EK-ORC25-PS-002

RC25 Disk Subsystem

Pocket Service Guide

Prepared by Educational Services
of
Digital Equipment Corporation

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PREFACE

This pocket service guide provides information on maintaining the RC25 disk subsystem in the field. The guide has four chapters.

Introduction
Controls, Indicators, and Jumpers
Troubleshooting
Removal and Replacement

Chapter 1 provides a short overview of the product.

Chapter 2 briefly explains the operator controls and indicators as well as the internal jumpers and switches that may be encountered during maintenance or installation.

Chapter 3 provides the troubleshooting procedures and hints for servicing the disk subsystem. They help to isolate problems to a faulty field replaceable unit (FRU).

Chapter 4 explains how to remove the faulty FRU and install a replacement.

The appendix shows the power distribution and provides a physical/functional block diagram for the master and slave disk drives.

For detailed information on how to install the RC25 disk drive, refer to the *RC25 Disk Subsystem Installation Guide* (EK-0RC25-IN).

1 INTRODUCTION

1.1 GENERAL

The RC25 disk drive is a completely self-contained, random access, mass storage device. It contains two 20-cm (8-in) rigid disk platters (one fixed and one removable) and has a formatted data storage capacity of 52 million bytes. Both platters are mounted on and driven by the same spindle. The drive is available in tabletop and rackmount versions.

Maintenance features of the drive include extensive internal fault detection and isolation diagnostics, including a reliability exerciser. These features contribute to a reduced mean time to repair. There are no adjustments or special tools, and alignment packs and fixtures are not required for on-site maintenance. Access to FRUs is quick when maintenance is necessary. All field replaceable logic modules in the drive are mounted so they can be reached without extenders.

1.2 DESCRIPTION

This section describes the basic subsystem architecture.

1.2.1 RC25 Disk Subsystem

The RC25 disk subsystem is made up of two major parts, the disk drive and the disk adapter module. The adapter module allows the I/O bus of a particular host computer system to communicate with the drive. System communication is via mass storage control protocol (MSCP) and UNIBUS/Q-Bus storage systems port (UQSSP).

Figure 1-1 shows a typical RC25 disk subsystem. The adapter module plugs into the host computer system bus. The drive connects to the adapter via an interface cable. The interface is Digital Equipment Corporation's standard low end storage interconnect (LESI) bus.

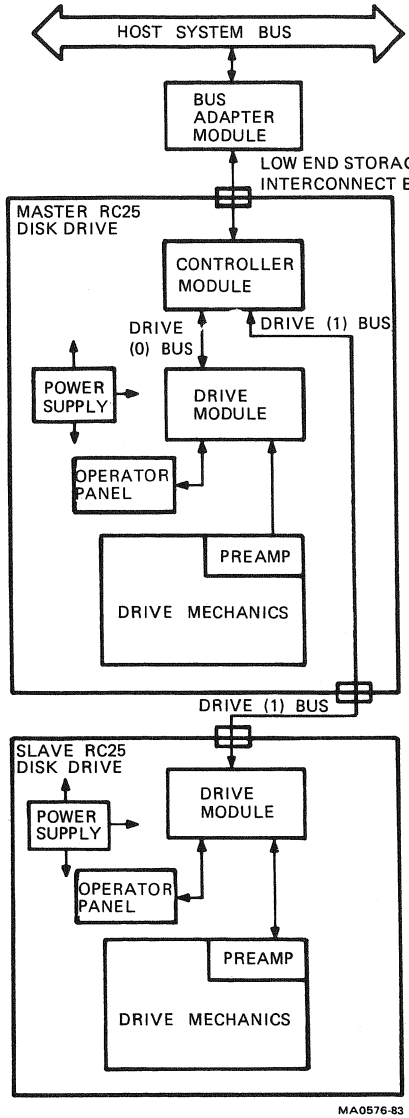


Figure 1-1 Subsystem Block Diagram

The RC25 disk drive is available in two basic configurations, the master drive and the slave drive. The master drive contains a controller module. The controller connects to the host adapter module through the LESI bus. The slave drive does not contain a controller module. The slave connects to the master drive's controller via the drive bus. Master and slave drives are equipped with separate power supplies.

Each adapter interfaces to one master drive and each master can control up to two disk spindles. This includes its own spindle and the spindle in the slave drive. Each spindle drives two disk platters. A logical unit number is assigned to each platter, therefore, each drive represents two units.

1.2.2 Disk Drive Packaging

The RC25 disk drive is available as a free-standing tabletop unit or as a unit mounted on slides, which fits into a standard 19-inch rack. Some systems can use variations of these two packages. With each type, the drive is available in the master and slave configuration.

1.3 PREVENTIVE MAINTENANCE

Preventive maintenance is not necessary. All mechanical assemblies are permanently lubricated for the life of the product. While the make-up filter is field replaceable, it has a lifespan that exceeds the life of the product in normal operating environments.

1.4 DOCUMENTATION

Table 1-1 provides a list of documentation that supports the RC25 disk drive and disk subsystems.

Table 1-1 RC25 Disk Subsystem Documentation

Part Number	Description
EK-0RC25-UG	*RC25 Disk Subsystem User Guide* – site planning, operation, care, ordering accessories and first-level problem diagnosis.
EK-RC25S-IN	*RC25 Tabletop Slave Disk Drive Installation Guide* – procedures for installing slave tabletop drive and running interface cables.
EK-0RC25-IN	*RC25 Disk Subsystem Installation Guide* – a Field Service guide to site planning, installing disk subsystem (tabletop drive, rackmount drive, adapter modules), and performance verification.
EK-0RC25-PS	*RC25 Disk Subsystem Pocket Service Guide* – procedures for troubleshooting and repairing RC25 to FRU.
EK-0RC25-IP	*Illustrated Parts Breakdown* – detailed parts breakdown of RC25 disk drive. Does not provide part numbers for printed circuit module components.
MP-01612-00	*RC25 Field Maintenance Print Set* – engineering drawings relating to drive and adapter modules. Includes mechanics, electronics, and power supply.
AA-L619A-TK	*MSCP Basic Disk Functions Manual* – description of Mass Storage Control Packets.
AA-L620A-TK	*Storage System Diagnostics and Utility Protocol* – description of DUP commands and responses.
AA-L621A-TK	*Storage Systems UNIBUS Port Description* – description of UNIBUS/Q-Bus bus port driver protocol.

2 CONTROLS, INDICATORS, AND JUMPERS

2.1 GENERAL

This chapter provides a short description of the operator and maintenance controls and indicators. It also provides brief loading/unloading and operating procedures.

Paragraph 2.2 describes the controls and indicators and summarizes the function of each. Paragraph 2.3 tells how to insert (load) and remove (unload) the disk cartridge. Paragraph 2.4 has a complete procedure for loading/running and stopping/unloading the drive. Paragraph 2.5 shows the switches and jumpers that you may encounter in the RC25 disk subsystem. Finally, Paragraph 2.6 tells how to remove the disk cartridge from the drive in the event of a power or component failure.

2.2 CONTROLS AND INDICATORS

Controls and indicators are on the front and back of the drive. Refer to Figures 2-1 (back) and 2-2 (front).

Voltage selection and power are controlled at the back of the drive.

An operator panel, on the front lower-right corner of the drive, contains the controls and indicators for routine operation (Figure 2-2). The panel has five miniature push-button switches, with indicators inside each, and a unit plug.

Two additional maintenance indicators are behind the front bezel.

The paragraphs that follow describe the function of each control and indicator.

2.2.1 Voltage Selection

The voltage selector switch (Figure 2-1) adapts the drive to the available ac voltage. The drive operates at either 120 Vac or 230 Vac.

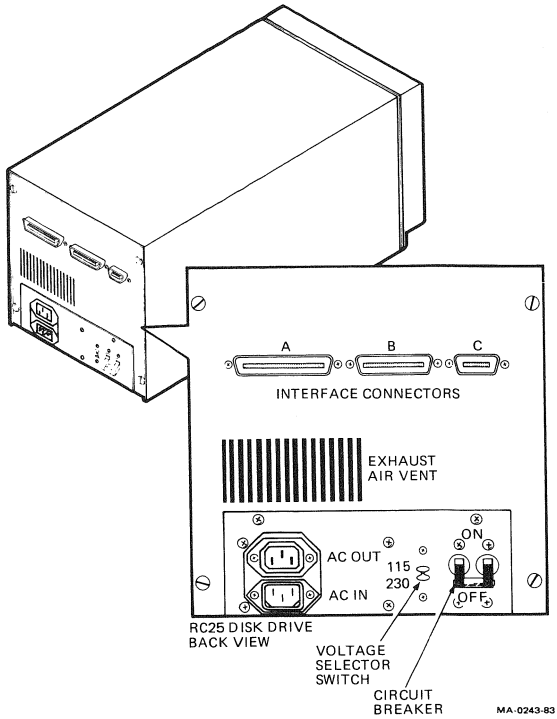


Figure 2-1 Voltage Selector Switch and ON/OFF Circuit Breaker

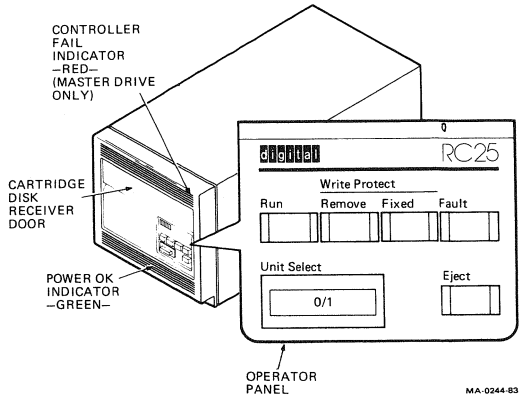


Figure 2-2 RC25 Front View Showing Buttons and Indicators

To change the voltage setting, insert a small nonconducting stylus into the slot and slide the switch up or down. Never use a lead pencil because the conductive graphite can get into the switch and cause a failure. Move the switch up if the drive is to be used in a 120 V circuit, down for a 230 V circuit.

CAUTION

Failure to set the voltage selector switch to 230 Vac when operating with a 180 to 256 Vac power source can damage the drive power supply and logic.

2.2.2 Power On/Off Circuit Breaker

A circuit breaker at the back of the drive (Figure 2-1) turns the power on and off. Push the circuit breaker handle up to turn power on and down to turn power off.

The circuit breaker controls the application of primary power to circuitry in the drive. It does not cause the internal spindle motor to start spinning the disk platters. This function is done by the operator panel controls.

2.2.3 Run

This control/indicator is a pushbutton switch and indicator on the operator panel.

2.2.3.1 Run Button – The alternate action Run button controls the spindle spin-up and spin-down sequence. When the Run button is pressed in, the cartridge receiver door locks and the disk platters spin up to operating speed (assuming a disk cartridge is installed). When the Run button is pressed again, and the current system level command is finished, the disk platters spin down. The cartridge receiver door remains closed until the Eject button is pressed. With the Run button pressed in and the drive on-line, the host computer can spin the platters down or up.

2.2.3.2 Run Indicator (Green) – In normal operating mode, the Run indicator shows the state of the disk spindle. When the disk platters are at rest, the Run indicator is off and the Eject indicator is on. When the disk spindle is spinning up or down, the Run indicator flashes once per second. When the Run indicator is on continuously, the disk spindle is at operating speed, the read/write heads are loaded, and the disk is ready to operate.

During a fault (Fault indicator is on), the Run indicator contains 1 bit of a 5-bit fault code that flashes at 10 Hz. Refer to Paragraph 2.2.6 for more information on the Fault control/indicator.

2.2.4 Eject

This control/indicator is a pushbutton switch and indicator on the operator panel.

2.2.4.1 Eject Button – The momentary Eject button opens the cartridge receiver door so that a cartridge disk can be removed or inserted. When the Eject button is pressed, the door unlatches and the disk cartridge ejects.

2.2.4.2 Eject Indicator (Green) – In normal operating mode, the Eject indicator shows the state of the lock on the cartridge receiver door. When the Eject indicator is off, the door is locked and the disk spindle is spinning up or down (Run indicator flashes slowly), or at speed (Run indicator is on). When the Eject indicator is on, the cartridge door is unlocked and the Eject button can be pressed to insert or remove a disk cartridge.

During a fault (Fault indicator is on), the Eject indicator contains 1 bit of a 5-bit fault code that flashes at 10 Hz. Refer to Paragraph 2.2.6 for more information on the Fault control/indicator.

2.2.5 Write Protect

These control/indicators are pushbutton switches and indicators on the operator panel.

2.2.5.1 Write Protect Buttons – The alternate action Write Protect buttons either inhibit or allow writing on the disk platters. When a Write Protect button is pressed in and locked, writing is not allowed. When released and unlocked, writing is allowed. The Write Protect Removable button (on the left) affects the removable cartridge disk platter. The Write Protect Fixed button (on the right) affects the fixed disk platter.

2.2.5.2 Write Protect Indicators (Yellow) – In normal operating mode, the Write Protect indicators show the write-protect state of the disk platters. This function is independent of the Write Protect buttons. The host system can send write-protect commands to the drive. When the Write Protect indicator is on, the corresponding disk platter cannot be written on. The host cannot release write protection from a platter when its Write Protect button is pressed.

During a fault (Fault indicator is on), the Write Protect indicators contain 2 bits of a 5-bit fault code that flashes at 10 Hz. Refer to Paragraph 2.2.6 for more information on the Fault control/indicator.

2.2.6 Fault

This control/indicator is a pushbutton switch and indicator on the operator panel.

2.2.6.1 Fault Button – The momentary action Fault button serves three purposes, depending on how it is used. When pressed briefly in response to the Fault indicator, it displays a 5-bit fault code. This fault code appears in all five of the operator panel indicators, which flash rapidly (10 Hz). If the Fault button is pressed briefly again, the controller tries to clear the fault condition and the drive tries to execute the operation again.

When pressed continuously for 10 or more seconds, the Fault button switches the master drive's controller from normal operating mode to maintenance mode. In maintenance mode, the subsystem does not act on any commands from the host computer system (except a bus initialize command). In this mode, all commands are issued through the operator panel by the Field Service engineer. Maintenance mode can be entered only when the drive is off-line to the host.

Chapter 3 explains more about the use of the Fault button and fault codes.

2.2.6.2 Fault Indicator (Red) – When on, the Fault indicator shows that the drive detects a hardware error from which there may be no recovery. The drive displays a fault code by rapidly flashing two or more of the five operator panel indicators after the Fault button is pressed. Chapter 3 explains more about fault codes.

Table 2-1 summarizes the functions of the operator panel indicators.

2.2.7 Unit Select Number

The RC25 disk drive can have any logical number pair from 0/1 to 252/253. The drive is addressed in pairs because each disk platter has a unique unit number. The fixed platter always has an odd number and the removable platter always has an even number. The unit select number is chosen during installation, but may be changed any time afterward. Just replace the unit select number plug with a plug that has the desired number.

If the desired number is not available as a preset plug, the existing plug can be modified as follows.

1. Remove the unit select number plug from the operator panel by grasping the plug handle and pulling straight out.

Table 2-1 Indicator States and Their Meaning

Run	Write Protect Remove	Write Protect Fixed	Fault	Eject	
off	–	–	off	on	Drive is not running and cartridge receiver door is unlocked.
slow flash*	–	–	off	off	Disk platters are spinning up or down.
on	–	–	off	off	Drive is ready to accept commands.
–	off	–	off	–	Removable disk cartridge is write enabled.
–	on	–	off	–	Removable disk cartridge is in read-only state. Writing is prevented.
–	–	off	off	–	Fixed disk platter is write enabled.
–	–	on	off	–	Fixed disk platter is in read-only state. Writing is prevented.
–	–	–	on	–	Drive detects a failure. Press Fault button briefly and refer to fault codes in Table 3-3 to determine what went wrong.
on	–	–	slow flash*	–	Drive is in maintenance mode and is running resident diagnostic tests.

* Slow flash is once per second.

2. The plug contains a small eight-position DIP switch. Remove this switch from the plug handle by pressing the two plastic retaining tabs and pulling straight out.
3. When working with the switch, orient it so that the number 1 position is on the left (Figure 2-3).

NOTE

This switch package selects the high seven binary bits of an 8-bit unit select field. The least significant bit of this 8-bit field is selected by the internal firmware because each drive has two units. Go to step 4 to set the DIP switches (Figure 2-3).

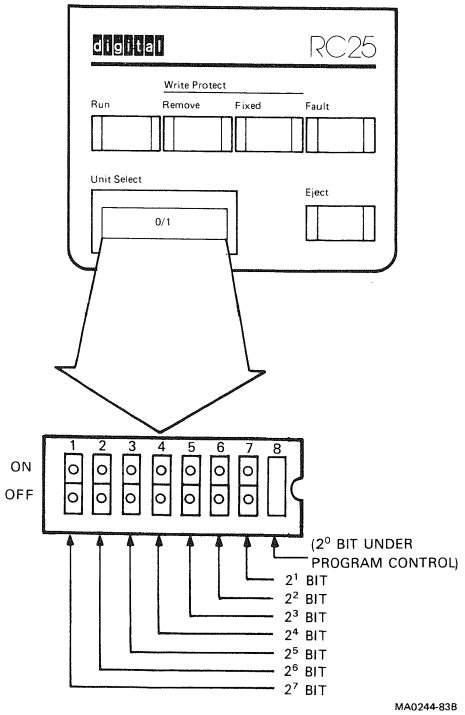


Figure 2-3 Changing the Unit Select Number DIP Switch

4. For the first drive in system, the unit select number can be 0/1 (although it does not have to be). Unit 0/1 is selected by setting all rocker switches to the on position. To set a switch to the on position, press in on the top of the switch. To set a switch to the off position, press in on the bottom. Select unit 2/3 by setting only switch 7 off and all others on. Set switch 6 off and all others on for unit 4/5. For unit 6/7, set switches 6 and 7 off and all others on. Other unit select numbers and switch combinations follow a binary sequence (Figure 2-3). Table 2-2 lists all the numbers and their switch patterns.
5. After setting the new number, press the DIP switch back into the plug handle and insert the plug back into the operator panel. Affix a new unit number sticker to the unit number plug.

Table 2-2 Unit Select Number Switch Settings

Unit Number	DIP Switch Position Number 1	2	3	4	5	6	7
0/1	on	on	on	on	on	on	on
2/3	on	on	on	on	on	on	off
4/5	on	on	on	on	on	off	on
6/7	on	on	on	on	on	off	off
8/9	on	on	on	on	off	on	on
10/11	on	on	on	on	off	on	off
12/13	on	on	on	on	off	off	on
14/15	on	on	on	on	off	off	off
16/17	on	on	on	off	on	on	on
18/19	on	on	on	off	on	on	off
20/21	on	on	on	off	on	off	on
22/23	on	on	on	off	on	off	off
24/25	on	on	on	off	off	on	on
26/27	on	on	on	off	off	on	off
28/29	on	on	on	off	off	off	on
30/31	on	on	on	off	off	off	off
32/33	on	on	off	on	on	on	on
34/35	on	on	off	on	on	on	off
36/37	on	on	off	on	on	off	on
38/39	on	on	off	on	on	off	off
40/41	on	on	off	on	off	on	on
42/43	on	on	off	on	off	on	off
44/45	on	on	off	on	off	off	on
46/47	on	on	off	on	off	off	off
48/49	on	on	off	off	on	on	on

Table 2-2 Unit Select Number Switch Settings (Cont)

Unit Number	DIP Switch Position Number 1	2	3	4	5	6	7
50/51	on	on	off	off	on	on	off
52/53	on	on	off	off	on	off	on
54/55	on	on	off	off	on	off	off
56/57	on	on	off	off	off	on	on
58/59	on	on	off	off	off	on	off
60/61	on	on	off	off	off	off	on
62/63	on	on	off	off	off	off	off
64/65	on	off	on	on	on	on	on
66/67	on	off	on	on	on	on	off
68/69	on	off	on	on	on	off	on
70/71	on	off	on	on	on	off	off
72/73	on	off	on	on	off	on	on
74/75	on	off	on	on	off	on	off
76/77	on	off	on	on	off	off	on
78/79	on	off	on	on	off	off	off
80/81	on	off	on	off	on	on	on
82/83	on	off	on	off	on	on	off
84/85	on	off	on	off	on	off	on
86/87	on	off	on	off	on	off	off
88/89	on	off	on	off	off	on	on
90/91	on	off	on	off	off	on	off
92/93	on	off	on	off	off	off	on
94/95	on	off	on	off	off	off	off
96/97	on	off	off	on	on	on	on
98/99	on	off	off	on	on	on	off
100/101	on	off	off	on	on	off	on
102/103	on	off	off	on	on	off	off
104/105	on	off	off	on	off	on	on
106/107	on	off	off	on	off	on	off
108/109	on	off	off	on	off	off	on
110/111	on	off	off	on	off	off	off
112/113	on	off	off	off	on	on	on
114/115	on	off	off	off	on	on	off
116/117	on	off	off	off	on	off	on
118/119	on	off	off	off	on	off	off
120/121	on	off	off	off	off	on	on
122/123	on	off	off	off	off	on	off
124/125	on	off	off	off	off	off	on
126/127	on	off	off	off	off	off	off
128/129	off	on	on	on	on	on	on

Table 2-2 Unit Select Number Switch Settings (Cont)

Unit Number	DIP Switch Position Number 1	2	3	4	5	6	7
130/131	off	on	on	on	on	on	off
132/133	off	on	on	on	on	off	on
134/135	off	on	on	on	on	off	off
136/137	off	on	on	on	off	on	on
138/139	off	on	on	on	off	on	off
140/141	off	on	on	on	off	off	on
142/143	off	on	on	on	off	off	off
144/145	off	on	on	off	on	on	on
146/147	off	on	on	off	on	on	off
148/149	off	on	on	off	on	off	on
150/151	off	on	on	off	on	off	off
152/153	off	on	on	off	off	on	on
154/155	off	on	on	off	off	on	off
156/157	off	on	on	off	off	off	on
158/159	off	on	on	off	off	off	off
160/161	off	on	off	on	on	on	on
162/163	off	on	off	on	on	on	off
164/165	off	on	off	on	on	off	on
166/167	off	on	off	on	on	off	off
168/169	off	on	off	on	off	on	on
170/171	off	on	off	on	off	on	off
172/173	off	on	off	on	off	off	on
174/175	off	on	off	on	off	off	off
176/177	off	on	off	off	on	on	on
178/179	off	on	off	off	on	on	off
180/181	off	on	off	off	on	off	on
182/183	off	on	off	off	on	off	off
184/185	off	on	off	off	off	on	on
186/187	off	on	off	off	off	on	off
188/189	off	on	off	off	off	off	on
190/191	off	on	off	off	off	off	off
192/193	off	off	on	on	on	on	on
194/195	off	off	on	on	on	on	off
196/197	off	off	on	on	on	off	on
198/199	off	off	on	on	on	off	off
200/201	off	off	on	on	off	on	on
202/203	off	off	on	on	off	on	off
204/205	off	off	on	on	off	off	on
206/207	off	off	on	on	off	off	off
208/209	off	off	on	off	on	on	on

Table 2-2 Unit Select Number Switch Settings (Cont)

Unit Number	DIP Switch Position Number 1	2	3	4	5	6	7
210/211	off	off	on	off	on	on	off
212/213	off	off	on	off	on	off	on
214/215	off	off	on	off	on	off	off
216/217	off	off	on	off	off	on	on
218/219	off	off	on	off	off	on	off
220/221	off	off	on	off	off	off	on
222/223	off	off	on	off	off	off	off
224/225	off	off	off	on	on	on	on
226/227	off	off	off	on	on	on	off
228/229	off	off	off	on	on	off	on
230/231	off	off	off	on	on	off	off
232/233	off	off	off	on	off	on	on
234/235	off	off	off	on	off	on	off
236/237	off	off	off	on	off	off	on
238/239	off	off	off	on	off	off	off
240/241	off	off	off	off	on	on	on
242/243	off	off	off	off	on	on	off
244/245	off	off	off	off	on	off	on
246/247	off	off	off	off	on	off	off
248/249	off	off	off	off	off	on	on
250/251	off	off	off	off	off	on	off
252/253	off	off	off	off	off	off	on
ILLEGAL	off	off	off	off	off	off	off

2.2.8 Controller Fail Indicator

The controller fail indicator almost always indicates a hardware failure when it is on. The exception is when it turns on briefly and then turns off during the power-up diagnostics, system bootstrap, or a bus initialization. When on, it can be accompanied by a fault code in the operator panel indicators.

2.2.9 Power OK Indicator

When on, the power OK indicator shows that the +5 V supply is within specification. If +5 V goes out of tolerance, the indicator turns off.

2.3 LOADING AND UNLOADING PROCEDURES

This section explains how to insert and remove the disk cartridge.

2.3.1 Cartridge Loading

To load the cartridge, hold it label- (writing-) side-up with the tapered end toward you. The opposite end has a small door through which the read/write heads enter. This is the end that enters the cartridge receiver first.

If the cartridge receiver door is not open, press the Eject button. Slide the cartridge straight in with a firm push and lock it in place. Close the receiver door firmly by swinging it back up and latching it into place.

2.3.2 Cartridge Unloading

With the disk spindle stopped and the receiver door unlocked (Eject indicator is on), press the Eject button. This step unlatches the door and ejects the cartridge. Once the door is open, the cartridge can be grasped and pulled straight out of the receiver.

When not in use, the cartridge receiver door should be kept closed. This precaution prevents contaminants from entering the disk enclosure.

2.4 OPERATING PROCEDURES

Use Tables 2-3 and 2-4 to start and stop the drive.

Table 2-3 Starting Procedure

Operator Action	Drive Reaction
None.	Initial state of drive: Run button is released (out). Run indicator is off. Eject indicator is on. Disk spindle is stopped.
Press Eject button.	Cartridge receiver door opens and, if cartridge is present, cartridge partially ejects.
Reload cartridge or replace with new one.	None.
Close cartridge receiver door.	None.
Set Write Protect buttons.	Corresponding Write Protect indicator turns on or off.

Table 2-3 Starting Procedure (Cont)

Operator Action	Drive Reaction
Press Run button in to lock it in.	Receiver door locks. Eject indicator turns off. Run indicator flashes slowly. Disk platters start to spin. Run indicator lights continuously.
Drive is ready for operation.	

NOTE
The spin-up cycle takes approximately 1 minute: spin disk platters up to operating speed, clean internal air system, load read/write heads, perform self-test.

A cartridge must be installed to spin up and operate the drive. The fixed disk does not spin up and run without a removable cartridge in place.

Table 2-4 Stopping Procedure

Operator Action	Drive Reaction
None.	Initial state of drive: Run button is pressed in. Disk platters are spinning. Run indicator is on. Eject indicator is off.
Press Run button in to release it.	Run indicator flashes slowly. Disk platters start to slow down. When disk platters stop spinning: Run indicator turns off. Eject indicator turns on. Receiver door unlocks.
Press Eject button.	Receiver door opens and cartridge ejects.
Remove cartridge.	
Close receiver door.	

CAUTION
Do not try to open the cartridge receiver door until the Eject indicator turns on and the Eject button is pressed. You can damage the drive and cartridge.

2.5 OTHER SWITCHES AND JUMPERS

The RC25 disk drive contains no internal switches or jumpers. The only switches and jumpers that must be set are on the subsystem adapter modules. The settings are summarized in the following paragraphs.

2.5.1 RUC25 UNIBUS Adapter Module (M8739)

There are ten switches, one jumper, and one jumper plug on the M8739 (Figure 2-4). Switches S1 to S10 (location E44) set UNIBUS base address bits A12 to A03. Jumper W2 sets UNIBUS base address bit A02. The UNIBUS priority plug (location E25) sets the priority for bus requests. Priority level 5 (BR5/BG5) is the suggested bus request level for the RUC25 subsystem.

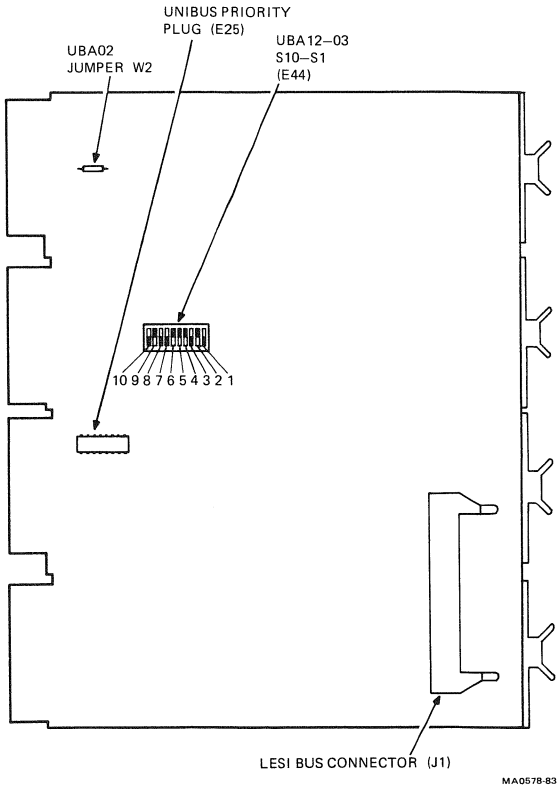


Figure 2-4 UNIBUS Adapter (M8739) Component Location

The first UNIBUS base address is 772150_8 ($F468_{16}$). The switches and jumper are set for this address at the factory. If the subsystem configuration requires other than standard addresses, set the switches/jumper as shown in Figures 2-5, 2-6, and 2-7. The location of the switches is shown in Figure 2-4. The A02 jumper for CS revision A and B modules is shown in Figure 2-6. The A02 jumper for modules at CS revision C and above is shown in Figure 2-7.

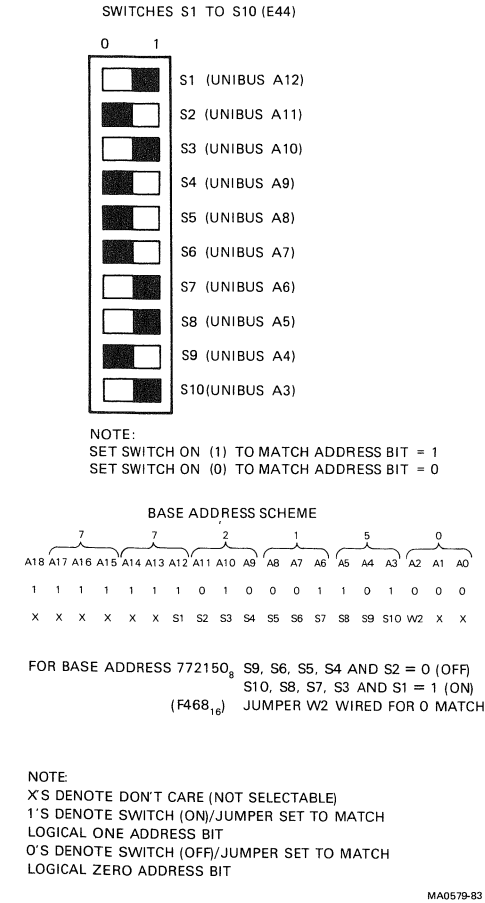


Figure 2-5 M8739 Address Switch/Jumper Configuration

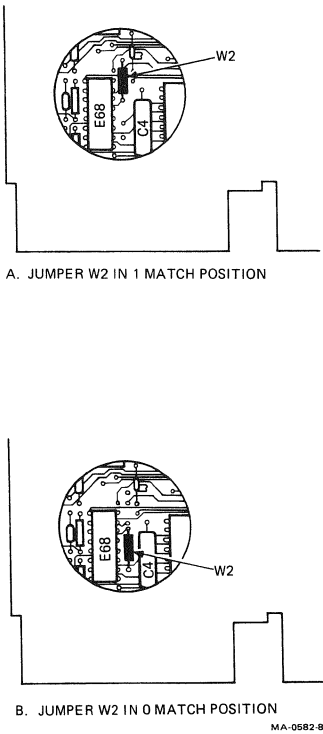
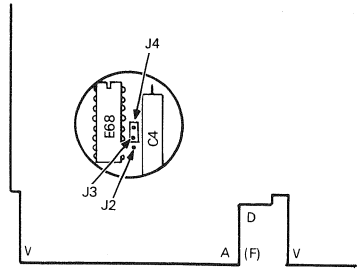
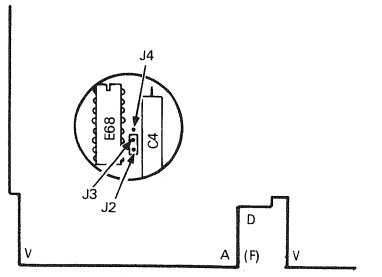


Figure 2-6 Address Bit 02 Wire Jumper W2 (CS Revision A and B)



A. JUMPER W2 IN 1 MATCH POSITION



B. JUMPER W2 IN 0 MATCH POSITION

MA1311-83

Figure 2-7 Address Bit 02 Bridge Jumper W2 (CS Revision C and Above)

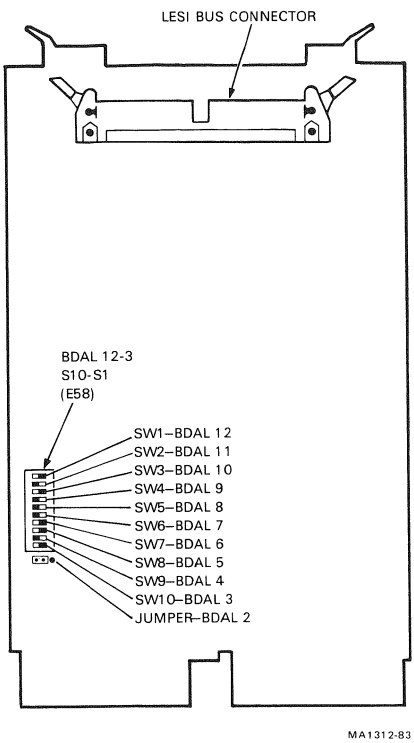


Figure 2-8 Q-Bus Adapter (M7740) Component Location

2.5.2 RQC25 Q-Bus Adapter Module (M7740)

There are ten switches and one jumper on the M7740 module (Figure 2-8). Switches S1 to S10 (location E58) set Q-Bus base address bits BDAL12 to BDAL3. Jumper W2 sets Q-Bus base address bit BDAL2.

The first suggested Q-Bus base address is 17772150_8. The switches and jumper are set for this address at the factory. If the subsystem configuration requires other than standard addresses, set the switches/jumper as shown in Figure 2-9. The location of the switches is shown in Figure 2-8. The M7740 is hardwired for a bus interrupt level of BR4 (BIRQ4).

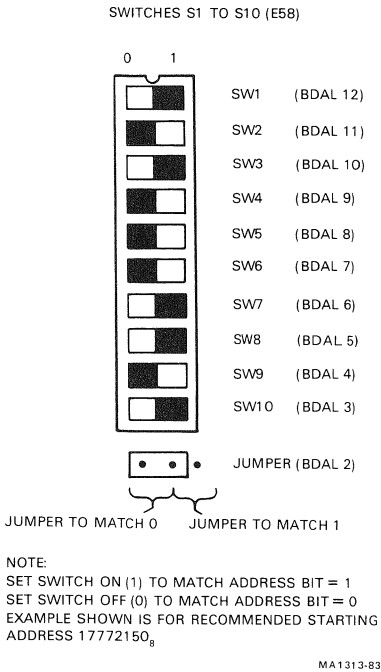


Figure 2-9 M7740 Address Switch/Jumper Configuration

2.6 EJECTING THE CARTRIDGE IN CASE OF FAILURE

You or the customer can be prevented from ejecting the cartridge in the event of a power or component/logic failure (Eject button does not work). However, if necessary, the cartridge can be ejected manually from the front of the drive. Refer to Figure 2-10.

CAUTION

Use this procedure only when you must remove the cartridge and the normal ejection procedure does not work.

The heads can crash. If the read/write heads are still over the platters (the hardware failed to retract the heads to the home position) the heads will contact the platters when the platters stop. Furthermore, the heads will scrape along the removable platter when it is withdrawn.

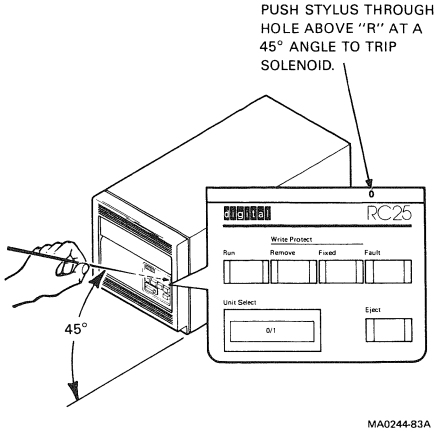


Figure 2-10 Ejecting the Disk Cartridge Manually

1. Turn off power to drive and wait 1 minute for the disk platters to stop spinning.
2. Insert a thin stylus (or similar object such as a straightened, rigid paper clip) through the small hole just above the R in RC25 at the top, right corner of the operator panel.
3. Position the stylus at about a 45 degree angle to slip through the corresponding hole in the panel's printed circuit board.
4. Push the stylus in firmly to contact the plunger of the door actuator solenoid. Pushing in the plunger simulates an eject operation and the door pops open.
5. Remove the cartridge.

After removing the cartridge, look through the open cartridge receiver door at the head/arm assemblies. If the heads are not fully retracted onto the loading/unloading cam, then there is a good possibility that the heads have contacted the disk. This abrasion renders the drive mechanics (fixed platter), and the cartridge just removed, defective. The mechanics must be replaced, along with the component that caused the problem in the first place. Discard the cartridge, regardless of the importance of the data recorded on it. If used in the new mechanics, it could destroy the read/write heads.

3 TROUBLESHOOTING

3.1 GENERAL

This chapter provides fault isolation procedures for the RC25 disk drive. These procedures depend mostly on drive resident diagnostics, exercisers, and their corresponding error indications. If a problem is found, the applicable diagnostic identifies it. The identification can be in the form of a lit indicator, a fault code, or an error/status code sent to the host computer.

The chapter begins with some basic checks and presents a fault isolation flowchart (Figure 3-1). The chapter then discusses the various ways an error can be displayed. It includes a fault isolation table, enabling the Field Service engineer to look up the most likely failing FRU for each fault code. The chapter ends by describing the available host level diagnostics.

3.2 BASIC CHECKS

Table 3-1 lists some of the problem symptoms you may find with the drive. It also lists some of the checks and corrections for solving the problems.

The information in Table 3-1 is organized by symptom. To use this table:

1. Determine what the disk is or is not doing.
2. Match your symptom with one in the symptom column. The most probable symptoms are listed first.
3. Check the conditions listed in column 2.
4. Follow the advice given in the columns.

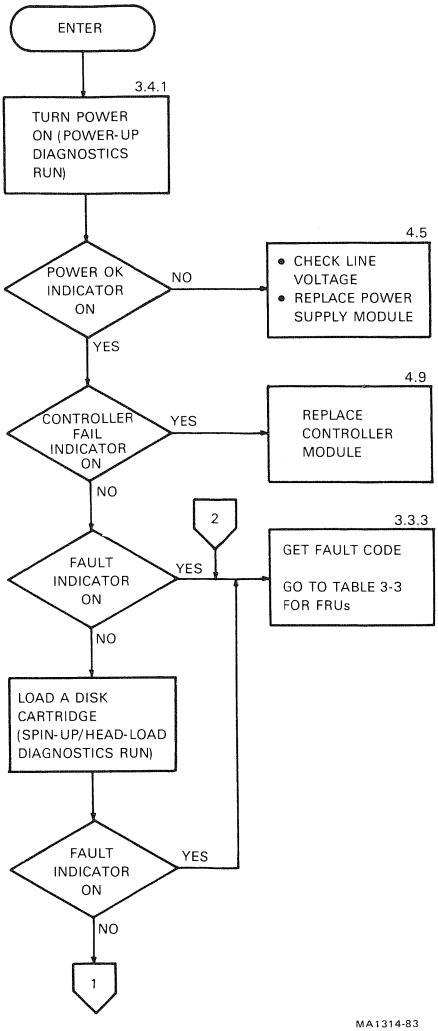


Figure 3-1 Troubleshooting Flowchart (Part 1)

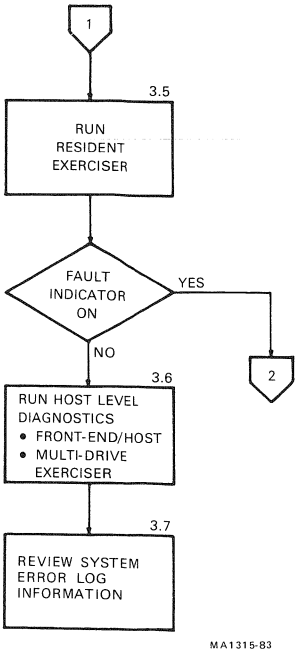


Figure 3-1 Troubleshooting Flowchart (Part 2)

Table 3-1 Isolating and Correcting Problems

Symptom	Cause	Solution
There is no power. Power OK indicator is not on. Eject indicator is not on when power is first turned on.	Dead socket	Check ac power by plugging in and turning on a light.
	Power cord connections	Check power cord connection at wall and drive.
	Tripped circuit breaker (off)	Set circuit breaker at rear of drive to OFF, then ON.
	Wrong voltage selector switch setting	Determine available line voltage and set switch accordingly.

Table 3-1 Isolating and Correcting Problems (Cont)

Symptom	Cause	Solution
Power OK and Eject indicators are on, but cartridge receiver door does not open when Eject button is pushed.	Electrical or mechanical malfunction	Possible drive module, drive mechanics, or operator panel problem. Replace one at a time.
Controller fail indicator remains on.	Electrical malfunction	See description of controller fail indicator.
Fault indicator is on.	One of many	See list of fault codes.
Abnormal noises are coming from inside drive.	Mechanical malfunction or head crash.	**Stop drive immediately. Do not try another cartridge in this drive and do not try to insert this cartridge into another drive. Cartridge and drive mechanics must be replaced.**
Excessive data errors when reading or writing.	Damaged or dirty disk platter	Try another cartridge.
	Mechanical or electrical malfunction	Problem with drive module or drive mechanics. Replace one at a time.
Host computer system cannot access drive.	Interface cable connections	Check cable connections at drive(s) and computer.
	Wrong unit select number	Make sure unit select number plug matches number specified in host computer software.

3.3 MAINTENANCE INDICATORS AND FAULT/ERROR CODES

The four methods that an RC25 subsystem uses to display error and status conditions are, in order of decreasing severity:

1. Lighting the controller fail indicator,
2. Depositing a fatal error code in the I/O page SA register,
3. Displaying a fault code on the operator panel, and
4. Sending an MSCP errorlog packet with error/status code to the host.

An RC25 subsystem uses these four methods in different combinations, depending on the type and severity of the particular error.

- Fatal errors (detected by internal microdiagnostic routines or other checks in the master drive's controller) light the controller fail indicator, leave a fatal error code in the host system I/O page SA register, and display a fault code on the master drive's operator panel.
- Master and slave drive faults, such as "Spindle Initialization Failure" (fault code 33_8), display a fault on the corresponding drive's operator panel and send an errorlog packet to the host system, if the host has enabled error logging.
- MSCP command errors return error codes and send corresponding errorlog packets to the host, if enabled.
- Finally, errors on an idle subsystem, such as "Drive Off Track" with no command outstanding, simply send an errorlog packet to the host, if enabled.

Table 3-2 lists the assigned fatal error codes and the reason for the error. These codes can be printed out while running host level diagnostics, or they can be accessed by reading the SA register (default 772152_8 or $F46A_{16}$). All of these codes include bit 15 set so that any time the host finds bit 15 of SA set, it knows that one of these errors has occurred. Host level diagnostics print out only the low byte of the code; the high byte (bit 15) is stripped off. Paragraph 3.7 and Table 3-5 describe all MSCP end/errorlog packet codes.

Table 3-2 Fatal Error Codes Deposited into SA Register

Error Code Octal	Hexadecimal	Description
100001	8001	Packet read error (parity or timeout)
100002	8002	Packet write error (parity or timeout)
100006	8006	Ring read error (parity or timeout)
100007	8007	Ring write error (parity or timeout)
100010	8008	Interrupt failure
100011	8009	Host access timeout (MSCP dependent)
100016	800E	Invalid virtual circuit connection identifier
100017	800F	Error on interrupt write (to ring-2/ring-4)
100022	8012	RAM error (on write/read check)
100023	8013	Port initialization sequence error
100024	8014	Wrong MSCP version
100026	8016	Map table entry read error
100310	80C8	VAX read/write error on interrupt
100311	80C9	Error while filling write buffer with data from host
100312	80CA	Error while emptying read data buffer to host
100313	80CB	Error while allocating temporary sector buffers in RAM
100314	80CC	Servo routine entered while servo was busy ("Positioning In Process" set)

Table 3-2 Fatal Error Codes Deposited into SA Register (Cont)

Error Code Octal	Hexadecimal	Description
100315	80CD	Servo routine entered while servo error set
100316	80CE	Trouble while attempting to dequeue a packet destined for host message ring
100317	80CF	Trouble while attempting to read in a host command packet
100320	80D0	Trouble while generating an attention message
100321	80D1	Trouble while attempting to make drive MSCP on-line
100322	80D2	Illegal D processor request
100323	80D3	Fence-post error in "Velocity Profile Table"
100324	80D4	Bad packet discovered while handling completion of queued command
100325	80D5	DM program illegal memory store
100326	80D6	Diagnostic utility protocol packet failed
100327	80D7	Port diagnostics could not find available RAM
100330	80D8	Elevator algorithm used for optimizing seeks had trouble selecting next command packet
100331	80D9	Servo system not active when seek attempted
100332	80DA	D processor found illegal opcode
100334	80DC	Drive declared an unknown bad status report and cannot translate to an MSCP error code

Table 3-2 Fatal Error Codes Deposited into SA Register (Cont)

Error Code Octal	Hexadecimal	Description
100335	80DD	Illegal "Extended Function Call" executed by diagnostic machine interpreter
100336	80DE	D processor buffer pointer was zero
100337	80DF	Trouble in D processor idle loop
100340	80E0	Diagnostic machine word count error on host DMA transfer
100341	80E1	Unknown display fault code
100342	80E2	Drive not faulting in forced off-line state
100343	80E3	U processor power-up diagnostics failed (Tests U sequencer, U stack, GP registers, ALU, and RAM)
100344	80E4	D processor power-up diagnostics failed (Tests D sequencer, D stack, ALU, RAM, LOG/ALOG ROM, SERDES, RSGEN, ENDEC, and ID ROM)
100345	80E5	Adapter module failure
100346	80E6	10 Hz transition timer bit that schedules operator panel and spindle state routines has timed out
100350	80E8	Revectoring suspended for unknown reason
100351	80E9	Adaptive runout correction system did not find closest undone zone for sector detent
100352	80EA	Seek to illegal track attempted
100353	80EB	DMA write failed during initialization diagnostics

Table 3-2 Fatal Error Codes Deposited into SA Register (Cont)

Error Code Octal	Hexadecimal	Description
100354	80EC	DMA compare failed during initialization diagnostics
100355	80ED	Trouble while trying to synchronize the U and D processors
100356	80EE	ACLO asserted on master drive

3.3.1 Power OK Indicator

The green power OK indicator is visible through the ventilation louvers in the lower-right corner of the master and slave drives (Figure 2-2). In normal operation, it turns on and remains on when drive power is switched on.

The power OK indicator is on when the +5 V supply is within specification. If the +5 V goes out of tolerance, the indicator turns off.

3.3.2 Controller Fail Indicator

The red controller fail indicator is visible through the ventilation louvers in the upper-right corner of the master drive (Figure 2-2). In normal operation, it turns on briefly (approximately 4 seconds) when power is applied to the drive and then turns off. This display is a function of the power-up diagnostics. The controller fail indicator also flashes as a result of the power-up diagnostics if the host system sends a bus initialize command.

If this indicator stays on when power is applied or turns on and stays on during operation, a hardware failure exists somewhere in the disk subsystem. If the Fault indicator accompanies this indicator, troubleshoot the fault code first. If not, try to examine the fatal error code in the SA register (I/O bus starting address +2). If no codes are available, start troubleshooting with the controller module in the master drive. If this doesn't solve the problem, work your way through the master drive followed by the adapter module/LESI cable and the slave drive (if one exists).

3.3.3 Fault Indicator

The Fault indicator turns on (Figure 2-2) during some RC25 detected errors. Most errors have fault codes. Push the Fault button to display the fault code. The fault code appears in the five operator panel indicators. Some or all of the indicators flash rapidly (approximately 10 Hz).

During fault errors, the Fault button and indicator act as follows:

1. When the controller detects a master or slave drive fault, it lights the master or slave Fault indicator and, if necessary, spins down the corresponding disk platters. In the case of a drive fault, all other operator panel buttons and indicators continue normal operation. During controller-fatal faults, all other buttons do not respond.
2. When the Fault button on the faulty drive is momentarily pressed and released, a 5-bit fault code flashes on the operator panel at 10 Hz. This code identifies the most likely failing FRU.
3. When the Fault button is momentarily pressed and released again, the controller tries to clear the error condition that initially caused the fault and return the drive to normal operation. This action can include spinning up the disk platters. However, some faults are fatal and cannot be cleared because they indicate that something is seriously wrong.

NOTE
All fault codes flash at least two indicators. If only one indicator flashes a code, first check the condition of the indicators by observing them during the power-up diagnostics (lamp check).

Table 3-3 lists the fault codes that flash in the master or slave operator panel indicators. The table describes errors that cause the faults and lists the most likely failing FRUs in order of probability.

Sometimes the table lists the drive mechanics as a high probability FRU. In these cases, it may be wise to try replacing lower probability FRUs first because of the time and cost involved in replacing the mechanics. Also, the fixed disk platter may contain customer data that was not backed up.

Table 3-3 Isolating Faults

Indicators* R	WPR	WPF	F	E	Description	Failed FRU†
o	o	o	o	o	Not used (illegal)	Controller module Drive module Operator panel
o	o	o	o	●	Not used (illegal)	Controller module Drive module Operator panel
o	o	o	●	o	Not used (illegal)	Controller module Drive module Operator panel
o	o	o	●	●	Not used (spare)	Controller module Drive module Operator panel
o	o	●	o	o	Not used (illegal)	Controller module Drive module Operator panel
o	o	●	o	●	Controller diagnostics failed	Controller module Power supply Cables
o	o	●	●	o	Controller detected diagnostic machine failure	Controller module Power supply Cables
o	o	●	●	●	Controller internal inconsistency	Controller module Power supply Cables
o	●	o	o	o	Not used (illegal)	Controller module Drive module Operator panel
o	●	o	o	●	Adapter module diagnostics failed	Adapter module LESI cables Controller module

*R = Run
WPR = Write Protect Removable
WPF = Write Protect Fixed
F = Fault
E = Eject

o = Off
● = On

† The FRUs are listed in the order in which they are most likely to cause the fault.

Table 3-3 Isolating Faults (Cont)

Indicators* R	WPR	WPF	F	E	Description	Failed FRU†
o	●	o	●	o	Interface port failed	Host software Adapter module Controller module
o	●	o	●	●	MSCP protocol failed	Host software revision level Adapter module Controller module Turn master drive off, then on.
o	●	●	o	o	Drive ACLO	Power line voltage Power supply Drive module Controller module
o	●	●	o	●	Drive over temperature	Ambient air temperature Cooling fan Drive module
o	●	●	●	o	Duplicate unit select number	Unit select plug address Operator panel Controller module
o	●	●	●	●	Operator panel loopback failed	Operator panel cable (J1) Operator panel Drive module
●	o	o	o	o	Not used (illegal)	Controller module Drive module Operator panel
●	o	o	o	●	Not used (spare)	Controller module Drive module Operator panel
●	o	o	●	o	Functional diagnostic test failed (seek/read/write)	Cartridge disk Drive mechanics Drive module Controller module

Table 3-3 Isolating Faults (Cont)

Indicators* R	WPR	WPF	F	E	Description	Failed FRU†
●	o	o	●	●	Margin diagnostic test failed (jitter/ offset)	Cartridge disk Drive mechanics Drive module Controller module
●	o	●	o	o	Drive in wrong stopped state or spin-down timed out	Drive module Drive mechanics Controller module Power supply
●	o	●	o	●	Drive in wrong speed state or spin-down timed out	Drive mechanics Drive module Controller module Power supply
●	o	●	●	o	Heads not in expected position over disk or heads home timed out	Drive mechanics Drive module Controller module Power supply
●	o	●	●	●	Unsafe attempt to unlock door	Drive mechanics Drive module Controller module Power supply
●	●	o	o	o	Cartridge or door error	Cartridge disk/ door (reseat cartridge/door) Drive mechanics Drive module

*R = Run
WPR = Write Protect Removable
WPF = Write Protect Fixed
F = Fault
E = Eject

o = Off
● = On

† The FRUs are listed in the order in which they are most likely to cause the fault.

Table 3-3 Isolating Faults (Cont)

Indicators* R	WPR	WPF	F	E	Description	Failed FRU†
●	●	o	o	●	Seek, sector, or detent error	Drive module Cartridge disk Drive mechanics
●	●	o	●	o	Servo, seek, read, or write error rate too high	Cartridge disk Drive mechanics Drive module
●	●	o	●	●	Servo initialization failure	Drive mechanics Drive module Power supply
●	●	●	o	o	Read/write diagnostics failed	Drive module Controller module Drive mechanics
●	●	●	o	●	Drive module diagnostics failed	Drive module Controller module Drive mechanics
●	●	●	●	o	Drive module failed initialization tests	Drive module interconnecting cables Drive module Controller module Turn master drive off, then on.
●	●	●	●	●	Drive cables not in place	Any one of internal or external controller-to-drive module cables Controller module Drive module

*R = Run
WPR = Write Protect Removable
WPF = Write Protect Fixed
F = Fault
E = Eject

o = Off
● = On

†The FRUs are listed in the order in which they are most likely to cause the fault.

3.4 POWER-UP/SPIN-UP/HEAD LOAD DIAGNOSTICS

These diagnostics should run each time power is applied to the drive and a disk cartridge is loaded. The following paragraph describes what they test, how to run them, and what the failure indications are.

3.4.1 Power-Up Diagnostics

The power-up diagnostics primarily check the controller module in the master drive. The adapter module is also checked partially if the drive is connected to it. These diagnostics run at power-up, host bus initialization, and at the completion of the resident exerciser.

Run the power-up diagnostics as follows.

1. Unload and eject any disk cartridges that may be mounted.
2. Remove power from all drives by setting ON/OFF circuit breaker at rear of enclosure to OFF (Figure 2-1). For rack mounted drives, turn system power off.
3. Turn power back on (circuit breaker to ON or system power on). In a dual-drive tabletop configuration, first turn slave drive's power on, then master drive's. This step allows master drive to recognize slave.
4. Master drive enters power-up diagnostic tests. Status of front indicators at completion of this test is:

   Controller fail (red) is off (master drives only).

   Power OK (green) is on (all drives).

   Eject (green) is on (all drives).

   NOTE

   A portion of this short diagnostic test causes all the front panel indicators, along with the controller fail indicator, to light momentarily. This is a lamp check and should not be considered a failure.

If the power-up diagnostics fail, the indications are as follows.

- The controller fail indicator remains lit,
- The master drive's operator panel can signal a fault, and
- A fatal error code can be deposited into the adapter's SA register.

3.4.2 Spin-Up/Head Load Diagnostics

The spin-up/head load diagnostics check the drive module and drive mechanics in master and slave drives.

Perform these tests separately on master and slave drives (if present) after determining that the power-up diagnostics pass.

1. Press Eject to open receiver door.
2. Load a disk cartridge into drive through open receiver door.
3. Close receiver door.
4. Press Run button in and lock it. This step causes five things to happen, during which the Run indicator flashes slowly (once per second).

   Cartridge receiver door locks.

   Disks spin up to speed during which the spindle motor and associated circuitry are checked.

   Internal filtration system enters a purge cycle (cleans internal air system).

   Drive module and mechanics enter a quick diagnostic test.

   Heads load onto disk platters and the servo initializes.

5. At completion of spin-up cycle, Run indicator turns on. Fault indicator should remain off.

A failure during the spin-up/head load diagnostics is indicated by a fault indication on the corresponding drive's operator panel.

3.5 RESIDENT EXERCISER

The resident exerciser is a program designed to test the integrity of an RC25 disk subsystem without host computer interaction. Perform this test only after determining that the drive passes the power-up and spin-up/head load diagnostics.

The exerciser is made up of four parts and can be run in either of two modes. The four parts are seek test, read/write test, servo noise test, and offset test. The two modes are quick-verify and continuous. In quick-verify mode, each of the four tests run once. In continuous mode, the sequence of four tests runs repeatedly until the operator requests the exerciser to halt or an error is found.

NOTE

These diagnostics cannot run on the master and slave drives together. Each drive must be tested separately.

3.5.1 Seek Test

The seek test does converging track seeks to the center of the media surface, thereby testing all seek lengths. After every successful track seek, a different surface is selected by switching heads.

3.5.2 Read/Write Test

All read/write operations are made to four special diagnostic track areas on each platter. These areas are adjacent to the inner and outer guard bands on each surface. Data written includes addresses, worst case peak shift, and single transitions separated by one, two, three, and four zeros.

3.5.3 Servo Noise Test

This test measures the jitter of the servo system. In quick-verify mode, some of the tracks nearest the hub are tested. In continuous mode, all tracks are tested.

3.5.4 Offset Test

This test verifies the accuracy of data retrieval under poor conditions. These conditions are simulated by offsetting the head (moving it off track).

3.5.5 Restrictions

There are four restrictions to keep in mind when running the resident exerciser in either mode.

1. The controller connected to the drive under test must not have any drives "MSCP ONLINE" to the host computer.
2. The power-up and spin-up/head load diagnostics must run to completion with no errors to operate this exerciser.
3. The host computer must not initialize the controller on which this exerciser is running (either by a hardware bus initialize or software initialize command). If the host does initialize the controller, the exerciser stops immediately and the drive returns to normal operation.
4. In a dual-drive configuration, master and slave drives cannot run this exerciser at the same time. They must be run separately.

3.5.6 Quick-Verify Mode

Run the resident exerciser on the drive in quick-verify mode as follows.

1. With disks spinning, heads loaded, and Run indicator on, press and lock in both Write Protect buttons. (Write Protect Fixed and Write Protect Remove indicators turn on).
2. Press Fault button and hold it in for at least 10 seconds. After 10 seconds, Fault indicator flashes slowly (1 Hz). Then release Fault button.

This procedure starts the resident exerciser in quick-verify mode. During the test, the Fault indicator flashes slowly, indicating that the test is still in progress. To stop the test before it is finished, release both Write Protect buttons.

The exerciser in quick-verify mode signals completion by running the power-up diagnostics. The Fault indicator stops flashing (normal operating state). The test should run to completion without any failures. If a failure does occur, the Fault indicator stops flashing, remains on continuously, and if necessary, the disk platters spin down. Then the Fault button can be pressed for the fault code.

After reading the fault code, press the Fault button again to clear the fault (if possible) and reinitialize. Some faults are fatal and cannot be cleared. In this case, the drive continues to flash the fault code.

3.5.7 Continuous Mode

The resident exerciser can run in continuous mode. That is, it can run repeatedly until commanded to stop. Running the exerciser for long periods may be necessary to uncover subtle or intermittent problems. It also demonstrates the integrity of the drive by running it overnight.

Start the exerciser the same way as in quick-verify mode, but leave the Write Protect Fixed button out (Write Protect Fixed indicator is off). Stop the exerciser by releasing both Write Protect buttons.

The exerciser runs in continuous mode until either a fault occurs, the acceptable error rate is exceeded and causes a fault, or the test aborts when the Write Protect Remove button is released, at which point the drive and controller reinitialize (execute power-up diagnostics) since there is no fault.

> **NOTE**
> **If the resident exerciser fails repeatedly and no solution can be found by replacing FRUs, isolate the drive(s) from the host by disconnecting the LESI interface cable from the master drive. Then rerun the exerciser. If it runs, the host or adapter is causing the fault. If it continues to fail, the problem remains in the drive.**

3.6 HOST LEVEL DIAGNOSTIC TESTS

The host level diagnostic tests are loaded into and reside in the host system and run under XXDP+ (PDP-11 series) or VMS (VAX series). However, some of the tests down-line load code into the drive, which is then executed remotely. In any event, the test currently running is always under control of and is monitored by the host system.

Each diagnostic has a program listing, which is prefaced by a user guide. The user guide contains operating instructions and explains system hardware requirements, software environment, tested features, how they are tested, program options and how to select them, how to interpret printouts, and dialogue with the diagnostic supervisor. The user guide and listings are available in print or microfiche.

When ordering diagnostic media, listings, manuals, or microfiche, check the current catalog or index for the latest revision level.

Table 3-4 describes the RC25 diagnostic programs available for service personnel.

Table 3-4 RC25 Diagnostic Programs for Service Personnel

Diagnostic Name PDP-11	Vax	Title
CZRCD	EVRMA (level 3)	**RC25 Disk Exerciser** – verifies integrity of up to four master and four slave drive combinations (16 platters) and detects faults at functional level. Runs multidrive exerciser or drive resident exerciser under host control in a standalone environment.
CZRCF	EVRMB	**Host/Front-End** – checks basic functions of RC25 disk subsystem including the following items. • Host/drive communication through adapter module • Seek and head selection • Seek and rotational times • Responses to basic MSCP commands Performs manual intervention checks for Write Protect switches
N/A	EVRMD (level 2)	**RC25 Disk Exerciser** – verifies integrity of up to four master and four slave drive combinations (16 platters) and detects faults at functional level. Runs multidrive exerciser under host control using VMS driver QIO requests.
CZRCH	EVRMC	**Formatter** – is a utility that prepares disk media for use as addressable storage by providing header records and replacement areas for bad blocks. It necessarily destroys all data previously written on disk. Performs four tasks. • Formats • Scans • Replaces • Checks All status and errors are reported. Drive must have good factory control table (FCT). Replacement and caching table (RCT) is regenerated. If FCT cannot be read, reconstruct mode should be used. Then both RCT and FCT are regenerated.

Table 3-4 RC25 Diagnostic Programs for Service Personnel (Cont)

Diagnostic Name PDP-11	VAX	Title
CXRCF	N/A	**DEC/X11 Module** – simulates dynamic bus loading. All drives can be exercised simultaneously. Drive can be exercised in read-only mode (customer data protected) or read/write mode (customer data overwritten).
CHRCC	N/A	**RC25 XXDP Driver** – is RC25 driver for the XXDP diagnostic monitor.

3.7 OPERATING SYSTEM ERRORLOG DECODING AND TROUBLESHOOTING

Status/error codes pass from the MSCP server (in the RC25) to the MSCP class driver (in the host). Hard MSCP command errors, such as trying to read from a drive that is off-line, return an MSCP error code in the command's end packet. Other nonfatal errors, such as seek errors, that occur during a command's execution return an error code in the command's end packet only if the error cannot be recovered after retries (hard).

Most of these nonfatal errors also try to send an errorlog packet to the host even if the error is recoverable or if there is a correlating MSCP command. However, log packets are sent only if the host has explicitly enabled logging and the internal RC25 log buffers do not contain previous, undelivered log information. The drive can send any combination of end/log packet status/error codes.

All status and error codes use the same format (Figure 3-2). A 5-bit major code occupies bits 04 through 00 and an 11-bit minor code occupies bits 15 through 05. (For MSCP conventions, the major code is the device code and the minor code is the subdevice code.) Most of the errorlog report generators in Digital's operating system decode the packets and provide text descriptions for the major and minor codes. However, host-based diagnostics and utilities may provide only the numeric code. A full 16-bit code, or perhaps just the 11-bit minor component, may be provided.

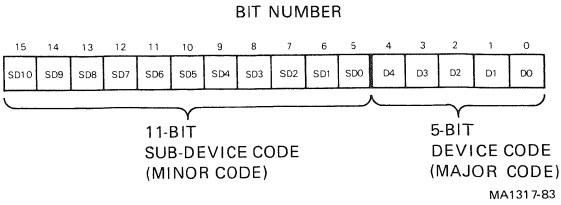


Figure 3-2 Error/Status Code Word Format

Table 3-5 lists all major and minor codes returned to the system by the RC25. The table is broken into sections, and each major code occupies a section. The major codes are listed by name in numeric order. The minor codes and descriptions follow.

For example, if the system logs an 00450 (octal) error, reduce the code to a major code of 10 (bits 04 through 00) and a minor code of 011 (bits 15 through 05). Now refer to the table. Major code 10 is a data error. Under the data error section, minor code 11 is a 2-symbol ECC error.

Table 3-5 MSCP Error Codes

Major Code Name	Minor Octal Code	Full Octal Code	Full Hex. Code	Minor Code Name
Success (xxx00)	000	00000	0000	Normal success (no error)
	001	00040	0020	Spin-down command ignored
	002	00100	0040	Still connected
	004	00200	0080	On-line duplicated (duplicate unit select number)
	010	00400	0100	Already on-line
Invalid command (xxx01)	High byte contains byte offset to field in error			
Command aborted (xxx02)	No substatus codes apply			

Table 3-5 MSCP Error Codes (Cont)

Major Code Name	Minor Octal Code	Full Octal Code	Full Hex. Code	Minor Code Name
Unit off-line (xxx03)	000	00003	0003	Unit unknown or on-line to another controller
	001	00043	0023	No volume mounted or drive disabled via Run button
	002	00103	0043	Unit is inoperative
	004	00203	0083	Duplicate unit select number
	010	00403	0103	Disabled by Field Service or internal diagnostic
Unit available (xxx04)	No substatus codes apply			
Media format error (xxx05)	005	00245	00A5	Disk not formatted with 512 byte sectors
	006	00305	00C5	Disk not formatted or factory control table (FCT) corrupted
	010	00405	0105	Replacement and caching table (RCT) corrupted
	011	00445	0125	No replacement block available
Unit write protected (xxx06)	200	10006	1006	Unit is software write protected
	400	20006	2006	Unit is hardware write protected
Compare error (xxx07)	No substatus codes used			

Table 3-5 MSCP Error Codes (Cont)

Major Code Name	Minor Octal Code	Full Octal Code	Full Hex. Code	Minor Code Name
Data error (xxx10)	000	00010	0008	Sector written with forced error modifier
	002	00110	0048	Header compare error (valid header not found
	004	00210	0088	ECC field corrections only
	007	00350	00E8	Uncorrectable ECC error
	010	00410	0108	1-symbol ECC error
	011	00450	0128	2-symbol ECC error
	012	00510	0148	3-symbol ECC error
	013	00550	0168	4-symbol ECC error
	014	00610	0188	5-symbol ECC error
	015	00650	01A8	6-symbol ECC error
	016	00710	01C8	7-symbol ECC error
	017	00750	01E8	8-symbol ECC error
Host buffer access error (xxx11)	001	00051	0029	Odd byte transfer address
	002	00111	0049	Odd byte count
	003	00151	0069	Nonexistent memory
	004	00211	0089	Host bus/memory parity error
	005	00251	00A9	Valid (V) bit not set for memory mapping (indicates host software error)

Table 3-5 MSCP Error Codes (Cont)

Major Code Name	Minor Octal Code	Full Octal Code	Full Hex. Code	Minor Code Name
Controller error (xxx12)	001	00052	002A	SERializer/ DESerializer (SERDES) over/under run error
	002	00112	004A	Nonforced error detection code (EDC) error
	005	00252	00AA	LESI interface parity error (input)
	006	00312	00CA	LESI interface parity error (output)
	007	00352	00EA	Cable-in-place signal (T2) deasserted
Drive error or positioner error (xxx13)	003	00153	006B	Positioner error (misseek)
	007	00353	00EB	Drive detected error
	010	00413	010B	Seek into guard band
	020	01013	020B	Negative track difference
	030	01413	030B	Distance traveled
	040	02013	040B	Not 1 track away
	050	02413	050B	Not 0 tracks away
	060	03013	060B	Drive off track
	070	03413	070B	Servo sample parity error
	100	04013	080B	Head switch dead band
	120	05013	0A0B	Servo sample error (SSE)
	130	05413	0B0B	A/D conversion timeout
	140	06013	0C0B	Head switch servo sample ready timeout

Table 3-5 MSCP Error Codes (Cont)

Major Code Name	Minor Octal Code	Full Octal Code	Full Hex. Code	Minor Code Name
Drive error or positioner error (xxx13)	150	06413	0D0B	Head switch servo sample error
	160	07013	0E0B	Head switch error (least five track address bits of servo burst do not match)
	170	07413	0F0B	Analog servo timeout or servo positioning timer error
Drive detected error (xxx53)	011	00453	012B	Drive status register disable write error
	021	01053	022B	Analog control register reported servo timeout
	031	01453	032B	D processor servo sample ready (SSR) timeout
	041	02053	042B	D processor found servo sample error
	051	02453	052B	D processor index timeout
	061	03053	062B	SERializer/ DESerializer (SERDES) parallel ready timeout
	071	03453	072B	Residue ready (RRDY EARLY) timeout
	101	04053	082B	Header word rate clock timeout
	111	04453	092B	Data word rate clock timeout
	121	05053	0A2B	Replace found positioner error
	131	05453	0B2B	Attempt to revector nonlogical block number

Table 3-5 MSCP Error Codes (Cont)

Major Code Name	Minor Octal Code	Full Octal Code	Full Hex. Code	Minor Code Name
Drive detected error (xxx53)	141	06053	0C2B	Replacement and caching table seek, read, or error detection code failed
	151	06453	0D2B	Replacement block number (RBN) not found in replacement and caching table
	161	07053	0E2B	Seek to replacement block number failed
	171	07453	0F2B	Seek back to original block failed
	201	10053	102B	Write command found nonzero servo offset
	231	11453	132B	Drive ACLO asserted
	241	12053	142B	Drive over temperature
	251	12453	152B	Duplicate unit select number detected
	261	13053	162B	Operator panel loopback failed
	271	13453	172B	Wrong stopped state
	301	14053	182B	Spin-down timed out
	311	14453	192B	Wrong speed state
	321	15053	1A2B	Spin-up timed out
	331	15453	1B2B	Heads not over disk
	341	16053	1C2B	Heads home timed out
	351	16453	1D2B	Heads home never went away
	361	17053	1E2B	Unsafe attempt to unlock door
	371	17453	1F2B	Cartridge or door error

Table 3-5 MSCP Error Codes (Cont)

Major Code Name	Minor Octal Code	Full Octal Code	Full Hex. Code	Minor Code Name
Drive detected error (xxx53)	401	20053	202B	Adaptive runout correction system (ARCS) seek hard error
	411	20453	212B	ARCS sector hard error
	421	21053	222B	ARCS detent hard error
	431	21453	232B	Servo error rate too high
	441	22053	242B	Spindle machine failed to initialize servo
	501	24053	282B	Track position detector (TPD) diagnostics failed
	511	24453	292B	TPD data bus check failed
	521	25053	2A2B	A/D offset/timing failed
	531	25453	2B2B	D/A offset/timing failed
	541	26053	2C2B	A/D-D/A linearity failed
	551	26453	2D2B	Integrator offset failed
	561	27053	2E2B	Drive module failed initialization test
	571	27453	2F2B	Drive module (master or slave) cable not in place
	601	30053	302B	Seek error rate too high
	611	30453	312B	Read/write error rate too high

4 REMOVAL AND REPLACEMENT

4.1 GENERAL

This chapter has procedures for removing and replacing the mechanical and electrical assemblies of the RC25 disk drive.

Figure 4-1 illustrates the removal procedures and the sequence to perform them. For example, Figure 4-1 shows that to remove the cooling fan, the cover/bezel and mechanics/module assemblies must be removed first.

Most procedures cover all drive configurations. However, some procedures refer to specific configurations such as tabletop (TT), rackmount (RM), master, or slave.

Digital recommends that the RC25 assemblies listed in Table 4-1 be replaced in their entirety in a field environment.

WARNING

Because hazardous voltages are inside this equipment, servicing should be performed only by qualified service representatives. Bodily injury or equipment damage can result from improper servicing. Always remove power from equipment before replacing any internal part.

NOTE

The head/disk assembly within the drive mechanics set is environmentally sealed. Do not try to disassemble or repair this unit in the field. Do not try to remove the fixed disk platter. To do so risks contamination and eventual destruction of the fixed disk and heads.

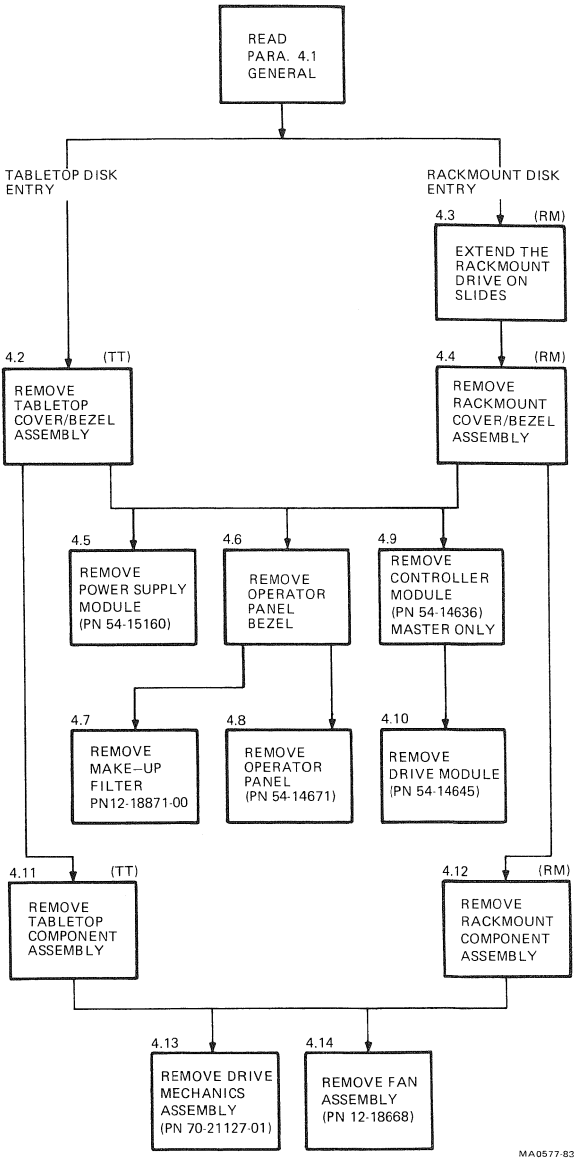


Figure 4-1 Assembly Removal Sequence

Table 4-1 Field Replaceable Units

Part Number	CD Kit Item	Description
12-18668-00	Y	Cooling fan
12-18871-00	Y	Make-up filter
12-19910-01	N	Circuit breaker
17-00083-09	N	115 V, 60 Hz ac power cord
17-00083-10	N	230 V, 50 Hz ac power cord
17-00150-02	N	Power cord, master to slave
17-00444-01 (BC18H-1F)	N	37-conductor round cable (tabletop drive 1 control)
17-00445-01 (BC17Y-03)	N	92-cm (3-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, straight connectors)
17-00445-02 (BC17Y-06)	N	183-cm (6-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, straight connectors)
17-00445-03 (BC17Y-09)	N	274-cm (9-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, straight connectors)
17-00445-04 (BC17Y-12)	N	366-cm (12-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, straight connectors)
17-00445-05 (BC17Y-15)	N	457-cm (15-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, straight connectors)
17-00445-06 (BC17Y-20)	N	610-cm (20-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, straight connectors)
17-00446-01 (BC18F-1F)	N	15-conductor round cable (tabletop drive 1 read/write)
17-00447-01 (BC18J-03)	N	92-cm (3-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, right-angle connectors)
17-00447-02 (BC18J-06)	N	183-cm (6-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, right-angle connectors)

Table 4-1 Field Replaceable Units (Cont)

Part Number	CD Kit Item	Description
17-00447-03 (BC18J-09)	N	274-cm (9-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, right-angle connectors)
17-00447-04 (BC18J-12)	N	366-cm (12-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, right-angle connectors)
17-00447-05 (BC18J-15)	N	457-cm (15-ft) 50-conductor round cable (bulkhead-to-bulkhead LESI bus, right-angle connectors)
54-14636-00	Y	Controller module
54-14645-00	Y	Drive module
54-14671-00	Y	Operator panel
54-15160-00	Y	Power supply module
70-17905-00	Y	Cartridge disk
70-17914-00	N	Solenoid, door
70-18642-00	N	15-conductor flat cable (master tabletop drive 1 read/write)
70-18642-01	N	15-conductor flat cable (slave tabletop drive 1 read/write)
70-18644-00	N	37-conductor flat cable (master tabletop drive 1 control)
70-18644-01	N	37-conductor flat cable (slave tabletop drive 1 control)
70-18649-00	N	10-conductor flat cable (operator panel switch/indicator bus)
70-18650-00	N	14-conductor flat cable (master drive 0 read/write)
70-18651-00	N	40-conductor flat cable (master drive 0 control)
70-18652-00	N	38-cm (15-in) flat cable (master drive LESI bus)

Table 4-1 Field Replaceable Units (Cont)

Part Number	CD Kit Item	Description
70-18652-01	N	76-cm (30-in) 50-conductor flat cable (adapter-to-bulkhead LESI bus)
70-18652-02	N	117-cm (46-in) 50-conductor flat cable (adapter-to-bulkhead LESI bus)
70-18652-03	N	158-cm (62-in) 50-conductor flat cable (adapter-to-bulkhead LESI bus)
70-18652-04	N	198-cm (78-in) 50-conductor flat cable (adapter-to-bulkhead LESI bus)
70-18652-05	N	239-cm (94-in) 50-conductor flat cable (adapter-to-bulkhead LESI bus)
70-18652-06	N	280-cm (110-in) 50-conductor flat cable (adapter-to-bulkhead LESI bus)
70-18652-07	N	320-cm (126-in) 50-conductor flat cable (adapter-to-bulkhead LESI bus)
70-18654-00	N	20-conductor flat cable (preamp spindle/actuator)
70-18654-01	N	20-conductor flat cable (preamp read/write/tach)
70-19143-00	N	AC input filter
70-19506-00	N	Voltage select switch
70-19560-00	N	Master dc power harness
70-19560-01	N	Slave dc power harness
70-19950-00	N	40-conductor flat cable (rackmount drive 1 control)
70-19951-00	N	40-conductor flat cable (rackmount drive 1 read/write)
70-21127-01	Y	Drive mechanics
74-26985-01	Y	Head restraint (shipping cartridge)
M7740	Y	Q-Bus adapter module
M8739	Y	UNIBUS adapter module

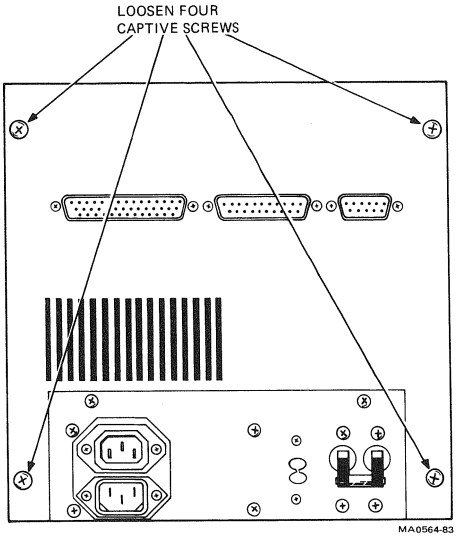


Figure 4-2 Removing the Tabletop Cover/Bezel Assembly

4.2 TABLETOP COVER/BEZEL ASSEMBLY

This procedure describes the removal and installation of the cover/bezel assembly for the tabletop configuration. This procedure applies to the master and slave drives.

4.2.1 Cover/Bezel Assembly Removal

Perform the following steps to remove the cover/bezel assembly.

1. Turn ac circuit breaker off at rear of drive and unplug ac power cord.
2. At rear of drive, release four captive phillips head screws that secure cover to rear bezel (Figure 4-2).
3. Grasp cover and slide it forward. This step disengages two front locating pins. Then lift cover straight up and off drive (Figure 4-3).

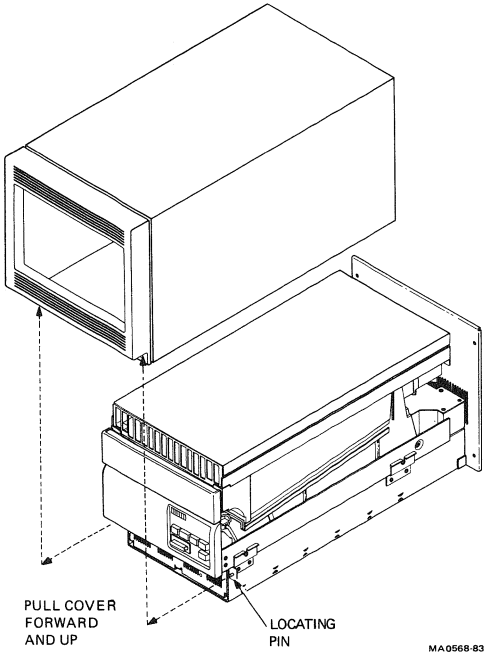


Figure 4-3 Cover/Bezel Assembly Locating Pins

4. If you are replacing power supply, go to Paragraph 4.5.

   If you are replacing make-up filter or operator panel, go to Paragraph 4.6.

   If you are replacing controller or drive modules, go to Paragraph 4.9.

   If you are replacing drive mechanics or cooling fan, go to Paragraph 4.11.

4.2.2 Cover/Bezel Assembly Replacement

Perform these steps to install the cover/bezel assembly.

1. Position cover directly over and slightly to front of drive.
2. Lower cover over drive.

3. Slide cover toward rear while engaging two front locating pins (Figure 4-3). Make sure no cables get caught between cover and rear bezel.
4. Screw in four captive screws to secure cover to rear bezel (Figure 4-2).

4.3 EXTENDING AND RETRACTING RACKMOUNT DRIVE

This procedure describes how to extend the rackmount drive out of the cabinet on its slide mechanisms. This allows the service engineer to reach the internal drive components. Instructions also tell how to retract the drive and secure it in the cabinet.

4.3.1 Extending the Chassis

Perform these steps to push the drive out of the cabinet.

1. Some cabinet configurations have a stabilizer foot at the center bottom of cabinet. If the cabinet you are working with has one, extend foot out to front of cabinet until it reaches its limit stop (Figure 4-4).

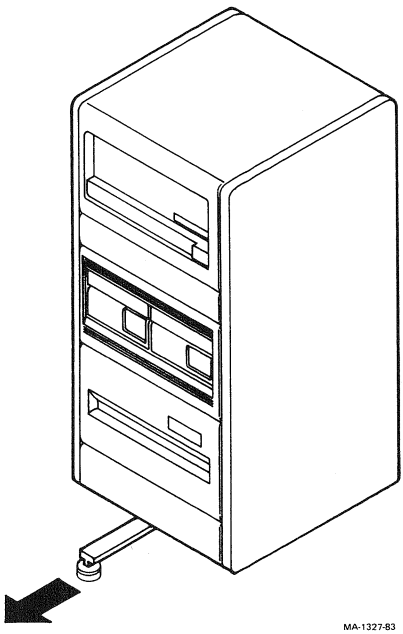


Figure 4-4 Extending the Stabilizer Foot

2. At rear of cabinet, open door or remove protective panel. Remove round LESI cable from connector at rear of drive chassis (Figure 4-5) by loosening two captive screws at cable connector and pulling connector straight out.
3. At rear of drive chassis, remove rear plate by loosening three captive screws (Figure 4-5). Pull plate up and out of chassis.
4. At rear of drive chassis, remove both shipping brackets, one at each side of chassis slides (Figure 4-6) by removing a single screw securing each bracket to slide assembly.
5. From rear, push drive chassis out on its slides until it reaches its maximum extension (Figure 4-7).

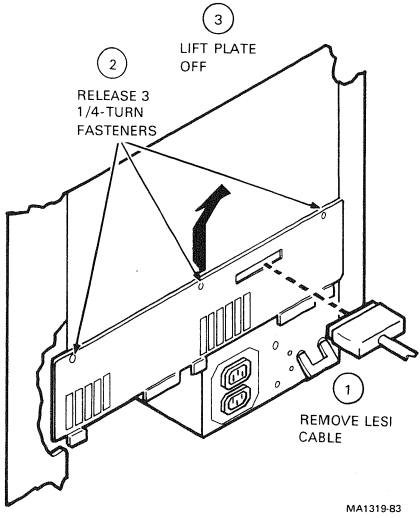


Figure 4-5 Removing the LESI Cable and Chassis Rear Plate

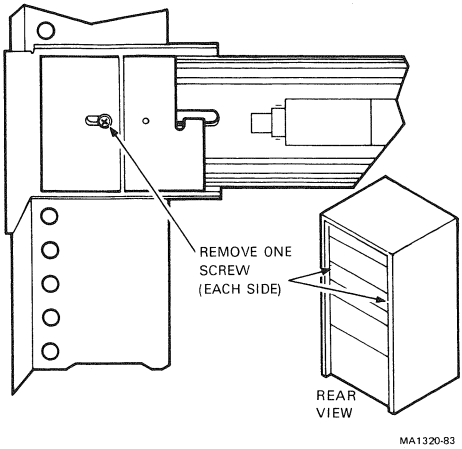


Figure 4-6 Releasing the Chassis

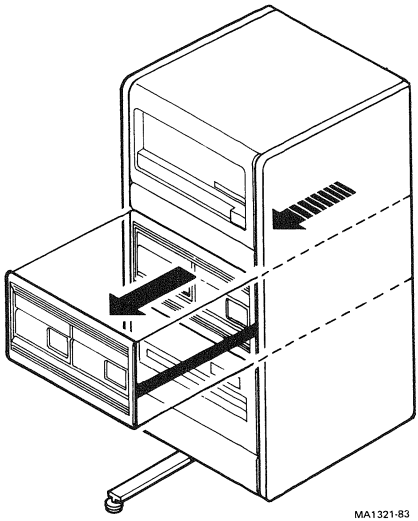


Figure 4-7 Extending the Chassis

4.3.2 Retracting the Chassis

Perform these steps to push the drive into the cabinet.

1. From front of cabinet, push drive chassis back into cabinet on its slides. Make sure no cables get pinched at rear.
2. Reinstall two shipping brackets to slides and secure them with screws. This step prevents drive chassis from sliding out.
3. Reinstall rear plate to chassis. Make sure no cables get caught between plate and cover assembly.
4. Reconnect round LESI bus cable to drive chassis.
5. Push stabilizer foot back into cabinet.

4.4 RACKMOUNT COVER/BEZEL ASSEMBLY

This procedure tells how to remove the cover/bezel assembly from the rackmounted drive chassis. Instructions also tell how to install the cover/bezel assembly in the rackmount drive chassis.

4.4.1 Cover/Bezel Assembly Removal

Perform these steps to remove the cover/bezel assembly.

1. Extend drive chassis (Paragraph 4.3.1).
2. Loosen, but do not remove, two screws on each side of cover/bezel assembly (Figure 4-8).
3. Slide cover/bezel assembly slightly forward and up, off of retaining screws.
4. If you are replacing power supply, go to Paragraph 4.5.

   If you are replacing make-up filter or operator panel, go to Paragraph 4.6.

   If you are replacing controller or drive modules, go to Paragraph 4.9.

   If you are replacing drive mechanics or cooling fan, go to Paragraph 4.12.

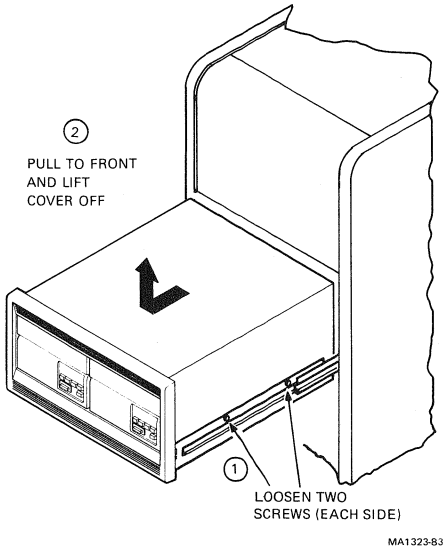


Figure 4-8 Removing the Rackmount Cover/Bezel Assembly

4.4.2 Cover/Bezel Assembly Replacement

Perform these steps to install the cover/bezel assembly.

1. Position cover/bezel assembly over chassis and lower it over retaining screws (Figure 4-8).
2. Slide cover to rear and engage two front pins (Figure 4-8). Tighten two retaining screws.
3. Retract drive chassis (Paragraph 4.3.2).

4.5 POWER SUPPLY MODULE

This procedure describes removing and installing the power supply module (PN 54-15160-00) once the appropriate covers have been removed (Paragraph 4.2, TT or 4.4, RM). This procedure applies to the master and slave drives in all configurations.

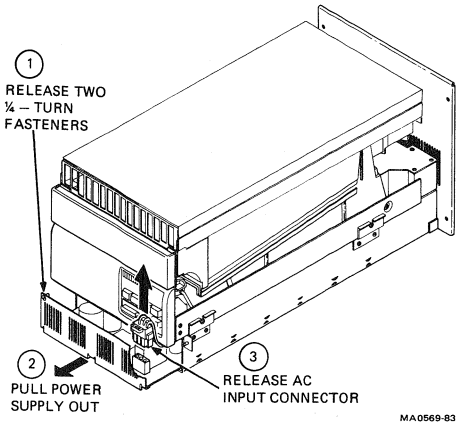


Figure 4-9 Removing the Power Supply Module

4.5.1 Power Supply Module Removal

Perform these steps to remove the power supply module.

1. Release power supply module by loosening two 1/4-turn fasteners at lower front of drive (Figure 4-9).
2. Grasp fasteners and pull power supply module out of frame approximately 6.5 cm (2.5 in).
3. Unplug ac power connector (Figure 4-9).
4. Pull power supply module the rest of the way out of chassis.

4.5.2 Power Supply Module Replacement

Perform these steps to install the power supply module.

1. Hold ac power connector up out of the way. Position power supply module in runners stamped into chassis side members.
2. Slide module in far enough to plug in ac power connector. Plug in connector, then slide in module the rest of the way.
3. Secure module by tightening two 1/4-turn fasteners.
4. Replace cover/bezel assembly (Paragraph 4.2.2, TT or 4.4.2, RM).

4.6 OPERATOR PANEL BEZEL

This procedure describes how to remove and replace the operator panel bezel. The make-up filter and operator panel are accessible after this bezel is removed.

4.6.1 Operator Panel Bezel Removal

Perform these steps to remove the operator panel bezel.

1. Remove cover/bezel assembly (Paragraph 4.2.1, TT or 4.4.1, RM).
2. Loosen, but do not remove, four bezel retaining screws (Figure 4-10).

   NOTE
   To reach the retaining screws in a dual-drive rackmount configuration, release the drive being worked on from the chassis and pull it forward. Refer to Paragraph 4.12.1, Step 4, and Figure 4-19 for instructions.

3. Pull bezel forward and off retaining screws. Allow bezel to hang temporarily from operator panel cables.

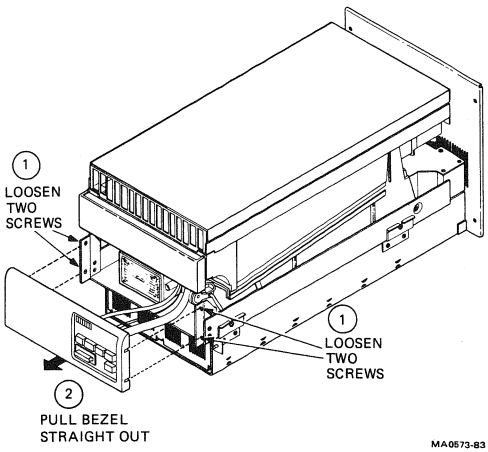


Figure 4-10 Removing the Operator Panel Bezel

4.6.2 Operator Panel Bezel Replacement

Perform these steps to install the operator panel bezel.

1. Slide bezel onto four retaining screws. Tighten screws to secure bezel to mechanics assembly.
2. Replace cover/bezel assembly (Paragraph 4.2.2, TT or 4.4.2, RM).

4.7 MAKE-UP FILTER

The make-up filter (PN 12-18871-00) should be replaced periodically in an unusually contaminated atmosphere or if it becomes discolored. This procedure describes removing and installing the make-up filter. It applies to the master and slave drives.

4.7.1 Make-Up Filter Removal

Perform these steps to remove the make-up filter.

1. Remove operator panel bezel (Paragraph 4.6.1).
2. Remove two screws securing make-up filter to drive mechanics assembly (Figure 4-11).

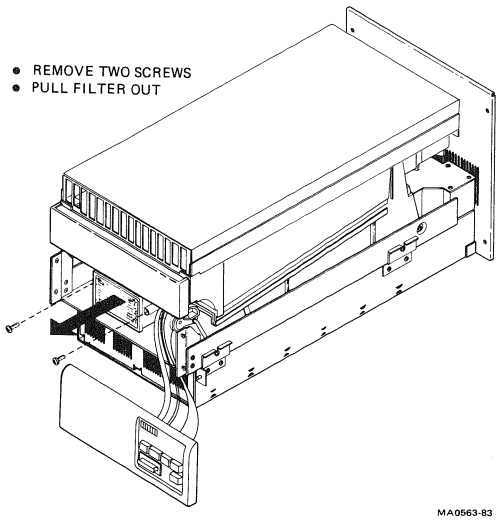


Figure 4-11 Removing the Make-Up Filter

3. Pull make-up filter with gasket forward and away from drive mechanics. Discard filter and gasket.

CAUTION
Do not allow any foreign matter or contamination to enter the exposed air inlet port in the drive mechanics while replacing the filter.

4.7.2 Make-Up Filter Replacement

Perform these steps to install the make-up filter.

1. Position make-up filter with gasket over air inlet port in drive mechanics casting.
2. Secure make-up filter to casting with two screws.
3. Replace operator panel bezel (Paragraph 4.6.2)

4.8 OPERATOR PANEL

This procedure describes removing and installing the operator panel (PN 54-14671-00). It applies to the master and slave drives.

4.8.1 Operator Panel Removal

Perform these steps to remove the operator panel.

1. Remove cover/bezel assembly (Paragraph 4.2.1, TT or 4.4.1, RM).
2. Remove operator panel bezel (Paragraph 4.6.1).
3. Remove five screws securing operator panel to operator panel bezel and lift panel off bezel (Figure 4-12).
4. Unplug three cables at operator panel location J1, J2, and J3 (Figure 4-12). J1 is panel I/O, J2 is door open solenoid, and J3 is door open sensor.

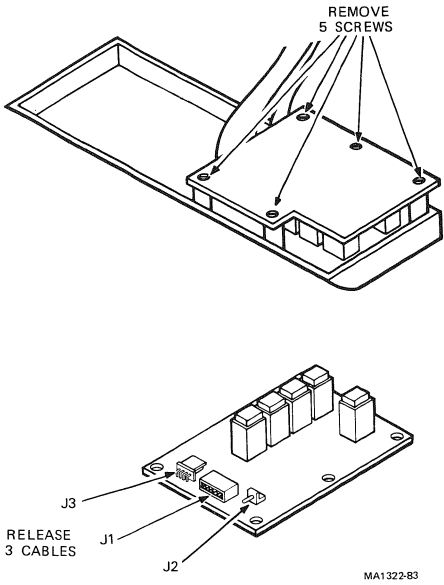


Figure 4-12 Removing the Operator Panel

4.8.2 Operator Panel Replacement

Perform these steps to install the operator panel.

1. Plug in three cables at J1, J2, and J3 of operator panel.
2. Put operator panel in place on operator panel bezel.
3. Replace five screws securing panel to bezel.
4. Replace operator panel bezel and tighten retaining screws.
5. Replace cover/bezel assembly (Paragraph 4.2.2, TT or 4.4.2, RM).

4.9 CONTROLLER MODULE

This procedure describes removing and installing the controller module (PN 54-14671-00). It applies to the master drive only.

4.9.1 Controller Module Removal

Perform these steps to remove the controller module.

1. Remove cover/bezel assembly (Paragraph 4.2.1, TT or 4.4.2, RM).
2. Remove module cover plate by releasing two 1/4-turn fasteners at front of drive (Figure 4-13). Then rotate front of cover plate up on two studs at rear of drive. Remove cover plate by lifting it off studs.
3. Rotate controller module up on its hinges to reach connecting plugs (Figure 4-14).
4. Release cable connectors and grounds at controller module jacks J1 (drive 0 control cable), J2 (drive 1 control cable), J3 (LESI cable), J5 (drive 0 read/write cable), J6 (drive 1 read/write cable), J7 (power), J9 (sense), and grounds at J10 (Figure 4-15). Jacks at J1, J2, J3, J5, and J6 are the lock/eject type. Grasp two tabs at ends of jack and rotate out. This releases cable connector.

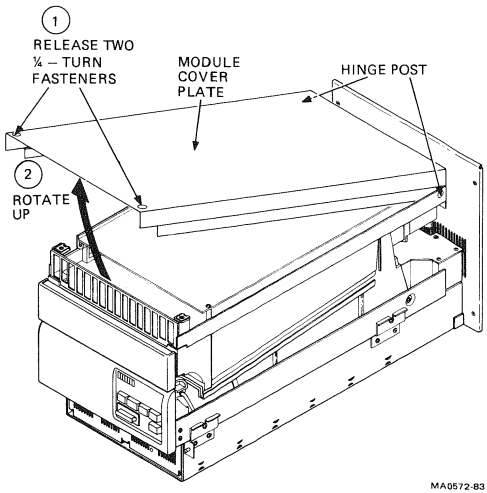


Figure 4-13 Removing the Module Cover Plate

5. Slide controller module forward and off its hinge pins.

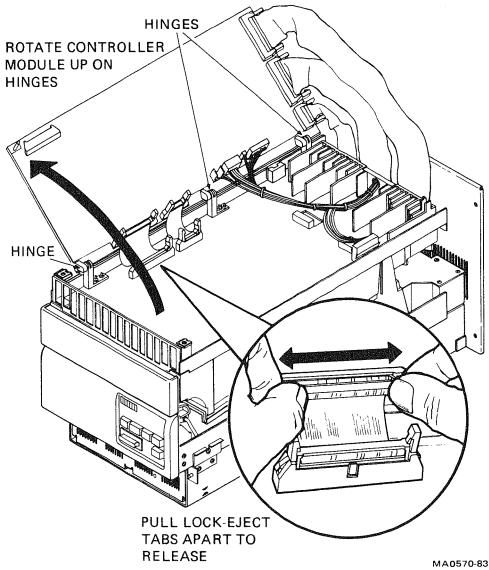


Figure 4-14 Removing the Controller Module

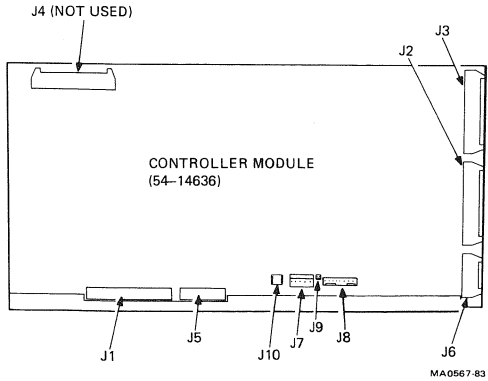


Figure 4-15 Controller Module

4.9.2 Controller Module Replacement

Perform these steps to install the controller module.

1. Align three hinge pins on drive module with the mating sleeves on controller module. Slide controller module to rear of drive and onto pins.
2. Plug appropriate cable and ground connectors into jacks J1 through J3 and J5 through J10 of controller module (Figure 4-15). Jacks at J1, J2, J3, J5, and J6 are the lock/eject type. Push cable connector in as far as it will go without forcing. Then grasp two tabs at ends of jack and rotate in. This seats cable connector.
3. Rotate controller module back down so it lays flat against drive module standoff legs. Make sure cables attached to rear plate are folded in and out of the way of the cover.
4. Replace module cover plate. Align hooks at rear of plate with retaining studs and rotate plate down over controller module. Secure cover plate with two 1/4-turn fasteners at front of drive.
5. Replace cover/bezel assembly (Paragraph 4.2.2, TT or 4.4.2, RM).

4.10 DRIVE MODULE

This procedure describes removing and installing the drive module (PN 54-14645). It applies to the master and slave drives.

> **CAUTION**
> **When handling the drive module, always hold printed circuit board with two hands. Use one hand to support heat sink casting and the other to support center of etched module. If heat sink is not supported correctly, the thin etches can crack.**

4.10.1 Drive Module Removal

Perform these steps to remove the drive module.

1. Remove cover/bezel assembly (Paragraph 4.2.1, TT or 4.4.2, RM).

2. Release cable connectors at drive module jacks J1 (control), J2 (controller read/write), J3 (preamp read/write), J4 (control panel), J5 (spindle control), J6 (power), J7 (power), and J8 (grounds) (Figure 4-16). Release heat sink thermal sensor connector leading to cooling fan.

NOTE
Cable connectors at jacks J3, J4, and J5 are the positive locking type. To release, squeeze tabs at edges of plug together and pull straight out.

3. Unscrew, but do not remove, six captive screws (Figure 4-16).
4. Unscrew and remove grounding screw at ground connector J8.
5. Free the dc power cable harness by releasing two 1/4-turn fasteners that secure the cable retaining bracket to the heat sink (Figure 4-16).
6. Remove drive module. Keep insulator between module and tray in place.

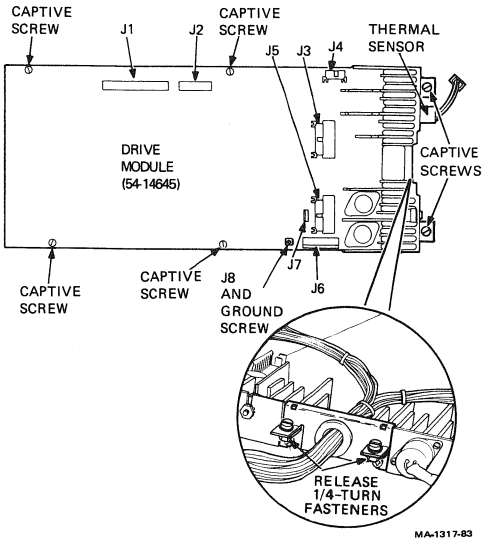


Figure 4-16 Drive Module

4.10.2 Drive Module Replacement

Perform these steps to install the drive module.

1. Lay dc power harness down into drive module heat sink recess. Secure harness retaining bracket with two bolts and nuts.
2. Lay drive module down onto the module tray. Make sure insulator is in place and secure it to module tray with six captive screws and grounding screw at J8 (Figure 4-16). Make sure grounding screw is secured tightly. Intermittent errors can result if this screw is loose.
3. Plug appropriate cable connectors into jacks J1, J2, J3, J4, J5, J6, J7, and J8 of drive module (Figure 4-16). Plug heat sink thermal sensor connector into cooling fan connector.
4. Replace cover/bezel assembly (Paragraph 4.2.2, TT or 4.4.2, RM).

4.11 TABLETOP COMPONENT ASSEMBLY

The component assembly (drive mechanics and module tray assemblies) must be separated from the power supply in the tabletop configuration before subsequent steps can be performed. This procedure describes how to disengage the component assembly and power supply. It applies to the master and slave drives.

4.11.1 Separating the Tabletop Component and Power Supply Assemblies

Perform these steps to separate the tabletop component and power supply assemblies.

1. Remove cover/bezel assembly (Paragraph 4.2.1).
2. Remove module cover plate by releasing two 1/4-turn fasteners at front of drive (Figure 4-13). Rotate front of cover plate up and slide it off two studs at rear of drive.

3. **Perform this step for master drive only.** Rotate controller module up on its hinges to reach connecting plugs. On controller module, remove cable connectors at jacks J2, J3, and J6 (Figure 4-15). Jacks J2, J3, and J6 are the lock/eject type. Grasp two tabs at ends of jack and rotate out. This releases cable connector.

   Perform this step for slave drive only. On the drive module, remove cable connectors at jacks J1 and J2 (Figure 4-16). Jacks J1 and J2 are the lock/eject type. Grasp two tabs at ends of jack and rotate out. This releases cable connector.

4. Remove four screws (two on each side of drive) securing component assembly to power supply frame (Figure 4-17).

5. Slide mechanics assembly forward on power supply frame approximately 6.5 cm (2.5 in).

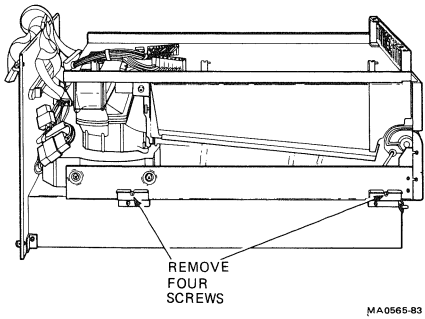


Figure 4-17 Separating the Tabletop Component and Power Supply Assemblies

6. Unplug dc power harness connector (Figure 4-18).
7. Unplug cooling fan power connector.
8. Lift component assembly up and off power supply frame.
9. If you are replacing drive mechanics, go to Paragraph 4.13.

   If you are replacing cooling fan, go to Paragraph 4.14.

4.11.2 Joining the Tabletop Component and Power Supply Assemblies

Perform these steps to join the tabletop and power supply assemblies.

1. Place mechanics/module assembly down on power supply frame. Allow some clearance at rear.
2. Join cooling fan power connectors.
3. Join dc power harness connectors.
4. Slide drive mechanics to rear of power supply frame until side mounting screw holes line up with brackets.
5. Replace four screws (two on each side of drive) securing mechanics assembly to power supply frame (Figure 4-17).

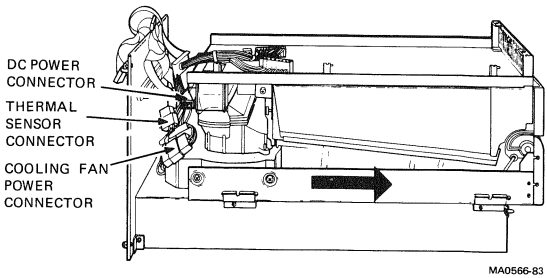


Figure 4-18 Uncabling the Tabletop Component Assembly

6. **Perform this step for master drive only.** On the controller module, plug in cable connectors at jacks J2, J3, and J6 (Figure 4-15). Jacks J2, J3, and J6 are the lock/eject type. Push cable connector in as far as it will go without forcing. Then grasp two tabs at ends of jack and rotate in. This seats cable connector. Rotate controller module back down so it lays flat against drive module standoff legs. Make sure cables attached to rear plate are folded in and out of the way of the cover.

   Perform this step for slave drive only. On the drive module, plug in cable connectors at jacks J1 and J2 (Figure 4-16). Jacks J1 and J2 are the lock/eject type. Push cable connector in as far as it will go without forcing. Then grasp two tabs at ends of jack and rotate in. This seats cable connector.

7. Reinstall module cover plate. Align hooks at rear of plate with retaining studs and rotate plate down over controller module. Secure cover plate with two 1/4-turn fasteners at front of drive.
8. Install cover/bezel assembly (Paragraph 4.2.2).

4.12 RACKMOUNT COMPONENT ASSEMBLY

The component assembly (drive mechanics and module tray assemblies) must be separated from the chassis in the rackmount configuration before subsequent steps can be performed. This procedure describes how to disengage the component assembly and chassis. It applies to the master and slave drives.

4.12.1 Separating the Rackmount Component Assembly and Chassis

Perform these steps to separate the rackmount component assembly and chassis.

1. Remove cover/bezel assembly (Paragraph 4.4.1).
2. Remove module cover plate by releasing two 1/4-turn fasteners at front of drive (Figure 4-13). Rotate front of cover plate up and slide it off two studs at rear of drive.

3. **Perform this step for master drive only.** Rotate controller module up on its hinges to reach connecting plugs. On the controller module, remove cable connectors at jacks J2, J3, and J6 (Figure 4-15). Jacks J2, J3, and J6 are the lock/eject type. Grasp two tabs at ends of jack and rotate out. This releases cable connector.

   Perform this step for slave drive only. On the drive module, remove cable connectors at jacks J1 and J2 (Figure 4-16). Jacks J1 and J2 are the lock/eject type. Grasp two tabs at ends of jack and rotate out. This releases cable connector.

4. Release component assembly from chassis by turning a screw on left (for master drive) or right (for slave) side of chassis (Figure 4-19). In both cases, turn screw counterclockwise to release assembly.
5. Loosen, but do not remove, two screws at bottom front of component assembly. This releases front of assembly.
6. Lift rear of component assembly slightly upward and slide whole assembly slightly forward on chassis to reach rear cables.
7. Unplug dc power harness connector (Figure 4-20).
8. Unplug cooling fan power connector.
9. Lift component assembly up and off chassis.
10. If you are replacing drive mechanics, go to Paragraph 4.13.

    If you are replacing cooling fan, go to Paragraph 4.14.

4.12.2 Joining the Rackmount Component Assembly and Chassis

Perform these steps to join the rackmount component assembly and chassis.

1. Place component assembly down on chassis. Allow some clearance at rear.
2. Join cooling fan power connectors.
3. Join dc power harness connectors.
4. Slide component assembly to rear of chassis and align front retaining screws until bottom retaining stud drops into chassis retaining bracket.
5. Tighten side screw securing component assembly to chassis (Figure 4-19).
6. Tighten two front retaining screws.

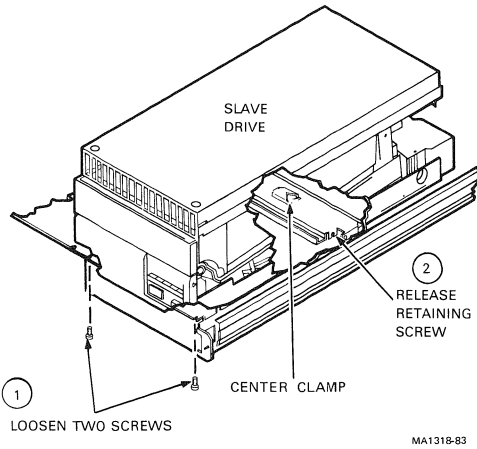


Figure 4-19 Releasing the Rackmount Component Assembly from the Chassis

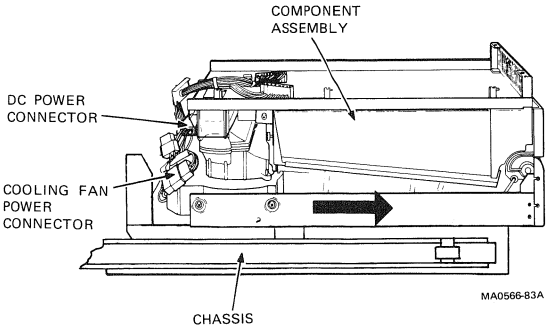


Figure 4-20 Uncabling the Rackmount Component Assembly

7. **Perform this step for master drive only.** On the controller module, plug in cable connectors at jacks J2, J3, and J6 (Figure 4-15). Jacks J2, J3, and J6 are the lock/eject type. Push cable connector in as far as it will go without forcing. Then grasp two tabs at ends of jack and rotate in. This seats cable connector. Rotate controller module back down so it lays flat against drive module standoff legs. Make sure cables attached to rear bezel are folded in and out of the way of the cover.

   Perform this step for slave drive only. On the drive module, plug in cable connectors at jacks J1 and J2 (Figure 4-16). Jacks J1 and J2 are the lock/eject type. Push cable connector in as far as it will go without forcing. Then grasp two tabs at ends of jack and rotate in. This seats cable connector.

8. Reinstall module cover plate. Align hooks at rear of plate with retaining studs and rotate plate down over controller module. Secure cover plate with two 1/4-turn fasteners at front of drive.
9. Install cover/bezel assembly (Paragraph 4.4.2).

4.13 DRIVE MECHANICS ASSEMBLY

This procedure describes how the drive mechanics assembly (PN 70-21127-01) can be separated from the module tray assembly. The drive mechanics assembly consists of the head/disk assembly and a sheet metal mounting frame. The cooling fan and the operator panel with bezel are not part of the mechanics assembly. They must be removed from the original mechanics assembly and reinstalled on the new one. This procedure applies to the master and slave drives.

> **NOTE**
> **The head/disk assembly is an environmentally sealed unit. Do not try to disassemble this unit for repair in the field. Do not try to remove fixed disk platter. To do so risks contamination and eventual destruction of fixed disk and heads.**

4.13.1 Drive Mechanics Assembly Removal

Perform these procedures to remove the drive mechanics assembly.

1. Remove cover/bezel assembly (Paragraph 4.2.1, TT or 4.4.1, RM).
2. Remove component assembly (Paragraph 4.11.1, TT or 4.12.1, RM).
3. Disconnect cables at drive module J3, J4, and J5 (Figure 4-16). Allow them to pass through cutouts in drive module.

   NOTE
   The cable connectors at jacks J3, J4, and J5 are the positive locking type. To release, squeeze tabs at edges of plug together and pull straight out.

4. Remove two screws, one on each side of module tray (Figure 4-21).
5. Slide module tray to rear of mechanics assembly. This step disengages tray from front retaining hooks. Remove module tray and set it aside.
6. Remove cooling fan (Paragraph 4.14.1).
7. Remove operator panel bezel assembly (Paragraph 4.6.1).
8. Disconnect three operator panel cables (Paragraph 4.8.1, step 3, and Figure 4-12).

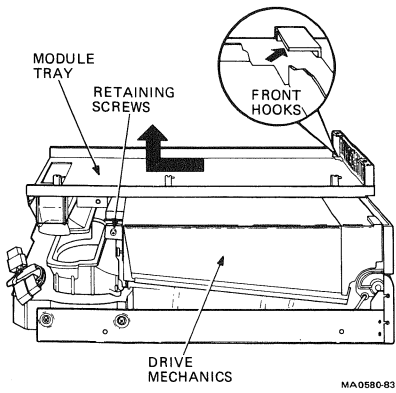


Figure 4-21 Separating the Module Tray from the Drive Mechanics

4.13.2 Drive Mechanics Assembly Replacement

Perform these steps to install the drive mechanics assembly.

1. Transfer two short cables at preamp connectors J1 and J2 (Figure 4-22) of original drive mechanics assembly to replacement assembly.
2. Install original cooling fan in drive mechanics assembly (Paragraph 4.14.2).
3. Connect operator panel cables to original panel (Paragraph 4.8.2, step 3, and Figure 4-12).
4. Replace operator panel bezel assembly (Paragraph 4.6.2).
5. Place module tray assembly on top of drive mechanics assembly and feed three cables up through cutouts.
6. Hook front of module tray into drive mechanics (Figure 4-21). Secure rear of module tray to drive mechanics with two screws.
7. Connect cables at drive module J3, J4, and J5.
8. Install component assembly (Paragraph 4.11.2, TT or 4.12.2, RM).

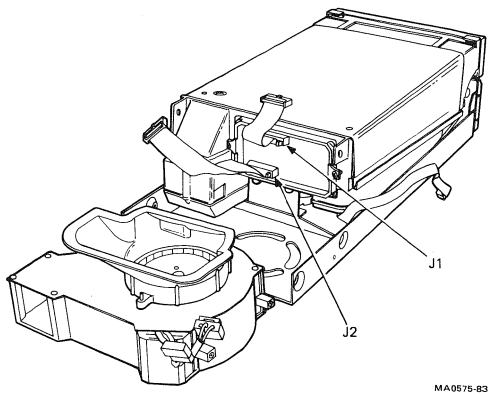


Figure 4-22 Preamp Module Connections

4.14 COOLING FAN

This procedure describes removing and installing the cooling fan (PN 12-18688-00). It applies to the master and slave drives.

4.14.1 Cooling Fan Removal

Perform these steps to remove the cooling fan.

1. Remove component assembly (Paragraph 4.11.1, TT or 4.12.1, RM).
2. Remove three fan retaining screws, one at right rear and two at left rear (Figure 4-23).
3. Slide cooling fan out of rear of component assembly.
4. If you are replacing the fan, remove three nuts securing bottom plenum half to old fan and transfer it to new fan.

4.14.2 Cooling Fan Replacement

Perform these steps to install the cooling fan.

1. Install cooling fan by sliding it into rear of component assembly.
2. Replace three fan retaining screws, one at right rear and two at left rear (Figure 4-23). Hold rubber shock mounts on fan assembly in place with long-nosed pliers.
3. Reinstall component assembly (Paragraph 4.11.2, TT or 4.12.2, RM).

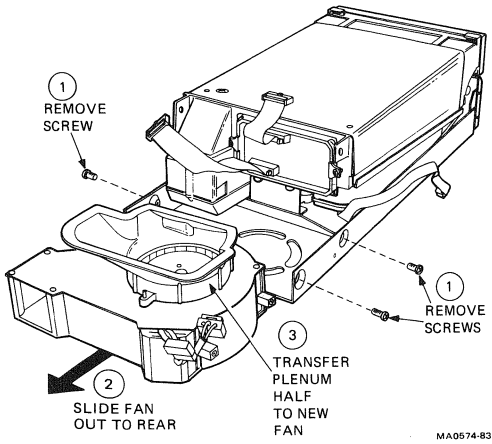


Figure 4-23 Removing the Cooling Fan

A DIAGRAMS

Figure A-1 shows the power distribution in the RC25 disk drive. Figure A-2 is a physical/functional block diagram of a master drive. Figure A-3 is a physical/functional block diagram of a slave drive.

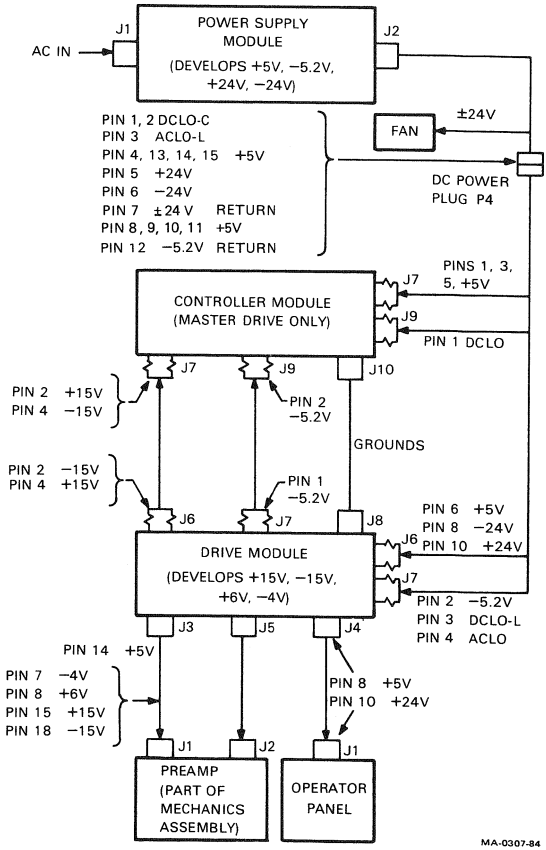


Figure A-1 Power Distribution

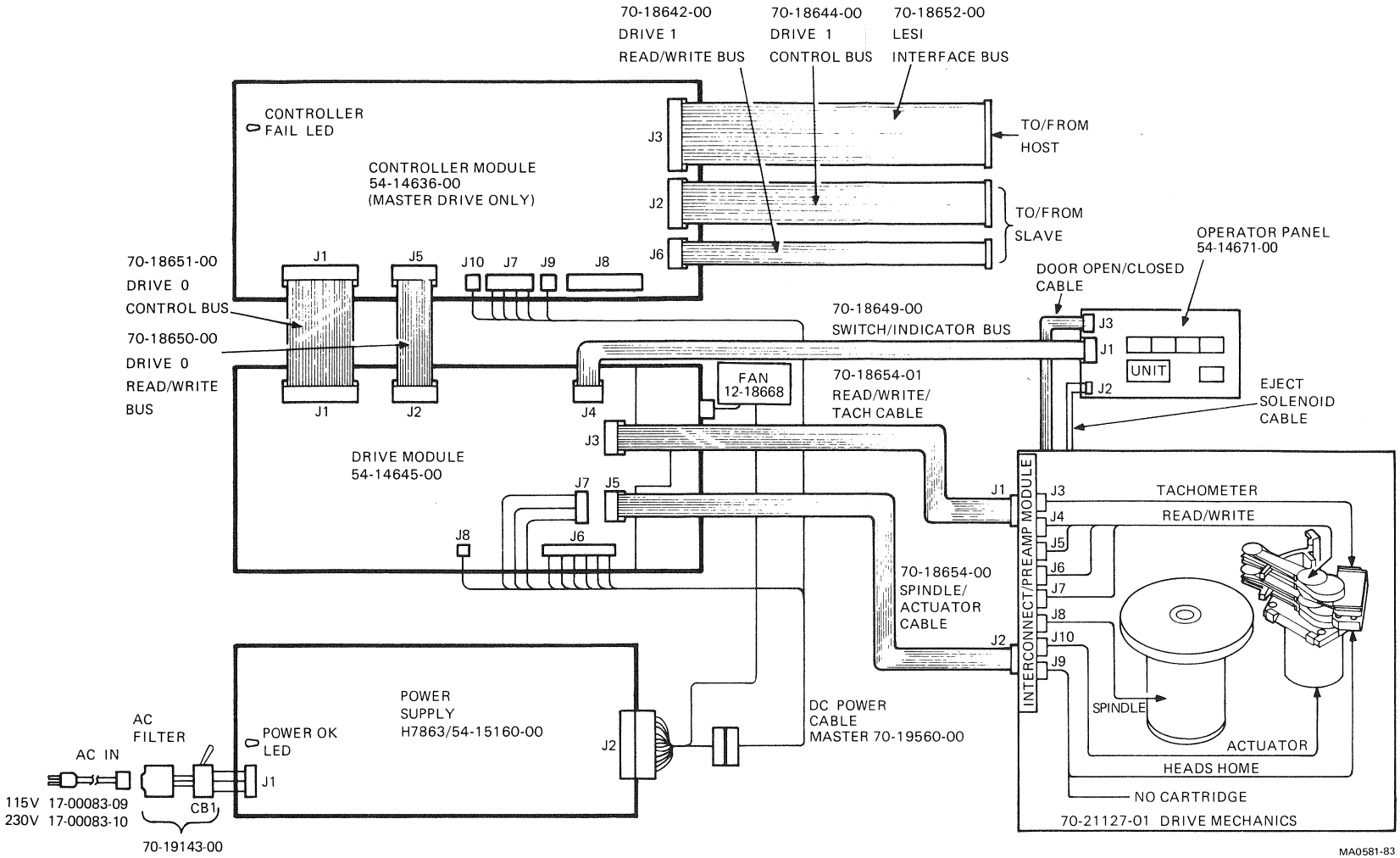


Figure A-2 Master Drive Physical/Functional Block Diagram

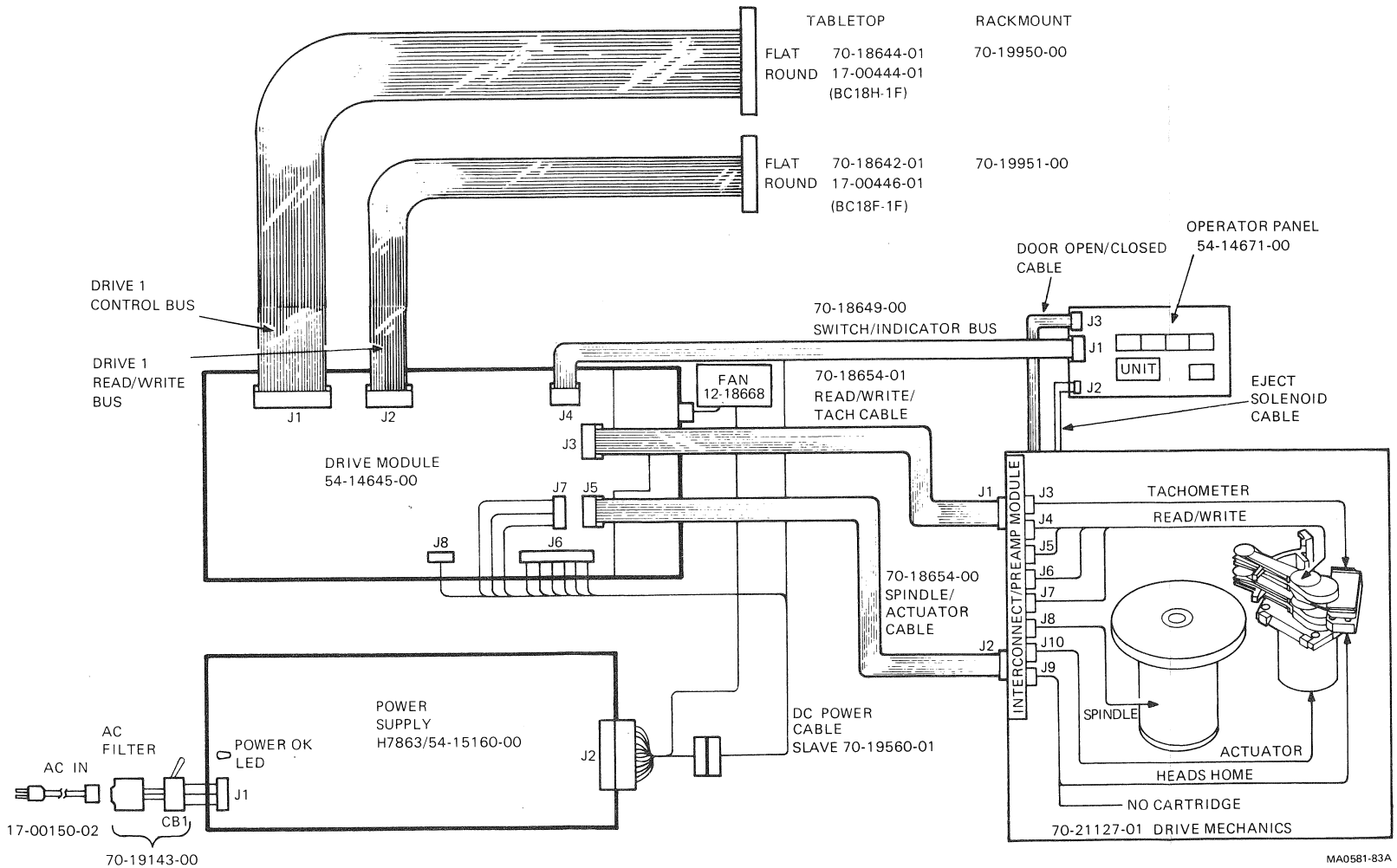


Figure A-3 Slave Drive Physical/Functional Block Diagram