ꙅꙅ Seagate

Sabre Disc Drive

ST82038J, ST82272J

ST82500J/K/N/ND, ST83050K

ST83073J, ST83220K

Maintenance Manual

(All Interfaces)

WARNING
(For all drives)

Do not attempt to install, operate, or repair the unit, before you read the important safety information located directly after the preface in this manual. Failure to follow that and other safety precautions in this manual could cause injury to yourself or others.

WARNING
(For ST82038J, ST82272J, ST82500J/K/N/ND drives)

This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of the FCC Rules which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

If the operator or status/control panel (component assembly) is not installed in the inner drawer, it is your responsibility to provide any additional RFI shielding or grounding needed to ensure FCC Class A compliance.

WARNING
(For ST83050K, ST83073J, ST83220K drives)

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the user's manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart B of Part 15 of the FCC Rules which are designed to provide reasonable protection against such interference when operated in a commercial environment. This device must not cause harmful interference; it must accept any interference received, including interference that may cause undesired operations.

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

Any unauthorized modifications to this equipment could result in revocation of the user's authority to operate the equipment. The subsystem must use shielded I/O cables and must meet the grounding requirements defined in the user's manual.

If the operator or status/control panel (component assembly) is not installed in the inner drawer, it is your responsibility to provide any additional RFI shielding or grounding needed to ensure FCC Class A compliance.
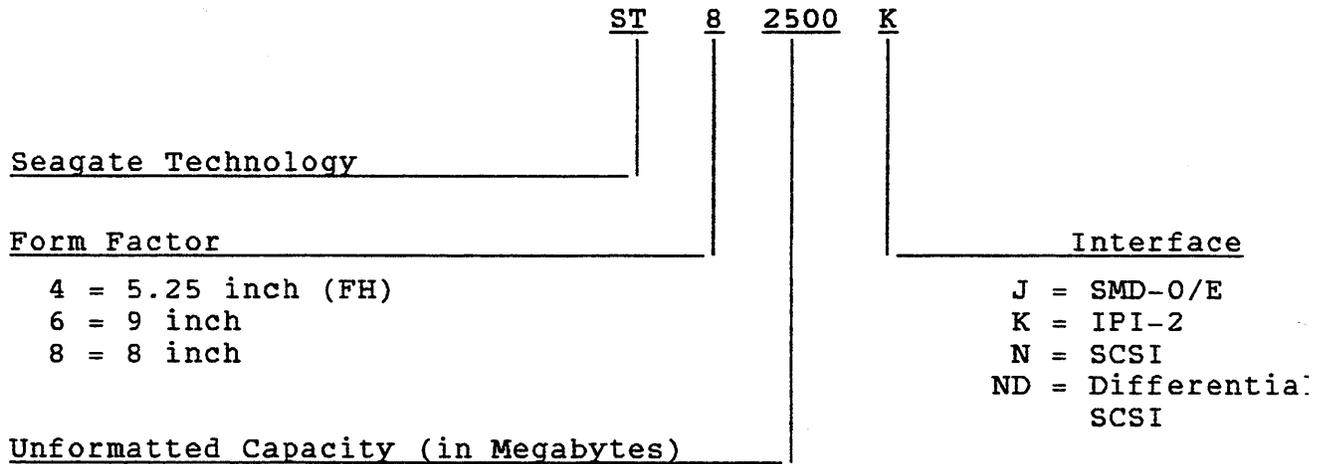
Sabre Disc Drive

ST82038J
ST82272J
ST82500J
ST82500K
ST82500N
ST82500ND
ST83050K
ST83037J
ST83220K

Maintenance Manual
(All Interfaces)

General Maintenance Information
Trouble Analysis
Repair and Replacement

Seagate Disc Drive Product Numbers

<pre>
                                  ST   8   2500   K
                                   | | | |
Seagate Technology | | | |
                                        | | |
Form Factor | | |_____ Interface
    4 = 5.25 inch (FH) | | J = SMD-0/E
    6 = 9 inch | | K = IPI-2
    8 = 8 inch | | N = SCSI
                                        | | ND = Differential
                                        | | SCSI
Unformatted Capacity (in Megabytes) |
</pre>

Copyright Notice

We value your comments. A comment sheet is provided at the
back of this manual.

Printed in the United States of America

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FIGURES

TABLES

PREFACE

This manual contains maintenance information for the Seagate
Sabre disc drives listed in the configuration chart following
the preface. It is prepared for customer engineers and other
technical personnel directly involved with maintaining the
drive.

The information in this manual is presented as follows:

Section 1 –   General Maintenance Information. Contains
              information on warnings and precautions,
              maintenance tools and materials, testing the
              drive, and accessing the drive for maintenance.

Section 2 –   Trouble Analysis. Contains procedures and
              information to assist in troubleshooting the
              drive.

Section 3 –   Repair and Replacement. Contains procedures and
              information on the replacement of drive
              assemblies.

Appendix A – Alternate Mounting Methods. Provides additional
              information on installation.

New features, technical changes, additions, and deletions in
this manual are indicated as follows:

- A vertical bar in the outer margin of a page marks the
  changed area.

- A dot by the page number indicates the entire page
  contains new or changed information.

- A vertical bar by the page number indicates the
  information was moved from another page, but there were
  no technical or editorial changes.

The following Sabre manuals are available for purchase from:

Seagate Technology, Inc.
Customer Services
12701 Whitewater Drive
Minnetonka, MN 55343

Phone: (612) 931-8612
Fax: (612) 931-8817

Publication No.	Title
83327200	ST82038J, ST82272J, ST82500J and ST83037J SMD Interface User's Manual (contains general description, installation, operation, and diagnostic information for drives with the SMD interface.)
83327210	ST82500K, ST83050K and ST83220K IPI Interface User's Manual (contains general description, installation, operation, and diagnostic information for drives with the IPI interface.)
83327220	ST82500N SCSI Interface User's Manual (contains general description, installation, operation, and diagnostic information for drives with the SCSI interface.)
83327230	Maintenance Manual
83327240	Parts Data Manual (contains listings of field replaceable parts, and manufacturer's recommended spare parts)
83327390	Pocket Reference (summarizes status codes and diagnostic operation for drives with the SCSI interface)
83327380	Pocket Reference (summarizes status codes and diagnostic operation for drives with the SMD and IPI interfaces)
83327530	Theory Manual

You can obtain more detailed information about the interfaces described in this manual by requesting a copy of the interface specification from your Seagate sales representative. The following specifications are available.

Specification No.	Title
64712402	SMD-E Interface Specification
64721701	Interface Specification for the Seagate Small Computer System Interface (SCSI)
64400300	Specification for Synchronized Spindle Systems
64731600	Seagate Specification for the IPI-2 Intelligent Peripheral Interface
ISO 9318-2	Device Specific Command Set for Magnetic Disc Drives (IPI-2)
ISO 9318-6	Enhanced Physical Level (IPI)

CONFIGURATION CHART

The following is a list of drives that this manual applies to:

Equipment Number	Model Number	Interface	Data Capacity (GB)	Sector Length
PA8F2A	ST82038J	Dual Channel SMD	2.038	Unspecified
PA8J2A	ST82272J	Dual Channel SMD	2.272	Unspecified
PA8J3A	ST82272J	Not Supplied	2.272	Unspecified
PA8T2A	ST82500J	Dual Channel SMD	2.500	Unspecified
PA8T2B	ST82500J	Dual Channel SMD	2.500	Unspecified
PA8T3A	ST82500J	Not Supplied	2.500	Unspecified
PA8U1A	ST82500ND	SCSI Differential	2.500	512 Bytes
PA8U1B	ST82500N	SCSI Single-Ended	2.500	512 Bytes
PA8U1C	ST82500ND	SCSI Differential	2.500	256 Bytes
PA8U1D	ST82500N	SCSI Single-Ended	2.500	256 Bytes
PA8V2A	ST82500K	IPI	2.500	Standard
PA8V2B	ST82500K	IPI	2.500	Standard
PA8V2C	ST82500K	IPI	2.500	Standard
PA8V2D	ST82500K	IPI	2.500	Standard
PA9A2A	ST83220K	IPI	3.220	Standard
PA9A2B	ST83220K	IPI	3.220	Standard
PA9D2A	ST83073J	Dual Channel SMD	3.073	Unspecified
PA9D2B	ST83073J	Dual Channel SMD	3.073	Unspecified
PA9G2A	ST83050K	IPI	3.050	Standard
PA9G2B	ST83050K	IPI	3.050	Standard

IMPORTANT SAFETY INFORMATION
AND PRECAUTIONS

Use of proper safety and repair techniques is important for
safe, reliable operation of this unit. Service should be done
only by qualified persons. We recommend the procedures in this
manual as effective ways of servicing the unit. Some
procedures require the use of special tools. For proper
maintenance and safety, you must use these tools as recommended.

The procedures in this manual and labels on the unit contain
warnings and cautions that must be carefully read and followed
to minimize or eliminate the risk of personal injury. The
warnings point out conditions or practices that may endanger
you or others. The cautions point out conditions or practices
that may damage the unit, possibly making it unsafe for use.

You must also understand that these warnings and cautions are
not exhaustive. We cannot possibly know, evaluate, and advise
you of all the ways in which maintenance might be performed or
the possible risk of each technique. Consequently, we have not
completed any such broad evaluation. If you use a non-approved
procedure or tool, first ensure that the method you choose will
not risk either your safety or unit performance.

For the safety of yourself and others, observe the following
warnings and precautions.

- Perform all maintenance by following the procedures in
  this manual.

- Follow all cautions and warnings in the procedures and on
  unit labels.

- Use the special tools called out in the procedures.

- Use sound safety practices when operating or repairing
  the unit.

- Use caution when troubleshooting a unit that has voltages
  present. Remove power from unit before servicing or
  replacing parts.

- Wear safety glasses when servicing units.

- Wear safety shoes when removing or replacing heavy parts.

- Use only designated Seagate replacement parts.
  Non-Seagate replacement parts can adversely affect safety
  in addition to degrading reliability, increasing
  maintenance downtime, and voiding warranty coverage.

- Use care while working with the power supply because line voltages are always present when the ac power cord is connected to a power source. Setting the power supply switch to position " ⏻ " disables dc power to the drive but has no effect on ac power within the supply. For complete safety, remove the ac power plug from the site power outlet.

- The site power outlet shall be installed near the equipment and shall be easily accessible.

- In case of fire or other emergency, isolate the drive from main power by removing the drive power plug from the ac outlet. In situations where pulling the plug is not possible or practical, use the system main power disconnect to isolate the drives from main power.

- In an IT power system, a disconnect device shall be provided which simultaneously interrupts all phase and neutral conductors.

- **WARNING:** In IT power systems, the unearthed neutral is considered as a phase conductor. For such IT power systems, double pole/neutral fusing is required.

- When the drive is mounted in an equipment rack or cabinet, ensure that the internal temperature of the rack or cabinet will not exceed the limits defined for the drive. Where units are stacked vertically, pay special attention to the top where temperatures are usually highest.

- This drive is designed to be installed and operated in accordance with UL1950, IEC380, IEC950, EN 60950, CSA C22.2 154, CSA C22.2 220, and VDE0806.

- Follow the precautions listed in section 1 under Protecting the Drive From Electrostatic Discharge.

- If the power supply is placed on a bench for testing, position the supply so all ventilation holes are open, to allow proper air flow to internal components.

- Do not attempt to disassemble the module. It is not field repairable. Replace the entire module assembly if it is defective.

- Do not operate the drive over an extended period of time without the top cover installed.

- The power supply is designed to be connected to an IT network.

- Do not attempt to disassemble the power supply. It is not field repairable. Replace the entire supply if it is defective.

- If you do not use a recommended Seagate power supply, ensure the supply meets the specifications in this manual and is designed to be used in accordance with UL1950, IEC380, IEC950, EN 60950, CSA C22.2 154, CSA C22.2 220, and VDE0806.

- Always deenergize drive before removing or installing circuit boards, cables, or any other electrical components.

ABBREVIATIONS

ABV	Above	EPROM	Eraseable Programmable Read Only Memory
ac	Alternating Current	ESP	Enhanced SCSI Protocol
ALT	Alternate	EXEC	Execute
BIB	Bus In Bit	EXT	External
BLW	Below	FCO	Field Change Order
BOB	Bus Out Bit	FRU	Field Replaceable Unit
C	Celsius, Continuous	FTU	Field Test Unit
CDIC	Controller/Drive Interface Chip	GND	Ground
CH	Channel	HEX	Hexagon, Hexadecimal
cm	Centimetre	HP	High Performance
CONTD	Continued	Hz	Hertz
CYL	Cylinder	IBP	Inhibit Block Pulse
D	Direct	IC	Integrated Circuit
dc	Direct Current	ID	Identification
DIAG	Diagnostic	IDENT	Identification
DMA	Direct Memory Access	INT	Internal
ECC	Error Correction Code	I/O	Input/Output
ECL	Emitter Coupled Logic	IPI	Intelligent Peripheral Interface
ECO	Engineering Change Order	LCD	Liquid Crystal Display

ABBREVIATIONS (CONTD)

LED	Light Emitting Diode		RST	Reset
LSB	Least Significant Bit		RTZ	Return to Zero
LSI	Large Scale Integration		R/W	Read/Write
			s	Second
LTD	Lock to Data		SBC	SCSI Bus Controller
LUN	Logical Unit Number		S/C	Series Code
MAC	Merged Architecture Controller		SCSI	Small Computer Systems Interface
MB	Megabyte		SEL	Select
MHz	Megahertz		STD	Standard
MPU	Microprocessor Unit		SYNC	Synchronization
MSB	Most Significant Bit		TP	Test Point
NRZ	Non Return to Zero		TSP	Troubleshooting Procedure
ns	Nanosecond		TTL	Transistor-Transistor Logic
P	Plug			
PFTU	Programmable Field Test Unit		V	Volts, Voltage
PROC	Procedure		W/	With
RAM	Random Access Memory		W/O	Without
REF	Reference		WRT	Write
REV	Reverse, Revision		2HP	Two-Head Parallel

INTRODUCTION

This section contains general information relating to maintenance of the drive. You should be familiar with the information in this section and with drive operation before attempting any maintenance procedures. Information is divided into the following areas:

- Electrostatic Discharge Protection -- Provides instructions for the proper handling of electrostatically sensitive devices.

- Maintenance Tools and Materials -- Lists the tools and materials required to perform maintenance on the drive.

- Testing the Drive -- Provides information concerning the electrical testing of the drive.

- Accessing Assemblies for Maintenance -- Identifies the various parts of the drive and describes how to access these parts for maintenance.

ELECTROSTATIC DISCHARGE PROTECTION

All drive electronic assemblies are sensitive to static electricity, due to the electrostatically sensitive devices used within the drive circuitry. Although some of these devices such as metal-oxide semiconductors are extremely sensitive, all semiconductors as well as some resistors and capacitors may be damaged or degraded by exposure to static electricity.

Electrostatic damage to electronic devices may be caused by a direct discharge of a charged conductor, or by exposure to the static fields that surround charged objects. To avoid damage to drive electronic assemblies, service personnel must observe the following precautions when servicing the drive:

- Remove boards from bags only when you are grounded -- all boards received from the factory are in static shielding bags, and should not be removed unless you are grounded.

- Turn off power to drive before removing or installing any circuit boards.

- Ground yourself to the drive -- whenever the drive
  electronics are or will be exposed, connect yourself to
  ground with a wrist strap (see Accessories in the User's
  manual). Connection may be made to any metal assembly on
  the drive. As a general rule, remember that you, the
  drive, and the circuit boards must all be at ground
  potential to avoid potentially damaging static discharges.

- Keep boards in conductive bags -- when circuit boards are
  not installed in the drive, keep them in conductive
  static shielding bags (see Accessories in the User's
  manual). These bags provide absolute protection from
  direct static discharge and from static fields
  surrounding charged objects. Remember that these bags
  are conductive and should not be placed where they might
  cause an electrical short circuit.

TABLE 1-1. MAINTENANCE TOOLS AND MATERIALS

Description	Part Number
Portable Status/Control Panel Kit	47097271
Programmable Field Test Unit (PFTU)* (TB2A3-G with SMD-O/SMD-E option)	73086308
Small Computer System Interface (SCSI) Testers (Options for PFTU listed above) Single-Ended Kit** Differential Kit**	86515700 86515800
Static Shielding Bags and Ground Wrist Straps	See Accessories in the User's manual
Volt/ohmmeter	Ballantine 345 or equivalent digital voltmeter

*No field test unit is currently available for drives with
 the IPI interface.
**Kit part numbers do not include the basic PFTU. The PFTU
 part number is listed above.

- Never use an ohmmeter on any circuit boards unless directed to in troubleshooting procedures.

- Do not touch pins on power supply connector J15. Power supply circuitry is sensitive to electrostatic discharge.

MAINTENANCE TOOLS AND MATERIALS

The maintenance procedures described in this manual require the use of certain special tools, test equipment, and materials. These are listed in table 1-1 along with the appropriate Seagate part number. Note that the list includes only special tools. We assume that you have normal maintenance tools.

How to use the items listed in table 1-1 is described in the procedures as they are required. Additional information is provided on the optional status/control panel (see section 2, Trouble Analysis) and the field test unit (see Testing the Drive).

TESTING THE DRIVE

During testing and troubleshooting, the drive is normally required to perform various operations such as reading and writing test data. Either a field test unit or system software can be used to control the drive during these operations.

Field Test Units

The TB2A3-G programmable field test unit (PFTU) is recommended for use with SMD and SCSI interface drives (see table 1-1 for tester part numbers). Testers are not currently available for drives with an IPI interface. The tester allows the drive to be operated and controlled independent of the rest of the system. For specific instructions on operating the tester, see the tester manual.

The following procedure describes how to connect the tester I/O cables to an SMD interface drive in place of the system I/O cables. For instructions on connecting a tester to a SCSI interface drive, refer to the manual provided with the SCSI tester.

CAUTION

To avoid possible damage to interface
circuitry, always deenergize drive,
controller, and tester before removing or
installing I/O cables.

1. Disable controller and set power supply On/Standby switch
    to Standby position. In a daisy chain system, power off
    all drives.

2. When drive is powered off, remove system I/O cables from
    drive to be tested.

3. Connect tester A cable to drive connector 1J03.

4. Connect tester B cable to drive connector 1J02.

5. Connect a terminator to drive connector 1J04.

See Accessories in the User's manual for the terminator part
number. In a daisy chain system, make whatever connections are
necessary to ensure that the other drives remain under system
control, and restore power to the other drives.

At the completion of testing, restore the drive to normal
operation by reversing the process outlined above.

Drive Diagnostics

The drive has built-in diagnostic tests. These diagnostic
tests may be performed via the optional status/control panel,
located behind the drive front panel insert. See section 2
(Trouble Analysis) for operating instructions.

System Software

The drive may also be tested by use of system diagnostic test
programs. This requires use of the controller and the
appropriate software. In this type of testing, the drive
communicates with the controller as in normal online
operations, and special I/O connections are unnecessary.

Refer to manuals or other documentation applicable to the
specific system or subsystem for information concerning the
system software routines.

ACCESSING ASSEMBLIES FOR MAINTENANCE

The major drive assemblies and components are shown on figure
1-1. These parts are accessed by removing the drive drawer
from the tray, and then removing the top cover from the drive.

When extending the drawer, be careful that the equipment rack
remains stable. Also, ensure the system cabling is not damaged
when sliding the drawer in and out of the tray. When removing
the top cover, be careful not to damage the logic boards.

If it is necessary to remove a rack-mounted drive, see the
drive removal procedure in section 3. Use this procedure if
the drive was installed with the ruggedized mounting kit into a
standard rack. A standard mounting kit using the 2X drawer is
available as an alternative. See appendix A for information
about removing a rack-mounted drive installed with the standard
mounting kit.

Section 3 also contains a top cover removal procedure and
procedures for removing most of the other field-replaceable
parts, including the circuit boards.

The control board is located below the top cover as shown on
figure 1-1. The I/O board is located between the rear panel
and the module. The arm matrix board is located within the
module and cannot be serviced.

The power supply (see figure 1-1) can be attached to the drawer
(directly in front of the drive) or mounted in a remote
location, provided clearance for proper air flow is available.

When the power supply is mounted in the drawer (in line with
the drive), drive cooling is provided by the fan in the power
supply. When the power supply is mounted in a remote location,
adequate ventilation must be provided for the drive. One
option for this is a fan and bracket assembly that mounts to
the I/O panel. Other cooling methods are acceptable as long as
they satisfy the requirements specified for the drive.

The operator panel and status/control panel are options that
mount to the front panel. With either panel, the operator
switches and indicators are accessible through an opening in
the front panel insert. The status/control panel has a
maintenance keyboard and display in addition to the switches
and indicators found on the simpler operator panel. These
unique features of the status/control panel are accessed by
removing the front panel insert.

COOLING FAN ⚠1 ⚠2

POWER SUPPLY ⚠1 ⚠3

TOP COVER

⚠4 I/O BOARD

AC POWER
CABLE
(OR TWO-
CABLE SET)

MODULE

CONTROL BOARD

REAR PANEL ⚠4

I/O CABLE CONNECTORS ⚠4
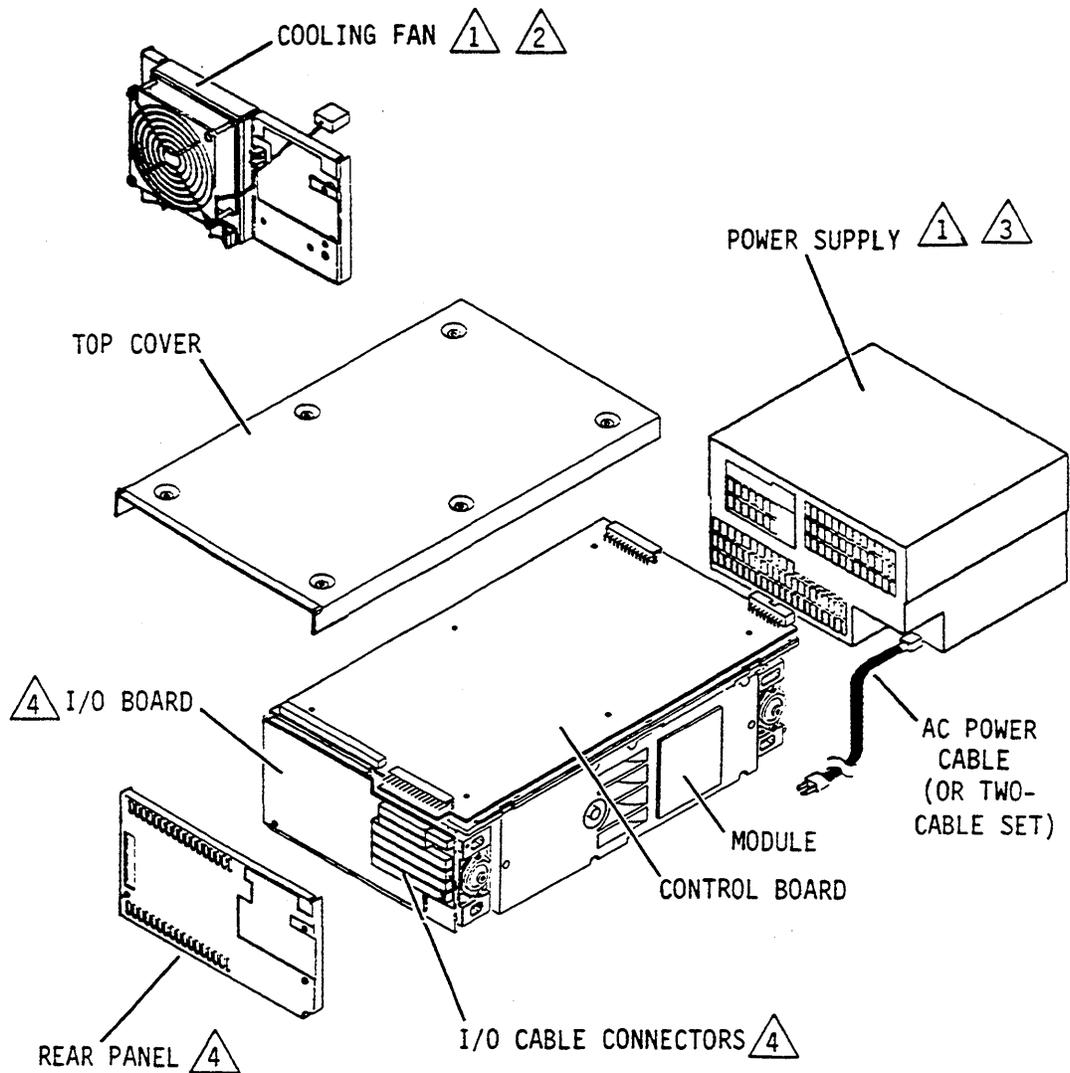
NOTES:

⚠1 OPTIONAL.

⚠2 MOUNTS TO I/O BOARD. USED WHEN POWER SUPPLY
IS MOUNTED IN REMOTE LOCATION.

⚠3 MOUNTED DIRECTLY IN FRONT OF DRIVE OR MOUNTED
IN REMOTE LOCATION.

⚠4 APPEARANCE VARIES DEPENDING ON TYPE OF I/O.

IIT32A

Figure 1-1.   Component Locator (Sheet 1 of 5)
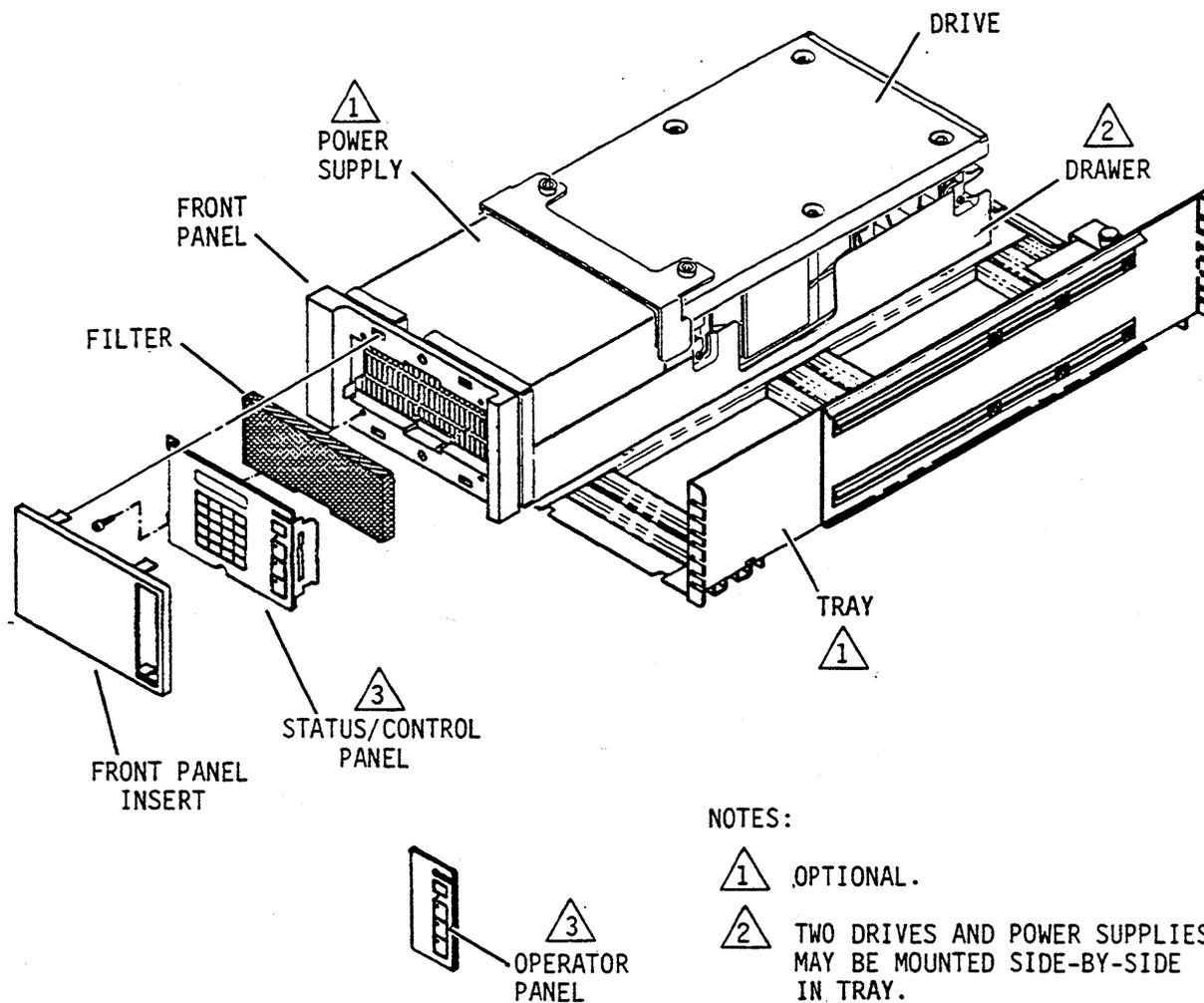
NOTES:

$\triangle{1}$ OPTIONAL.

$\triangle{2}$ TWO DRIVES AND POWER SUPPLIES MAY BE MOUNTED SIDE-BY-SIDE IN TRAY.

$\triangle{3}$ THE OPTIONAL OPERATOR PANEL OR STATUS/CONTROL PANEL MOUNTS BEHIND THE FRONT PANEL INSERT.

IIT33A

Figure 1-1. Component Locator (Sheet 2)
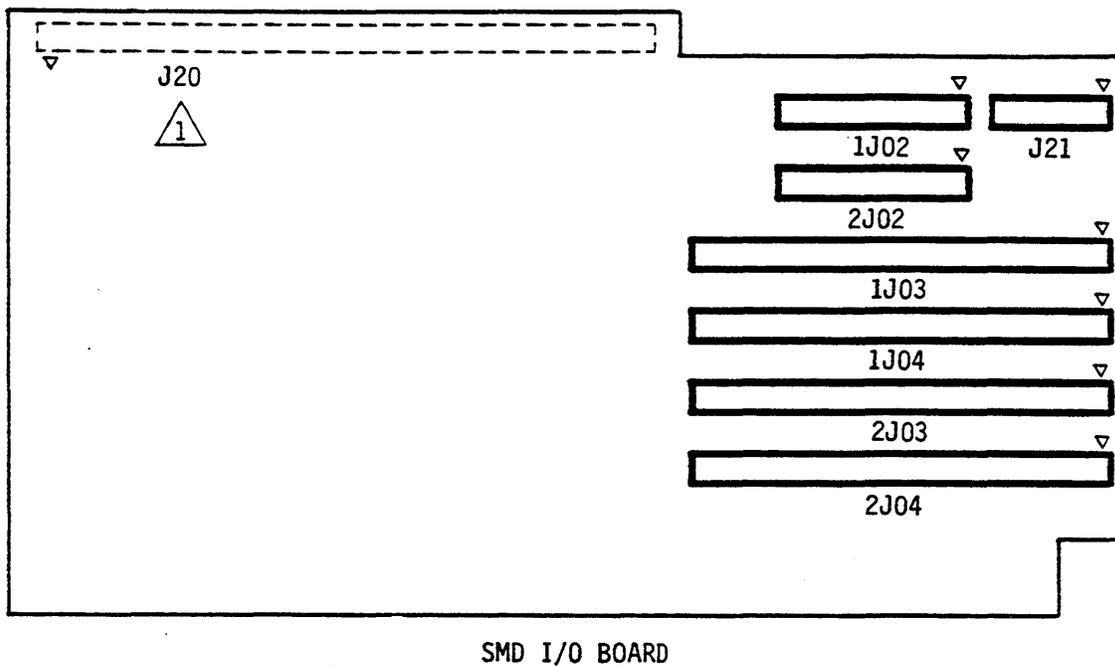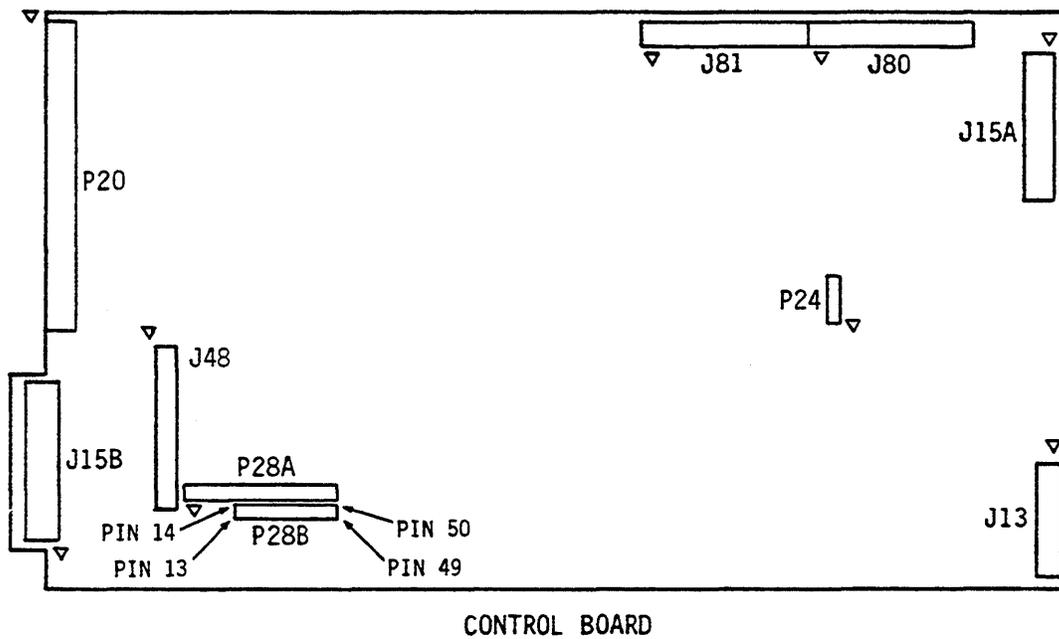
CONTROL BOARD

SMD I/O BOARD

NOTES:

⚠1 CONNECTS TO CONTROL BOARD

2. ▽ = LOCATION OF PIN 1

11T34 B

Figure 1-1. Component Locator (Sheet 3)
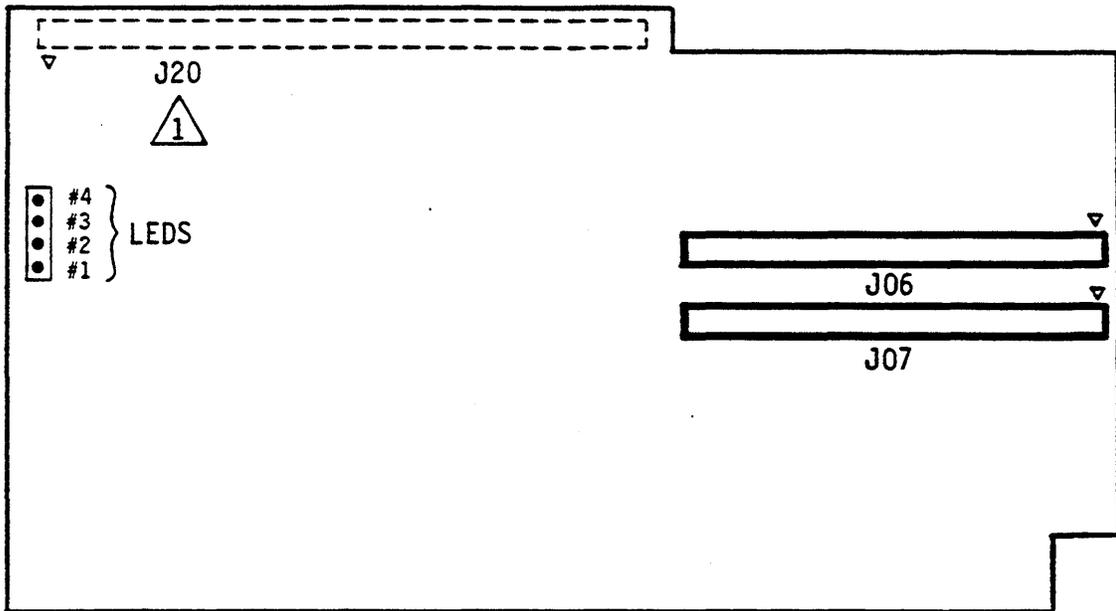
SCSI I/O BOARD
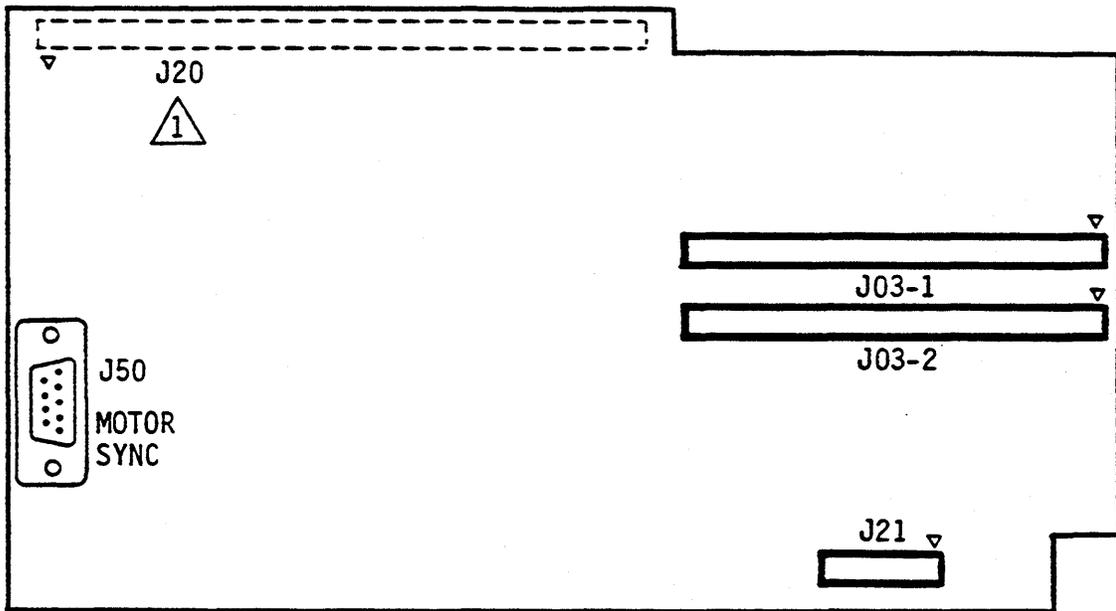
IPI I/O BOARD

NOTES:

⚠1 CONNECTS TO CONTROL BOARD

2. ▽ = LOCATION OF PIN 1

IIT112

Figure 1-1. Component Locator (Sheet 4)

STATUS/CONTROL PANEL
(OPTIONAL)
2
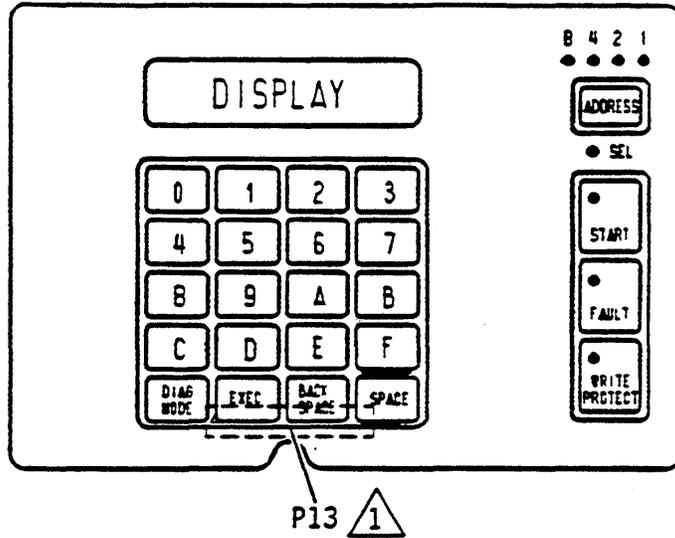
OPERATOR PANEL
(OPTIONAL)
2
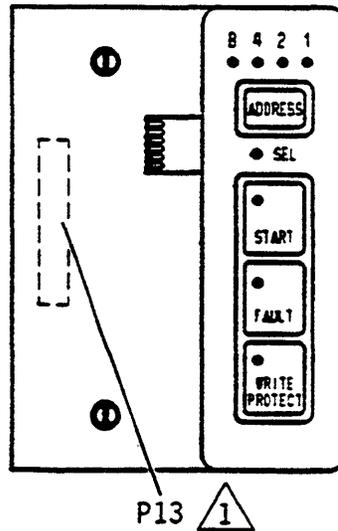
NOTES:

1 CONNECTS TO CONTROL BOARD

2 MOUNTS TO FRONT PANEL OR REMOTE LOCATION

11H87A

Figure 1-1. Component Locator (Sheet 5)

CAUTION

When servicing the drive, observe all
precautions listed under Electrostatic
Discharge Protection in section 1 of this
manual. Failure to observe these precautions
can result in serious damage to electronic
assemblies.

INTRODUCTION

The trouble analysis section contains information on isolating
and correcting problems causing improper drive operation.
Prior to performing troubleshooting, you should be thoroughly
familiar with drive operation, with all information in section
1, and with the safety information in the front of this manual.

Because of the many types of malfunctions that may occur, the
information in this section will not provide a solution to
every problem. The intention, therefore, is to solve common
problems and to provide a starting point for the rest. The
final recommendation in all cases is to call field support.

For trouble analysis, a status/control panel is needed. If the
drive installation does not include a status/control panel, we
advise that you connect one to the drive during troubleshooting.

When using the status/control panel for trouble analysis on
drives with the IPI interface, disable the I/O by setting the
port disable switches (DA - DB) on the I/O board to the On
(Closed) position. Failure to disable the I/O may prevent
completion of diagnostics initiated on the status/control
panel, and the LCD may go blank if the controller selects the
drive.

To avoid possible system problems on drives with the SCSI
interface, ensure there is no activity on the SCSI bus before
proceeding with offline diagnostic testing.

Trouble analysis information is divided as follows:

- Drive Power On Test -- describes drive self-tests that
  occur when dc power is applied to the drive and lists
  what corrective actions to take if a test failure occurs.

- Voltage Checks -- describes how to measure dc voltages supplied to the drive.

- Troubleshooting Procedures -- describes how to isolate and correct common drive problems. The procedures cover all the major areas of drive operation: power, servo, read and write.

- Diagnostic Testing -- describes how to use offline diagnostic testing to isolate drive malfunctions.

- Drive Status Codes -- provides information on correcting problems associated with drive power-up/power-down and with servo operations.

- Interface Testing -- describes self-tests by the I/O MPU (SCSI and IPI drives) and online diagnostics (all drives).

Many of the corrective actions in this section refer to procedures given in section 3, Repair and Replacement. All procedures are referred to by number. For example, a reference to procedure 3302 refers to 3302 - Control Board Removal & Replacement in section 3. The first digit (3) always indicates the section where the procedure is found.

DRIVE POWER ON TEST

When dc power is applied to the drive, the Control MPU performs a series of self-tests. During these tests the Address, Ready, FAULT, and WRITE PROTECT lights on the operator panel or status/ control panel will be lit. After approximately four seconds, the FAULT light will go off, indicating successful completion of the self-tests. If the Ready and FAULT lights remain on constantly, it indicates the drive failed the power on self-test. The Address lights will then indicate which self-test routine the drive failed to complete. Refer to table 2-1 to determine which test failed and what action to take.

In addition to the individual tests listed in table 2-1, the Control MPU attempts to communicate with the status/control panel. If this communication is unsuccessful, the Control MPU displays the message PANEL FAILURE on the LCD of the panel.

On drives with a SCSI or IPI interface, the I/O MPU begins a series of self-tests while the drive self-tests are running. Refer to Interface Testing at the end of this section for more information.

TABLE 2-1. POWER ON TEST FAILURE

Address Lights* 8 4 2 1				Hex Code	Test Failed** & Actions
●	●	●	●	F	**RAM Test** Action: 1. Replace control board.
●	●	●	o	E	**ROM Test** Action: 1. Replace control board.
●	●	o	●	D	**I/O Chip Test** Actions: 1. Replace I/O board. 2. Replace control board.
●	●	o	o	C	**Peripheral Chip (Test 1)** Action: 1. Replace control board.
●	o	●	●	B	**Peripheral Chip (Test 2)** Action: 1. Replace control board.

* Darkened circles indicate light is On.

**Ready and FAULT lights remain on constantly, indicating
  drive failed four second power on self test.

VOLTAGE CHECKS

The following procedure provides an overall check of the dc
voltages used by the drive. Table 2-2 shows the voltages
required by each drive component.

Prior to performing this procedure you should be thoroughly
familiar with drive operation; with all information in section
1, and with the safety information in the front of this manual.

CAUTION

Because some voltage measurements are on pins
adjacent to each other, it is possible to
touch both pins simultaneously, thus causing a
short circuit. A short circuit will cause
serious damage to drive electronic
assemblies. Therefore, use extreme caution
when performing the following steps.

1. Command continuous seeks between cylinder 0 and 256.

2. Connect voltmeter ground lead to J15-03 (chassis ground).

3. Measure between ground and the appropriate connection
    points to check the following voltages:

Voltage	Connection	Specification
+5 volts	J15-1	+4.85 to +5.25 volts
-5 volts	J15-5	-4.90 to -5.30 volts
-12 volts	J15-7	-11.4 to -12.6 volts
+24 volts	J15-12	+22.8 to +25.2 volts
+12 volts	J13-21	+11.80 to +12.20 volts
Ground	J15-3	

TABLE 2-2. DC VOLTAGE DISTRIBUTION

Component	Voltage				
	+5 V	-5 V	-12 V	+12 V	+24 V
Control Board	X	X	X	X	X
I/O Board	X	X			
Status/Control Panel	X	X		X	
Operator Panel	X	X		X	
Fan					X

TROUBLESHOOTING PROCEDURES

The troubleshooting procedures describe how to isolate and correct common drive problems. Figure 2-1 is an example of a troubleshooting procedure and explains the format. The following paragraphs explain how to use the troubleshooting procedures.

Before starting a procedure, ensure that all assumptions have been satisfied. The assumptions along with other advisory information are given in the introductory paragraph to the procedure and describe conditions that must exist for the procedure to be valid.

When the assumptions are satisfied, proceed to the first step of the procedure. After performing the action or answering the question, follow the line down to the next step. For a question, follow the line beneath the appropriate Y (yes) or N (no) response. Continue until a corrective action is reached.

After taking the first recommended action, retest the unit. If the test results do not change, try recommended action 2, and so on, being sure to retest after each action. The corrective actions which are easier to perform (checking a signal or changing a circuit board, for example) are listed before the more difficult tasks such as replacing the module. If the corrective actions do not solve the problem, call field support.

The procedures appear in the following order:

- TSP1 - Power Check: Isolates problems in the drive related to short circuits.

- TSP2 - Voltage Fault Check: Isolates problems in the drive related to dc power failures.

- TSP3 - First Seek Check: Provides possible causes for the drive failing to successfully complete a first seek.

- TSP4 - Seek Check: Provides possible causes for the drive failing to successfully complete a seek.

- TSP5 - Write Check: Provides information for isolating cause of write errors.

- TSP6 - Read Check: Provides information for isolating cause of read errors.

- TSP7 - Address Mark Check: Provides possible causes for read or write address mark problems.

INDICATES THAT THIS IS SHEET 1
OF TROUBLESHOOTING PROCEDURE 1
(TSP31-1). SHEET 2 WOULD BE TSP31-2

TITLE

ASSUMPTIONS AND/OR
ADVISORY INFORMATION

TSP31-1

TSP31 - Power Check

Refer to procedure C101 - Power System Checks for voltage
specifications.

STEP
NUMBER

001   Set START switch to Off and CB1 to On. ──── ACTION TO BE PERFORMED

002   Does CB1 trip? ──── FIRST TROUBLESHOOTING QUESTION
      N   Y

YES OR NO RESPONSE
FOR QUESTION BEING
ASKED

          1   Check site power to power supply.

          2   Replace power supply (proc 5204).   FIRST CORRECTIVE ACTION
                                                   TO BE PERFORMED IN RESPONSE
                                                   TO STEP 002

003   Do fans start?
      Y   N

UNDERLINE INDICATES
LAST CORRECTIVE
ACTION IN THIS   1   Check -24 volts at P38. If power is OK, replace
PARTICULAR SEQUENCE   fans (proc D201). Otherwise, check wiring.

                            2   Replace power supply (proc 5204).

004   Is - 24 volts OK?
      Y   N

                                                   INDICATES THAT PROCEDURE 5204
          1   Go to TSP33 - ± 24 Volt Load Check. PROVIDES INFORMATION ON POWER
                                                   SUPPLY REPLACEMENT
UNDERLINE ALSO
INDICATES THAT   005   Is +24 volts OK?
ONLY ONE ACTION   Y   N
IS TO BE PERFORMED
                             1   Go to TSP33 - +24 Volt Load Check.

006   Is +5 volts OK?
      Y   N

          1   Go to TSP32 - +5 Volt Load Check.

      2
      A

INDICATES THAT PROCEDURE IS
CONTINUED ON SHEET 2 COLUMN A

10R177

Figure 2-1. Example of Troubleshooting Procedure

TSP1 - Power Check

This procedure isolates problems in the drive or power supply
related to short circuits. Refer to the voltage checks
procedure (earlier in this section) for voltage specifications.

001   Apply ac power and set power supply On/Standby switch to
On (1).
      ↓

002   Does fan in power supply start?
      N   Y
      | ↓

003   No short circuit exists. Power check is OK.

004   Set power supply On/Standby switch to Standby and
remove ac power cord from site power source.
      ↓

005   Check for short circuits between the dc voltages and
to ground at the following locations:

            • +5 volts: J15-1
            • -5 volts: J15-5
            • -12 volts: J15-7
            • +24 volts: J15-12
            • Ground: J15-3

006   Ensure that voltage selection switch on power supply is
set correctly.
      ↓

007   Do any short circuits exist?
      Y   N
      | ↓

      | 1   Inspect dc power cable (P15) between power supply
      | and drive, for open ±5 volt sense lines
      | (J15-2, J15-4, J15-6).

      | 2   Replace power supply (proc 3204).

      2
      A

A
1
↓

008   Inspect dc power cable (P15) between power supply and drive. If cable is OK, disconnect dc power cable from drive and recheck for short circuits at J15 on control board.
↓

009   Do any short circuits exist?
     Y N
     | ↓
     | 1   Replace power supply (proc 3204).

010   Disconnect jumper cable from J13 (control board).
↓

011   Do any short circuits exist at J15 on control board?
     Y N
     | ↓
     | 1   Replace operator panel (proc 3203) or status/ control panel (proc 3202).

012   Remove I/O board (proc 3301).
↓

013   Do any short circuits exist?
     Y N
     | ↓
     | 1   Replace I/O board (proc 3301).

014   Remove control board (proc 3302).
↓

015   Do any short circuits exist at J15 on control board?
     N Y
     | ↓
     | 1   Replace control board (proc 3302).

016   1   Replace module (proc 3205).

TSP2 - Voltage Fault Check

This procedure isolates problems in the drive or power supply, related to dc power failures.

001   Apply ac power and set power supply On/Standby switch to On (1).
       ↓

002   Does a voltage fault exist? See status/control panel or check if J80-3 -(Voltage Fault) is active (low).
       Y   N
       | ↓
003 | No voltage fault exists. Voltage fault check is OK.
       ↓

004   Check dc voltages at the following locations. Refer to voltage checks procedure (earlier in this section) for voltage specifications.

       | ● +5 volts: J15-1
       | ● -5 volts: J15-5
       | ● -12 volts: J15-7
       | ● +12 volts: J13-21
       | ● Ground: J15-3
       ↓

005   Are dc voltages OK?
       N   Y
       | ↓
006 | Is voltage fault intermittent?
       | N   Y
       | | ↓
       | | 1   Replace control board (proc 3302).
       | ↓
       | 1   Replace I/O board (proc 3301).
       | ↓
       | 2   Replace control board (proc 3302).
       ↓

007   Is -12 volts OK?
       Y   N
       | ↓
008 | Set power supply On/Standby switch to Standby and disconnect ac power cord from site power source.
       | ↓
009 | Check J15-7 on dc power cable for continuity between power supply and drive.
       ↓   ↓
       2   2
       A   B

```
        A   B
        1   1
        |   |
                ↓
010     |   Is dc power cable OK?
        |   Y   N
        |       |
        |       ↓
        |       1    Replace dc power cable (P15).
        |
        |   1   Replace power supply (proc 3204).
        |   ↓
        |   2   Replace control board (proc 3302).
        ↓
011     Is +12 volts OK?
        Y   N
        |   |
        |   ↓
012     |   Is +24 volts OK?
        |   Y   N
        |       |
        |       ↓
013     |   Set power supply On/Standby switch to Standby
        |   and disconnect ac power cord from site power.
        |       ↓
014     |   Check J15-10 and 12 on dc power cable for
        |   continuity between power supply and drive.
        |       ↓
015     |   Is dc power cable OK?
        |   Y   N
        |   |   ↓
        |   |   1    Replace dc power cable (P15).
        |   |
        |   1   Replace power supply (proc 3204).
        |   ↓
        |   2   Replace control board (proc 3302).
        |   ↓
        |   3   Replace module (proc 3205).
        |
016     |   Disconnect jumper cable from J13 (control board).
        |       ↓
017     |   Is +12 volts OK?
        |   N   Y
        |   |   ↓
        |   |   1    Replace operator panel (proc 3203) or
        |   |        status/control panel (proc 3202).
        |   ↓
        |   1   Replace control board (proc 3302).
        ↓
        3
        A
```

TSP2-3

```
        A
        2
        |
        ↓
018     Is -5 volts OK?
        Y   N
        |   |
        |   ↓
019     |   Set power supply On/Standby switch to Standby and
        |   disconnect ac power cord from site power source.
        |   |
        |   ↓
020     |   Check J15-5 and 6 on dc power cable for continuity
        |   between power supply and drive.
        |   |
        |   ↓
021     |   Is dc power cable OK?
        |   Y   N
        |   |   |
        |   |   ↓
        |   |   1    Replace dc power cable (P15).
        |   |
        |   ↓
        |   1   Replace power supply (proc 3204).
        |   |
        |   ↓
        |   2   Replace I/O board (proc 3301).
        |   |
        |   ↓
        |   3   Replace control board (proc 3302).
        |
        ↓
022     Is +5 volts OK?
        Y   N
        |   |
        |   ↓
023     |   Set power supply On/Standby switch to Standby and
        |   disconnect ac power cord from site power.
        |   |
        |   ↓
024     |   Check J15-1 and 2 on dc power cable for continuity
        |   between power supply and drive.
        |   |
        |   ↓
025     |   Is dc power cable OK?
        |   Y   N
        |   |   |
        |   |   ↓
        |   |   1    Replace dc power cable (P15).
        |   |
        |   ↓
026     |   Disconnect jumper cable from J13 (control board).
        |   |
        ↓   ↓
        4   4
        A   B
```

```
        A   B
        3   3
            |
            ↓
027     |   Is +5 volts OK?
        |   N   Y
        |   |   ↓
        |   |   1   Replace operator panel (proc 3203) or
        |   |       status/control panel (proc 3202)
        |   |
        |   ↓
        |   1   Replace power supply (proc 3204).
        |   ↓
        |   2   Replace I/O board (proc 3301).
        |   ↓
        |   3   Replace control board (proc 3302).
        |   ↓
        |   4   Replace module (proc 3205).
        |
        ↓
028     Voltage Fault Check is OK.  If problem persists, call
        field support.
```

TSP3 - First Seek Check

This test assumes that the status/control panel is connected to the drive.

001   Initiate first seek as follows:

          a.   <u>For drives with SMD or IPI interface</u>, set Remote/Local switch to Local.

          b.   Apply power to drive.

          c.   Press START switch on status/control panel. Observe rapid blinking of Ready indicator (indicating spindle power up is in progress).

002   Does Ready indicator light steadily?
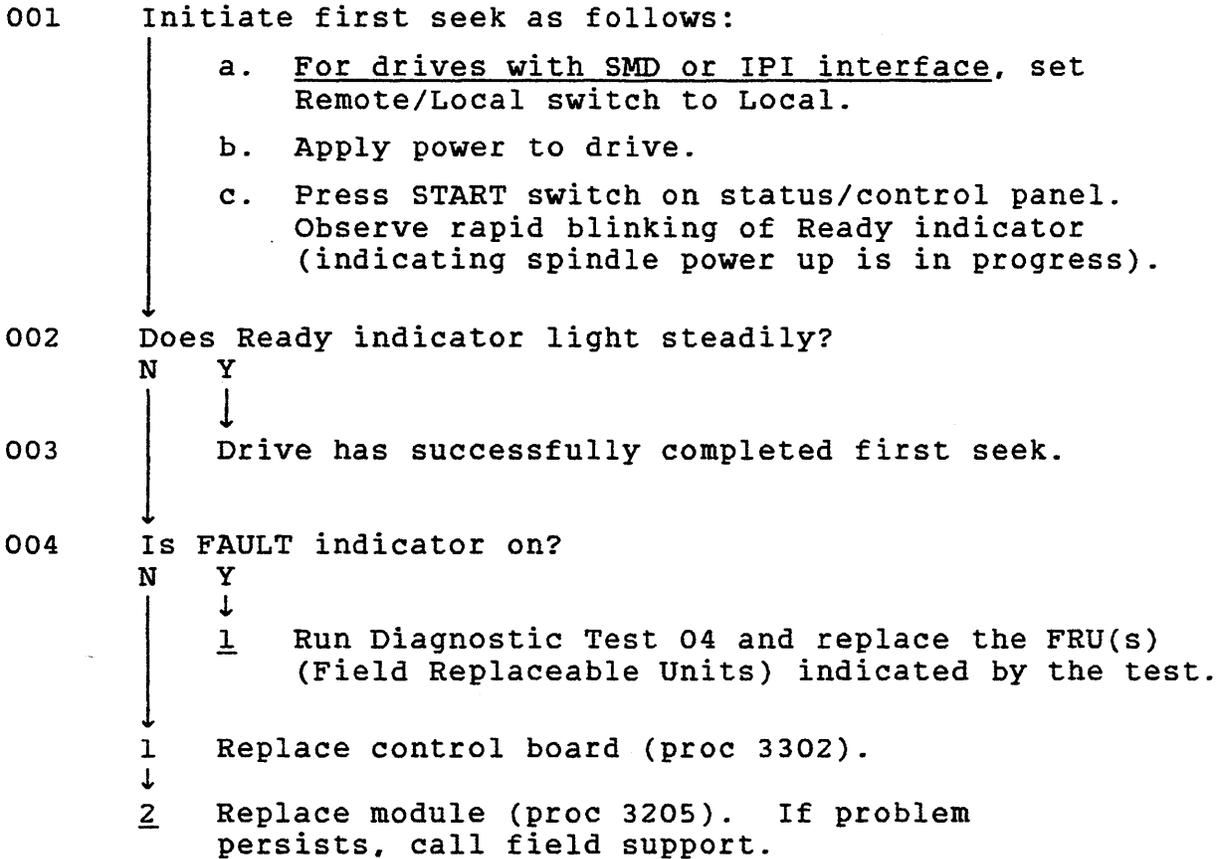   N   Y

003   Drive has successfully completed first seek.

004   Is FAULT indicator on?
         N   Y

             <u>1</u>   Run Diagnostic Test 04 and replace the FRU(s) (Field Replaceable Units) indicated by the test.

        1   Replace control board (proc 3302).

        <u>2</u>   Replace module (proc 3205). If problem persists, call field support.

TSP4 - Seek Check

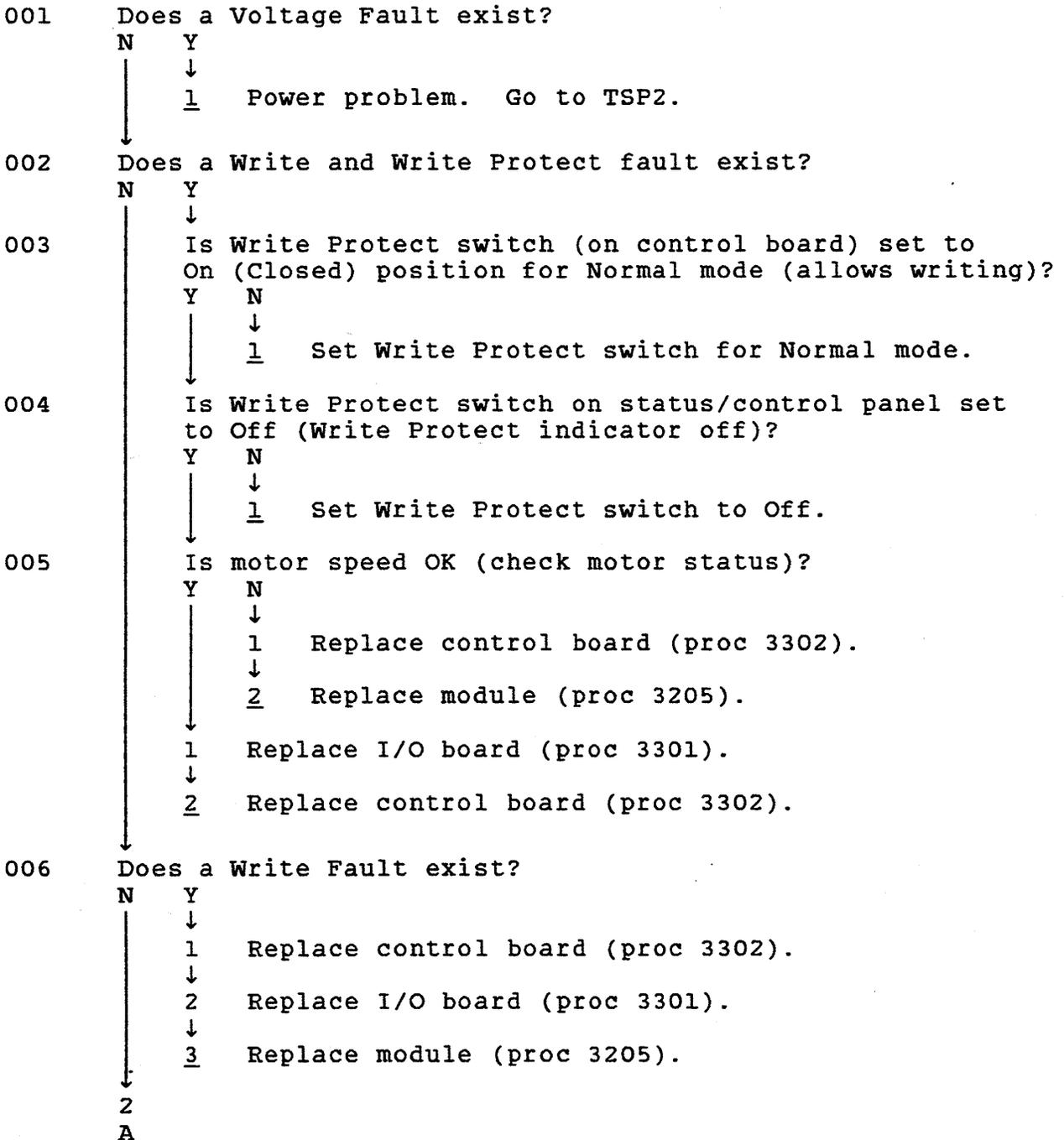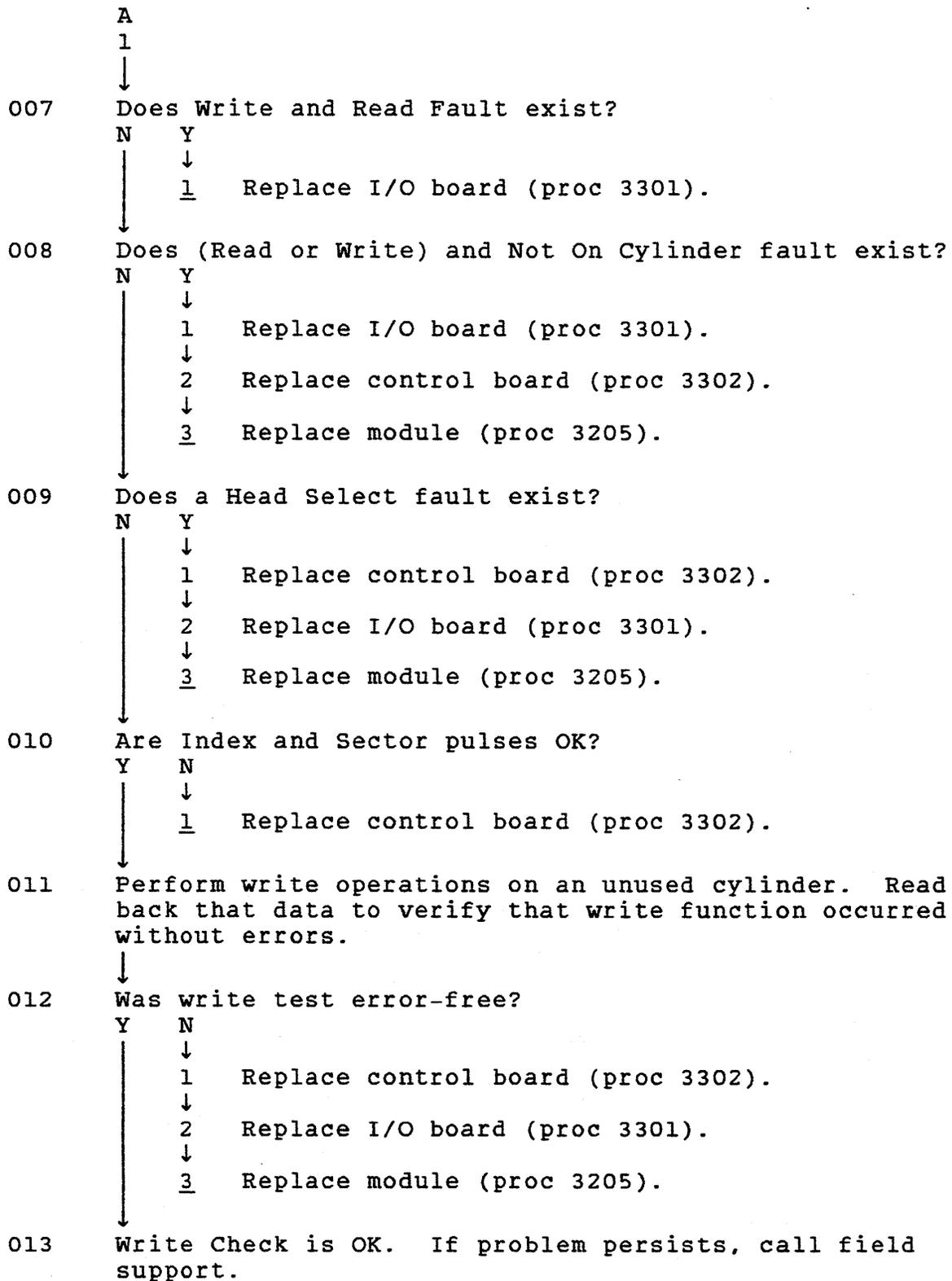This test assumes that the following conditions exist: (1) drive is operating under control of a PFTU (or system software if a PFTU is unavailable) and (2) first seek was successfully completed.

```
001     Is FAULT indicator lit?
        N   Y
        |   |
002     |   Run Diagnostic Test 04 and replace the FRU(s)
        |   (Field Replaceable Units) indicated by the test.
        |
003     Is Seek Error active?
        N   Y
        |   |
        |   1   Replace control board (proc 3302).
        |   |
        |   2   Replace module (proc 3205).
        |   |
        |   3   Replace I/O board (proc 3301).
        |   |
        |   4   If problem persists, call field support.
        |
004     Seek Check is OK.
```
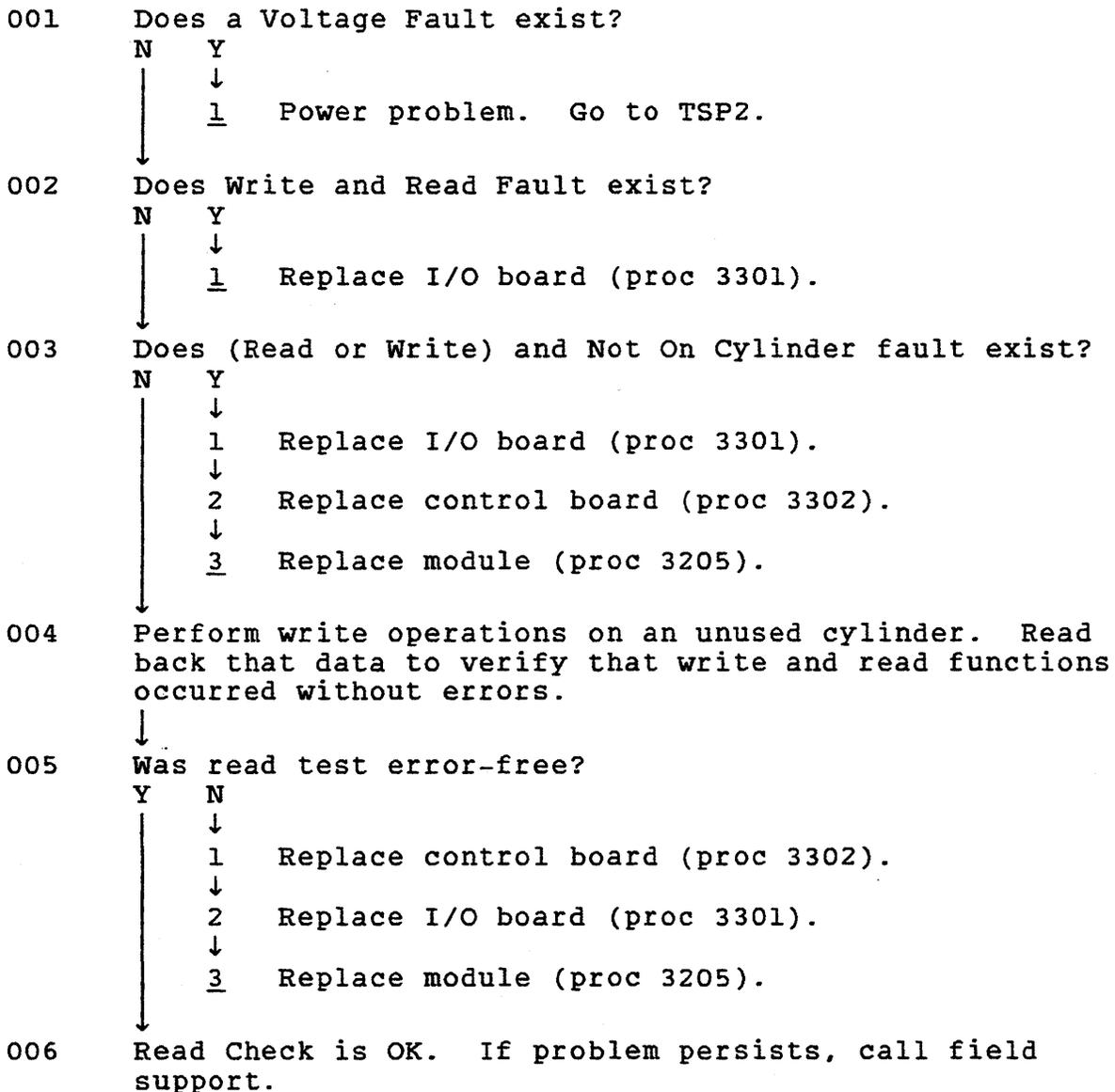
TSP5 - Write Check

This check assumes that the drive is performing write or write
format operations under control of a PFTU (or system software if
a PFTU is unavailable). If a fault occurs during testing,
observe the status display window (on status/control panel) for
type of fault present.


```
001     Does a Voltage Fault exist?
        N   Y
        |   ↓
        |   1    Power problem.  Go to TSP2.
        |
        ↓
002     Does a Write and Write Protect fault exist?
        N   Y
        |   ↓
003     |   Is Write Protect switch (on control board) set to
        |   On (Closed) position for Normal mode (allows writing)?
        |   Y   N
        |   |   ↓
        |   |   1    Set Write Protect switch for Normal mode.
        |   |
        |   ↓
004     |   Is Write Protect switch on status/control panel set
        |   to Off (Write Protect indicator off)?
        |   Y   N
        |   |   ↓
        |   |   1    Set Write Protect switch to Off.
        |   |
        |   ↓
005     |   Is motor speed OK (check motor status)?
        |   Y   N
        |   |   ↓
        |   |   1    Replace control board (proc 3302).
        |   |   ↓
        |   |   2    Replace module (proc 3205).
        |   |
        |   ↓
        |   1    Replace I/O board (proc 3301).
        |   ↓
        |   2    Replace control board (proc 3302).
        |
        ↓
006     Does a Write Fault exist?
        N   Y
        |   ↓
        |   1    Replace control board (proc 3302).
        |   ↓
        |   2    Replace I/O board (proc 3301).
        |   ↓
        |   3    Replace module (proc 3205).
        |
        ↓
        2
        A
```

```
        A
        1
        ↓
007     Does Write and Read Fault exist?
        N   Y
        |   ↓
        |   1   Replace I/O board (proc 3301).
        |
        ↓
008     Does (Read or Write) and Not On Cylinder fault exist?
        N   Y
        |   ↓
        |   1   Replace I/O board (proc 3301).
        |   ↓
        |   2   Replace control board (proc 3302).
        |   ↓
        |   3   Replace module (proc 3205).
        |
        ↓
009     Does a Head Select fault exist?
        N   Y
        |   ↓
        |   1   Replace control board (proc 3302).
        |   ↓
        |   2   Replace I/O board (proc 3301).
        |   ↓
        |   3   Replace module (proc 3205).
        |
        ↓
010     Are Index and Sector pulses OK?
        Y   N
        |   ↓
        |   1   Replace control board (proc 3302).
        |
        ↓
011     Perform write operations on an unused cylinder.  Read
        back that data to verify that write function occurred
        without errors.
        ↓
012     Was write test error-free?
        Y   N
        |   ↓
        |   1   Replace control board (proc 3302).
        |   ↓
        |   2   Replace I/O board (proc 3301).
        |   ↓
        |   3   Replace module (proc 3205).
        |
        ↓
013     Write Check is OK.  If problem persists, call field
        support.
```

TSP6 - Read Check

This check assumes that the drive is performing read operations under control of a PFTU (or system software if a PFTU is unavailable). If a fault occurs during testing, observe the status display window (on status/control panel) for type of fault present.

```
001     Does a Voltage Fault exist?
        N   Y
        |   ↓
        |   1    Power problem.  Go to TSP2.
        |
        ↓
002     Does Write and Read Fault exist?
        N   Y
        |   ↓
        |   1    Replace I/O board (proc 3301).
        |
        ↓
003     Does (Read or Write) and Not On Cylinder fault exist?
        N   Y
        |   ↓
        |   1    Replace I/O board (proc 3301).
        |   ↓
        |   2    Replace control board (proc 3302).
        |   ↓
        |   3    Replace module (proc 3205).
        |
        ↓
004     Perform write operations on an unused cylinder.  Read
        back that data to verify that write and read functions
        occurred without errors.
        |
        ↓
005     Was read test error-free?
        Y   N
        |   ↓
        |   1    Replace control board (proc 3302).
        |   ↓
        |   2    Replace I/O board (proc 3301).
        |   ↓
        |   3    Replace module (proc 3205).
        |
        ↓
006     Read Check is OK.  If problem persists, call field
        support.
```

TROUBLE ANALYSIS

TSP7 - Address Mark Check

The following check assumes that the drive is under control of a
PFTU (or system software if a PFTU is unavailable).

001   Perform write format operations in address mark mode on
        an unused cylinder. Read back that data to verify that
        write and read functions occurred without errors in
        address mark mode.
        ↓
002   Is address mark mode functional?
        Y   N
        │   ↓
        │   1   Replace I/O board (proc 3301).
        │   ↓
        │   2   Replace control board (proc 3302).
        ↓
003   Read AM Check OK. If problem persists, call field support.

DIAGNOSTIC TESTING

General

The drive's offline diagnostics are initiated and monitored via the keyboard and LCD of the status/control panel (see figure 2-2). Table 2-3 describes the function of the switches and indicators.

In addition to offline diagnostic tests, the drives can perform online testing at the request of the system. Each interface defines a unique set of diagnostic commands and drive responses. For more information about online testing, refer to Interface Testing at the end of this section.
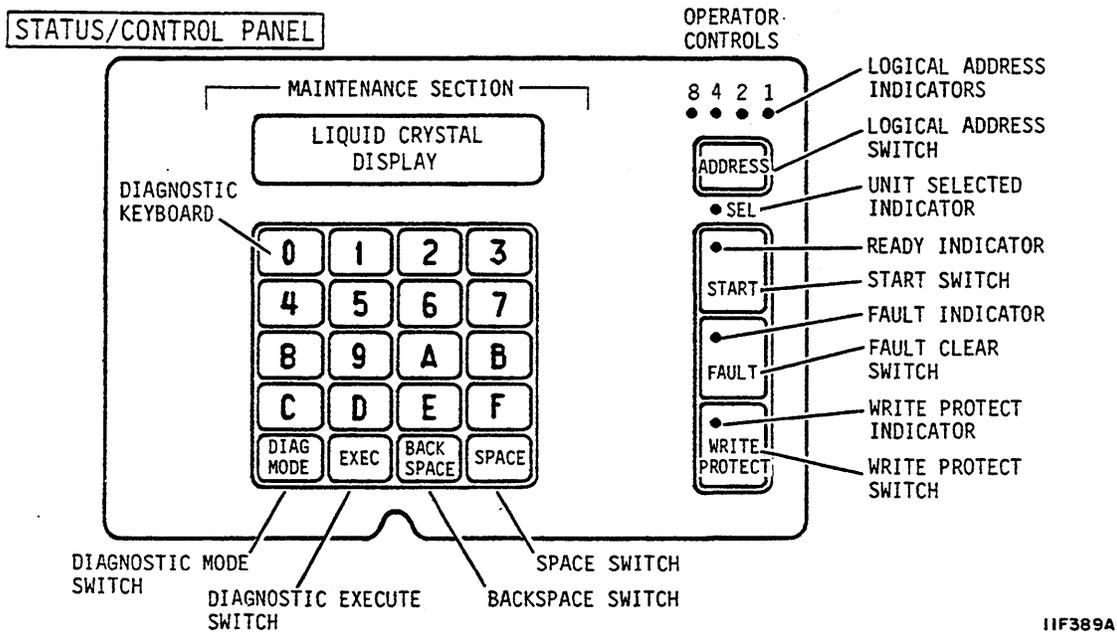
Figure 2-2. Switches and Indicators

TABLE 2-3. SWITCH/INDICATOR DESCRIPTIONS

Description	Function
Diagnostic Keyboard	Used to enter diagnostic tests and parameters.
Liquid Crystal Display	Displays drive status, faults, and current cylinder address.
DIAG MODE (Diagnostic Mode) Switch	Places drive in diagnostic mode and disables the I/O.
SPACE and BACK SPACE Switches	Used to enter the desired diagnostic tests.
EXEC (Execute) Switch	Starts and stops diagnostic tests.

Test Selection Procedure

To run offline diagnostic tests on the drive, place the drive
in diagnostic mode and select the tests desired. To do this:

1. On IPI interface drives, disable the I/O by setting the
    port disable switches (DA – DB) on the I/O board to the
    On (Closed) position. Failure to disable the I/O may
    prevent completion of diagnostics initiated on the
    status/control panel, and the LCD may go blank if the
    controller selects the drive.

2. On SCSI interface drives, to avoid possible system
    problems, ensure there is not activity on the SCSI bus
    before proceeding with offline diagnostic testing.

3. Press the DIAG MODE switch to enter diagnostic mode and
    observe that the LCD reads DIAG TEST XX.

4. Enter two hexadecimal characters on the keyboard and
    press EXEC switch to select the first test.

Directions for running the individual diagnostic tests appear
later in this section. When the EXEC switch is pressed one
more time, the test ends and the LCD again reads DIAG TEST XX.
At this point you have two choices:

*   Enter two hexadecimal characters on the keyboard and
    press EXEC switch to select another test, or

*   Press the DIAG MODE switch to exit diagnostic mode and
    observe that the LCD displays drive operating status.
    On IPI interface drives, reenable the I/O by setting the
    port disable switches (DA – DB) on the I/O board to the
    Off (Open) position. On SCSI interface drives, bus
    activity can resume.

Test Descriptions

The individual offline diagnostic tests are listed in table 2-4 and are described in the following topics.

Do not attempt to enter any test numbers that are not listed in table 2-4. Doing so will result in invalid test information. The drive will not run tests that produce seeks (05, 08, 09, or OE) unless the spindle motor is up to speed and the heads are loaded. The following LCD displays indicate why seek tests will not run:

- SPEED NOT OK -- the spindle was not up to speed when the test was executed.

- ACT PARKED -- the carriage was parked and locked when the test was executed.

If you connected a status/control panel to the drive temporarily to do troubleshooting, run Tests 06 and 07 before you continue with other tests. When powered off, the panel stores its status log and fault log in a nonvolatile RAM. When the panel is powered on initially, these logs may reflect operation of the panel with a different drive.

TABLE 2-4. SUMMARY OF DIAGNOSTIC TESTS

Test Number	Title
00	Display Drive Operating Status Log
01	Display Fault Log
04	Calculate Three Most Likely Field Replaceable Units
05	Servo Test
06	Clear Drive Operating Status Log
07	Clear Fault Log
08	Direct Or Continuous Seeks
09	Random Seek
OC	Display EPROM Part Number
OE	Return To Zero
12	Sequential One-Track Seeks
2F	I/O Test (SCSI Interface Drives Only)

Test 00 -- Display Drive Operating Status Log

NOTE

If you connected status/control panel to drive
for troubleshooting, run Test 05 initially to
clear invalid data from status log and to
introduce new data to the log. Continue with
Test 00.

This test displays the 8 most recently generated drive status
codes. After test selection, the display provides a
hexadecimal status code from the internal log. This code is
preceded by a character (0-7) and a colon, indicating the
position of the status code in the status log. To execute test
00, perform the following steps:

1. Enter Test 00, then press EXEC switch. The LCD will
    display DRIVE LOG: 0:XX where the number 0 indicates the
    position in the log and XX represents the status code
    entered in that position.

2. Press SPACE switch repeatedly until you see a code
    preceded by an asterisk (for example, DRIVE LOG: *5:XX).
    The asterisk identifies that code as the most recent
    entry in the status log.

3. Use the SPACE switch to step through from the 8th most
    recent to the most recent status.

4. Press EXEC switch to end the test and return to test
    selection.

Test 01 -- Display Fault Log

NOTE

If you connected status/control panel to drive
for troubleshooting, run Test 05 initially to
clear invalid data from fault log and to
introduce new data to the log. Continue with
Test 01.

This test displays the 8 most recently stored fault codes.
After test selection, a hexadecimal fault code will be
displayed. This code is preceded by a character (0-7) and a
colon, indicating the position of the fault code in the fault
log. To execute test 01, perform the following steps:

1. Enter Test 01, then press EXEC switch. The LCD will
    display FAULT LOG: 0:XX where the number 0 indicates the
    position in the log and XX represents the fault code
    entered in that position.

2. Press SPACE switch repeatedly until you see a code
    preceded by an asterisk (for example, FAULT LOG: *5:XX).
    The asterisk identifies that code as the most recent
    entry in the fault log.

3. Use the SPACE switch to step through from the 8th most
    recent to the most recent fault.

4. If more than one fault occurs simultaneously (multiple
    faults), more than one bit in the fault code will be set.
    Check the bit-mapped locations of each fault by referring
    to the following list:

Bit		Definition
0	(LSB)	Read●Write Fault (01)
1		(Read+Write)●Off Cylinder Fault (02)
2		First Seek Fault (04)
3		Write Fault (08)
4		Write●Write Protected Fault (10)
5		Head Select Fault (20)
6		Voltage Fault (40)
7	(MSB)	Not Used (80)

5. Press EXEC switch to end the test and return to test
    selection.

Test 04 – Calculate Three Most Likely Field Replaceable Units

                              NOTE

        If you connected status/control panel to drive
        for troubleshooting, run Test 05 initially to
        clear invalid data from status and fault logs
        and to introduce new data to the logs.
        Continue with Test 04.

        If the status/control panel is part of drive
        installation, do not execute Tests 05, 06, or
        07 prior to running Test 04.

This test uses the fault status and the drive operating status
history (Tests 00 and 01) to predict the most likely cause of
drive failure. Table 2-5 lists the individual codes and their
corresponding replacement part. To execute Test 04, perform
the following steps:

1. Enter Test 04, then press EXEC switch. The LCD will
   display FRUS: XX XX XX. Upon test completion, the three
   field replaceable units will be displayed, with the first
   hex code being the most likely cause of the failure.

2. Press EXEC switch to end the test and return to test
   selection.

             TABLE 2-5. CODING OF FIELD REPLACEABLE UNITS

Hex Display	Field Replaceable Unit
01	Control Board
02	Module
03	Power Supply
04	I/O Board

Test 05 -- Servo Test

This test clears both the drive status log and fault log.
Because Test 04 relies on status history that would be cleared
by Test 05, you might want to run Test 04 before running Test
05. Test 05 automatically performs several types of seek
operations. They are as follows:

Operation	Number Of Times Executed
RTZ	1
1 Track Seek	16
RTZ	1
Partial Servo Recalibrate	1
RTZ	1
Maximum Length Seek	16
RTZ	1

Execution stops when an error is detected or the test
completes. To execute Test 05, perform the following steps:

1. Enter Test 05, then press EXEC switch. Upon successful
   completion of the test, the LCD will display OK, CYL:
   000. If an error occurs, the LCD will display
   SERVO ERROR: XX. Drive status codes (servo errors) are
   defined in table 2-6 later in this section.

2. Press EXEC switch to end the test and return to test
   selection.

Test 06 -- Clear Drive Operating Status Log

This test clears the drive status log resident in program RAM.
Because Test 04 relies on status history that would be cleared
by Test 06, you might want to run Test 04 before running Test
06. To execute Test 06, perform the following steps:

1. Enter Test 06 and press EXEC switch. The LCD will
   display DRIVE LOG CLEAR.

2. Press EXEC switch to end the test and return to test
   selection.

Test 07 -- Clear Fault Log

This test clears the fault log. Because Test 04 relies on
status history that would be cleared by Test 07, you might want
to run Test 04 before running Test 07. To execute Test 07,
perform the following steps:

1. Enter Test 07 and press EXEC switch. The LCD will
   display FAULT LOG CLEAR.

2. Press EXEC switch to end the test and return to test
   selection.

Test 08 -- Direct or Continuous Seeks

This test performs direct or continuous seeks between cylinder
0 and the desired cylinder address. Operation stops if an
error occurs or if the EXEC switch is pressed. To execute Test
08, perform the following steps:

1. Enter Test 08 and press EXEC switch.

2. The display HEX CYL XXX asks you to supply a valid
   destination address (between 0 and A32 inclusive on
   2.038, 2.272 and 2.500 GB drives; between 0 and A5E
   inclusive on 3.037, 3.050, and 3.220 GB drives). Enter
   three characters and press SPACE switch. If you enter a
   destination address identical to the current address (a
   zero-track seek), Test 08 will not run and drive status
   code 61 will be displayed.

3. The display DIR OR CONT? D/C asks you to select either
   DIRect (D) or CONTinuous (C) seeks. Enter either C or D
   to start test.

4. If D was entered and the direct seek was successful, the
   LCD will display OK, CYL: XXX, where XXX is the
   destination address previously entered. Press EXEC
   switch to end the test and return to test selection.

5. If either D or C was entered and an error occurs, the LCD
   will display SERVO ERROR: XX. Drive status codes (servo
   errors) are defined in table 2-6 later in this section.
   By running Test 05 or Test 0E, you can clear the seek
   error.

6. If C was entered, press EXEC switch to end the test and
   return to test selection.

Test 09 -- Random Seek

This test performs random seeks between cylinder 0 and the maximum cylinder address (0-2610 on 2.038, 2.272, and 2.500 GB drives; 0-2654 on 3.037, 3.050, and 3.220 GB drives). Operation stops if an error occurs or if the EXEC switch is pressed. To execute Test 09, perform the following steps:

1. Enter Test 09 and press EXEC switch.

2. The LCD will display OK, CYL: XXX if execution was successful.

3. If an error occurs during the test, the LCD will display SERVO ERROR: XX. Drive status codes (servo errors) are defined in table 2-6 later in this section.

4. Press EXEC switch to end the test and return to test selection.

Test 0C -- Display EPROM Part Number

This test displays the 8-digit part number of the control microprocessor EPROM. To execute Test 0C, perform the following steps:

1. Enter Test 0C and press EXEC switch. The LCD will display the 8-digit part number of the EPROM (for example, EPROM# = 12345678).

2. Press EXEC switch to end the test and return to test selection.

Test 0E -- Return to Zero

This test initiates a return to zero command. To execute Test 0E, perform the following steps:

1. Enter Test 0E and press EXEC switch. The LCD will display OK, CYL: 000.

2. If an error occurs during the test, the LCD will display SERVO ERROR: XX. Drive status codes (servo errors) are defined in table 2-6 later in this section.

3. Press EXEC switch to end the test and return to test selection.

Test 12 – Sequential One-Track Seeks

This test performs sequential one-track seeks starting at cylinder 0 and moving inward toward the maximum cylinder address. When the maximum cylinder is reached, a sequence of one-track seeks is performed toward cylinder 0, and the process repeats. The test ends if an error occurs or if the EXEC switch is pressed. Perform the following steps to run Test 12:

1. Enter Test 12 and press EXEC switch.

2. The LCD will display OK, CYL: XXX if execution was successful.

3. If an error occurs during the test, the LCD will display SERVO ERROR: XX. Drive status codes (servo errors) are defined in table 2-6 later in this section.

4. Press EXEC switch to end the test and return to test selection.

Test 2F – I/O Test

This test causes the I/O MPU to run a self-test of the I/O circuitry (in SCSI interface drives only). To execute Test 2F, perform the following steps:

1. Enter Test 2F and press EXEC switch.

2. If an error occurs during the test, the LCD will display SCSI CM:2F ST:28.

3. If the test runs error-free, the LCD will display SCSI CM:2F ST:18.

4. Press EXEC switch to end the test and return to test selection.

DRIVE STATUS CODES

Whenever the drive is in a power on condition (dc power active), the Control MPU is periodically checking the operation of the drive and generating appropriate operating status codes. These status codes are displayed on the status/control panel (if present) and can be reported to the system in response to an interface command. Refer to Interface Testing at the end of this section for more information about status reporting to the controller or host.

If a status/control panel is attached to the drive, the codes can be visually monitored by removing the drive front panel insert. Table 2-6 lists the status codes and a definition of each code. If a drive malfunction occurs, observe the error code and perform Diagnostic Test 04 to calculate the action to be taken.

Figure 2-3 shows an example of the LCD during normal operation and when a fault occurs. During normal operation, the LCD displays current drive status, current cylinder address, and (except for IPI interface drives) which drive channel is selected and/or reserved. If a fault occurs, the LCD displays the type of fault(s) that occurred along with the current drive status. If more than one fault occurred, use the SPACE switch to step through the fault log to determine what faults are present.

Pressing the Fault Clear switch on the status/control panel clears the LCD fault display and the FAULT indicator, provided that the fault condition is no longer present. However, a Fault Clear signal from the controller clears only the FAULT indicator.

NORMAL OPERATION

CURRENT DRIVE
CYLINDER ADDRESS

DRIVE STATUS: 🔲 🔲

CYL: 🔲 🔲 🔲 S:1 R:1

INDICATES WHICH CHANNEL
IS SELECTED AND/OR
RESERVED

INDICATES CURRENT
DRIVE STATUS

FAULT CONDITION

DRIVE STATUS: 🔲 🔲

FAULT(S)   RD•WRT

INDICATES TYPE OF
FAULT THAT OCCURRED

INDICATES THAT MORE THAN ONE
FAULT OCCURRED. STEP THROUGH
FAULT LOG, USING SPACE SWITCH.
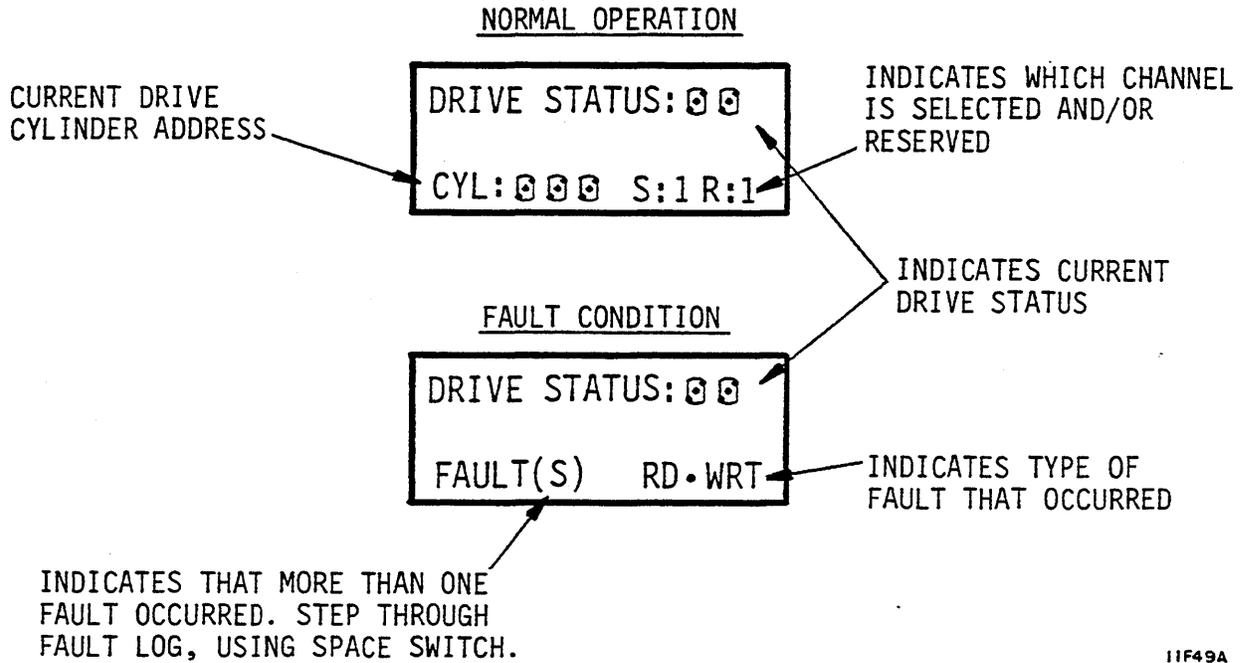
11F49A

Figure 2-3. Example of LCD (Liquid Crystal Display)

TABLE 2-6. DRIVE STATUS CODES

Code	Title	Description
NORMAL OPERATION CODES		
00	Ready	The drive is on cylinder and ready to perform normal operations.
02	Motor Stopping	The motor is coasting down, or motor braking is in progress.
03	Motor Stopped	The spindle motor is stopped. The status remains at 03 until start conditions are available.

—————— Continued ——————

TABLE 2-6.   DRIVE STATUS CODES (Contd)

Code	Title	Description
NORMAL OPERATION CODES (Contd)		
04	Load/Cal in Progress	The heads are moved from the landing zone to the data tracks, the first RTZ is performed, and a servo calibration (self-test) is completed.
05	Power Sequence in Progress	For SMD and IPI interface drives, displayed in Remote mode during the power on sequence delay. The length of delay is the logical address number multiplied by 5 seconds. After the delay, the status changes to 07. For SCSI interface drives, this status code never appears because the drive address is always set to zero.
06	START Switch Pressed and Waiting for Power Sequence Signals	The Control MPU sets this status code to indicate that the START switch was pressed and that the drive is waiting for power sequence signals from the controller. For SMD and IPI interface drives, this code appears in Remote mode and precedes the sequence delay. For SCSI interface drives, this code follows a timeout in the controller circuitry.
07	Starting Motor	All start conditions (codes 05 and 06) have been satisfied. The status remains at 07 until the motor reaches full speed.

——————— Continued ———————

TABLE 2-6.   DRIVE STATUS CODES (Contd)

Code	Title	Description
NORMAL OPERATION CODES (Contd)		
08	Motor Up to Speed	The motor is up to full speed.
09	I/O Self-Test Passed (SCSI and IPI Drives)	The I/O MPU successfully executed its power on initialization self-test.
0A	Drive in Sweep Segment	The drive is executing a series of seeks for a sweep cycle. On Cylinder and Seek End are inactive at this time.
0B	Heads Left on Last Cylinder of Sweep	Current head position determined by last sweep cycle -- not by a controller-requested seek. On Cylinder and Seek End are inactive at this time.
10	Ready & Spindle in Sync	The drive is on cylinder, its spindle is synchronized, and it is ready to perform normal operations.
14	Load/Cal in Progress & Spindle in Sync	The heads are moved from the landing zone to the data tracks, the spindle is synchronized, the first RTZ is performed, and a servo calibration (self-test) is initiated.
18	Motor Up to Speed & Spindle in Sync	The motor is up to full speed and the spindle is synchronized.
19	I/O Self-Test Passed & Spindle in Sync (SCSI and IPI Drives)	The I/O MPU successfully executed its power on initialization self-test and the spindle is synchronized.
1A	Drive in Sweep Segment & Spindle in Sync	The drive is executing a series of seeks for a sweep cycle with the spindle synchronized. On Cylinder and Seek End are inactive at this time.

Continued

TABLE 2-6. DRIVE STATUS CODES (Contd)

Code	Title	Description
NORMAL OPERATION CODES (Contd)		
1B	Heads Left on Last Cylinder of Sweep & Spindle in Sync	Current head position determined by last sweep cycle -- not by a controller-requested seek. The spindle is synchronized, and On Cylinder and Seek End are inactive at this time.
DRIVE ERROR CODES		
46	Seek Timeout	The Servo MPU took longer than the time allowed by the Control MPU to respond to a move request.
4A	Move Failed Due to Demodulator Check	The servo move failed because of a demodulator failure.
4B	Off Track Seek Error	The drive failed to stay on cylinder. The heads float and Seek Error is set.
4C	Seek Error Due to Actuator Locked or No Demodulator Active	The Servo MPU could not complete the move because the actuator was locked or the demodulator was inactive.
4D	Illegal Cylinder Address	During a normal seek, the Control MPU received too high a cylinder address (>2610 for 2.038, 2.272, and 2.500 GB drives; >2654 for 3.037, 3.050, and 3.220 GB drives). Track following continues but Seek Error is set.
4E	Seek Error Due to Fault	The drive could not complete a seek because Fault was set. The seek request is never sent to the Servo MPU.

———— Continued ————

TABLE 2-6. DRIVE STATUS CODES (Contd)

Code	Title	Description
DRIVE ERROR CODES (Contd)		
4F	Seek Error on Settle In	The Servo MPU could not settle in on the destination cylinder. The heads float and Seek Error is set.
50	Low Vcc Glitch Recovery	A Low Vcc condition occurred in the drive. The drive executed a Low Vcc glitch recovery.
51	Control MPU Hang Recovery	A Control MPU hang condition caused the drive to reset itself, and a Control MPU hang recovery was executed.
52	Motor Stopped -- Braking Loop Failure	The motor stopped, but there was a braking loop failure.
53	First Seek Fault -- Motor Below Speed	The Servo MPU failed to complete a first seek because the motor was not up to speed.
54	First Seek Fault -- Data Ready Pulse 1 Not Found	The Servo MPU failed to complete the first seek because it did not see the first data ready pulse.
55	First Seek Fault -- Data Ready Pulse 2 Not Found	The Servo MPU failed to complete the first seek because it did not see the second data ready pulse.
56	First Seek Fault -- Demodulator Active Not Found	The Servo MPU failed to complete the first seek because Demodulator Active was not found.
57	First Seek Fault -- Index Not Found	The Servo MPU failed to complete the first seek because Index was not found.
58	Speed Loss	Indicates that the spindle speed fell below a minimum value. The Control MPU activates the Write Protect line, drops the Ready signal, and performs a retract operation.

——— Continued ———

TABLE 2-6. DRIVE STATUS CODES (Contd)

Code	Title	Description
DRIVE ERROR CODES (Contd)		
59	Locked Rotor	The motor would not start because the rotor was locked.
5B	Motor Stopping -- Braking Loop Failure	A braking loop failure is detected while the motor is being stopped.
5D	Failed Flying Speed Check	The motor failed the flying speed check.
5E	Failed Up to Speed Check	The motor failed the up to speed check.
5F	Motor Failed RPM Control	The motor failed RPM control after the start.
61	Servo MPU Communication Check Failed	The Control MPU was unable to communicate with the Servo MPU.
62	I/O Status Transfer Failed (SCSI and IPI Drives)	The I/O MPU failed to transfer status successfully to the Control MPU during a diagnostic test.
64	Seek Error on First Seek	The Servo MPU failed to complete a first seek because of a seek error.
69	Speed Loss Restart	The Servo MPU is automatically attempting to restart the motor after a speed loss without receiving another Start command.
6E	I/O Self-Test Failed (SCSI and IPI Drives)	The I/O MPU failed its power on initialization self-test.

INTERFACE TESTING

This topic describes the unique self-tests and online
diagnostic tests available with each interface type. The
product is available with the SMD, SCSI, or IPI interface.

Testing SMD Interface Drives

If an SMD interface drive has the SMD-E (enhanced SMD)
interface version selected, it offers diagnostic information to
the controller. When the controller issues Tag 5 (Extended
Status), the drive responds in one of the following ways:

- Extended Fault Status -- When Bus Out Bit 0 = 0 and Bus
  Out Bit 1 = 0, the drive defines on Bus In Bit 0-6 which
  specific fault is present. Bus In Bit 7 indicates that
  valid status is available.

- Operating Status -- When Bus Out Bit 0 = 1 and Bus Out
  Bit 1 = 0, the drive provides the current drive status
  code on Bus In Bit 0-6. These codes are defined earlier
  in this section in table 2-6. Bus In Bit 7 indicates
  that valid status is available.

- Diagnostic FRU Status -- When Bus Out Bit 0 = 0 and Bus
  Out Bit 1 = 1, the drive provides a code defining the
  most likely failed field replaceable unit (FRU). The
  codes, which appear on Bus In Bit 0-3, are defined in
  table 2-7. Bus In Bit 4-7 are not used. Bus In Bit 7
  indicates that valid status is available.

- Execute Diagnostic Test Command -- When Bus Out Bit 0 = 1
  and Bus Out Bit 1 = 1, the drive executes a standard
  series of diagnostic tests. Bus In Bit 7 goes active
  when the test begins. Seek End remains inactive during
  test execution and goes active when the test stops.

TABLE 2-7. SMD-E ONLINE FRU CODES

BIB 3-0	Field Replaceable Unit
0001	Control Board
0010	Module
0011	Power Supply
0100	I/O Board
0101	Not Used
0110	Not Used
0111	Not Used
1000	Not Used
1001	Not Used
1010	Not Used
1011	Not Used
1100	Not Used
1101	Not Used
1110	Not Used
1111	Not Used

Testing SCSI Interface Drives

The SCSI controller (I/O board) has a self-test feature. Four
LEDs on the I/O board indicate various SCSI controller
conditions. In addition, there are interface commands that
tell the target (drive) to send status to the initiator.

I/O Board Self-Test

Two power on test sequences occur as dc power is applied to the
drive. The SCSI controller (I/O board) firmware is tested and
initialized first. This is not an exhaustive diagnostic test
but it verifies the integrity of the major components. The
drive firmware is initialized if SCSI firmware testing and
initialization are successful.

Controller testing consists of a hardware self-test that
verifies the integrity of the controller hardware. The
controller halts further initialization if this test fails.

The initialization sequence occurs under any of the following
three conditions:

- Controller (I/O) power-up sequence occurs
- SCSI Bus Reset (-RST signal is asserted)
- BUS DEVICE RESET message is received on SCSI Bus

The controller does not respond to a Selection Phase on the
SCSI bus during the self-test sequence. The self-test sequence
consists of the following events:

- Test Microprocessor
- Test Buffer Controller
- Test RAM Memory
- Test SCSI Interface

The SCSI Firmware initialization sequence is as follows:

- Set status for the LUN (logical unit number) to Busy
- Initialize the SCSI

The Drive Firmware initialization sequence occurs next and is
as follows:

- Initialize disk interface (I/O board-to-drive)
- Initialize LUN parameters
- Start the drive spindle (only during power on sequence)
- Read parameters from cylinder 0 sector 0 of the drive
- Test controller/drive interface (only during power on
  sequence)
- Do write/read test on diagnostic cylinder (only during
  power on sequence)

When the SCSI controller firmware is initialized, the
controller will respond to a Selection Phase. It returns BUSY
status until the entire drive initialization process is
complete.

The drive initialization firmware spins up the drive, and it
attempts to read the saved controller parameters from a
reserved area of the drive. These parameters define the disk
characteristics and other operating parameters. As part of a
power on sequence, the drive initialization concludes with the
following tests:

- Test controller/drive interface
- Do write/read test on diagnostic cylinder (2 patterns)

Errors encountered during these tests will result in flashing
I/O LEDs as explained later in this section. If an error
occurs, the drive will no longer respond to SCSI commands.
However, a SCSI reset will abort the error indication and any
further diagnostic testing, and it will complete the
initialization sequence. Powering down and then up while in
the failure mode will restart the test.

The controller uses the default parameters if it cannot read
the saved controller parameters from a reserved area of the
disk or if that data is invalid (the disk has not been
formatted). No controller/drive interface or write/read test
will be done in this mode.

When the entire initialization process is complete, the first
command sent by an Initiator is terminated with CHECK status
and UNIT ATTENTION Sense Key.

INQUIRY Command

The INQUIRY command requests the characteristics of the target
(drive) be sent to the initiator. The INQUIRY command data
consists of a five-byte header followed by the product
characteristics as shown in the example in table 2-8.

TABLE 2-8. TYPICAL INQUIRY DATA

Byte/Bit	7	6	5	4	3	2	1	0
0	Peripheral Device Type (00)							
1	O	Device Type Qualifier (00)						
2	O	O	ECMA Version (0)		ANSI Version (1)			
3	O	O	O	O	O	O	O	1
4	Additional Length (1FH)							
5	Reserved (00H)							
6	Reserved (00H)							
7	Reserved (00H)							
8	Vendor Identification ASCII S (53H)							

——————— Continued ———————

TABLE 2-8. TYPICAL INQUIRY DATA (Contd)

Byte/Bit	7	6	5	4	3	2	1	0
9	Vendor Identification ASCII E (45H)							
10	Vendor Identification ASCII A (41H)							
11	Vendor Identification ASCII G (47H)							
12	Vendor Identification ASCII A (41H)							
13	Vendor Identification ASCII T (54H)							
14	Vendor Identification ASCII E (45H)							
15	Vendor Identification ASCII blank (20H)							
16	Product Identification ASCII E (45H)							
17	Product Identification ASCII M (4DH)							
18	Product Identification ASCII D (44H)							
19	Product Identification ASCII blank (20H)							
20	Product Identification ASCII 9 (39H)							
21	Product Identification ASCII 7 (37H)							
22	Product Identification ASCII 2 (32H)							
23	Product Identification ASCII 0 (30H)							
24	Product Identification ASCII 1 (31H)							
25	Product Identification ASCII blank (20H)							
26	Product Identification ASCII ((28H)							
27	Product Identification ASCII 2 (32H)							
28	Product Identification ASCII . (2EH)							
29	Product Identification ASCII 5 (35H)							
30	Product Identification ASCII) (29H)							

———————— Continued ————————

TABLE 2-8. TYPICAL INQUIRY DATA (Contd)

Byte/Bit	7	6	5	4	3	2	1	0
31	Product Identification ASCII blank (20H)							
32	Revision Number ASCII blank (20H)							
33	Revision Number ASCII blank (20H)							
34*	Revision Number First ASCII # (xxH)							
35*	Revision Number Second ASCII # (xxH)							
* These two bytes indicate two-digit microcode revision								

RECEIVE DIAGNOSTIC RESULTS Command

The RECEIVE DIAGNOSTIC RESULTS command requests that analysis data be sent to the initiator following completion of a SEND DIAGNOSTICS command. Diagnostic data return bytes are shown in table 2-9.

TABLE 2-9. DIAGNOSTIC DATA RETURN BYTES

Byte	Description
0	Additional Length (MSB)
1	Additional Length (LSB)
2	FRU Code (Most probable)
3	FRU Code
4	FRU Code
5	FRU Code (Least probable)
6	Error Code (MSB)
7	Error Code (LSB)

Additional Length Bytes

This two-byte value indicates the number of additional bytes included in the diagnostic data list. This value can be either 0006H or 0000H. A value of 0000H means that there are no additional bytes. A value of 0006H means that there are six additional bytes (bytes 2 - 7).

FRU Code

The FRU code byte identifies the assembly that may have failed. The codes are listed in probability order with the most probable assembly listed first and the least probable listed last. FRU codes are shown in table 2-10. These codes should not be confused with the FRU codes reported during the drive offline tests.

TABLE 2-10.   SCSI ONLINE FRU CODES

Code	Description
00H	No FRU Information Available
01H	Entire Drive
02H	Control Board
03H	Module
04H	Power Supply
05H	SCSI I/O Board
06H	Control Board
07H	Module

Error Code

This two-byte value provides information about what part of the diagnostic operation has failed. The error codes are shown in table 2-11.

TABLE 2-11.   ERROR CODES

Code	Description
01H	Microprocessor test
02H	Static RAM test
03H	MAC register test
04H	Buffer controller test
05H	Disk formatter test
06H	Dynamic RAM test
07H	SCSI protocol chip test
08H	CDIC test
09H	DMA to/from FIFO test
10H	Sequencer diagnostic error
11H	External RAM diagnostic error
12H	No drive ready
13H	No sector or index found
14H	Fatal hardware error during drive diagnostics
15H	Unable to set drive sector size
16H	Unable to clear drive attention
17H	Unable to recalibrate drive (check drive switches)
18H	Unable to send write current data to drive
19H	Unable to issue drive seek command
1AH	Unable to read user table from drive
1BH	Ran out of sectors during drive diagnostics
1CH	Unable to read reallocation table
1DH	Unable to read ETF log sector zero
1FH	Drive unable to locate calibration track center
20H	80186 timer error
21H	DMA chip diagnostic error

———————————— Continued ————————————

TABLE 2-11. ERROR CODES (Contd)

Code	Description
22H	Buffer RAM diagnostic error
23H	Data miscompare during drive diagnostics
46H	Seek timeout status
4BH	Off-track seek error status
4DH	Illegal cylinder address status
4FH	Seek error on settle-in status
50H	Low Vcc glitch recovery (speed >2400 r/min)
51H	Control MPU hang reset (speed >2400 r/min)
54H	First seek fault on retract
55H	First seek fault on load
56H	First seek fault on RTZ
57H	First seek fault on calibrate
58H	Speed loss status
59H	Motor cannot start due to error status
5AH	Emergency retract status
60H	Motor MPU fail status
61H	Servo MPU fail status
90H thru D0H	CDIC register test

Reading the I/O Board LEDs on SCSI Drives

Four light emitting diodes (3 red, 1 green) are visible on the I/O board at the rear of the drive. any one or a combination of LEDs can be on, off, or flashing to indicate a specific controller condition.

Table 2-12 gives the meanings of each LED display on the I/O board.


```
LED #4 ──── ○ RED
LED #3 ──── ○ RED
LED #2 ──── ○ RED
LED #1 ──── ○ GRN
```
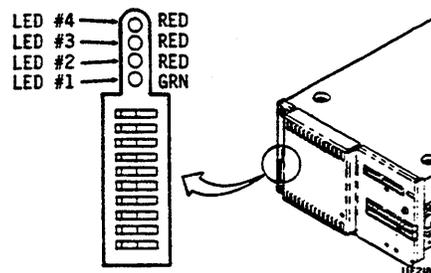
TABLE 2-12.   I/O BOARD LEDS ON SCSI DRIVES

LED 4 Red	3 Red	2 Red	1 Grn	Meaning
Off	On	Off	F	No activity and drive is available. Flashing green is "heartbeat".
Off	Off	Off	F	Command is executing and unit is not available.
On	On	On	Off	Read or write retry is in progress.
F	F	F	F	CDIC failure.
On	On	Off	Off	Write/read test failure
Off	Off	On	On	on diagnostic cylinder. LED 3 & 4 flash alternately with 1 & 2.
The following binary displays (codes) show test failure information for drives with the high performance SCSI only. The corrective action for each code is to replace the I/O board.				
Off	Off	Off	On	Microprocessor test
Off	Off	On	Off	Static RAM test
Off	Off	On	On	MAC register test
Off	On	Off	Off	Buffer controller test
Off	On	Off	On	Disk formatter test
Off	On	On	Off	Dynamic RAM test
Off	On	On	On	ESP Test
On	Off	Off	Off	CDIC Test
On	Off	Off	On	DMA to/from FIFO test
On	Off	On	Off	IBP test
On	Off	On	On	DRAM parity error test
On	On	On	On	Complete failure: microprocessor not functioning
F = LED is flashing.				

Testing IPI Interface Drives

This topic describes the unique self-tests and online
diagnostic tests available with the IPI interface.

The Self-Test and Initialization Sequence

Figure 2-4 is a flowchart of the drive self-test and
initialization sequence. This flowchart makes references to
status codes that appear on the optional status/control panel
and that are saved in the drive status log. The status log can
be displayed via offline diagnostic test 00, described earlier
in this section.

The I/O MPU and Control MPU self-test sequences start when dc
power is applied (see the flowchart).

The I/O and drive circuits are tested simultaneously. The I/O
tests include checks of the serializer/deserializer (SERDES)
and I/O circuits, and an I/O MPU self-test. The drive
self-test checks the Control MPU. Testing stops and status is
reported if an error is found.

If the I/O and drive self-tests run error-free, the drive
begins its start sequence when start conditions are present.
As part of the spindle power-up, the Control MPU in the drive
runs a series of servo tests. The drive is capable of normal
operation if these tests run error-free.

Write/read diagnostic testing occurs only when all of the
following conditions are true:

- The drive is in local mode.

- The drive is not write protected.

- Write/read diagnostic testing is enabled via an I/O board
  switch setting.

- This is the initial spindle power-up after dc power is
  applied.

If write/read diagnostic testing is performed, the I/O MPU
reports pass/fail status to the Control MPU. Following a
successful handshake between the two processors, the drive is
ready and operational.

If write/read diagnostic testing is bypassed, the drive is
ready and operational with no I/O self-test status posted.

Figure 2-4. Power On Self-Test (Sheet 1 of 2)

FROM
SHEET 1

A (LOCAL MODE)

DRIVE STARTS
MOTOR, LOADS
HEADS, AND
CALIBRATES SERVO

OK? → NO → DISPLAY
SERVO
ERROR CODE

YES

W/R
DIAGNOSTICS
ENABLED → NO

YES

IS
DRIVE WRITE
PROTECTED → YES → DRIVE IS
READY AND
OPERATIONAL

(DISPLAY 00) △1

NO

I/O MPU RUNS
WRITE/READ
TEST

I

SHEET 2

I

I/O MPU RUNS
HANDSHAKE
TEST

SPINDLE
IN SYNC
? → YES

NO

DISPLAY 09   DISPLAY 19

DRIVE IS
READY AND
OPERATIONAL

△1
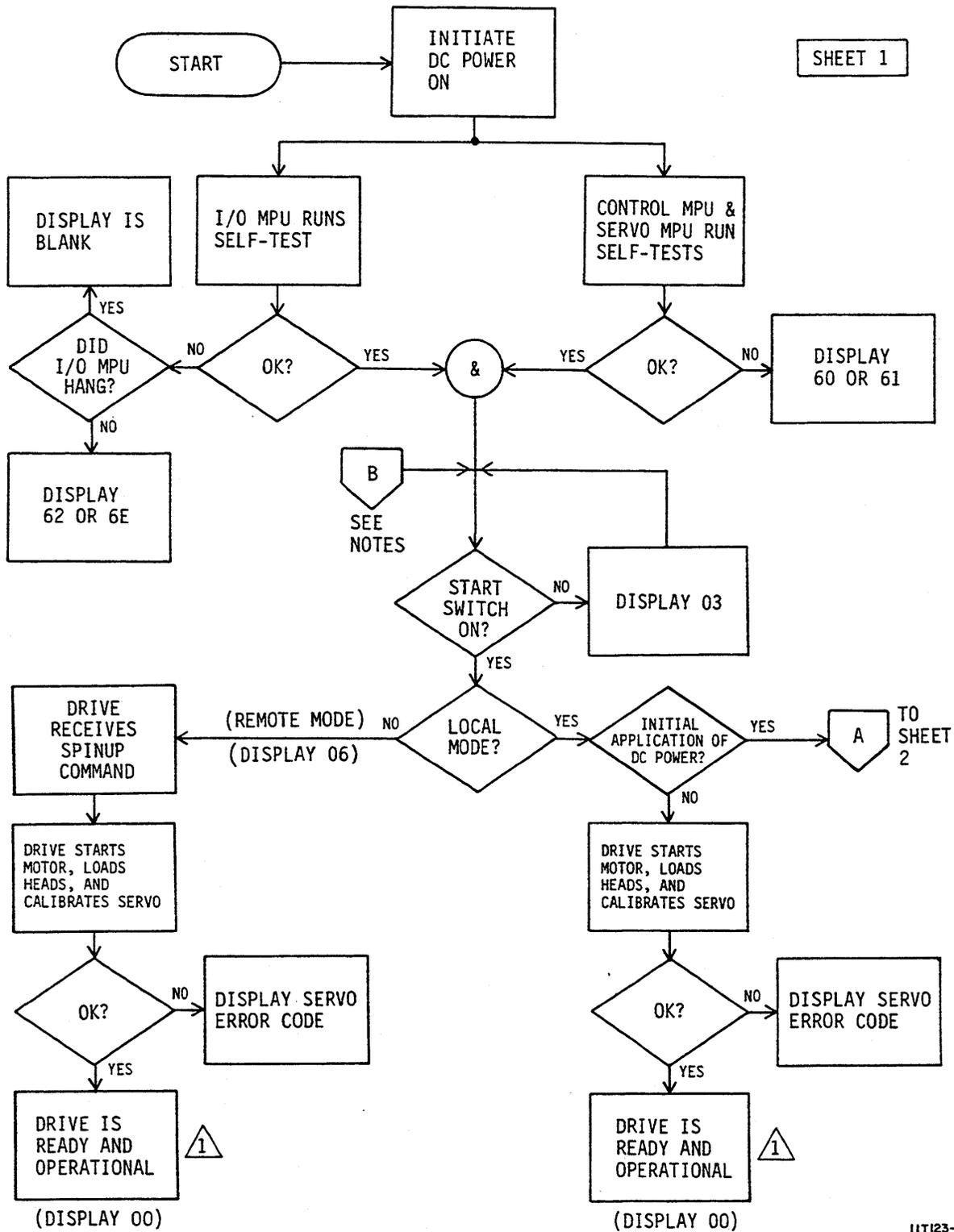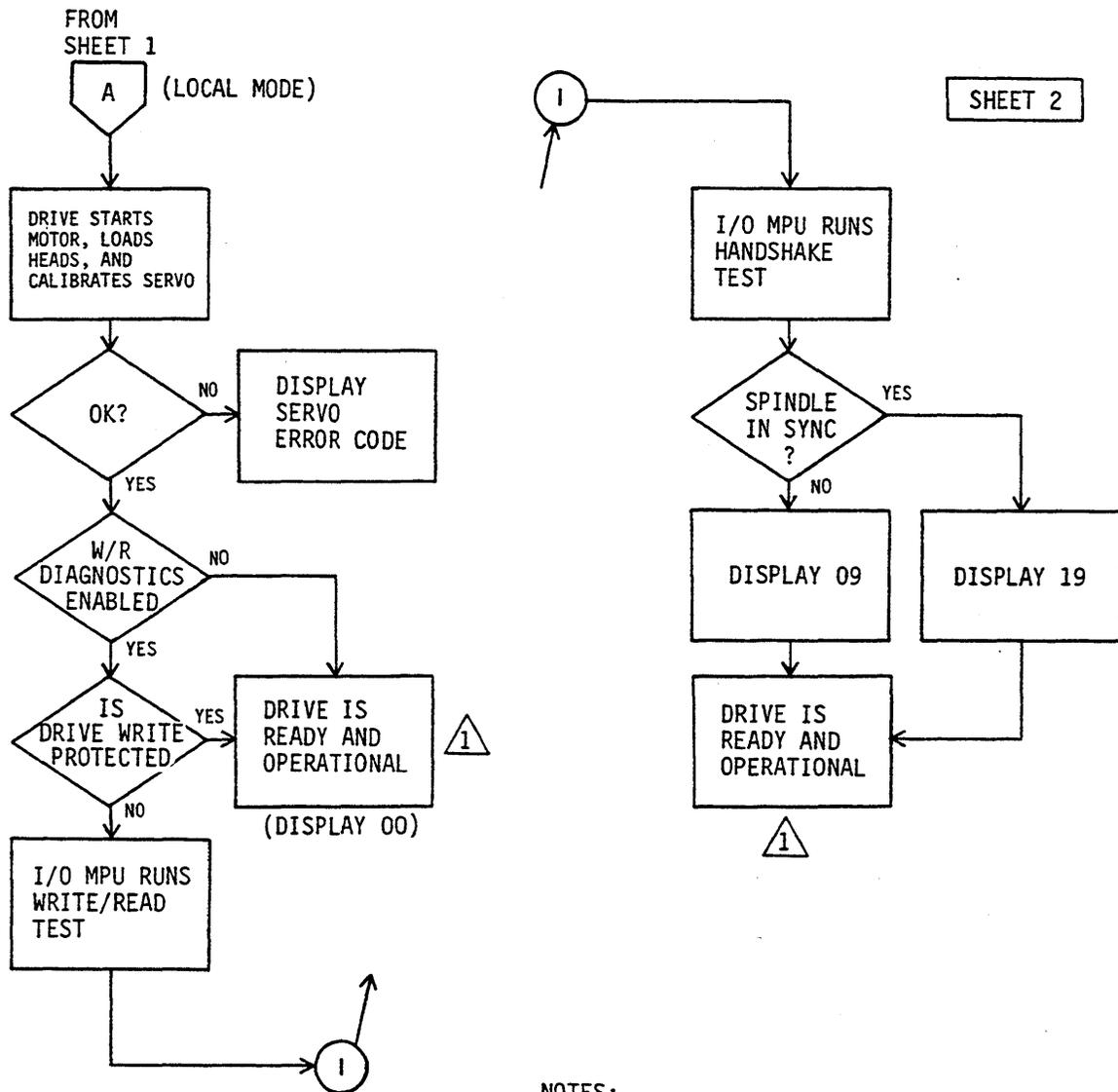
NOTES:

△1 IF START SWITCH IS CYCLED FROM
START TO STOP TO START DURING
OPERATION, REENTER FLOWCHART
AT B ON SHEET 1.

2. ALL DISPLAY CODES APPEAR ON
STATUS/CONTROL PANEL. IPI
CODES ARE DIFFERENT.

11T123-2A

Figure 2-4. Power On Self-Test (Sheet 2)

Execute Internal Diagnostics Function

Receipt of this function runs an access test, a head select test, and a read/write test.

The access test performs the following operations:

- Return to zero seek operation
- Single track seek
- Servo recalibrate
- Maximum seek
- Random seek

Successful completion of this test allows starting of the Head Select test provided the Disable Write/Read Diagnostic bit is not set. The Head Select and Write/Read tests can be disabled by issuing the Disable Read/Write Diagnostics Function Code.

The Head Select test performs a seek to the diagnostic cylinder, waits for on-cylinder, and then sequentially selects all heads on the cylinder. Successful completion of this test allows starting of the Write/Read test.

The write and read tests run if the drive is Ready, is not write protected, and no fault conditions exist. If the drive is write protected, it will run only the access and read tests. The header is read and verified on the diagnostic cylinder. If no errors are found, data patterns are written on the diagnostic cylinder, after which they are read back and verified.

Read Drive Specific Information (Bus Control 43)

The Read Drive Specific Information bus control transfers status information to the controller. This status information fits into two general categories:

- Native-controlled status -- generated by the Control MPU. Although the codes are numerically different, they report the information available via the status/control panel.

- Interface-controlled status -- generated by the I/O MPU.

The response to the bus control has the following parameters:

- Native-Controlled Diagnostic Status Codes -- presented in octets 02 - 11 and listed in table 2-13. Refer to table 2-6 earlier in this section for more complete status definitions.

- Native-Controlled Diagnostic FRU Codes -- presented in octets 12 - 15 and listed in table 2-14.

- Native-Controlled Diagnostic Fault Codes -- presented in octets 16 - 1D and listed in table 2-15.

- Interface-Controlled Diagnostic Status Codes -- presented in octets 1E - 1F and listed in table 2-16.

- Interface-Controlled Diagnostic FRU Codes -- presented in octets 20 - 21 and listed in table 2-17.

- Interface-Controlled Diagnostic Fault Codes -- presented in octets 22 - 23 and listed in table 2-18.

TABLE 2-13. NATIVE-CONTROLLED DIAGNOSTIC STATUS CODES

Status Code	Status Description
	NORMAL OPERATION CODES
80	Ready
82	Stopping Motor
83	Motor Stopped
84	Load/Cal in Progress
85	Power Sequence in Progress
86	START Switch Pressed & Waiting for Power Sequence Signals
87	Starting Motor
88	Motor Up to Speed
89	I/O Self-Test Passed
8A	Sweep Segment in Progress
8B	Heads Left on Last Cylinder of Sweep
90	Ready & Spindle in Sync
94	Load/Cal in Progress & Spindle in Sync
98	Motor Up to Speed & Spindle in Sync
99	I/O Self-Test Passed & Spindle in Sync
9A	Sweep Segment in Progress & Spindle in Sync
9B	Heads Left on Last Cylinder of Sweep & Spindle in Sync

———— Continued ————

TABLE 2-13.   NATIVE-CONTROLLED DIAGNOSTIC STATUS CODES (Contd)

Status Code	Status Description
	DRIVE ERROR CODES
C6	Seek Timeout
CA	Move Failed Due to Demodulator Check
CB	Off Track Seek Error
CC	Seek Error Due to Actuator Locked or No Demodulator Active
CD	Illegal Cylinder Address
CE	Seek Error Due to Fault
CF	Seek Error on Settle In
D0	Low Vcc Glitch Recovery
D1	Control MPU Hang Recovery
D2	Motor Stopped -- Braking Loop Failed
D3	First Seek Fault -- Motor Below Speed
D4	First Seek Fault -- Data Ready Pulse 1 Not Found
D5	First Seek Fault -- Data Ready Pulse 2 Not Found
D6	First Seek Fault -- Demodulator Active Not Found
D7	First Seek Fault -- Index Not Found
D8	Speed Loss
D9	Locked Rotor
DB	Motor Stopping -- Braking Loop Failure
DD	Failed Flying Speed Check
DE	Failed Up to Speed Check
DF	Motor Failed RPM Control
E1	Servo MPU Communication Check Failed
E2	I/O Status Transfer Failed
E4	Seek Error on First Seek
E9	Speed Loss Restart
EE	I/O Self-Test Failed

TABLE 2-14.   NATIVE-CONTROLLED DIAGNOSTIC FRU CODES

FRU Code	FRU Description
81	Control Board
82	Module
83	Power Supply
84	I/O Board

TABLE 2-15.   NATIVE-CONTROLLED DIAGNOSTIC FAULT CODES

Fault Code	Fault Description
80	Good Status
81	Read ● Write Fault
82	(Read + Write) ● Off Cylinder Fault
84	First Seek Fault
88	Write Fault
90	Write ● Write Protected Fault
A0	Head Select Fault
C0	Voltage Fault

TABLE 2-16. INTERFACE-CONTROLLED DIAGNOSTIC STATUS CODES

Status Code	Status Description
Write/Read Tests	
00	Good Status
01	Failed during seek to diagnostic cylinder
02	Failed during RTZ seek from diagnostic cylinder
03	Not defined
04	Not defined
05	Failed during head select test
06	Failed during read header test
07	Failed during write data test
08	Failed during read data test
09	Sync byte error during read header test
0A	Data error during read header test
0B	Sync byte error during read data test
0C	Data error during read data test
Access Tests	
13	Failed during servo test
14	Failed during random seek test
15	Failed during access RTZ test
Read Drive Specific Tests	
20	Failed during read up of diagnostic status/error code log test
21	Failed during read up of FRU log test
22	Failed during read up of display fault log test

TABLE 2-17.   INTERFACE-CONTROLLED DIAGNOSTIC FRU CODES

FRU Code	FRU Description
01	Control Board
02	Module
03	Power Supply
04	I/O Board
05	Control Board

TABLE 2-18.   INTERFACE-CONTROLLED DIAGNOSTIC FAULT CODES

Fault Code	Fault Description
00	Good Status
01	Read • Write Fault
02	(Read + Write) • Off Cylinder Fault
04	First Seek Fault
08	Write Fault
10	Write • Write Protected Fault
20	Head Select Fault
40	Voltage Fault

CAUTION

When servicing the drive, observe all
precautions listed under Electrostatic
Discharge Protection in section 1 of this
manual. Failure to observe these precautions
can result in serious damage to electronic
assemblies.

INTRODUCTION

Repair of the drive is limited to replacement of defective
parts and assemblies. This section describes removal and
replacement of all major field replaceable parts and
assemblies. The information here should be used in conjunction
with that in the parts data manual.

The procedures in this section are written for a drive mounted
in a drawer, which is installed into a tray. The tray is
installed into an equipment rack or cabinet. It is necessary
to remove the drive and drawer from the tray for most
maintenance procedures.

All procedures require that power be removed from the drive and
power supply. Prior to performing the maintenance, you should
be thoroughly familiar with the operation of the drive, with
all information in section 1, and with the safety information
at the front of this manual.

Some steps in the procedures in this section apply only to
drives with one of the available interfaces (SMD, SCSI, or
IPI). The User's manual for your drive provides more detailed
information about interface (I/O) cabling and accessories. It
also describes how to set the switches located on the circuit
boards.

Each procedure is assigned a unique number. The numbers are
used elsewhere in the manual to reference the procedures. The
procedures and numbers are organized into three categories:
31XX – mechanical, 32XX – electromechanical, and 33XX –
electronic (circuit boards).

- 3101 – Drawer Removal & Replacement

- 3102 – Top Cover Removal & Replacement

- 3103 – Front Panel Removal & Replacement

- 3201 – Drive Removal & Replacement

- 3202 – Status/Control Panel Removal & Replacement

- 3203 – Operator Panel Removal & Replacement

- 3204 – Power Supply Removal & Replacement

- 3205 – Module Removal & Replacement

- 3206 – Fan Removal & Replacement

- 3301 – I/O Board Removal & Replacement

- 3302 – Control Board Removal & Replacement

3101 - DRAWER REMOVAL & REPLACEMENT

This procedure describes how to remove and replace the drawer in the rack mounting tray if the drive was installed with the ruggedized mounting kit into a standard rack. A standard mounting kit using the 2X drawer is available as an alternative. See appendix A for information about removing and replacing a rack-mounted drive installed with the standard mounting kit. Figure 3-1 shows the ruggedized version.

Removal

1. Gain access to rear of drive. Lift lock knob to release drawer, and push drawer forward several inches.

2. Set On/Standby switch on power supply to Standby position.

3. Disconnect the ac power cord from the power source.

NOTE

On SMD interface drives, the I/O cover and cable clamps have to be removed to disconnect the I/O cables.

4. Disconnect the I/O cables at the rear of the drive.

5. Disconnect the spindle sync cable (if used).

6. Remove system ground strap from drive.

7. Remove drawer from tray.

Replacement

1. Slide drawer into tray.

2. Attach system ground strap to drive.

3. Connect the spindle sync cable (if used).

NOTE

On SMD interface drives, the I/O cover and cable clamps have to be installed after connecting the I/O cables.

4. Connect the I/O cables at the rear of the drive.

PULL UPWARDS
TO DISENGAGE
LOCK

LOCK KNOB

DRAWER   TRAY

IIT67A
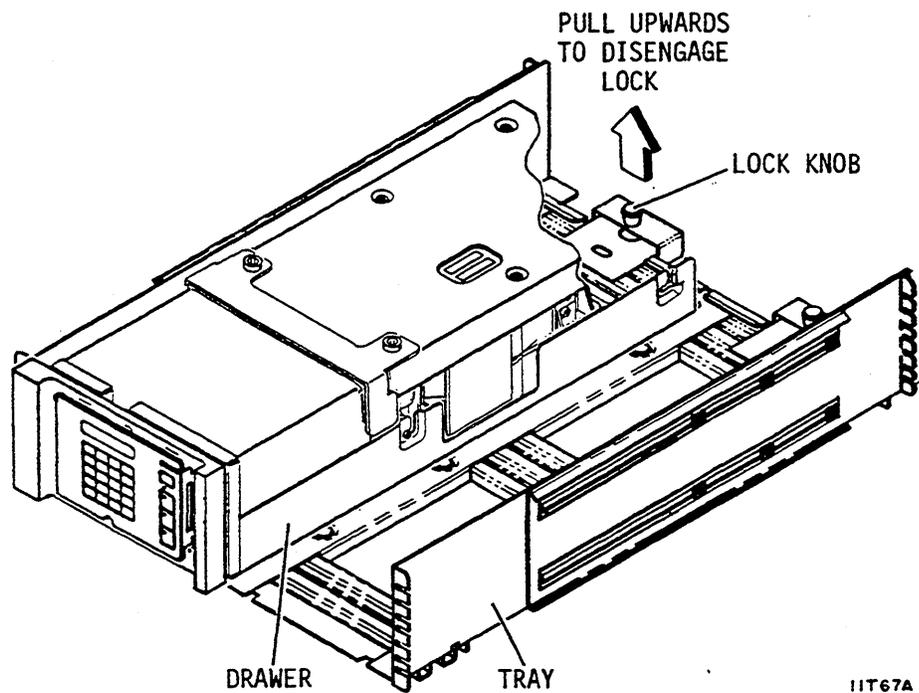
Figure 3-1. Drawer Replacement

5. Connect the ac power cable.

6. Set On/Standby switch on power supply to On position.

7. Push drawer toward rear of tray until lock is engaged.

3102 - TOP COVER REMOVAL & REPLACEMENT

This procedure describes how to remove and replace the top cover.

Removal

1. Perform Drawer Removal procedure (3101).

CAUTION

With the top cover removed, electrostatic sensitive components are exposed and may be seriously damaged by static electricity. To avoid possible damage, observe all precautions listed under Electrostatic Discharge Protection in section 1 of this manual.

2. Remove screws securing top cover to drive (see figure 3-2).
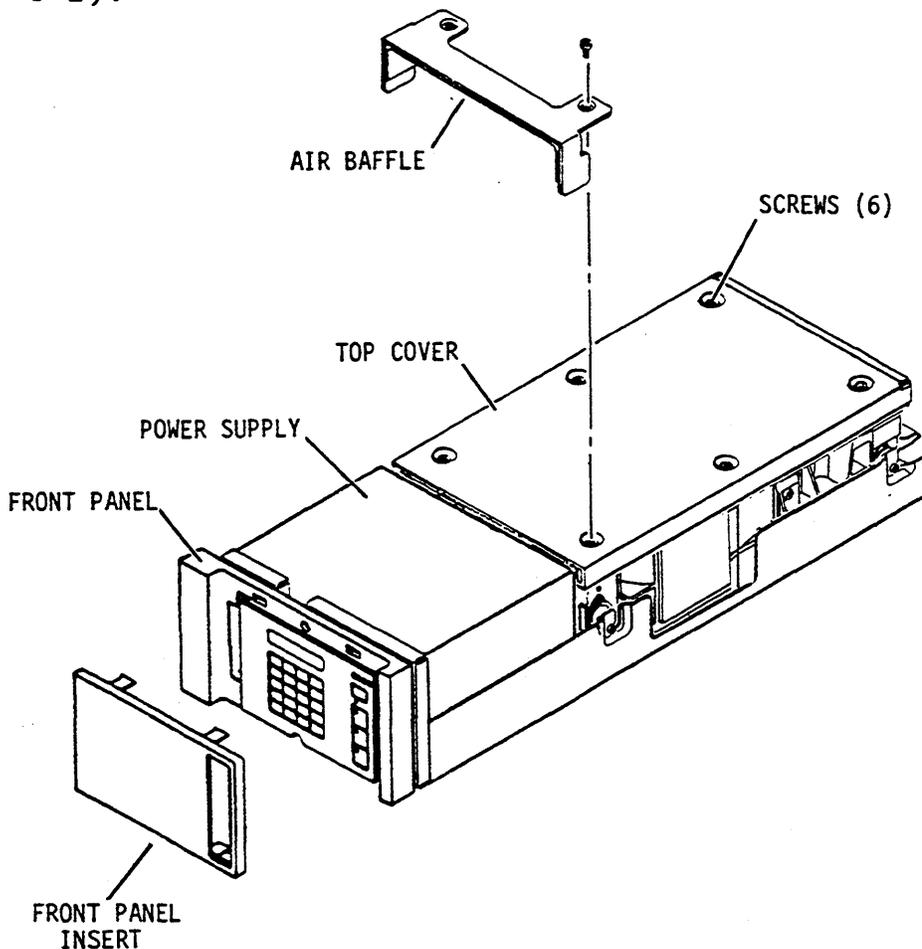
Figure 3-2. Top Cover Replacement

NOTE

To maintain drive configuration whenever the
top cover is removed, always identify which
drive the top cover was removed from.

3. Carefully lift off air baffle (if used) and cover.

Replacement

1. If new (replacement) top cover is being installed, copy
    drive information from labels of old top cover to new
    labels and attach new labels to new top cover.

CAUTION

When replacing cover, use care to avoid
damaging logic boards.

2. Ensure that power is removed from drive. Place top cover
    on drive.

3. Place air baffle (if used) over gap between power supply
    and top cover and secure it and top cover with screws.

4. Perform Drawer Replacement procedure (3101).

3103 - FRONT PANEL REMOVAL & REPLACEMENT

There are three different front panel removal and replacement procedures, depending on the drive configuration. They are:

● Drives With Status/Control Panel

● Drives With Operator Panel

● Drives Without Status/Control Panel Or Operator Panel

Perform the procedure that applies to your drive.

Drives With Status/Control Panel

Removal

1. Remove front panel insert.

2. Perform Drawer Removal procedure (3101).

3. Remove two screws (left side of front panel) securing status/control panel to front panel (see figure 3-3).

4. Disconnect jumper cable from P13 while removing status/control panel from front panel.
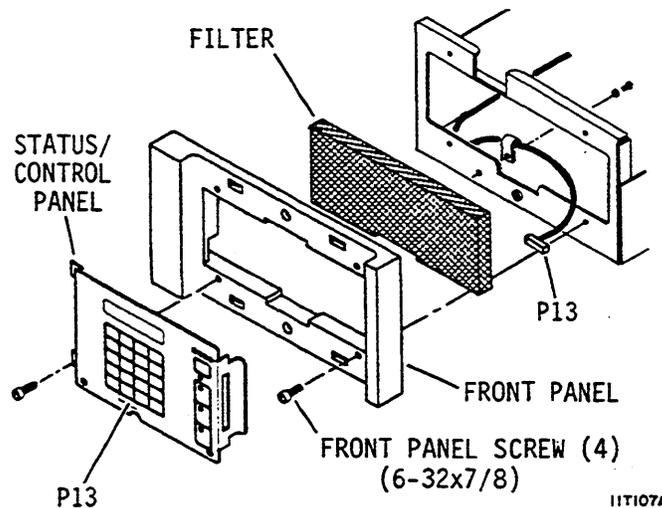
Figure 3-3. Front Panel Replacement For
Drives With Status/Control Panel

5. Remove filter from front panel.

6. Remove front panel by removing screws that secure it to
    drawer.

Replacement

1. Orient front panel so wide edge faces left on left drive
    or faces right on right drive.

2. Center screw holes in front panel on screw holes in
    drawer.

3. Insert two screws on right side of front panel.

4. Install filter.

5. Connect P13 on jumper cable to P13 on status/control
    panel.

6. Align status/control panel to front panel and secure with
    screws.

7. Perform Drawer Replacement procedure (3101).

8. Install front panel insert.

Drives With Operator Panel

Removal

1. Remove front panel insert.

2. Perform Drawer Removal procedure (3101).

3. Remove screws securing operator panel to shield and remove operator panel (see figure 3-4).

4. Disconnect jumper cable from P13 on operator panel.

5. Remove screws securing shield to front panel and remove shield.

6. Remove filter from front panel.

7. Remove the two screws (left side of front panel) securing front panel to drawer and remove front panel from drawer.
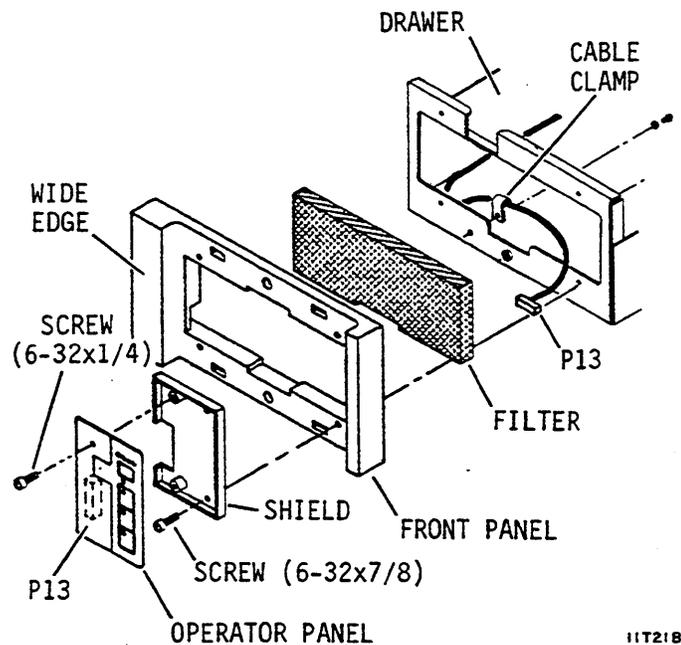
Figure 3-4. Front Panel Replacement For
Drives With Operator Panel

Replacement

1. Orient front panel so wide edge faces left on left drive or faces right on right drive.

2. Center screw holes in front panel on screw holes in drawer.

3. Insert two screws on left side of front panel.

4. Install filter.

5. Align shield and front panel and secure both to drawer with screws.

6. Connect P13 on jumper cable to P13 on operator panel.

7. Position operator panel on shield and secure with screws.

8. Perform Drawer Replacement procedure (3101).

9. Install front panel insert.

Drives Without Status/Control Panel Or Operator Panel

Removal

1. Remove front panel insert.

2. Perform Drawer Removal procedure (3101).

3. Remove filter from front panel (see figure 3-5).

4. Remove screws securing front panel to drawer and remove front panel from drawer.

Replacement

1. Orient front panel so wide edge faces left on left drive or faces right on right drive.

2. Align top edge of front panel with top edge of drawer.

3. Ensure front panel is positioned for best alignment and appearance and secure it with four screws.

4. Install filter.

5. Perform Drawer Replacement procedure (3101).

6. Install front panel insert.
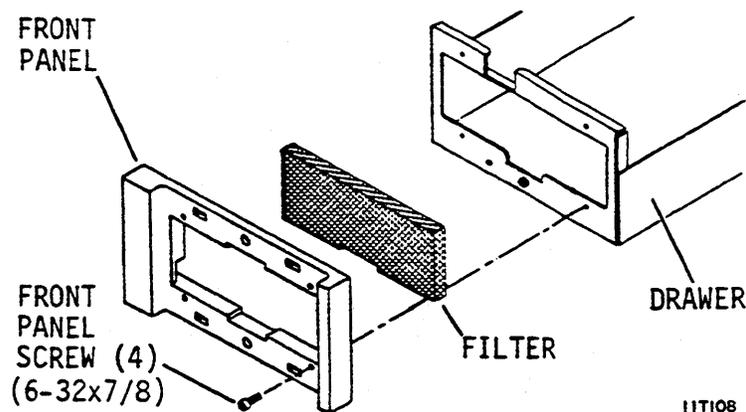
.Figure 3-5. Front Panel Replacement For Drives Without Status/Control Panel or Operator Panel

3201 - DRIVE REMOVAL & REPLACEMENT

This procedure describes how to remove and replace a drive that is mounted in a drawer (see figure 3-6).

Removal

1. Perform Drawer Removal procedure (3101).

2. Remove air baffle.

3. Remove screw and washer that secure DC ground strap to drive.

4. Loosen four shock mount screws that secure module to drawer, and slide drive away from power supply slightly.

5. Lift power supply end of drive and disconnect dc power cable from J15A on control board. Disconnect status/control panel or operator panel jumper cable (if used) from J13 on control board and remove long clamp from side of module.

6. Remove gasket located between power supply and drive.

7. Carefully lift drive out of drawer and place on a work surface prepared for work on ESD sensitive devices.

8. For SMD interface drives, if drive is being replaced, remove I/O cable bracket from drive rear panel.

9. For 3.037, 3.050, and 3.220 GB drives, if drive is being replaced, remove ground straps from 2 rear shock mounts and attach them to rear shock mounts on replacement drive.

Replacement

1. Attach I/O cable bracket to drive rear panel on SMD interface drives.

2. Loosely insert screws into four shock mounts.

3. With I/O connectors facing away from power supply, place drive into drawer so it rests on shock mount screws.

4. Orient the gasket as shown, and slide it into position between the drive and power supply.
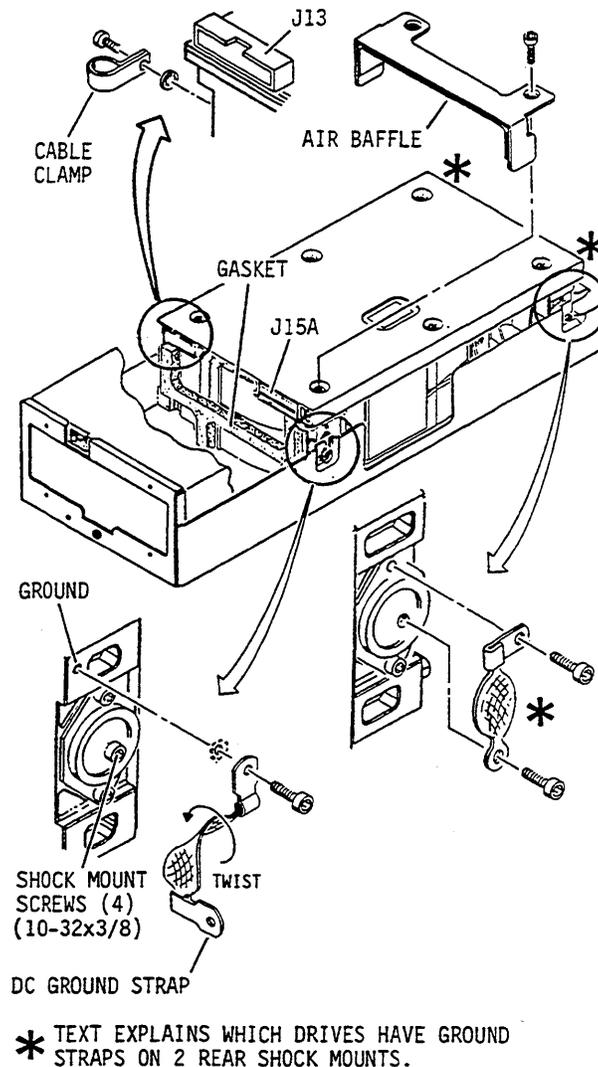
Figure 3-6. Drive Replacement

5. Lift power supply end of drive and connect dc power cable to J15A on control board. Connect status/control panel or operator panel jumper cable (if used) to J13 on control board and secure with long clamp on side of module. Ensure lockwasher is between clamp and module.

6. Move drive into position so that shock mount screws are in slots in drawer. For 3.037, 3.050, and 3.220 GB drives, ensure that ground straps connect across 2 rear shock mounts. Tighten shock mount screws.

7. Attach power supply ground strap to module. Ensure lockwasher is between module and strap.

8. Install air baffle.

9. Perform Drawer Replacement procedure (3101).

3202 - STATUS/CONTROL PANEL REMOVAL & REPLACEMENT

The status/control panel is located behind the front panel insert. It has no replaceable parts and must be replaced as an assembly.

Removal

1. Remove front panel insert.

2. Perform Drawer Removal procedure (3101).

3. Remove two screws (left side of front panel) securing status/control panel to front panel (see figure 3-7).

4. Disconnect jumper cable from P13 while removing status/control panel from front panel.

Replacement

1. Connect P13 on jumper cable to P13 on status/control panel.

2. Align status/control panel to front panel and secure with screws.

3. Perform Drawer Replacement procedure (3101).

4. Install front panel insert.
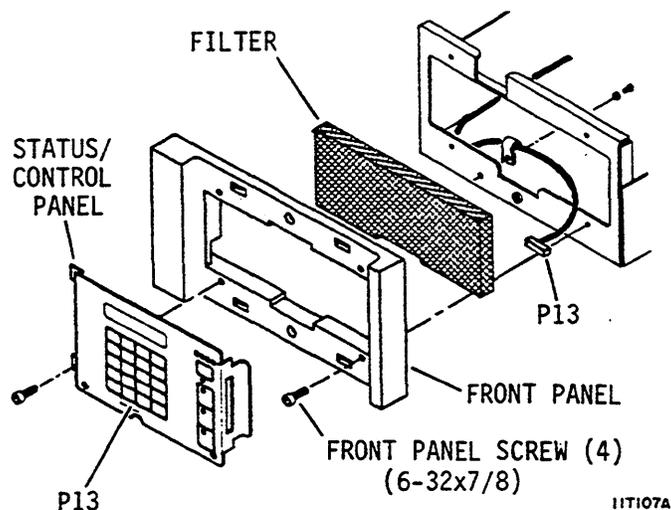
Figure 3-7. Status/Control Panel Replacement

3203 - OPERATOR PANEL REMOVAL & REPLACEMENT

The operator panel is located behind the front panel insert.
It has no replaceable parts and must be replaced as an assembly.

Removal

1. Remove front panel insert.

2. Perform Drawer Removal procedure (3101).

3. Remove screws securing operator panel to shield and remove operator panel (see figure 3-8).

4. Disconnect jumper cable from P13 on operator panel.

Replacement

1. Connect P13 on jumper cable to P13 on operator panel.

2. Position operator panel on shield and secure with screws.

3. Perform Drawer Replacement procedure (3101).

4. Install front panel insert.
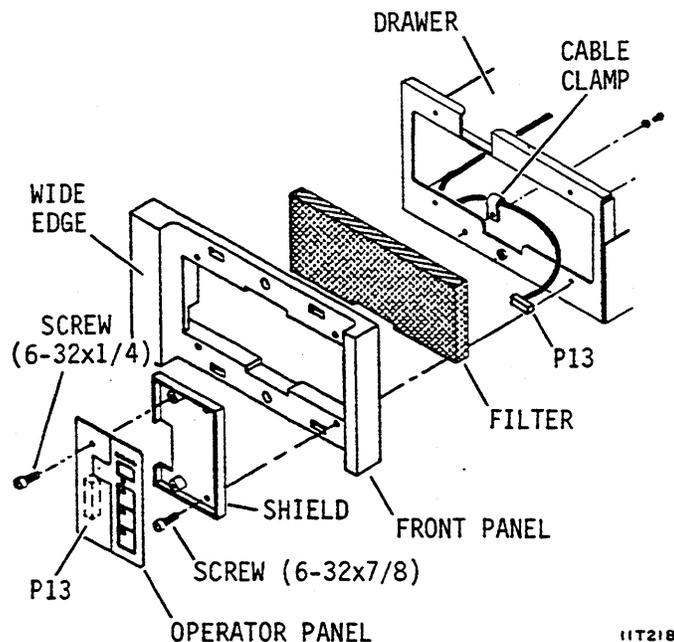
Figure 3-8. Operator Panel Replacement

3204 - POWER SUPPLY REMOVAL & REPLACEMENT

The following procedure describes how to remove and replace the power supply when it is mounted in line with the drive in the drawer (see figure 3-9).

Removal

1. Perform Drive Removal procedure (3201).

2. Remove screws securing power supply to drawer.

3. Lift power supply from drawer, disconnect ac power cord from connector J1, and place power supply on suitable work surface.

4. If power supply is being replaced, remove cable retainer (if used), and disconnect dc power cable from J15. Disconnect ground strap by removing ground screw on power supply.
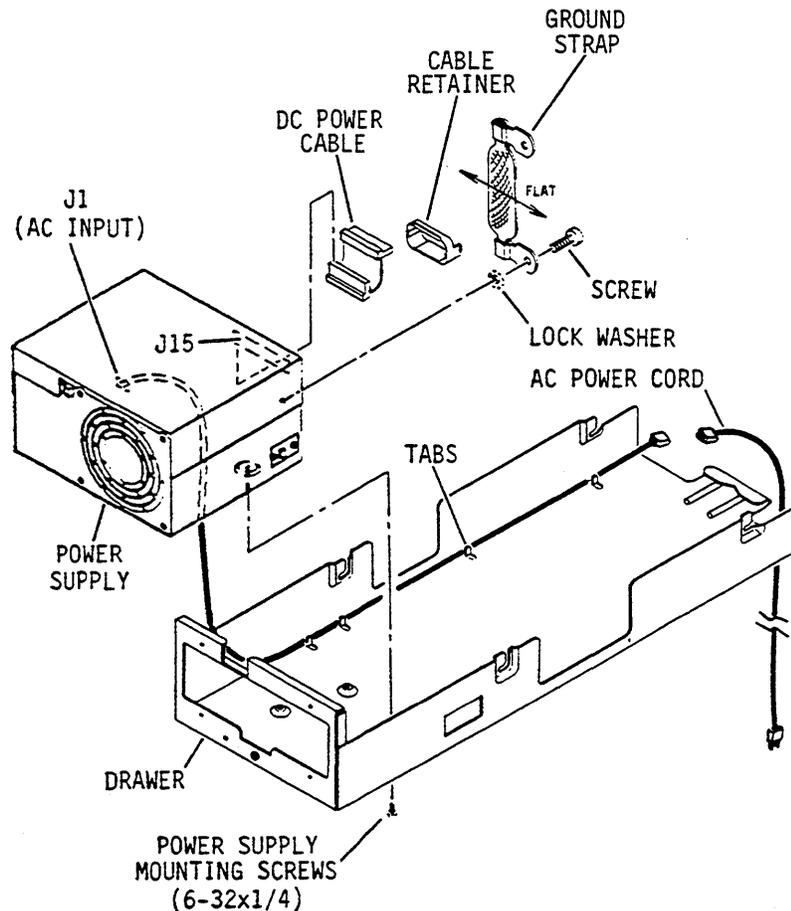
Figure 3-9. Power Supply Replacement

REPAIR AND REPLACEMENT

Replacement

CAUTION

Power supply could fail if voltage select
switch is not matched with input ac voltage.

1. Ensure that voltage select switch is set to desired
   voltage range (see figure 3-10). If it is not, perform
   the following:

   a. Remove screw securing voltage select plate to power
      supply and remove plate. Retain plate and hardware.

   b. Set voltage select switch to desired range.

   c. Reverse voltage select plate and install it to lock
      switch in place.

3. Connect dc power cable to J15 on power supply. Lock
   cable in place with cable retainer (if used).

4. Attach ground strap to ac ground terminal on power
   supply. Ensure that lockwasher is placed between ground
   strap and power supply.

5. Connect ac power cord to connector J1 and place power
   supply in drawer.

6. Secure power supply to drawer with screws.

7. Perform Drive Replacement procedure (3201).

NOTES:

⚠1 LOCKS VOLTAGE SWITCH IN EITHER 115V POSITION
OR 230V POSITION (OTHER SIDE)

115 V

230 V

⚠1
VOLTAGE
SELECT
PLATE

ON/STANDBY
SWITCH
(ON = 1
STANDBY = ⏻)

VOLTAGE
SELECT
SWITCH
(115V OR 230V)

IIF47C
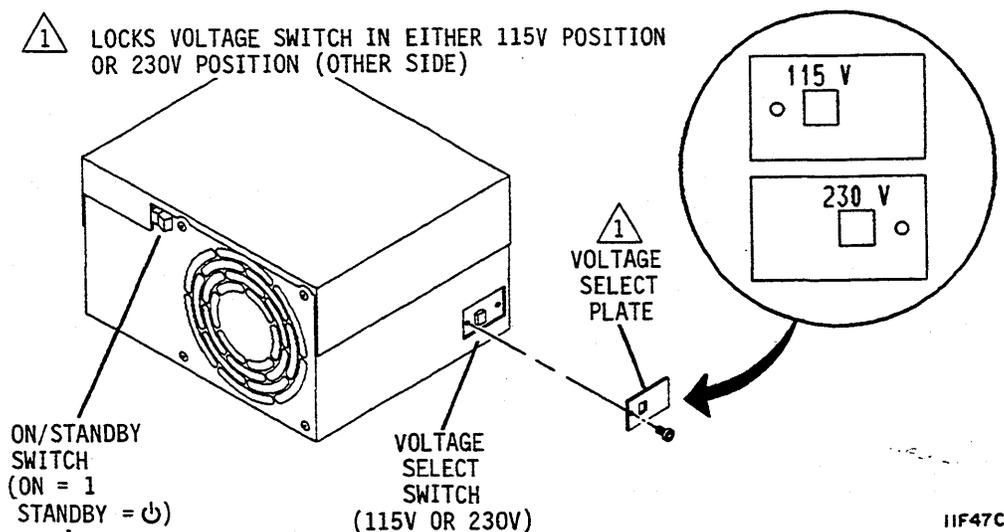
Figure 3-10. Power Supply Voltage Conversion

3205 - MODULE REMOVAL & REPLACEMENT

A temperature stabilization period of 4 or more hours may be
required for a replacement module to reach the ambient
temperature of the drive environment. Follow the instructions
provided with the module regarding temperature stabilization.

A jumper (used for factory test select) may or may not be on
module connector P24 between pins 9 and 10. DO NOT CHANGE
JUMPER (do not move it from one module to another).

Removal

1. Perform Drive Removal procedure (3201), except do not
    remove I/O cable bracket from rear panel on drives with
    SMD interface.

2. Perform Control Board Removal procedure (3302).

    By performing procedures 3201 and 3302, you have removed
    the drive from its mounting and removed all drive
    assemblies that were attached to the module.

3. Remove board pan from module (see figure 3-11).

Replacement

1. Orient board pan as shown in figure 3-11 and place it on
    module.

2. Perform Control Board Replacement procedure (3302).

3. Perform Drive Replacement procedure (3201).

BOARD
PAN

MODULE

IITI27A
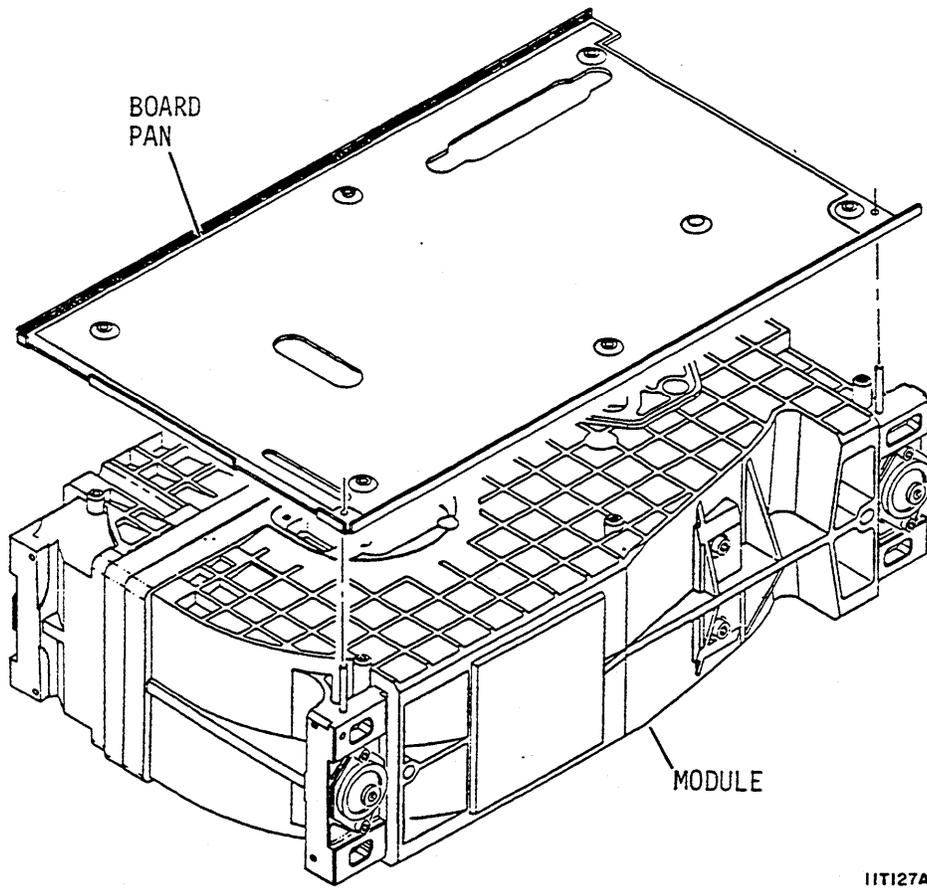
Figure 3-11. Module Replacement

3206 - FAN REMOVAL & REPLACEMENT

This procedure describes how to replace a fan mounted on a fan bracket (see figure 3-12). If the drive is installed in a standard mounting kit (not the ruggedized version described here), see appendix A for power removal instructions.

Removal

1. Gain access to rear of drive. Lift lock knob to release drawer, and push drawer forward several inches.

2. Set On/Standby switch on power supply to Standby position.

3. Push drawer toward rear of tray until lock is engaged.
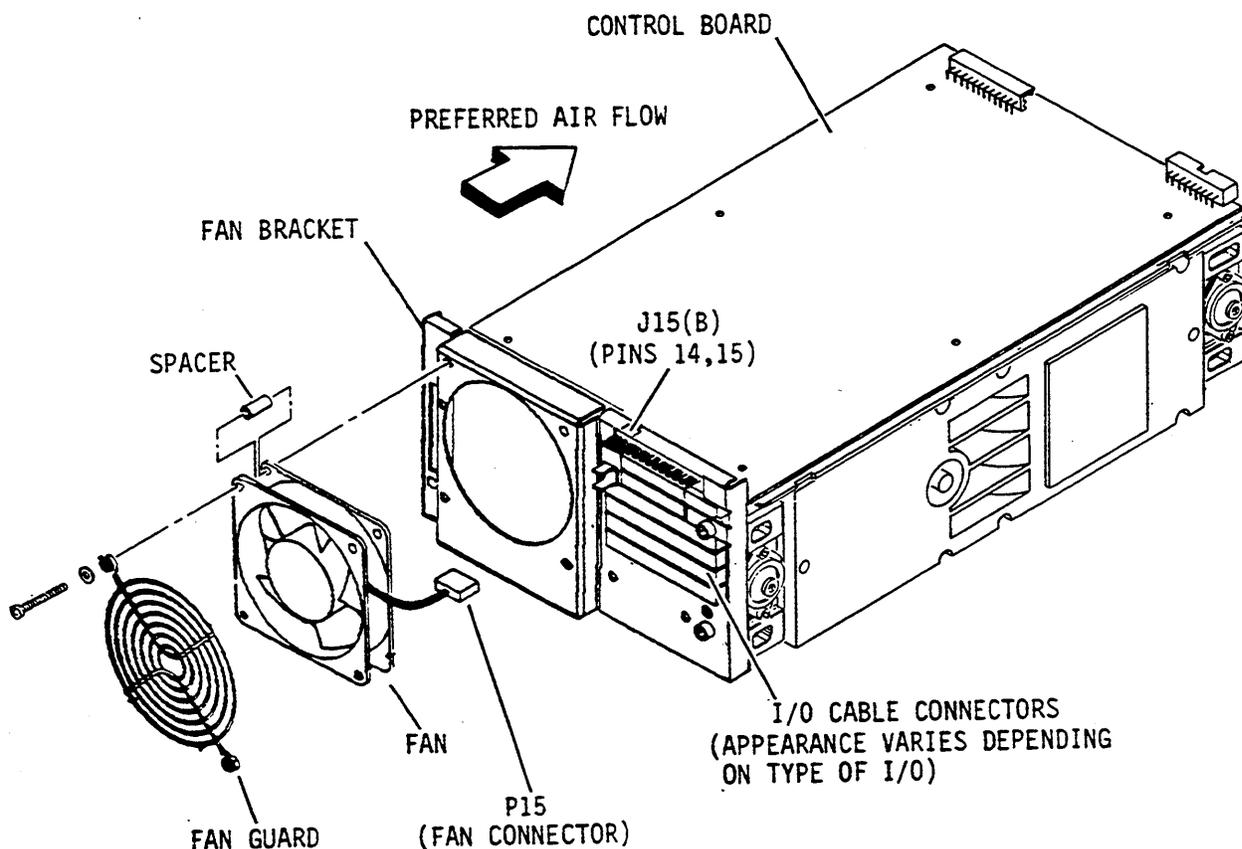
Figure 3-12. Fan Replacement

4. Disconnect the ac power cable from the power source.

5. Disconnect fan connector P15 from J15B on control board.

6. Note direction of arrow (indicating air flow) on side of fan. For most installations, fan blows cooling air through the drive (preferred method). Other installations require reversed air flow.

7. Remove screws securing fan to bracket and remove fan from drive. Retain fan guard and spacers for use with replacement fan.

Replacement

1. Orient fan and fan guard on bracket, ensuring that arrow on new fan points in same direction as arrow on old fan. Secure parts with screws and spacers.

2. Connect fan connector P15 to J15B (pins 14 and 15) on control board.

3. Connect the ac power cable to site power.

4. Gain access to rear of drive. Lift lock knob to release drawer, and push drawer forward several inches.

5. Set On/Standby switch on power supply to On position, and observe fan operation.

6. Push drawer toward rear of tray until lock is engaged.

3301 - I/O BOARD REMOVAL & REPLACEMENT

I/O board replacement is described in three separate procedures -- one for each interface. Figure 3-13 shows I/O board replacement for SMD and SCSI interface drives. Figure 3-14 shows the same thing for IPI interface drives.

SMD I/O Board Removal

1. Perform Top Cover Removal procedure (3102).

2. <u>For drives with a fan on the rear panel</u>, disconnect fan connector P15 from J15B on control board.

3. Remove screws securing rear panel and I/O board to drive.

4. Remove rear panel from drive. Retain panel and hardware.

5. Remove I/O board by disconnecting J20 from P20 on control board.

SMD I/O Board Replacement

1. Ensure all circuit board switches are set either to match removed board or as indicated in the installation section of the user's manual.

2. Align J20 on I/O board to P20 on control board and push two connectors together.

3. Align rear panel to I/O board and secure rear panel and I/O board to drive with screws.

4. <u>For drives with a fan on the rear panel</u>, connect fan connector P15 to J15B (pins 14 and 15) on control board.

5. Perform Top Cover Replacement procedure (3102).

SCSI I/O Board Removal

1. Perform Top Cover Removal procedure (3102).

2. Remove I/O adapter board and cover from connectors on I/O board (see figure 3-13).

3. <u>For drives with a fan on the rear panel</u>, disconnect fan connector P15 from J15B on control board.

4. Remove screws securing rear panel and I/O board to drive.

5. Remove rear panel from drive. Retain panel and hardware.

6. Remove I/O board by disconnecting J20 from P20 on control board.

SCSI I/O Board Replacement

1. Ensure all circuit board switches, jumpers, and select plugs are set either to match removed board or as indicated in the installation section of the user's manual.
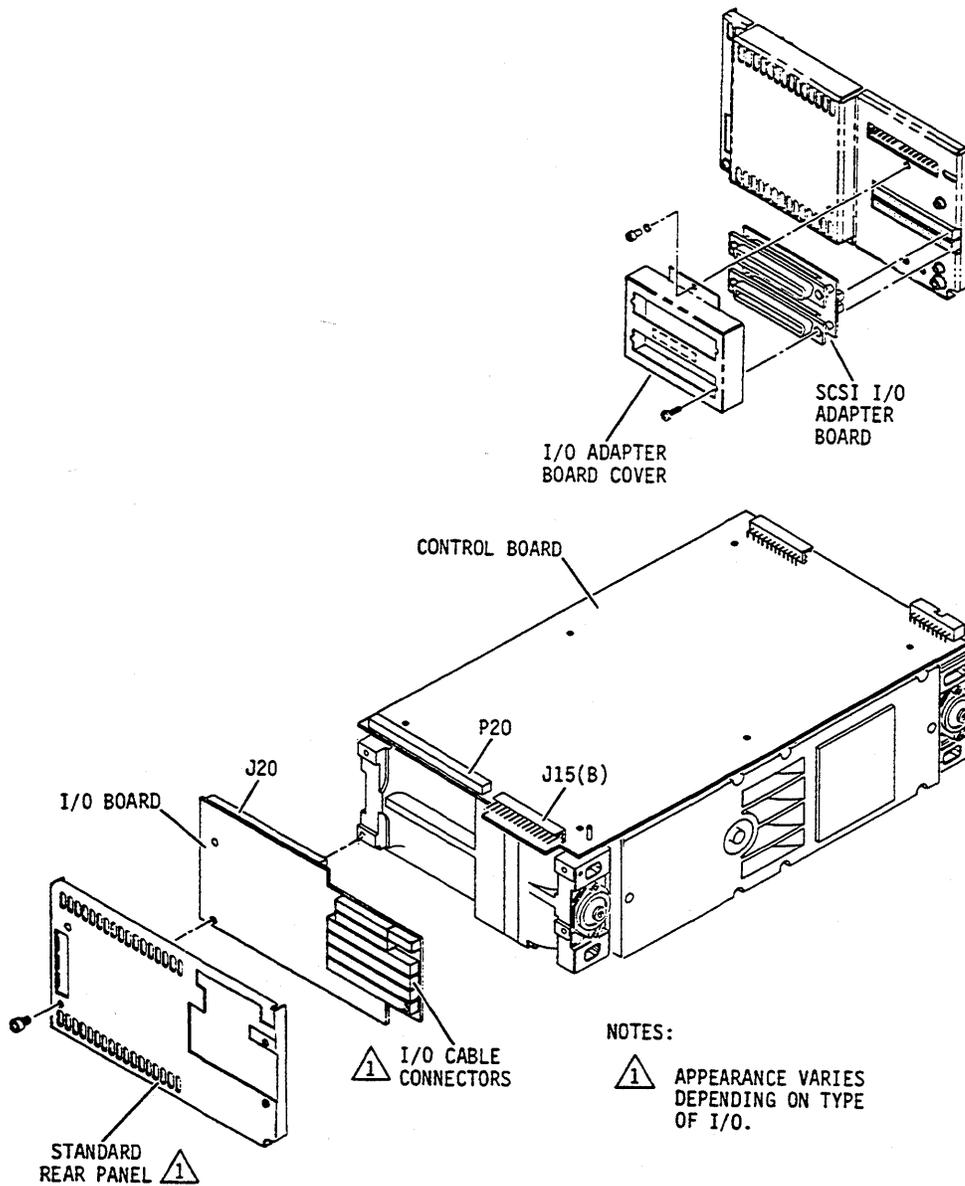
SCSI I/O
ADAPTER
BOARD

I/O ADAPTER
BOARD COVER

CONTROL BOARD

P20

J20

J15(B)

I/O BOARD

I/O CABLE
CONNECTORS

STANDARD
REAR PANEL ⚠1

NOTES:

⚠1 APPEARANCE VARIES
DEPENDING ON TYPE
OF I/O.

IIT46A

Figure 3-13. I/O Board Replacement (SMD and SCSI)

2. Align J20 on I/O board to P20 on control board and push two connectors together.

3. Align rear panel to I/O board and secure rear panel and I/O board to drive with screws.

4. <u>For drives with a fan on the rear panel</u>, connect fan connector P15 to J15B (pins 14 and 15) on control board.

5. Attach I/O adapter board and cover to ·I/O connectors on I/O board.

6. Perform Top Cover Replacement procedure (3102).

IPI I/O Board Removal

1. Perform Top Cover Removal procedure (3102).

2. <u>For drives with a fan on the rear panel</u>, disconnect fan connector P15 from J15B on control board.

3. <u>For drives with a detachable I/O adapter board cover</u>, remove I/O adapter board and cover from connectors on I/O board.

4. Remove screws securing rear panel and I/O board to drive.

5. Remove rear panel from drive. Retain panel and hardware.

6. <u>If rear panel has a built-in I/O adapter board</u>, remove bracket from right side of I/O board.

7. Remove I/O board by disconnecting J20 from P20 on control board.

IPI I/O Board Replacement

1. Ensure all circuit board switches, jumpers, and select plugs are set either to match removed board or as indicated in the installation section of the user's manual.

2. Align J20 on I/O board to P20 on control board and push two connectors together.

3. <u>If rear panel has a built-in I/O adapter board</u>, reinstall bracket on right side of I/O board.

4. Align rear panel to I/O board and secure rear panel and I/O board to drive with screws.

5. <u>For drives with a fan on the rear panel</u>, connect fan connector P15 to J15B (pins 14 and 15) on control board.

6. <u>For drives with a detachable I/O adapter board cover</u>, reattach I/O adapter board and cover to I/O connectors on I/O board.

7. Perform Top Cover Replacement procedure (3102).
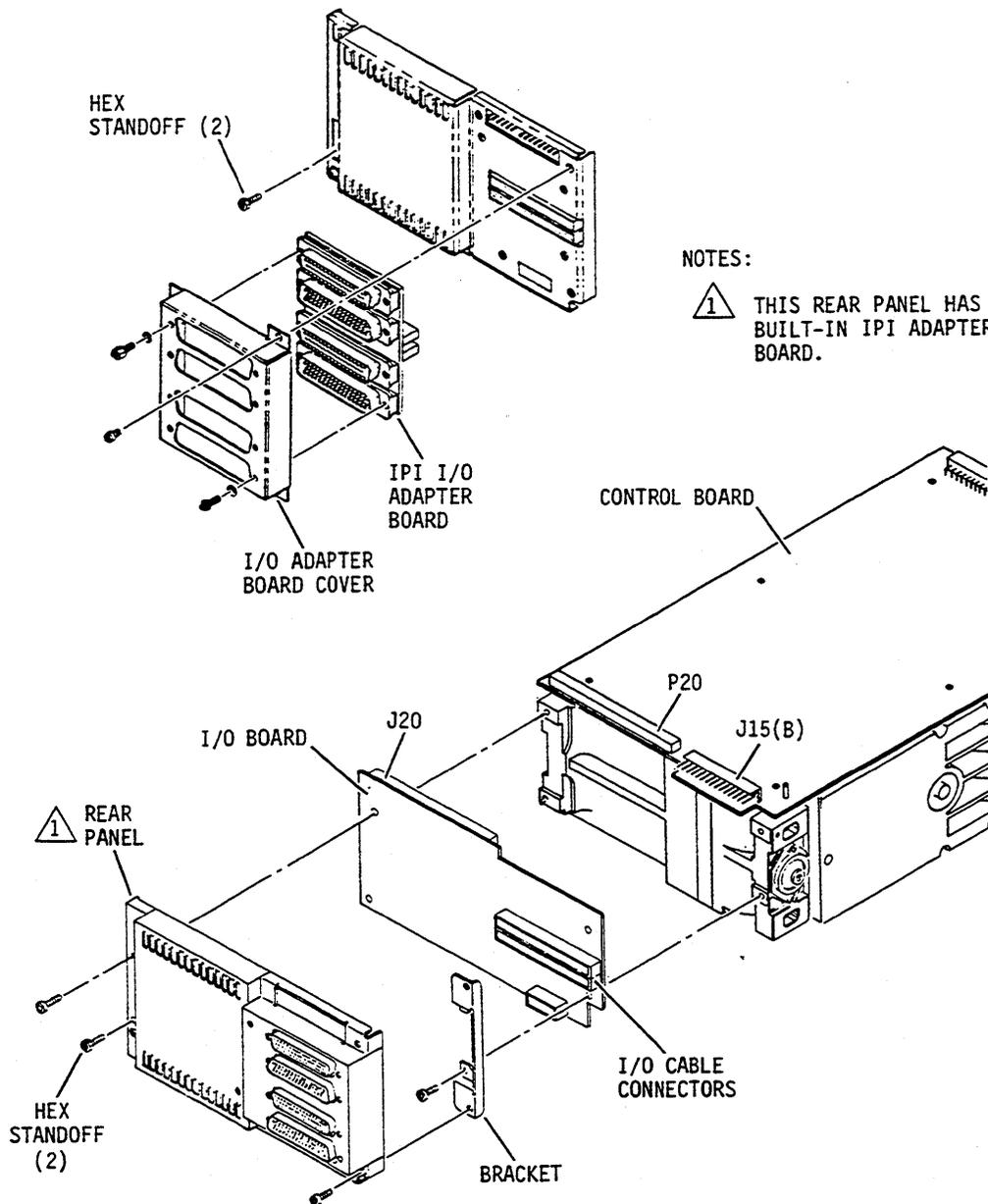
Figure 3-14. I/O Board Replacement (IPI)

3302 - CONTROL BOARD REMOVAL & REPLACEMENT

This procedure describes how to remove the control board (see figure 3-15).

Removal

1. Perform I/O Board Removal procedure (3301).

2. Remove (6) hex standoffs securing control board to module.

CAUTION

Pins on P28A and P28B on control board are not protected in a connector. Be careful not to bend pins after control board is removed from module or they will not align properly when attaching board to module.

3. Disconnect P24 from J24, P28A from J28A, and P28B from J28B by carefully lifting up on board to remove it from module.

Replacement

CAUTION

Ensure that there are no bent pins on P28A and P28B on control board prior to attaching board to module.

1. Set all circuit board switches and jumpers to match removed board or as indicated in user's manual.

CAUTION

During next 2 steps, ensure that gasket placed between module and power supply does not extend underneath control board.

2. Place control board on module guide pins.

3. Align P24 with J24, P28A with J28A, and P28B with J28B and push down to connect board to module.

4. Secure control board to module with hex standoffs.

5. Perform I/O Board Replacement procedure (3301).

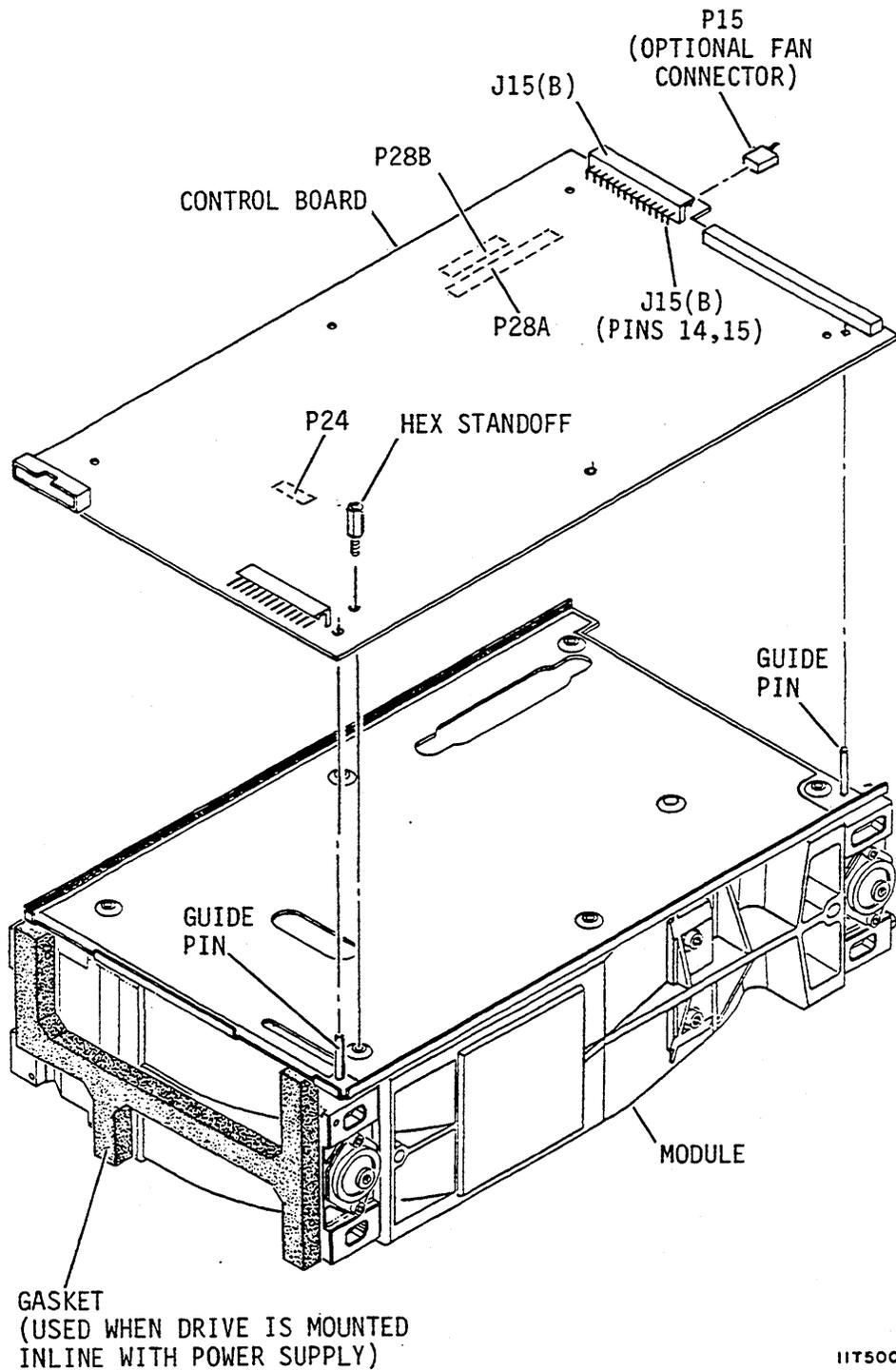6. Perform Top Cover Replacement procedure (3102).

Figure 3-15. Control Board Replacement

ALTERNATE MOUNTING METHODS   A

CAUTION

When servicing the drive, observe all
precautions listed under Electrostatic
Discharge Protection in section 1 of this
manual. Failure to observe these precautions
can result in serious damage to electronic
assemblies.

INTRODUCTION

This appendix works in conjunction with the information
presented about repair and replacement in section 3, and it
contains the following topics:

- Using the Standard Rack Mounting Kit

- Inner Drawer Removal and Replacement

- The Power Supply On/Standby Switch

USING THE STANDARD RACK MOUNTING KIT

The standard rack mounting kit
differs from the ruggedized
mounting kit described in
section 3. As shown to the
right, the standard kit has
two inner drawers -- one for
each drive and power supply.
The two inner drawers mount
in a 2X drawer, which is
slide-mounted in a 483 mm (19
in) standard rack. The slides
allow outward extension of the
2X drawer for ease of
maintenance.

In contrast, the ruggedized
kit has a tray attached to the
rack and individual drawers
that slide in and out of the
tray.
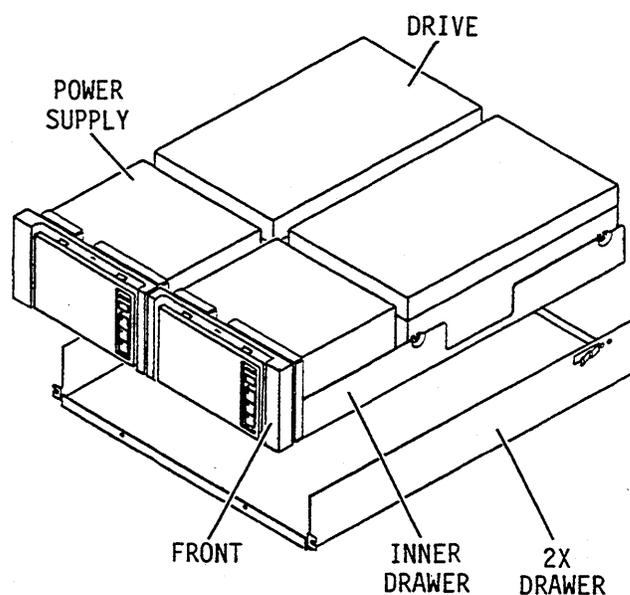
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INNER DRAWER REMOVAL & REPLACEMENT

This procedure describes how to remove and replace the inner drawer in the 2X drawer if the drive was installed with the standard mounting kit. It is similar to the Drawer Removal & Replacement procedure (3101) in section 3 (which applies to the ruggedized mounting kit).

Removal

1. Remove front panel insert from each drive.

   NOTE

   The release latch on the left-hand drive locks the 2X drawer in the rack. The release latch on the right-hand drive has no function.

2. Push 2X drawer release latch to the right and extend 2X drawer to gain access to On/Standby switch on power supply.

3. Remove power from drive as follows:

   • <u>For drives with operator panel or status/control panel</u>:

   a. Press START switch to stop the drive.

   b. Wait for Ready indicator (in START switch) to stop flashing; then, set On/Standby switch on power supply to Standby position.

   • <u>For drives without either panel</u>, set On/Standby switch on power supply to Standby position.

4. Push 2X drawer back to closed position in rack.

5. <u>For SMD interface drives</u>, remove I/O cover and cable clamps from I/O cable bracket.

6. Disconnect I/O cables and system ground strap from drive.

7. <u>For drives with synchronized spindles</u>, disconnect the spindle sync cable.

8. Disconnect ac power cable from site power.

9. Push 2X drawer release latch to the right and extend 2X drawer to fully extended position.

10. Remove inner drawer locking screw.

11. Push 2X drawer release latch to the right, lift inner drawer up and remove it from 2X drawer. Place inner drawer on work table.

Replacement

1. Place inner drawer in 2X drawer and secure with locking screw.

2. Push 2X drawer back to closed position in rack.

3. Connect I/O cables to drive connectors.

4. For SMD interface drives, attach strain relief clamp, I/O cable cover, and grounding clamp to cable bracket.

5. For drives with synchronized spindles, connect the spindle sync cable.

6. Connect system ground strap to drive rear panel.

7. Connect ac power cord to site power.

8. Push 2X drawer release latch to the right and extend 2X drawer to gain access to On/Standby switch on power supply.

9. Set On/Standby switch on power supply to On (1) position.

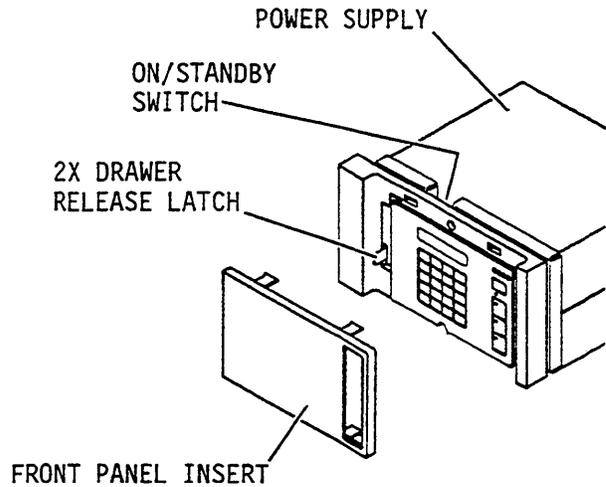10. Push 2X drawer back to closed position in rack.

11. Install front panel insert.

2X DRAWER RELEASE LATCH

INNER DRAWER

2X DRAWER

LOCKING SCREW (8-32x3/8)
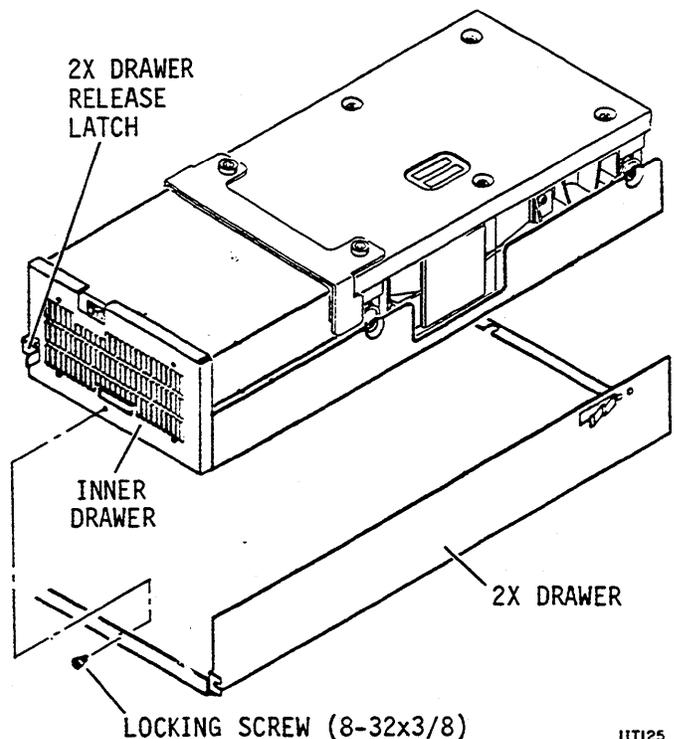
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THE POWER SUPPLY ON/STANDBY SWITCH

The On/Standby switch is on
the power supply. This switch
controls dc power to the drive
and is not routinely used. If
the standard rack mounting kit
is used, access the switch as
follows:

1. Remove the front panel
   insert.

2. Push the 2X drawer
   release latch to the
   right.

3. Extend the 2X drawer
   from the rack to expose
   the power supply.

4. Place the On/Standby
   switch in the desired
   position.

POWER SUPPLY

ON/STANDBY
SWITCH

2X DRAWER
RELEASE LATCH

FRONT PANEL INSERT

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⑤⑤ Seagate