ⒼⒹ CONTROL DATA

CDC® FIXED STORAGE DRIVE

PA5A1

PA5A2

GENERAL DESCRIPTION

OPERATION

INSTALLATION AND CHECKOUT

PARTS DATA

Volume 1

HARDWARE MAINTENANCE MANUAL

REVISION RECORD

REVISION	DESCRIPTION
01 (04-20-82)	Preliminary Release
02 (07-09-82)	Preliminary manual updated with technical and editorial changes. This edition obsoletes all previous editions.
03 (09-09-82)	Preliminary manual updated with editorial changes.
A (10-21-82)	Original Release. Covers Series Code 01 and 02 units. This edition obsoletes all previous editions.
B (01-21-83)	Manual revised to incorporate the following series code 03 changes: ECOs DJ05168, DJ05154, DJ05184, DJ05170, DJ05171, DJ05182, DJ05185, DJ05197, technical changes, and editorial changes. Section 4 (Parts Data) completely rewritten.
C (04-15-83)	Manual revised to incorporate the following series code 04 and 05 changes: ECOs DJ05196, DJ05210, DJ05212, DJ05198, DJ05238, DJ05226, FCOs DJ05102, DJ05185, technical changes, and editorial changes. This edition obsoletes all previous editions.
D (08-18-83)	Manual revised to incorporate the following series code 05 changes: ECOs DJ05225, DJ05227, DJ03308, DJ03366, DJ03392, technical changes, and editorial changes. This edition obsoletes all previous editions.
E (10-12-83)	Manual revised to incorporate the following series code 06 changes: ECO DJ05267, technical changes, and editorial changes.
F (12-30-83)	Manual revised to incorporate the following series code 07 changes: ECOs DJ05240, DJ05584, DJ05555, DJ05527, technical changes, and editorial changes.

REVISION LETTERS I, O, Q
AND X ARE NOT USED.

Address comments concerning this
manual to:
     Control Data Corporation
     Technical Publications Dept.
     5950 Clearwater Drive
     Minnetonka, MN 55343
or use Comment Sheet in the back
of this manual.

REVISION RECORD (Contd)

REVISION	DESCRIPTION
G (05-01-84)	Manual revised to incorporate the following series code 08 changes: ECO DJ05723, technical changes and editorial changes. This edition obsoletes all previous editions.
H (06-29-84)	Manual revised to incorporate series code 09 technical and editorial changes.
J (11-01-84)	Manual revised to incorporate the following series code 10 and 11 changes: Class 2 ECOs DJ03601, DJ03663, DJ03672, DJ05750, DJ05796, DJ05832, DJ05898, DJ05918, DJ05926, DJ05938, DJ05942, DJ08190, technical changes, and editorial changes. This edition obsoletes all previous editions.
K (03-01-85)	Manual revised to incorporate the following series code 12/13/14 changes: Class 1 ECOs DJ03727, DJ03741, Class 2 ECOs DJ03715, DJ03745, DJ05949, DJ28006, technical changes, and editorial changes.
L (04-11-86)	Incorporated the following series code 15/16/17/18/19 changes: Class 1 ECOs DJ03811, DJ03851, DJ03867, DJ03882, DJ03908, DJ28002, DJ28003, DJ28028, DJ28042, DJ28056, Class 2 ECOs DJ03833, DJ03873, DJ03905, DJ28036, DJ28038, DJ28071, DJ28111, DJ30021, DJ30249, DJ30282, DJ30334, technical changes, and editorial changes. This edition obsoletes all previous editions.
M (04-15-87)	Incorporated the following series code 20 changes: Class 1 ECO DJ28143, Class 2 ECOs DJ28130, DJ03978, DJ28146, technical changes, and editorial changes.
N (01-12-88)	Incorporated the following series code 20/21 changes: class 1 ECOs DJ28141, DJ28156, technical changes, and editorial changes.

MANUAL TO EQUIPMENT LEVEL CORRELATION

This manual reflects the equipment configurations listed below.

EXPLANATION: Locate the equipment type and series code number, as shown on the Equipment Configuration Log, in the list below. Immediately to the right of the series code number is an FCO number. If that number and all of the numbers underneath it match all of the numbers on the Equipment Configuration Log, then this manual accurately reflects the equipment.

This correlation sheet also applies to the following related manuals:

Pub. No.___83324510_____Rev.__J__

Pub. No.___83324640_____Rev.__J__

EQUIPMENT TYPE	SERIES CODE	WITH FCOs	COMMENTS
PA5A1/PA5A2	01	05102	BPXX to CPXX
	02	05185	Remove studs on base.
	03	None	
	04	None	
	05	None	
	06	05648	EPROM change to – PXX board.
	07	None	
	08	None	
	09	None	
	10	None	
	11	None	
	12	None	
	13	None	
	14	None	
	15	None	
	16	None	
	17	None	
	18	None	
	19	None	
	20	None	
	21	None	

LIST OF EFFECTIVE PAGES

This manual is at revision __N__ . Each page in your
manual should be at the revision level listed
below. The "Div" is a colored divider page.

PAGE/REV		PAGE/REV		PAGE/REV		PAGE/REV		PAGE/REV	
Cover	–	1-7	J	3-13	K	3-45	N	4-21	L
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Title P	–	1-9	J	3-15	M	3-47	N	4-23	L
f-2	N	Blank	–	3-16	M	3-48	N	4-24	L
f-3	N	S-2 Div	–	3-17	L	3-49	N	4-25	M
Blank	–	Blank	–	3-18	N	3-50	N	4-26	N
f-5	N	2-1	N	3-19	L	3-51	N	4-27	M
Blank	–	2-2	N	3-20	N	3-52	N	4-28	N
f-7	N	2-3	N	3-21	K	3-53	N	4-29	N
Blank	–	2-4	N	3-22	L	Blank	–	4-30	N
f-9	N	2-5	N	3-23	L	S-4 Div	–	4-31	N
f-10	N	2-6	N	3-24	L	Blank	–	4-32	N
f-11	N	2-7	N	3-25	L	4-1	N	4-33	N
f-12	N	2-8	N	3-26	L	4-2	N	4-34	L
f-13	N	2-9	N	3-27	L	4-3	L	4-35	L
f-14	N	2-10	N	3-28	L	4-4	L	4-36	L
f-15	N	2-11	N	3-29	L	4-5	M	4-37	L
Blank	–	Blank	–	3-30	L	4-6	L	4-38	L
f-17	N	S-3 Div	–	3-31	L	4-7	M	4-39	L
Blank	–	Blank	–	3-32	L	4-8	L	4-40	M
f-19	N	3-1	J	3-33	L	4-9	L	4-41	L
f-20	N	3-2	M	3-34	L	4-10	L	4-42	M
f-21	N	3-3	L	3-35	N	4-11	L	4-43	N
f-22	N	3-4	L	3-36	N	4-12	L	4-44	N
S-1 Div	–	3-5	M	3-37	N	4-13	L	4-45	N
Blank	–	3-6	M	3-38	N	4-14	L	4-46	L
1-1	H	3-7	M	3-39	N	4-15	L	4-47	L
1-2	M	3-8	M	3-40	N	4-16	L	Blank	–
1-3	M	3-9	M	3-41	N	4-17	L	Cmt Sht	–
1-4	J	Blank	–	3-42	N	4-18	L	Rtn Env	–
1-5	J	3-11	J	3-43	N	4-19	L	Blank	–
1-6	L	3-12	L	3-44	N	4-20	L	Cover	–

PREFACE

This manual contains maintenance information for the CONTROL DATA® PA5A1/PA5A2 Fixed Storage Drive (FSD). It provides instructions to all personnel who operate the FSD and to customer engineers who install and check out the FSD. Customer engineers who troubleshoot and repair FSDs should obtain copies of the hardware maintenance manual, volumes 2 and 3 (listed below) that pertain to the drives they are maintaining.

The information in this manual is presented as follows:

    Section 1 - General Description. Describes equipment functions and specifications.

    Section 2 - Operation. Describes and illustrates the location and use of all controls and indicators, and provides operating procedures.

    Section 3 - Installation and Checkout. Describes site requirements, unpackaging and inspection, installation and checkout.

    Section 4 - Parts Data. Contains illustrated parts breakdown and spare parts list.

The following manuals apply to the FSD and are available from Control Data Corporation, Literature Distribution Services, 308 North Dale Street, St. Paul, MN 55103:

Publication No.	Title
83324500	PA5A1/PA5A2 Hardware Maintenance Manual, Volume 1
83324510	PA5A1/PA5A2 Hardware Maintenance Manual, Volume 2 (contains theory of operation and maintenance)
83324640	PA5A1/PA5A2 Hardware Maintenance Manual, Volume 3 (contains diagrams)
83325440	RSD/FSD Power Supply Diagrams Manual (contains power supply diagrams, which are intended for reference use only)
83325310	A Guide for the Disk Drive Operator

Preface Continued

Publication No.	Title
83325360	Reference Card (provides status code and diagnostics information)
83322440	CDC Microcircuits, Volume 1 (provides functional descriptions for integrated circuits)
83324440	CDC Microcircuits, Volume 2 (provides functional descriptions for integrated circuits)

CONTENTS

FIGURES

TABLES

IMPORTANT SAFETY INFORMATION AND PRECAUTIONS

Proper safety and repair is important to the safe, reliable operation of this unit. Service should be done by qualified personnel only. This maintenance manual describes procedures recommended by the manufacturer as effective methods of servicing the unit. Some of these procedures require the use of specially designed tools. For proper maintenance and safety, these specially designed tools should be used as recommended.

The procedures in this maintenance manual and labels on the unit contain warnings and cautions which must be carefully read and observed in order to minimize or eliminate the risk of personal injury. The warnings point out conditions or practices that are potentially hazardous to maintenance personnel. The cautions point out practices which, if disregarded, could damage the unit and make it unsafe for use.

For the safety of maintenance and operating personnel, the following precautions must be observed:

- Perform all maintenance by following the procedures given in this manual and using only CDC/MPI replacement parts.

- Read and observe all cautions and warnings provided in the procedures and labeled on the unit.

- Use the special tools called out in the maintenance procedures.

- Observe sound safety practices when performing maintenance.

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

- Wear safety glasses when servicing units.

- Wear safety shoes when removing or replacing heavy components.

It is also important to understand that these warnings and cautions are not exhaustive. The manufacturer could not possibly know, evaluate and advise maintenance personnel of all conceivable ways in which maintenance might be performed or the possible risk of each maintenance technique. Consequently, the manufacturer has not completed any such broad evaluation. Thus, any persons who use any non-approved maintenance procedure or tool must first satisfy themselves that neither their safety nor the unit performance will be jeopardized by the maintenance techniques they select.

CONFIGURATION CHART

EQUIPMENT NUMBER*	INTERFACE	DATA CAPACITY (MB)	POWER SUPPLY
PA5A1A	Single Channel	160	Remote
PA5A1B	Single Channel	160	Remote
PA5A1C	Single Channel	160	Remote
PA5A1F	Single Channel	160	Integral
PA5A1G	Single Channel	160	Remote
PA5A1H	Single Channel	160	Integral
PA5A1K	Single Channel	160	Integral
PA5A1M	Single Channel	160	Integral
PA5A1N	Single Channel	160	Remote
PA5A1P	Single Channel	160	Integral
PA5A2B	Dual Channel	160	Remote
PA5A2C	Dual Channel	160	Remote
PA5A2E	Dual Channel	160	Integral
PA5A2F	Dual Channel	160	Remote
PA5A2G	Dual Channel	160	Integral
PA5A2H	Dual Channel	160	Integral

* Refer to section 4 for equipment package list-
ings that include painted parts and other sup-
plied options.

ABBREVIATIONS

A	Ampere		CLK	Clock
ABV	Above		CLR	Clear
ac	Alternating Current		cm	Centimeter
ADD	Address		CNTR	Counter
ADDR	Address		COMP	Comparator
ADJ	Adjust		CONT	Control
ADRS	Address		CONTD	Continued
AGC	Automatic Gain Control		CT	Center Tap
ALT	Alternate		CYL	Cylinder
AM	Address Mark		D/A	Digital to Analog
AME	Address Mark Enable		dc	Direct Current
AMP	Amplifier, Ampere		DET	Detect
ASSY	Assembly		DIFF	Differential
BLW	Below		DIV	Division
C	Celsius		DLY	Delay
CB	Circuit Breaker		DRVR	Driver
CDA	Complete Drive Assembly		ECL	Emitter Coupled Logic
CDC	Control Data Corporation		ECO	Engineering Change Order
CH	Channel		EN	Enable
CHK	Check		ENBL	Enable

ABBREVIATIONS (Cont'd)

EXT	External	IND	Index
F	Fahrenheit, Fuse	INT	Internal
FCO	Field Change Order	INTRPT	Interrupt
FDBK	Feedback	I/O	Input/Output
FIG	Figure	IPB	Illustrated Parts Breakdown
FLT	Fault	IPS	Inches per Second
FRU	Field Replaceable Unit	kg	Kilogram
FSD	Fixed Storage Drive	kPa	Kilopascal
ft	Foot	kW	Kilowatt
FTU	Field Test Unit	lb	Pound
FWD	Forward	lbf	Pounds-Force
GND	Ground	LED	Light Emitting Diode
HD	Head	LSI	Large Scale Integration
HEX	Hexagon	LTD	Lock to Data
Hg	Mercury	m	Meter
HR	High Resolution	MAX	Maximum
HYST	Hysteresis	MB	Megabyte
Hz	Hertz	MEM	Memory
IC	Integrated Circuit	MHz	Megahertz
IDENT	Identification	mm	Millimeter
in	Inch		

ABBREVIATIONS (Contd)

MPI	Magnetic Peripherals, Inc.		PROG	Programmable
MPU	Microprocessor Unit		PS	Power Supply
MRK	Mark		PWR	Power Supply
ms	Millisecond		RCVR	Receiver
MTR	Motor		RD	Read
mV	Millivolt		RDY	Ready
N	Newton		REF	Reference
NC	No Connection		REQ	Request
NORM	Normal		RES	Resolution
NRZ	Non Return to Zero		REV	Reverse, Revision
ns	Nanosecond		RGTR	Register
OC	On Cylinder		r/min	Revolutions Per Minute
OS	One-Shot		RSD	Removable Storage Drive
OSC	Oscillator		RTZ	Return to Zero
P	Plug		R/W	Read/Write
PD	Peak Detect		s	Second
pF	Picofarad		S/C	Series Code
PG	Page		SEC	Second
PHH	Phillips Head		SEL	Select
PLO	Phase Lock Oscillator		SEQ	Sequence
PROC	Procedure		SPD	Speed

ABBREVIATIONS (Contd)

SS	Sector Switch		W	Watts
T	Tracks to go		W/	With
TF	Thread Forming		W/O	Without
TIM	Timer		W PROT	Write Protect
TP	Test Point		W+R	Write or Read
TSP	Troubleshooting Procedure		W·R	Write and Read
TTL	Transistor-Transistor Logic		WRT	Write
			XFR	Transfer
V	Volts, Voltage		Ω	Ohms
Vbb	Bias Voltage		$	Hexadecimal Address
VCC	Bias Voltage		uF	Microfarad
VCO	Voltage Controlled Oscillator		us	Microsecond

SECTION 1

GENERAL DESCRIPTION

INTRODUCTION

The Control Data PA5A1/PA5A2 Fixed Storage Drives (FSDs) are high speed, random access digital data storage devices that connect to a central processor through a controller. The total data storage capacity of the drive is 160 megabytes. All the equipment specifications for the drives are listed in table 1-1.

The remainder of this section provides a general description of the drives and is divided into the following areas:

- Equipment Functional Description -- Explains the basic function of the drive.

- Equipment Physical Description -- Provides a basic description of the drive's physical characteristics.

- Equipment Configuration -- Describes the various drive configurations and how to identify them.

EQUIPMENT FUNCTIONAL DESCRIPTION

The drive contains all the circuits and mechanical devices necessary to record data on and recover it from its disks. The necessary power for this is provided by the power supply, which receives its input power from the site main power source. The power supply is shipped as an option with the drive.

All functions performed by the drive are done under direction of the controller. The controller communicates with the drive via the interface which consists of a number of I/O lines carrying the necessary signals to and from the drive.

Some interface lines, including those that carry commands to the drive, are not enabled unless the drive is selected by the controller. Unit selection allows the controller, which can be connected to more than one drive, to initiate and direct an operation on a specific drive.

TABLE 1-1. DRIVE SPECIFICATIONS

Characteristics	Conditions	Specifications
PHYSICAL		
Size	Dimensions	See Space Requirements in section 3
	Weight (Drive only)	27.2 kg (60.0 lb)
	Weight (Power Supply only)	5.4 kg (12.0 lb)
Recording	Total Capacity (Unformatted)	160 megabytes
	Bytes per track	20 160 bytes
	Number of disks	6
	Movable data heads	10
	Servo Heads	1
	Tracks per inch	551
	Physical heads per surface	1
	Logical cylinders per head/disk assy	823 (0-822)
PERFORMANCE		
Transfer rate	Disk speed at 3600 r/min	9.677 MHz (1.2 megabytes/sec)
Table Continued on Next Page		

TABLE 1-1. DRIVE SPECIFICATIONS (Contd)

Characteristics	Conditions	Specifications
PERFORMANCE		
Latency		Latency is time to reach a particular track address after positioning is complete.
	Average	8.33 milliseconds (disk rotation speed at 3600 r/min)
	Maximum	16.83 milliseconds (disk rotation speed at 3564 r/min)
Recording	Mode	2-7 code
	Density	9492 bits per inch (inner track)
Seek Time	Full	55 milliseconds maximum
	Average	30 milliseconds
	Single Track	7 milliseconds maximum
Start Time		10 seconds typical 30 seconds maximum
Stop Time		10 seconds typical 15 seconds maximum

All operations performed by the drive are related to data storage and recovery (normally referred to as writing and reading). The actual reading and writing is performed by electromagnetic devices called heads that are positioned over the recording surfaces of the rotating disks. There is a separate head for each disk surface, and the heads are positioned in such a way that data is written in concentric tracks around the disk surfaces (see figure 1-1).

DATA RECORDED
IN CONCENTRIC TRACKS

HEADS

DISKS

CONTROLLER

I/O LINES

INTERFACE

UNIT SELECTION LOGIC

HEAD SELECTION LOGIC

READ/WRITE LOGIC

SEEK LOGIC

POSITIONING DEVICE

TRACK ORIENTATION LOGIC

ERROR DETECTION LOGIC

POWER SUPPLY
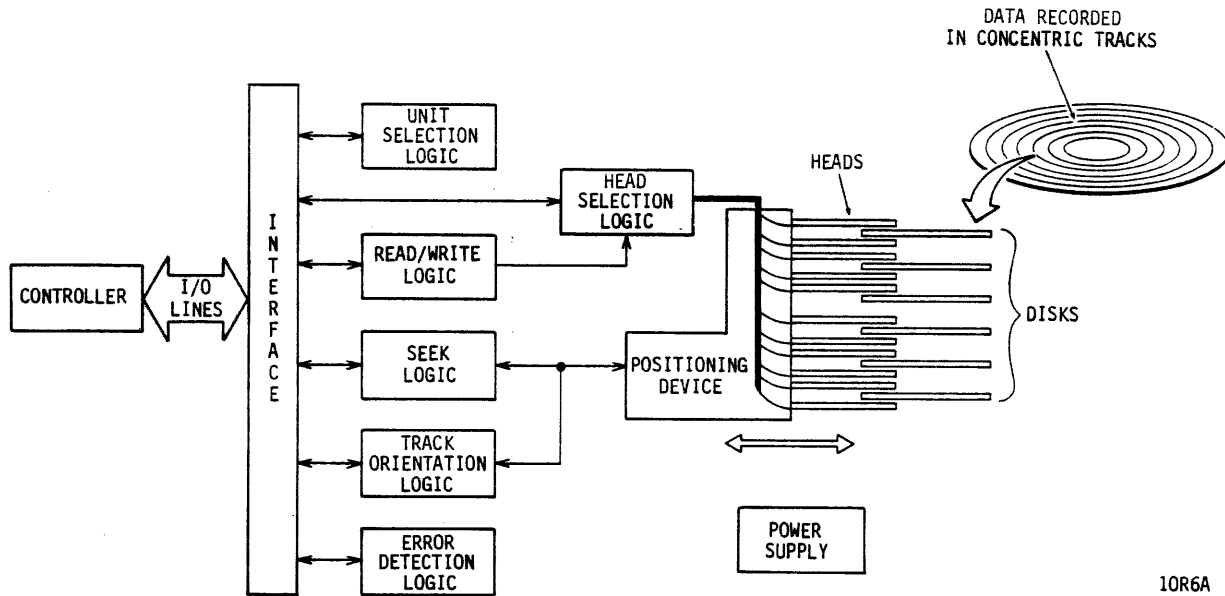
1OR6A

Figure 1-1. Drive Functional Block Diagram

Before any read or write operation can be performed, the con-
troller must instruct the drive to position the heads over the
desired track (called seeking) and also to use the head located
over the surface (head selection) where the operation is to be
performed.

After selecting a head and arriving at the data track, the con-
troller still must locate that portion of the track on which
the data is to be written or read. This is called track orien-
tation and is done by using the Index and Sector signals gener-
ated by the drive. The Index signal indicates the logical be-
ginning of each track, and the Sector signals are used by the
controller to determine the position of the head on the track
with respect to Index.

When the desired location is reached, the controller commands the drive to actually read or write the data. During a read operation, the drive recovers data from the disks and transmits it to the controller. During a write operation, the drive receives data from the controller, processes it and writes it on the disks.

The drive is also capable of recognizing certain errors that may occur during its operation. When an error is detected, it is indicated either by a signal to the controller or by a maintenance indicator on the drive itself.

EQUIPMENT PHYSICAL DESCRIPTION

The following paragraphs provide a physical description of the drive. The components mentioned in this discussion are identified in figure 1-2.

An installation requires a drive, interconnecting cabling, and a power supply. Site power enters the power supply via the ac power cable. The power supply develops the dc voltages required by the drive. These voltages are supplied to the drive by the dc harness.

The drive package includes a deck, front and rear panels, and a top cover. Air flow is provided by a fan, mounted on the rear panel, to circulate cooling air around the electronic assemblies. This air enters a port in the front panel, passes through an air filter, and exhausts through the rear panel opening.

The drive front panel contains the operator controls. The operator controls consist of the logic plug and all switches and indicators used by the operator to control normal operation of the drive.

The drive's internal components include a set of circuit boards and a module. The circuit boards are interconnected, and they contain the electronics required for drive operation. The module is a sealed unit containing the electromechanical components used for data storage and retrieval. These components include the disks, spindle, drive motor, actuator, and heads.

The six disks provide the recording medium for the drive. These disks are center-mounted on a spindle, and the spindle is coupled directly to the drive motor. When activated, the drive motor rotates the disks at 3600 r/min and also produces a circulation of air within the sealed module.

Figure 1-2. Drive Major Assemblies

TOP COVER

POWER SUPPLY

FAN

AC
POWER
CABLE

MODULE $\triangle$1

OPERATOR CONTROLS

REAR PANEL

CIRCUIT
BOARDS

FRONT PANEL
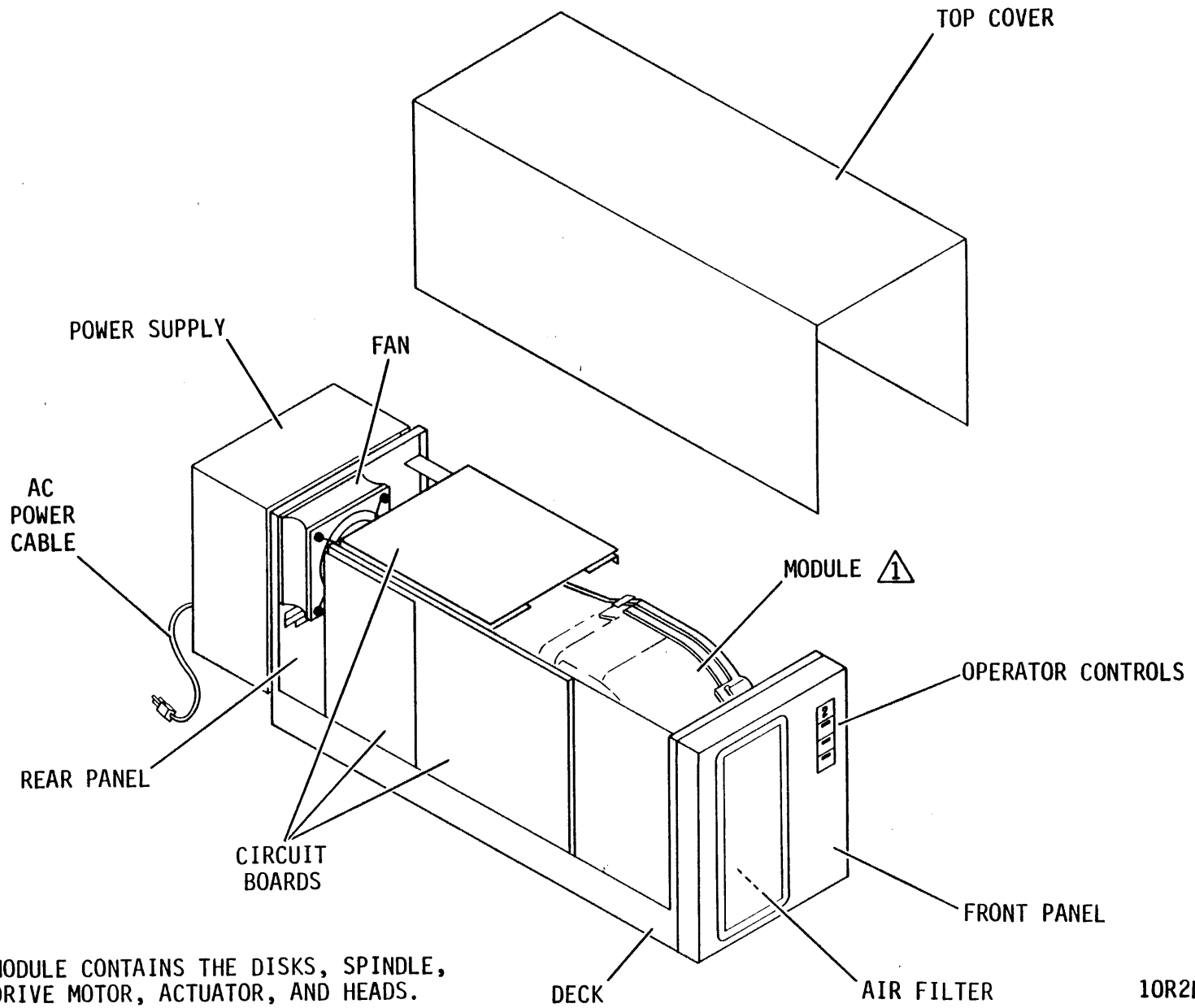
NOTES:

$\triangle$1 MODULE CONTAINS THE DISKS, SPINDLE,
DRIVE MOTOR, ACTUATOR, AND HEADS.

DECK

AIR FILTER

10R2D

The actuator is the assembly that holds the heads and moves the heads over the rotating disks. There are eleven heads; a servo head to control actuator positioning, and ten data heads used for data transfers to and from the disks. The actuator has a voice coil which rotates in and out of a permanent magnetic field in response to signals from the servo positioning circuitry. Voice coil rotation moves the heads in an arc across the rotating disks. When the drive is not in use, the heads rest on the disk surface in the preassigned landing zone (beyond the data zone in the inner area of the disk surface). The actuator is automatically latched in this position, at shutdown, for moving or shipping protection. When the drive is activated to bring the disks up to speed, the heads fly on a cushion of air close to the disk surface.

A complete listing of field-replaceable parts is given in the parts data section of this manual. Refer to volume II of the hardware maintenance manual for theory of operation of the drive components.

EQUIPMENT CONFIGURATION

GENERAL

The equipment configuration is identified by the equipment identification label and by the Equipment Configuration Log. It is necessary to identify the equipment configuration to determine if the manuals being used are applicable to the equipment. The following describes the equipment identification label, Equipment Configuration Log, and Manual To Equipment Level Correlation sheet.

EQUIPMENT IDENTIFICATION

General

The equipment is identified by labels attached to the drive and to the power supply. The label on the drive identifies the basic mechanical and logical configuration of the drive at the time it leaves the factory. The label on the power supply references the components making up the drive installation and lists the site power requirements for the power supply. The information contained on these labels is defined in the following paragraphs.

Equipment Identification Number

The equipment identification number is divided into the two parts shown in the example:

EXAMPLE:

```
              PA5           A1A
               |             |
   Equipment___|             |_____Type
   Identifier                       Identifier
```
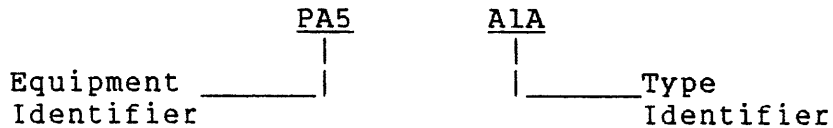
The equipment identifier indicates the basic functional capabilities of the drive.

The type identifier indicates differences between drives that have the same equipment identifier. These differences are necessary to adapt a drive to specific system requirements. However, they do not change the overall capabilities of the drive as defined in table 1-1.

The standard drive has single channel access. An option is available that gives the drive dual channel access. Single channel drives can connect to and communicate with one controller. Dual channel drives can connect to and communicate with two controllers.

Series Code

The series code represents a time period within which a unit is built. All units are interchangeable at the system level, regardless of series code; however, parts differences may exist within units built in different series codes. When a parts difference exists, that difference is noted in the parts data section of this manual.

Part Number

The equipment identification label on the power supply lists three numbers: the equipment package part number, the CDA number, and the power supply number. The equipment package part number is the number assigned to the complete unit including drive, power supply (if applicable), painted panels, installation hardware, etc. If the drive has an integral power supply, the CDA part number is the number assigned to the drive and power supply as one unit. On units with a remote power supply or no power supply, the CDA part number is the number assigned to the drive only. The power supply number is the part number for the power supply only.

Serial Number

Each drive has a unique serial number assigned to it. Serial numbers are assigned sequentially within a family of drives. Therefore, no two equipments will have the same serial number.

EQUIPMENT CONFIGURATION LOG

Engineering Change Orders (ECOs) are electrical or mechanical changes that are performed at the factory and may cause a series code change. When the factory installs an ECO early (prior to a series code change), it is logged on the Equipment Configuration Log.

Field Change Orders (FCOs) are electrical or mechanical changes that may be performed either at the factory or in the field. FCO changes do not affect the series code but are indicated by an entry on the Equipment Configuration Log that accompanies each machine. The components of a machine with an FCO installed may not be interchangeable with those of a machine without the FCO; therefore, it is important that the Equipment Configuration Log be kept current by the person installing the FCO.

MANUAL TO EQUIPMENT LEVEL CORRELATION

Throughout the life cycle of a machine, changes are made, either in the factory build (a series code change) or by FCOs installed in the field. All of these changes are also reflected in changes to the manual package. In order to assure that the manual correlates with the machine, refer to the Manual To Equipment Level Correlation sheet located in the front matter of this manual. This sheet records all the FCOs which are reflected in the manual. It should correlate with the machine Equipment Configuration Log if all the FCOs have also been installed in the machine.

SECTION 2

OPERATION

INTRODUCTION

This section provides the information and instructions to operate the drive. It is divided into the following areas:

- Switches and Indicators - locates and describes the various controls and indicators.

- Operating Instructions - describes procedures for operating the drive.

- Filter Replacement and Cleaning - describes filter maintenance for the drive operator.

SWITCHES AND INDICATORS

Switches and indicators are found in four locations on the drive:

- Power Supply
- Front Panel
- Control Board
- I/O Board

Figure 2-1 shows these controls and indicators, and they are explained in table 2-1 and in the following text.

POWER SUPPLY

Drive power is controlled by the ON/STANDBY switch (CB1 breaker on older supplies) on the power supply. Remote supplies and older integral supplies have -24 V, +24 V, and -5 V circuit breakers. On newer integral supplies (without circuit breakers), if dc voltage is lost due to overvoltage, overcurrent, or overtemperature, restore power by resetting the ON/STANDBY switch.

INDIVIDUAL FAULT INDICATORS:

UNIT SELECTED INDICATOR

LOGIC PLUG

READY INDICATOR

START SWITCH

FAULT INDICATOR

FAULT CLEAR SWITCH

WRITE PROTECT INDICATOR

WRITE PROTECT SWITCH

1st SEEK
R/W • $\overline{OC}$
WRT
RD • WRT
VOLT

OPERATOR
CONTROLS

I/O BOARD

CONTROL BOARD
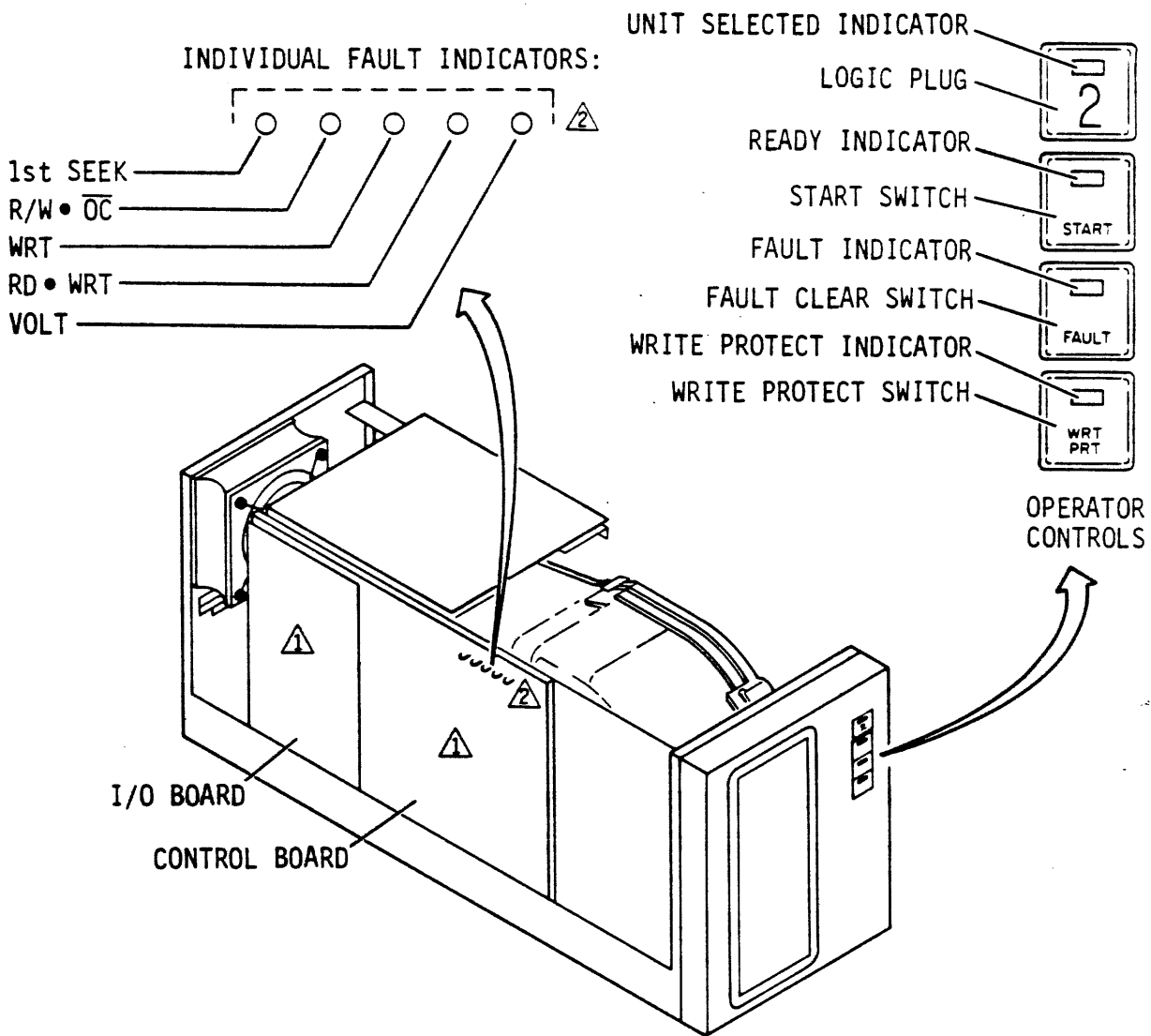
NOTES:

△1 SWITCHES LOCATED ON CIRCUIT BOARDS ARE ILLUSTRATED IN SECTION 3.

△2 INDIVIDUAL FAULT INDICATORS ARE VISIBLE THROUGH OPENINGS IN TOP
COVER. 1ST SEEK LED LABELLED "MPU" AND RD•WRT LED LABELLED
"HD SEL" ON OLDER DRIVES.

10R8H

Figure 2-1. Switches and Indicators (Sheet 1 of 3)

+24 V, -24 V, -5 V
DC CIRCUIT BREAKERS

ON/OFF CIRCUIT BREAKER
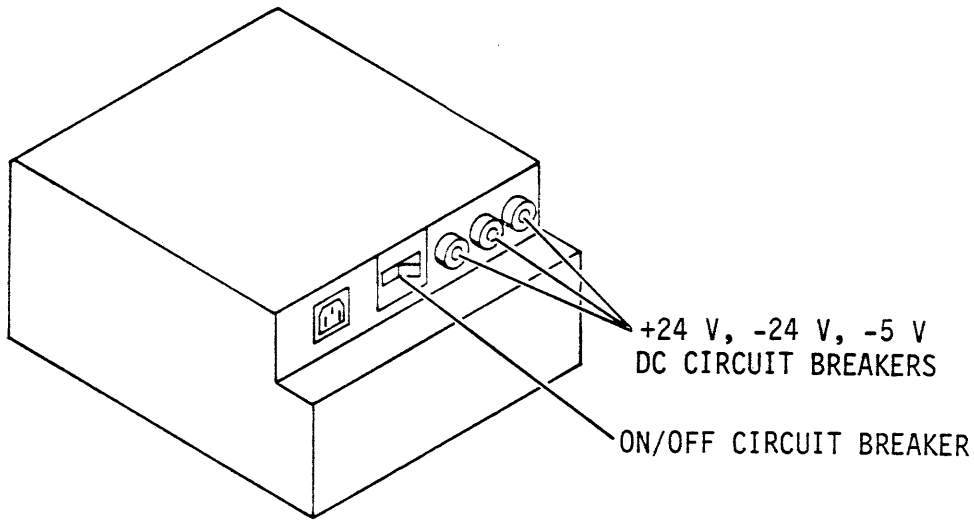
REMOTE POWER SUPPLY (P/N 728965XX)

VOLTAGE PROGRAMMING SWITCH

ON/OFF CIRCUIT BREAKER

+24 V, -24 V, -5 V
DC CIRCUIT BREAKERS
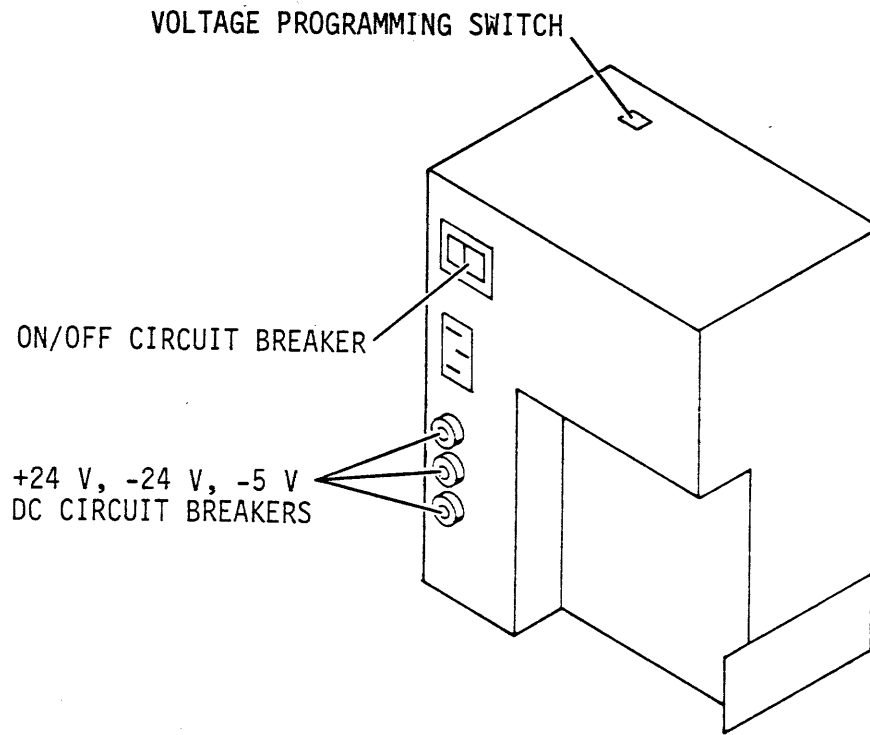
INTEGRAL POWER SUPPLY (P/N 81542300)

11D636

Figure 2-1. Switches and Indicators (Sheet 2)

VOLTAGE PROGRAMMING SWITCH

ON/OFF CIRCUIT BREAKER

+24 V, -24 V, -5 V DC CIRCUIT BREAKERS

INTEGRAL POWER SUPPLY (P/N 81542301/02/03)

ON/STANDBY SWITCH (ON = 1, STANDBY = 0)

VOLTAGE PROGRAMMING SWITCH
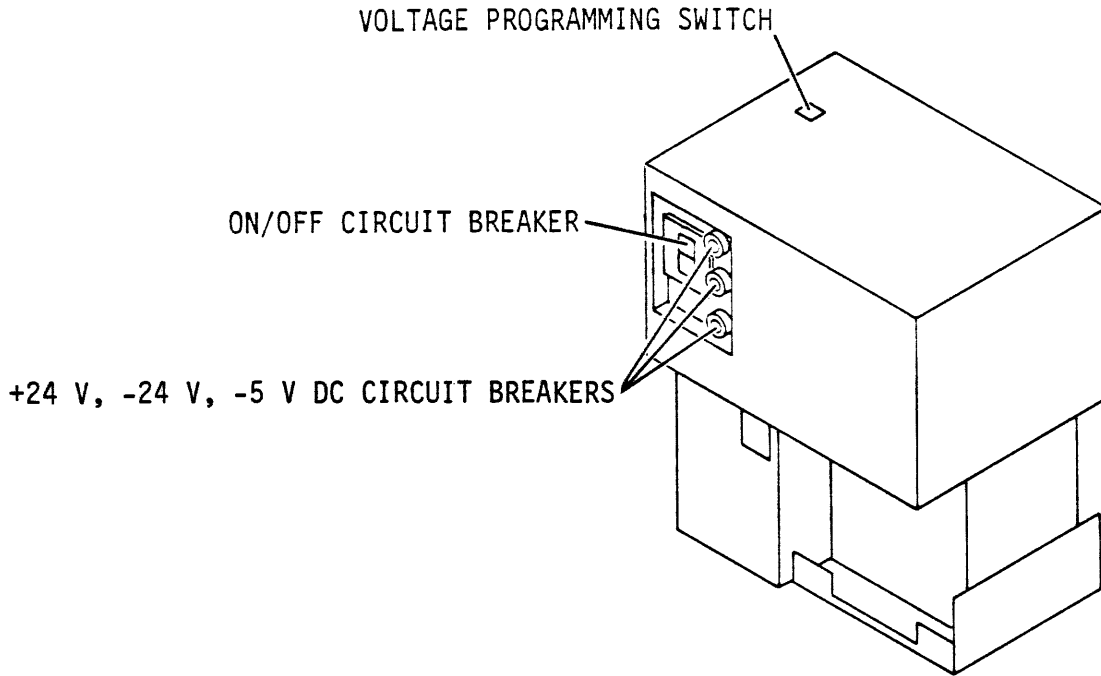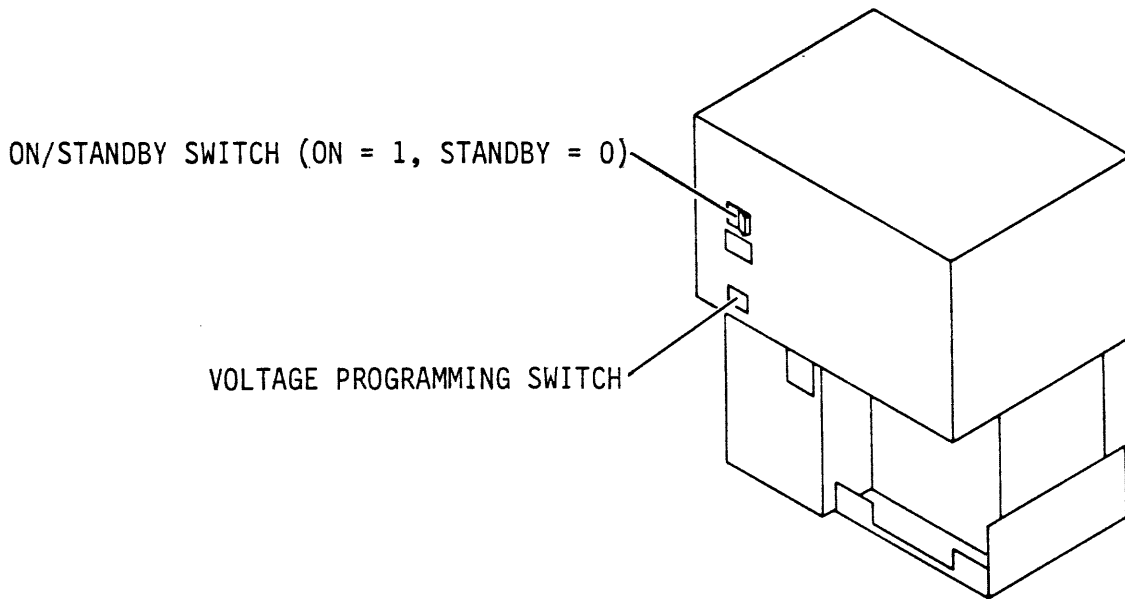
INTEGRAL POWER SUPPLY (P/N 81542304)

11D637

Figure 2-1. Switches and Indicators (Sheet 3)

FRONT PANEL

The front panel contains all the switches and indicators re-
quired to control and monitor the basic operation of the drive.

CONTROL BOARD

The control board contains switches set during drive installa-
tion and indicators used for maintenance purposes. Refer to
the installation and checkout section of this manual for in-
structions on setting the switches.

I/O BOARD

The LOCAL/REMOTE switch on the I/O board is set during drive
installation according to instructions in the installation and
checkout section of this manual.

TABLE 2-1.   DRIVE SWITCHES AND INDICATORS

Switch or Indicator	Function
POWER SUPPLY	
ON (1)/STANDBY (0) switch (on newer integral supplies) and ON/OFF Circuit Breaker (on other supplies)	Applies dc operating voltages to the drive electronics and fan.
Voltage Program-ming Switch	Refer to Power Supply Voltage Conversion procedure in section 3.
Table Continued on Next Page	

TABLE 2-1. DRIVE SWITCHES AND INDICATORS (Contd)

Switch or Indicator	Function
FRONT PANEL	
-24 V Circuit Breaker*	Protects the -24 V supply. To reset circuit breaker, press in pop-out element.
+24 V Circuit Breaker*	Protects the +24 V supply. To reset circuit breaker, press in pop-out element.
-5 V Circuit Breaker*	Protects the -5 V supply. To reset circuit breaker, press in pop-out element. The +5 and +40 V supplies are protected by current-limiting circuitry in the power supply.
Logic Plug/Unit Selected Indicator	The logic plug activates switches that establish the logical address of the device. Logic plugs numbered 0 through 7 are available. The Unit Selected indicator (present on newer drives only) is lit if drive is selected.
START Switch/ Ready Indicator	The START switch has alternate action, in for Start and out for Stop, and it contains the Ready indicator. Pressing the START switch to the Start position enables the power on sequence. The Ready indicator flashes until the disks are up to speed, the heads are loaded, and there are no fault conditions. The Ready indicator is on steadily with power on complete. Pressing the START switch to release it from the Start position causes the Ready indicator to flash un- til disk rotation has stopped.
*Not found on all power supplies. Newer power supplies are internally protected.	
Table Continued on Next Page	

TABLE 2-1. DRIVE SWITCHES AND INDICATORS (Contd)

Switch or Indicator	Function
FRONT PANEL (Contd)	
FAULT Indicator/ Fault Clear Switch	The FAULT indicator is inside the Fault Clear switch, and it lights if a fault exists within the drive. It is turned off by any of the following (provided that the error condition or conditions no longer exist): • Pressing the Fault Clear switch • Fault Clear command from the controller • A drive power on operation
WRT PRT Switch/Indicator	The operation of the WRT PRT switch or the control board W PROT switch places the drive in the write protected mode (preventing write operations) and lights the WRT PRT indicator.
CONTROL BOARD	
W PROT/NORM (Write Protect) Switch	Placing the switch in the W PROT position prevents the drive from performing write operations. The switch must be returned to the NORM position to enable write operations.
1st SEEK Indicator	Indicates drive failed first seek/load attempt. (Labelled MPU on some drives).
R/W·$\overline{OC}$ Indicator	Indicates write or read conditions existed during a seek operation (an off cylinder condition).
Table Continued on Next Page	

TABLE 2-1. DRIVE SWITCHES AND INDICATORS (Contd)

Switch or Indicator	Function
CONTROL BOARD (Contd)	
WRT Indicator	Indicates that a write fault has oc-curred.
RD·WRT Indicator	Indicates that a write and a read com-mand had existed simultaneously. (La-belled HD SEL on some drives).
VOLT Indicator	Indicates a below normal voltage existed.
Sector Select Switches	Allow the dividing of the disk into spe-cific segments or sectors. The switch settings determine the number of sectors per track.
I/O BOARD	
LOCAL/REMOTE Switch	Controls whether the drive can be powered up from the drive (LOCAL) or controller (REMOTE). In both switch positions, power up requires turning ON CB1 and pressing the START switch; however, in REMOTE position, a power sequence signal must come from the controller.

OPERATING INSTRUCTIONS

GENERAL

Operating instructions are presented in the following sequence:

- Power On Procedure

- Power Off Procedure

POWER ON PROCEDURE

The following procedure describes how to turn on drive power. It is assumed that dc power is supplied to the drive because the power supply switch/circuit breaker is normally left in the ON position.

1. Press START switch to engage it in Start position. If the LOCAL/REMOTE switch was set in the REMOTE position during drive installation, the power on sequence continues when power sequence ground is available from the controller. If it was set in the LOCAL position, the power on sequence begins immediately.

2. Observe that Ready indicator (located in START switch) flashes, indicating that power on is in progress.

3. Observe that Ready indicator lights steadily within 30 seconds, indicating that disks are up to speed and heads are loaded.

4. Ensure that FAULT indicator is off.

The power on sequence is now complete, and the drive is ready to read or write data.

POWER OFF PROCEDURE

The following procedure describes how to turn off the drive.

1. Press START switch to release it from Start position.

2. Observe that Ready indicator (located in START switch) flashes, indicating that power down is in progress.

3. Observe that Ready indicator goes off within 15 seconds, indicating that power down is complete.

With power off complete, the heads are positioned in the landing zone and the disks are not rotating. Normally, the power supply switch/circuit breaker is left ON to continue supplying dc power to the drive.

FILTER REPLACEMENT AND CLEANING

GENERAL

The air filter must be clean to ensure proper air circulation through the drive. The filter is located behind the front panel insert, as shown in figure 2-2. The operator should inspect

FRONT PANEL

FRONT
PANEL
INSERT
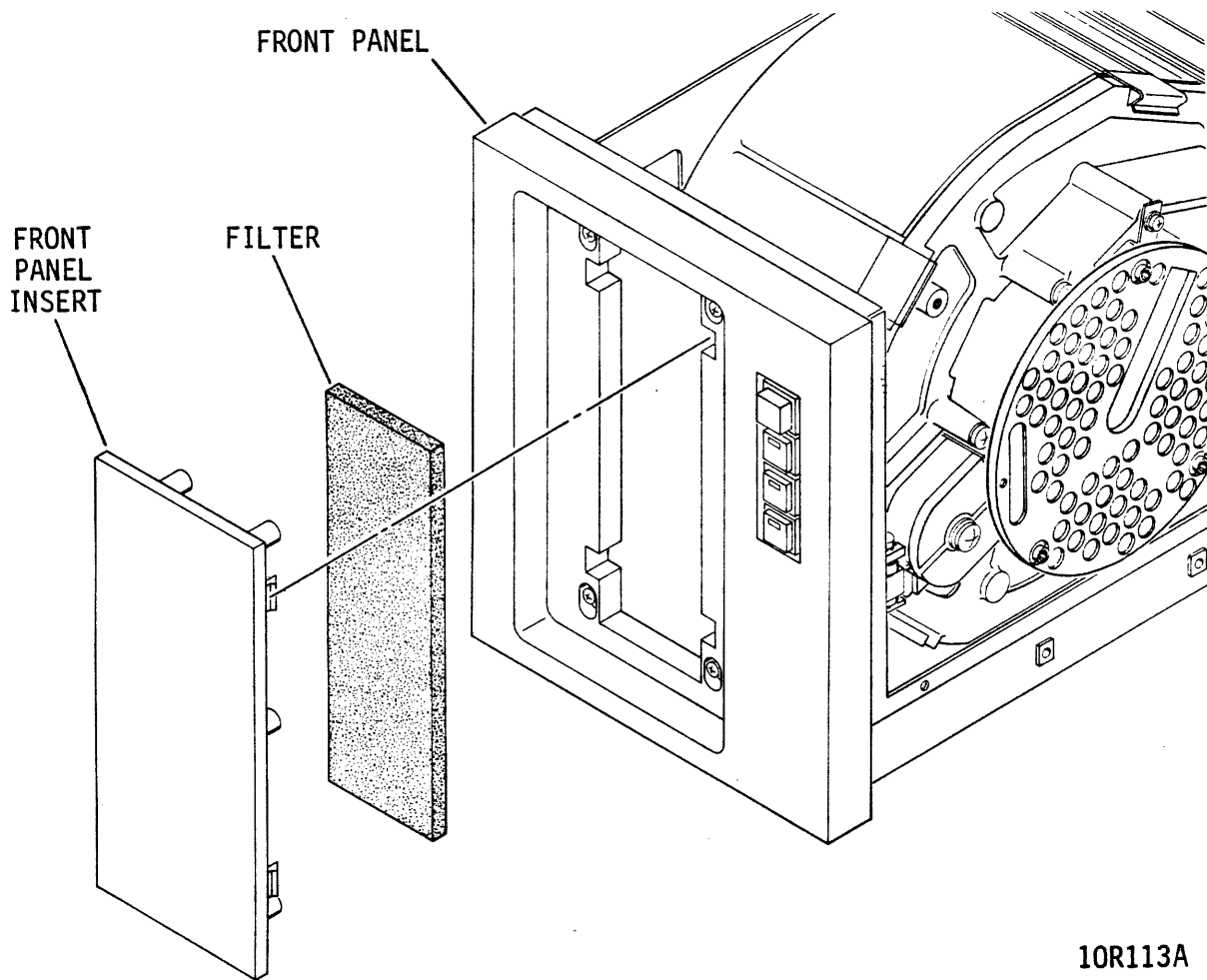
FILTER

10R113A

Figure 2-2.   Filter Replacement

the filter periodically and either replace or clean it when it
is dirty.   Cleaning the filter is recommended only if replace-
ment filters are not available.   The interval for filter main-
tenance depends on the operating environment.   In computer room
conditions, a 6-month interval is suggested.   In other condi-
tions, the filter should be checked more frequently.

FILTER REPLACEMENT

1.   Remove panel insert by pulling forward to disengage
     catches securing insert to front panel.

2.   Remove old filter.

3. Install new filter.

4. Replace panel insert by aligning catches to slots in front panel, and pushing on insert until catches snap into place.

FILTER CLEANING

The filter should not be cleaned if replacement filters are available.

1. Remove panel insert by pulling forward to disengage catches securing insert to front panel.

2. Remove filter.

3. Clean filter by agitating in solution of water and mild detergent.

4. Rinse filter thoroughly with clean running water and allow to dry.

5. Install filter.

6. Replace panel insert by aligning catches to slots in front panel, and pushing on insert until catches snap into place.

SECTION 3

INSTALLATION AND CHECKOUT

INTRODUCTION

The information contained in this section describes installation and initial checkout of the drive.

SITE REQUIREMENTS

GENERAL

The site requirements considered are electrostatic discharge protection, environment, space, power, grounding, and interface.

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 which surround charged objects. To avoid damage to drive electronic assemblies, service personnel must observe the following precautions when servicing the drive:

- Ground yourself to the drive whenever the drive electronics are or will be exposed. Connect yourself to ground with a wrist strap (refer to Accessories in section 4 for part numbers). Connection may be made to any metal assembly or to the ground lug at the rear of 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 (refer to Accessories in section 4 for part numbers). 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.

- 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.

- Never use an ohmmeter on any circuit boards.

ENVIRONMENTAL REQUIREMENTS

All environmental requirements for the drive are listed in table 3-1.

SPACE REQUIREMENTS

The drive slide-mounts side-by-side with another drive into a 483 mm (19 in) standard rack. The slide action allows a complete outward extension of either unit for ease of maintenance. The space requirements are shown in figure 3-1.

The combined mass of the drive and power supply is 32.6 kg (72 lb). With both units mounted inline and extended on the slides, the center of gravity is approximately 36 cm (14 in) from the rack front.

TOP VIEW

210 mm
8.2 in

144 mm
5.62 in

252 mm
9.88 in

FRONT VIEW   SIDE VIEW

✱ INTEGRAL POWER SUPPLY

TOP VIEW

200 mm
7.92 in

113 mm
4.44 in

242 mm
9.50 in

FRONT VIEW   SIDE VIEW

✱ REMOTE POWER SUPPLY

TOP VIEW

217mm
8.50 in

640 mm
23.86 in

FRONT VIEW

260 mm
10.2 in

727 mm
28.73 in

25 mm
1.00 in

⚠2 25 mm
1.0 in

✱

SIDE VIEW

1.5 mm
.06 in

NOTES:

1. DIMENSIONS SHOWN ARE NOMINAL.

⚠2 THIS DIMENSION NOT REQUIRED FOR
NEWER INTEGRAL POWER SUPPLIES.

10R65C

Figure 3-1.   Drive Space Requirements

TABLE 3-1. ENVIRONMENTAL REQUIREMENTS

Conditions	Characteristics	Specifications
TEMPERATURE		
Non-Operating (Unpackaged)	Range	-10 to 50°C (14 to 122°F)
	Maximum change per hour	15°C (27°F)
Storage/Transit (Packaged)	Range	-40 to 60°C (-40 to 140°F)
	Maximum change per hour	20°C (36°F)
Operating	Range	10 to 45°C (50 to 114°F)
	Maximum change per hour	10°C (18°F)
Table Continued on Next Page		

TABLE 3-1.   ENVIRONMENTAL REQUIREMENTS (Contd)

Conditions	Characteristics	Specifications
RELATIVE HUMIDITY		
Non-Operating (Unpackaged)	Range	10% to 90%
Storage/Transit (Packaged)	Range	5% to 95%
Operating	Range	20% to 80% 10% per hour maximum change
BAROMETRIC PRESSURE (STANDARD DAY)		
Non-Operating (Unpackaged)	Range	-300 m to 3000 m (-983 ft to 10 000 ft) 105 kPa to 69 kPa (31 in Hg to 20 in Hg)
Storage/Transit (Packaged)	Range	-300 m to 3000 m (-983 ft to 10 000 ft) 105 kPa to 69 kPa (31 in Hg to 20 in Hg)
Operating	Range	-300 m to 3000 m (-983 ft to 10 000 ft) 105 kPa to 69 kPa (31 in Hg to 20 in Hg)

```
┌──────────────┐
│   WARNING    │
└──────────────┘
```

This unit has a single-phase power supply with
a capacitor input filter (sometimes called a
switching type supply). If power to the unit
originates from a 3-phase, 4-wire, wye branch
or feeder circuit, ensure the circuit meets
the latest requirements of the United States
National Electrical Code. Failure to meet
these requirements may result in hazardous
conditions due to high currents (and heating)
in the neutral conductors and transformers
supplying the system.

Drive ac power requirements are listed in table 3-2. Conver-
sion to the different line voltages is explained in the instal-
lation procedures. If an ac cord is not supplied with the
unit, either order one from CDC (see figure 3-8 and the parts
data section) or obtain one commercially per the specifications
in table 3-3. Drive current versus start-up time is shown in
figure 3-2 for 120 and 220/240 volt connections.
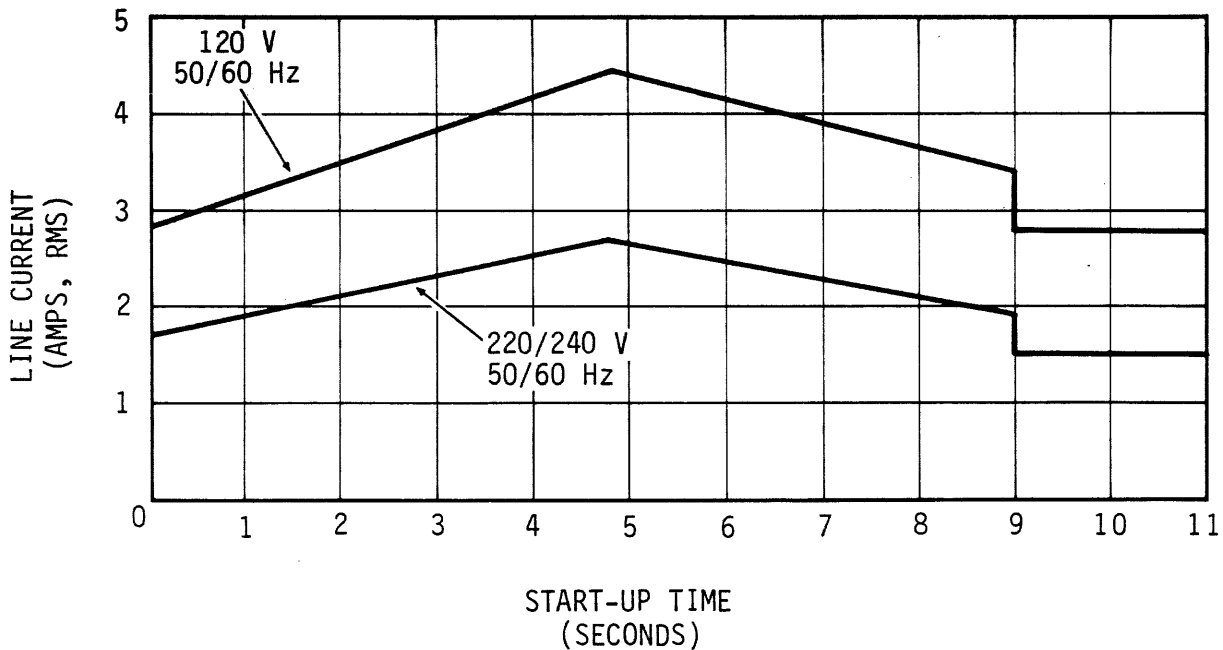
10R83B

Figure 3-2.   Line Current Versus Start-up Time

TABLE 3-2.   POWER REQUIREMENTS

Specifications	Values	
	100/120 V ac	208/240 V ac
Voltage Range	87 to 128 V	179 to 256 V
Nominal Line Frequency	50/60 Hz	50/60 Hz
Frequency Range	48.0 to 62.0 Oz	48.0 to 62.0 Hz
Phase Requirements	Single Phase	Single Phase
Power Consumed* Integral Power Supply	0.244 kW	0.245 kW
Remote Power Supply	0.244 kW	0.236 kW
Line Current* Integral Power Supply	3.43 A	2.2 A
Remote Power Supply	2.80 A	1.6 A
Power Factor* Integral Power Supply	0.70	0.51
Remote Power Supply	0.73	0.69
Start Up Current	See figure 3-2.	See figure 3-2.

*Measured when disks are rotating and carriage is moving.

TABLE 3-3. AC CORD SET MINIMUM RATINGS

Used On	Current	Voltage	Conductor Size	Number of Conductors
100 to 120 V 50/60 Hz	13 A	125 V	16 AWG	3
208 to 240 V 50/60 Hz	6 A	250 V	16 AWG	3
Note : Cord set must be U.L. Listed, C.S.A. Certified, and one of the following basic cord types: SV, SP-2, SP-3, S, or SJ. A cord set is defined as a cord with its connectors attached.				

GROUNDING REQUIREMENTS

Safety grounding, (connecting the drive power cord to a grounded outlet) and system grounding (establishing a common ground between the drives, the power supplies, and the controller) are discussed in the following paragraphs.

Safety Grounding

A safety ground must be provided by the site ac power system. The green (or green and yellow striped) wire in the drive's power cord provides the safety ground connection between the power supply and the site power system. In turn, the site ac power system must tie this connection (safety ground) to earth ground. All site ac power connection points, including convenience outlets for test equipment, must be maintained at the same safety ground potential.

System Grounding

In addition to safety grounding, system ground connections are also required. System ground is established by a set of ground straps connected in a star or daisy chain configuration. The ground straps connect ground on the controller to earth ground and to each power supply in the system. The interconnect cabling between each drive and its power supply connects case ground on the power supply to case ground on the drive. The installation procedures in this section provide detailed grounding instructions and a schematic diagram of the star and daisy chain configurations.

INTERFACE REQUIREMENTS

An important part of site preparation is planning the layout and routing of I/O cables. The I/O cables are designated as A and B cables. The I/O A cables may be connected in either a star or daisy chain configuration as shown in figure 3-3. Each configuration calls for the use of terminators; these too are shown in figure 3-3.

The following discussion of the I/O configurations applies to single channel installations where a set of drives are interfaced to one controller. Extending the discussion to dual channel installations (involving two controllers) requires doubling the quantities of cables and terminators because the two channels have independent cabling.

The star configuration has individual A and B cables going from the controller to each drive, and each drive has a terminator installed on it. The daisy chain configuration has individual B cables going from the controller to each drive. However, a single A cable connects the controller to the first drive. Other A cables go from drive to drive, and the last drive in the string has a terminator installed on it.

In estimating the I/O cables needed for an installation, decide which configuration will be used and allow sufficient length to permit extension of rack-mounted drives. Limitations on I/O cable lengths may influence system layout. The maximum length for each B cable is 15.3 m (50 ft). Each star system A cable or the cumulative A cabling in a daisy chain system cannot exceed 30.6 m (100 ft) in length. Refer to Accessories in section 4 for terminator and I/O cable part numbers.

Figure 3-4 shows the pin assignments and signal names for the A cable. Figure 3-5 shows the pin assignments and signal names for the B cable. Detailed information about interface lines is given in section 1 of the hardware maintenance manual, volume 2.

STAR CABLED SYSTEM
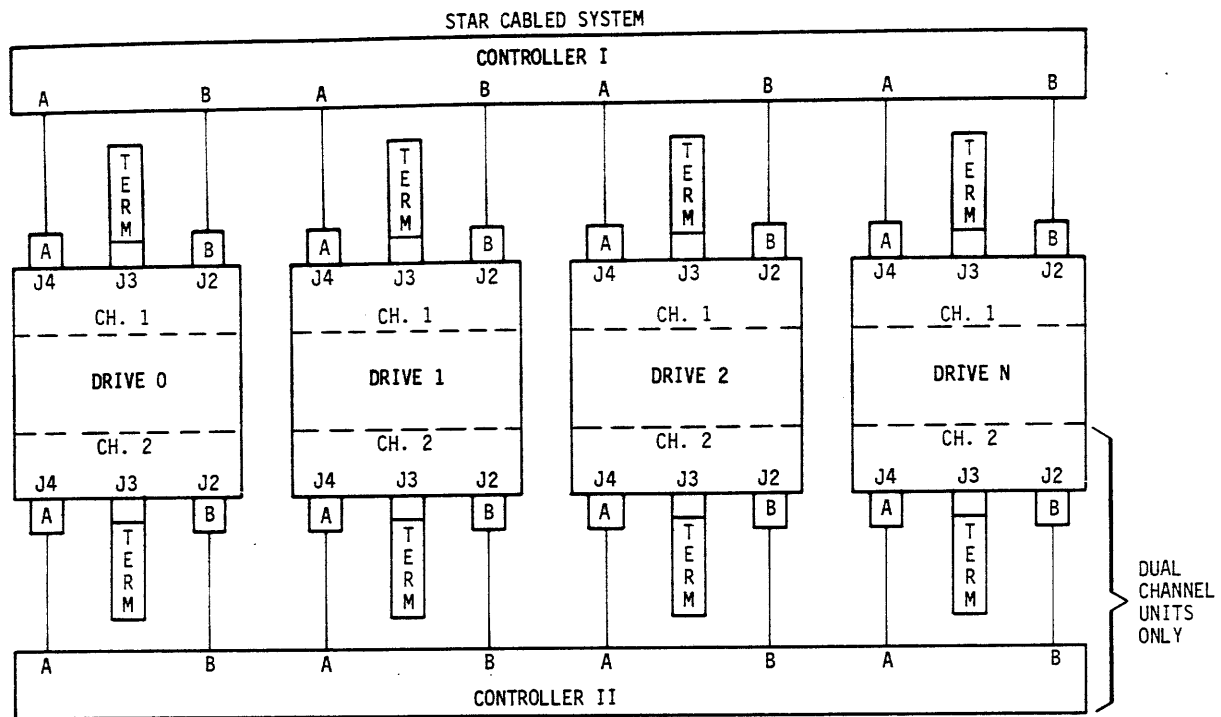
NOTES:
1. MAXIMUM INDIVIDUAL A CABLE LENGTHS = 100 FEET (STAR)
2. MAXIMUM CUMULATIVE A CABLE LENGTHS = 100 FEET (DAISY CHAIN)
3. MAXIMUM INDIVIDUAL B CABLE LENGTHS = 50 FEET
4. A SYSTEM MAY INCLUDE UP TO 8 DRIVES

DAISY CHAIN CABLED SYSTEM
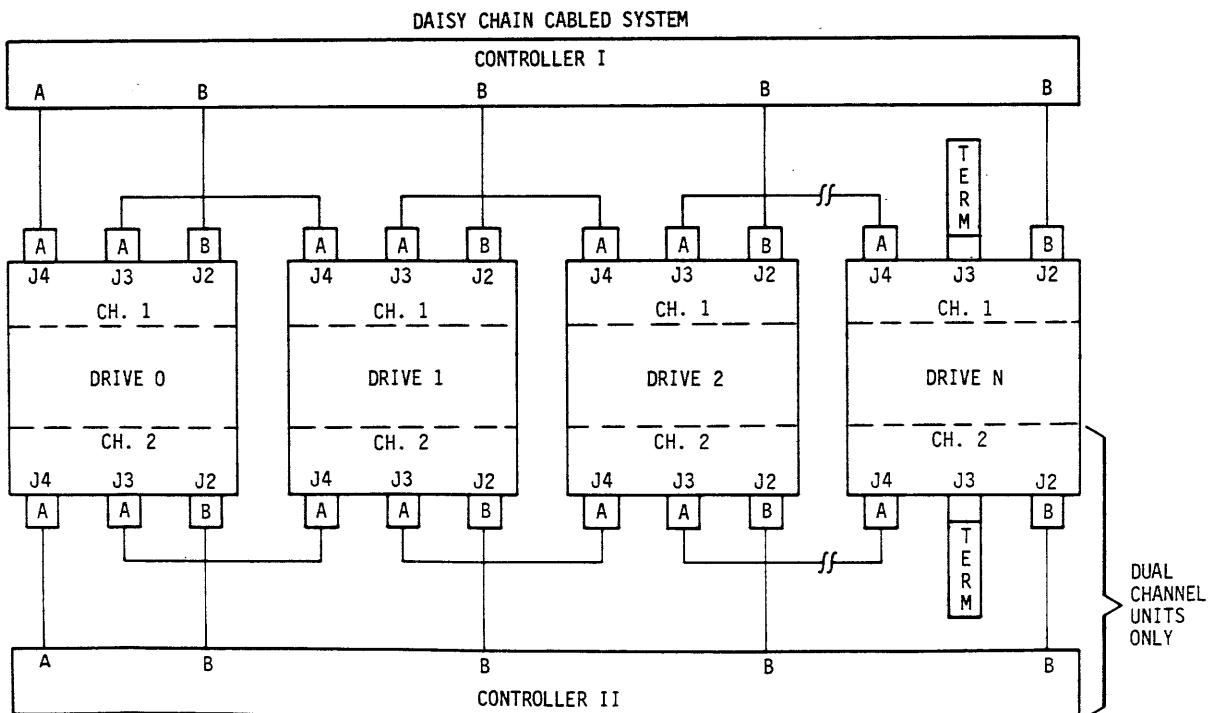
10R50B

Figure 3-3.   System Cabling

CONTROLLER		LO, HI	DRIVE
UNIT SELECT TAG		22, 52	
UNIT SELECT BIT 0		23, 53	
UNIT SELECT BIT 1		24, 54	
UNIT SELECT BIT 2		26, 56	
UNIT SELECT BIT 3		27, 57	
TAG 1 /2\		1, 31	
TAG 2 /2\		2, 32	
TAG 3 /2\		3, 33	
BIT 0 /2\		4, 34	
BIT 1 /2\		5, 35	
BIT 2 /2\		6, 36	
BIT 3 /2\		7, 37	
BIT 4 /2\		8, 38	
BIT 5 /2\		9, 39	
BIT 6 /2\		10, 40	
BIT 7 /2\		11, 41	
BIT 8 /2\		12, 42	
BIT 9 /2\		13, 43	
OPEN CABLE DETECT		14, 44	
RESERVED FOR INDEX	/2\ /3\	18, 48	
RESERVED FOR SECTOR	/2\ /3\	25, 55	
FAULT /2\		15, 45	
SEEK ERROR /2\		16, 46	
ON CYLINDER /2\		17, 47	
UNIT READY /2\		19, 49	
ADDRESS MARK /2\		20, 50	
WRITE PROTECTED /2\		28, 58	
SEQUENCE PICK IN/OUT		29	} ONE
SEQUENCE HOLD		59	} TWISTED
BUSY /2\	/1\	21, 51	} PAIR
NOT USED		30, 60	

NOTES:

/1\ DUAL CHANNEL UNITS ONLY

/2\ GATED BY UNIT SELECT

/3\ INDEX AND SECTOR MAY BE IN "A" CABLE, "B" CABLE, OR "A" AND "B" CABLES.

10R339A

Figure 3-4.   A Cable

"B" CABLE

CONTROLLER		LO, HI	DRIVE
	WRITE DATA	8, 20	
	GROUND	7	
	WRITE CLOCK	6, 19	
	GROUND	18	
	SERVO CLOCK	2, 14	
	GROUND	1	
	READ DATA	3, 16	
	GROUND	15	
	READ CLOCK	5, 17	
	GROUND	4	
	SEEK END	10, 23	
	GROUND	11	
	UNIT SELECTED	22, 9	
	GROUND	21	
	RESERVED FOR INDEX ⚠2	12, 24	
	GROUND	25	
	RESERVED FOR SECTOR ⚠2	13, 26	
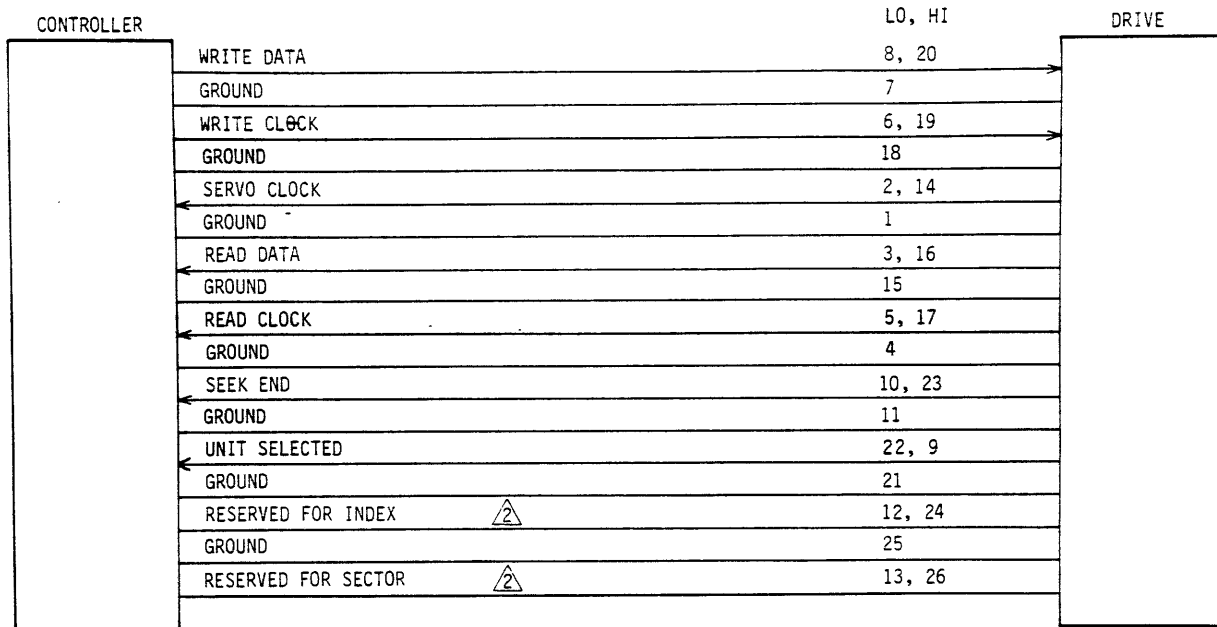
NOTES:

1 NO SIGNALS GATED BY UNIT SELECTED.

⚠2 INDEX AND SECTOR MAY BE IN "A" CABLE,
   "B" CABLE, OR "A" AND "B" CABLES.

10R340

Figure 3-5. B Cable

FINAL UNPACKAGING AND INSPECTION

GENERAL

After removing packaging material according to the unpackaging
instructions provided with the drive, inspection for shipping
damage should be carried out and several final unpackaging pro-
cedures performed. Most packaging materials can be reused if
it is necessary to ship the drive at some future date. To ob-
tain packaging instructions, contact:

        Packaging Engineer, Material Services Dept.
        Normandale Division, MPI
        7801 Computer Ave
        Minneapolis, MN 55435

When ordering packaging instructions, specify the exact equip-
ment number and series code of the drive as shown on the equip-
ment identification label.

UNPACKAGING

1. Open package (save all packaging materials).

2. If drive has a slide mount option, remove packages containing two slide mounts and slide mount hardware kit.

3. Remove package containing ac and dc power cables.

4. Remove plastic dust cover from around drive.

5. Remove plastic dust cover from around power supply.

6. Check all items against shipping bill for required equipment and hardware to complete installation. Discrepancies, missing items, damaged equipment, etc., should be reported to the CDC account sales representative responsible for the equipment.

INSPECTION

Inspect the drive, power supply, and accessory items for possible shipping damage. All claims for shipping damage should be filed with the carrier involved.

INSTALLATION PROCEDURES

GENERAL

The following text provides the procedures necessary to install the drive and power supply. It is assumed that the requirements for site preparation have been completed prior to performing the installation procedures.

The following procedures should be considered in the order presented, but the order may be altered for a specific installation:

- Mounting Drive in Rack

- Remote Power Supply Bracket Installation

- Power Supply Voltage Conversion

- System I/O Cabling

- System Grounding and Interconnect Cabling

- Mounting Remote Power Supply in Rack

- Setting Circuit Board Switches

MOUNTING DRIVE IN RACK

A drive mounting kit for mounting the drive in a standard rack
is available as an accessory (refer to Accessories in section 4
for part number). For drives with the integral power supply,
the support bracket must be removed prior to slide installa-
tion (see figure 3-6). For drives with the remote power sup-
ply, the slide assemblies permit inline mounting of the drive
and remote power supply. With the slides fully extended, both
units are positioned beyond the front surface of the rack for
ease of maintenance. The following procedures provide instruc-
tions for attaching the drive and power supply to the slides.

NOTE

The procedure describing how to mount the re-
mote power supply on the slide assemblies fol-
lows System Grounding and Interconnect Cabling.

Drive Installation (Integral Power Supply)

1. Remove support bracket (one on each side) from drive.
    Discard brackets and retain screws for inner slide in-
    stallation on drive (see figure 3-6).

2. Remove mounting screws from slide hardware kit.

3. Disengage inner slide from intermediate and outer slides
    of each slide assembly by pressing lock release and pull-
    ing out inner slide.

4. Mount right-hand and left-hand inner slides and insula-
    tors on drive by installing screws through holes in inner
    slide into square nuts in drive. Figure 3-6 defines
    which slide component is used on the right-hand side of
    the drive.

5. Mount right-hand and left-hand outer slides of slide as-
    semblies in rack in accordance with user requirements.
    Figure 3-6 defines which slide component mounts on the
    right side of the rack.

6. Push each intermediate slide to fully retracted position
    inside outer slide.

7. Lift drive and guide inner slides into intermediate
    slides of slide assemblies. Continue pushing slides
    together until their lock releases engage.

POWER SUPPLY MOUNT

△3 △4

SLIDE ASSEMBLY

FLATHEAD SCREWS

LOCK RELEASE

SELF-TAPPING SCREW

INNER SLIDE

INTERMEDIATE SLIDE

POWER SUPPLY

INTEGRAL POWER SUPPLY

OUTER SLIDE

△1

REMOTE POWER SUPPLY

△2
SUPPORT BRACKET

SLIDE ASSEMBLY

LOCK RELEASE

INNER SLIDE

OUTER SLIDE

INTERMEDIATE SLIDE

△1
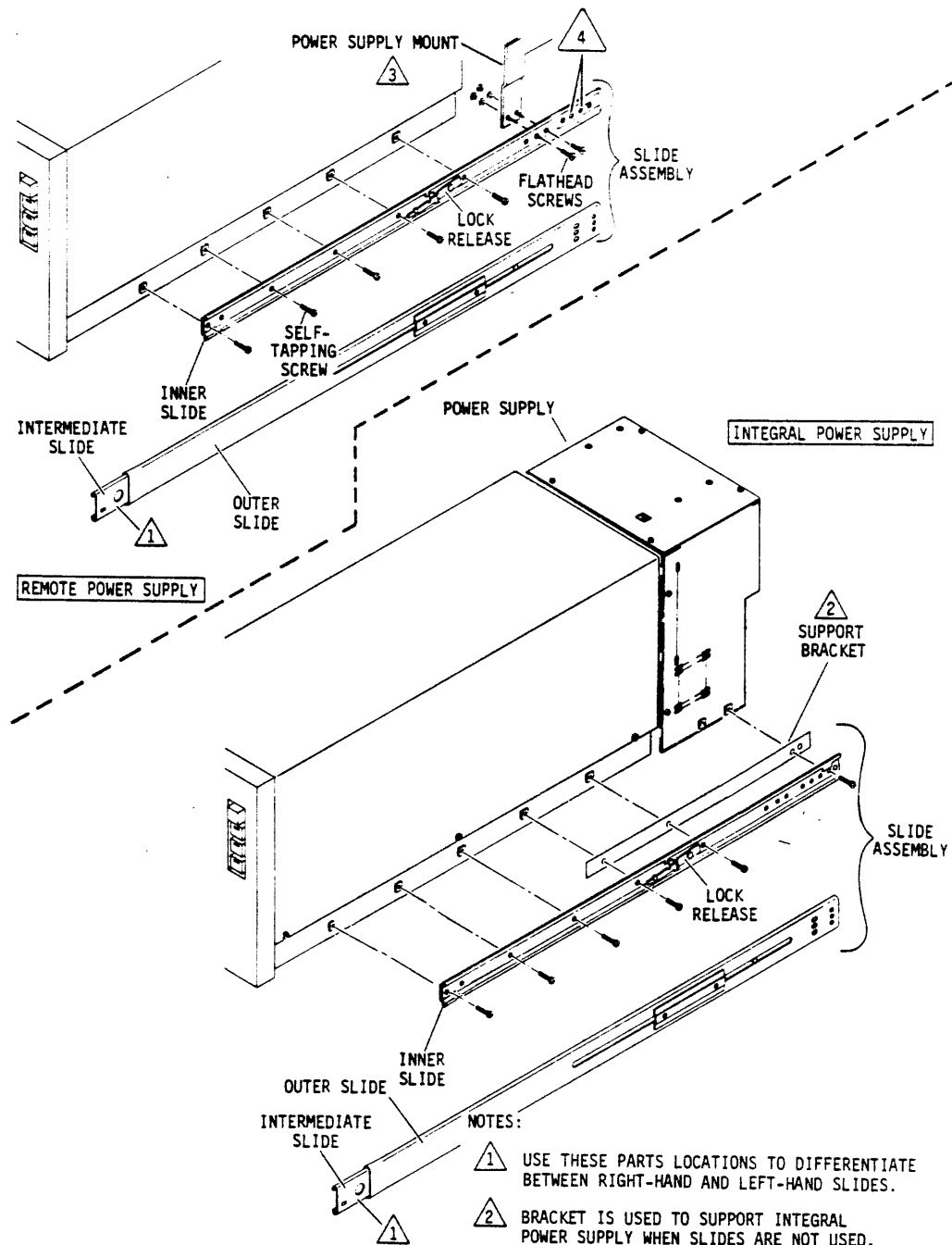
NOTES:

△1 USE THESE PARTS LOCATIONS TO DIFFERENTIATE BETWEEN RIGHT-HAND AND LEFT-HAND SLIDES.

△2 BRACKET IS USED TO SUPPORT INTEGRAL POWER SUPPLY WHEN SLIDES ARE NOT USED.

△3 MOUNT IS AN OPTIONAL PART AND IS NOT SUPPLIED WITH ALL UNITS.

△4 IF CABINET DEPTH PERMITS, THESE HOLES CAN BE USED TO ATTACH POWER SUPPLY MOUNT. THIS ALTERNATIVE PLACEMENT PROVIDES MORE SPACE BETWEEN DRIVE AND POWER SUPPLY.

10R330C

Figure 3-6. Drive Installation

Drive Installation (Remote Power Supply)

1. Remove mounting screws from slide hardware kit.

2. Disengage inner slide from intermediate and outer slides of each slide assembly by pressing lock release and pulling out inner slide (see figure 3-6).

3. Install remote power supply mounts (if supplied) on inner slides using mounting hardware.

4. Mount right-hand and left-hand inner slides on drive by installing screws through holes in inner slide into square nuts in drive. Figure 3-6 defines which slide component is used on the right-hand side of the drive.

5. Mount right-hand and left-hand outer slides of slide assemblies in rack in accordance with user requirements. Figure 3-6 defines which slide component mounts on the right side of the rack.

6. Push each intermediate slide to fully retracted position inside outer slide.

7. Lift drive and guide inner slides into intermediate slides of slide assemblies. Continue pushing slides together until their lock releases engage.

REMOTE POWER SUPPLY BRACKET INSTALLATION

If the power supply is to be installed on slide assemblies, a mounting bracket must first be attached to the power supply. Newer drives will have the bracket already attached. On older drives, attach bracket as follows:

1. Remove and discard the 4 screws from power supply, where bracket attaches (see figure 3-7).

2. Align the bracket holes with the vacated holes in power supply and secure into place using the four 6-32 x 3/8 screws supplied with hardware kit.

POWER SUPPLY   BRACKET
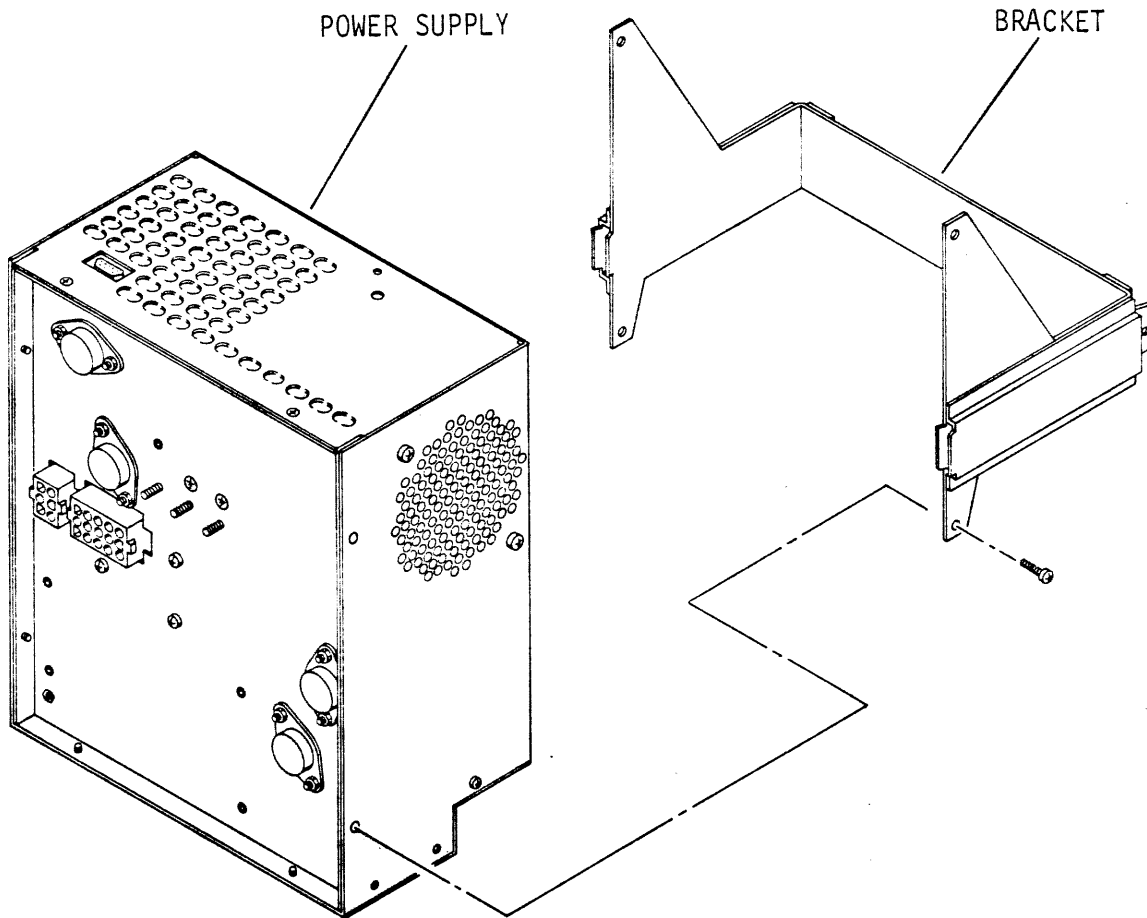
10R319

Figure 3-7. Remote Power Supply Bracket Installation

POWER SUPPLY VOLTAGE CONVERSION

The power supply is configured before shipment to operate in one of two ranges of ac input voltages. The equipment label on the power supply indicates the voltage range selected prior to shipment. The voltage range for drives with the integral power supply is determined by setting the voltage programming switch to the desired range. The voltage range for drives with the remote power supply is determined by: 1) on older supplies, which voltage programming plug is installed inside the power supply, or 2) on newer supplies, setting the voltage programming switch to the desired range. The ac power cord must be replaced if the voltage range is changed. Either order a CDC cord (see figure 3-8 and the parts data section) or select a commercially available cord per the specifications in table 3-3.

GROUND

120 V - 60 Hz POWER CORD
P/N = 75168323

NEUTRAL

PHASE

PHASE

NEUTRAL   GROUND

220 V - 50 Hz POWER CORD
P/N = 75168324

GROUND

NEUTRAL

PHASE

240 V - 60 Hz POWER CORD
P/N = 75168334
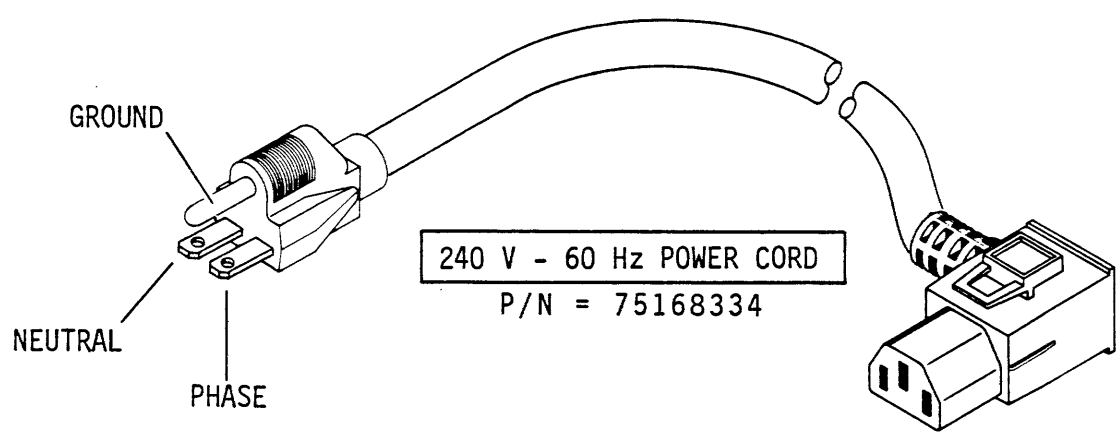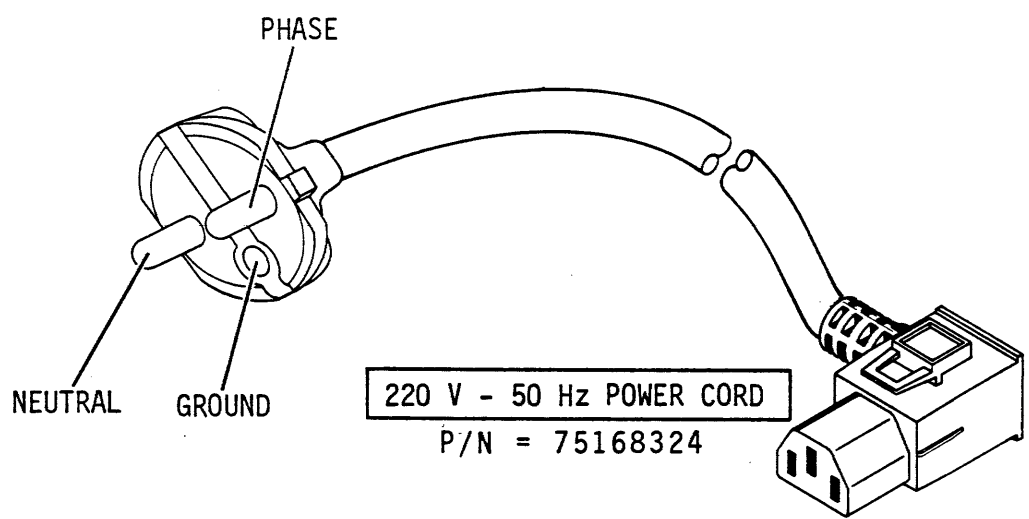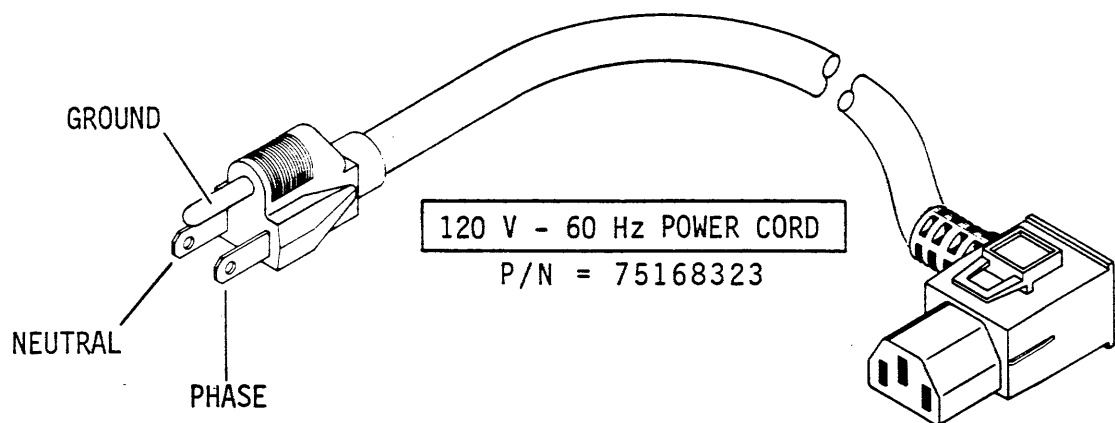
10R56F

Figure 3-8. AC Power Cables

1. Ensure that ac power cable is disconnected from power supply.

NOTE

Perform step 2 on integral supplies, and on newer remote supplies, which have a voltage programming switch. Perform step 3 on older remote supplies, which do not have a voltage programming switch.

2. Change voltage programming switch to desired setting.

3. On older remote power supplies, perform the following:

   a. Remove attaching hardware (designated "A" in figure 3-9) from power supply.

   b. Place power supply on work surface with bottom cover facing up.

CAUTION

Use caution during the following steps to avoid damaging internal components and wiring.

   c. Slide bottom cover and front panel away from main chassis without straining internal wiring.

   d. Remove attaching hardware (designated "B") and tilt bottom cover away from front panel to expose voltage programming plug.

NOTE

The voltage programming plugs are stamped to indicate their voltage ranges. The plug for 120 V ac has blue jumper wires, and the plug for 220/240 V ac has red jumper wires.

   e. Squeeze retaining tabs and remove voltage programming plug from its socket. Install replacement voltage programming plug in socket.

   f. Align bottom cover with front panel and replace attaching hardware (designated "B").

"A"   "B"   "A"   VOLTAGE
                                              PROGRAMMING
                                                 PLUG
                              BOTTOM   BOTTOM
                              COVER   COVER
"A"   "B"   "A"

AC
GROUND   "A"
STUDS

"A"   "A"

        FRONT   "A"   FRONT   MAIN
        PANEL   MAIN   PANEL   CHASSIS
              "A"   CHASSIS
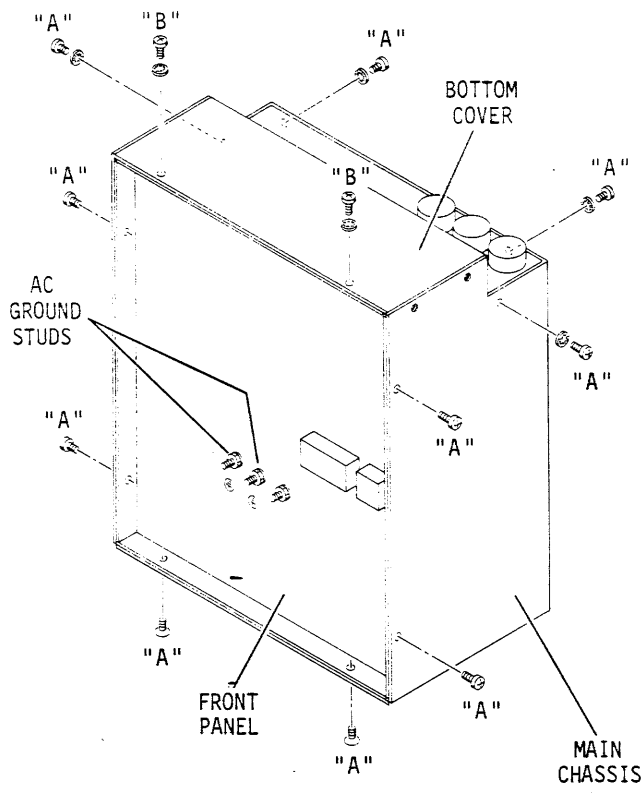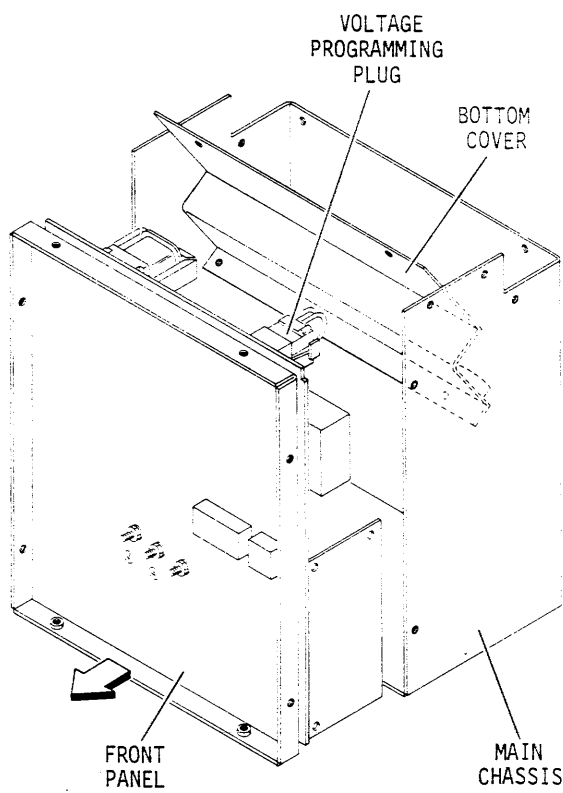
          HARDWARE REMOVAL   VOLTAGE PROGRAMMING PLUG REMOVAL

NOTES:
  1. REMOVE HARDWARE DESIGNATED "A"
      PRIOR TO REMOVING HARDWARE
      DESIGNATED "B"

KEY   PIN   PIN   KEY   PIN   PIN
       3   5   3   5
                               PIN 1

PIN   PIN   PIN
2   6   4

      —120 V—   —220 V—
  (BLUE JUMPER WIRES)   (RED JUMPER WIRES)
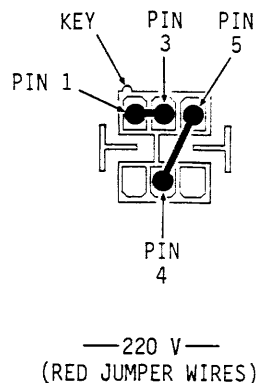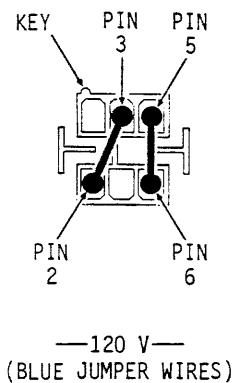
          IDENTIFYING VOLTAGE PROGRAMMING PLUGS

                                                        10R84B

    Figure 3-9.   Voltage Conversion (Older Remote Power Supplies)

g. Slide bottom cover and front panel back into alignment with main chassis.

h. Install hardware (designated "A") to attach bottom cover and front panel to main chassis.

4. Modify equipment label to reflect new ac operating voltage range for power supply.

5. Replace existing ac power cable with the ac power cable specified for new operating voltage.

SYSTEM I/O CABLING

This procedure describes how to connect the I/O cables and terminators. The recommended connections are A cable to J4 and terminator to J3. These connections may be reversed without affecting drive operation. Figure 3-10 shows typical I/O cable connections at the drive I/O plate.

The site preparation information, provided earlier in this section, describes both star and daisy chain cable routing. With the correct number of terminators and lengths of I/O cables available, you are ready to begin connecting the system I/O cabling. Unless otherwise noted, each step in the following procedure applies to all drives in the system.

In installations where the remote power supply is slide mounted directly behind the drive, it is necessary to remove the power supply from the slides to connect or disconnect the I/O cables.

1. On drives with integral power supply, remove I/O shield from I/O plate (see figure 3-10).

2. Install cable bracket on panel below I/O plate with attaching hardware.

NOTE

Steps 3 through 6 apply to single channel drives and must be repeated for dual channel drives. The I/O plate on dual channel drives has two sets of connectors: 1J2, 1J3, and 1J4 for channel 1, and 2J2, 2J3, and 2J4 for channel 2.

3. Connect B cables from controller to connector J2 on each drive.

B CABLE CONNECTOR

CONNECTOR PIN 1

J2

J4

J3

A CABLE CONNECTOR

EXPOSED SHIELDING

⚠4 GROUNDING CLAMP

⚠4 STRAIN RELIEF CLAMP

CONNECTOR PIN 1

I/O PLATE

CABLE BRACKET
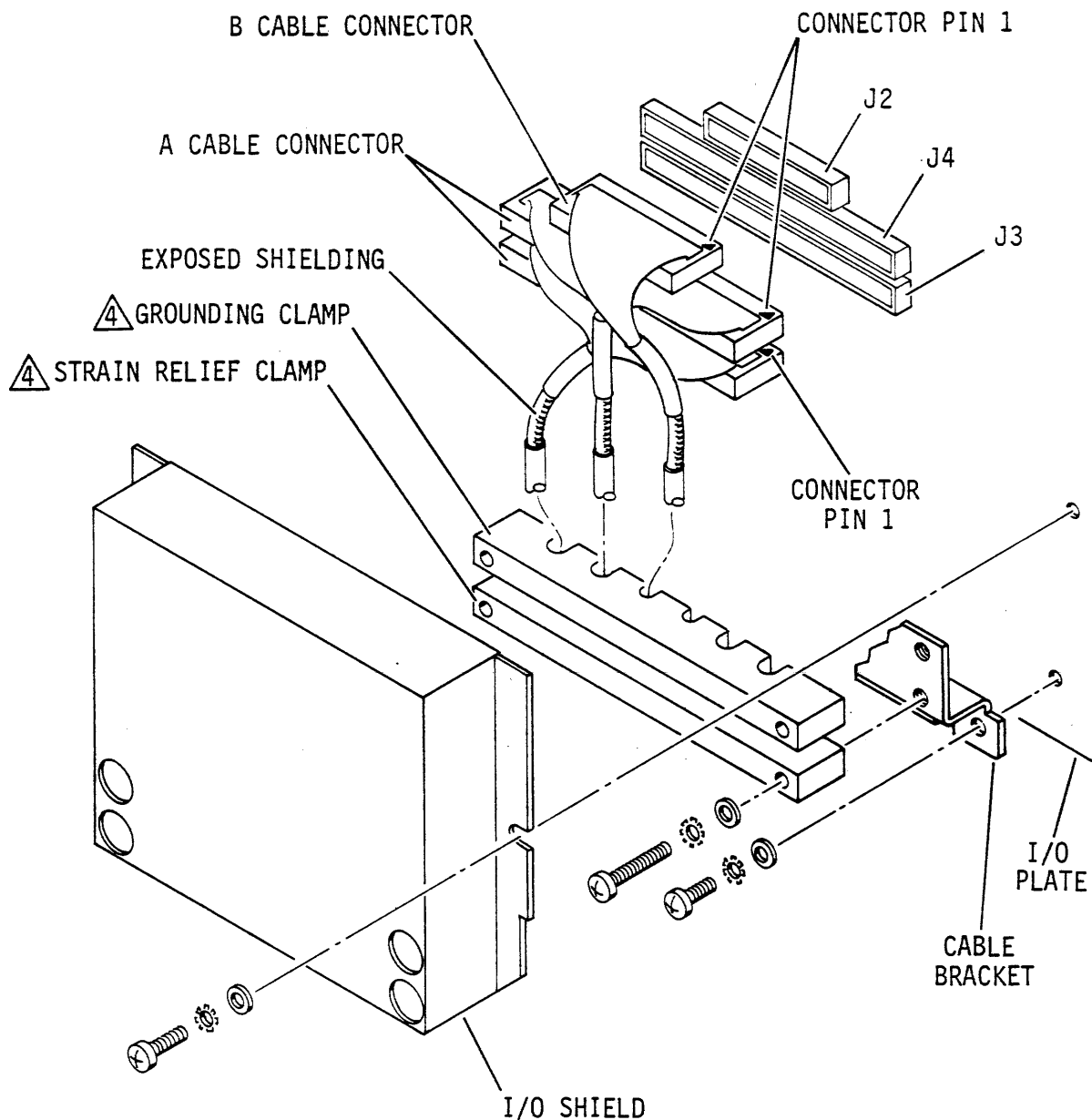
I/O SHIELD

NOTES:

1. CABLE BRACKET IS ATTACHED TO EITHER REAR PANEL OR I/O PLATE, DEPENDING ON DRIVE CONFIGURATION.
2. EXACT PLACEMENT OF CONNECTORS J2, J3, AND J4 ON I/O PLATE VARIES.
3. I/O SHIELD IS USED ON INTEGRAL POWER SUPPLY ONLY.

⚠4 CABLE OPENINGS ARE LARGER ON STRAIN RELIEF CLAMP THAN ON GROUNDING CLAMP.

11D13F

Figure 3-10.   I/O Cable Attachment (Typical)

NOTE

Figure 3-3 defines star and daisy chain
systems. In star systems, repeat step 4 for
each drive, and skip to step 6. In daisy
chain systems, perform step 4 for first drive
in daisy chain and repeat step 5 for remaining
drives.

4. Connect A cable from controller to drive connector J4.

5. Connect A cable from connector J3 on each drive to
   connector J4 on next drive in daisy chain.

6. Install terminator on drive connector J3 and make termi-
   nator ground connection (see figure 3-11). Terminators
   are required on:

   • all drives in a star system.

   • last drive in a daisy chain system.

NOTES:
1. TERMINATOR GROUND CONNECTION IS MADE ON EITHER REAR PANEL
   OR ON I/O PLATE DEPENDING ON DRIVE CONFIGURATION. EXACT
   PLACEMENT OF CONNECTORS J2, J3, AND J4 ALSO VARIES.
2. REMOVE/INSTALL TERMINATOR BY HAND. IT COULD BE DAMAGED IF
   A PLIERS OR OTHER TOOL IS USED.

10R331A
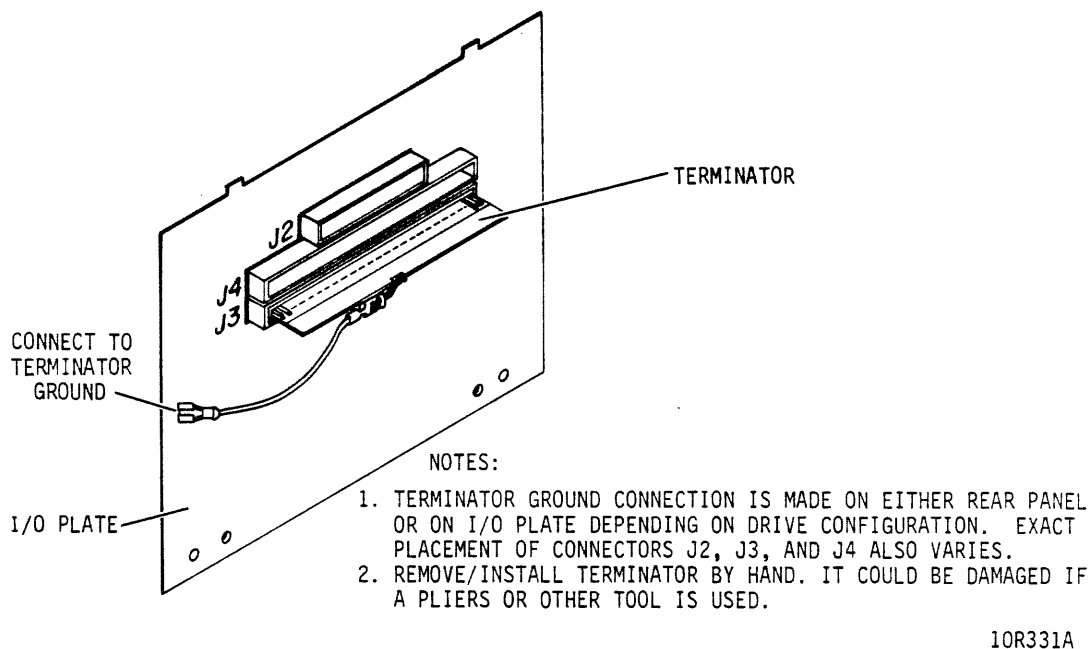
Figure 3-11. Terminator Installation (Typical)

NOTE

On each I/O cable, there are several locations
where heat shrink tubing can be removed to ex-
pose the ground shield. By selecting the pro-
per section of heat shrink for removal in the
following step, the ground shield will be ex-
posed only where it is contacted by the
grounding clamp.

7. Strip heat shrink tubing from all cables so that bare
    shielding will be in contact with grounding clamp.

8. Loosely install grounding clamp (grounding clamp has
    smaller diameter openings than strain relief clamp) onto
    cable bracket with cables positioned as shown in figure
    3-10. Ensure that bare shielding on each cable is in
    contact with grounding clamp.

9. Position cabling so that outer insulation begins just
    below grounding clamp; then secure grounding clamp into
    place. This will ensure that the strain relief clamp
    (installed in the following step) is in contact with
    outer insulation of cabling.

10. Install strain relief clamp onto cable bracket with
    cables positioned as shown in figure 3-10.

11. Install I/O shield (if used) on I/O plate with attaching
    hardware.

SYSTEM GROUNDING AND INTERCONNECT CABLING

This section contains instructions on grounding the system and
interconnecting the remote power supply and drive. It is as-
sumed that the site has been prepared in accordance with the
site requirements information provided earlier in this sec-
tion. The following procedures describe how to ground the
system in a star or daisy chain configuration as shown in
figure 3-12.

For drives with the integral power supply, interconnect ground
cabling between drive and power supply has already been in-
stalled during manufacturing. For drives with remote power
supply, interconnect cabling is supplied with each drive and
installed on site, between case ground on each drive and case
ground on its power supply. Refer to Accessories in section 4
for grounding accessories part numbers.
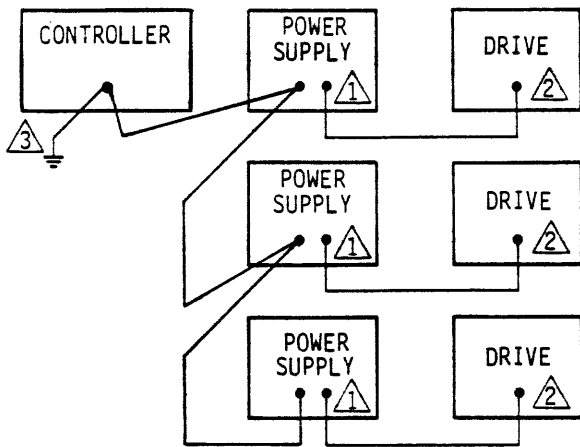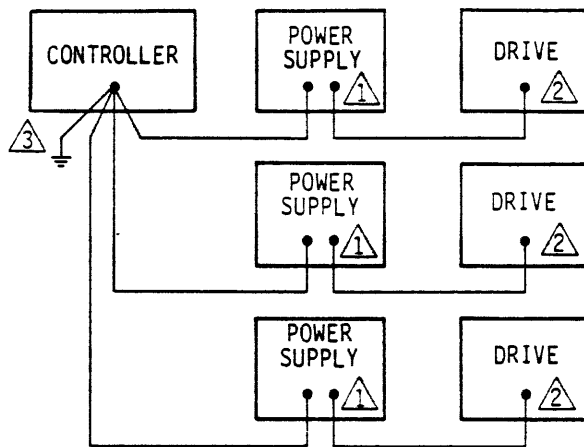
DAISY CHAIN CONFIGURATION   STAR CONFIGURATION

NOTES:

⚠1 GROUND CONNECTIONS TO POWER SUPPLY USE STUDS MARKED⊕ .
     THERE MUST BE NO CONNECTION TO STUD MARKED "± 5V RET."

⚠2 DRIVE IS GROUNDED AT "DC GND" SCREW ON DRIVE REAR PANEL.

     IF DRIVE HAS INTEGRAL POWER SUPPLY:
     DC GROUND CABLE BETWEEN DRIVE AND POWER SUPPLY
     HAS ALREADY BEEN INSTALLED DURING MANUFACTURING.

     IF DRIVE HAS REMOTE POWER SUPPLY:
     DRIVES SUPPLIED WITH ONE-FOOT DC POWER CABLE HAVE A
     SEPARATE GROUND STRAP THAT CONNECTS BETWEEN POWER SUPPLY
     AND DRIVE. DRIVES SUPPLIED WITH A LONGER DC POWER CABLE
     USE THE CABLE SHIELD FOR A GROUND CONNECTION BETWEEN
     POWER SUPPLY AND DRIVE. EACH END OF THESE CABLES HAS A
     SEPARATE GROUND STRAP CONNECTED TO GROUND SHIELD.

⚠3 EARTH GROUND CONNECTION

                                                 11D15A

Figure 3-12. System Grounding Diagram

Star Grounding Procedure

This procedure describes how to ground the system in a star configuration. In this configuration, ground straps connect the controller ground to each power supply in the system as shown in figure 3-12.

1. Prepare ground straps as follows:

   a. Allowing sufficient length for drive extension, cut ground straps to length needed for the following connections:

      • Controller to earth ground
      • Controller to each power supply

   b. Crimp and solder terminal lugs to both ends of each ground strap.

2. Referring to figure 3-12, connect ground straps to controller as follows:

   a. Connect one end of each of the ground straps to controller ground terminal.

   b. Connect one of the ground straps to earth ground.

   c. Route the remaining ground straps to the power supplies.

                              NOTE

   For drives with integral power supply, perform
   step 3 only. For drives with remote power
   supply, skip to step 4.

3. Connect a ground strap from controller to each power supply as follows:

   a. Remove nut and lockwasher from one of the system ground studs on each power supply. These studs are identified by ground symbols. The stud marked "+5V RET" is not used. See figure 3-13.

   b. Place lockwasher on ground stud. Then place terminal lug on stud and secure with nut.

SYSTEM GROUND STUD

J1 AC INPUT
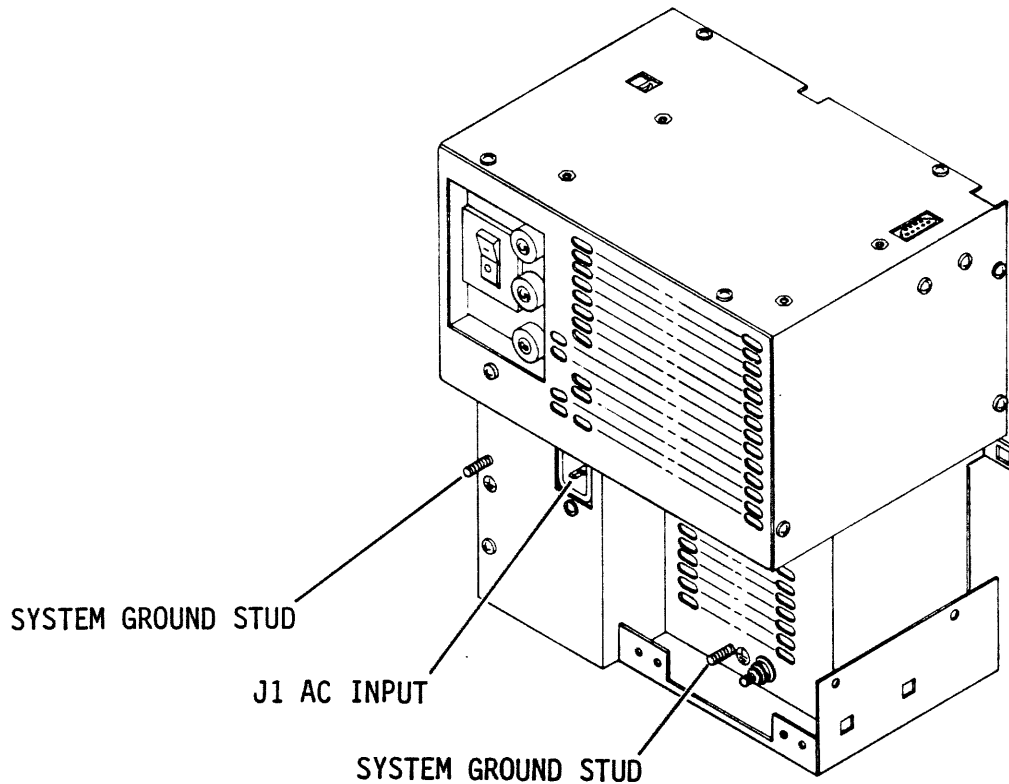
SYSTEM GROUND STUD

NOTE:

1. PLACEMENT OF SYSTEM GROUND STUD AND AC INPUT
   CONNECTOR IS NOT THE SAME ON ALL INTEGRAL
   POWER SUPPLIES.   11D387

Figure 3-13. System Grounding (Integral Power Supply)

NOTE

Ground connections to remote power supply pre-
cede installation of power supply in cabinet.

4. Referring to figure 3-9, attach a ground strap from con-
    troller to each power supply as follows:

    a. Locate power supply close to where it will be in-
       stalled.

    b. Remove nuts and lockwashers from two ground studs on
       front panel of power supply. These studs are identi-
       fied by ground symbols. The stud marked "+5V RET" is
       not used.

c. Place lockwasher on ground stud farthest from connector J15.

d. Place terminal lug of ground strap on stud and secure with nut.

5. Identify whether dc power cable has a ground shield strap attached at each end. If it does, proceed with step 6. Otherwise, skip to step 7.

6. Referring to figures 3-12 and 3-14, connect shielded dc power cable between power supply and drive as follows:

a. Connect shielded dc power cable between connector J15 on front panel of power supply and connector J40 on rear panel of drive.

b. Place lockwasher on remaining ground stud on power supply.

c. Place terminal lug of ground shield strap over lockwasher on stud and secure with nut.

d. Remove DC GND screw and lockwasher from rear panel of drive.

e. Insert screw through terminal lug of ground shield strap and then through lockwasher.

f. Reinstall screw in rear panel of drive.

7. Referring to figures 3-12 and 3-14, connect the unshielded dc power cable and the ground strap between power supply and drive as follows:

a. Connect unshielded dc power cable between connector J15 on front panel of power supply and connector J40 on rear panel of drive.

b. Place lockwasher on remaining ground stud on power supply.

c. Place terminal lug of ground strap over lockwasher on stud and secure with nut.

d. Remove DC GND screw and lockwasher from rear panel of drive.

e. Insert screw through terminal lug of ground strap and then through lockwasher.

f. Reinstall screw in rear panel of drive.

NOTES:

⚠️1 SHIELDED DC POWER CABLE
IS SHOWN.
UNSHIELDED DC POWER CABLES
REQUIRE SEPARATE GROUND
STRAP.
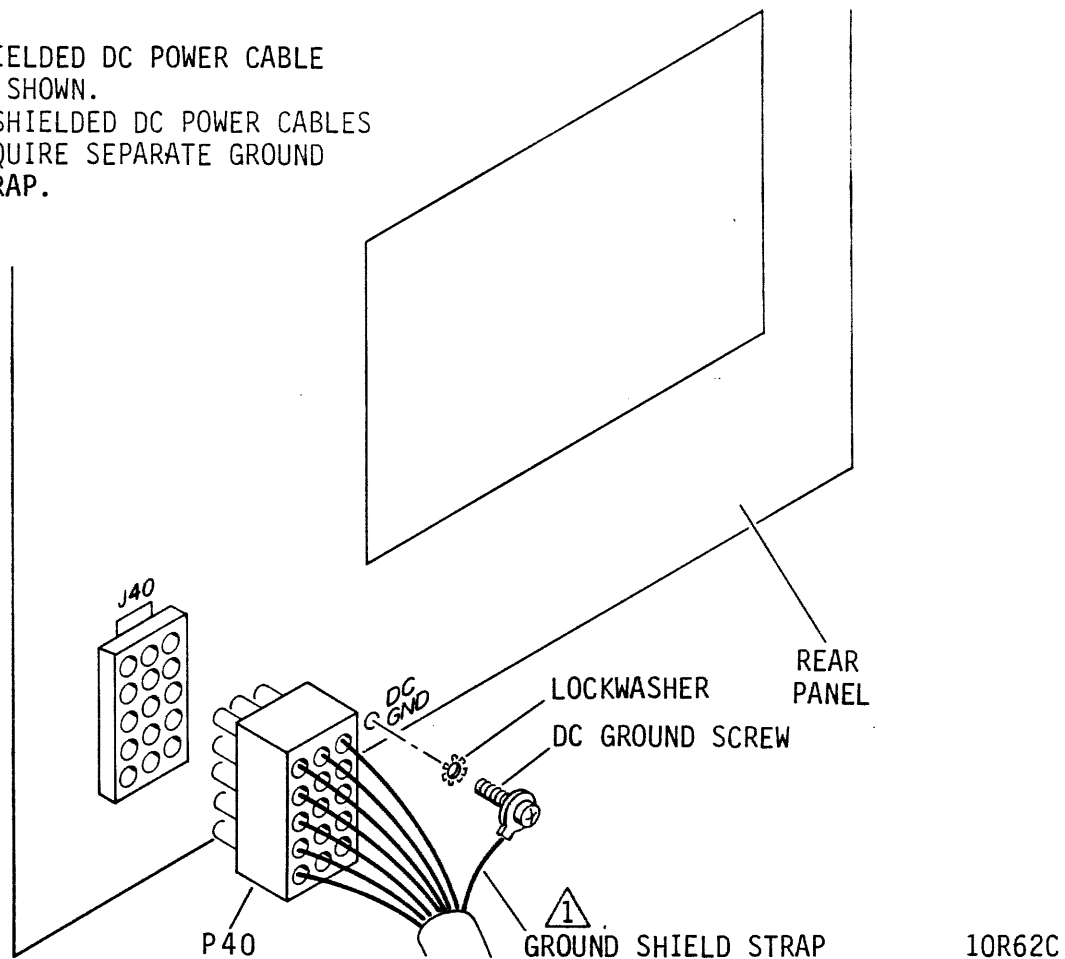
Figure 3-14.   Drive Grounding (Remote Power Supply)

Daisy Chain Grounding Procedure

This procedure describes how to ground the system in a daisy
chain configuration. In this configuration, a ground strap
connects the controller ground to the first power supply in the
system. The remainder of the power supplies are connected by
grounding straps going from the first power supply to the sec-
ond, the second to the third, and so on. See figure 3-12.

1. Prepare ground straps as follows:

    a. Allowing sufficient length for drive extension, cut
       ground straps to length needed for the following con-
       nections:

       •   Controller to earth ground
       •   Controller to nearest drive
       •   Each drive to next drive in daisy chain

b. Crimp and solder terminal lugs to both ends of each ground strap.

2. Referring to figure 3-12, connect ground straps to controller as follows:

   a. Connect two ground straps to controller ground terminal.

   b. Connect one of the ground straps to earth ground.

   c. Route the other ground strap to the first power supply in the daisy chain. Route the remaining ground straps (prepared in step 1) from power supply to power supply.

NOTE

For drives with integral power supply, perform step 3 only. For drives with remote power supply, skip to step 4.

3. Make the daisy chain ground connections at each power supply as follows:

   a. Remove nut and lockwasher from one of the system ground studs on each power supply. These studs are identified by ground symbols. The stud marked "+5V RET" is not used. See figure 3-13.

   b. Place lockwasher on ground stud. Then place terminal lug(s) on stud and secure with nut.

NOTE

Ground connections to remote power supply precede installation of power supply in cabinet.

4. Referring to figure 3-9, make daisy chain connections at each power supply as follows:

   a. Locate power supply close to where it will be installed.

   b. Remove nuts and lockwashers from two ground studs on front panel of power supply. These studs are identified by ground symbols. The stud marked "±5V RET" is not used.

   c. Place lockwasher on ground stud farthest from connector J15.

d. Place terminal lug of ground strap(s) on stud and secure with nut.

5. Identify whether dc power cable has a ground shield strap attached at each end. If it does, proceed with step 6. Otherwise, skip to step 7.

6. Referring to figures 3-12 and 3-14, connect shielded dc power cable between power supply and drive as follows:

   a. Connect shielded dc power cable between connector J15 on front panel of power supply and connector J40 on rear panel of drive.

   b. Place lockwasher on remaining ground stud on power supply.

   c. Place terminal lug of ground shield strap over lockwasher on stud and secure with nut.

   d. Remove DC GND screw and lockwasher from rear panel of drive.

   e. Insert screw through terminal lug of ground shield strap and then through lockwasher.

   f. Reinstall screw in rear panel of drive.

7. Referring to figures 3-12 and 3-14, connect the unshielded dc power cable and the ground strap between power supply and drive as follows:

   a. Connect unshielded dc power cable between connector J15 on front panel of power supply and connector J40 on rear panel of drive.

   b. Place lockwasher on remaining ground stud on power supply.

   c. Place terminal lug of ground strap over lockwasher on stud and secure with nut.

   d. Remove DC GND screw and lockwasher from rear panel of drive.

   e. Insert screw through terminal lug of ground strap and then through lockwasher.

   f. Reinstall screw in rear panel of drive.

MOUNTING REMOTE POWER SUPPLY IN RACK

The following procedure provides instructions for mounting the power supply behind the drive on the slide assemblies and connecting the ac power cable to the supply. Power supplies on older units are mounted directly on the slide assemblies and do not use a mounting bracket. In this case, a second person is needed to support the power supply while the mounting hardware is being installed. Power supplies on newer units are attached with a bracket and mounts. Figure 3-8 shows the ac power cable provided with the power supply.

NOTE

If the power supply is not installed behind the drive, ensure that the location provides adequate clearance for good airflow, and connect ac power cable to AC INPUT connector J1 and site ac power source.

Units Without Mounting Bracket

1. Extend drive from rack to the full extension allowed by slide assemblies.

2. Support power supply above drive.

NOTE

At full slide extension, power supply mounting holes in inner slide are accessible through clearance holes in intermediate slide, as shown in figure 3-15.

3. Attach power supply to inner slides with screws provided in slide hardware kit.

4. Connect ac power cable to AC INPUT connector J1 and to site ac power source.

Units With Mounting Bracket

1. Ensure that power supply mounts have been installed on the slides as directed in Mounting Drive in Rack procedure.

POWER SUPPLY

UNITS WITHOUT
POWER SUPPLY
MOUNTING BRACKET

CONNECTOR J15

DRIVE

POWER SUPPLY

LOCKING
SCREW

ACCESS HOLE

MOUNTING
SCREWS

CONNECTOR J15

LOCKING
HOLE

MOUNTING
BRACKET

INTERMEDIATE
SLIDE

DRIVE

INNER SLIDE

LOCKING
HOLE

UNITS WITH
POWER SUPPLY
MOUNTING BRACKET

MOUNT

INTERMEDIATE SLIDE

INNER SLIDE

10R320A
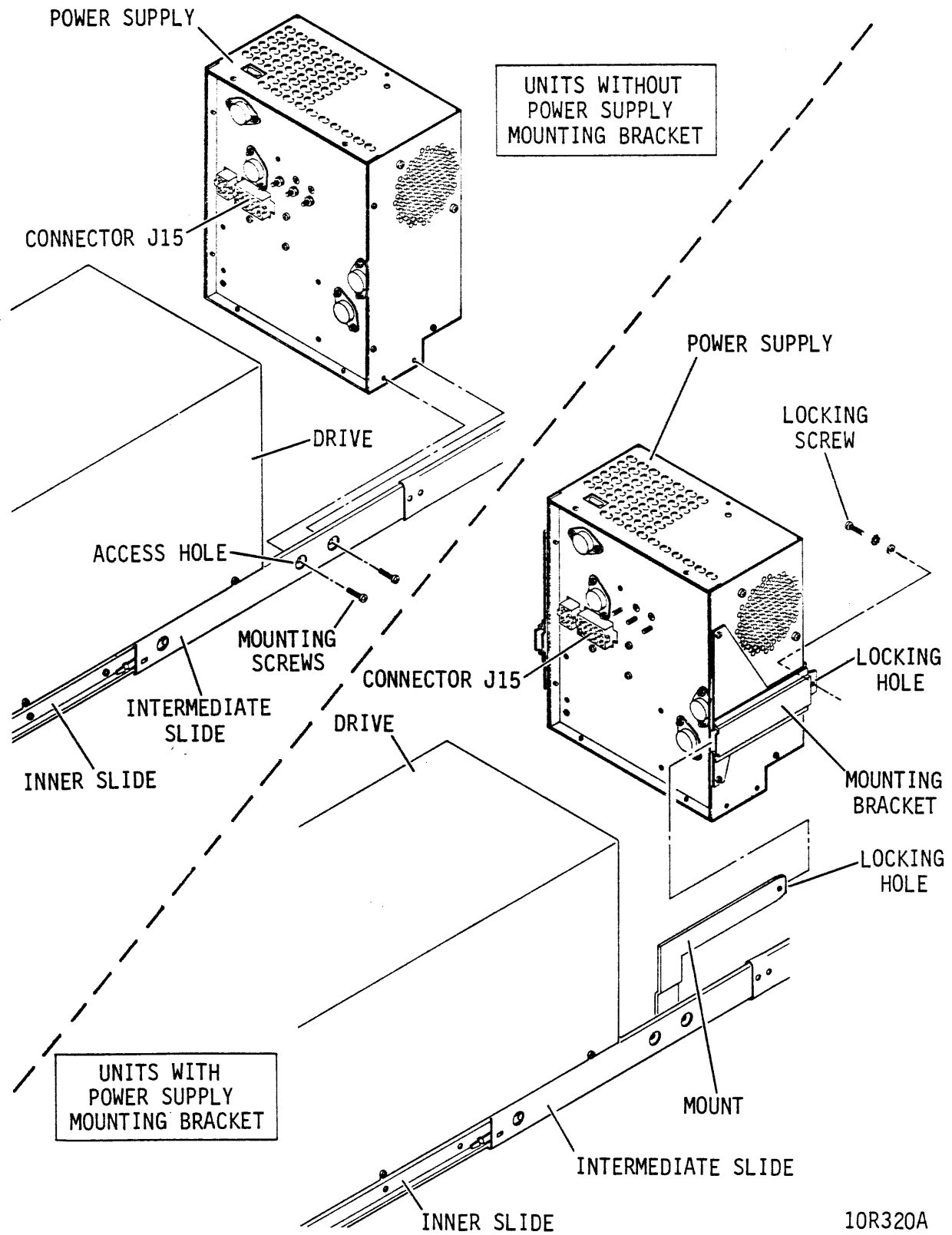
Figure 3-15.   Installing Remote Power Supply on Slides

2. Position power supply so that mounts and matching slots in bracket are aligned as shown in figure 3-15. Slide power supply toward drive until locking holes in bracket align with locking holes in mounts.

3. Secure power supply bracket to mounts with 8-32 x 5/16 screws, washers, and lockwashers.

4. Connect ac power cable to AC INPUT connector J1 and to site ac power source.

SETTING CIRCUIT BOARD SWITCHES

The circuit boards inside the drive contain a number of switches that must be set correctly for normal operation of the drive. Figures 3-16 through 3-19 identify these switches and give their locations on the circuit boards. They also give the correct settings for normal drive operation for all switches except the sector select switches. Setting the sector select switches is discussed in the following paragraphs.

Figure 3-19 shows the location of the Sector Select switch assembly. The Sector Select switch assembly has twelve independent switches used for selecting sectors. The number of sectors per revolution generated by the drive logic must be matched to that required by the controller. Therefore, sector select switches are provided in the drive logic to allow selection of different sector counts.

Two methods are provided for determining sector switch settings. One is a recommended method, and the other is an alternate method. The two methods are identical when the number of sector clocks per revolution of the disk is evenly divisible by the number of sectors. However, if the division has a remainder, the two methods treat the remainder differently. With the recommended method, the remainder results in an extra sector pulse just before index. Some controllers, however, cannot accommodate the extra sector pulse. With the alternate method, there is no extra sector pulse. Descriptions of both methods follow.

INDEX SECTOR
JUMPER

LOCAL/REMOTE SWITCH

LOCAL

REMOTE

A B

B·□·A

J05   C639
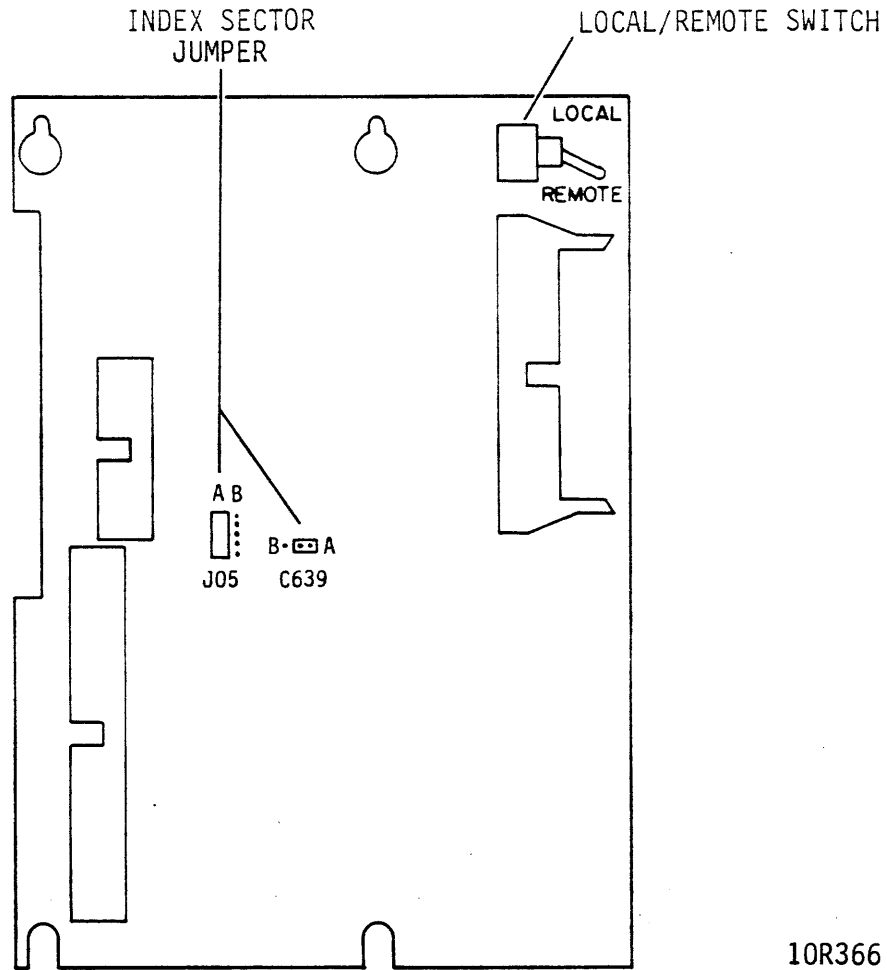
10R366

SWITCH	SETTING	DESCRIPTION
LOCAL/REMOTE	LOCAL	Drive power on independent of controller.
	REMOTE	Drive power on dependent on controller.
Index/Sector jumper*	A	Index and sector signals are in A cable.
	B	Index and sector signals are in B cable.
	Jumper removed	Index and sector signals are in A and B cables (applies to newer boards only).

*Location J05 applies to older boards.
 Location C639 applies to newer boards.

Figure 3-16. Switch Settings on _EBN I/O Board

INDEX/SECTOR
JUMPERS

LOCAL/REMOTE SWITCH

A B

A B

J06

J05

CH 2 DISABLE

CH 1 DISABLE

ABR/RTM
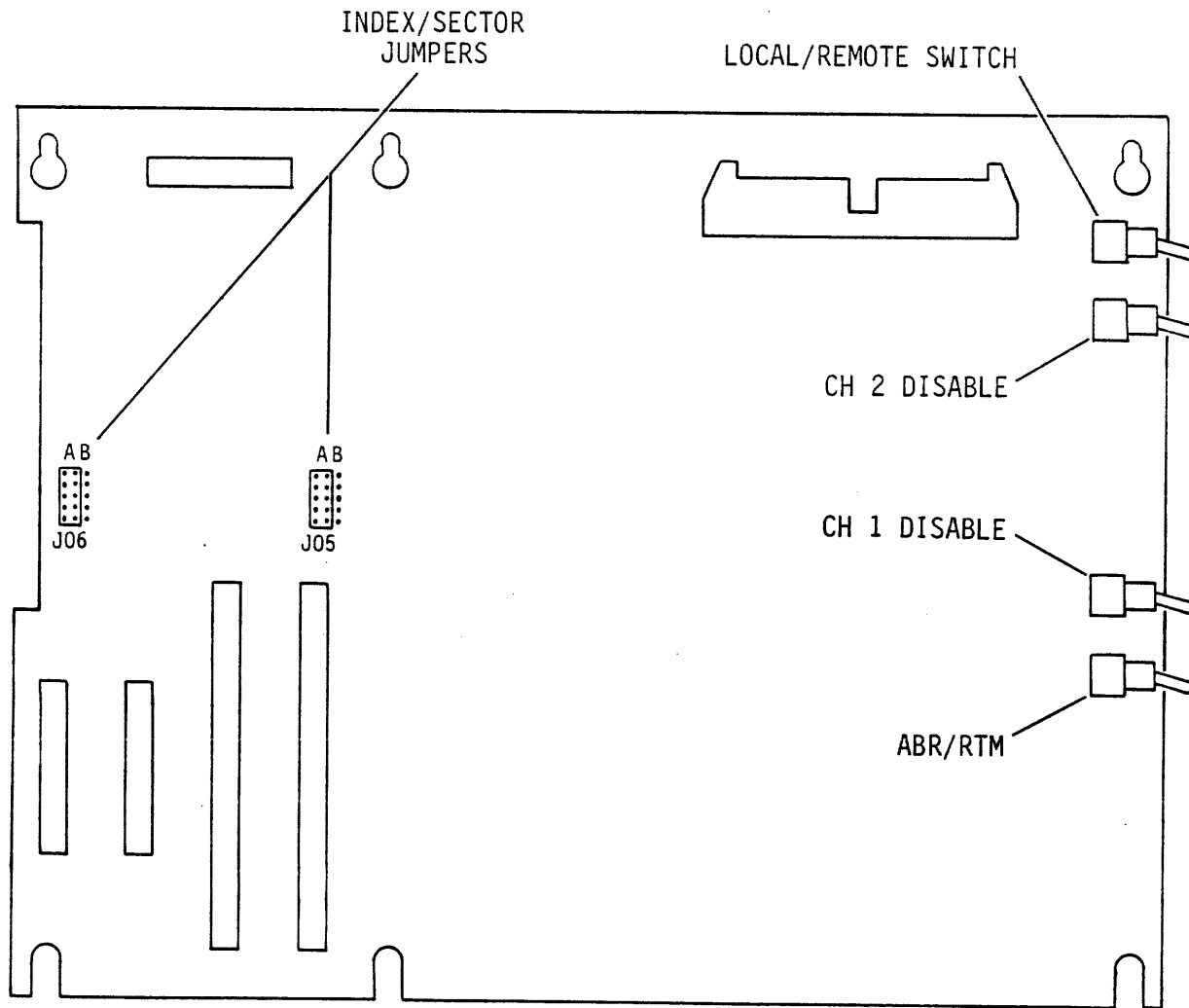
10R367

Figure 3-17.   Switch Settings on AEDN/CEDN I/O Boards
(Sheet 1 of 2)

SWITCH	SETTING	DESCRIPTION
Index/Sector jumpers	A	Index and sector signals are in A cable.
	B	Index and sector signals are in B cable.
	Jumper removed	Index and sector signals are in A and B cables.
LOCAL/REMOTE	LOC	Drive power on independent of controller.
	REM	Drive power on dependent on controller.
CH 2 Disable	NORM	Setting for normal operation.
	D1	
CH 1 Disable	NORM	Setting for normal operation.
	D1	Disables channel 1.
ABR/RTM	ABR	Drive remains reserved until it receives release or priority select command.
	RTM	Drive is released from reserved condition approximately 500 ms after being selected.

Figure 3-17. Switch Settings on AEDN/CEDN I/O Boards (Sheet 2)
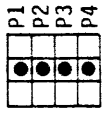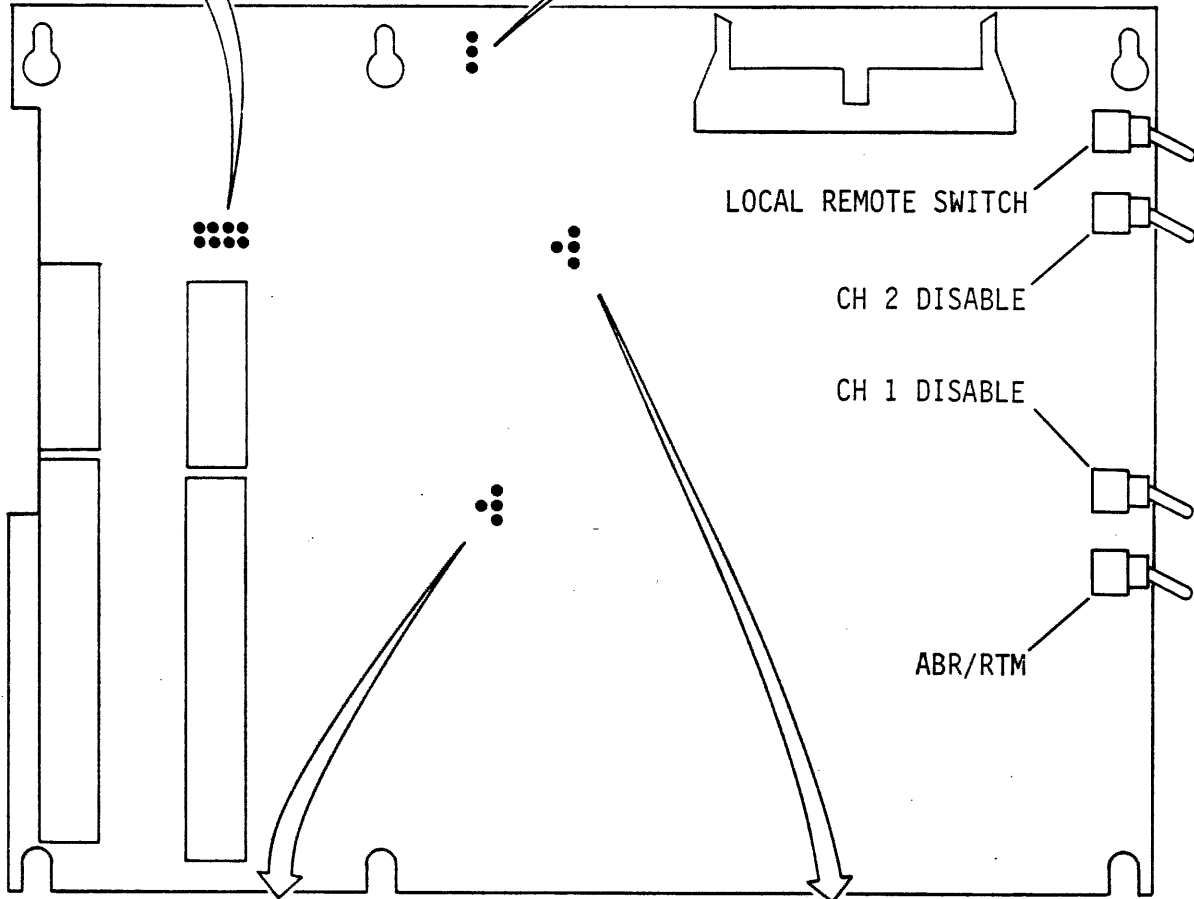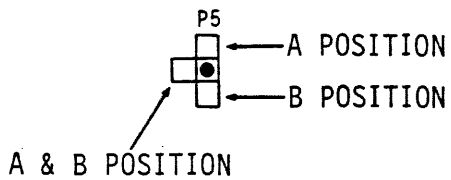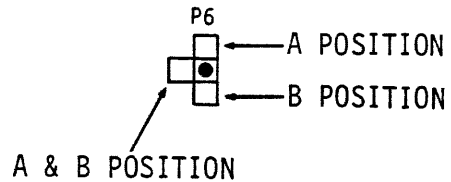
Figure 3-18. Switch Settings on DEDN I/O Board (Sheet 1 of 2)

10R368

SWITCH	SETTING	DESCRIPTION
30/60 Grounding Jumpers	P1 grounded	Pin 60 of Ch 2 A cable is grounded.
	P1 not grounded	Pin 60 of Ch 2 A cable is not grounded.
	P2 grounded	Pin 30 of Ch 2 A cable is grounded.
	P2 not grounded	Pin 30 of Ch 2 A cable is not grounded.
	P3 grounded	Pin 60 of Ch 1 A cable is grounded.
	P3 not grounded	Pin 60 of Ch 1 A cable is not grounded.
	P4 grounded	Pin 30 of Ch 1 A cable is grounded.
	P4 not grounded	Pin 30 of Ch 1 A cable is not grounded.
Unit Select Jumper	0-15	Capable of selecting drives numbered 0 thru 15.
	0-7	Capable of selecting drives numbered 0 thru 7.
Index/Sector Jumper	A	Index and sector signals are in A cable.
	B	Index and sector signals are in B cable.
	A & B	Index and sector signals are in A and B cables.
Local/Remote	LOC	Drive power on independent of controller.
	REM	Drive power on dependent on controller.
CH 2 Disable	NORM	Setting for normal operation.
	D1	Disables channel 2.
CH 1 Disable	NORM	Setting for normal operation.
	D1	Disables channel 1.
ABR/RTM	ABR	Drive remains reserved until it receives release or priority select command.
	RTM	Drive is released from reserved condition approximately 500 ms after being selected.

Figure 3-18. Switch Settings on DEDN I/O Boards (Sheet 2)

WRITE PROTECT SWITCH   SECTOR
                                        SWITCHES

NORM   W PROT

$2^{11} \rightarrow$

$2^0 \rightarrow$
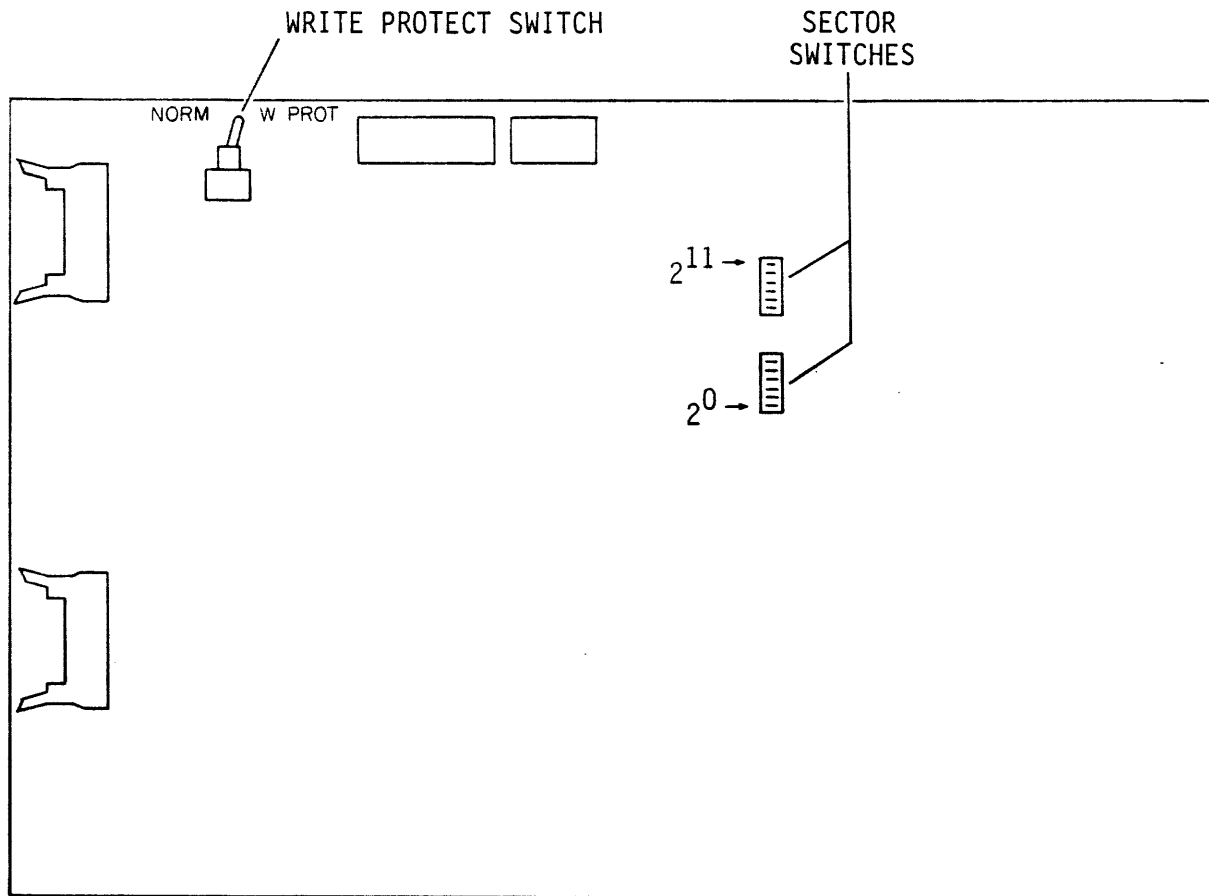
10R369

SWITCH	SETTING	DESCRIPTION
Sector switches		See discussion on setting circuit board switches.
Write Protect	NORM	Normal.
	W PROT	Write Protect.

Figure 3-19. Switch Settings on _PXX Control Board

Recommended Method for Sector Switch Settings

Refer to the subsystem reference manual to determine the number of sectors required by the controller; then locate that number in table 3-4. Across from the number of sectors listed in the table is a row of Cs and Os. C represents the Closed or On position of the sector switch. O represents the Open or Off position of the sector switch. Set the switches to the positions designated in the table while referring to figure 3-20 for an illustration of the switch positions.

TABLE 3-4. SECTOR SELECT SWITCH SETTINGS

Number of Sectors	Switch Number
	0	1	2	3	4	5	6	7	8	9	10	11
4	C	C	C	C	C	O	O	O	C	O	C	C
5	C	C	C	C	C	C	C	O	O	C	O	C
6	C	C	C	C	C	C	O	C	O	O	O	C
7	C	C	C	C	C	C	C	O	C	C	C	O
8	C	C	C	C	O	O	O	C	O	C	C	O
9	O	O	C	O	C	O	C	C	C	O	C	O
10	C	C	C	C	C	C	O	O	C	O	C	O
11	O	O	C	O	O	O	C	C	O	O	C	O
12	C	C	C	C	C	O	C	O	O	O	C	O
13	O	O	O	C	O	O	O	O	O	O	C	O
14	C	C	C	C	C	C	O	C	C	C	O	O
15	C	C	C	C	C	C	C	O	C	C	O	O
16	C	C	C	O	O	O	C	O	C	C	O	O
17	C	O	C	O	C	O	O	O	C	C	O	O
18	C	O	O	C	O	C	C	C	O	C	O	O

Table Continued on Next Page

TABLE 3-4. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
19	O	C	O	O	O	O	C	C	O	C	O	O
20	C	C	C	C	C	O	O	C	O	C	O	O
21	C	C	C	C	C	C	C	O	O	C	O	O
22	C	O	O	O	O	C	C	O	O	C	O	O
23	C	C	C	O	O	O	C	O	O	C	O	O
24	C	C	C	C	O	C	O	O	O	C	O	O
25	O	O	O	C	C	O	O	O	O	C	O	O
26	C	C	O	O	O	O	O	O	O	C	O	O
27	O	O	O	O	C	C	C	C	C	O	O	O
28	C	C	C	C	C	O	C	C	C	O	O	O
29	O	C	C	C	O	O	C	C	C	O	O	O
30	C	C	C	C	C	C	O	C	C	O	O	O
31	O	O	O	O	C	C	O	C	C	O	O	O
32	C	C	O	O	O	C	O	C	C	O	O	O
33	O	C	C	O	C	O	O	C	C	O	O	O
34	O	C	O	C	O	O	O	C	C	O	O	O
35	C	C	C	C	C	C	C	O	C	O	O	O
36	O	O	C	O	C	C	C	O	C	O	O	O
37	O	C	O	C	O	C	C	O	C	O	O	O
38	O	O	O	O	O	C	C	O	C	O	O	O
39	C	C	C	O	C	O	C	O	C	O	O	O
40	C	C	C	C	O	O	C	O	C	O	O	O
41	O	C	C	O	O	O	C	O	C	O	O	O
42	C	C	C	C	C	C	O	O	C	O	O	O

Table Continued on Next Page

TABLE 3-4.   SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
43	C	C	C	O	C	C	O	O	C	O	O	O
44	O	O	O	O	C	C	O	O	C	O	O	O
45	C	O	O	C	O	C	O	O	C	O	O	O
46	C	C	O	O	O	C	O	O	C	O	O	O
47	O	O	C	C	C	O	O	O	C	O	O	O
48	C	C	C	O	C	O	O	O	C	O	O	O
49	C	O	O	O	C	O	O	O	C	O	O	O
50	C	C	O	C	O	O	O	O	C	O	O	O
51	O	C	C	O	O	O	O	O	C	O	O	O
52	C	O	O	O	O	O	O	O	C	O	O	O
53	O	O	C	C	C	C	C	C	O	O	O	O
54	C	C	C	O	C	C	C	C	O	O	O	O
55	C	C	O	O	C	C	C	C	O	O	O	O
56	C	C	C	C	O	C	C	C	O	O	O	O
57	O	C	O	C	O	C	C	C	O	O	O	O
58	O	C	C	O	O	C	C	C	O	O	O	O
59	O	C	O	O	O	C	C	C	O	O	O	O
60	C	C	C	C	C	O	C	C	O	O	O	O
61	C	C	O	C	C	O	C	C	O	O	O	O
62	C	C	C	O	C	O	C	C	O	O	O	O
63	O	O	C	O	C	O	C	C	O	O	O	O
64	C	O	O	O	C	O	C	C	O	O	O	O
65	C	O	C	C	O	O	C	C	O	O	O	O
66	O	C	O	C	O	O	C	C	O	O	O	O

Table Continued on Next Page

TABLE 3-4. SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
67	C	C	C	O	O	O	C	C	O	O	O	O
68	O	O	C	O	O	O	C	C	O	O	O	O
69	C	O	O	O	O	O	C	C	O	O	O	O
70	C	C	C	C	C	C	O	C	O	O	O	O
71	O	O	C	C	C	C	O	C	O	O	O	O
72	C	O	O	C	C	C	O	C	O	O	O	O
73	C	C	C	O	C	C	O	C	O	O	O	O
74	O	O	C	O	C	C	O	C	O	O	O	O
75	O	C	O	O	C	C	O	C	O	O	O	O
76	C	C	C	C	O	C	O	C	O	O	O	O
77	C	O	C	C	O	C	O	C	O	O	O	O
78	C	C	O	C	O	C	O	C	O	O	O	O
79	C	O	O	C	O	C	O	C	O	O	O	O
80	C	C	C	O	O	C	O	C	O	O	O	O
81	O	O	C	O	O	C	O	C	O	O	O	O
82	O	C	O	O	O	C	O	C	O	O	O	O
83	O	O	O	O	O	C	O	C	O	O	O	O
84	C	C	C	C	C	O	O	C	O	O	O	O
85	C	O	C	C	C	O	O	C	O	O	O	O
86	C	C	O	C	C	O	O	C	O	O	O	O
87	C	O	O	C	C	O	O	C	O	O	O	O
88	C	C	C	O	C	O	O	C	O	O	O	O
89	O	C	C	O	C	O	O	C	O	O	O	O
90	O	O	C	O	C	O	O	C	O	O	O	O

Table Continued on Next Page

TABLE 3-4.   SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
91	O	C	O	O	C	O	O	C	O	O	O	O
92	C	O	O	O	C	O	O	C	O	O	O	O
93	C	C	C	C	O	O	O	C	O	O	O	O
94	C	O	C	C	O	O	O	C	O	O	O	O
95	O	O	C	C	O	O	O	C	O	O	O	O
96	C	C	O	C	O	O	O	C	O	O	O	O
97	C	O	O	C	O	O	O	C	O	O	O	O
98	O	O	O	C	O	O	O	C	O	O	O	O
99	O	C	C	O	O	O	O	C	O	O	O	O
100	C	O	C	O	O	O	O	C	O	O	O	O
101	O	O	C	O	O	O	O	C	O	O	O	O
102	O	C	O	O	O	O	O	C	O	O	O	O
103	C	O	O	O	O	O	O	C	O	O	O	O
104	O	O	O	O	O	O	O	C	O	O	O	O
105	C	C	C	C	C	C	C	O	O	O	O	O
106	C	O	C	C	C	C	C	O	O	O	O	O
107	O	O	C	C	C	C	C	O	O	O	O	O
108	C	C	O	C	C	C	C	O	O	O	O	O
109	O	C	O	C	C	C	C	O	O	O	O	O
110	C	O	O	C	C	C	C	O	O	O	O	O
111	O	O	O	C	C	C	C	O	O	O	O	O
112	C	C	C	O	C	C	C	O	O	O	O	O
113	C	O	C	O	C	C	C	O	O	O	O	O
114	O	O	C	O	C	C	C	O	O	O	O	O

Table Continued on Next Page

TABLE 3-4.   SECTOR SELECT SWITCH SETTINGS (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
115	C	C	O	O	C	C	C	O	O	O	O	O
116	O	C	O	O	C	C	C	O	O	O	O	O
117	C	O	O	O	C	C	C	O	O	O	O	O
118	O	O	O	O	C	C	C	O	O	O	O	O
119	C	C	C	C	O	C	C	O	O	O	O	O
120	C	C	C	C	O	C	C	O	O	O	O	O
121	O	C	C	C	O	C	C	O	O	O	O	O
122	C	O	C	C	O	C	C	O	O	O	O	O
123	O	O	C	C	O	C	C	O	O	O	O	O
124	C	C	O	C	O	C	C	O	O	O	O	O
125	O	C	O	C	O	C	C	O	O	O	O	O
126	C	O	O	C	O	C	C	O	O	O	O	O
127	O	O	O	C	O	C	C	O	O	O	O	O
128	O	O	O	C	O	C	C	O	O	O	O	O

Note: C = Closed or On position; O = Open or Off position.

The switch settings listed in table 3-4 have been determined from a formula. Use of this formula is demonstrated below to provide the user with an additional tool for determining sector switch settings. Also, there are examples showing how to calculate the number of bytes in a sector.

Each sector will contain a certain number of clock pulses (received from the servo tracks). The number of clock pulses in each sector is the result of the number of sectors required by the controller. Thus:

$$\text{Selected Clock Pulses} = \frac{13\ 440}{\text{Number of Sectors}} - 1$$

ROCKER-TYPE SWITCHES

SWITCH NUMBER
SWITCHES LOCATED ON CONTROL BOARD

SWITCH TYPE "A"

*

SWITCH TYPE "B"

*
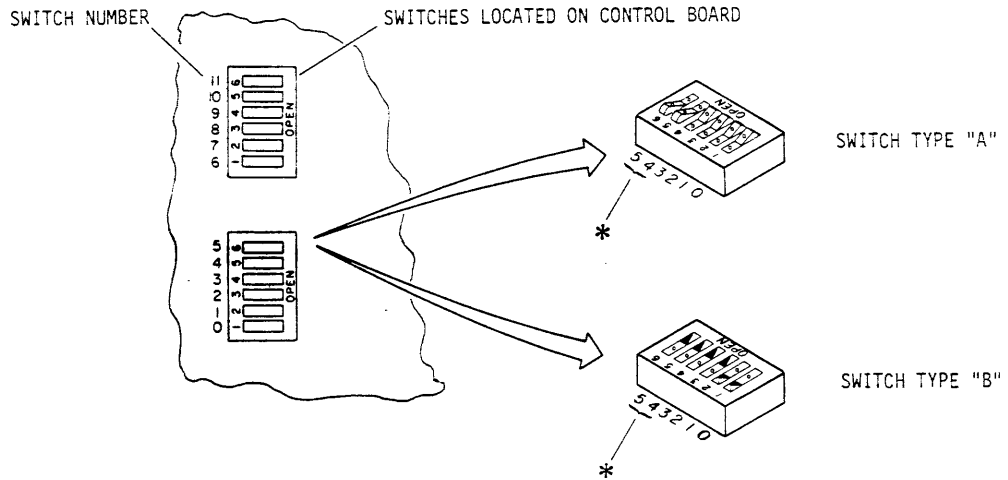
ROCKER TYPE SWITCHES:

TO ACTUATE A SWITCH TO ITS CLOSED POSITION,
PRESS ON END OF SWITCH FARTHEST FROM "OPEN" LETTERING.   *SWITCHES 4 AND 5 SHOWN IN OPEN POSITION

SLIDE-TYPE SWITCHES

SWITCH NUMBER
SWITCHES LOCATED ON CONTROL BOARD

SWITCH TYPE "C"

*

SWITCH TYPE "D"

*
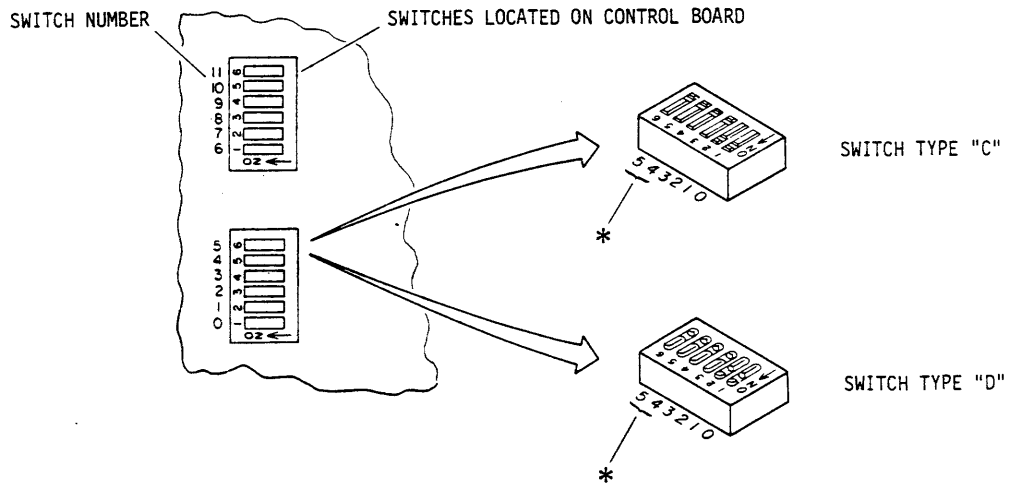
SLIDE-TYPE SWITCHES:

TO ACTUATE A SWITCH TO ITS ON (CLOSED) POSITION,   * SWITCHES 4 AND 5 SHOWN IN OFF POSITION
SLIDE SWITCH IN DIRECTION OF ARROW SHOWN ON SWITCH.

10R55A

Figure 3-20. Miniature Switches

Ignore any remainder in the calculation. The existence of a remainder adds a "short" sector before index.

Each sector switch represents a binary and decimal value of clock pulses (as counted in the logic). The values related to each switch are as follows:

Switch No.	Binary Value	Decimal Value
0	2^0	1
1	2^1	2
2	2^2	4
3	2^3	8
4	2^4	16
5	2^5	32
6	2^6	64
7	2^7	128
8	2^8	256
9	2^9	512
10	2^{10}	1024
11	2^{11}	2048

Here is an example of determining the switch settings for selecting 63 sectors:

$$\text{Selected Clock Pulses} = \left(\frac{13\ 440}{63} - 1\right) = (213.33 - 1) = 212.33$$

If there is a remainder, it should be ignored. In this case, the number of selected clock pulses becomes 212.

Determine which switches to place in the Closed or On position as follows:

Selected clock pulses	212
Clock pulses selected by switch 7	128
(Difference)	84
Clock pulses selected by switch 6	64
(Difference)	20
Clock pulses selected by switch 4	16
(Difference)	4
Clock pulses selected by switch 2	4
(Difference)	0

Thus, placing switches 2, 4, 6, and 7 in the Closed or On position selects 63 sectors. Since a remainder existed in the calculation formula, an additional sector pulse will be present just before index.

To calculate the number of bytes in one sector, based on the above switch settings, proceed as follows:

- Add 1 to the selected clock pulses: 212 + 1 = 213.

- Multiply this number by the number of bytes per clock pulse (1.5) to find the number of bytes per sector: 213 X 1.5 = 319.5

Alternate Method for Sector Switch Settings

Use the following formula to determine sector switch settings if the subsystem cannot accept an extra sector pulse before index.

Here is an example of determining the switch settings for selecting 63 sectors:

$$\text{Selected Clock Pulses} = (\frac{13\ 440}{63} - 1) = (213.33 - 1) = 212.33$$

If there is a remainder, it is necessary to round up to the next whole number. In this case, the number of selected clock pulses becomes 213.

Determine which switches to place in the Closed or On position as follows:

Selected clock pulses	213
Clock pulses selected by switch 7	128
(Difference)	85
Clock pulses selected by switch 6	64
(Difference)	21
Clock pulses selected by switch 4	16
(Difference)	5
Clock pulses selected by switch 2	4
(Difference)	1
Clock pulses selected by switch 0	1
(Difference)	0

Thus, placing switches 0, 2, 4, 6, and 7 in the Closed or On position selects 63 sectors. Since a remainder existed in the calculation formula, the last (63rd) sector will be shorter than those preceding it.

To calculate the number of bytes in each of the first 62 sectors, based on the above switch settings, proceed as follows:

- Add 1 to the selected clock pulses: $213 + 1 = 214$

- Multiply this number by the number of bytes per clock pulse (1.5) to find the number of bytes per sector: $214 \times 1.5 = 321.0$

To calculate the number of bytes in the 63rd sector, proceed as follows:

- Multiply the number of bytes per sector (calculated above) by 62 (the number of full-length sectors): $321 \times 62 = 19\ 902$

- Subtract this number from the number of bytes per track (20 160) to find the number of bytes in the 63rd sector: $20\ 160 - 19\ 902 = 258$

CHECKOUT

After completing installation of the drive, follow the sequence outlined below for initial startup. Refer to section 2 of this manual for information about operation of the drive.

1. Install logic plug in operator panel. Logic plug for each drive in a system must have a unique number.

2. Set LOCAL/REMOTE switch to LOCAL position. Switch is accessible through opening in left side of cover.

3. Set power supply switch/circuit breaker to ON position, and observe that the drive cooling fan operates.

4. Press START switch on drive operator panel, and observe that the following events occur:

    - The drive motor starts.

    - The Ready indicator (inside the START switch) lights steadily within 30 seconds of startup. This indicates that the drive motor is up to speed and that the heads are at track 0.

    If any of these events do not occur, a problem exists in the drive. Then refer to troubleshooting information in volume 2 of the hardware maintenance manual.

5. Turn off drive power.

6. Set LOCAL/REMOTE switch to REMOTE position if remote operation is desired.

7. Return drive to normal operating position in equipment rack.

8. Drive is now ready for online operation.

SECTION 4

PARTS DATA

INTRODUCTION

This section contains listings of field replaceable parts, (including FRUs) manufacturer's recommended spare parts, and accessories. Use only CDC/MPI replacement parts. Using non-CDC/MPI parts can adversely affect safety. Using other manufacturers' parts could also degrade reliability, increase maintenance downtime, and void warranty coverage.

NOTE

ORDER AND REPLACE LOGIC BOARDS BY PART NUMBER ONLY.

Logic boards have an alpha card type designator stamped on them. In the past, ECOs that changed a board part number also changed the first letter of the designator (AWXY to BWXY). Effective 1 August 1987, only the part number changed. The card type does not change.

FIELD REPLACEABLE PARTS LIST

This listing is divided into four columns:

- INDEX NO – The numbers in this column correspond to the numbers shown within the facing page illustration.

- PART NUMBER – Contains one of the following:

  1. Eight digit part number – use this number to order a replacement part. Within the continental U.S., parts may be ordered from Control Data Corporation, World Distribution Center, 304 North Dale St., St. Paul, MN, 55103, Telephone 612-292-2200.

  2. Optional – parts which are not used in all applications. To determine usage in a particular equipment, you must first know the Equipment Package part number (refer to Equipment Configuration in section 1 of this manual for definition and location of this number) and then refer to table 4-1. Table 4-1 contains the

Equipment Package part number (the first 6 digits are on line 1, and the last 2 digits are on line 2) and a list of optional parts. If an optional part is used in a particular Equipment Package, "XX" will appear in that column.

3. Spare - indicates that the item is a manufacturer's recommended spare part. Refer to table 4-2 for replacement part number information.

● PART DESCRIPTION - Contains part nomenclature/description. If an item is indented more than the previous item, it indicates it is part of the previous item (assembly).

● NOTE - Usually contains entries to define differences between machine configurations (i.e., model differences, older units vs newer units, etc.).

MANUFACTURER'S RECOMMENDED SPARE PARTS

This listing (table 4-2) is divided into three columns:

● DESCRIPTION/NOTES - Contains the part nomenclature/description and other pertinent information.

● PART NUMBER - Contains the part number of the part when the unit was manufactured or as a result of the latest FCO. This part can be used as a replacement on the series code and types of units indicated in the Description/Notes column. However, always use Replacement Part Number when ordering new parts or spares.

● REPLACEMENT PART NUMBER - Contains the interchangeable replacement part number. Use this number for ordering replacement or spare parts.

ACCESSORIES

This listing (table 4-3) contains the following:

● PART NUMBER - Use this number to order this part. See Field Replaceable Parts List for ordering information.

● DESCRIPTION - Contains the part nomenclature/description.

LOCATOR

SEE
FIGURES
9,10

SEE
FIGURE
6

SEE
FIGURE
5

SEE
FIGURE
4

SEE
FIGURES
7,8

SEE
FIGURE
6

SEE
FIGURE
3

SEE
FIGURE
2

19-000F
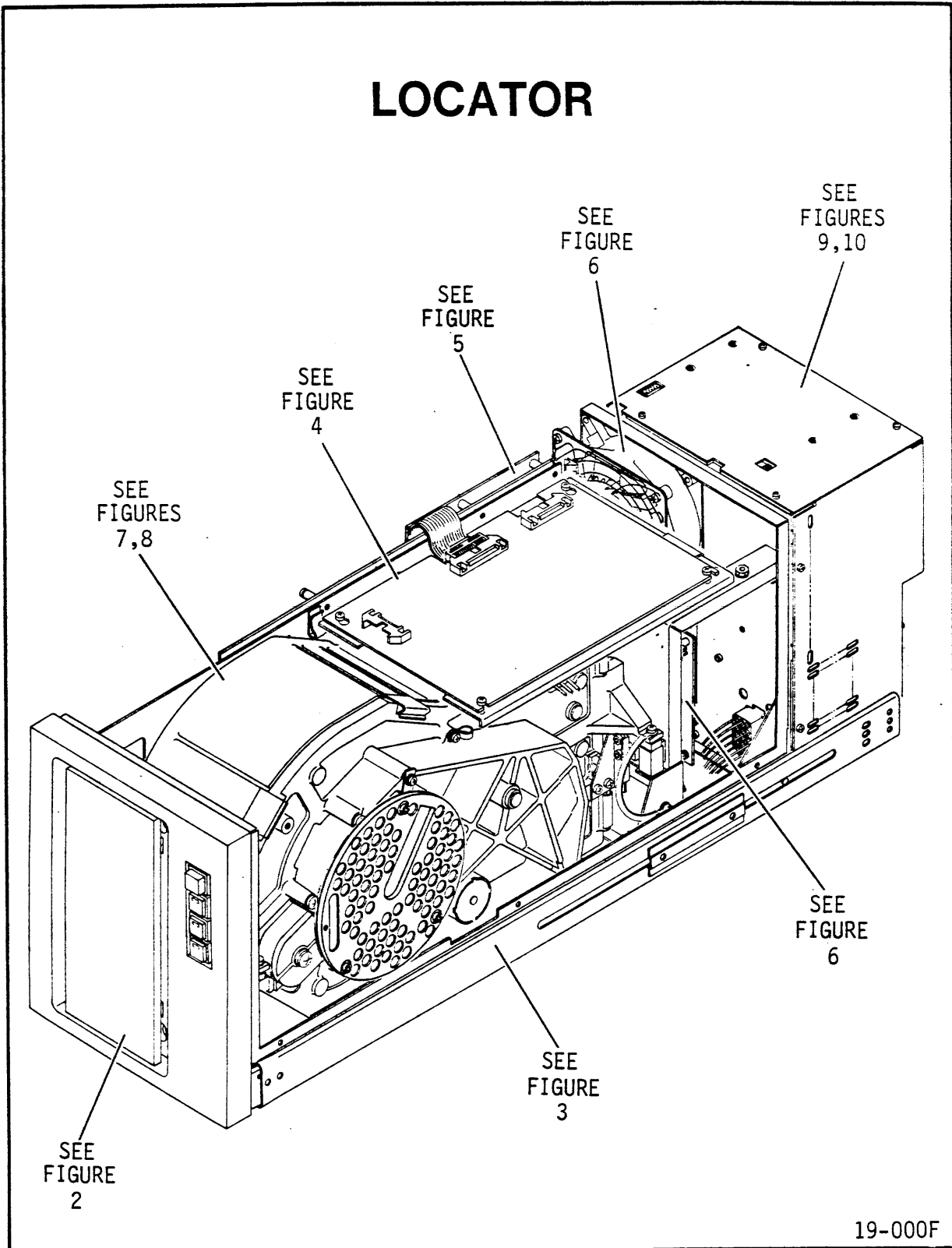
Figure 4-1

Figure 4-2

19-100F

83324500 L
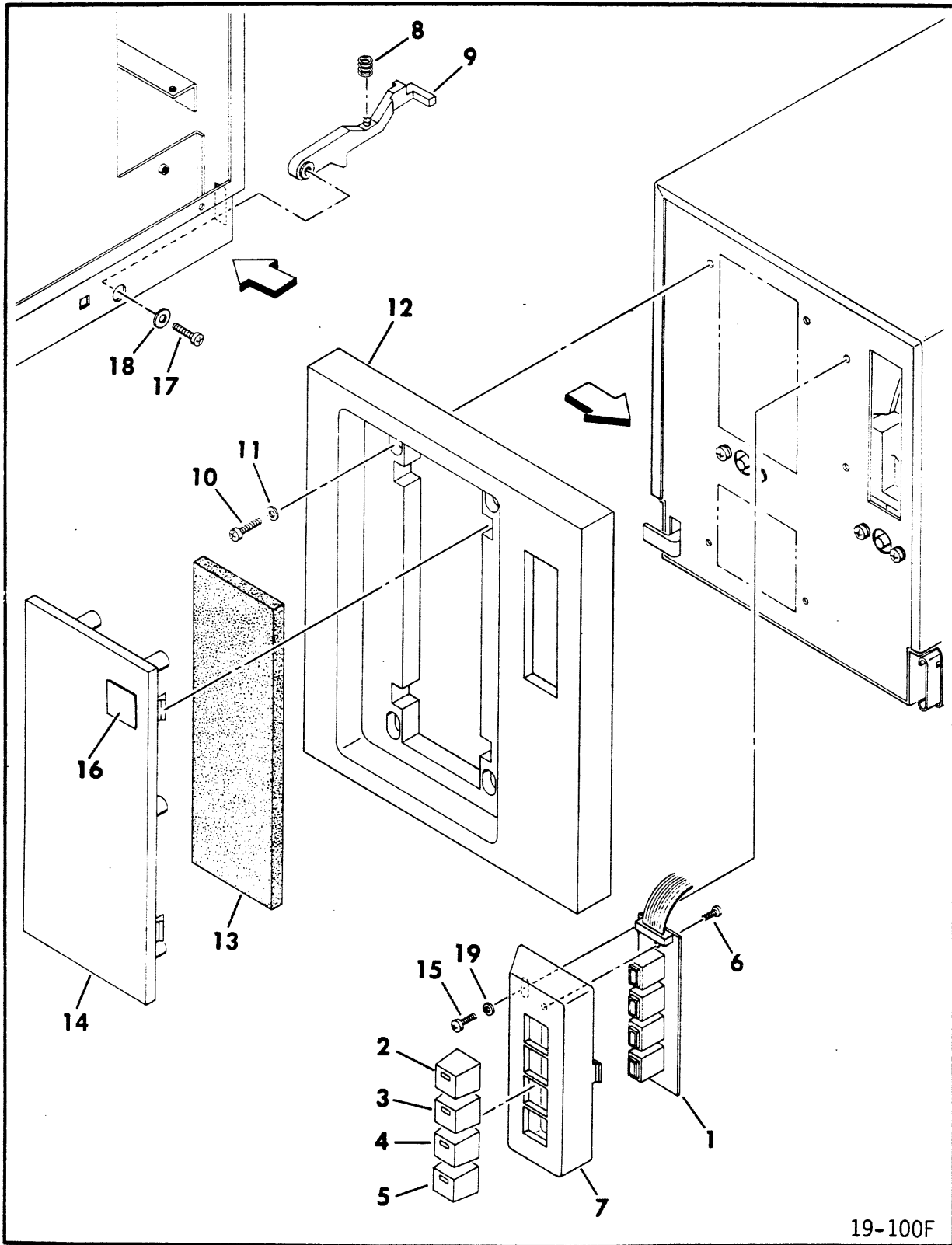
INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Spare	OPERATOR PANEL	
2		LOGIC PLUG	See Note 3
	Spare	LOGIC PLUG KIT (PA5A1K only)	See Note 2
3	94394255	LENS, "START"	See Note 1
3	15181644	LENS, "START"	See Note 2
4	94394256	LENS, "FAULT"	See Note 1
4	15181643	LENS, "FAULT"	See Note 2
5	94394257	LENS, "WRITE PROTECT"	See Note 1
5	15181645	LENS, "WRT PRT"	See Note 2
6	10127102	SCREW, PHH, 4-40 x 1/4	See Note 2
7	81903870	BRACKET, Switch	See Note 2
8	94205567	SPRING	See Note 4
9	72857411	LATCH, Cabinet	See Note 4
10	92743164	SCREW, PHH, 6-32 x 1/2	
11	94047001	WASHER, Special	
12	Optional	PANEL, Front	
13	Spare	FILTER, Air	Except PA5A1K
13	45070750	FILTER ASSEMBLY	PA5A1K only
14	Optional	INSERT, Front Panel	
15	92743160	SCREW, PHH, 6-32 x 5/16	
16	Optional	EMBLEM, Product Ident	
17	92743200	SCREW, PHH, 8-32 x 3/8	See Note 4
18	10125606	WASHER, #8	See Note 4
19	10125605	WASHER, #6	

Note 1:   Used on older operator panels, which have
          logic plugs without indicator lights.
Note 2:   Used on newer operator panels, which have
          logic plugs with indicator lights.
Note 3:   Refer to table 4-3 (Accessories) for
          listing of available logic plugs.
Note 4:   Not supplied with PA5A1C/G/H/K/M,
          PA5A2C/F/H drives.
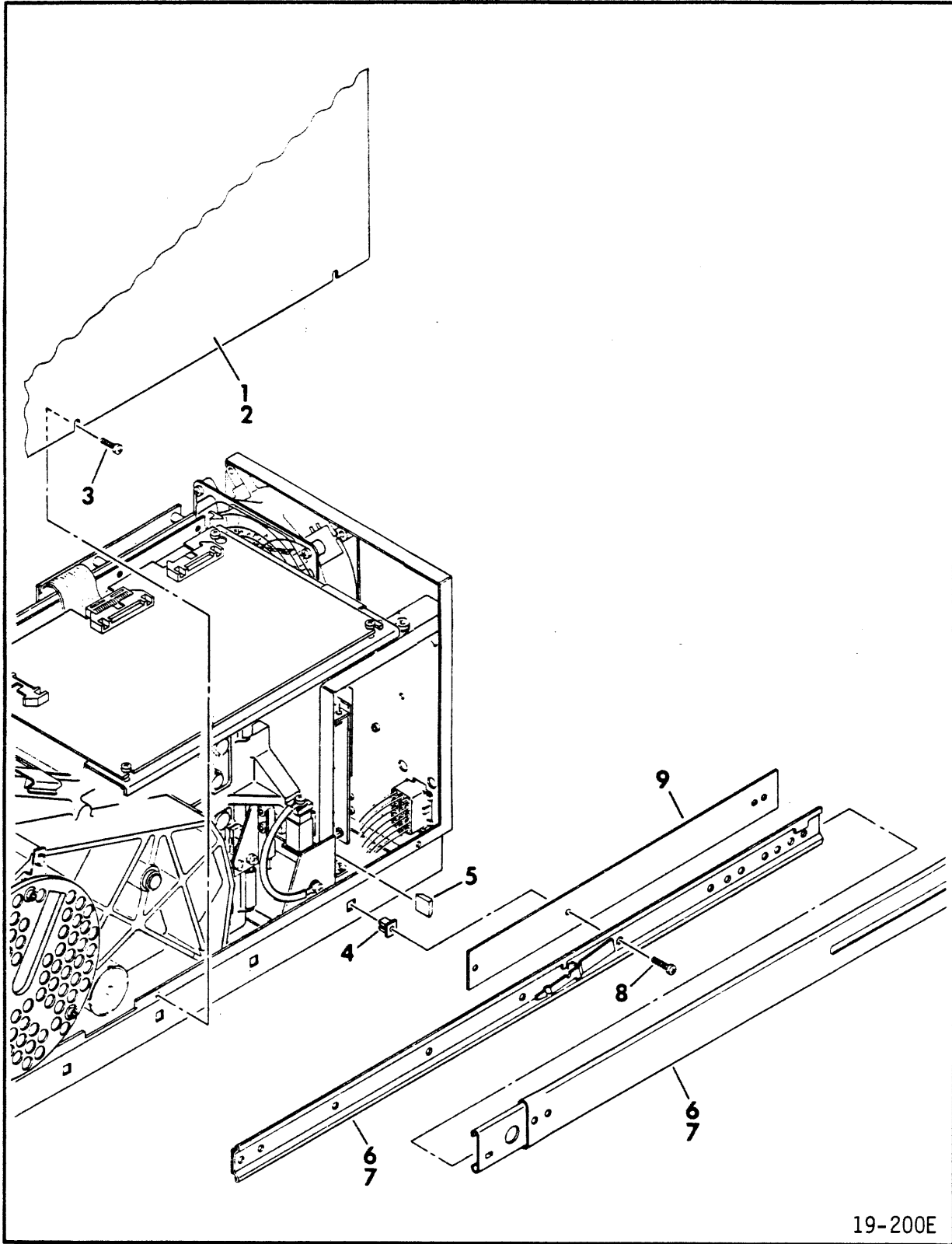
19-200E

Figure 4-3

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	41540100	COVER	
2	95138400	PLUG, Access Hole, Top Cover	
3	92743156	SCREW, PHH, 6-32 x 3/16	
4	72854290	NUT, Square	
5	51805800	BUMPER	S/C 14 & Blw
6	Optional	SLIDE ASSEMBLY, RH	
7	Optional	SLIDE ASSEMBLY, LH	
8	94375825	SCREW, PHH, 8-16 x 1/2	
9	93265870	BRACKET, Support	See Note 1

Note 1: Used on integral power supply drives only
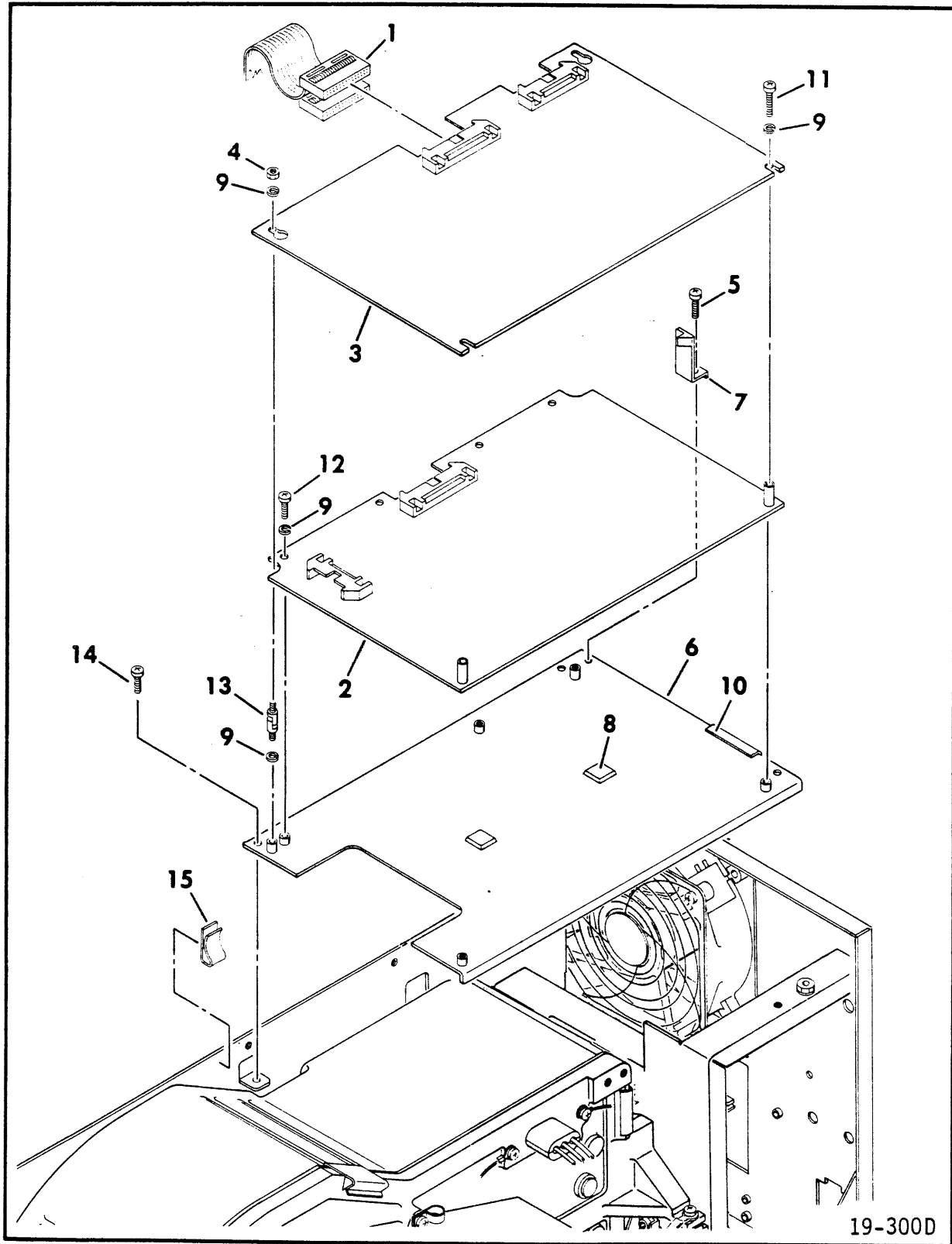
Figure 4-4 (Drives With 2-Board Read/Write)

19-300D

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Spare	CABLE ASSEMBLY (P29/P30/P31)	
2	Spare	DATA LATCH BOARD	
3	Spare	R/W PLO BOARD	
4	10125105	NUT, Hex, 6-32	
5	92743160	SCREW, PHH, 6-32 x 5/16	
6	72855702	BRACKET, R/W Boards	
7	72855990	LATCH, Card	
8	51805802	BUMPER	
9	10125803	**LOCKWASHER, #6**	
10	94060003	EDGING	
11	92743170	SCREW, PHH, 6-32 x 7/8	
12	92743160	SCREW, PHH, 6-32 x 5/16	
13	47402261	STANDOFF, Hinged	
14	17901508	SCREW, PHH, 6-32 x 1/4	
15	94241019	CLIP, Cable	
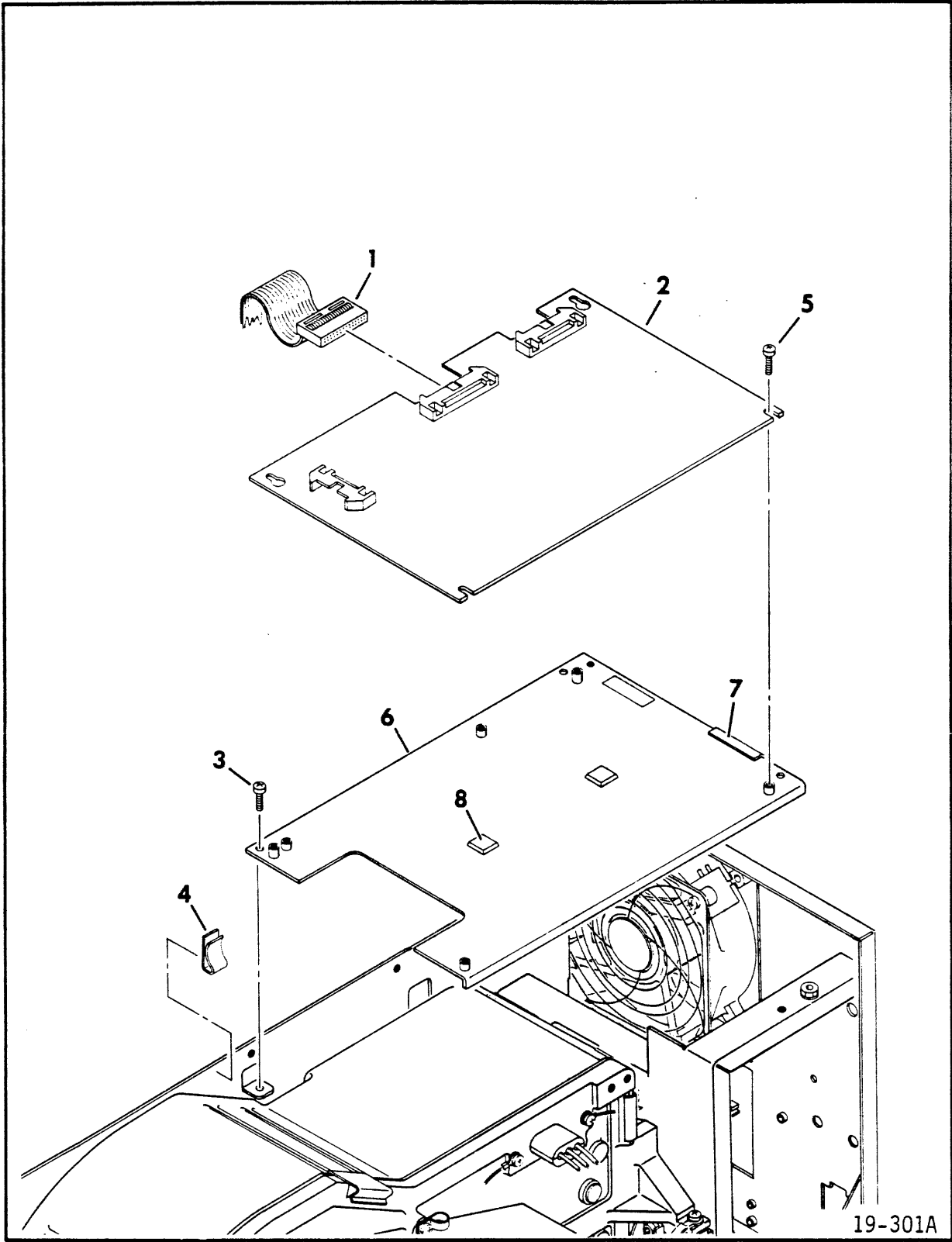
Figure 4-4   (Drives With 1-Board Read/Write)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Spare	CABLE ASSEMBLY (P29/P30)	
2	Spare	R/W PLO & DATA LATCH BOARD	
3	17901508	SCREW, PHH, 6-32 x 1/4	
4	94241019	CLIP, Cable	
5	92743160	SCREW, PHH, 6-32 x 5/16	
6	72855702	BRACKET, R/W Boards	
7	94060003	EDGING	
8	51805802	BUMPER	

19-400F
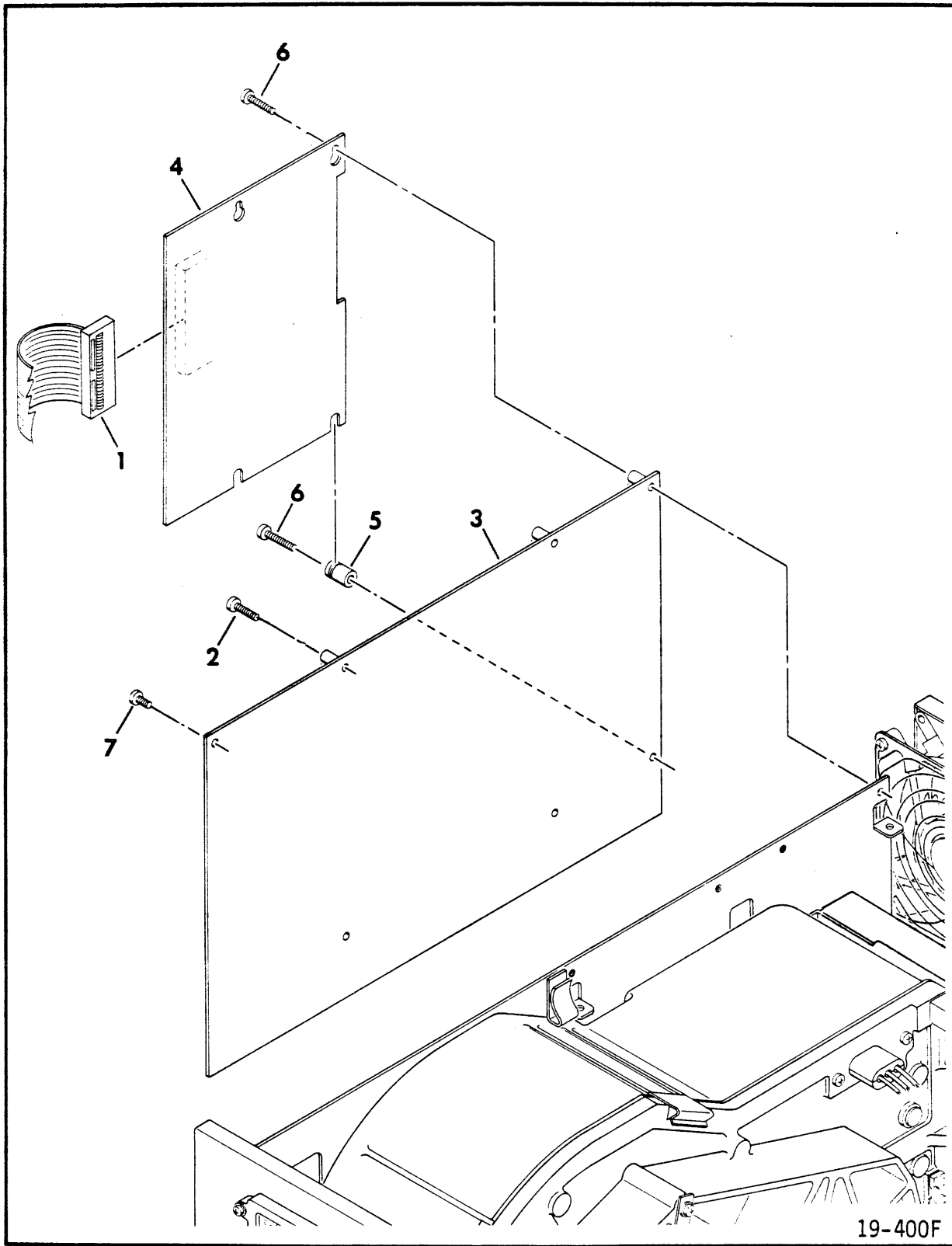
Figure 4-5

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Spare	CABLE ASSEMBLY (P14/P20)	
2	92743168	SCREW, PHH, 6-32 x 3/4	
3	Spare	CONTROL BOARD	
4	Spare	I/O BOARD	
5	92555237	STANDOFF	
6	92743170	SCREW, PHH, 6-32 x 7/8	
7	92743160	SCREW, PHH, 6-32 x 5/16	
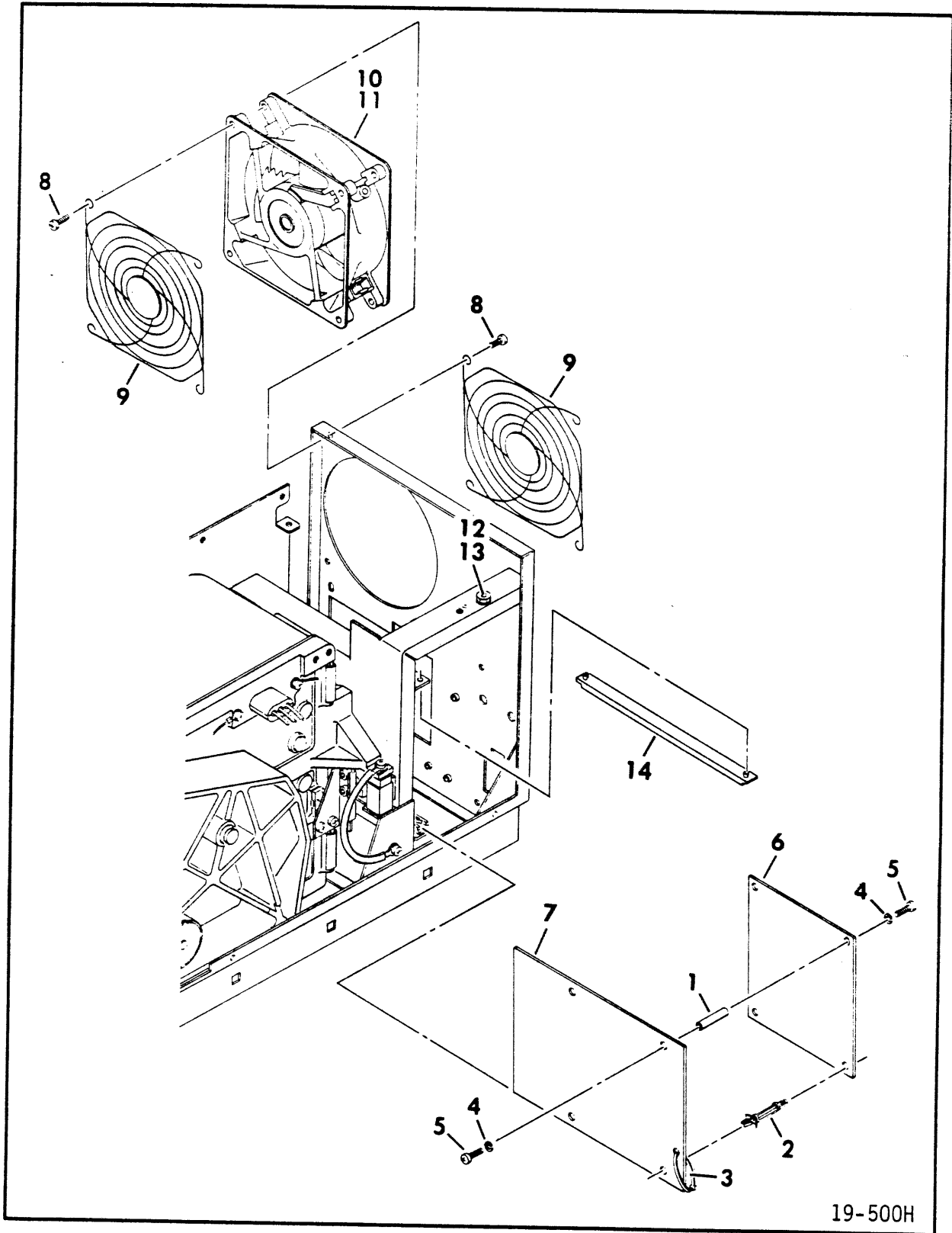
Figure 4-6

19-500H

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	93114317	STANDOFF	
2	94378825	SUPPORT, Circuit Board	
3	94277422	TIEWRAP	
4	10125803	LOCKWASHER, #6	
5	92743162	SCREW, PHH, 6-32 x 3/8	
6	Spare	POWER AMP BOARD	
7	Spare	MOTOR SPEED CONTROL BOARD	
8	10127124	SCREW, PHH, 8-32 x 5/8	See Note 1
9	94375408	GUARD, Finger	
10	Spare	FAN, DC	
11	94227400	TIEWRAP	
12	93879001	JACK, Banana	
13	10126106	LOCKWASHER, 1/4	
14	72856240	SLIDE	

Note 1: Older fans with untapped holes use self-
tapping screws, p/n 17901518.
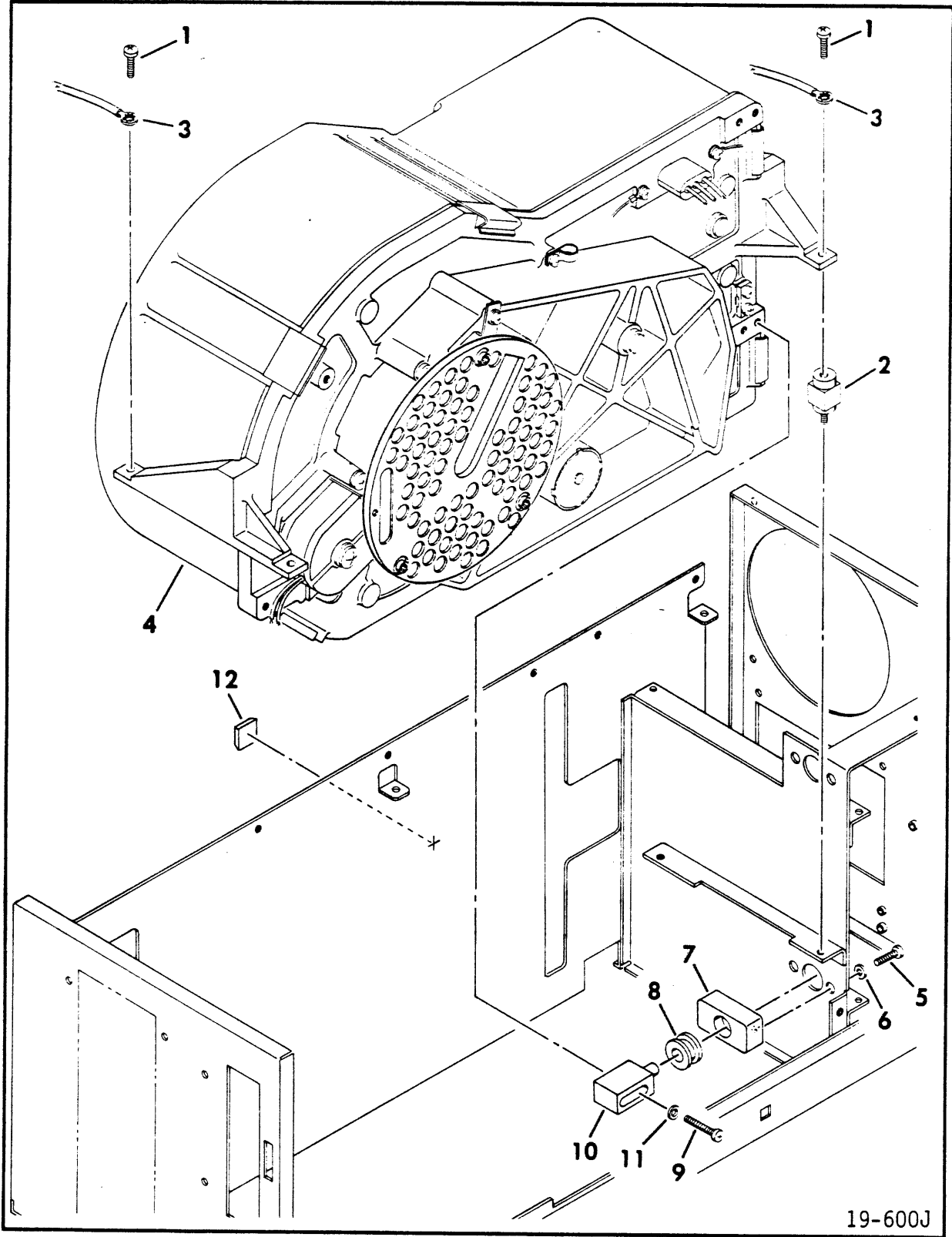
Figure 4-7 (Series Code 14 & Blw)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	92743200	SCREW, PHH, 8-32 x 3/8	
2	72856800	SHOCK MOUNT	
3	94469414	GROUND CABLE	
4	Spare	MODULE ASSEMBLY	
5	93242238	SCREW, PHH, 10-32 x 3/8	
6	10125607	WASHER, #10	
7	72852590	RETAINER, Shipping	
8	72855911	GROMMET	
9	10127147	SCREW, PHH, 10-32 x 1	
10	72855900	PIN, Shipping Retainer	
11	73045100	WASHER, Special	
12	51805802	BUMPER	

19-601G
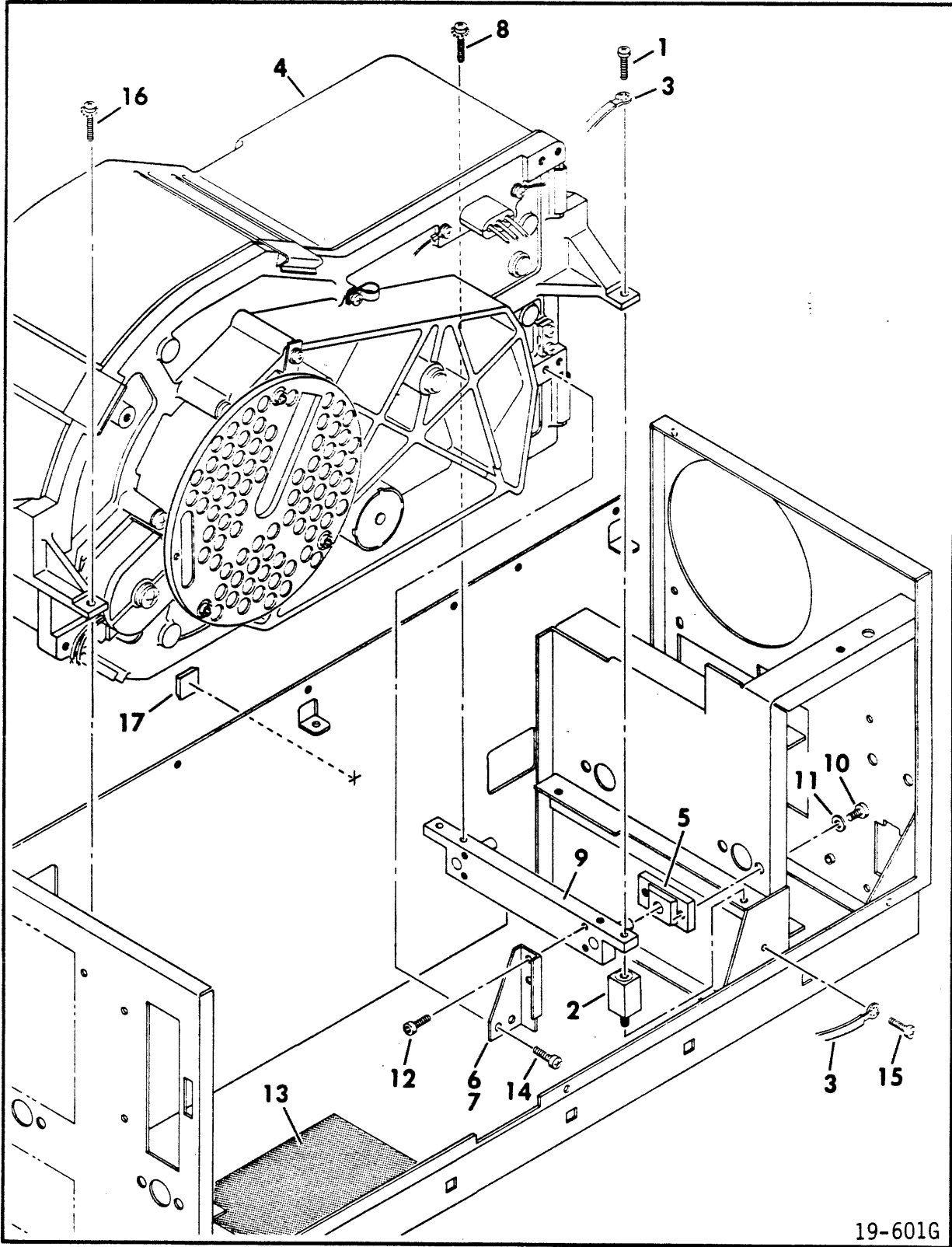
Figure 4-7 (Series Code 15 & Abv)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	92743202	SCREW, PHH, 8-32 x 1/2	
2	72856801	SHOCK MOUNT	
3	94469414	GROUND CABLE	
4	Spare	MODULE ASSEMBLY	
5	41286510	DAMPER, Vibration	
6	45070660	BRACKET, Rear	
7	45070661	BRACKET, Front	
8	93660079	SCREW, PHH, 8-32 x 1/2	
9	45070670	BAR, Retaining	
10	93242236	SCREW, PHH, 10-32 x 5/16	
11	10125607	WASHER, #10	
12	10126224	SCREW, Socket Hd, 8-32 x 1/4	
13	41286580	PAD, Rubber	
14	93660109	SCREW, PHH, 10-32 x 5/16	
15	92743204	SCREW, PHH, 8-32 x 5/8	
16	93660081	SCREW, PHH, 8-32 x 5/8	
17	51805802	BUMPER	
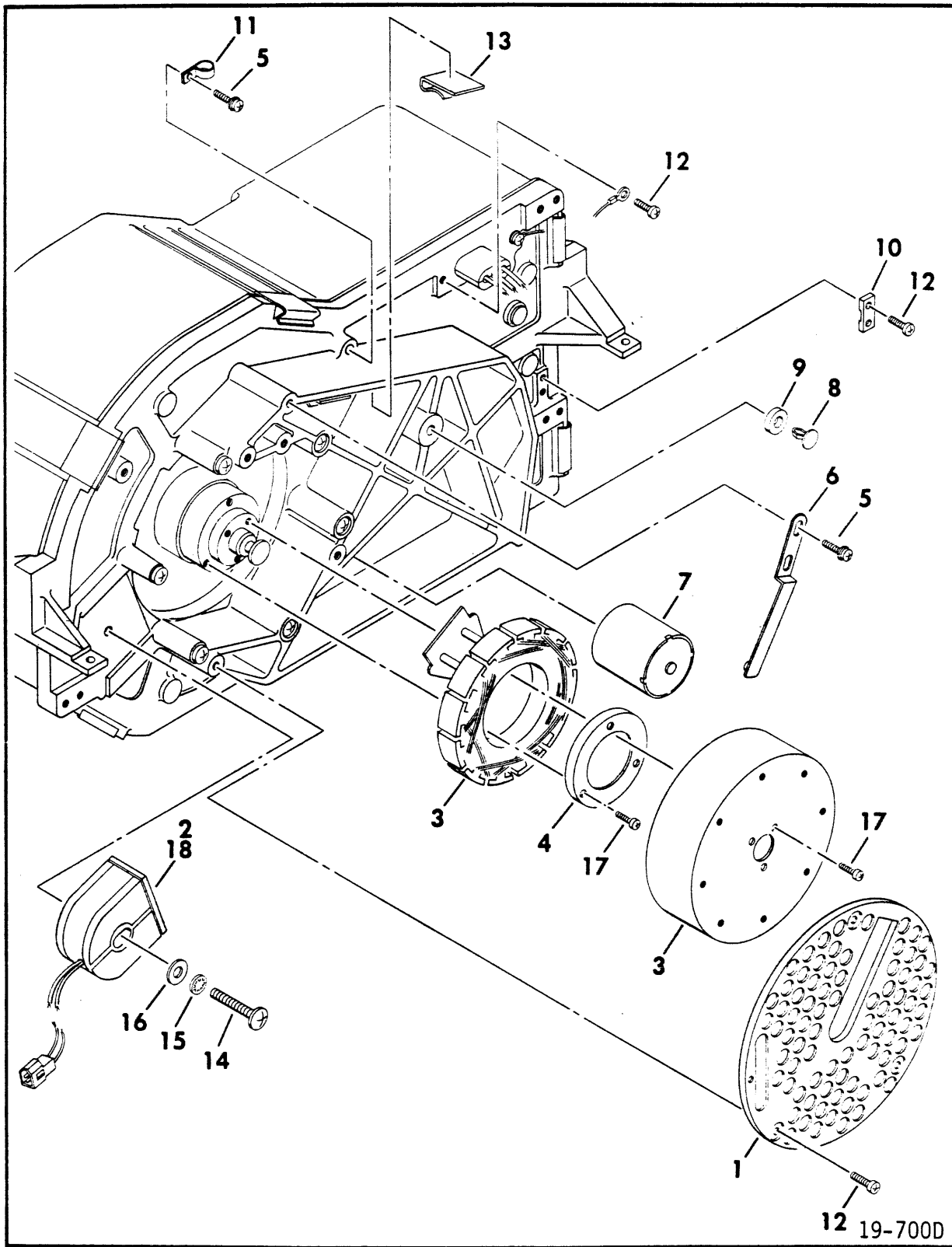
Figure 4-8

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	72856001	SHIELD, Motor	
2	Spare	BRAKE ASSEMBLY	
3	94231900	MOTOR AND CABLE ASSEMBLY	
4	72850900	CLAMP, Motor	
5	92001700	SCREW, W/Washer, 6-32 x 5/16	
6	72854200	GROUND SPRING ASSEMBLY	
7	72854300	LOCKING SOLENOID COIL	
8	94387809	CLIP, Plastic	
9	73005100	PLUG	
10	72854100	CLAMP, Cable	
11	92602004	CLAMP, Cable	
12	92743160	SCREW, PHH, 6-32 x 5/16	
13	94241017	CLIP, Cable	
14	92745327	SCREW, PHH, 1/4-20 x 1 3/8	
15	10126106	LOCKWASHER, 1/4	
16	10125608	WASHER, 1/4	
17	92743162	SCREW, PHH, 6-32 x 3/8	
18	94227400	TIEWRAP	
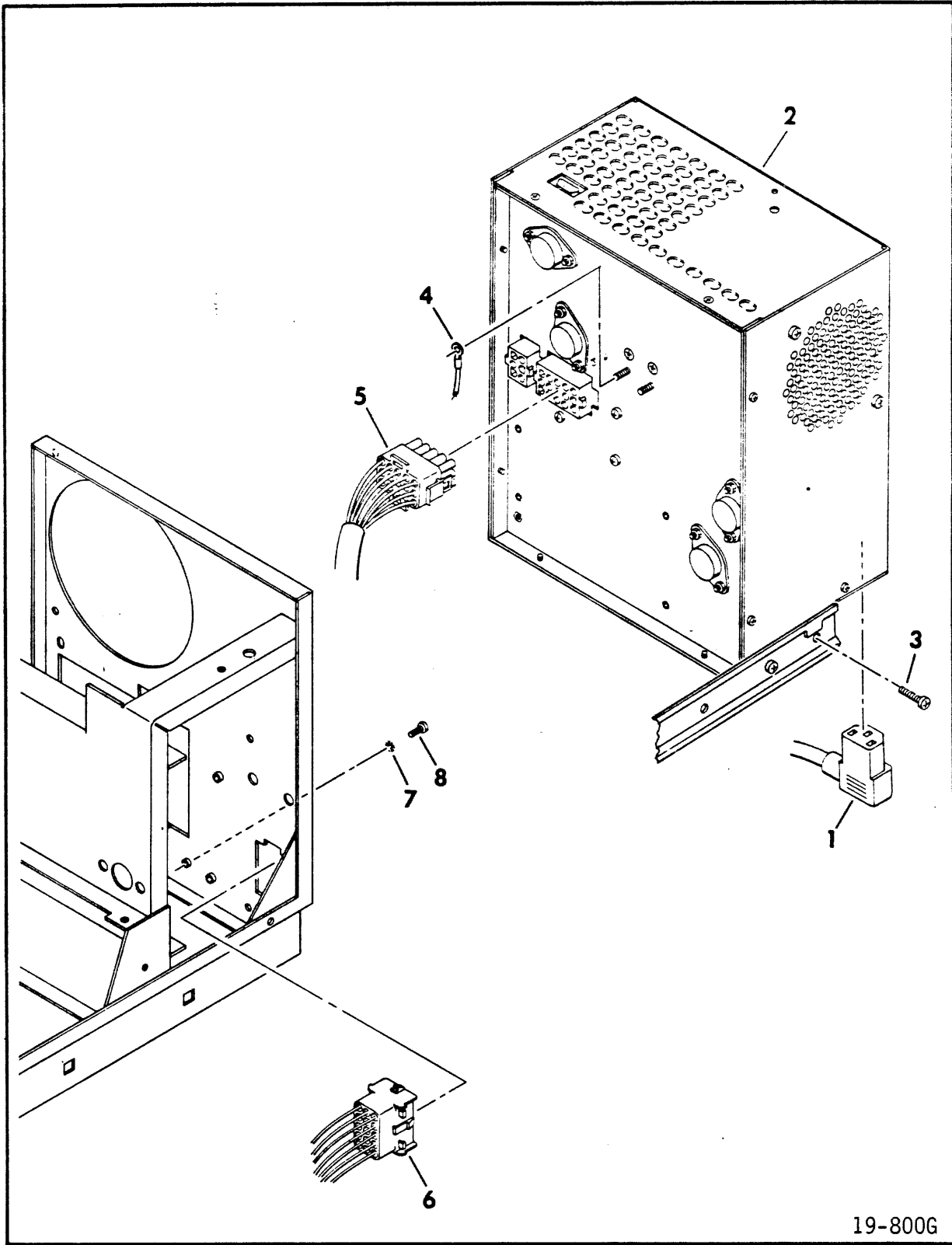
Figure 4-9.   (Drives With Remote Power Supply Mounted Directly
On Slides)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Optional	AC POWER CABLE (P01)	
2	Spare	POWER SUPPLY ASSEMBLY, Remote	
3	17901517	SCREW, PHH, 8-32 x 1/2	
4	Optional	GROUND CABLE	
5	Optional	DC POWER CABLE (P15/P40)	
6	Spare	DC HARNESS (P19/P21/P22/P35/P36 P37/P38/J40)	
7	10126403	LOCKWASHER, #10	
8	93242238	SCREW, PHH, 10-24 x 3/8	
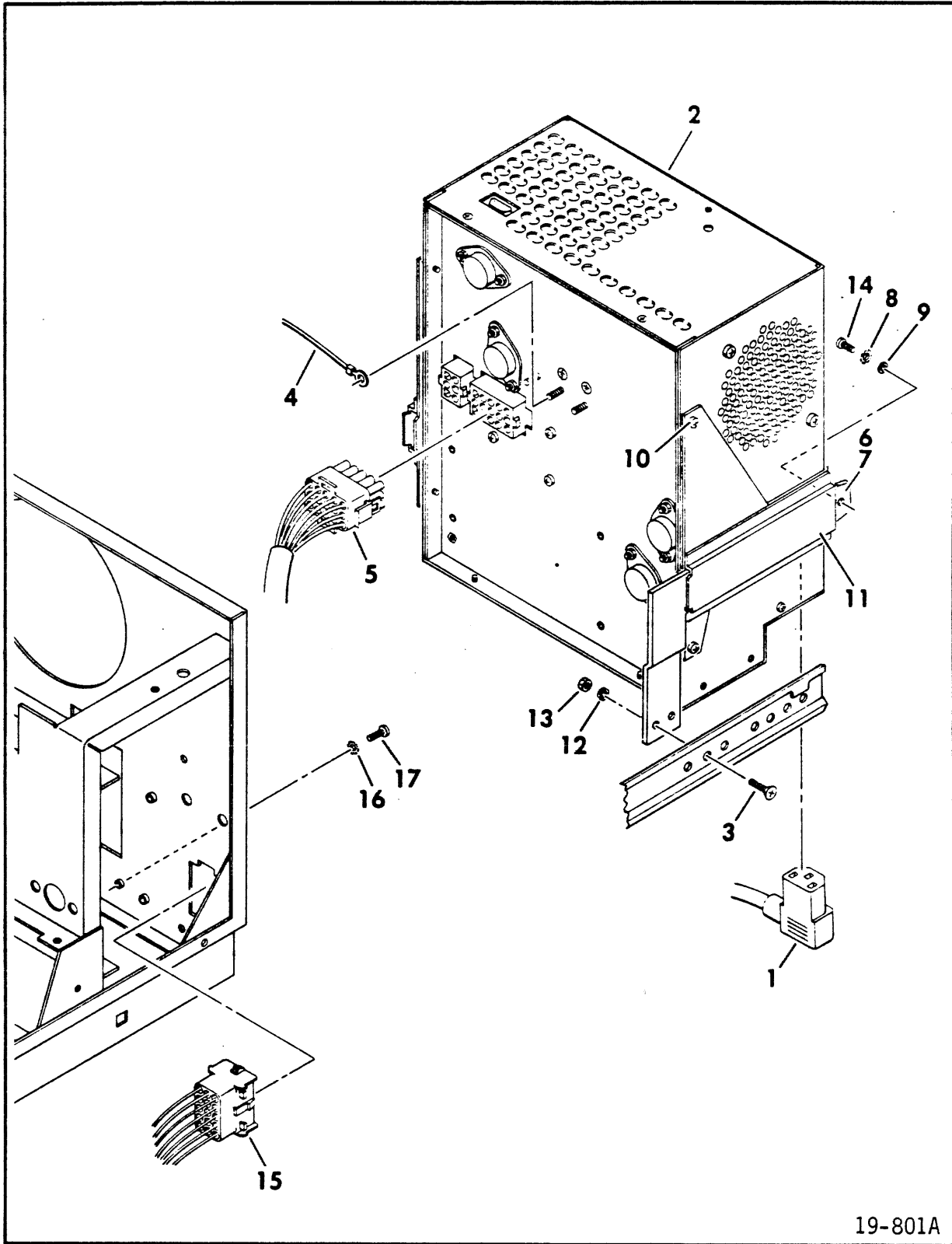
Figure 4-9. (Drives With Remote Power Supply Mounted On Brackets)

19-801A

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Optional	AC POWER CABLE (P01)	
2	Spare	POWER SUPPLY ASSEMBLY, Remote	See Note 1
3	92905077	SCREW, PHH, 8-32 x 1/2	
4	Optional	GROUND CABLE	
5	Optional	DC POWER CABLE (P15/P40)	
6	Optional	MOUNT, LH	
7	Optional	MOUNT, RH	
8	10126402	LOCKWASHER, #8	
9	10125606	WASHER, #8	
10	17901509	SCREW, PHH, 6-32 x 3/8	
11	Optional	BRACKET, Mounting	
12	10125804	LOCKWASHER, #8	
13	10125106	NUT, 8-32	
14	92743200	SCREW, PHH, 8-32 x 3/8	
15	Spare	DC HARNESS (P19/P21/P22/P35/P36/ P37/P38/J40)	
16	10126403	LOCKWASHER, #10	
17	93242238	SCREW, PHH, 10-24 x 3/8	

Note 1: Not supplied with Equipment Package 72858774

19-802B
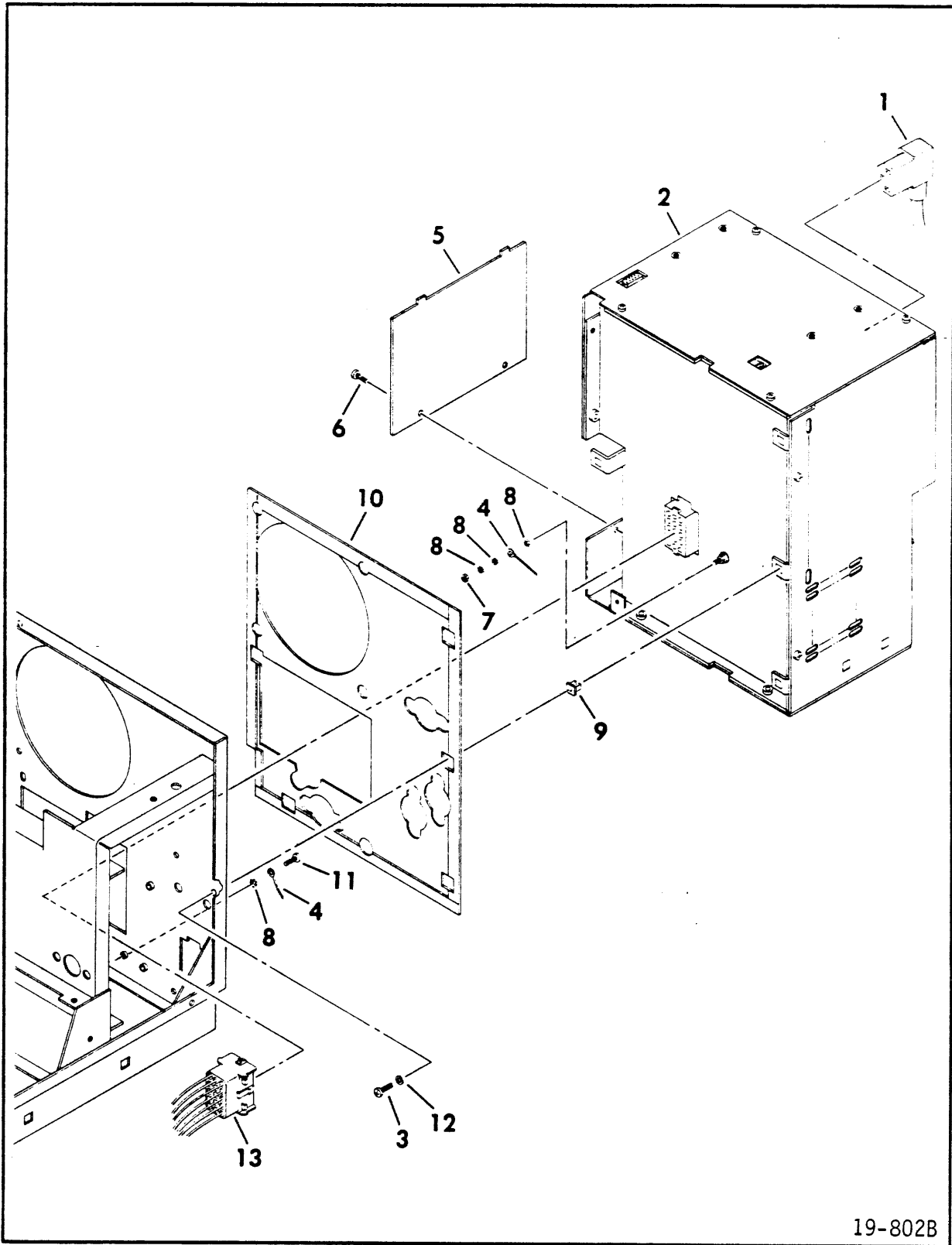
Figure 4-9. (Drives With Integral Power Supply)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Optional	AC POWER CABLE (P01)	
2	Spare	POWER SUPPLY ASSEMBLY, Integral	
3	94375825	SCREW, PHH, 8-16 x 1/2	
4	94281437	GROUND CABLE	
5	76376370	PLATE, Cover	See Note 1
5	76376371	PLATE, Cover	See Note 2
6	92001710	SCREW W/WASHER, 6-32 x 5/16	
7	10125108	NUT, Hex, 10-32	
8	10126403	LOCKWASHER, #10	
9	72854290	NUT, Square	
10	76376351	GASKET, RF	
11	93242238	SCREW, PHH, 10-32 x 3/8	
12	10125607	WASHER, #10	
13	Spare	DC HARNESS (P15/P19/P21/P22/P35/ P36/P37/P38)	

Note 1: Used on older type (p/n 81542300) power supplies.
Note 2: Used on newer (shorter) power supplies.
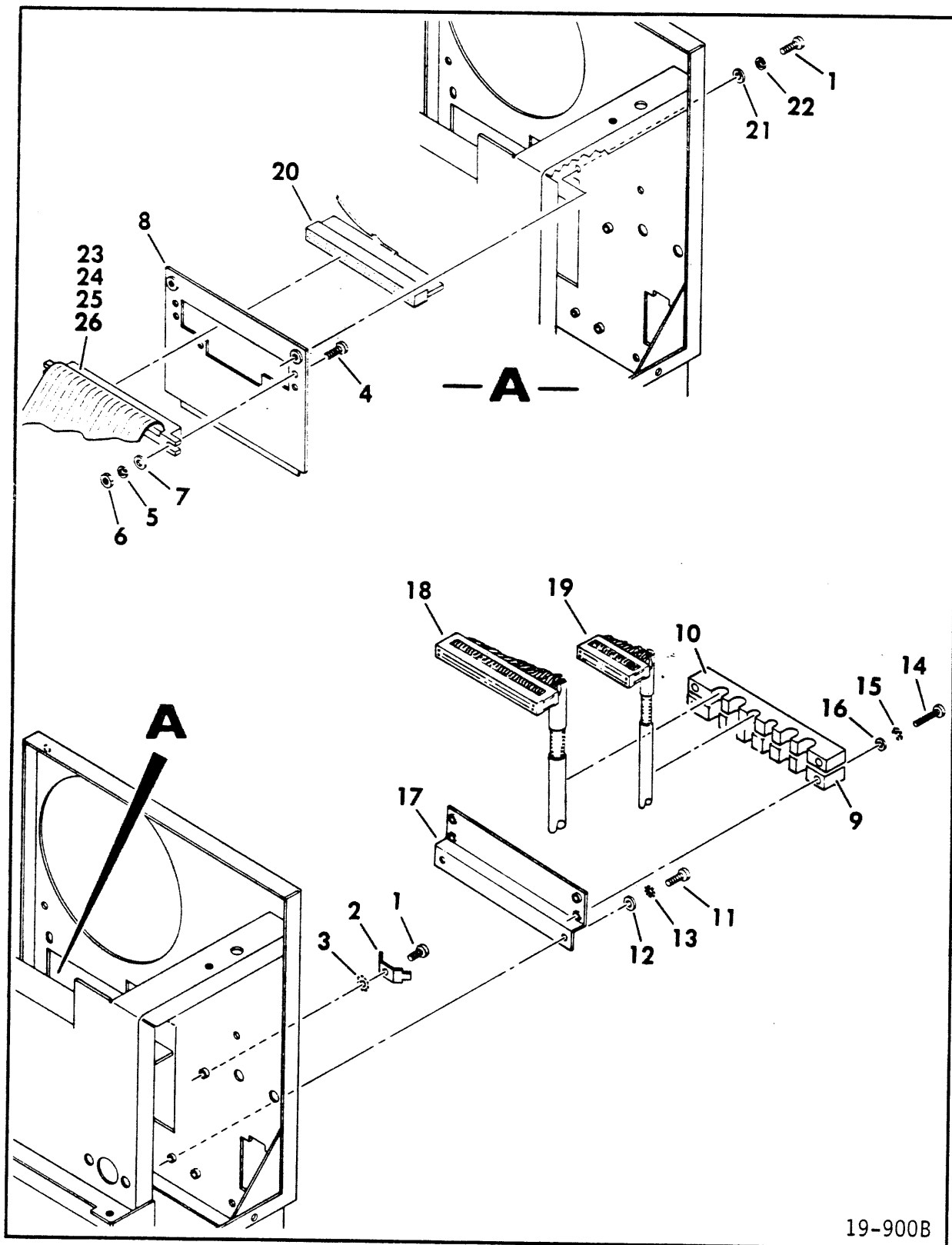
Figure 4-10.   (Drives With Remote Power Supply)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	92743160	SCREW, PHH, 6-32 x 5/16	
2	94274113	TERMINAL	
3	10126401	LOCKWASHER, #6	
4	92743088	SCREW, PHH, 4-40 x 1/2	
5	10125801	LOCKWASHER, #4	
6	10125103	NUT, Hex, 4-40	
7	10125603	WASHER, #4	
8	72856525	PLATE, I/O	Single Ch Drives
8	72856526	PLATE, I/O	Dual Ch Drives
9	72851231	CLAMP, Strain Relief	
10	72851230	CLAMP, Grounding	
11	17901510	SCREW, PHH, 6-32 x 1/2	
12	10125605	WASHER, #6	
13	10126401	LOCKWASHER, #6	
14	10127146	SCREW, PHH, 10-32 x 7/8	
15	10126403	LOCKWASHER, #10	
16	10125607	WASHER, #10	
17	72851240	BRACKET, Cable	
	93920481	CLAMP (For Flat Cables)	
18	Optional	A CABLE, External	
19	Optional	B CABLE, External	
20	Optional	TERMINATOR	
21	10125605	WASHER, #6	
22	10125803	LOCKWASHER, #6	
23	92439610	A CABLE, Int (Single Ch)	See Note 1
23	92439615	A CABLE, Int (Dual Ch, Ch 1)	See Note 1
23	92439614	A CABLE, Int (Dual Ch, Ch 2)	See Note 1
24	92246311	B CABLE, Int (Single Ch)	See Note 1
24	92246315	B CABLE, Int (Dual Ch, Ch 1)	See Note 1
24	92246314	B CABLE, Int (Dual Ch, Ch 2)	See Note 1
25	77431008	STRAIN RELIEF, B Cable	
26	77431010	STRAIN RELIEF, A Cable	

Note 1: Drives with detachable internal I/O cables only.
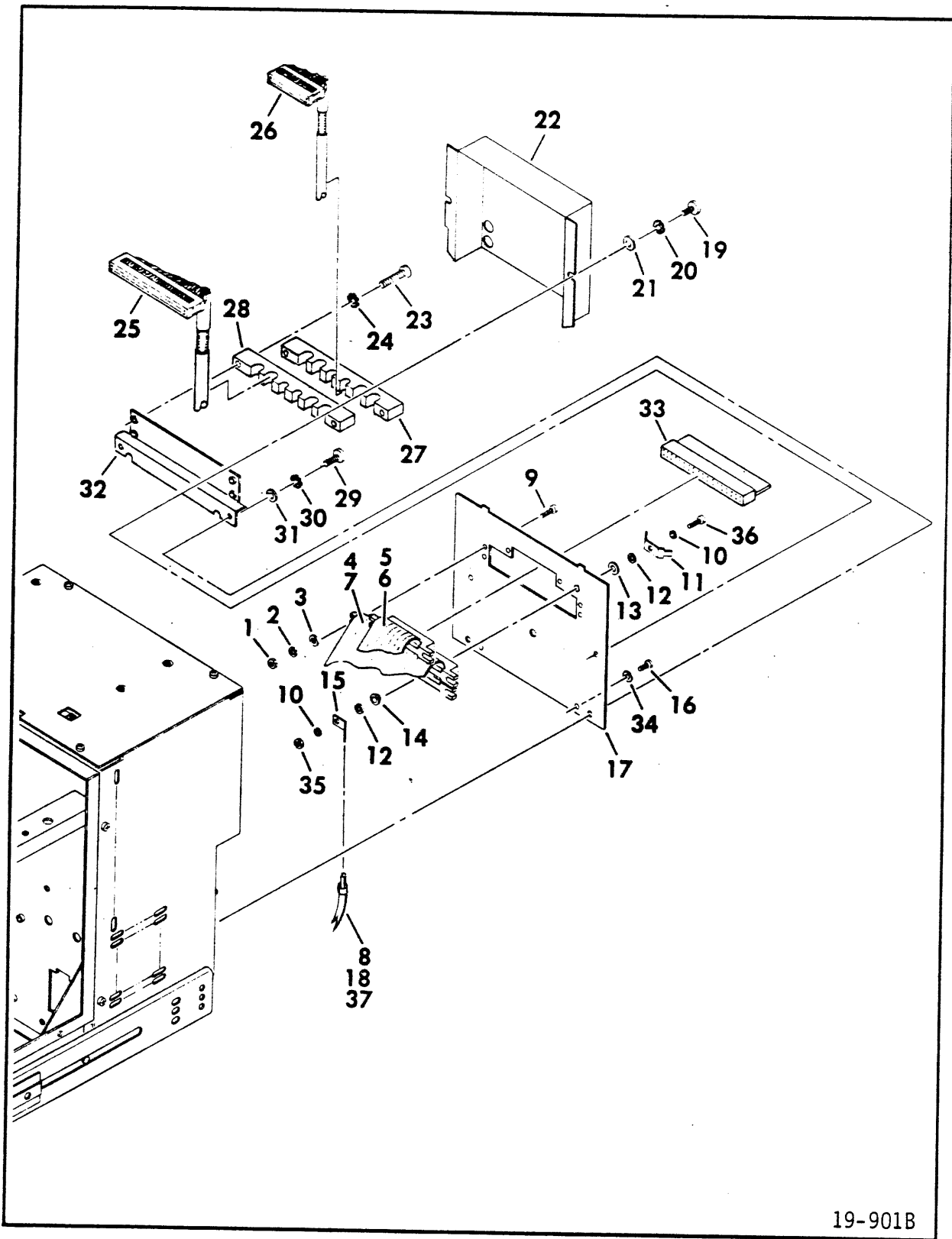
Figure 4-10 (Drives With Older Integral Power Supply--P/N
81542300--Except PA5AlK)

19-901B

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	10125103	NUT, Hex, 4-40	
2	10125801	LOCKWASHER, #4	
3	10125603	WASHER, #4	
4	92439611	A CABLE, Int (Single Ch)	See Note 1
4	92439613	A CABLE, Int (Dual Ch, Ch 1)	See Note 1
4	92439612	A CABLE, Int (Dual Ch, Ch 2)	See Note 1
5	92246310	B CABLE, Int (Single Ch)	See Note 1
5	92246313	B CABLE, Int (Dual Ch, Ch 1)	See Note 1
5	92246312	B CABLE, Int (Dual Ch, Ch 2)	See Note 1
6	77431008	STRAIN RELIEF, B Cable	
7	77431010	STRAIN RELIEF, A Cable	
8		NOT USED	
9	92743088	SCREW, PHH, 4-40 x 1/2	
10	95524401	LOCKWASHER, #6	
11	94274116	TERMINAL	
12	94047078	WASHER, Special	
13	95797301	WASHER, Phenolic	
14	95643808	WASHER, Insulated	
15	94274104	TERMINAL	
16	17901508	SCREW, PHH, 6-32 x 1/4	
17	72855611	PLATE, I/O, Single Ch	
17	72855612	PLATE, I/O, Dual Ch	
18	76376380	GROUND CABLE	
19	10127113	SCREW, PHH, 6-32 x 3/8	
20	10126103	LOCKWASHER, #6	
21	10125605	WASHER, #6	
22	92070380	SHIELD, I/O	
23	10127146	SCREW, PHH, 10-32 x 7/8	
24	10126403	LOCKWASHER, #10	
25	Optional	A CABLE, External	
26	Optional	B CABLE, External	
27	72851231	CLAMP, Strain Relief	
28	72851230	CLAMP, Grounding	
29	17901510	SCREW, PHH, 6-32 x 1/2	
30	10126401	LOCKWASHER, #6	
31	10125605	WASHER, #6	
32	72851240	BRACKET, Cable	
33	Optional	TERMINATOR	
34	10125606	WASHER, #8	
35	95510030	NUT, Hex, 6-32	
36	92751164	SCREW, PHH, 6-32 x 1/2	
37		NOT USED	
	93920481	CLAMP (For Flat Cables)	

Note 1: Drives with detachable internal I/O cables only.
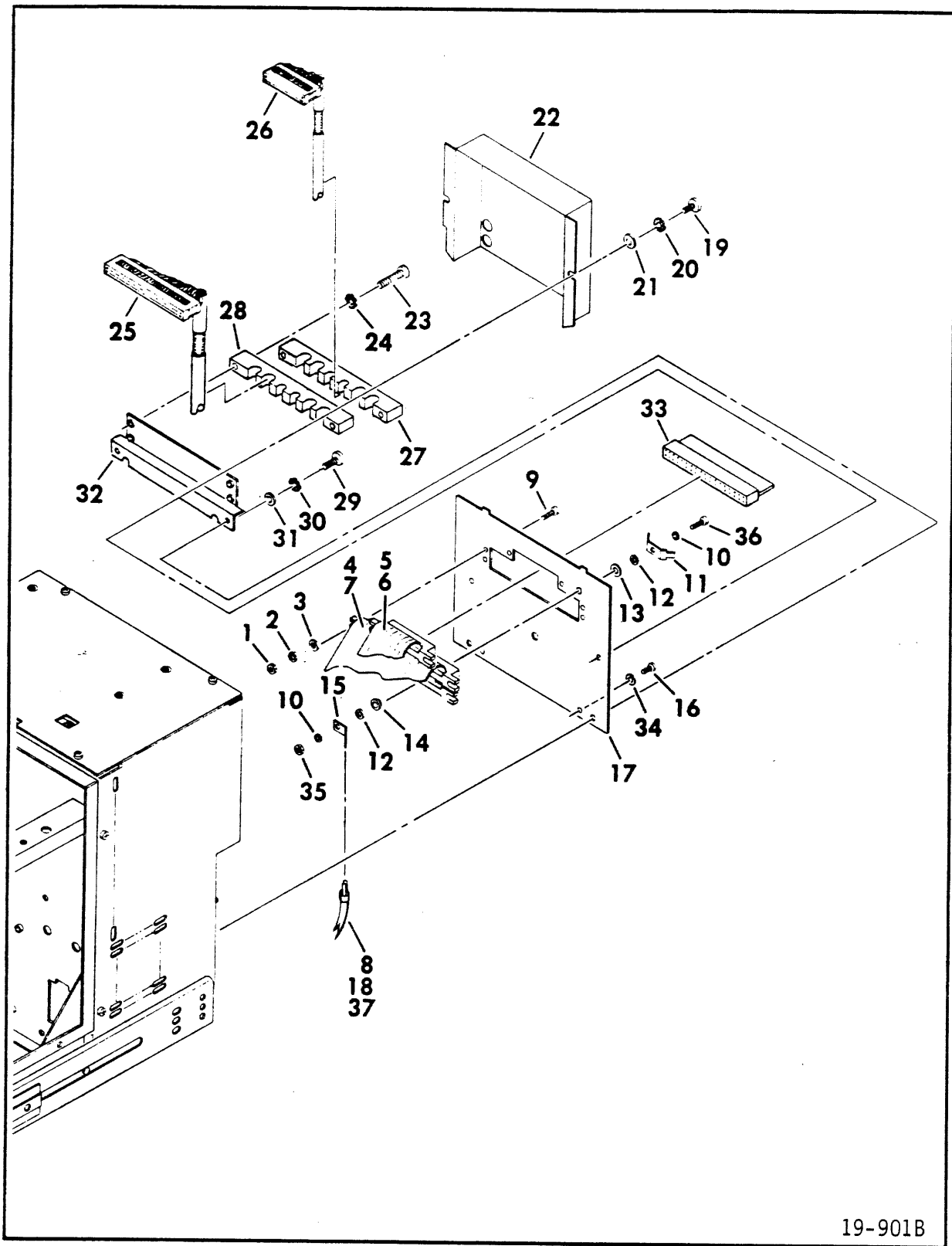
Figure 4-10 (Drives With Newer--Shorter--Integral Power Supply,
Except PA5A1K)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	10125103	NUT, Hex, 4-40	
2	10125801	LOCKWASHER, #4	
3	10125603	WASHER, #4	
4	92439611	A CABLE, Int (Single Ch)	See Note 1
4	92439613	A CABLE, Int (Dual Ch, Ch 1)	See Note 1
4	92439612	A CABLE, Int (Dual Ch, Ch 2)	See Note 1
5	92246310	B CABLE, Int (Single Ch)	See Note 1
5	92246313	B CABLE, Int (Dual Ch, Ch 1)	See Note 1
5	92246312	B CABLE, Int (Dual Ch, Ch 2)	See Note 1
6	77431008	STRAIN RELIEF, B Cable	
7	77431010	STRAIN RELIEF, A Cable	
8	10126403	LOCKWASHER, #10	
9	92743088	SCREW, PHH, 4-40 x 1/2	
10	95524401	LOCKWASHER, #6	
11	94274116	TERMINAL	
12	94047078	WASHER, Special	
13	95797301	WASHER, Phenolic	
14	95643808	WASHER, Insulated	
15	94274104	TERMINAL	
16	10127121	SCREW, PHH, 8-32 x 5/16	
17	95131791	PLATE, I/O, Single Ch (except PA5A1M)	
17	95131795	PLATE, I/O (PA5A1M)	
17	95131792	PLATE, I/O, Dual Ch	
18	76376381	GROUND CABLE	
19	10127113	SCREW, PHH, 6-32 x 3/8 (except PA5A1M)	
19	10127122	SCREW, PHH, 8-32 x 3/8 (PA5A1M)	
20	10126103	LOCKWASHER, #6 (except PA5A1M)	
20	10126402	LOCKWASHER, #8 (PA5A1M)	
21	10125605	WASHER, #6 (except PA5A1M)	
21	10125606	WASHER, #8 (PA5A1M)	
22	92070381	SHIELD, I/O	
23	10127146	SCREW, PHH, 10-32 x 7/8	
24	10126403	LOCKWASHER, #10	
25	Optional	A CABLE, External	
26	Optional	B CABLE, External	
27	72851232	CLAMP, Strain Relief (except PA5A1M)	
27	45419023	CLAMP, Strain Relief (PA5A1M)	
28	72851233	CLAMP, Grounding (except PA5A1M)	
28	45419022	CLAMP, Grounding (PA5A1M)	
29	10127122	SCREW, PHH, 8-32 x 3/8	
30	10126402	LOCKWASHER, #8	
31	10125606	WASHER, #8	
32	72851241	BRACKET, Cable	
33	Optional	TERMINATOR	
34	10125606	WASHER, #8	
35	95510030	NUT, Hex, 6-32	
36	92751164	SCREW. PHH, 6-32 x 1/2	
37	10125108	NUT, Hex, 10-32	
	93920483	CLAMP (For Flat Cables)	

Note 1: Drives with detachable internal I/O cables only.
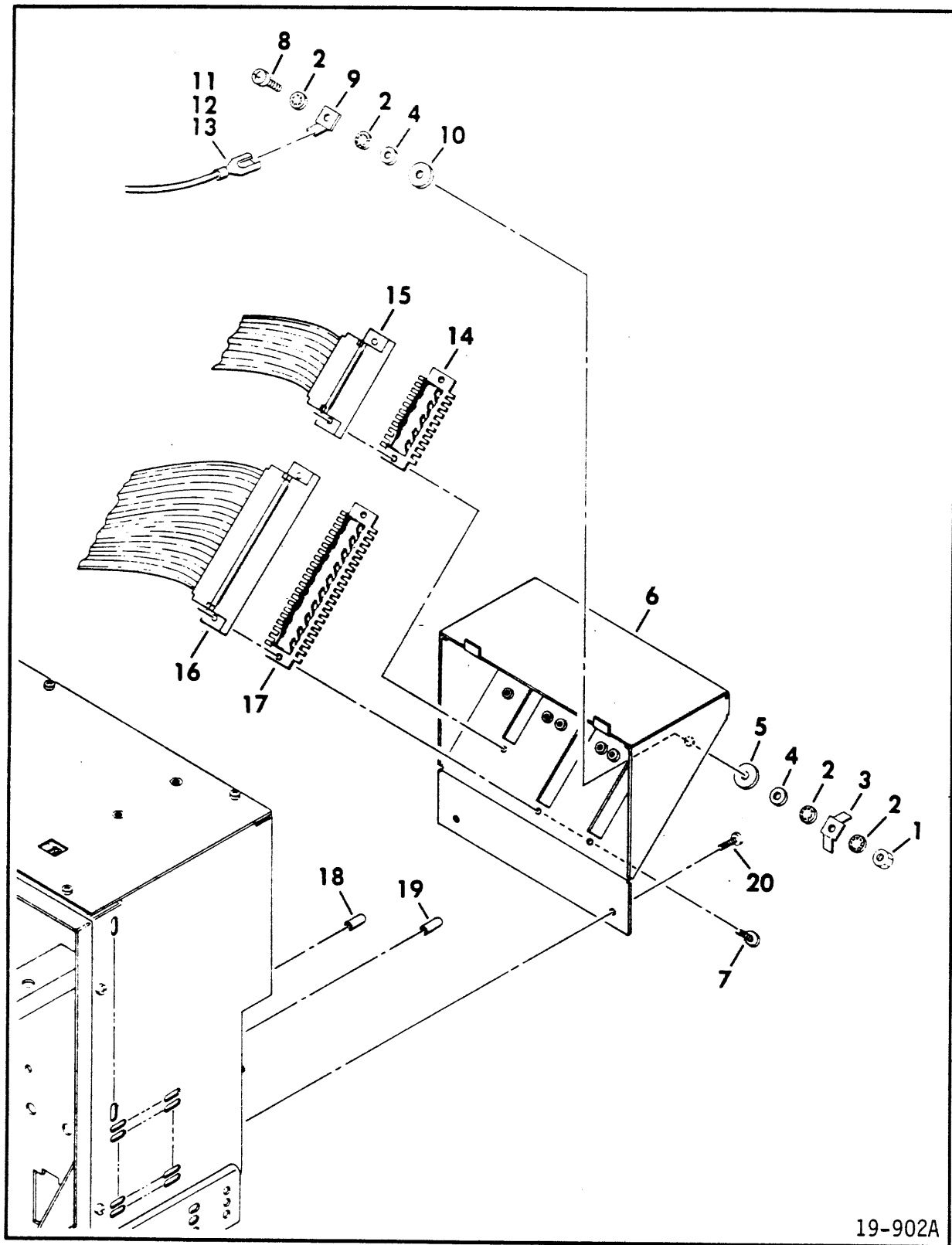
19-902A

Figure 4-10 (PA5A1K)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	95510030	NUT, Hex, 6-32	
2	95524401	LOCKWASHER, #6	
3	94274116	TERMINAL	
4	94047078	WASHER, Special	
5	95797301	WASHER, Phenolic	
6	95752260	PLATE, I/O	See Note 1
6	95752261	PLATE, I/O	See Note 2
7	10127104	SCREW, PHH, 4-40 x 3/8	
8	92751164	SCREW, PHH, 6-32 x 1/2	
9	94274104	TERMINAL	
10	95643808	WASHER, Insulated	
11	76376382	GROUND CABLE	See Note 1
11	76376381	GROUND CABLE	See Note 2
12	10125108	NUT, Hex, 10-32	See Note 2
13	10126403	LOCKWASHER, #10	See Note 2
14	15183358	GROUND PLANE	
15	92246309	B CABLE, Internal	
16	92439609	A CABLE, Internal	
17	15183357	GROUND PLANE	
18	45071900	BOOT, Ground Lug	
19	45071901	BOOT, Ground Lug	
20	17901508	SCREW, PHH, 6-32 x 1/4	
	81308300	CLAMP KIT ASSEMBLY	
	45070641	CABLE RESTRAINT	
	45070640	CABLE RESTRAINT	
	17901509	SCREW	

Note 1: Used on older type (p/n 81542300) power supplies.
Note 2: Used on newer (shorter) type power supplies.

TABLE 4-1. OPTIONAL PARTS

PART NO.	PART DESCRIPTION	EQUIPMENT PACKAGE 728587xx*												
		01	02	04	05	07	08	09	10	11	12	13	14	15
72859301	PA5A1A DRIVE	XX		XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
72859302	PA5A2B DRIVE		XX											
72854001	FRONT PANEL	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
94397022	EMBLEM, Pr Id	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
72858101	INSERT, Fr Pan	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
73157939	SLIDE ASSY, RH	XX	XX	XX	XX	XX	XX				XX	XX		XX
73157938	SLIDE ASSY, LH	XX	XX	XX	XX	XX	XX				XX	XX		XX
75168323	AC CABLE (P01)	XX	XX	XX				XX		XX		XX	XX	
75168324	AC CABLE (P01)				XX	XX	XX		XX		XX			XX
94369549	GROUND CABLE						XX					XX		
92081500	DC CABLE (P40)	XX	XX		XX				XX	XX			XX	XX
92081501	DC CABLE (P40)			XX		XX		XX			XX			
93991802	DC CABLE (P40)						XX					XX		
92723680	MOUNT, LH	XX	XX	XX	XX	XX	XX				XX	XX		XX
92723681	MOUNT, RH	XX	XX	XX	XX	XX	XX				XX	XX		XX
93402700	BRACKET, Mtg	XX	XX	XX	XX	XX	XX				XX	XX		XX
93270700	TERMINATOR									XX	XX			XX

*Remote Power Supply Drives

Table Continued on Next Page

TABLE 4-1. OPTIONAL PARTS (Contd)

PART NO.	PART DESCRIPTION	EQUIPMENT PACKAGE 728587xx*												
		16	17	18	19	20	21	22	23	24	25	26	27	28
72859301	PA5A1A DRIVE	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
72854001	FRONT PANEL	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
94397022	EMBLEM, Pr Id	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
72858101	INSERT, Fr Pan	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
73157939	SLIDE ASSY, RH	XX							XX	XX		XX		
73157938	SLIDE ASSY, LH	XX							XX	XX		XX		
75168323	AC CABLE (P01)	XX			XX		XX		XX		XX			
75168324	AC CABLE (P01)		XX	XX		XX		XX		XX		XX		
94369549	GROUND CABLE						XX	XX	XX	XX	XX	XX	XX	XX
93991802	DC CABLE (P40)						XX	XX	XX	XX	XX	XX	XX	XX
92081500	DC CABLE (P40)	XX	XX											
92081501	DC CABLE (P40)			XX	XX	XX								
92723680	MOUNT, LH	XX						XX	XX	XX				
92723681	MOUNT, RH	XX						XX	XX	XX				
93402700	BRACKET, Mtg	XX						XX	XX	XX				
93270700	TERMINATOR	XX	XX		XX	XX			XX	XX	XX	XX	XX	XX

*Remote Power Supply Drives

Table Continued on Next Page

TABLE 4-1. OPTIONAL PARTS (Contd)

PART NO.	PART DESCRIPTION	EQUIPMENT PACKAGE 728587xx*												
		29	30	31	32	33	34	35	36	37	38	39	40	41
72859301	PA5A1A DRIVE	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
72854001	FRONT PANEL	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
94397022	EMBLEM, Pr Id	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
72858101	INSERT, Fr Pan	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	XX
73157939	SLIDE ASSY, RH	XX		XX	XX		XX		XX			XX		XX
73157938	SLIDE ASSY, LH	XX		XX	XX		XX		XX			XX		XX
94369549	GROUND CABLE	XX	XX											
92081500	DC CABLE (P40)			XX	XX	XX								
92081501	DC CABLE (P40)						XX	XX	XX	XX				
93991802	DC CABLE (P40)	XX	XX											
93270700	TERMINATOR			XX			XX	XX					XX	XX

*Remote Power Supply Drives

Table Continued on Next Page

TABLE 4-1.   OPTIONAL PARTS (Contd)

PART NO.	PART DESCRIPTION	EQUIPMENT PACKAGE 728587xx*												
		42	44	45	46	47	49	52	54	55	56	57	64	65
72859301	PA5A1A DRIVE	XX			XX	XX			XX	XX			XX	XX
72859302	PA5A2B DRIVE			XX										
72859305	PA5A1B DRIVE		XX											
72859307	PA5A1C DRIVE						XX							
72859310	PA5A2C DRIVE							XX						
72859312	PA5A1G DRIVE										XX			
72859313	PA5A2F DRIVE											XX		
72854001	FRONT PANEL	XX	XX	XX	XX	XX							XX	XX
72854005	FRONT PANEL								XX	XX				
72854006	FRONT PANEL										XX	XX		
72854007	FRONT PANEL						XX	XX						
94397022	EMBLEM	XX	XX	XX	XX	XX							XX	XX
72858101	INSERT, Fr Pan	XX	XX	XX	XX	XX							XX	XX
72858103	INSERT, Fr Pan								XX	XX				
72858106	INSERT, Fr Pan										XX	XX		
72858107	INSERT, Fr Pan						XX	XX						
73157939	SLIDE ASSY, RH		XX		XX	XX			XX	XX	XX	XX		
81737591	SLIDE ASSY, RH												XX	XX
73157938	SLIDE ASSY, LH		XX		XX	XX			XX	XX	XX	XX		
81737590	SLIDE ASSY, LH												XX	XX
75168323	AC CABLE (P01)		XX	XX	XX	XX				XX				
75168324	AC CABLE (P01)								XX				XX	XX
75168325	AC CABLE (P01)										XX	XX		
94369549	GROUND CABLE		XX			XX	XX	XX	XX	XX				
92081500	DC CABLE (P40)	XX				XX			XX	XX	XX	XX		XX
92081501	DC CABLE (P40)			XX	XX	XX							XX	
93991802	DC CABLE (P40)		XX			XX	XX	XX	XX	XX				
92723680	MOUNT, LH		XX		XX	XX			XX	XX	XX	XX	XX	XX
92723681	MOUNT, RH		XX		XX	XX			XX	XX	XX	XX	XX	XX
93402700	BRACKET, Mtg		XX		XX	XX			XX	XX	XX	XX	XX	XX
81537401	A CABLE, Ext								XX	XX				
81537402	A CABLE, Ext					XX								
92708901	B CABLE, Ext								XX	XX				
92708902	B CABLE, Ext					XX								
93270700	TERMINATOR	XX			XX	XX			XX	XX			XX	XX

*Remote Power Supply Drives

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TABLE 4-1. OPTIONAL PARTS (Contd)

PART NO.	PART DESCRIPTION	EQUIPMENT PACKAGE 728587xx*											
		66	67	68	73	74	75						
72859301	PA5A1A DRIVE	XX	XX	XX		XX	XX						
72859317	PA5A1N DRIVE				XX								
72854001	FRONT PANEL	XX	XX		XX	XX	XX						
72854008	FRONT PANEL			XX									
94397022	EMBLEM	XX	XX	XX	XX	XX	XX						
72858101	INSERT, Fr Pan	XX	XX		XX	XX	XX						
72858108	INSERT, Fr Pan			XX									
73157939	SLIDE ASSY, RH			XX	XX								
81737591	SLIDE ASSY, RH	XX	XX				XX						
73157938	SLIDE ASSY, LH			XX	XX								
81737590	SLIDE ASSY, LH	XX	XX				XX						
75168323	AC CABLE (P01)	XX	XX	XX	XX								
75168324	AC CABLE (P01)						XX						
92081500	DC CABLE (P40)	XX											
92081501	DC CABLE (P40)		XX										
92081510	DC CABLE (P40)						XX						
93991802	DC CABLE (P40)			XX	XX								
92723680	MOUNT, LH	XX	XX	XX	XX	XX	XX						
92723681	MOUNT, RH	XX	XX	XX	XX	XX	XX						
93402700	BRACKET, Mtg	XX	XX	XX	XX		XX						
93270700	TERMINATOR	XX	XX			XX							
92678803	FILLER PANEL			XX									
81244505	BAR KIT			XX									

*Remote Power Supply Drives

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TABLE 4-1.   OPTIONAL PARTS (Contd)

PART NO.	PART DESCRIPTION	EQUIPMENT PACKAGE 813445xx*												
		01	02	03	04	07	08	09	10	11	12	13	14	15
81420701	PA5A1F DRIVE	XX				XX	XX	XX	XX			XX		XX
81420702	PA5A2E DRIVE		XX											
81420703	PA5A1H DRIVE			XX										
81420704	PA5A2H DRIVE				XX									
81420707	PA5A1K DRIVE									XX	XX			
81420708	PA5A2G DRIVE												XX	
72854001	FRONT PANEL	XX	XX			XX	XX	XX	XX					XX
72854006	FRONT PANEL			XX	XX									
72854011	FRONT PANEL												XX	
72854012	FRONT PANEL											XX		
94397022	EMBLEM, Pr Id	XX	XX			XX	XX	XX	XX					XX
72858101	INSERT, FR PAN	XX	XX			XX	XX	XX	XX					XX
72858103	INSERT, FR PAN											XX		
72858106	INSERT, FR PAN			XX	XX									
72858111	INSERT, FR PAN												XX	
73157939	SLIDE ASSY, RH	XX	XX	XX	XX	XX	XX	XX	XX			XX	XX	
73157938	SLIDE ASSY, LH	XX	XX	XX	XX	XX	XX	XX	XX			XX	XX	
75168321	AC CABLE (PO1)			XX	XX									
75168323	AC CABLE (PO1)	XX	XX				XX		XX	XX		XX		XX
75168324	AC CABLE (PO1)					XX	XX		XX	XX		XX		
93270700	TERMINATOR			XX	XX		XX	XX	XX					
93270701	TERMINATOR									XX	XX			
92678805	FILLER PANEL											XX		
81244507	BAR KIT											XX		

*Integral Power Supply Drives

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TABLE 4-1. OPTIONAL PARTS (Contd)

PART NO.	PART DESCRIPTION	EQUIPMENT PACKAGE 813445xx*											
		16	17	18	19	20							
81420701	PA5A1F DRIVE	XX	XX										
81420709	PA5A1M DRIVE			XX									
81420710	PA5A1P DRIVE				XX	XX							
72854002	FRONT PANEL			XX									
72854018	FRONT PANEL	XX	XX		XX	XX							
72858103	INSERT, Fr Pan			XX									
72858116	INSERT, Fr Pan	XX	XX		XX	XX							
73157939	SLIDE ASSY, RH	XX	XX		XX	XX							
73157938	SLIDE ASSY, LH	XX	XX		XX	XX							
75168347	AC CABLE (P01)					XX							
75168329	AC CABLE (P01)	XX			XX								
75168330	AC CABLE (P01)		XX			XX							
93270700	TERMINATOR			XX									

*Integral Power Supply Drives

83324500 M

TABLE 4-2.   MANUFACTURER'S RECOMMENDED SPARE PARTS

DESCRIPTION/NOTES	PART NUMBER	REPLACE-MENT PART NUMBER
OPERATOR PANEL		
DPBX replacement kit (includes HPBX operator panel assembly, logic plugs 0 thru 7, lenses,and bracket).	54330903	17190500
HPBX--S/C 12 & Abv	54330907	54330907
LOGIC PLUG KIT (PA5A1K only)	81397702	81397702
AIR FILTER (except PA5A1K)		
S/C 01	72852570	72852571
S/C 02 & Abv	72852571	72852571
CABLE ASSEMBLY P29/P30/P31		
2-Board Read/Write	93458300	93458300
1-Board Read/Write	93458302	93458302
DATA LATCH BOARD (2-Board R/W)		
BPFX--S/C 04 & Blw	54332501	46604101¢
CPFX--S/C 05-16	54332503	46604101¢
R/W PLO BOARD (2-Board R/W)		
BPGX--S/C 02 & Blw	54332901	46604101¢
CPGX--S/C 02	54332902	46604101¢
DPGX--S/C 03-04	54332904	46604101¢
FPGX--S/C 05-06	54332906	46604101¢
GPGX--S/C 07-16	54332907	46604101¢
R/W PLO & DATA LATCH BOARD (1-Board R/W)		
ARUX--S/C 17	54356900	54356902
CRUX--S/C 18 & Abv	54356902	54356902
CABLE ASSEMBLY P14/P20		
Single Channel Drives	95276300	95276300
Dual Channel Drives	95276301	95276301
CONTROL BOARD		
CPXX--S/C 02 & Blw (FCO 05102)	54338902	54338906*
DPXX--S/C 03-04	54338903	54338906
EPXX--S/C 05-19	54338904	54338906
GPXX--S/C 19 & Abv	54338906	54338906
I/O BOARD (Single Channel)		
BEBN/EEBN/FEBN		
Replacement Kit for PA5A1A/B/C/G		45424201+
Replacement Kit for PA5A1F/H		45424200+
Replacement Kit for PA5A1K		45424202+
GEBN--S/C 14-15	54020507	54020510
KEBN--S/C 16 & Abv	54020510	54020510
I/O BOARD (Dual Channel)		
AEDN--Remote Power Supply S/C 22 & Blw	54021300	45424205@
CEDN--Integral Power Supply S/C 22 & Blw	54021302	45424206@
DEDN--S/C 22 & Abv	54021304	54021304

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TABLE 4-2. MANUFACTURER'S RECOMMENDED SPARE PARTS (Contd)

DESCRIPTION/NOTES	PART NUMBER	REPLACE-MENT PART NUMBER
POWER AMP BOARD		
BQHX--S/C 02 & Blw	54342901	54342902*
CQHX--S/C 03 & Abv	54342902	54342902
MOTOR SPEED CONTROL BOARD (CPMX)	54334902	54334902
DC FAN		
S/C 02 & Blw	72857900	81235100
S/C 03-04	81235100	81235100
S/C 05 & Abv, & drives with ECO 03308 installed	81235101	81235101
MODULE ASSEMBLY		
PA5A1A/F, PA5A2B/E/G		
S/C 01	72853200	92396301*
S/C 02	92396300	92396301*
S/C 03 & Abv	92396301	92396301
PA5A1B		
S/C 14 & Blw	92396304	92396313
S/C 15 & Abv	92396313	92396313
PA5A1C/PA5A2C	92396306	92396306
PA5A1G/H, PA5A2F/H	92396307	92396307
PA5A1K	92396310	92396310
PA5A1M	92396314	92396314
PA5A1N	92396315	92396315
PA5A1P	92396316	92396316
BRAKE ASSEMBLY	72856100	72856100
POWER SUPPLY ASSEMBLY, Remote		
S/C 04 & Blw	72896501	72896504
S/C 05-06		
PA5A1C/PA5A2C	72896501	72896504
All others	72896502	72896504
S/C 07-08		
PA5A1C/PA5A2C	72896503	72896504
All others	72896502	72896504
S/C 09-13	72896503	72896504
S/C 14-18		
PA5A1C/PA5A2C	72896504	72896504
All others	72896503	72896504
S/C 19 & Abv	72896504	72896504
POWER SUPPLY ASSEMBLY, Integral		
Longer Type	81542300	81542301=
Shorter Type (older)	81542301	81542304
Shorter Type (newer)	81542304	81542304

Table Continued on Next Page

TABLE 4-2.   MANUFACTURER'S RECOMMENDED SPARE PARTS (Contd)

DESCRIPTION/NOTES	PART NUMBER	REPLACE- MENT PART NUMBER
DC HARNESS(P19/P21/P22/P35/P36/P37/P38/J40)		
2-Board R/W Drives with Remote P/S		
S/C 04 & Blw	93151300	93151300
S/C 05-16	93151303	93151303
2-Board R/W Drives with Integral P/S	93151304	93151304
1-Board R/W Drives with Remote P/S	93151306	93151306
1-Board R/W Drives with Integral P/S	93151308	93151308

*Modules 72853200 and 92396300 require BPXX (54338901) or CPXX (54338902) Control Board and BQHX (54342901) Power Amp Board.
Module 92396301 can be used with all _PXX boards except BPXX or CPXX, and all _QHX boards except BQHX.

+Includes KEBN I/O board, internal A and B cables, and I/O plate assembly.

=Power supply replacement kit, p/n 45776800 (p/n 45776802 for PA5A1K) is also required.

¢2-Board read/write replacement kit (includes CRUX board and necessary hardware for installation).

@Includes DEDN I/O board and internal A and B cables.

TABLE 4-3.   ACCESSORIES

PART NUMBER	DESCRIPTION
12263496	STATIC GROUND WRIST STRAP, 6 1/2 to 8 inch wrist
12263623	STATIC GROUND WRIST STRAP, up to 6 1/2 inch wrist
12263624	STATIC SHIELDING BAG, 5 x 8 inch
12263625	STATIC SHIELDING BAG, 8 x 12 inch
12263626	STATIC SHIELDING BAG, 10 x 12 inch
12263499	STATIC SHIELDING BAG, 14 x 18 inch
12263627	STATIC SHIELDING BAG, 16 x 24 inch
81537400	I/O A CABLE, 5 foot (1.5 metre) long
81537401	I/O A CABLE, 10 foot (3.0 metre) long
81537402	I/O A CABLE, 15 foot (4.5 metre) long
81537403	I/O A CABLE, 20 foot (6.1 metre) long
81537404	I/O A CABLE, 25 foot (7.6 metre) long
81537405	I/O A CABLE, 30 foot (9.1 metre) long
81537406	I/O A CABLE, 40 foot (12.2 metre) long
81537407	I/O A CABLE, 50 foot (15.3 metre) long
81537408	I/O A CABLE, 100 foot (30.6 metre) long
92708900	I/O B CABLE, 5 foot (1.5 metre) long
92708901	I/O B CABLE, 10 foot (3.0 metre) long
92708902	I/O B CABLE, 15 foot (4.5 metre) long
92708903	I/O B CABLE, 20 foot (6.1 metre) long
92708904	I/O B CABLE, 25 foot (7.6 metre) long
92708905	I/O B CABLE, 30 foot (9.1 metre) long
92708906	I/O B CABLE, 40 foot (12.2 metre) long
92708907	I/O B CABLE, 50 foot (15.3 metre) long
93270700	I/O TERMINATOR
81244502	DRIVE MOUNTING KIT (for mounting drive in a standard rack)
24534808	GROUND STRAP (specify length desired)
40125601	GROUND LUG
10126403	LOCKWASHER, #10 (for grounding)
93991802	DC POWER CABLE, 1 foot (0.3 metre) long
92081500	DC POWER CABLE, 5 foot (1.5 metre) long
92081501	DC POWER CABLE, 8 foot (3.0 metre) long
94398817	LOGIC PLUG "0" (See Note 1)
94398818	LOGIC PLUG "1" (See Note 1)
94398819	LOGIC PLUG "2" (See Note 1)
94398820	LOGIC PLUG "3" (See Note 1)
94398821	LOGIC PLUG "4" (See Note 1)
94398822	LOGIC PLUG "5" (See Note 1)
94398823	LOGIC PLUG "6" (See Note 1)
94398824	LOGIC PLUG "7" (See Note 1)
15181751	LOGIC PLUG "0" (See Note 2)
15181752	LOGIC PLUG "1" (See Note 2)
15181753	LOGIC PLUG "2" (See Note 2)

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TABLE 4-3. ACCESSORIES (Contd)

PART NUMBER	DESCRIPTION
15181754	LOGIC PLUG "3" (See Note 2)
15181755	LOGIC PLUG "4" (See Note 2)
15181756	LOGIC PLUG "5" (See Note 2)
15181757	LOGIC PLUG "6" (See Note 2)
15181758	LOGIC PLUG "7" (See Note 2)

Note 1: Used on older operator panels, which have logic plugs without indicator lights.

Note 2: Used on newer operator panels, which have logic plugs with indicator lights.

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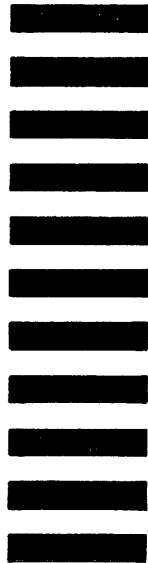
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