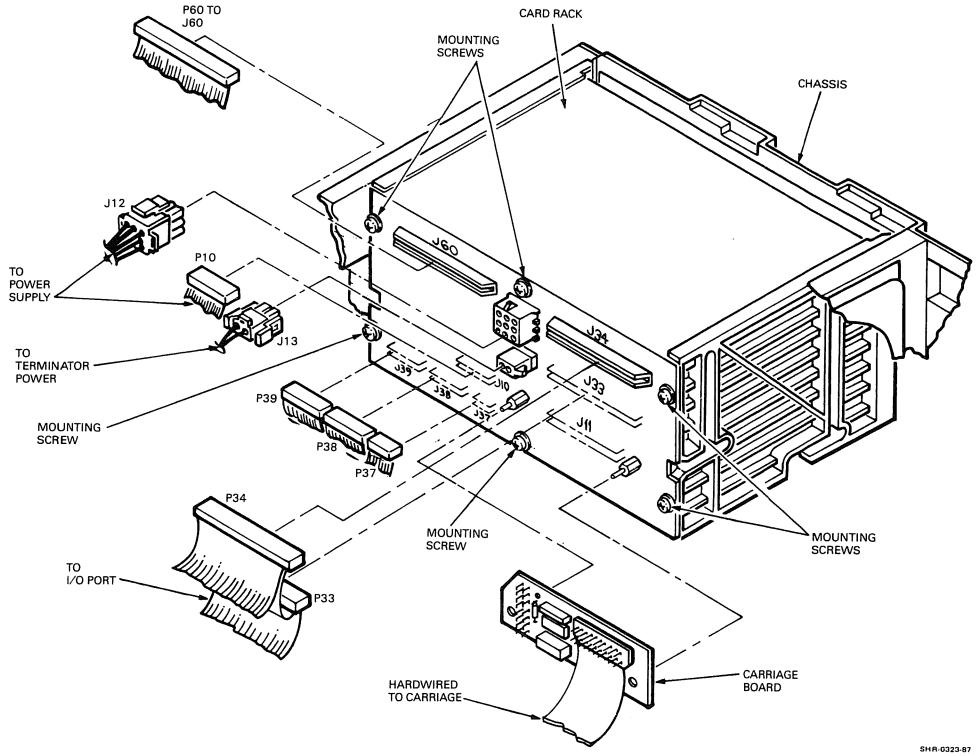
CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Make sure all power is removed from the system (CB1 is in the OFF position).
2. Remove the top cover as described in Paragraph 4.3.3. Remember to extend the H9643 cabinet stabilizer leg before attempting to slide the RV20 out.
3. Lift the card rack up from the chassis and place it in the service position shown in Figure 4-6.
4. Remove the PCA mounting brackets on both sides of the card rack (Figure 4-7).
5. Remove each module, one at a time, by releasing the injector tabs on either side of the modules (use Figure 4-3, if necessary). Slide each module out of the card rack and place on a non-conductive surface.
6. Disconnect all connectors at the rear of the card rack and make note of their orientation and location (Figure 4-8). All connectors on the modules have a J designation, and all connectors going into the modules have a P designation.
7. Carefully place the card rack into its removal position (Figure 4-6), and lift it out of the chassis.
8. Place the card rack on a non-conductive surface.

To replace the card rack, proceed as follows.

1. Slide the card rack into the chassis vertically, and place the rack in its service position (45 degree angle, see Figure 4-6).
2. Connect all module connectors at the rear of the card rack.
3. Replace all modules into their proper positions in the card rack.
4. Replace the PCA mounting brackets on both sides of the card rack and secure with four screws.
5. Seat the card rack back into its closed position. To accomplish this, lift the card rack up slightly from its service position, straighten it out, and slide the rack down so it is flush with the chassis (Figure 4-6).

Figure 4-8 Card Rack Backplane



6. Replace the top cover as described in Paragraph 4.3.3.

4.4.4 Card Rack Backplane Removal and Replacement

To remove the card rack backplane, proceed as follows.

1. Follow the instructions for removing the card rack in Paragraph 4.4.3.
2. Remove the six screws that secure the card rack backplane to the card rack frame (Figure 4-8).
3. Slide the backplane out of the card rack.

To replace the card rack backplane, proceed as follows.

1. Slide the new card rack backplane into the card rack frame and secure with six screws (Figure 4-8).
2. Replace the card rack as described in Paragraph 4.4.3.

4.5 Removal and Replacement — Internal Front Parts

This paragraph gives removal and replacement procedures for the internal parts that are housed under the front half of the top cover. Most of these parts are attached to the baseplate assembly, so the majority of these procedures require you to remove the baseplate assembly from the RV20 frame.

The removal and replacement procedures for the spindle pulley belt, the baseplate terminator PCA, and the fan assembly are the only ones that do not require removal of the baseplate assembly.

Figure 4-3 shows the baseplate assembly in the frame. Figure 4-9 shows the baseplate removed from the RV20 frame. Figure 4-9 provides two views of the baseplate assembly. Familiarize yourself with the illustration. Some procedures in this section require you to work from the bottom of the baseplate. This is the second view, Figure 4-9 (2 of 2). The illustration will be referred to throughout this paragraph.

Figure 4-9 RV20 Baseplate Parts Locations (1 of 2)

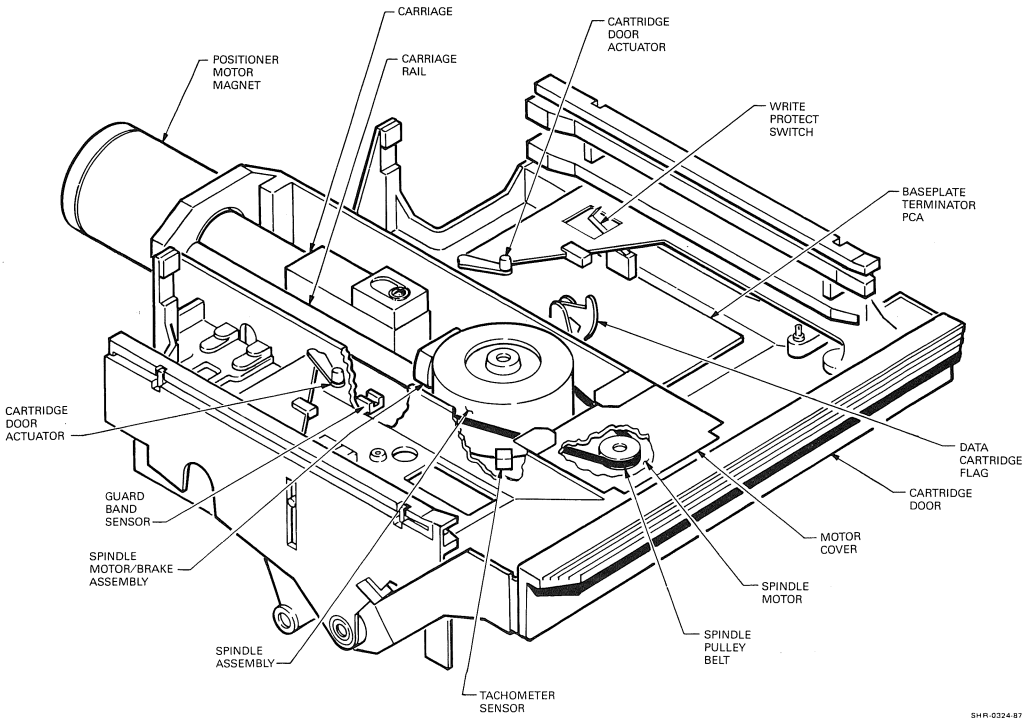
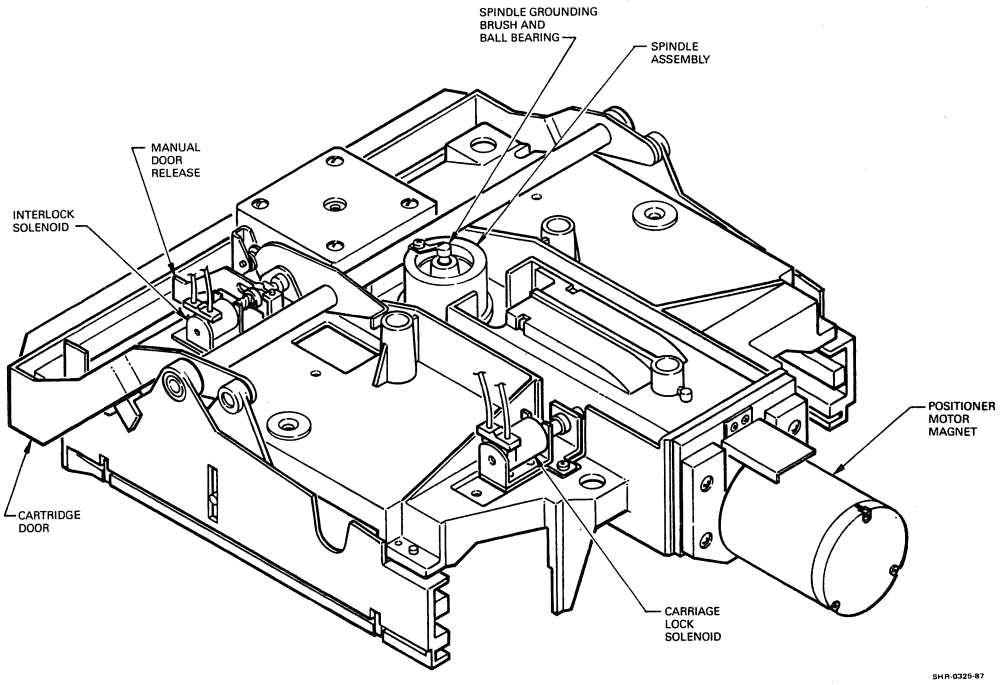
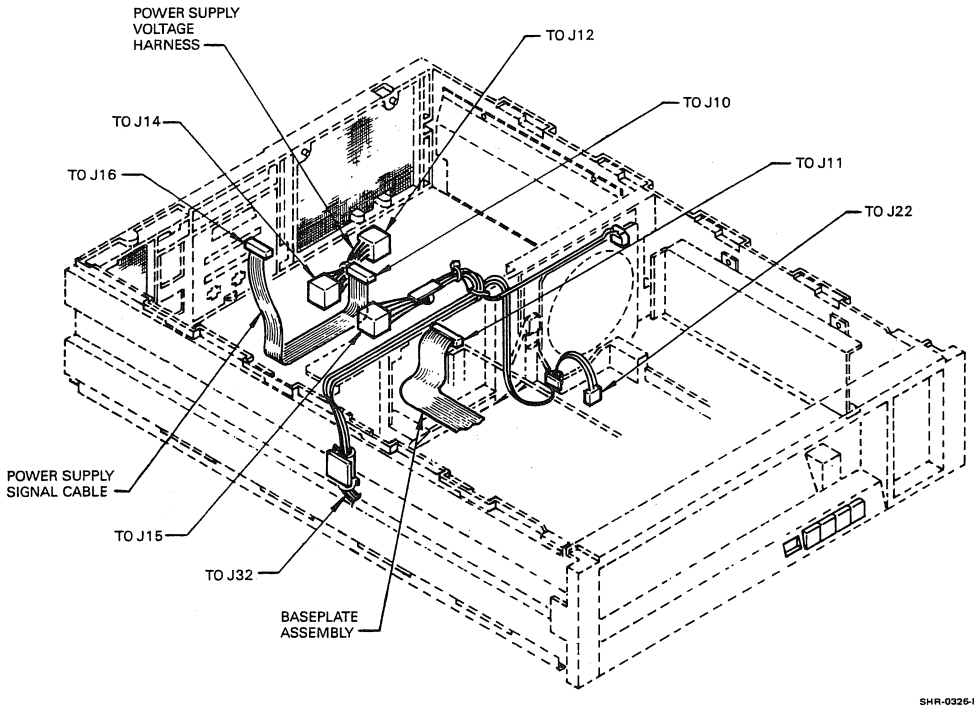


Figure 4-9 RV20 Baseplate Parts Locations (2 of 2)



Figures 4-10 and 4-11 show wiring paths through the RV20. These illustrations will also be referred to throughout this paragraph.

Figure 4-10 RV20 Wiring



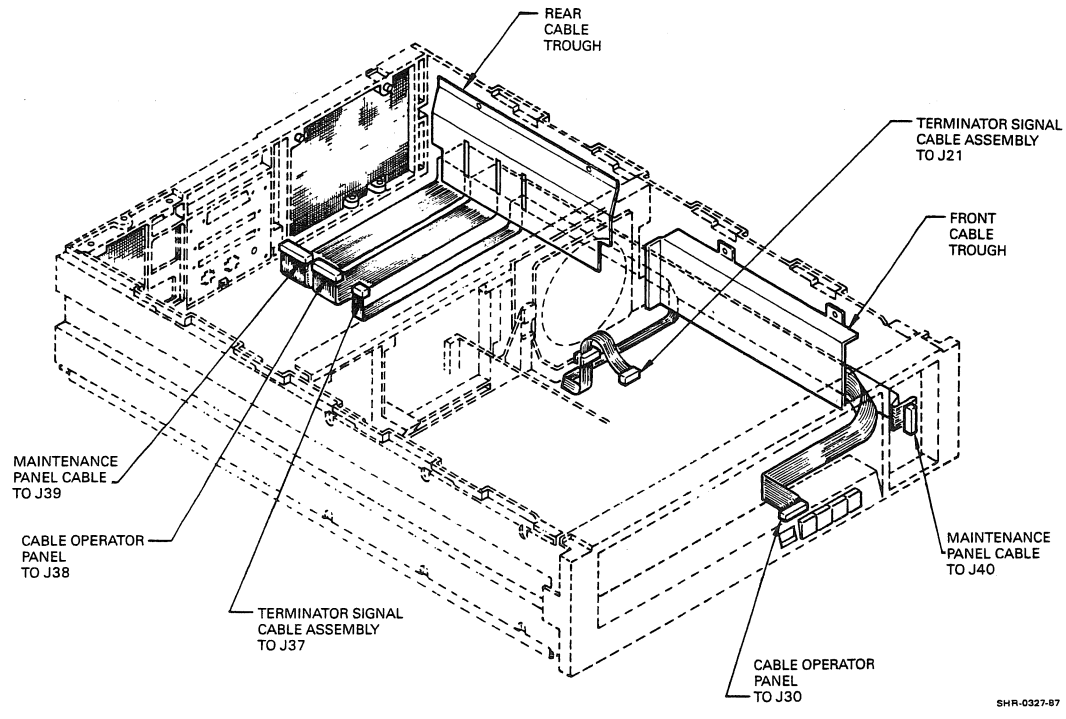
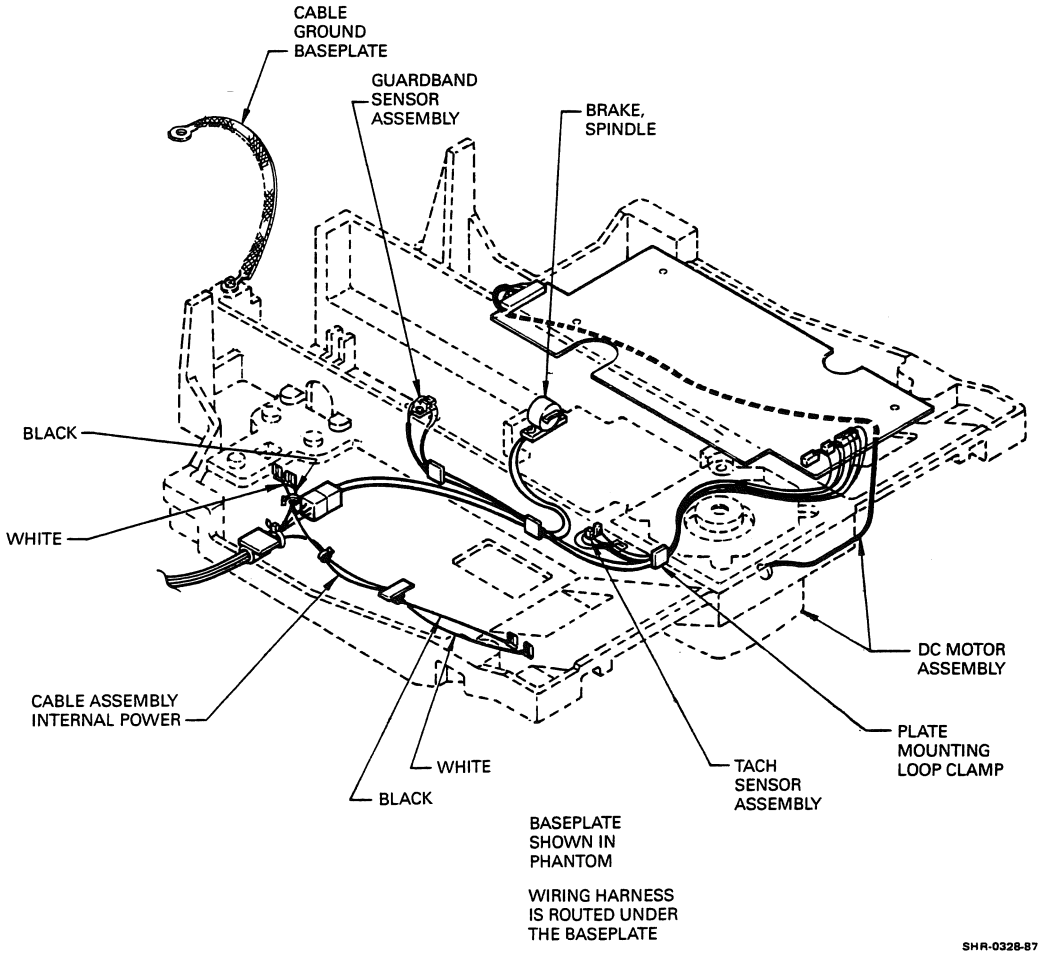


Figure 4-11 Baseplate Wiring



4.5.1 Fan Assembly Removal and Replacement

The fan assembly is shown in Figure 4-3. To remove the fan assembly, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Make sure all power is removed from the system (CB1 is in the OFF position).
2. Remove the top cover and front bezel as described in Paragraph 4.3.3. Remember to extend the H9643 cabinet stabilizer leg before pulling the RV20 out.
3. Remove the four screws that secure the cross-member stiffener to the intermediate cross member (Figure 4-3). Remove the stiffener.
4. Disconnect the fan power plug on the top of the fan assembly (Figure 4-10).
5. The fan assembly sits inside the intermediate cross member. The power plug is its only anchor. Lift the fan assembly up and out of the intermediate cross member.

To replace the fan assembly, proceed as follows.

1. Seat the fan assembly inside the intermediate cross member with the fan grill facing toward the front of the RV20.
2. Connect the fan power plug.
3. Replace the cross-member stiffener on the intermediate cross member. Seat the cable assembly properly on the stiffener and secure with four screws.
4. Replace the top cover and front bezel as described in Paragraph 4.3.3.

4.5.2 Baseplate Removal and Replacement

The baseplate assembly is shown in Figure 4-3. To remove the baseplate assembly, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Make sure all power is removed from the system (CB1 is in the OFF position).
2. Access the internal parts of the RV20 by removing the front bezel and the top cover as described in Paragraph 4.3.3. Remember to extend the H9643 cabinet stabilizer leg before pulling the RV20 out.
3. Remove the four screws that secure the cross-member stiffener to the cross member (Figure 4-3). Remove the stiffener.
4. Remove the ground strap next to the rear of the carriage rail (Figure 4-11).

CAUTION
Do not allow the ground strap to touch the carriage assembly or the carriage PCA. Doing so could seriously damage the carriage assembly.

5. Disconnect P15 at the power supply to free the cable harness that sits on the cross member. Lay the cables on the baseplate. Make sure the cables are not touching the carriage assembly.
6. Figure 4-10 shows the cable routing paths. Notice that on the left side of the frame, there is a harness hold down attached to the frame. Use a screwdriver to pry open the hold down. Remove the cable.
7. Disconnect the fan power plug.
8. Place the card rack assembly in the service position shown in Figure 4-6.
9. Remove P34 and P33 from the card rack backplane to access carriage connector P11 on the card rack backplane (use Figure 4-8, if necessary).

10. Using extreme care, disconnect carriage connector P11 from the card rack backplane.

11. Remove the front cross member (Figure 4-3) by removing the three screws securing it to the frame. Lift the front cross member straight up and out from the frame.

12. Disconnect P21 on the rear of the baseplate terminator PCA (Figure 4-11).

13. Locate the four screws that secure the baseplate to the RV20 frame. These screws sit on blue rubber shock mounts. Remove these four screws.

14. Make sure the cartridge door is closed.

CAUTION
If there is resistance when lifting the baseplate, set it back down and make sure all wires and plugs have been disconnected.

15. Grasp the baseplate assembly at the front and rear and very carefully lift it up out of the chassis. Place the baseplate assembly on a non-conductive surface.

To replace the baseplate assembly, proceed as follows.

1. Make sure that all wires, cables, and connectors inside the chassis are out of the way. Grasp the baseplate assembly at the front and rear. Using the four screw holes as a guide, carefully place the baseplate into the frame.

2. Install the four screws to secure the baseplate to the chassis.

3. Slide the manual door release to the side and make sure the cartridge door assembly is in the open position.

4. Connect P21 at the rear of the baseplate terminator PCA (Figure 4-9).

5. Connect the ground strap to the screw just to the left of the carriage rail.

CAUTION
Do not allow the ground strap to touch the carriage assembly or the carriage PCA. Doing so could seriously damage the carriage assembly.

6. Install the front cross member with three screws.

7. Connect carriage connector P11 to the card rack backplane.

8. Connect P34 and P33 to the card rack backplane (use Figure 4-8, if necessary).

9. Seat the card rack back into its closed position (Figure 4-6).

10. Connect the fan power plug.

11. Install the cable harness into the hold down on the left side of the frame (Figure 4-10).

12. Replace the intermediate cross-member stiffener on the cross member. Seat the cable assembly on the stiffener. Connect P15 to the power supply.

13. Secure the cross-member stiffener to the cross member with four screws.

14. Replace the front bezel and top cover as described in Paragraph 4.3.3.

4.5.3 Spindle Pulley Belt Removal and Replacement

To remove the spindle pulley belt, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Make sure all power is removed from the system (CB1 is in the OFF position).
2. Remove the top cover and front bezel as described in Paragraph 4.3.3. Remember to extend the H9643 cabinet stabilizer leg before pulling the RV20 out.
3. Remove the two screws that secure the spindle motor cover (Figure 4-12). Remove the motor cover.
4. Use extreme care while removing the pulley belt. The belt must be replaced exactly as it sits on the spindle. Be careful not to twist the belt. Remove the belt by rotating the spindle while sliding the belt off.

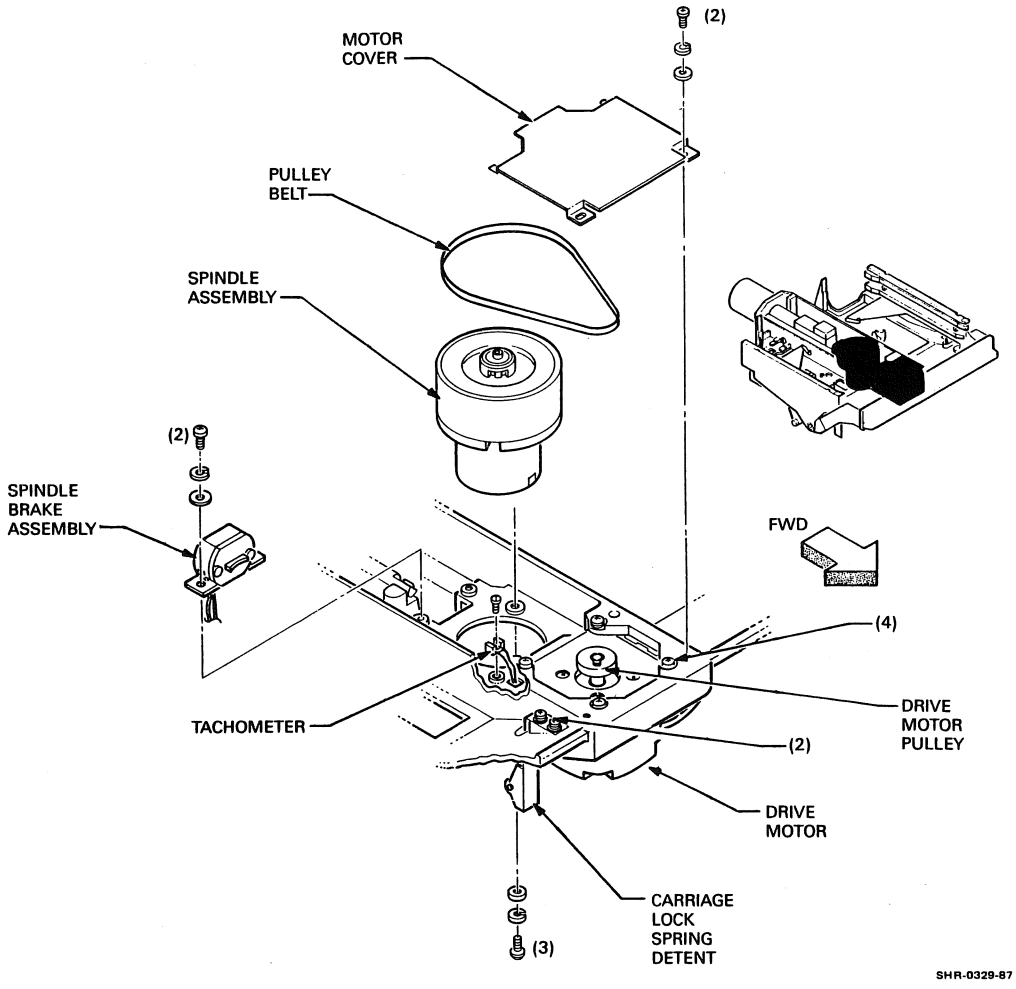
To replace the spindle pulley belt, proceed as follows.

1. Rotate the spindle while slipping the pulley belt over the spindle and pulley. Make sure that the belt is oriented properly.

WARNING
Failure to orient the belt properly will cause a fault upon power-up.

2. Rotate the spindle to make sure that the belt is oriented properly. There should be very minimal resistance to the rotation.
3. Replace the motor cover and secure with two screws.
4. Replace the top cover and front bezel as described in Paragraph 4.3.3.

Figure 4-12 Spindle Parts



4.5.4 Spindle Grounding Brush Removal and Replacement

To remove the spindle grounding brush, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Remove the baseplate as described in Paragraph 4.5.2.
2. The grounding brush holds down a ball bearing on the bottom of the spindle (if necessary, use Figure 4-16 to locate the grounding brush and ball bearing). Working from the bottom, remove the screw that holds the spindle grounding brush.
3. Carefully remove the spindle grounding brush and the ball bearing from the center of the spindle.

To replace the spindle grounding brush, proceed as follows.

1. Replace the ball bearing in the center of the retainer hole in the spindle.
2. Position the center section of the brush on the ball bearing in the center of the spindle.
3. Replace the holding screw on the outside edge of the grounding brush.
4. Replace the baseplate as described in Paragraph 4.5.2.

4.5.5 Spindle Assembly Removal and Replacement

To remove the spindle, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Remove the baseplate as described in Paragraph 4.5.2.

2. Remove the spindle pulley belt. Proceed as follows.

   a. Remove the two screws that secure the spindle motor cover (Figure 4-12). Remove the motor cover.

   b. Use extreme care while removing the pulley belt. The belt must be replaced exactly as it sits on the spindle. Be careful not to twist the belt. Remove the belt by rotating the spindle while sliding the belt off.

3. Working from the bottom of the baseplate, remove the three screws from the bottom of the spindle (Figure 4-12).

4. Lift the spindle out of the baseplate.

5. Remove the spindle grounding brush. Proceed as follows.

   a. Remove the screw that holds the spindle grounding brush (use Figure 4-16, if necessary).

   b. Carefully remove the spindle grounding brush and the ball bearing from the center of the spindle.

To replace the spindle, proceed as follows.

1. Replace the spindle grounding brush and ball bearing at the bottom of the spindle. Proceed as follows.

   a. Replace the ball bearing in the center of the retainer hole in the spindle.

   b. Position the center section of the brush on the ball bearing in the center of the spindle.

   c. Replace the holding screw on the outside edge of the grounding brush.

2. Seat the spindle in the baseplate and secure it with three screws. Be careful to turn the screws in evenly to ensure proper seating of the spindle.

3. Install the spindle pulley belt. Proceed as follows.

   a. Rotate the spindle while slipping the pulley belt over the spindle and pulley. Make sure that the belt is oriented properly.

WARNING
Failure to orient the belt properly will cause a fault upon power-up.

   b. Rotate the spindle to make sure that the belt is oriented properly. There should be very minimal resistance to the rotation.

   c. Replace the motor cover and secure with two screws.

4. Replace the baseplate as described in Paragraph 4.5.2.

4.5.6 Spindle Motor/Cable Assembly Removal and Replacement

To remove the spindle motor/cable assembly, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Remove the baseplate as described in Paragraph 4.5.2.
2. Remove the spindle pulley belt. Proceed as follows.

   a. Remove the two screws that secure the spindle motor cover (Figure 4-12). Remove the motor cover.

   b. Use extreme care while removing the pulley belt. The belt must be replaced exactly as it sits on the spindle. Be careful not to twist the belt. Remove the belt by rotating the spindle while sliding the belt off.

3. Working from the bottom of the baseplate, follow the wiring from the spindle motor to the baseplate terminator PCA (Figure 4-11). Disconnect the connector on the baseplate terminator PCA.

4. Remove any cables and tie wraps from the spindle motor to the spindle brake (if so equipped) and to the baseplate terminator PCA (Figure 4-11).

5. Remove the four mounting screws securing the spindle motor. Remove the spindle motor (Figure 4-12).

6. Locate and inspect the drive motor pulley (Figure 4-12). Note the orientation of the set screw and standoff for pulley replacement. Remove the spindle pulley. Loosen the set screw enough to remove the pulley from the motor shaft. Do not remove the set screw.

To replace the spindle motor/cable assembly, proceed as follows.

1. Return the pulley to the motor shaft and secure by tightening the set screw. Make sure that the pulley is positioned away from the base to allow enough clearance for the pulley to move freely.

2. Mount the spindle motor on the baseplate with four screws.

3. Reroute the cables from the motor to the spindle brake (if so equipped) and to the baseplate terminator PCA. Secure the cables with a tie wrap, if necessary.

4. Connect the connector to the baseplate terminator PCA and the spindle brake (if so equipped).

5. Replace the spindle pulley belt. Proceed as follows.

    a. Rotate the spindle while slipping the pulley belt over the spindle and pulley. Make sure that the belt is oriented properly.

WARNING
Failure to orient the belt properly will cause a fault upon power-up.

    b. Rotate the spindle to make sure that the belt is oriented properly. There should be very minimal resistance to the rotation.

    c. Replace the motor cover and secure with two screws.

6. Replace the baseplate as described Paragraph 4.5.2.

4.5.7 Spindle Brake Removal and Replacement

Not all drives are equipped with a spindle brake. If your drive is so equipped, the brake is located just behind the spindle (Figure 4-9). It is mounted on the baseplate with two screws. The wiring is shown in Figure 4-11.

To remove the spindle brake, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Remove the baseplate as described in Paragraph 4.5.2.
2. Working from the bottom of the baseplate, locate the spindle brake assembly wiring and disconnect molex connector P32.
3. Working from the top of the baseplate, remove the two screws and mounting hardware that secure the spindle brake to the spindle. Remove the brake assembly from the spindle.
4. Lift the spindle brake cable and P32 up through the baseplate.

To replace the spindle brake assembly, proceed as follows.

1. Working from the top of the baseplate, thread connector P32 and the spindle brake cable through the baseplate.
2. Put the brake assembly in place and secure it with two sets of mounting hardware.
3. Working from the bottom of the baseplate, connect P32.
4. Replace the baseplate as described in Paragraph 4.5.2.

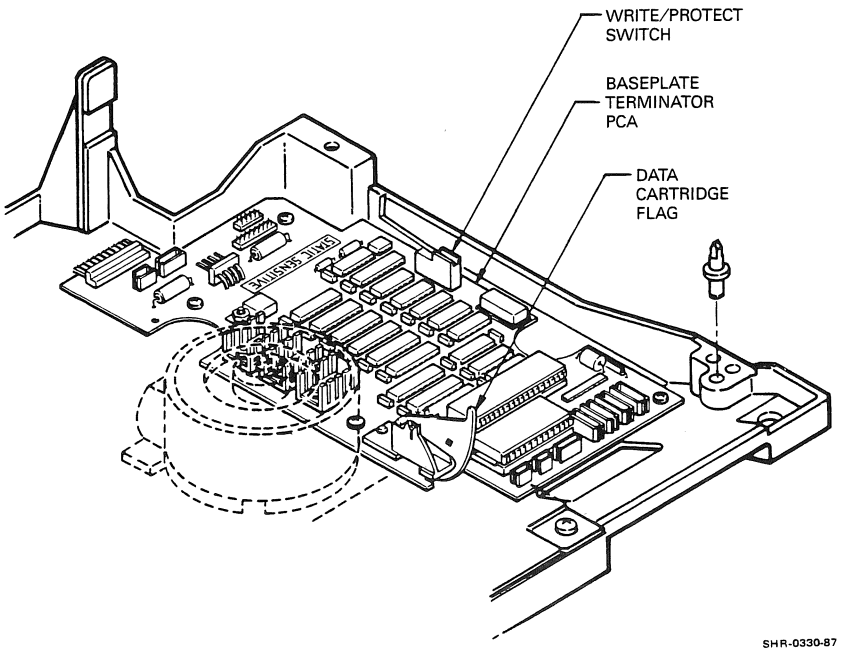
4.5.8. Baseplate Terminator PCA Removal and Replacement

To remove the baseplate terminator PCA, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV80.

1. Make sure all power is removed from the system (CB1 is in the OFF position).
2. Remove the top cover as described in Paragraph 4.3.3. Make sure that the H9643 cabinet stabilizer leg is extended before pulling the RV20 out.
3. Make sure the cartridge door is in the open position to allow room for the baseplate terminator PCA to be removed. Use the manual door release to open the cartridge door. (Figure 4-2 shows the location of the manual door release.)
4. Disconnect all leads on the baseplate terminator PCA, noting their locations and orientation. J25 and J26 on the front of the PCA are particularly important because they are identical. Make sure you know which one is which.
5. Disconnect the four screws that hold the baseplate terminator to the baseplate (Figure 4-13).
6. Carefully slide the PCA out toward the front of the baseplate.

Figure 4-13 Baseplate Terminator PCA



To replace the baseplate terminator PCA, proceed as follows.

1. Make sure that the cartridge door is in the open position to allow adequate clearance for the baseplate terminator PCA (see Figure 4-13). Carefully slide the PCA in from the front of the baseplate and line it up with its four screw holes.
2. Check the operation of the data cartridge flag (Figure 4-13). The cable that sits underneath the PCA can get in the way if it is improperly seated.
3. Insert the four PCA mounting screws but do not tighten them yet.
4. Close the cartridge door and make sure that it is not interfering with the Write Protect switch (Figure 4-13).
5. Tighten the four screws that hold the baseplate terminator to the baseplate.
6. Connect all leads on the baseplate terminator PCA. Make sure that P21 is oriented properly. Pin 1 of P21 must plug into pin 1 of J21 on the PCA. Pin 1 of P21 is marked with a small triangle.
7. Replace the top cover as described in Paragraph 4.3.3.

4.5.9 Carriage Assembly Removal and Replacement

To remove the carriage assembly, proceed as follows.

WARNING
Never disassemble the laser optics on the carriage assembly. Invisible Class 3B laser beam can cause serious eye damage.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Remove the baseplate assembly as described in Paragraph 4.5.2.

2. Remove the motor magnet positioner (Figure 4-14). Use extreme caution when removing the positioner. Proceed as follows.

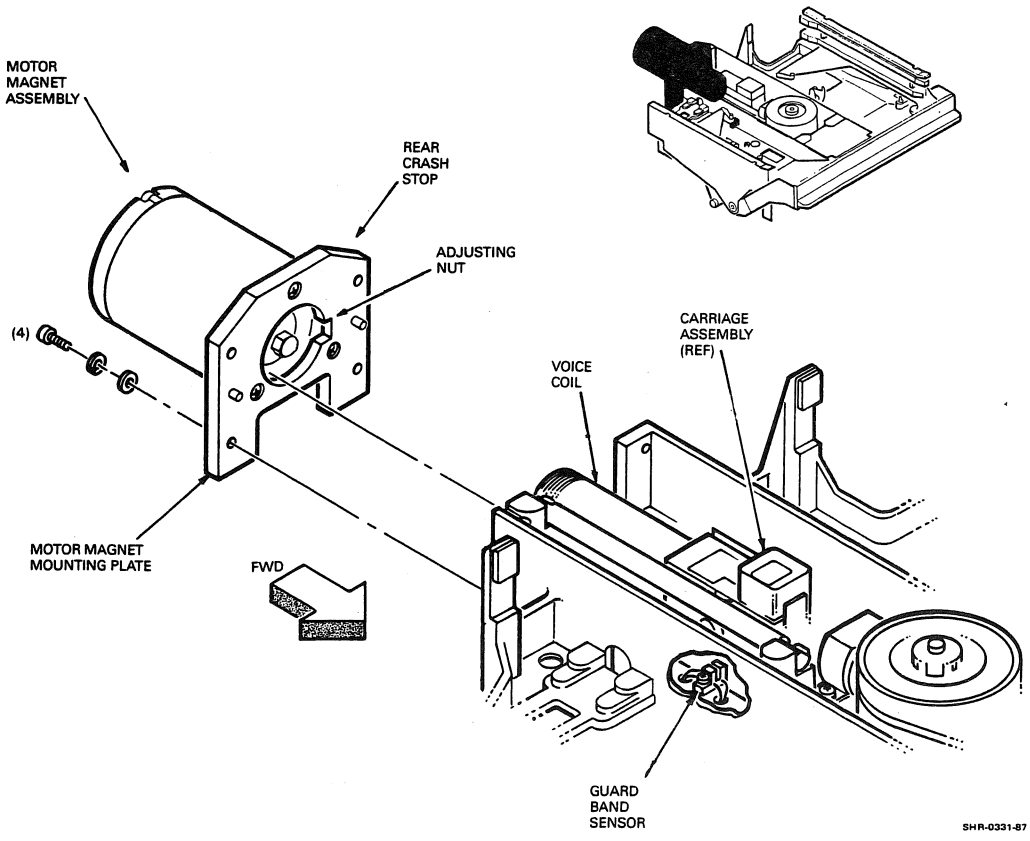
   a. Using Figure 4-14, find the motor magnet mounting plate. Locate the four screws that secure the mounting plate to the baseplate. You must remove these four screws without disturbing the voice coil.

   b. Remove the four screws (the lower two first, then the upper two) while holding the positioner steady with your other hand.

   c. Use extreme care as you slide the positioner toward the rear.

3. If necessary, remove the motor magnet positioner from its mounting plate by removing the three securing screws (Figure 4-14).

Figure 4-14 Carriage Location



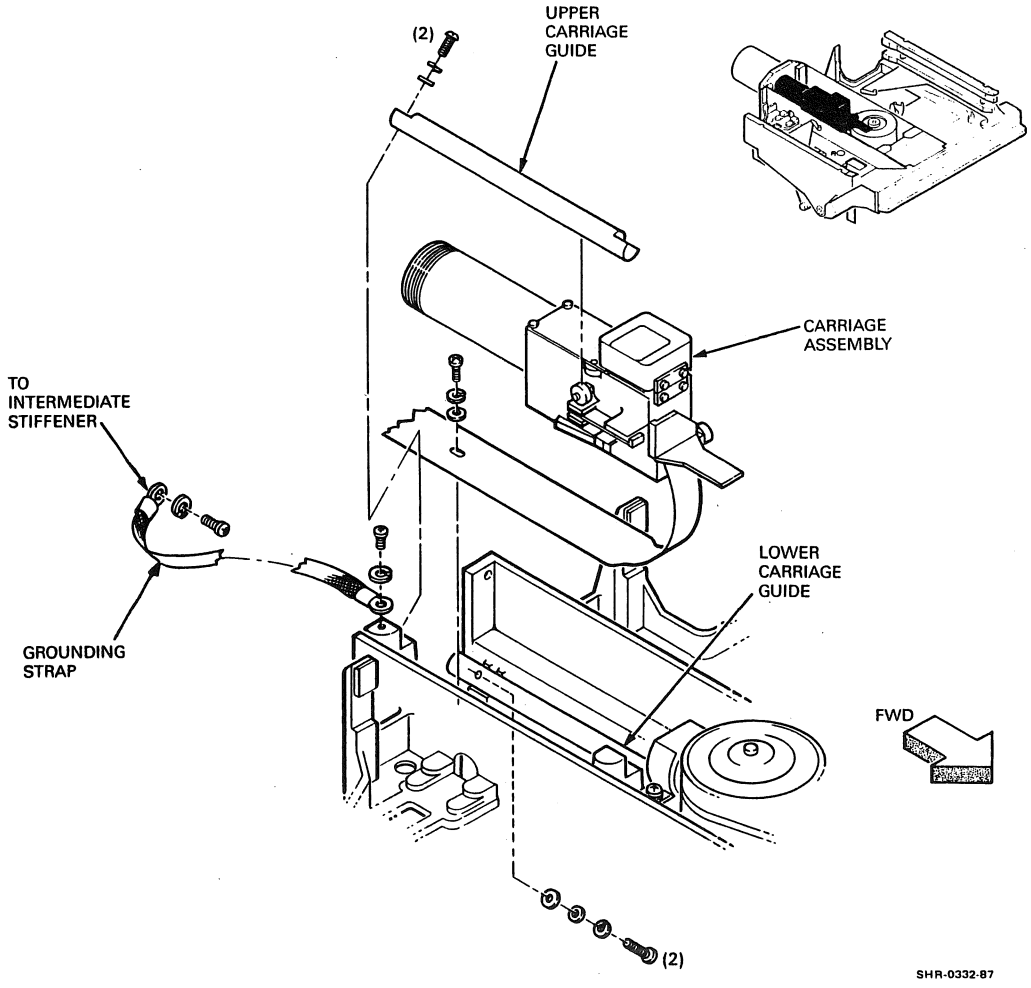
4. Remove the two screws that secure the upper carriage guide rail (Figure 4-15), and remove the rail.

5. Grasp the voice coil carefully and raise it back to gain access to the flex cable hold-down screw (Figure 4-15).

6. Remove the flex cable hold-down screw.

7. Carefully slide the carriage assembly off the lower carriage guide rail and place it on a non-conductive surface.

Figure 4-15 Carriage Removal



To replace the carriage assembly, proceed as follows.

1. Hold onto the voice coil of the carriage assembly and line up the flex cable. Secure the flex cable with the hold-down screw (Figure 4-14).
2. Carefully put the carriage assembly in place on the lower carriage guide rail.
3. Place the upper carriage guide rail (Figure 4-14) in place and secure it with two screws.
4. If the motor magnet positioner has been separated from its mounting plate, reposition it now. Replace the three screws (Figure 4-14).
5. Replace the motor magnet positioner (Figure 4-14). Use extreme caution when handling the positioner. Proceed as follows.
    a. Use extreme care as you slide the positioner toward the voice coil. The four screw holes should be lined up.
    b. Replace the four screws (the upper two first, then the lower two) while holding the positioner steady with your other hand.
6. Replace the baseplate assembly as described in Paragraph 4.5.2.

4.5.10 Guardband Sensor Removal and Replacement

Figures 4-9 and 4-14 show the location of the guardband sensor. Figure 4-11 shows the wiring from the guardband sensor to P25 and P26 on the baseplate terminator PCA.

To remove the guardband sensor, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Remove the baseplate as described in Paragraph 4.5.2.

2. Working from the bottom of the baseplate, release the cable-restraining hardware (hold-down clamps or tie wraps) to free the sensor wires.

3. At the baseplate PCA, disconnect P25 and P26 and make note of their locations. Make sure they are marked. The connectors are identical.

4. Remove the small screw holding the sensor to the baseplate.

5. At the carriage assembly, release the carriage lock solenoid momentarily to allow the carriage to move back toward the motor magnet. Carefully move the carriage assembly toward the motor magnet positioner.

6. Pull the guardband sensor wires out through the top of the baseplate. If there is resistance, make sure that the cable-restraining hardware has been released to free the wires from the main cable harness.

To replace the guardband sensor, proceed as follows.

1. Insert the sensor wires down through the top of the baseplate.

2. Attach the sensor to the baseplate with the small screw.

3. Carefully slide the carriage forward so the carriage lock solenoid engages.

4. Working from the bottom of the baseplate, attach the wires to the main cable harness.

5. At the baseplate terminator PCA, connect P25 and P26.

6. Replace the baseplate as described in Paragraph 4.5.2.

4.5.11 Tachometer Sensor Removal and Replacement

The tachometer sensor (Figure 4-12) is hardwired to the baseplate terminator PCA. The path is shown in Figure 4-11.

To remove the tachometer sensor, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Remove the baseplate as described in Paragraph 4.5.2.
2. Remove the spindle as described in Paragraph 4.5.5.
3. Remove the screw that holds the tachometer sensor to the baseplate (see Figure 4-12).
4. Disconnect sensor connector P22 on the front of the baseplate terminator PCA.
5. Working from the bottom of the baseplate, release the cable-restraining hardware (hold-down clamps or tie wraps) to free the sensor wires.
6. Pull the sensor down through the opening. Make sure that the cable-restraining hardware has been released to free the wires from the main cable harness.

To replace the tachometer sensor, proceed as follows.

1. Insert the sensor wires through the square hole located on the baseplate below the sensor mount (Figure 4-12).
2. Attach a new tachometer sensor to the baseplate with the small screw.
3. Working from the bottom of the baseplate, attach the wires to the main cable harness.
4. At the baseplate terminator PCA, connect P22.
5. Replace the spindle as described in Paragraph 4.5.5.
6. Replace the baseplate as described in Paragraph 4.5.2.

4.5.12 Interlock Solenoid Removal and Replacement

To remove the interlock solenoid, proceed as follows.

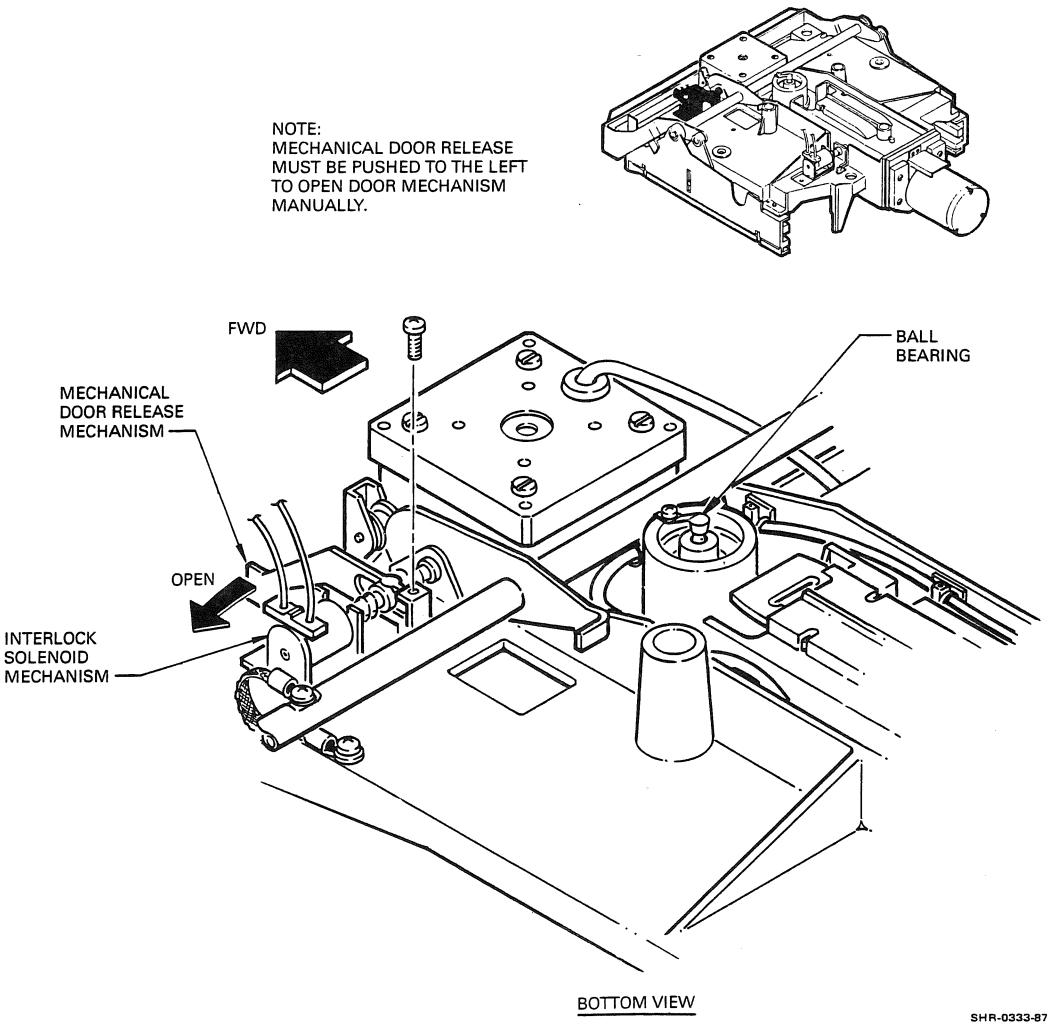
CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

1. Remove the baseplate as described in Paragraph 4.5.2.
2. Working from the bottom of the baseplate, locate the interlock solenoid (see Figure 4-16). Operate the cartridge door and notice how the solenoid works. Leave the door in the closed (solenoid engaged) position.
3. Disconnect the J70 connector, which is wired to the two solenoid tabs.
4. Remove the three screws that secure the solenoid assembly adapter plate to the baseplate.
5. Turn the solenoid over and remove the two mounting screws that hold the solenoid to the adapter plate and remove the solenoid.

To replace the interlock solenoid, proceed as follows.

1. Mount the new solenoid on the adapter plate with two screws.
2. Install the solenoid adapter plate on the baseplate, using the three mounting screws, but do not tighten the screws.
3. Connect the J70 connector, which is wired to the two solenoid tabs.
4. Check to be sure the solenoid is working properly by moving the cartridge door to the open, and then the closed position. Make sure the solenoid engages properly when the cartridge door is in the closed position.
5. Replace the baseplate as described in Paragraph 4.5.2.

Figure 4-16 Interlock Solenoid Removal



4.5.13 Carriage Lock Solenoid Removal and Replacement

To remove the carriage lock solenoid, proceed as follows.

CAUTION
Use a static discharge kit with a grounded wrist strap whenever accessing the internal parts of the RV20.

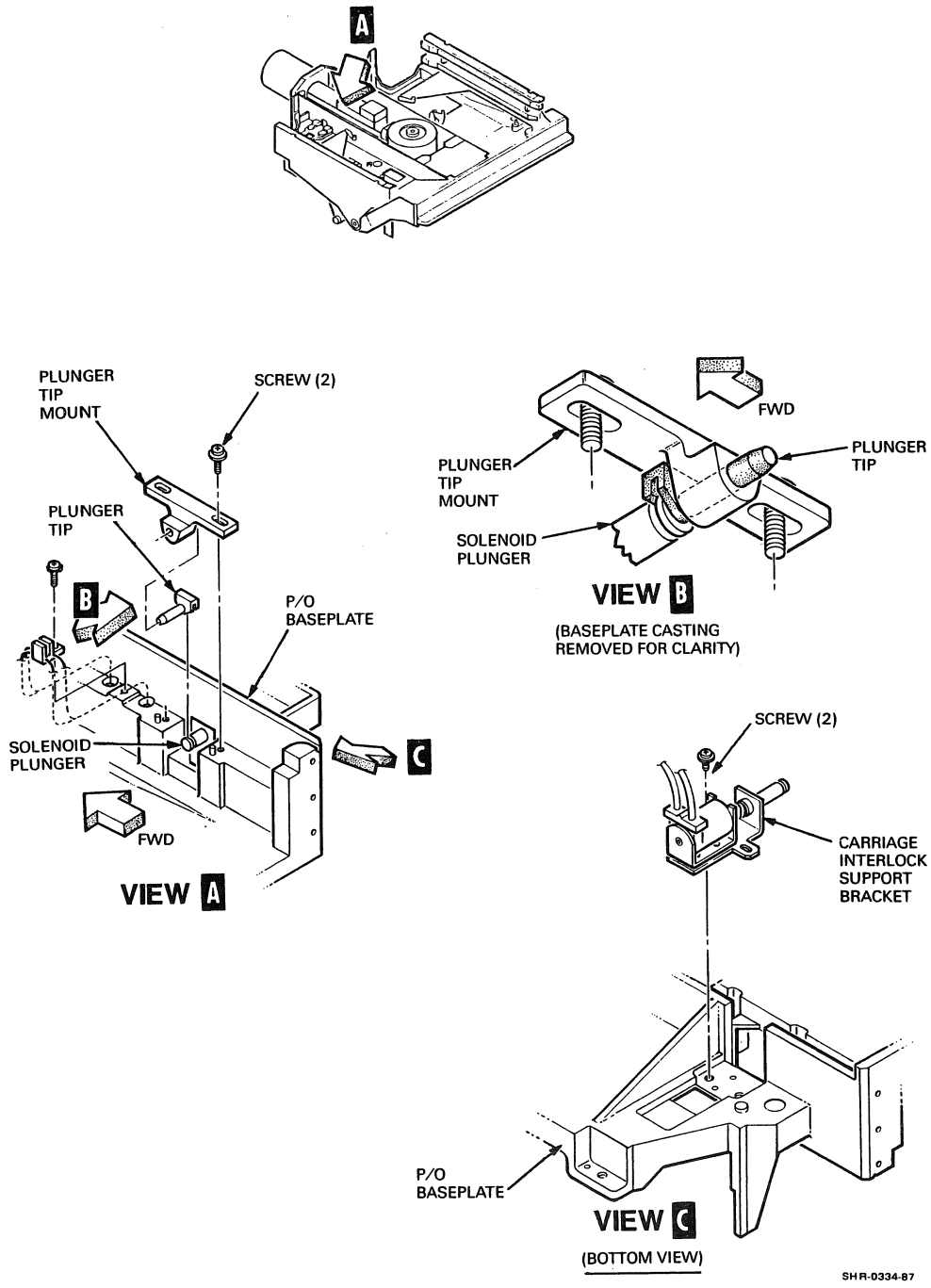
1. Remove the baseplate as described in Paragraph 4.5.2.
2. The carriage lock solenoid is shown in Figure 4-9. Figure 4-17 is a more detailed set of illustrations of the solenoid. Working from the bottom of the baseplate, make sure the motor magnet is facing you while you perform this procedure.
3. Disconnect the J71 connector, which is wired to the two solenoid tabs.
4. Remove the solenoid from the baseplate by removing two screws.
5. Remove the solenoid from the baseplate casting. Be careful when removing it. The plunger is holding the carriage assembly.

WARNING
When the plunger has been removed, the carriage is no longer locked in place. Be very careful not to move the baseplate, as the carriage can be damaged.

To replace the carriage lock solenoid, proceed as follows.

1. Install the new plunger through the baseplate casting to reengage the carriage (Figure 4-17).
2. Seat the new solenoid into the installed plunger. Line up the base of the solenoid with the holes in the baseplate.
3. Secure the solenoid to the baseplate with two screws.
4. Connect the J71 connector, which is wired to the two solenoid tabs.
5. Very carefully turn the baseplate over.
6. Once the baseplate is turned over, check to be sure the solenoid is operating properly. Release the solenoid by hand to allow the carriage to move. Gently slide the carriage back so it is not engaged by the solenoid. Then move the carriage forward to make sure the carriage lock solenoid engages properly.
7. Replace the baseplate as described in Paragraph 4.5.2.

Figure 4-17 Carriage Lock Solenoid Removal



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