

**CONTROL DATA CORPORATION
FIXED STORAGE DRIVE
INSTALLATION
Volume 1**

Models:

**PA5G1/G2 (Wang 2268V-3)
PA5N1/N2 (Wang 2268V-4)**

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**Customer Engineering
OEM Reprint**

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PREFACE

The purpose of this manual is to provide the Wang-trained Customer Engineer (CE) with instructions to troubleshoot and repair the Control Data Corporation Fixed Storage Drive, Wang 2268V-3 and Wang 2268V-4.

First Edition (April 1985)

This document is a reprint of volume 1 of the Maintenance Manual for the Control Data Corporation Fixed Storage Drive. The material in this document may be used only for the purpose stated in the Preface. Updates and/or changes to this document will be published as Publications Update Bulletins (PUB's) or subsequent editions.

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CDC® FIXED STORAGE DRIVE

PA5G1

PA5G2

PA5N1

PA5N2

GENERAL DESCRIPTION

OPERATION

INSTALLATION AND CHECKOUT

PARTS DATA

Volume 1

HARDWARE MAINTENANCE MANUAL

REVISION RECORD

REVISION	DESCRIPTION
01 (08-10-83)	Preliminary release.
02 (09-30-83)	Preliminary manual updated with technical and editorial changes. This edition obsoletes all previous editions.
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REVISION LETTERS I, O, Q
AND X ARE NOT USED.

Address comments concerning this
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Control Data Corporation
Twin Cities Disk Division
Customer Documentation Dept.
5950 Clearwater Drive
Minnetonka, MN 55343

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or use Comment Sheet in the back
of this manual.

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. 83324770 Rev. B

Pub. No. 83324780 Rev. C

EQUIPMENT TYPE	SERIES CODE	WITH FCOs	COMMENTS
PA5G1/2, PA5N1/2	01	None	
	02	05751	
	03	None	
	04	None	
	05	None	
	06	None	

LIST OF EFFECTIVE PAGES

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S-4 Div	-	Rtn Env	-
Blank	-	Blank	-
4-1	D	Cover	-

PREFACE

This manual contains maintenance information for the CONTROL DATA® PA5G1/2 and PA5N1/2 Fixed Storage Drives (FSDs). 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:

<u>Publication No.</u>	<u>Title</u>
83324760	PA5G1/PA5G2 and PA5N1/PA5N2 Hardware Maintenance Manual, Volume 1
83324770	PA5G1/PA5G2 and PA5N1/PA5N2 Hardware Maintenance Manual, Volume 2 (contains theory of operation and maintenance)
83324780	PA5G1/PA5G2 and PA5N1/PA5N2 Hardware Maintenance Manual, Volume 3 (contains diagrams)
83322440	CDC Microcircuits, Volume 1 (provides functional descriptions for integrated circuits)
83324440	CDC Microcircuits, Volume 2 (provides functional descriptions for integrated circuits)

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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 in accordance with the procedures given in this manual.
- 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)
PA5G1A	Single Channel	340
PA5G1B	Single Channel	340
PA5G1C	Single Channel	340
PA5G1D	Single Channel	340
PA5G1G	Single Channel	340
PA5G2A	Dual Channel	340
PA5G2B	Dual Channel	340
PA5G2D	Dual Channel	340
PA5G2E	Dual Channel	340
PA5G2G	Dual Channel	340
PA5N1A	Single Channel	515
PA5N1B	Single Channel	515
PA5N1C	Single Channel	515
PA5N1D	Single Channel	515
PA5N2A	Dual Channel	515
PA5N2B	Dual Channel	515
PA5N2C	Dual Channel	515
PA5N2E	Dual Channel	515

* Refer to Section 4 for equipment package listings that include painted parts and other supplied 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 (Contd)

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

ABBREVIATIONS (Contd)

MPU	Microprocessor Unit	PS	Power Supply
MRK	Mark	PWR	Power Supply
ms	Millisecond	RCVR	Receiver
MTR	Motor	RD	Read
mV	Millivolt	RDY	Ready
NC	No Connection	REF	Reference
NORM	Normal	REQ	Request
NRZ	Non Return to Zero	RES	Resolution
ns	Nanosecond	REV	Reverse, Revision
OC	On Cylinder	RGTR	Register
OS	One-Shot	r/min	Revolutions Per Minute
OSC	Oscillator	RSD	Removable Storage Drive
P	Plug	RTZ	Return to Zero
PD	Peak Detect	R/W	Read/Write
pF	Picofarad	s	Second
PG	Page	S/C	Series Code
PHH	Phillips Head	SEC	Second
PLO	Phase Lock Oscillator	SEL	Select
PROC	Procedure	SEQ	Sequence
PROG	Programmable	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
V	Volts, Voltage	XFR	Transfer
Vbb	Bias Voltage	Ω	Ohms
VCC	Bias Voltage	\$	Hexadecimal Address
VCO	Voltage Controlled Oscillator	uF	Microfarad
		us	Microsecond

SECTION

1

GENERAL

DESCRIP-

TION

1. GENERAL DESCRIPTION

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INTRODUCTION

The Control Data PA5G1/PA5G2 and PA5N1/PA5N2 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 PA5G1 and PA5G2 is 340 megabytes. The total data storage capacity of the PA5N1 and PA5N2 is 515 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.

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)	33.0 kg (70.0 lbs)
Recording	Weight (Power Supply only)	4.5 kg (10.0 lb)
	Total Capacity (Formatted) PA5G1/PA5G2 PA5N1/PA5N2	340 megabytes 515 megabytes
	Number of disks	7
	Movable data heads	24
	Servo Heads	1
	Tracks per inch	960
	Physical heads per surface	2
	Logical cylinders per head/disk assy	711 (0-710)
Transfer rate	Disk speed at 3600 r/min PA5G1/PA5G2	9.677 MHz (1 209 625 bytes/sec)
	PA5N1/PA5N2	14.52 MHz (1 814 438 bytes/sec)
Table Continued on Next Page		

TABLE 1-1. DRIVE SPECIFICATIONS (Contd)

Characteristics	Conditions	Specifications
PERFORMANCE		
Latency	Average	Latency is time to reach a particular track address after positioning is complete.
	Maximum	8.33 milliseconds (disk rotation speed at 3600 r/min) 16.83 milliseconds (disk rotation speed at 3564 r/min)
Recording	Mode PA5G1/PA5G2 PA5N1/PA5N2	MF 2-7 code
	Density PA5G1/PA5G2 PA5N1/PA5N2	10 000 bits per inch (inner track) 15 159 bits per inch (inner track)
Seek Time	Full	45 milliseconds maximum
	Average	20 milliseconds
	Single Track	5 milliseconds maximum
Start Time		30 seconds maximum
Stop Time		32 seconds typical

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 are two heads 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).

Before any read or write operation can be performed, the controller 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 controller still must locate that portion of the track on which the data is to be written or read. This is called track orientation and is done by using the Index and Sector signals generated by the drive. The Index signal indicates the logical beginning 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.

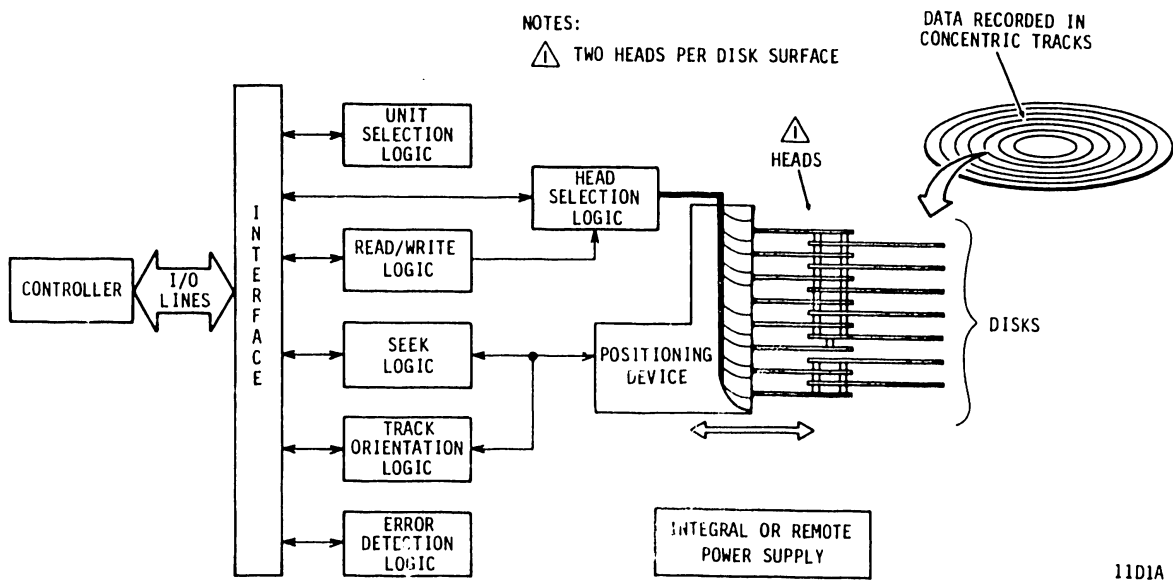


Figure 1-1. Drive Functional Block Diagram

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.

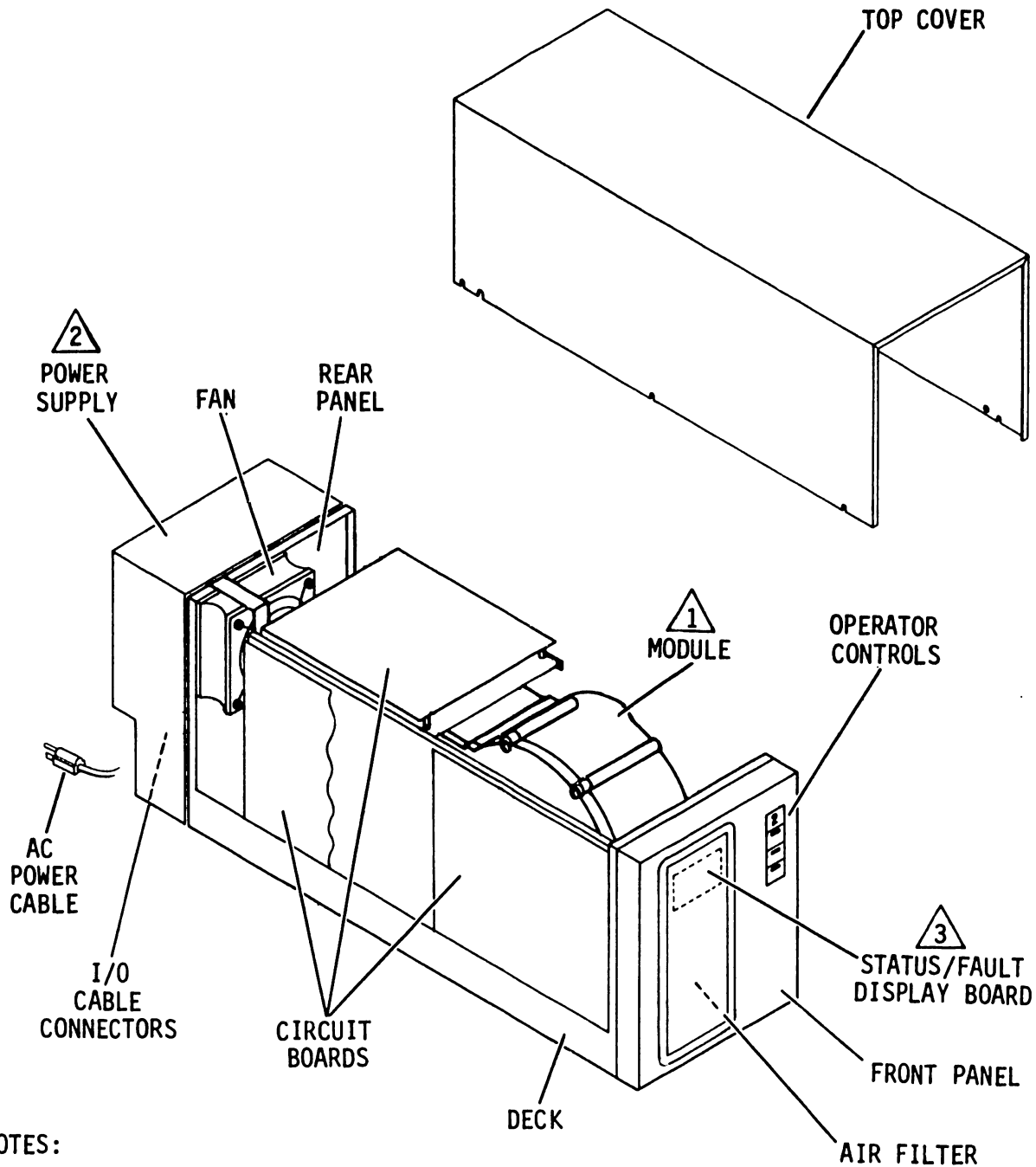
A drive installation requires a drive, interconnecting cabling, and a power supply. Site power enters the power supply via the ac power cable. The power supply develops the dc voltages required by the drive. These voltages are supplied to the drive by the dc power cable.

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 and a Fault Display board (located behind front panel insert and filter). 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 through a mother board, 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 seven 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.



NOTES:

- ① MODULE CONTAINS THE DISKS, SPINDLE, DRIVE MOTOR, ACTUATOR, AND HEADS.
- ② SHOWN WITH INTEGRAL POWER SUPPLY. A REMOTE POWER SUPPLY IS ALSO AVAILABLE.
- ③ LOCATED BEHIND FRONT PANEL INSERT.

11D5A

Figure 1-2. Drive Major Assemblies

The actuator is the assembly that holds the heads and moves the heads over the rotating disks. There are 25 heads; a servo head to control actuator positioning, and 24 data heads used for data transfers to and from the disks. The actuator has a voice coil which moves in and out of a permanent magnetic field in response to signals from the servo positioning circuitry. The voice coil forces the actuator carriage to roll on parallel rails to move the heads accurately across the disk surfaces. 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 outer 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 2 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

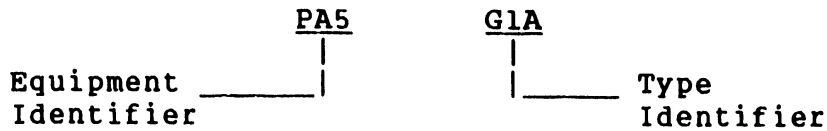
General

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:



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 units 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

OPERA-

TION

2. OPERATION

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General.....	2-1
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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

GENERAL

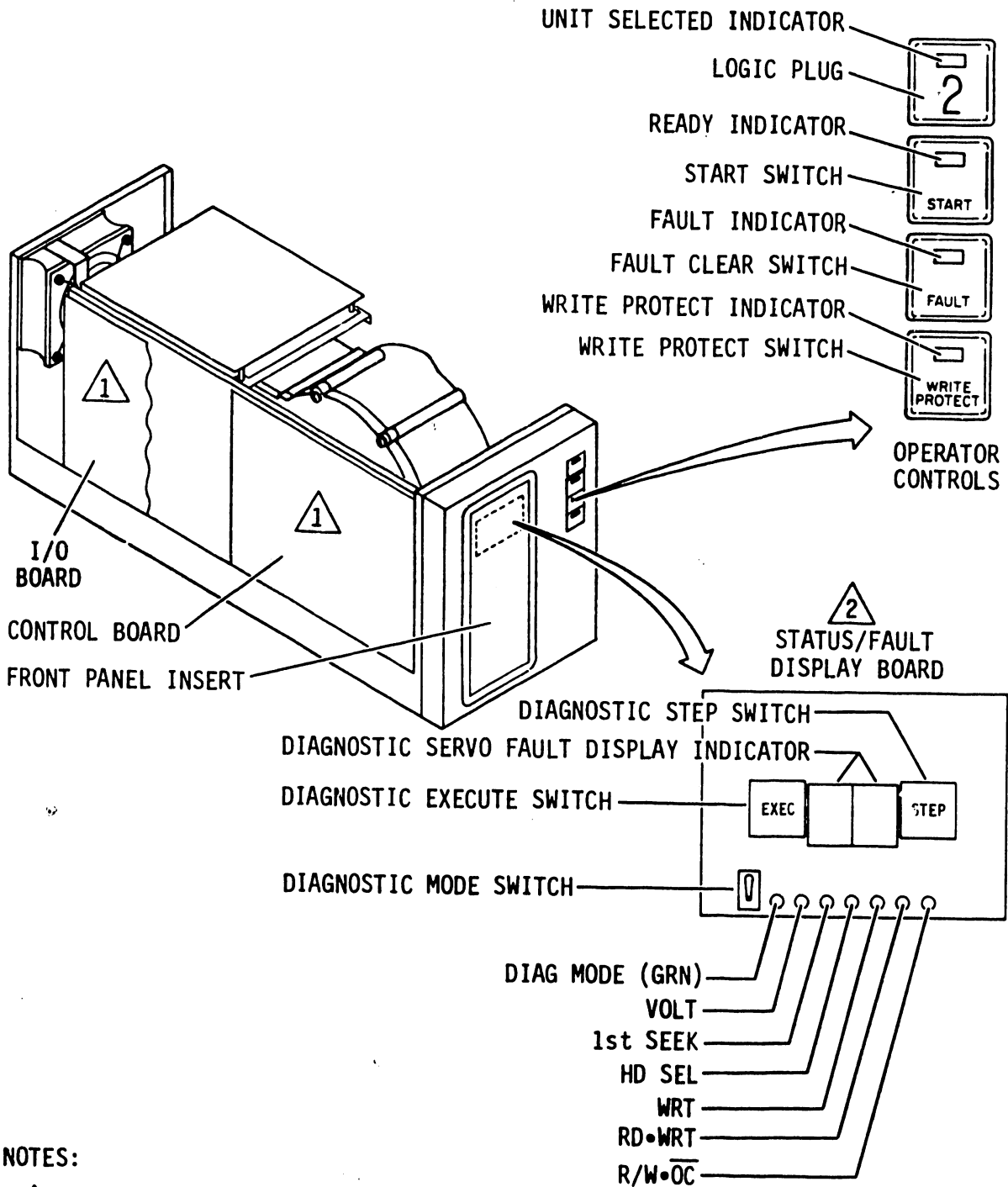
Switches and indicators are found in four locations on the drive:

- Power Supply
- Front Panel (also behind front panel insert)
- 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

The ac power is controlled by the CBI breaker on the power supply. Normally, CBI is left ON. All operating voltages for the drive are generated by the power supply.



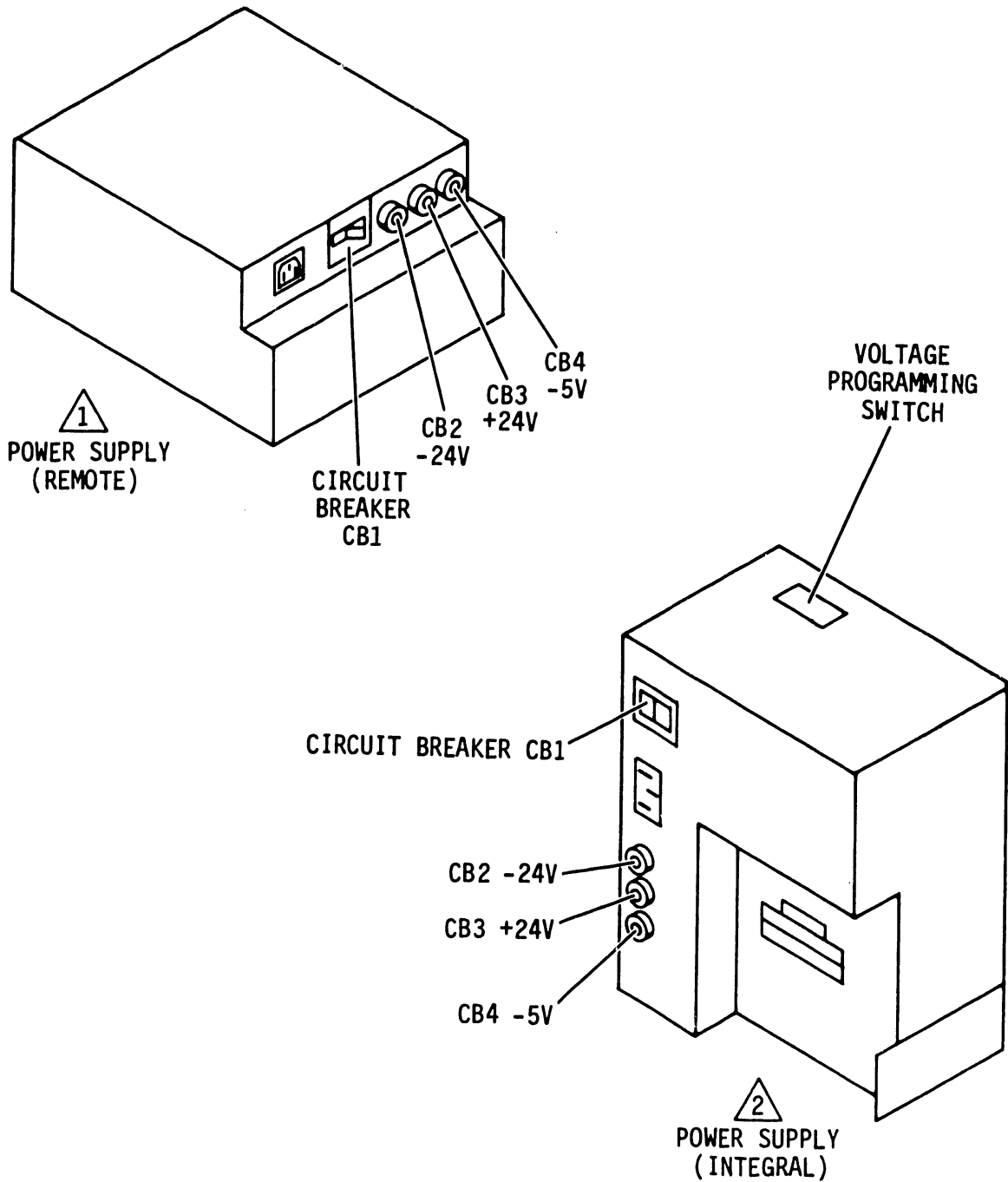
NOTES:

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

2 STATUS/FAULT DISPLAY BOARD IS LOCATED BEHIND FRONT PANEL INSERT AND FILTER.

11D2B

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



NOTES:

1 POWER SUPPLY SHOWN WITH REAR SURFACE UP.

2 POWER SUPPLY IS MOUNTED ON REAR OF DRIVE.

11D7 A

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

FRONT PANEL

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

CONTROL BOARD

The control board contains switches which are set during drive installation. Refer to the installation and checkout section of this manual for instructions 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	
CB1 (ON/OFF) Circuit Breaker	Applies site ac power to power supply, which in turn supplies the dc operating voltages to the drive electronics and fan.
CB2 (-24) Circuit Breaker	Protects the -24 V supply. To reset circuit breaker, press in pop-out element.
CB3 (+24) Circuit Breaker	Protects the +24 V supply. To reset circuit breaker, press in pop-out element.
CB4 (-5) 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.
Table Continued on Next Page	

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

Switch or Indicator	Function
FRONT PANEL	
<p>Logic Plug/Unit Selected Indicator</p>	<p>The logic plug activates switches that establish the logical address of the device. Logic plugs are available with numbers 0 through 7. The Unit Selected indicator (present on newer drives only) is lit if drive is selected.</p>
<p>START Switch/ Ready Indicator</p>	<p>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 activates the power up sequence, and 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 steady with power up complete. Pressing the START switch to release it from the Start position causes the Ready indicator to flash until disk rotation has stopped.</p>
<p>FAULT Indicator/ Fault Clear Switch</p>	<p>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):</p> <ul style="list-style-type: none"> • Pressing the Fault Clear switch • Fault Clear command from the controller • A drive power up operation
Table Continued on Next Page	

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

Switch or Indicator	Function
FRONT PANEL (Contd)	
WRITE PROTECT Switch/Indicator	The operation of the WRITE PROTECT switch or the control board W PROT jumper places the drive in the write protected mode (preventing write operations) and lights the WRITE PROTECT indicator.
STATUS/FAULT DISPLAY BOARD	
Diagnostic Mode Switch	Places drive in diagnostic mode and disables the I/O.
Diagnostic Mode Indicator	Indicates that the drive is in diagnostic mode.
Diagnostic Execute Switch	Starts and stops diagnostic tests.
Diagnostic Step Switch	Selects individual diagnostic tests.
Diagnostic/Servo Fault Display Indicator	When drive is in diagnostic mode, display indicates which diagnostic test are being initiated. If a failure occurs, display indicates which major assembly to replace to correct failure. When drive is not in diagnostic mode, display indicates error code, generated by microprocessor.
VOLT Indicator	Indicates a below normal voltage existed.
1st SEEK Indicator	Indicates drive failed first seek/load attempt.
Table Continued on Next Page	

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

Switch or Indicator	Function
STATUS/FAULT DISPLAY BOARD (Contd)	
<p>HD SEL Indicator</p> <p>WRT Indicator</p> <p>RD·WRT Indicator</p> <p>R/W·\overline{OC} Indicator</p>	<p>Indicates that more than one head arm preamp chip was selected at the same time.</p> <p>Indicates that a write fault has occurred.</p> <p>Indicates that a write and a read command had existed simultaneously.</p> <p>Indicates write or read conditions existed during a seek operation (an off cylinder condition).</p>
CONTROL BOARD	
<p>W PROT/NORM (Write Protect) Jumper</p> <p>Sector Select Switches</p>	<p>Moving the jumper to the W PROT position prevents the drive from performing write operations. The jumper must be returned to the NORM position to enable write operations.</p> <p>Allow the dividing of the disk into specific segments or sectors. The switch settings determine the number of sectors per track (see Setting Sector Select Switches in section 3).</p>
Table Continued on Next Page	

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

Switch or Indicator	Function
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 power up the drive. It is assumed that dc power is available to the drive because power supply circuit breaker CB1 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 LOCAL position, the power up sequence begins immediately. If it was set in the REMOTE position, the power up sequence continues when power sequence ground is available from the controller. In the REMOTE position, power up sequence to each drive is delayed. The length of delay is determined by the number of the unit logic plug used, in increments of 5 seconds.

For example:

Logic Plug 0 = 0 second delay

Logic Plug 7 = 35 second delay

2. After the delay is completed, the Ready indicator (located in START switch) will flash, indicating that power up 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 up sequence is now complete, and the drive is ready to read or write data.

POWER OFF PROCEDURE

The following procedure describes how to power down the drive.

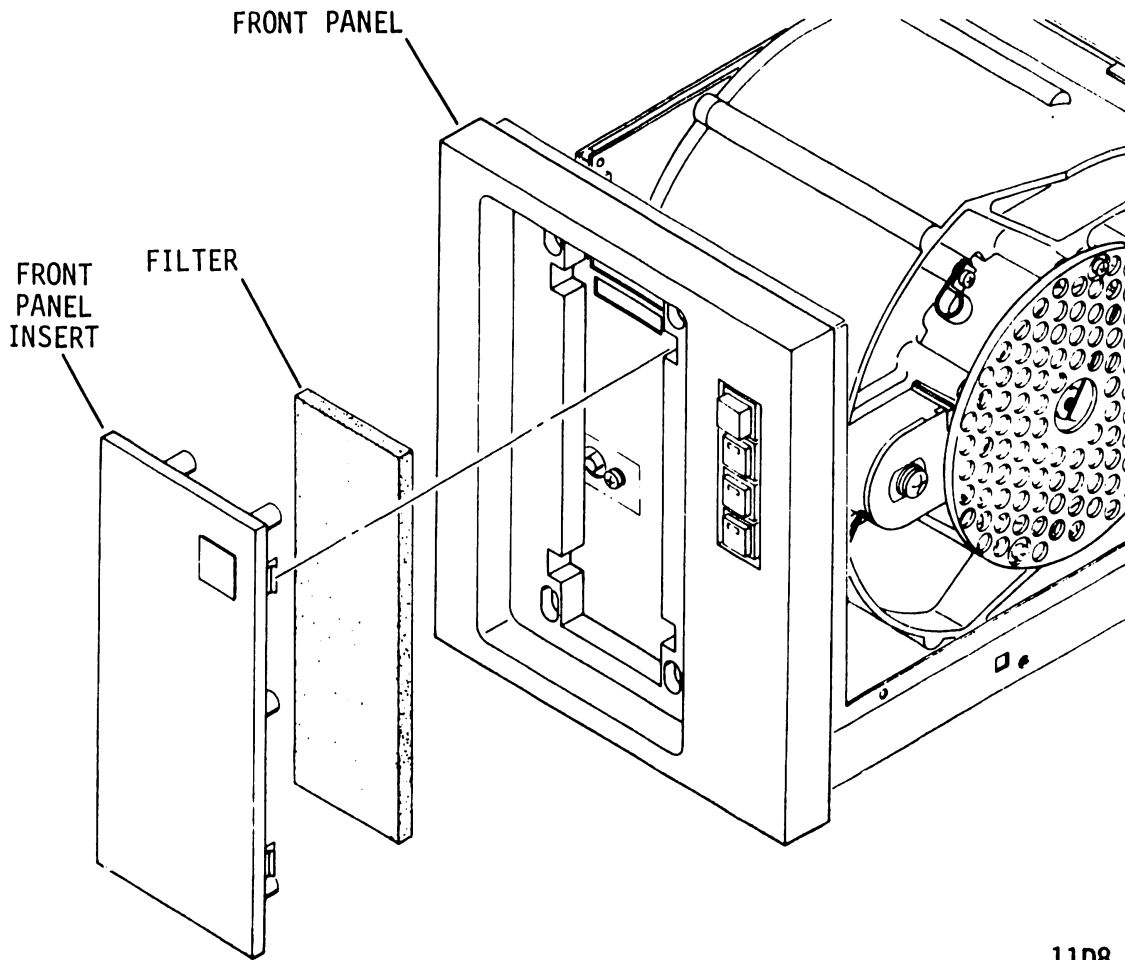
1. Press START switch to release it from Start position.
2. Observe that Ready indicator (located in START switch) flashes, indicating that power down is in progress.
3. Observe that Ready indicator goes off within 45 seconds, indicating that power down is complete.

With power down complete, the heads are positioned in the landing zone and the disks are not rotating. Normally, power supply circuit breaker CB1 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 the filter periodically and either replace or clean it when it is dirty. Cleaning the filter is recommended only if replacement filters are not available. The interval for filter maintenance depends on the operating environment. In computer room conditions, a 6-month interval is suggested. In other conditions, the filter should be checked more frequently.



11D8

Figure 2-2. Air Filter Replacement

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

INSTAL-

LATION

AND

CHECKOUT

3. INSTALLATION AND CHECKOUT

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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.

TABLE 3-1. ENVIRONMENTAL REQUIREMENTS

Conditions	Characteristics	Specifications
	TEMPERATURE	
Storage	Range	-10 to 50°C (14 to 122°F)
	Maximum change per hour	15°C (27°F)
Transit	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)
	Gradient	10°C (18°F)
Table Continued on Next Page		

TABLE 3-1. ENVIRONMENTAL REQUIREMENTS (Contd)

Conditions	Characteristics	Specifications
RELATIVE HUMIDITY		
Range	Storage	10% to 90%
Range	Transit	5% to 95%
Range	Non-operating	20% to 80% 10% per hour maximum change (no condensation allowed).
Range	Operating	20% to 80% 10% per hour maximum change (no condensation allowed).
BAROMETRIC PRESSURE (STANDARD DAY)		
Range	Storage/ Non-Operating	-300 m to 3000 m (-983 ft to 10 000 ft) 105 kPa to 69 kPa (31 in to 20 in Hg)
Range	Transit	-300 m to 3000 m (-983 ft to 10 000 ft) 105 kPa to 69 kPa (31 in Hg to 20 in Hg)
Range	Operating	-300 m to 3000 m (-983 ft to 10 000 ft) 105 kPa to 69 kPa (31 in Hg to 20 in Hg)

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 37.0 kg (82 lbs). With both units mounted inline and extended on the slides, the center of gravity is approximately 36 cm (14 in) from the rack front.

POWER REQUIREMENTS

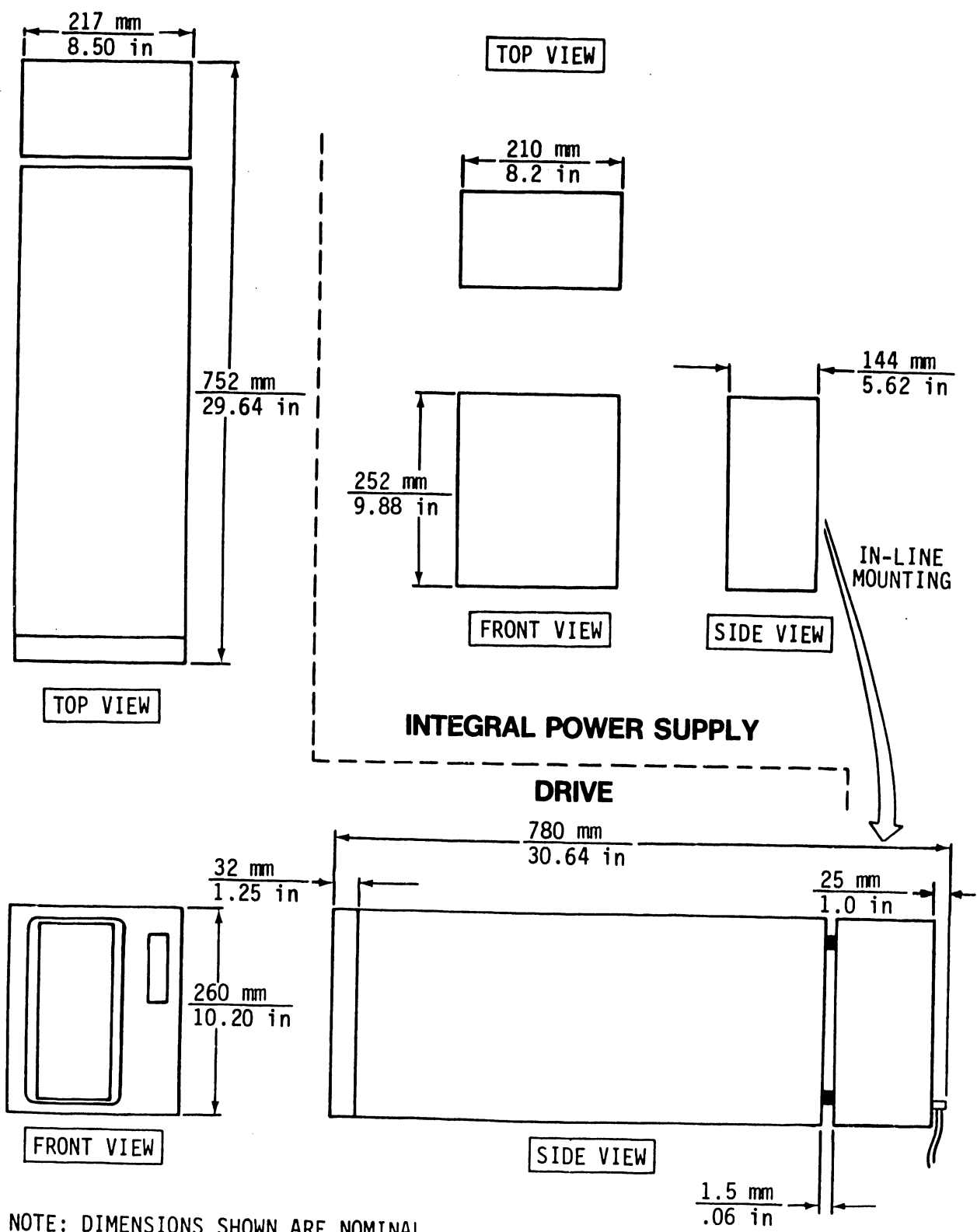
Normal Requirements

Drive ac power requirements are listed in table 3-2. Conversion to the different line voltages is explained in the installation procedures. Typical drive current versus start-up time is shown in figure 3-2 for 120 and 220/240 volt connections.

TABLE 3-2. POWER REQUIREMENTS

Specifications	VALUES	
	120 V ac	220/240 V ac
Voltage Range	104 to 128 V	191 to 256 V
Nominal Line Frequency	50/60 Hz	50/60 Hz
Frequency Range	49.0 to 60.6 Hz	49.0 to 60.6 Hz
Phase Requirements	Single Phase	Single Phase
Power Consumed*	0.260 kW	0.252 kW
Line Current*	3.4 A	2.1 A
Power Factor*	0.712	0.659
Start Up Current	See figure 3-2.	See figure 3-2.

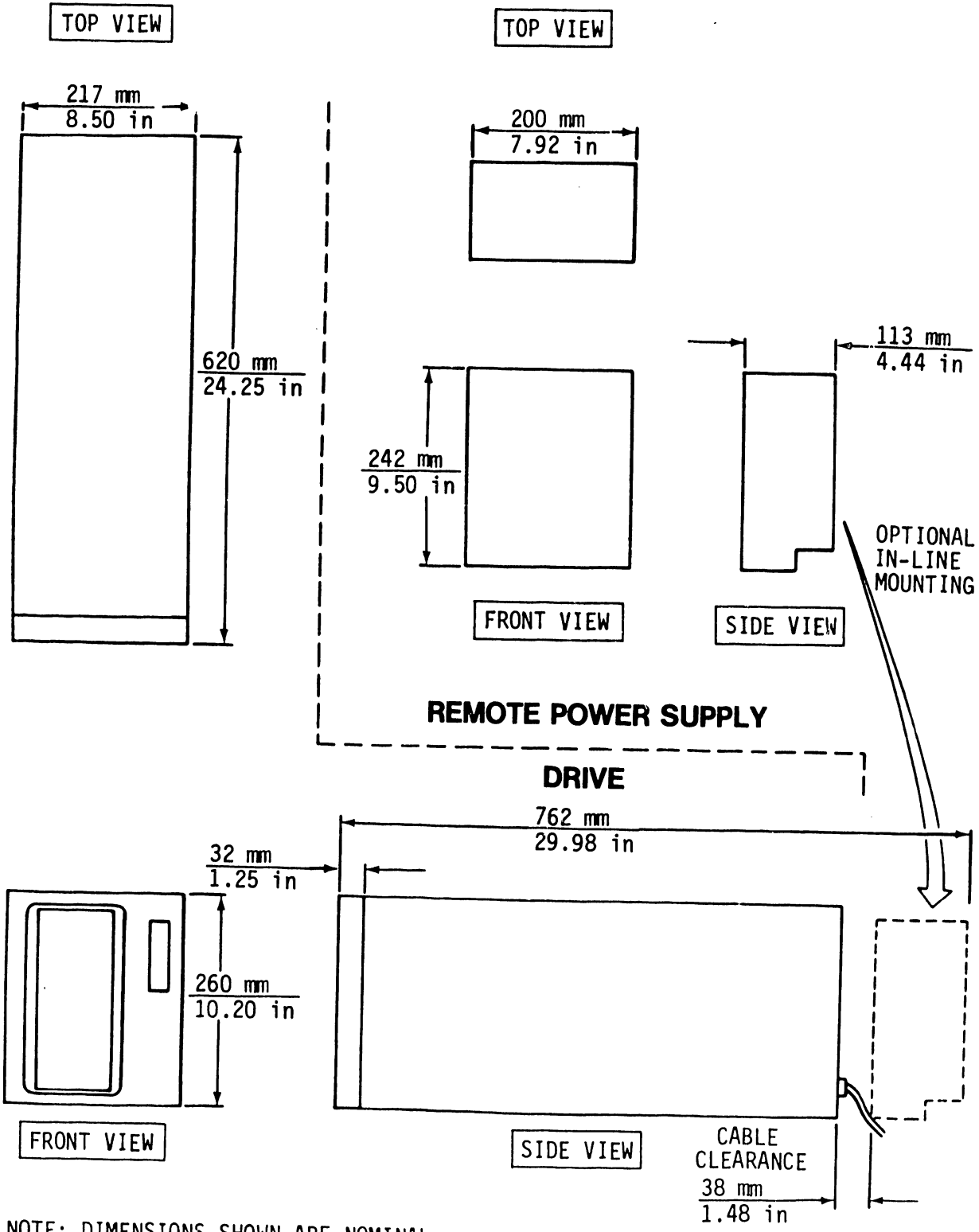
*Measured when disks are rotating and carriage is moving.



NOTE: DIMENSIONS SHOWN ARE NOMINAL.

11D9A

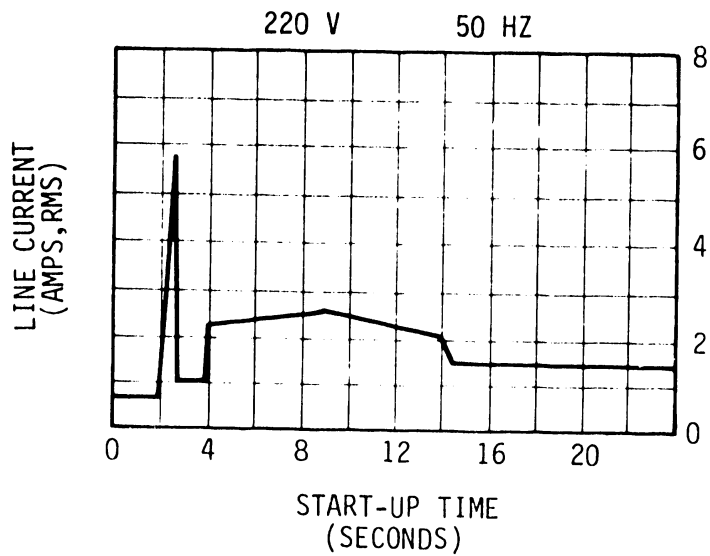
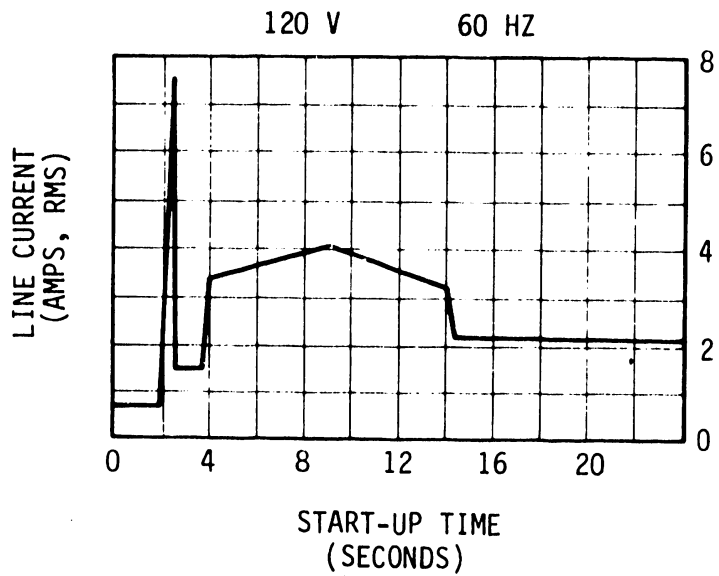
Figure 3-1. Drive Space Requirements (Sheet 1 of 2)



NOTE: DIMENSIONS SHOWN ARE NOMINAL.

11D10A

Figure 3-1. Drive Space Requirements (Sheet 2)



11D11

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

WARNING

If power to the unit originates from a 3-phase, 4-wire, wye branch or feeder circuit, always ensure that the circuit meets the requirements given in the following topic. These requirements must be met in the United States, in order to comply with the National Electrical Code, and are recommended for installations in other countries. 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.

Special Requirements for 3-Phase, 4-Wire Wye Site Power

General

This unit uses single-phase power. If the power originates from a 3-phase, 4-wire, wye branch or feeder circuit ensure that the circuit meets the following specifications (see preceding warning).

Specifications for Neutral Conductor

Always consider the neutral in the 3-phase, wye circuit as a current carrying conductor and ensure that it is large enough to have at least 175% of the rating of the line conductors.

Limiting Branch and Feeder Circuit Load Currents

The size of the neutral conductor determines the maximum load current allowed in each 3-phase, wye conductor (lines and neutral). If the neutral in the 3-phase, wye circuit has at least 175% the rating of the line conductors, limit the maximum load current in each conductor (lines and neutral) to the values shown in table 3-3. If the neutral is not 175% as large as the line conductors but is at least the same size (which is the minimum acceptable), limit current as shown in table 3-4.

Transformers

If over one half of the load consists of equipment containing switching power supplies, derate the power transformer to 70% of its nameplate rating. Ensure that input protection to the transformer does not allow more than 70% of the normal (nameplate) full load primary current rating. Connect the individual neutral leads from the transformer secondary coils directly to a neutral bus or connection strap which is large enough to carry at least 175% of the total secondary load current.

TABLE 3-3. LOAD CURRENT LIMITS WITH LARGER NEUTRAL

Number of Conductors in Conduit, Cable or Raceway	Limit to this Percentage of Value Specified by NEC* or Local or National Regulations
4 through 6	80%
7 through 24	70%
25 through 42	60%
43 and above	50%
* United States National Electrical Code.	

TABLE 3-4. LOAD CURRENT LIMITS WITH SAME SIZE NEUTRAL

Number of Conductors in Conduit, Cable or Raceway	Limit to this Percentage of Value Specified by NEC* or Local or National Regulations
4 through 6	70%
7 through 24	61%
25 through 42	53%
43 and above	44%
* United States National Electrical Code.	

GROUNDING REQUIREMENTS

General

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.

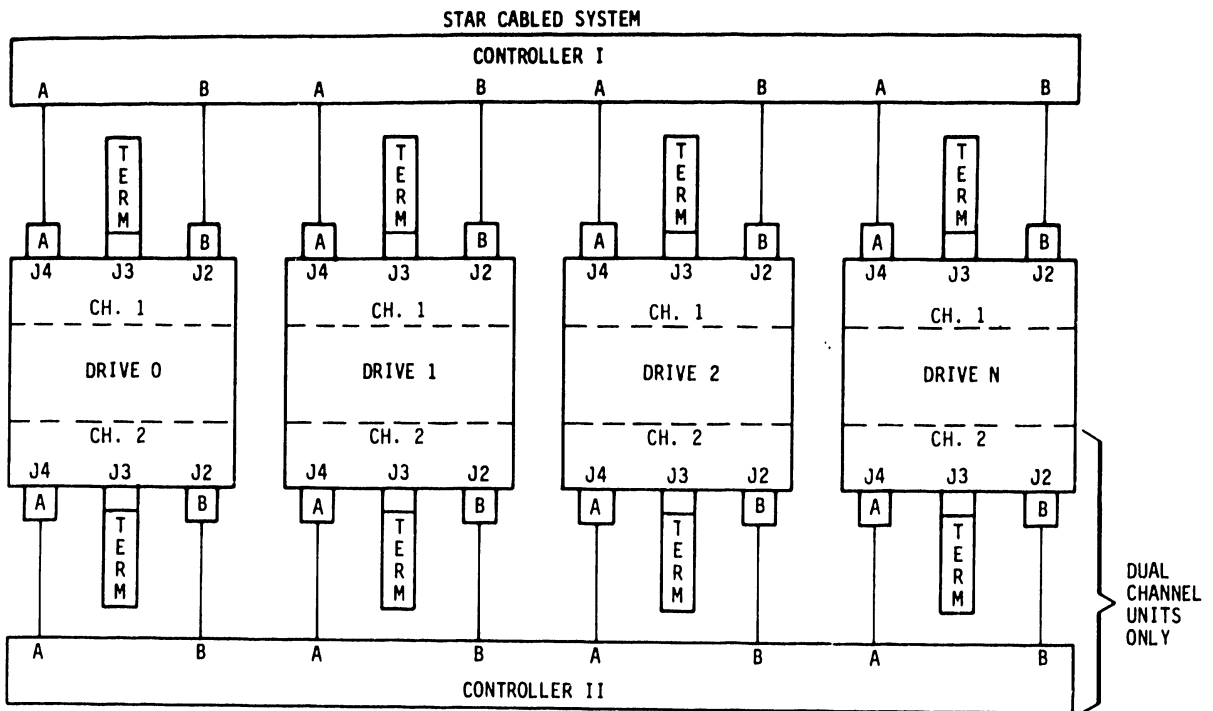
System Grounding

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

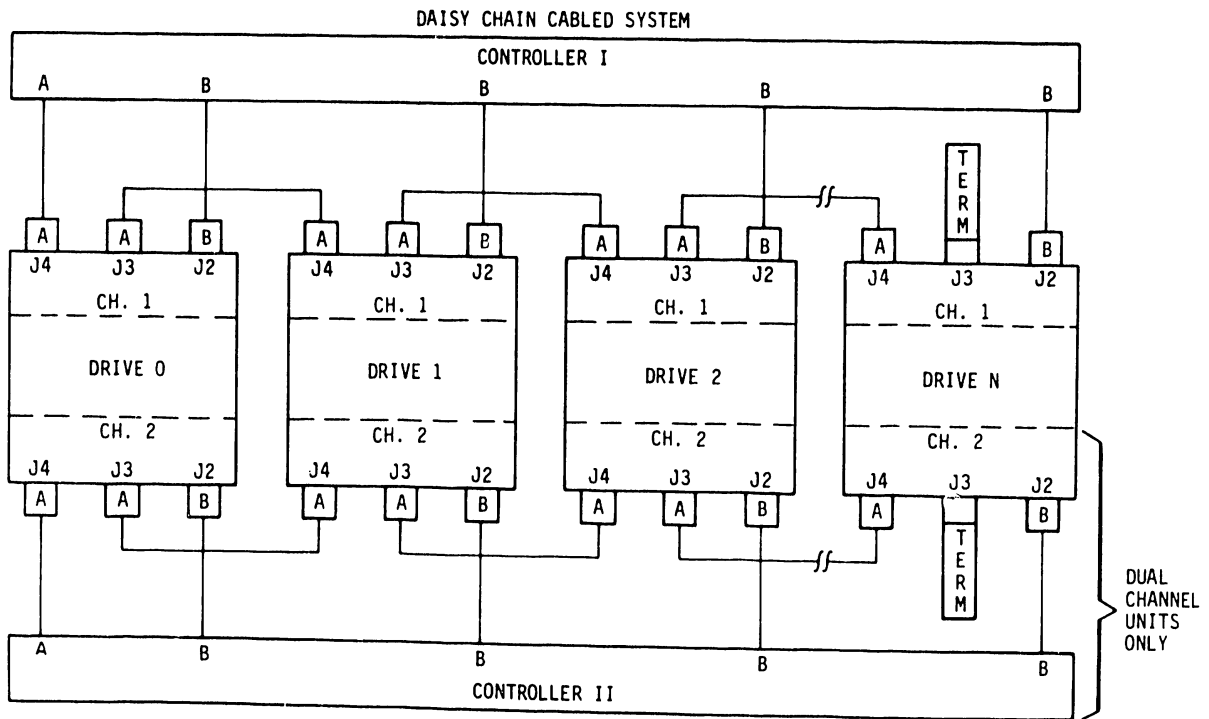
An important part of site preparation is planning the layout and routing of I/O cables. The I/O cables are designated as A and B cables. The I/O A cables may be connected in either a star or daisy chain configuration as shown in figure 3-3. Each configuration calls for the use of terminators; these too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



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



10R50B

Figure 3-3. System 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 hardware maintenance manual, volume 2.

FINAL UNPACKAGING AND INSPECTION

GENERAL

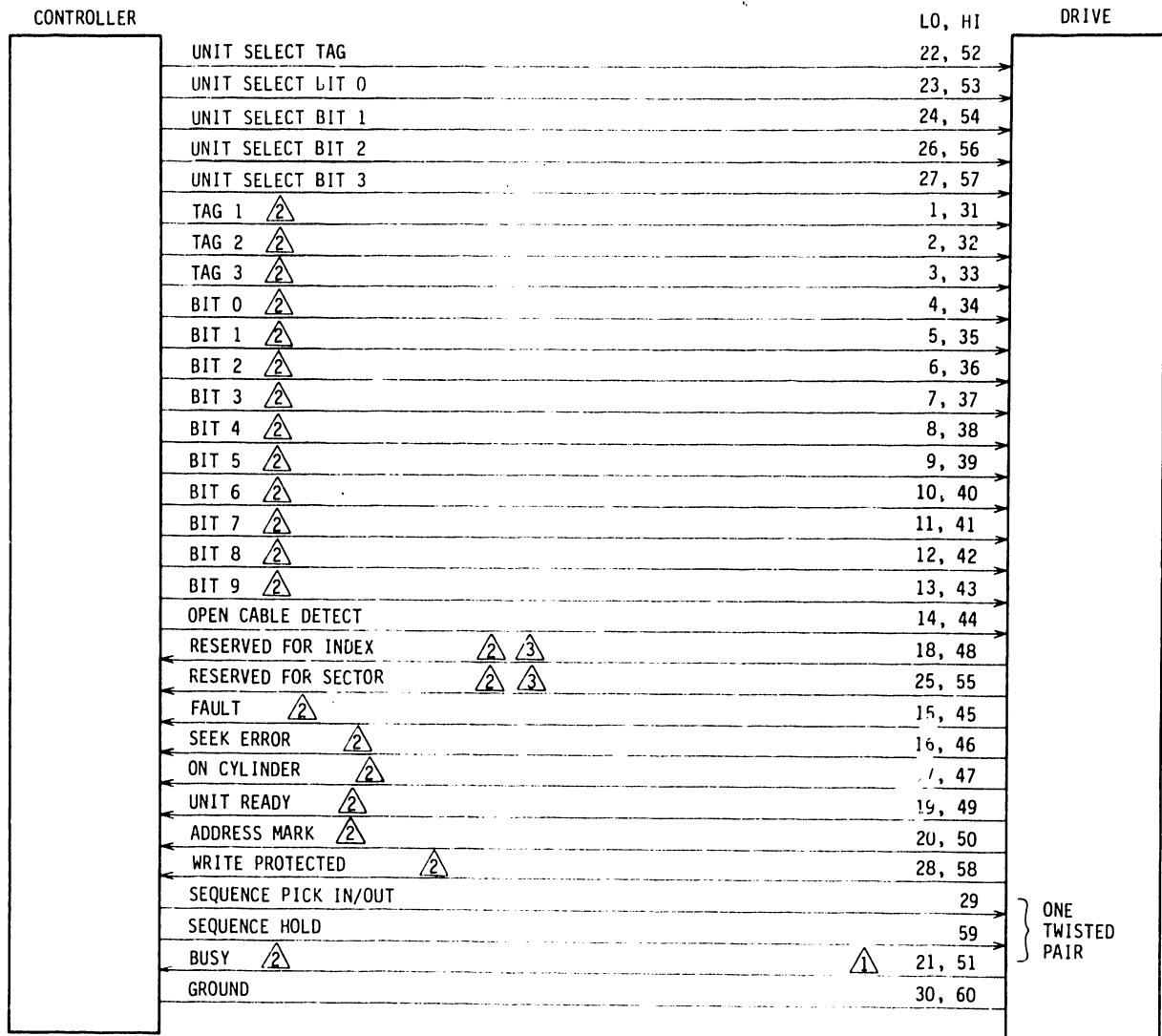
After removing packaging material according to the unpackaging instructions provided with the drive, inspection for shipping damage should be carried out and several final unpackaging procedures performed. Most packaging materials can be reused if it is necessary to ship the drive at some future date.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

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




When ordering packaging instructions, specify the exact equipment number and series code of the drive as shown on the equipment 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. For drives with integral power supply, inner slides have already been installed in manufacturing.



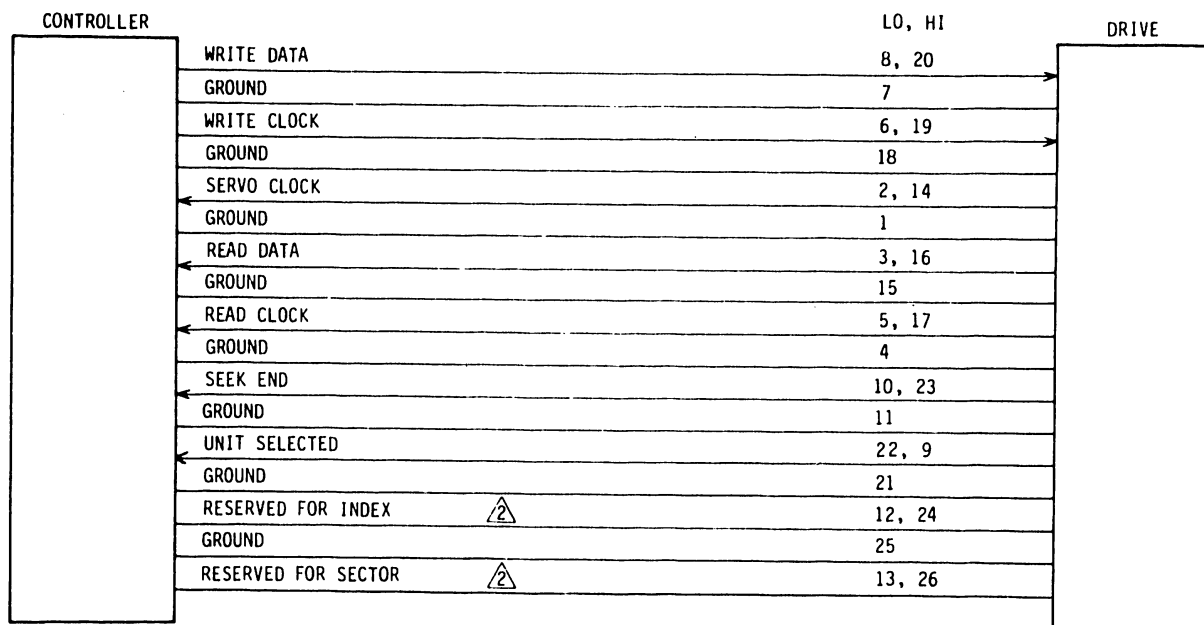
NOTES:

-  DUAL CHANNEL UNITS ONLY
-  GATED BY UNIT SELECT
-  INDEX AND SECTOR MAY BE IN "A" CABLE OR "B" CABLE

10R51A

Figure 3-4. A Cable

"B" CABLE



NOTES:

1 NO SIGNALS GATED BY UNIT SELECTED.

INDEX AND SECTOR MAY BE IN "A" CABLE OR "B" CABLE.

10R52

Figure 3-5. B Cable

3. Remove package containing ac power cable (and dc power cable for drives with remote power supply).
4. Remove plastic dust cover from around drive and power supply.
5. 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

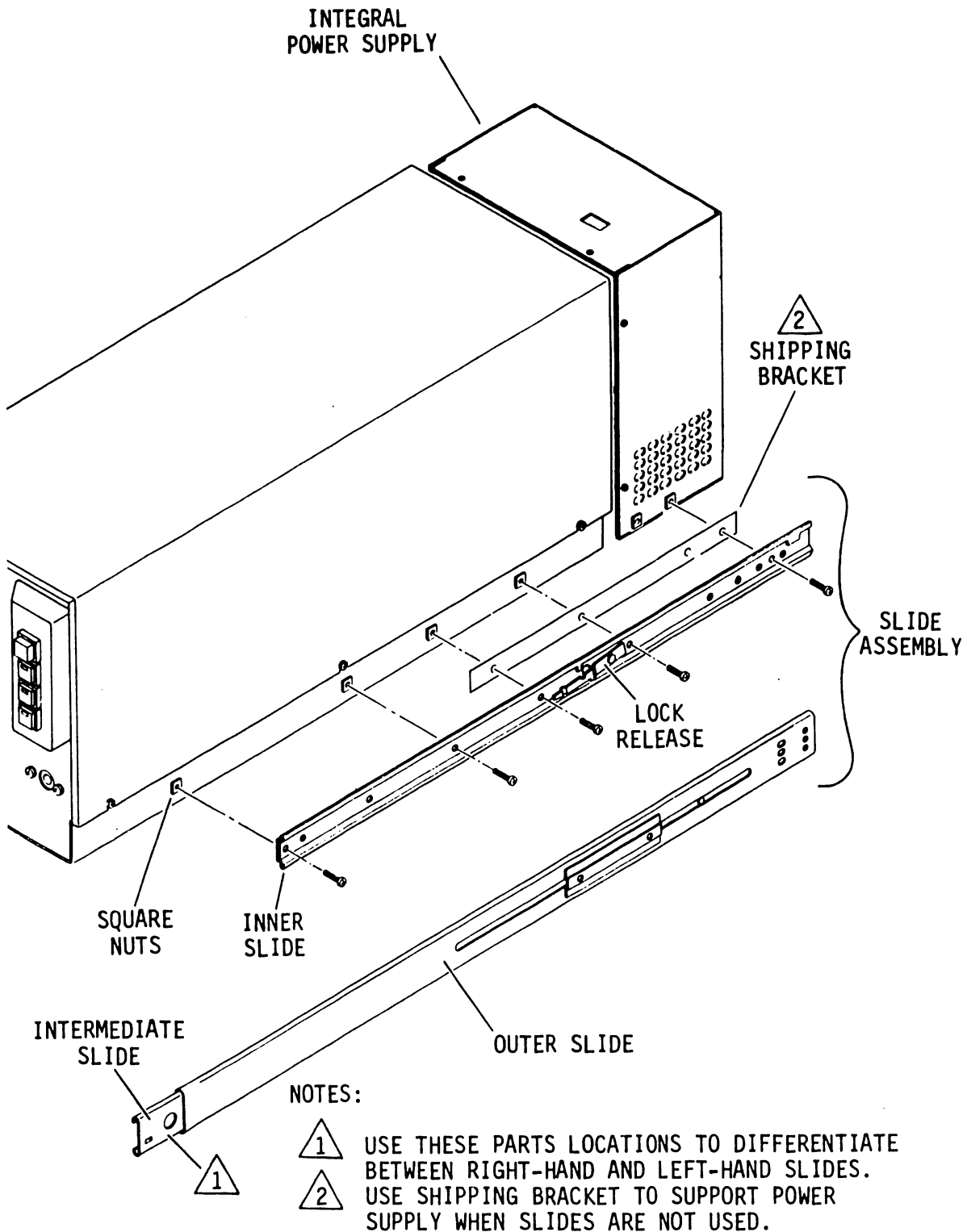
A drive mounting kit for mounting the drive in a standard rack is available as an accessory (refer to Accessories in section 4 for part number). For drives with the integral power supply, the shipping bracket must be removed prior to slide installation (see figure 3-6). For drives with the remote power supply, 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 instructions for attaching the drive and power supply to the slides.

NOTE

The procedure describing how to mount the remote power supply on the slide assemblies follows System Grounding and Interconnect Cabling.

Drive Installation (Integral Power Supply)

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



11D12 A.

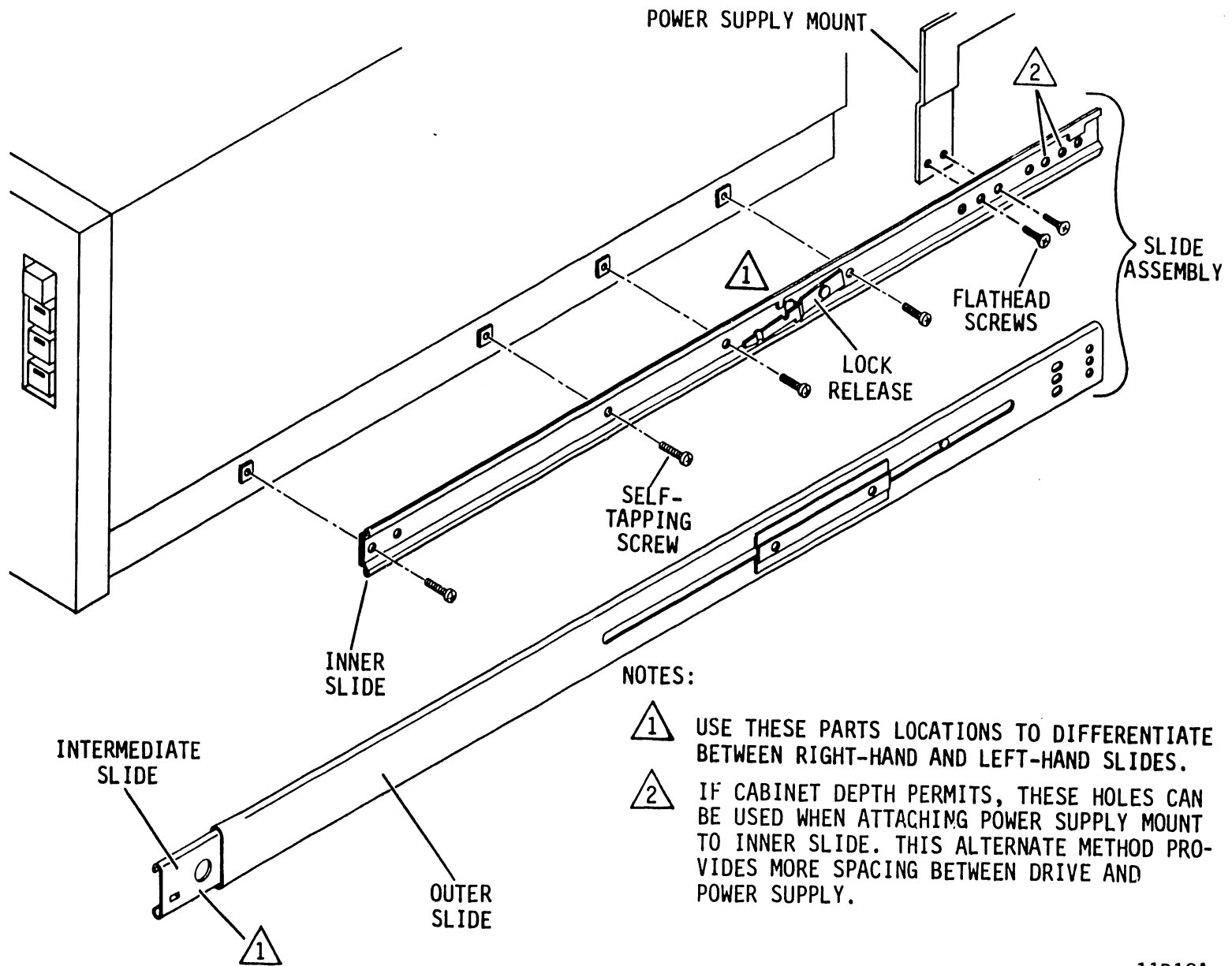
Figure 3-6. Drive Installation (Integral Power Supply)

2. Remove screws (4 each) from slide hardware kit.
3. Disengage inner slide from intermediate and outer slides of each slide assembly by pressing lock release and pulling out inner slide.
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.

Drive Installation (Remote Power Supply)

1. Remove screws (8 each) from slide hardware kit. Set aside the remaining screws in kit for remote power supply installation.
2. Disengage inner slide from intermediate and outer slides of each slide assembly by pressing lock release and pulling out inner slide (see figure 3-7).
3. Install remote power supply mounts on inner slides using flat head screws.
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 3-7 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 3-7 defines which slide component mounts on the right side of the rack.

Figure 3-7. Drive Installation (Remote Power Supply)



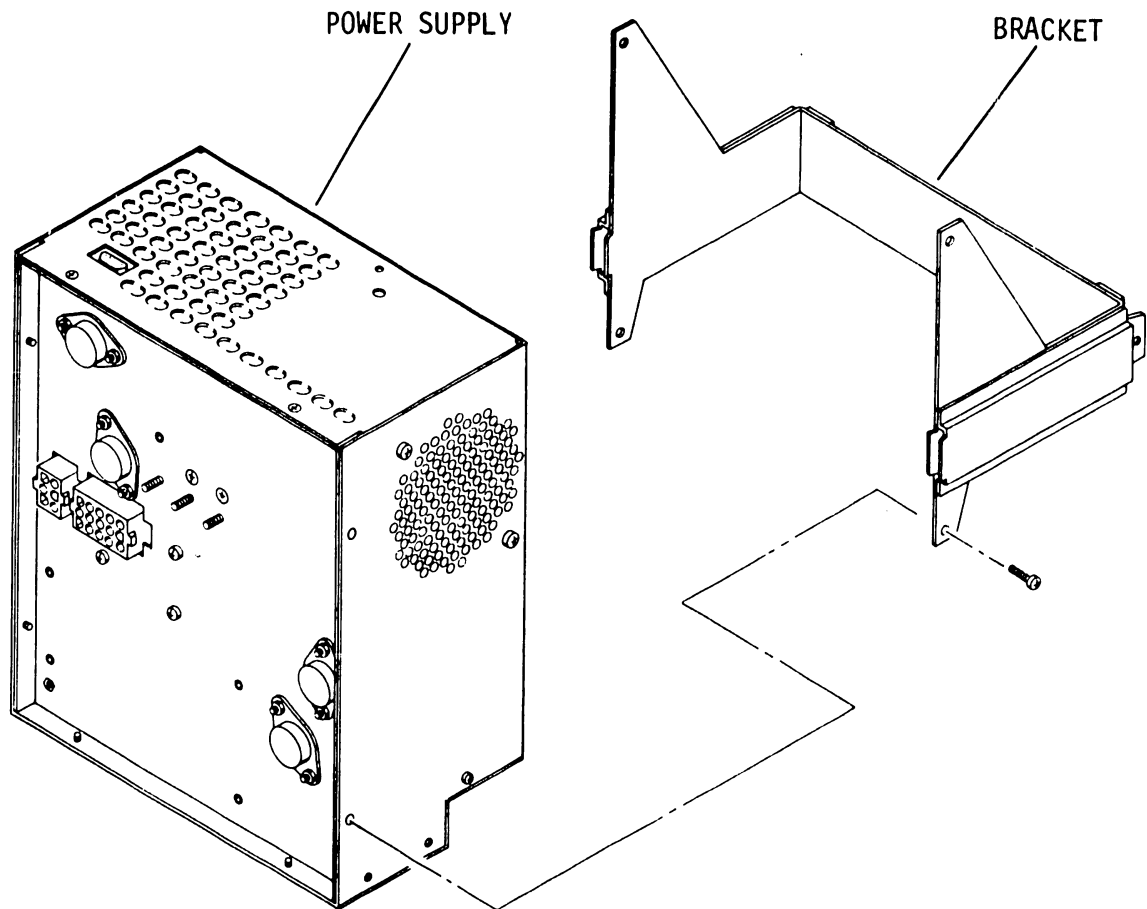
11D18A

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 the slide assemblies, a mounting bracket must first be attached to the power supply. Newer drives 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 3-8).



10R319

Figure 3-8. Remote Power Supply Bracket Installation

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 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 (located on top of power supply) 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 (located on bottom of power supply) to the desired range. The ac power cord must be replaced if the voltage range is changed. Refer to figure 3-9 and to the Parts Data section for information about ordering the replacement ac power cable.

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

NOTE

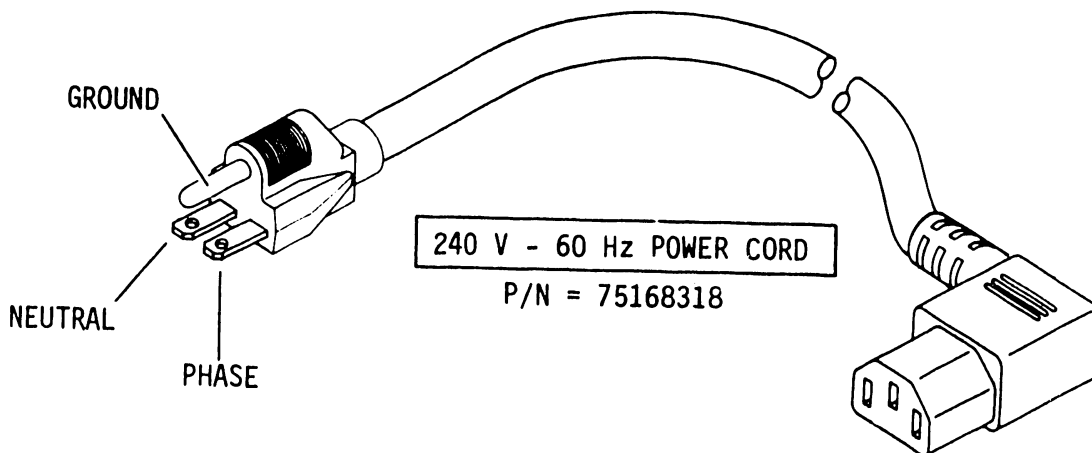
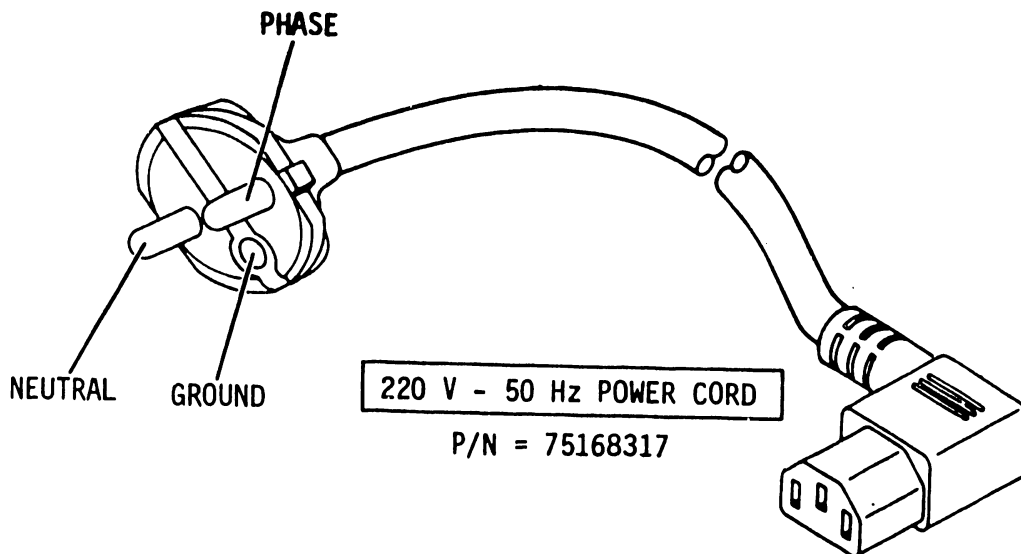
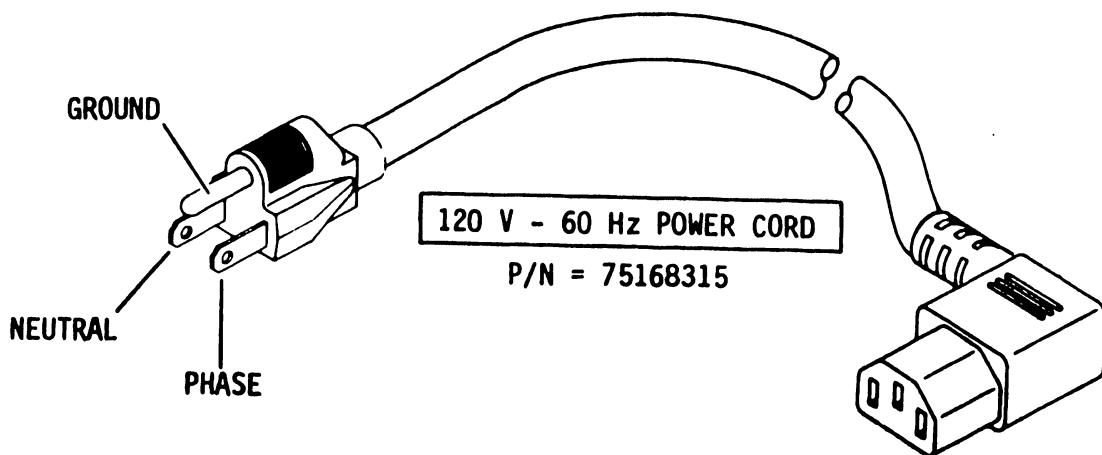
Perform step 2 on integral supplies, and on newer remote supplies which have a voltage programming switch. Perform step 3 on older remote supplies, which do not have a voltage programming switch.

2. Change voltage programming switch to desired setting (switch is located on top of integral power supply, and on bottom of remote power supply).
3. On older remote power supplies, perform the following:
 - a. Remove attaching hardware (designated "A" in figure 3-10) 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.

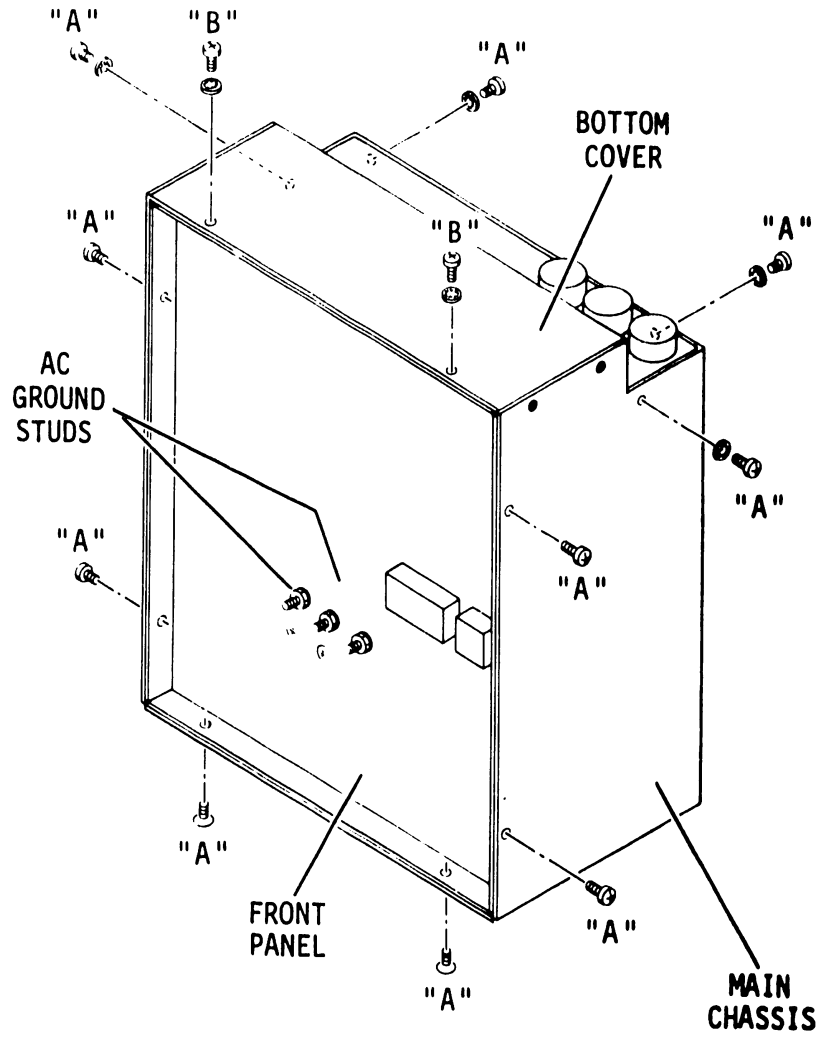
- c. Slide bottom cover and front panel away from main chassis without straining internal wiring.



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Figure 3-9. AC Power Cables

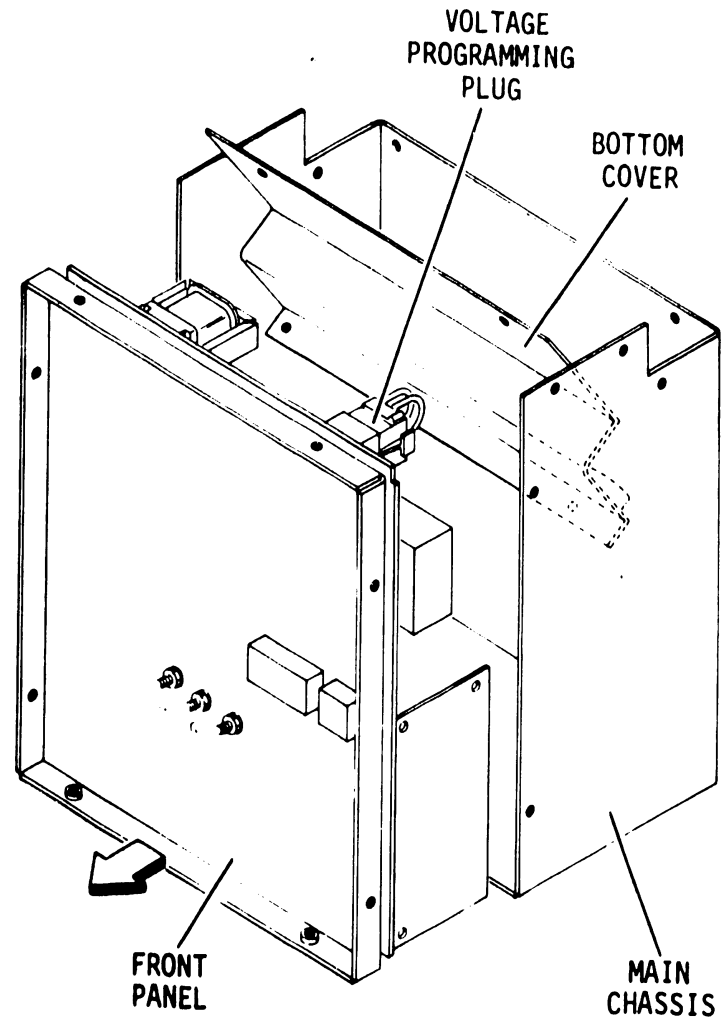
Figure 3-10. Voltage Conversion (Older Remote Power Supplies)



HARDWARE REMOVAL

NOTES:

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



VOLTAGE PROGRAMMING PLUG REMOVAL

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

NOTE

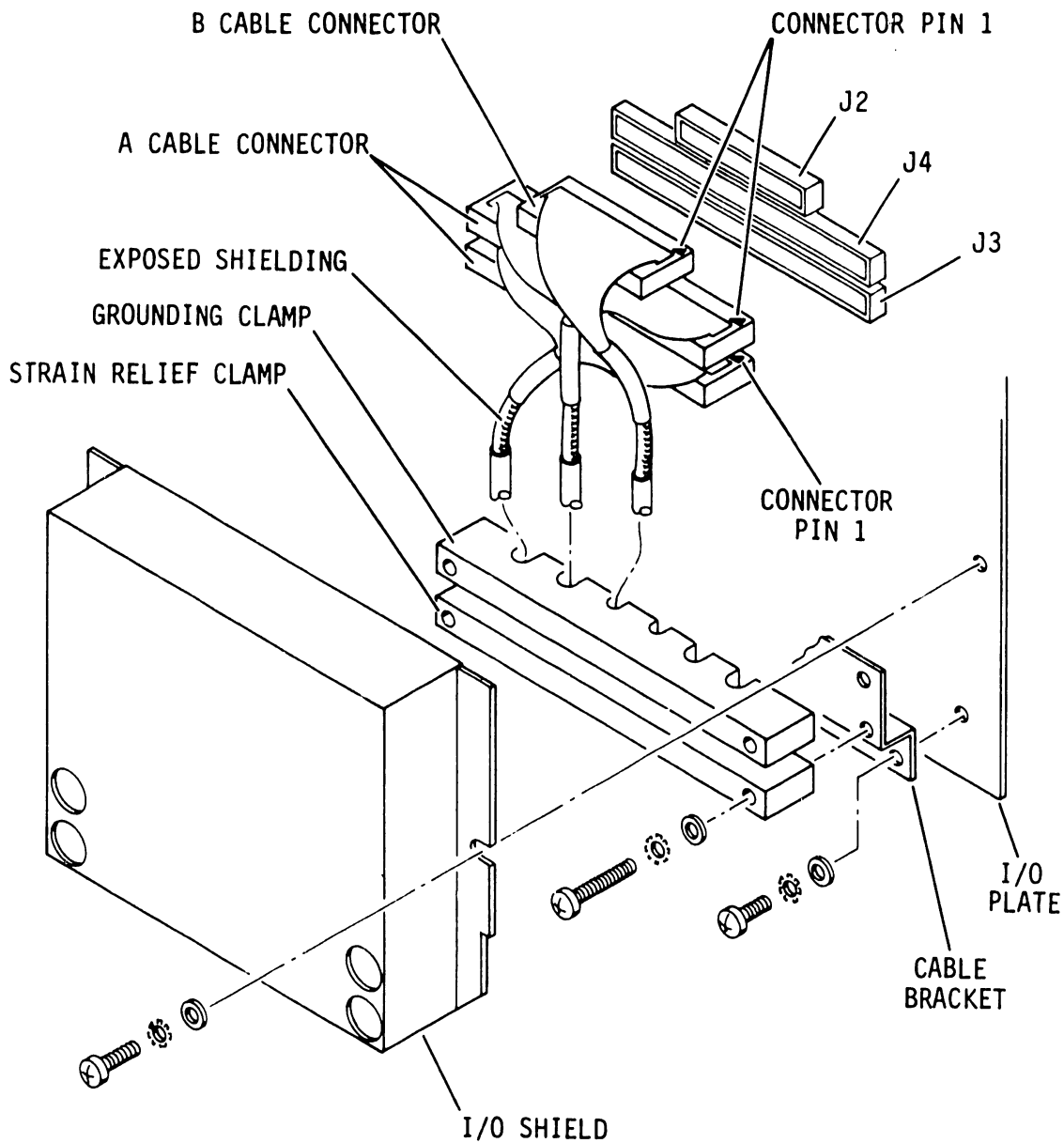
The voltage programming plugs are stamped to indicate their voltage ranges. The plug for 120 V ac has blue jumper wires, and the plug for 220/240 V ac has red jumper wires.

- 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").
 - 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. Those connections may be reversed without affecting drive operation. It is assumed that the site has been prepared in accordance with the site preparation information provided earlier in this section. Refer to that discussion for cable routing information.

Figure 3-11 shows typical I/O cable connections. 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.



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.

11D13D

Figure 3-11. I/O Cable Attachment

1. On drives with integral power supply, remove I/O shield from I/O plate (see figure 3-11).
2. Install cable bracket on panel below I/O plate with attaching hardware.

NOTE

Steps 3 through 8 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 cable from controller to drive connector J2 on I/O plate.

NOTE

Steps 4 and 5 apply only to drives using star I/O cabling configuration.

4. Connect A cable from controller to drive connector J4 on I/O plate.
5. Install terminator on drive connector J3 and make terminator ground connection.

NOTE

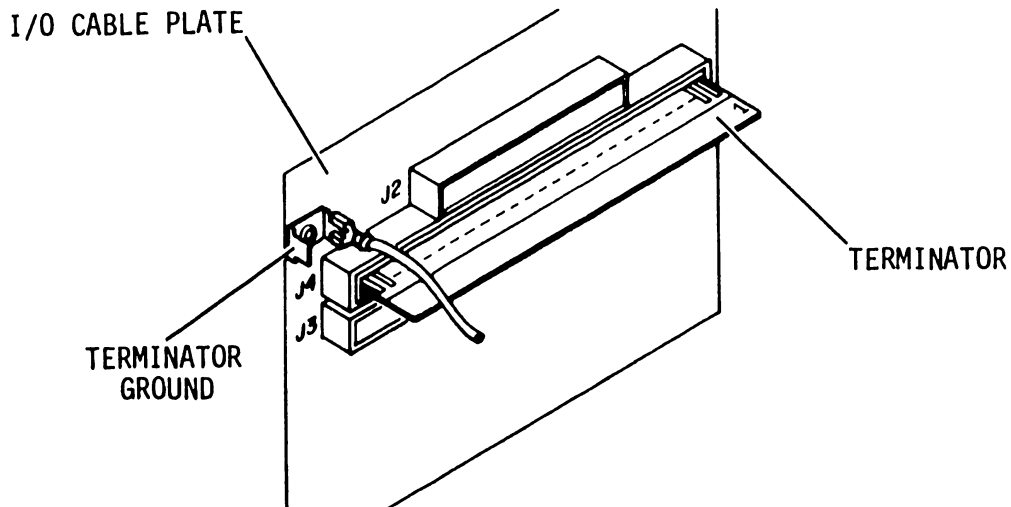
Steps 6 through 8 apply only to drives using daisy chain I/O cabling configuration. In these steps, upstream and downstream define drives adjacent to a particular drive in daisy chain with upstream drive closer to controller.

6. Connect A cable to drive connector J4 on I/O plate either from controller or from connector J3 on upstream drive.

NOTE

If drive is not last in daisy chain, perform step 7. If drive is last in daisy chain, perform step 8.

7. Connect another A cable from drive connector J3 to connector J4 on downstream drive.
8. Install terminator on drive connector J3 and make terminator ground connection (see figure 3-12).



11D14B

Figure 3-12. Terminator Installation (Typical)

NOTE

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

9. Strip heat shrink tubing from all cables so that bare shielding will be in contact with grounding clamp.
10. Loosely install grounding clamp (P/N 72851230 is stamped on part) onto cable bracket with cables positioned as shown in figure 3-11.

NOTE

Ensure that bare shielding on each cable is in contact with grounding clamp.

11. 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.

12. Install strain relief clamp (P/N 72851231 is stamped on part) onto cable bracket with cables positioned as shown in figure 3-11.
13. On drives with integral power supply, install I/O shield on I/O plate with attaching hardware.

SYSTEM GROUNDING AND INTERCONNECT CABLING

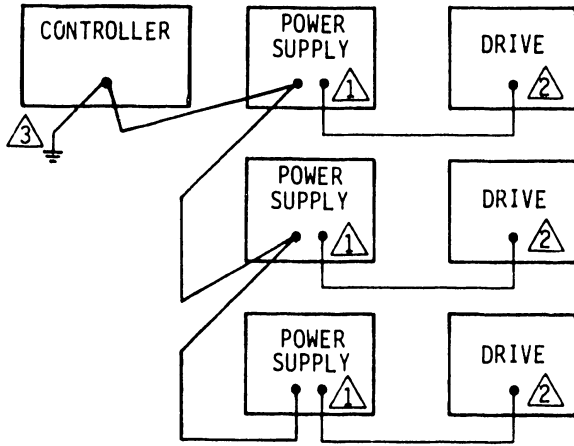
This section contains instructions on grounding the system and interconnecting the remote power supply and drive. It is assumed that the site has been prepared in accordance with the site requirements information provided earlier in this section. The following procedures describe how to ground the system in a star or daisy chain configuration as shown in figure 3-13.

For drives with the integral power supply, interconnect ground cabling between drive and power supply has already been installed 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.

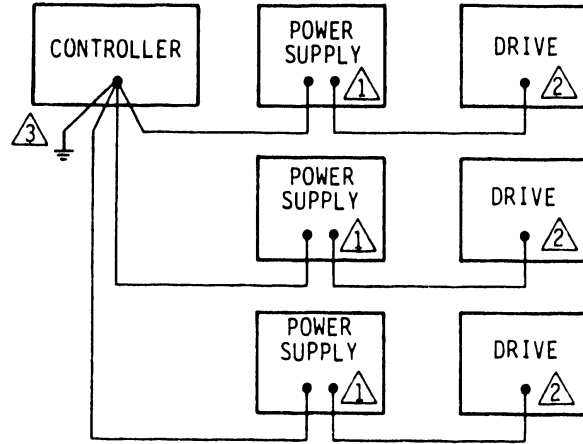
Star Grounding Procedure

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 3-13.

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. Strip back vinyl coating at both ends of each ground strap.
 - c. Crimp and solder terminal lugs to both ends of each ground strap.
2. Referring to figure 3-13, connect ground straps to controller as follows:



DAISY CHAIN CONFIGURATION



STAR CONFIGURATION

NOTES:

- ⚠️ 1 GROUND CONNECTIONS TO POWER SUPPLY USE STUDS MARKED \oplus . 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

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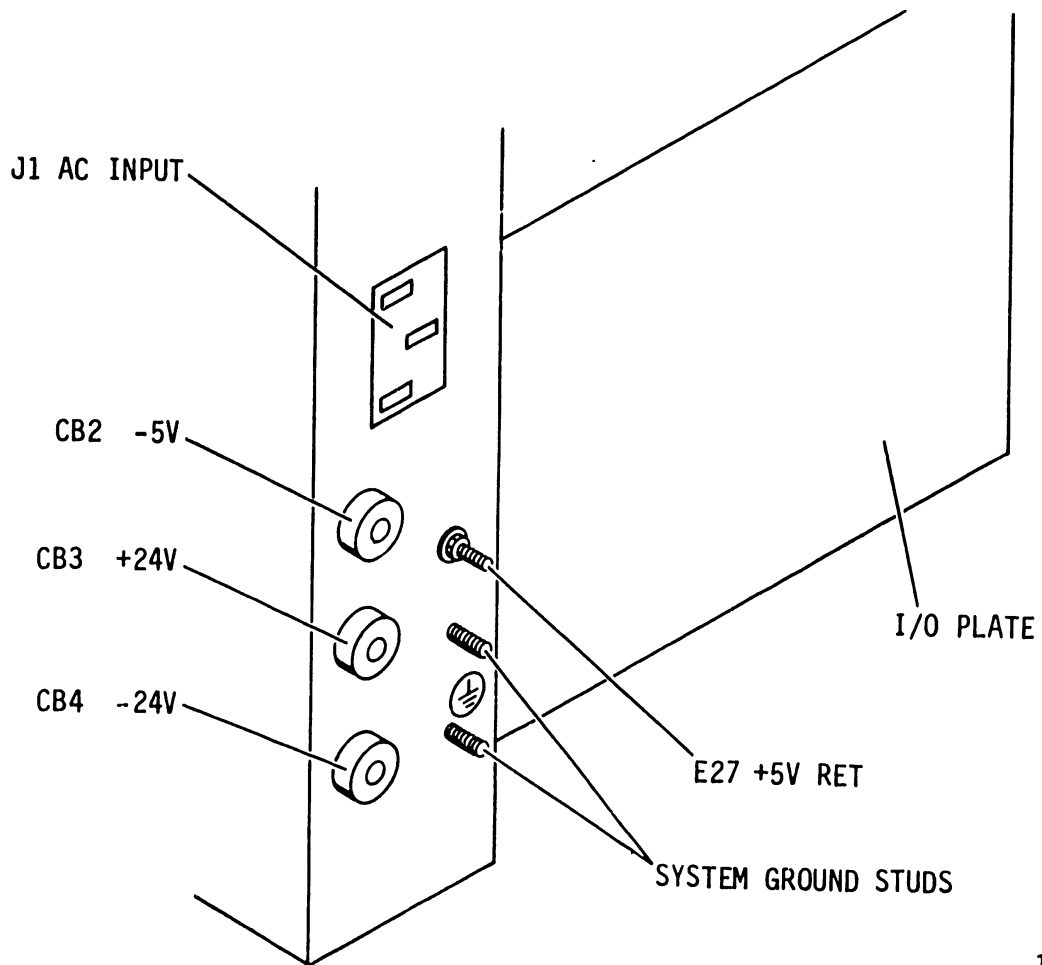
Figure 3-13. System Grounding Diagram

- 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:



11D16B

Figure 3-14. System Grounding (Integral Power Supply)

- 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 3-14.
- b. Place lockwasher on ground stud. Then place terminal lug on stud and secure with nut.

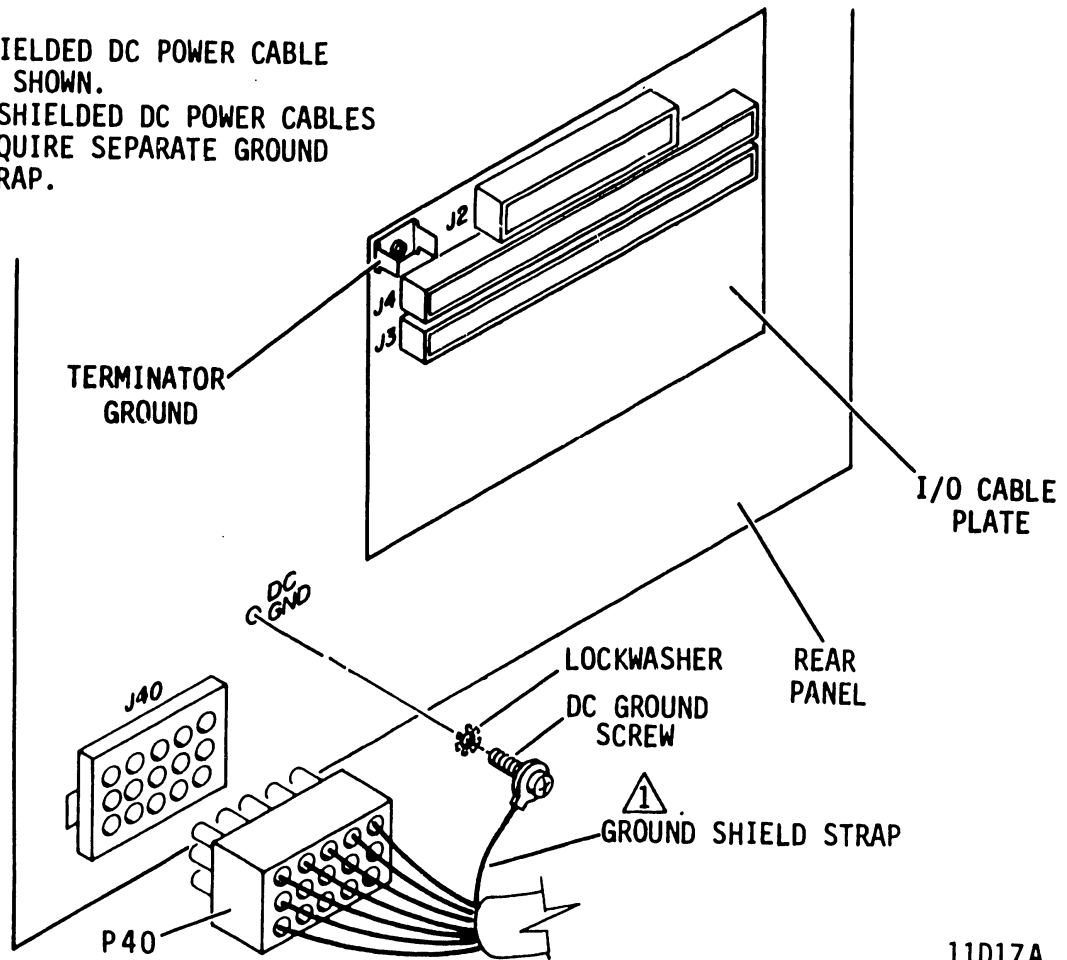
NOTE

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

4. Referring to figure 3-10, attach a ground strap from controller to 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 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 3-13 and 3-15, 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.

NOTES:

- ⚠ SHIELDED DC POWER CABLE IS SHOWN. UNSHIELDED DC POWER CABLES REQUIRE SEPARATE GROUND STRAP.



11D17A

Figure 3-15. Drive Grounding (Remote Power Supply)

- f. Reinstall screw in rear panel of drive.
7. Referring to figures 3-13 and 3-15, 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.

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 second, the second to the third, and so on. See figure 3-13.

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 nearest drive
 - Each drive to next drive in daisy chain
 - b. Strip back vinyl coating at both ends of each ground strap.
 - c. Crimp and solder terminal lugs to both ends of each ground strap.
2. Referring to figure 3-13, 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 3-14.
 - 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 3-10, 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 3-13 and 3-15, 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 3-13 and 3-15, 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

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.

The following procedure provides instructions for mounting the remote power supply behind the drive on the slide assemblies and connecting ac power cable to the supply. Figure 3-9 shows the ac power cable provided with the power supply.

1. Ensure that power supply mounts have been installed on the slides as directed in Mounting Drive in Rack procedure.
2. Position power supply so that mounts and matching slots in bracket are aligned as shown in figure 3-16.
3. Slide power supply toward drive, until locking holes in bracket align with locking holes in mounts.
4. Secure power supply bracket to mounts with 8-32 x 5/16 screws, washers and lockwashers.
5. 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. Figure 3-17 identifies these switches for single and dual channel drives and gives their locations on the circuit boards. It also gives 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 3-17 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. These switches are located on the control board and appear as in figure 3-18.

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 a short, extra sector just before index. Some controllers, however, cannot accommodate the extra sector pulse. With the alternate method, there is no short, extra sector. Descriptions of both methods follow.

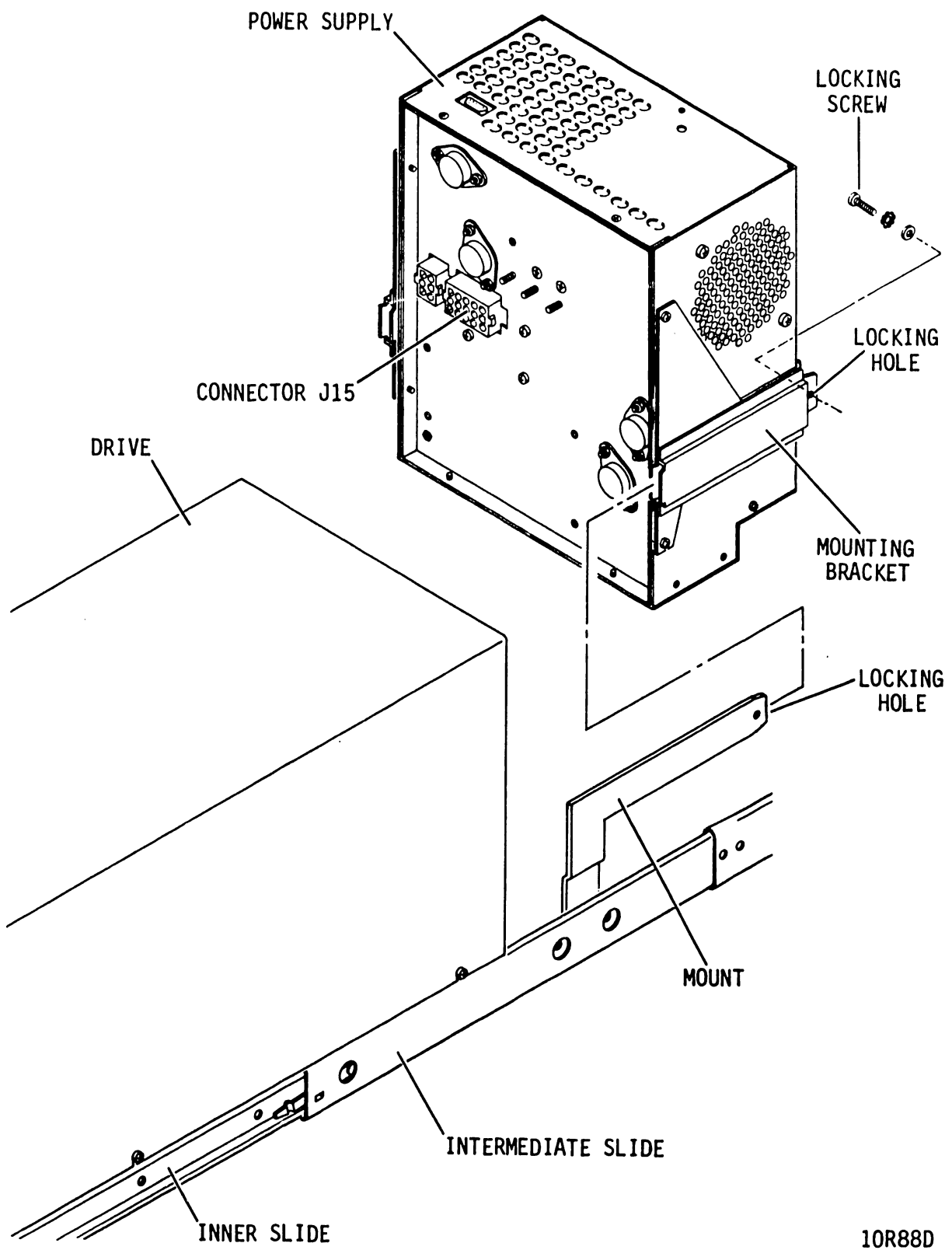
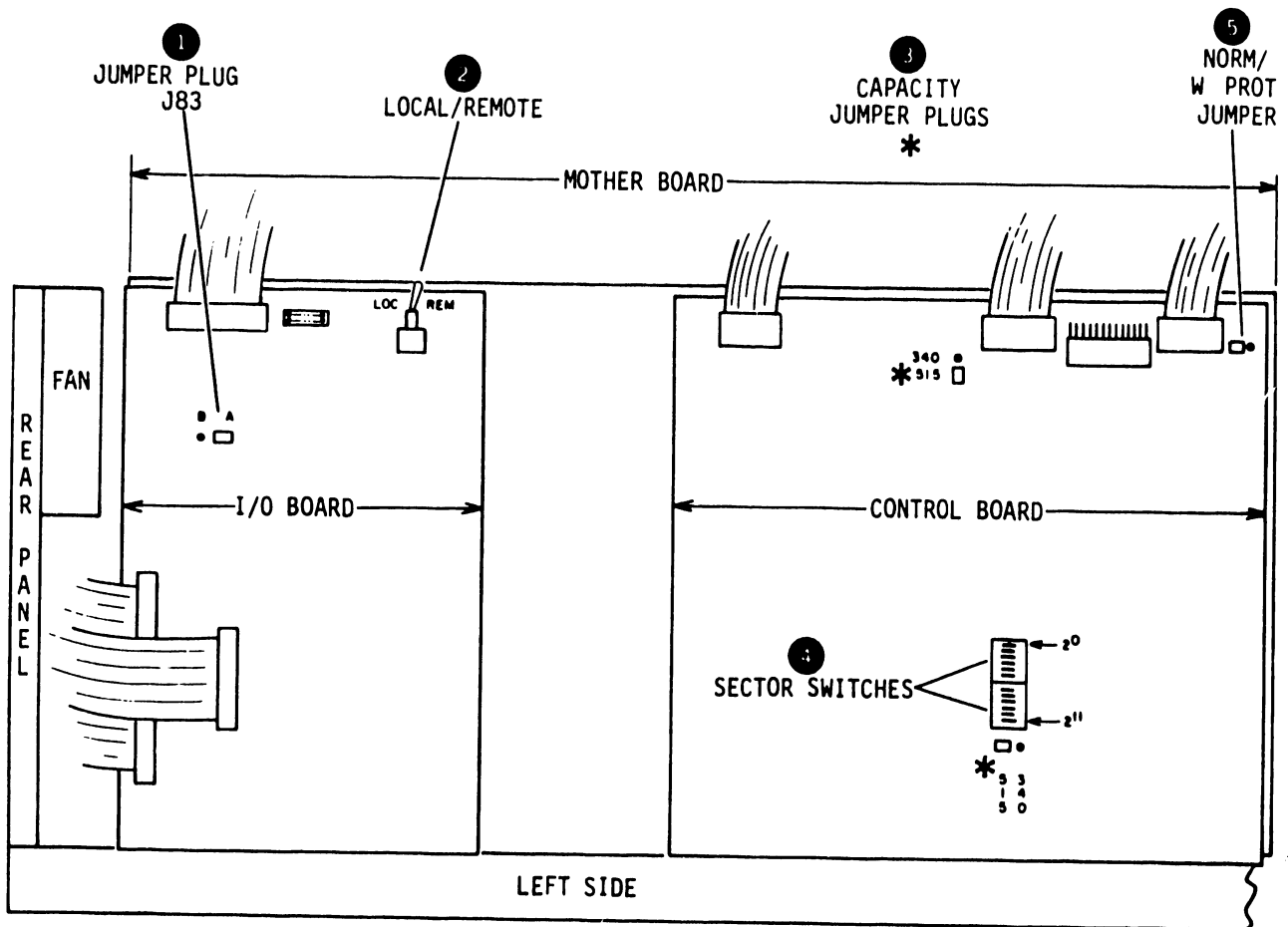


Figure 3-16. Installing Remote Power Supply on Slides

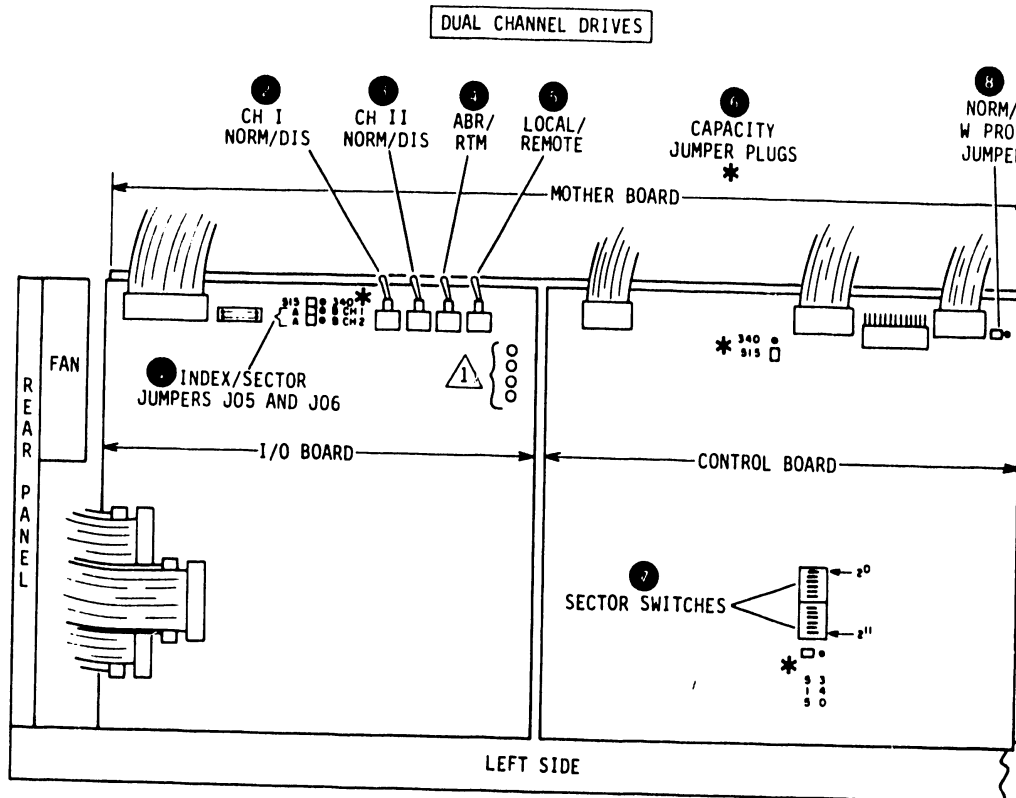
SINGLE CHANNEL DRIVES



INDEX	SWITCH	SETTING
ON I/O BOARD:		
1	INDEX/SECTOR JUMPER PLUGS	LEAVE J05 IN "A" POSITION FOR INDEX/SECTOR IN "A" CABLE OR PLACE IN "B" POSITION FOR INDEX/SECTOR IN "B" CABLE.
2	LOCAL/REMOTE	LOCAL: DRIVE POWER UP INDEPENDENT OF CONTROLLER. REMOTE: DRIVE POWER UP INDEPENDENT OF CONTROLLER.
ON CONTROL BOARD:		
3	DRIVE CAPACITY JUMPER PLUGS 340/515	PRESET IN FACTORY ACCORDING TO CURRENT CONFIGURATION.
4	SECTOR SWITCHES	SEE DISCUSSION ON SETTING CIRCUIT BOARD SWITCHES.
5	NORM/W PROT JUMPER PLUG	NORM

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Figure 3-17. Setting Circuit Board Switches (Sheet 1 of 2)

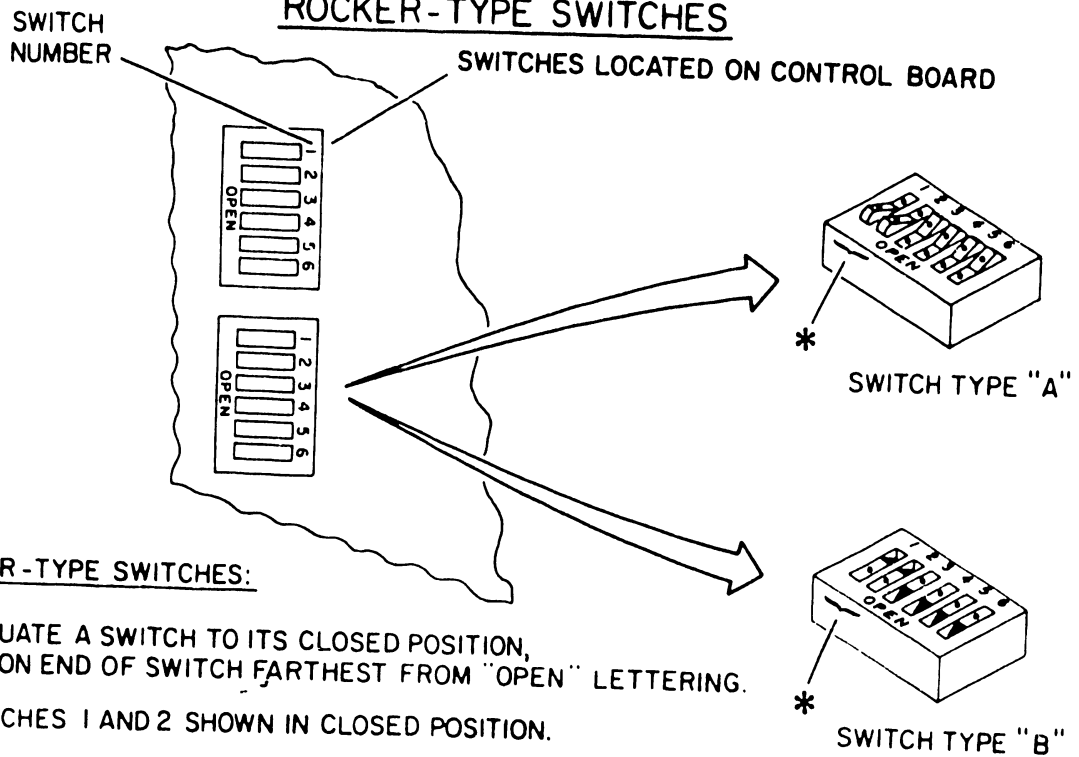


INDEX	SWITCH	SETTING
ON I/O BOARD:		
1	INDEX/SECTOR JUMPER PLUGS	LEAVE J05 AND J06 IN "A" POSITION FOR INDEX/SECTOR IN "A" CABLE OR PLACE IN "B" POSITION FOR INDEX/SECTOR IN "B" CABLE.
2	CH I NORM/DIS	NORM
3	CH II NORM/DIS	NORM
4	ABR/RTM	ABR (ABSOLUTE RESERVE): DRIVE REMAINS RESERVED UNTIL IT RECEIVES RELEASE OR PRIORITY SELECT COMMAND. RTM (RESERVE TIMEOUT): DRIVE IS RELEASED FROM RESERVED CONDITION APPROX. 500 MS AFTER BEING SELECTED.
5	LOCAL/REMOTE	LOCAL: DRIVE POWER UP INDEPENDENT OF CONTROLLER. REMOTE: DRIVE POWER UP DEPENDENT OF CONTROLLER.
ON CONTROL BOARD:		
6	DRIVE CAPACITY JUMPER PLUGS 340/515	PRESET IN FACTORY ACCORDING TO CURRENT CONFIGURATION.
7	SECTOR SWITCHES	SEE DISCUSSION ON SETTING CIRCUIT BOARD SWITCHES.
8	NORM/W PROT JUMPER PLUG	NORM
NOTES:		
1	CH I AND CH II SEL/RES LEADS.	

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Figure 3-17. Setting Circuit Board Switches (Sheet 2)

ROCKER-TYPE SWITCHES
 SWITCHES LOCATED ON CONTROL BOARD

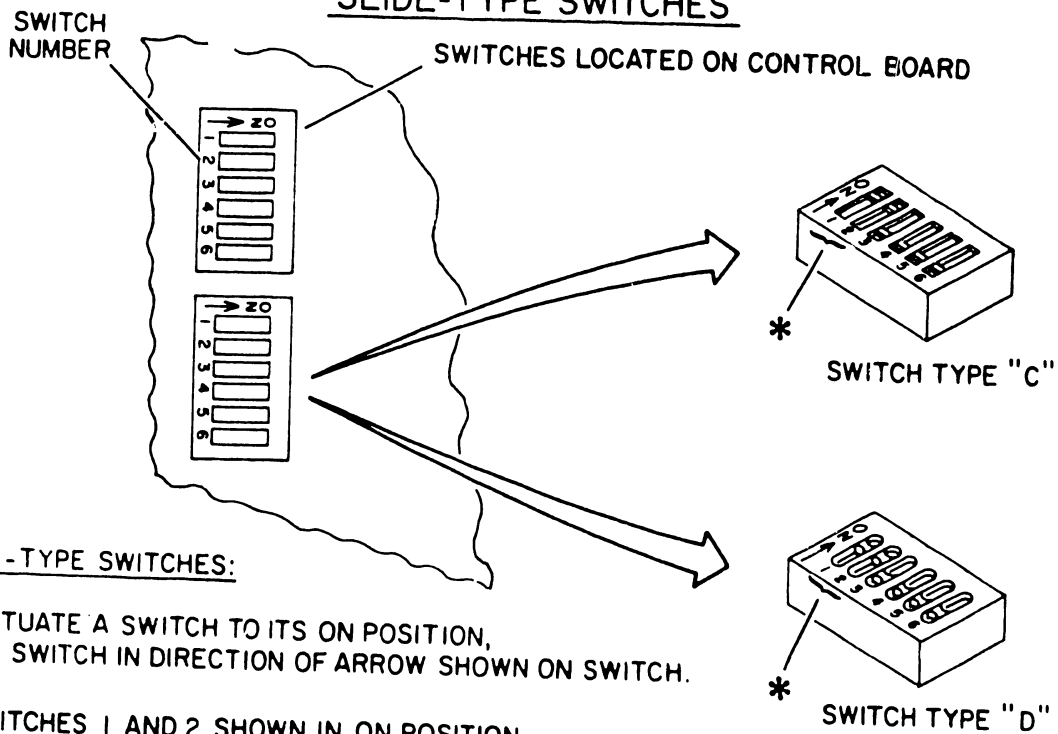


ROCKER-TYPE SWITCHES:

TO ACTUATE A SWITCH TO ITS CLOSED POSITION, PRESS ON END OF SWITCH FARTHEST FROM "OPEN" LETTERING.

* SWITCHES 1 AND 2 SHOWN IN CLOSED POSITION.

SLIDE-TYPE SWITCHES
 SWITCHES LOCATED ON CONTROL BOARD



SLIDE-TYPE SWITCHES:

TO ACTUATE A SWITCH TO ITS ON POSITION, SLIDE SWITCH IN DIRECTION OF ARROW SHOWN ON SWITCH.

* SWITCHES 1 AND 2 SHOWN IN ON POSITION.

11D23A

Figure 3-18. Miniature Switches

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 3-5. 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 3-18 for an illustration of the switch positions.

TABLE 3-5. 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 3-5. 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 3-5. 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 3-5. 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 3-5. 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 3-5. 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 3-5 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.

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:

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

NOTE

Ignore any remainder in the calculation. In most drives 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:

<u>Switch No.</u>	<u>Binary Value</u>	<u>Decimal Value</u>
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 "short" sector will be present just before index.

Alternate Method for Sector Switch Settings

Use the following formula to determine sector switch settings if the subsystem cannot accept a short, extra sector before index.

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 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.

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. Remove drive top cover and set LOCAL/REMOTE switch to LOCAL position.
3. Set circuit breaker CBI at rear of power supply in 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. Power down drive.
6. Set LOCAL/REMOTE switch to REMOTE position if remote operation is desired and install top cover.
7. Return drive to normal operating position in equipment rack.
8. Drive is now ready for online operation.

SECTION

4

PARTS

DATA

4. PARTS DATA

Introduction.....	4-1
Field Replaceable Parts List.....	4-1
Manufacturer's Recommended Spare Parts.....	4-2
Accessories.....	4-2

INTRODUCTION

This section contains listings of field replaceable parts, manufacturer's recommended spare parts, and accessories.

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

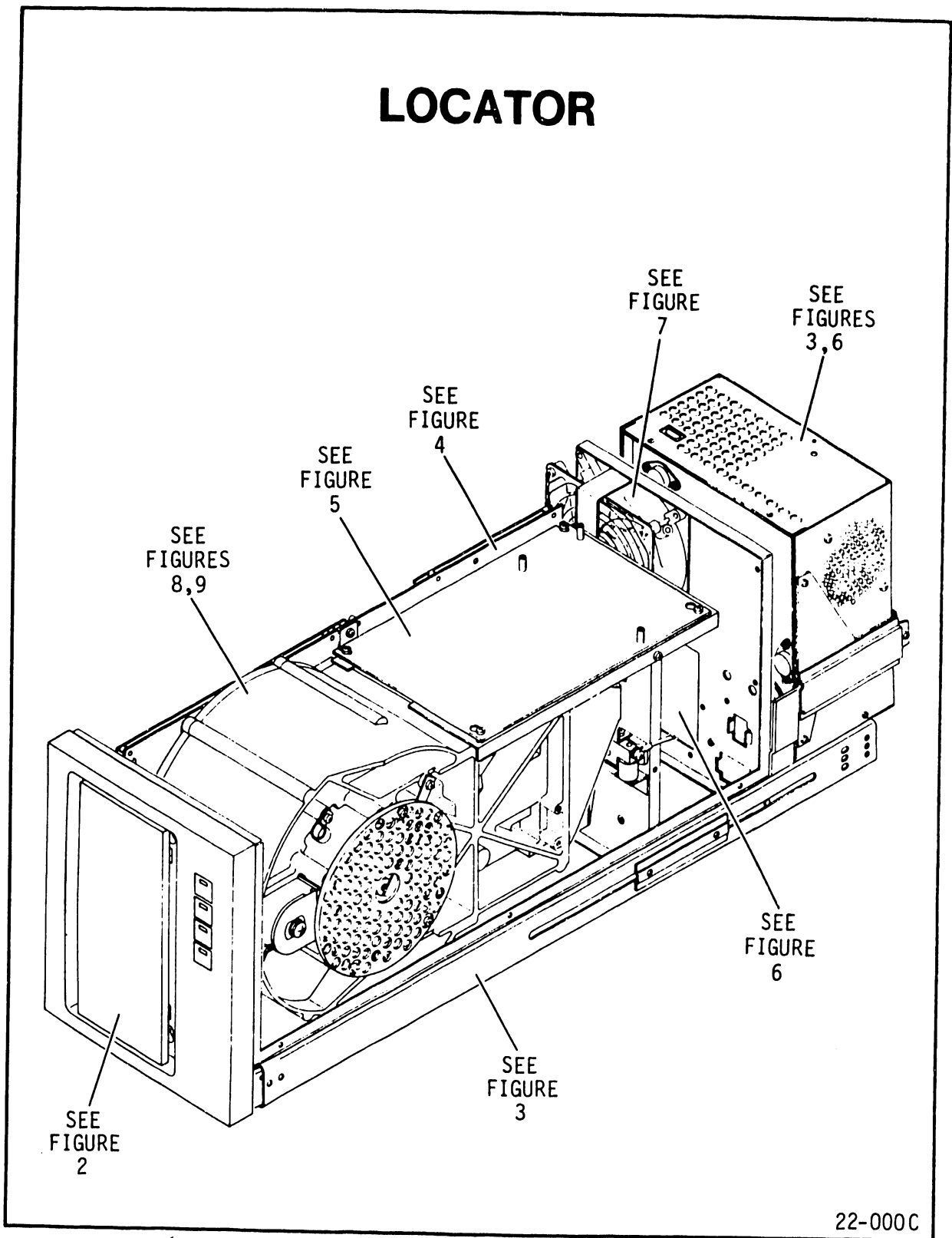


Figure 4-1.

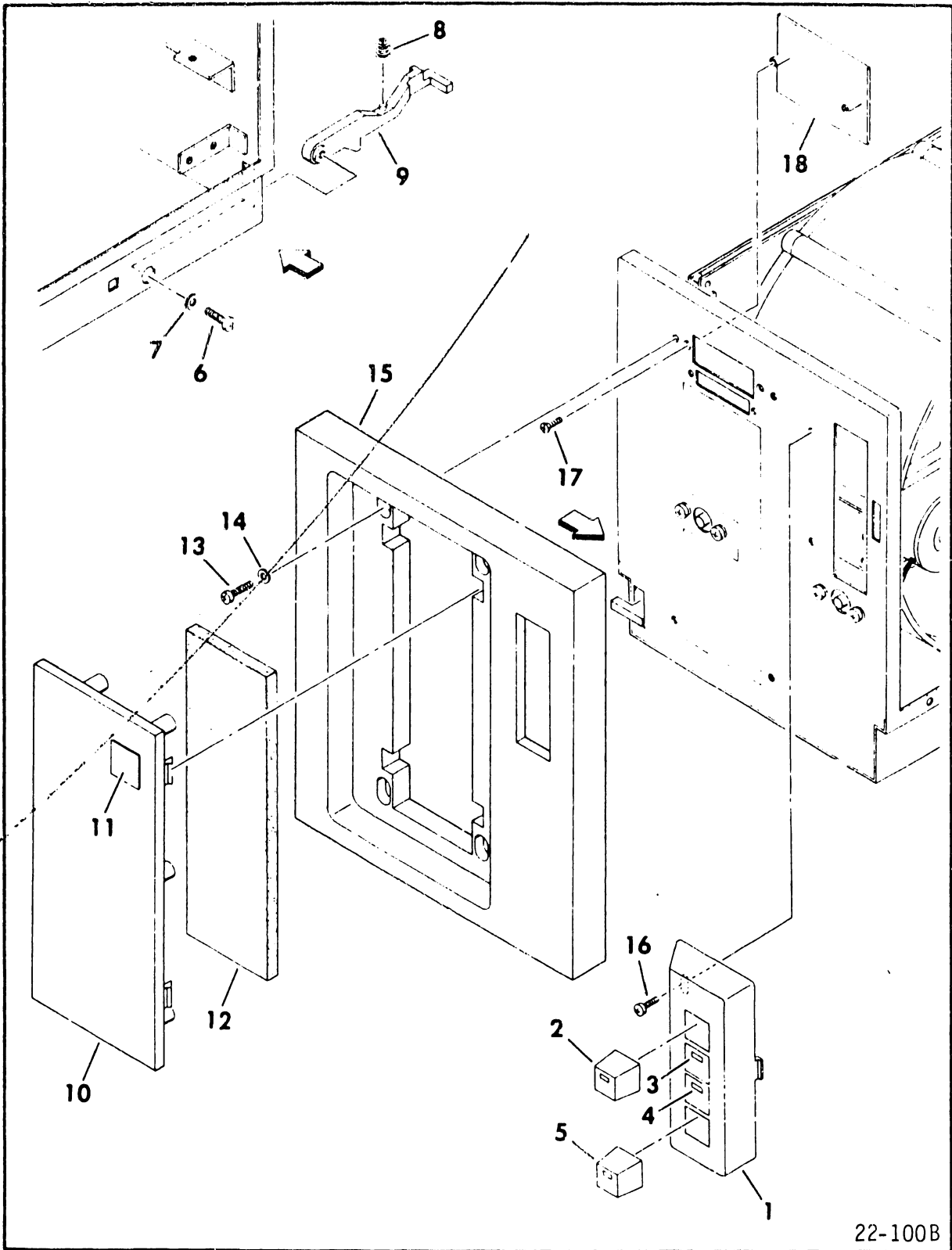


Figure 4-2.

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Spare	CONTROL PANEL ASSEMBLY	Includes Operator Panel, Logic Plugs 0 thru 7, Lenses, and Bracket
2	94398817	LOGIC PLUG "0"	See Note 1
2	94398818	LOGIC PLUG "1"	See Note 1
2	94398819	LOGIC PLUG "2"	See Note 1
2	94398820	LOGIC PLUG "3"	See Note 1
2	94398821	LOGIC PLUG "4"	See Note 1
2	94398822	LOGIC PLUG "5"	See Note 1
2	94398823	LOGIC PLUG "6"	See Note 1
2	94398824	LOGIC PLUG "7"	See Note 1
2	15181751	LOGIC PLUG "0"	See Note 2
2	15181752	LOGIC PLUG "1"	See Note 2
2	15181753	LOGIC PLUG "2"	See Note 2
2	15181754	LOGIC PLUG "3"	See Note 2
2	15181755	LOGIC PLUG "4"	See Note 2
2	15181756	LOGIC PLUG "5"	See Note 2
2	15181757	LOGIC PLUG "6"	See Note 2
2	15181758	LOGIC PLUG "7"	See Note 2
	Spare	LOGIC PLUG KIT	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, "WRITE PROTECT"	See Note 2
6	10127120	SCREW, PHH, 8-32 x 1/4	See Note 3
7	10125606	WASHER, #8	See Note 3
8	94205567	SPRING	See Note 3
9	72857411	LATCH, Cabinet	See Note 3

-Continued-

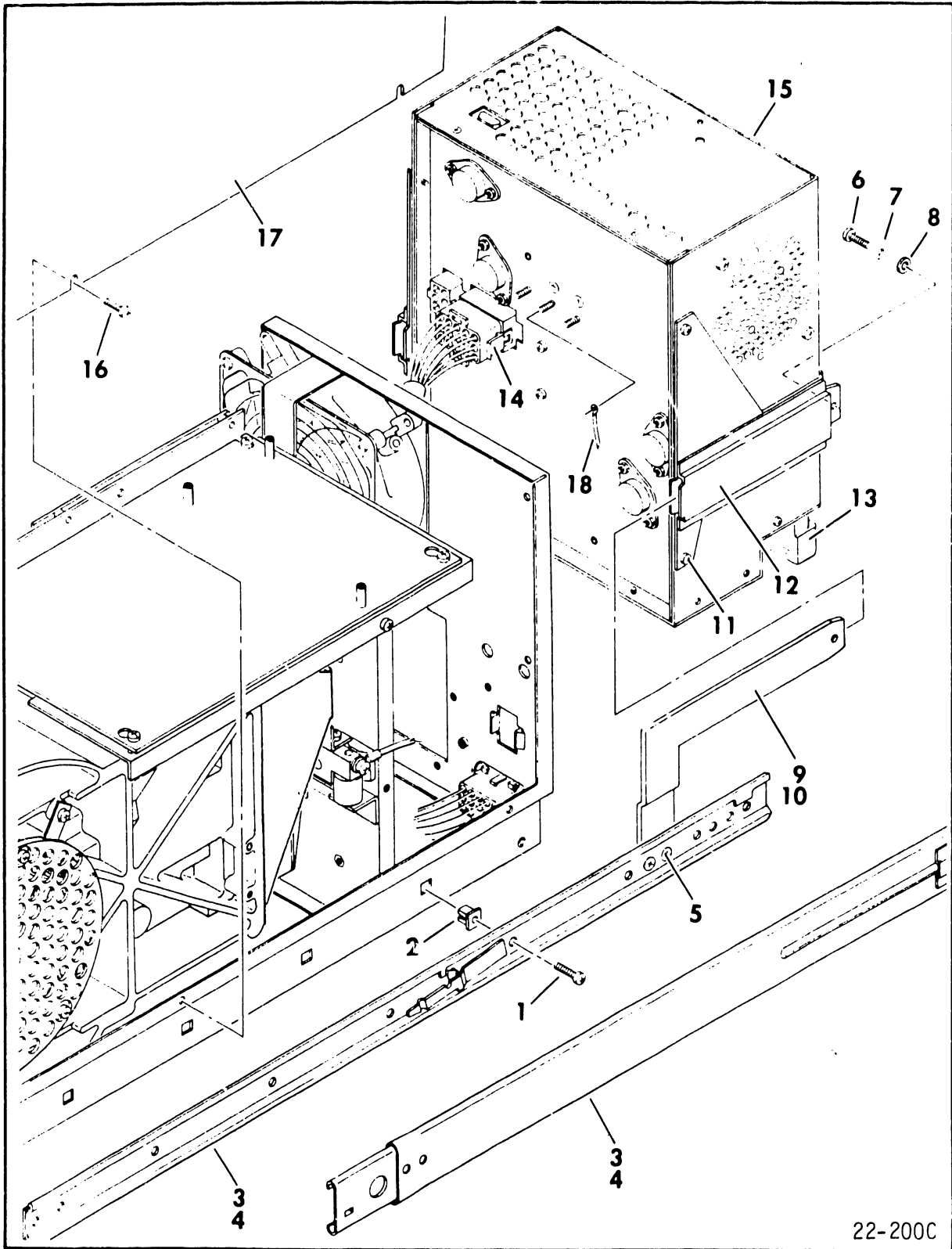
- Note 1: Used on Type 1 Control Panel, which has logic plug without indicator light. Type 1 Control Panels are on early model drives only.
- Note 2: Used on Type 2 Control Panel, which has logic plug with indicator light. Type 2 Control Panels are on newer model drives, and are used for replacements for Type 1 Control Panels.
- Note 3: Not supplied with PA5G1B/D/G, PA5G2B/D/E/G, PA5N1B/C, PA5N2B/C drives.
- Note 4: All available logic plugs (0 thru 7) are listed. Actual plugs supplied with each drive is determined by customer requirements.

INDEX NO	PART NO	PART DESCRIPTION	NOTE
-------------	------------	------------------	------

-Figure 4-2 Continued-

10	Optional	INSERT, Front Panel	
11	Optional	EMBLEM, Product Ident	
12	Spare	FILTER, Primary	See Note 1
13	10127114	SCREW, PHH, 6-32 x 1/2	
14	94047001	WASHER, Special	
15	Optional	PANEL, Front	
16	10127111	SCREW, PHH, 6-32 x 1/4	
17	10125711	SCREW, PHH, 6-32 x 3/16	
18	Spare	_UQX (FAULT DISPLAY) BOARD	

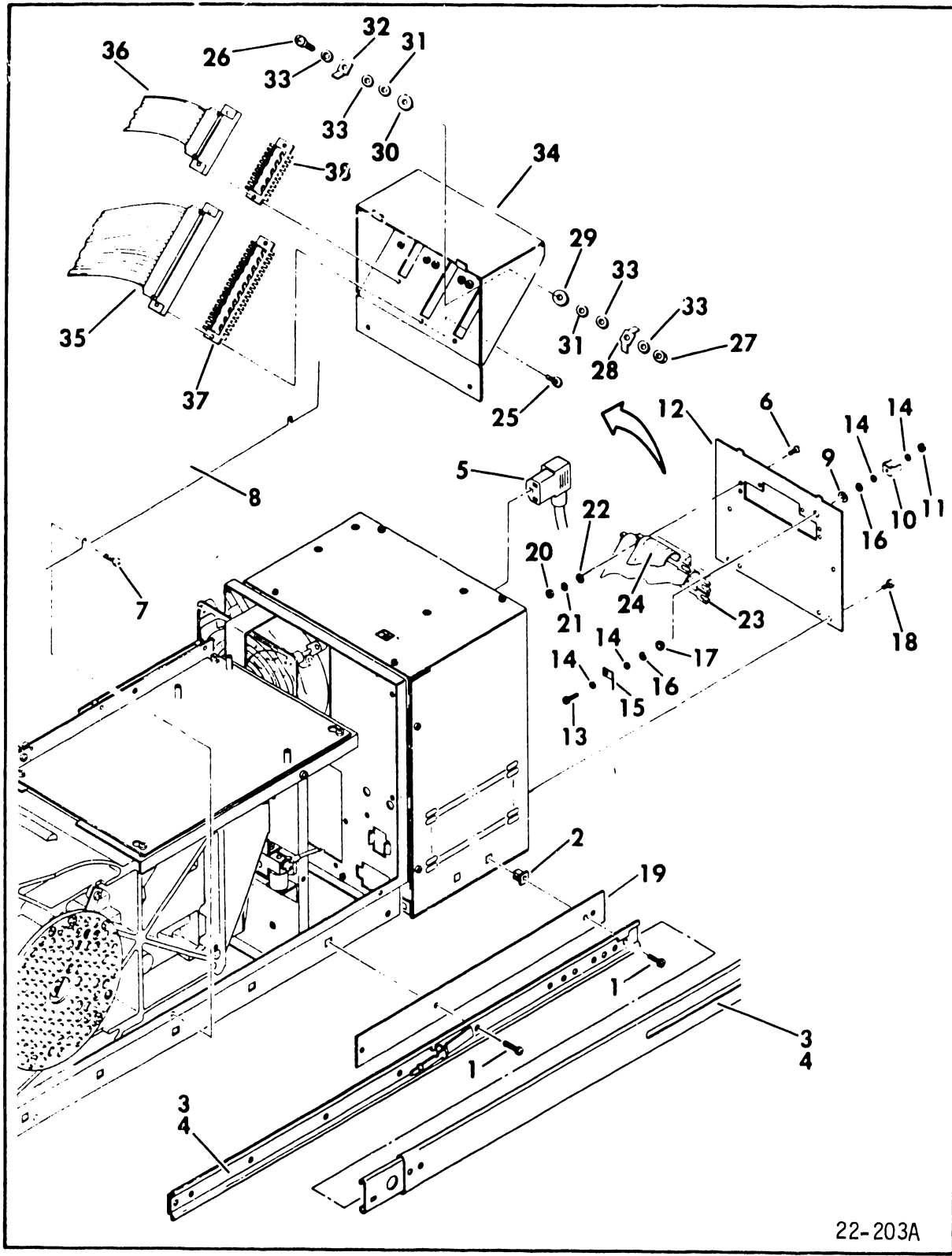
Note 1: Not supplied with PA5N1C drives.



22-200C

Figure 4-3 (Drives With Remote Power Supply).

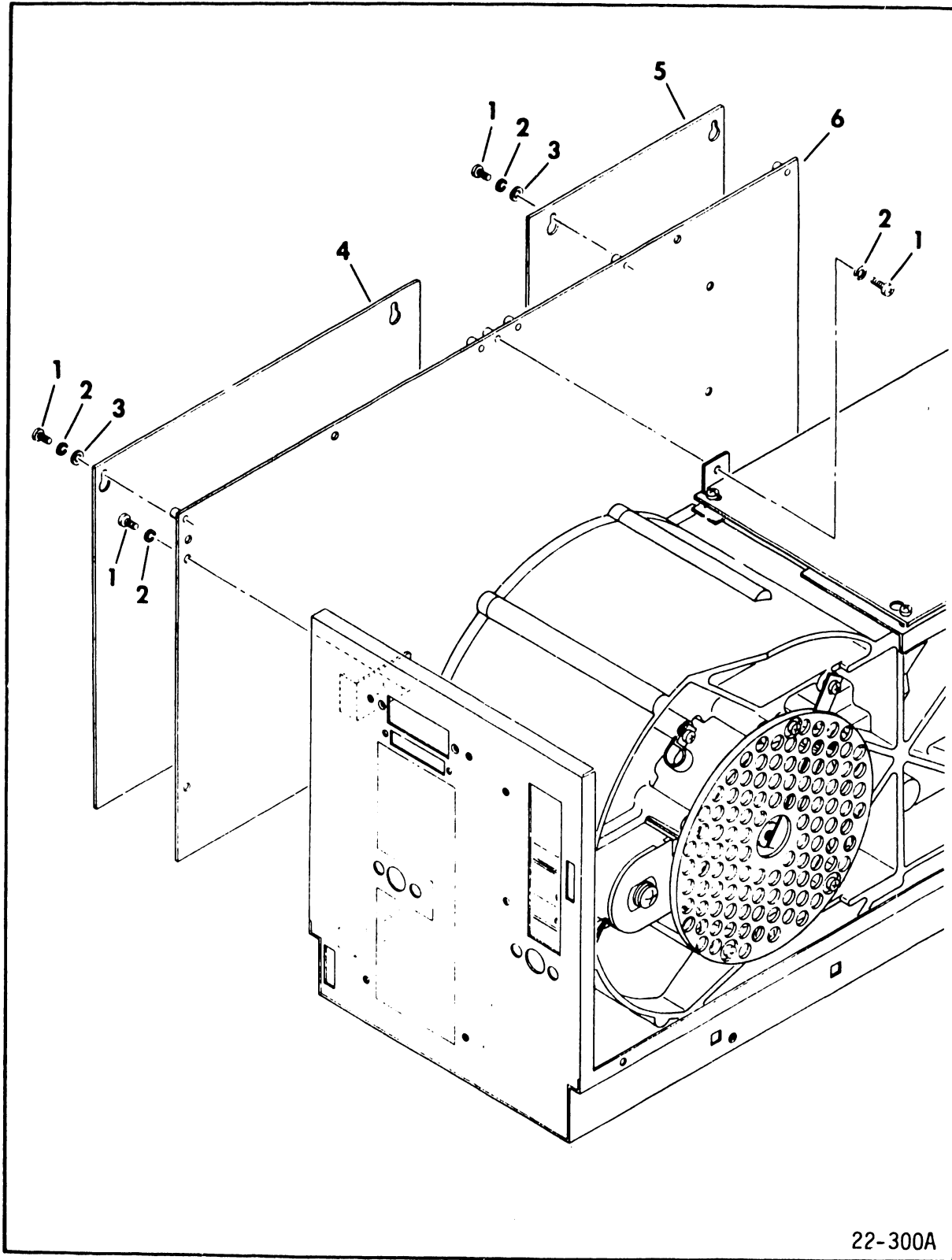
INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Optional	SCREW, PHH, 8-16 x 1/2	
2	72854290	NUT, Square	
3	Optional	SLIDE ASSEMBLY, LH	
4	Optional	SLIDE ASSEMBLY, RH	
5	Optional	SCREW, PHH, 8-32 x 1/4	
6	Optional	SCREW, PHH, 8-32 x 5/16	
7	Optional	LOCKWASHER, #8	
8	Optional	WASHER, #8	
9	Optional	MOUNT, LH	
10	Optional	MOUNT, RH	
11	Optional	SCREW, PHH, 6-32 x 3/8	
12	Optional	BRACKET, Mounting	
13	Optional/ Spare	AC POWER CABLE (P01)	
14	Optional/ Spare	DC POWER CABLE (P15/P40)	
15	Optional/ Spare	POWER SUPPLY, Remote	
16	10127111	SCREW, PHH, 6-32 x 1/4	
17	72852546	COVER	
18	Optional	GROUND CABLE	



22-203A

Figure 4-3 (Drives With Integral Power Supply).

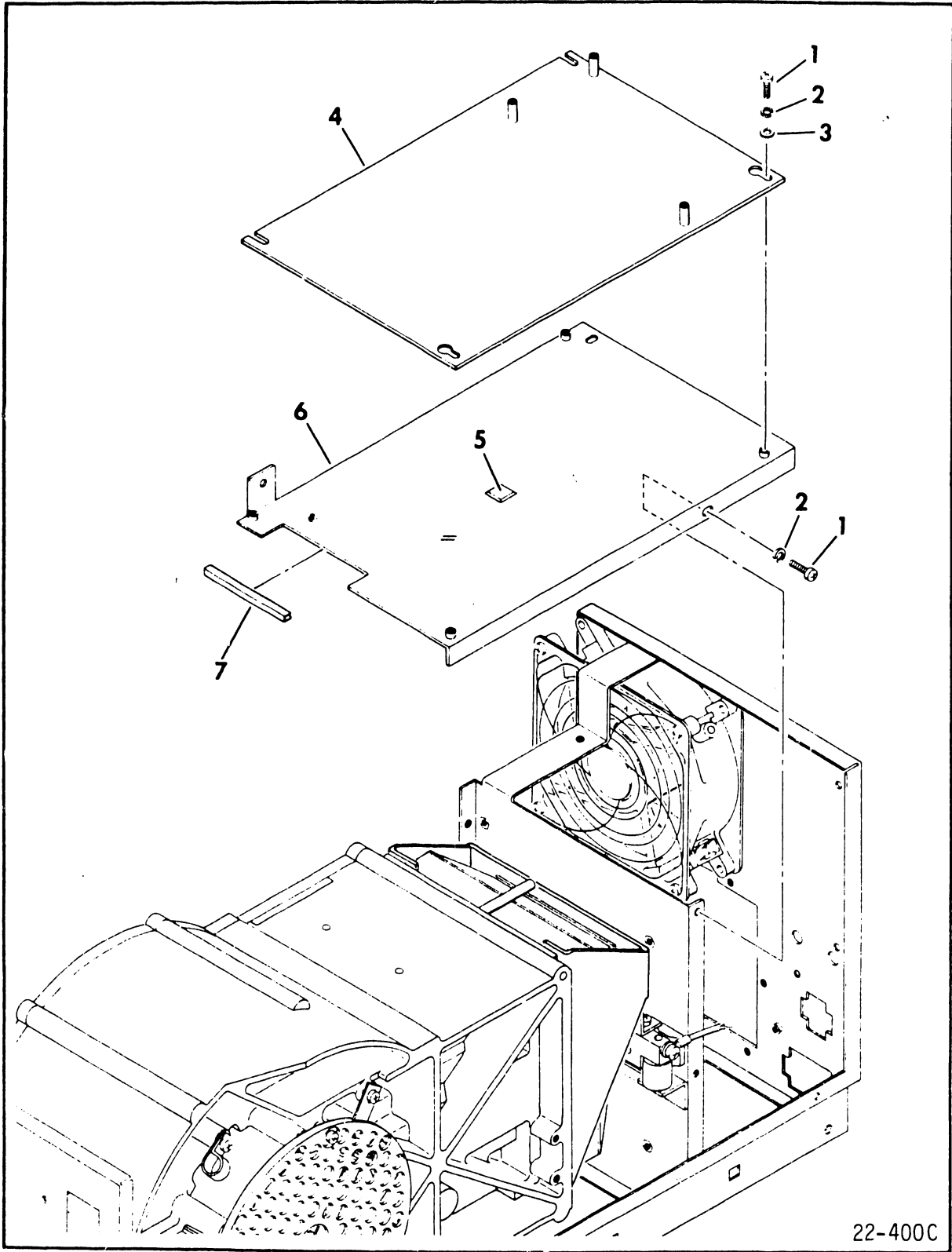
INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Optional	SCREW, PHH, 8-16 x 1/2	
2	72854290	NUT, Square	
3	Optional	SLIDE ASSEMBLY, LH	
4	Optional	SLIDE ASSEMBLY, RH	
5	Optional/ Spare	AC POWER CABLE (P01)	
6	10127105	SCREW, PHH, 4-40 x 1/2	See Note 1
7	10127111	SCREW, PHH, 6-32 x 1/4	
8	72852546	COVER	
	95170000	I/O PLATE ASSEMBLY	See Note 2
	95170002	I/O PLATE ASSEMBLY	See Note 3
9	95797301	WASHER, Phenolic	
10	94274116	TERMINAL	
11	95510030	NUT, Hex, 6-32	
12	72855611	PLATE, I/O	See Note 2
12	72855613	PLATE, I/O	See Note 3
13	92751168	SCREW, PHH, 6-32 x 3/4	
14	95524401	LOCKWASHER, #6	
15	94274104	TERMINAL	
16	94047078	WASHER, Special	
17	95643808	WASHER, Insulated	
18	17901508	SCREW, PHH, 6-32 x 1/4	
19	93265870	BRACKET, Shipping	
20	10125103	NUT, Hex, 4-40	See Note 1
21	10125801	LOCKWASHER, #4	See Note 1
22	10125603	WASHER, #4	See Note 1
23	Spare	"A" CABLE, Internal	
24	Spare	"B" CABLE, Internal	
	93055600	I/O PLATE ASSEMBLY	See Note 4
25	10127104	SCREW, PHH, 4-40 x 3/8	
26	92751164	SCREW, PHH, 6-32 x 1/2	
27	95510030	NUT, Hex, 6-32	
28	94274116	TERMINAL	
29	95797301	WASHER, Phenolic	
30	95643808	WASHER, Insulated	
31	94047078	WASHER, Special	
32	94274104	TERMINAL	
33	95524401	LOCKWASHER, #6	
34	95752260	PLATE, I/O	
35	Spare	"A" CABLE, Internal	
36	Spare	"B" CABLE, Internal	
37	15183357	GROUND PLANE	
38	15183358	GROUND PLANE	
	Note 1:	Not used on PA5N1C drives	
	Note 2:	Used on single channel drives (except PA5N1C) only.	
	Note 3:	Used on dual channel drives only.	
	Note 4:	Items 25 thru 38 are used on PA5N1C drives only.	



22-300A

Figure 4-4.

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	10127111	SCREW, PHH, 6-32 x 1/4	
2	10125803	LOCKWASHER, #6	
3	94047001	WASHER, Special	
4	Spare	_VCX (CONTROL) BOARD	
5	Spare	_SYX (I/O) BOARD	Single Ch Drives
5	Spare	_TQX (I/O) BOARD	Dual Ch Drives
6	Spare	_SVX (MOTHER) BOARD	



22-400C

Figure 4-5.

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	10127111	SCREW, PHH, 6-32 x 1/4	
2	10125803	LOCKWASHER, #6	
3	94047001	WASHER, Special	
4	Spare	_UGX (R/W) BOARD	340 MB Drives
4	Spare	_VHX/_SUX (R/W) BOARD	515 MB Drives
5	51805802	BUMPER	
6	72857460	BRACKET, R/W Board	
7	94060003	CHANNEL, Rubber	

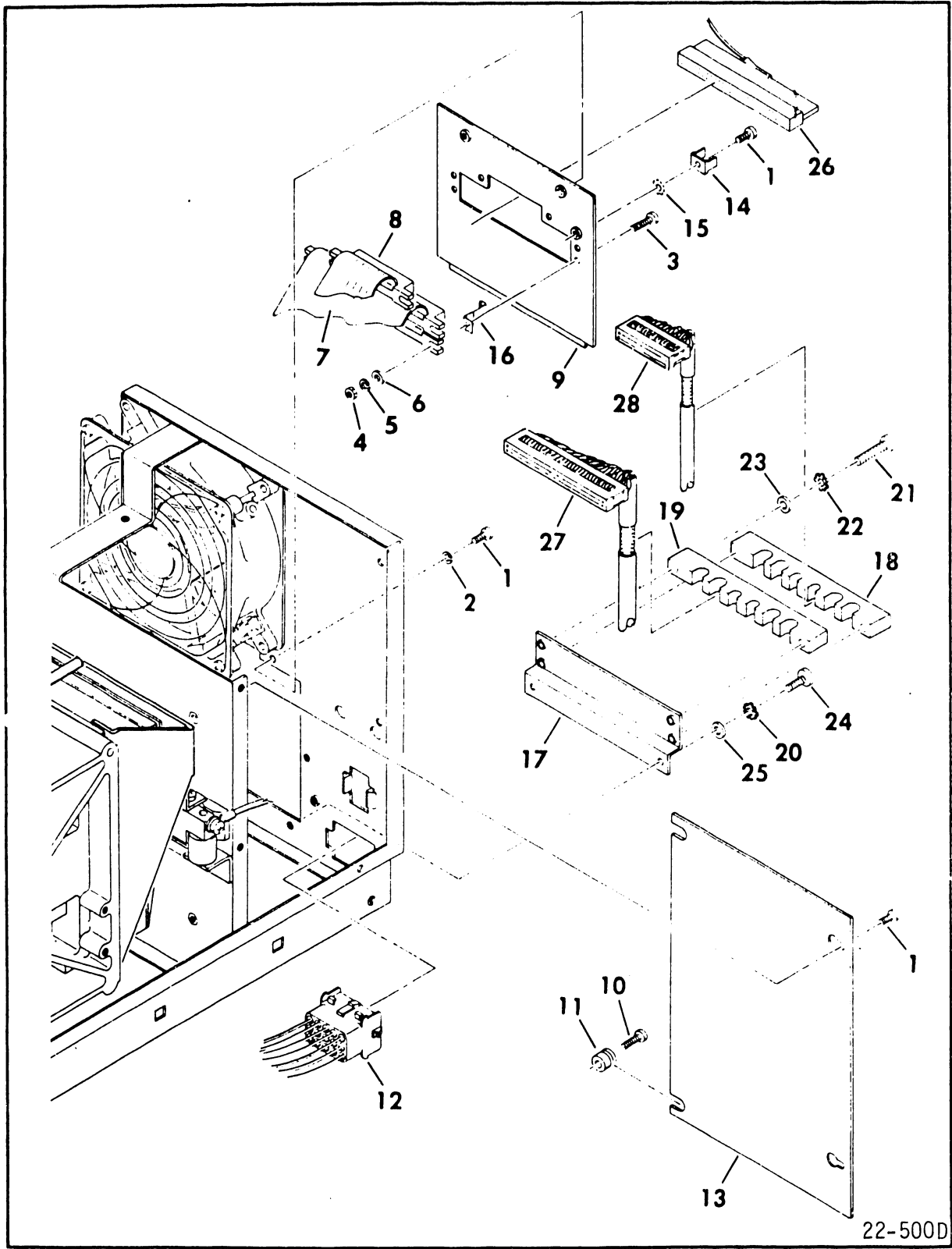


Figure 4-6 (Drives With Remote Power Supply).

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	10127111	SCREW, PHH, 6-32 x 1/4	
2	10125803	LOCKWASHER, #6	
3	10127105	SCREW, PHH, 4-40 x 1/2	
4	10125103	NUT, Hex, 4-40	
5	10125801	LOCKWASHER, #4	
6	10125603	WASHER, #4	
7	Spare	"A" CABLE, Internal	
8	Spare	"B" CABLE, Internal	
9	72856550	I/O PLATE	Single Ch Drives
9	72856551	I/O PLATE	Dual Ch Drives
10	10127114	SCREW, PHH, 6-32 x 1/2	
11	92723601	SPACER	
12	80547300	DC POWER CABLE (P35/J40)	
13	Spare	_SWX (MOT SPD & PWR AMP) BOARD	
14	94274116	TERMINAL	
15	10126401	LOCKWASHER, #6	
16	92010915	CLIP, Connector	
	92353801	I/O CABLE CLAMP KIT	
17	72851240	BRACKET, Cable	
18	72851231	CLAMP, Strain Relief	
19	72851230	CLAMP, Grounding	
20	10126401	LOCKWASHER, #6	
21	10127146	SCREW, PHH, 10-32 x 7/8	
22	10126403	LOCKWASHER, #10	
23	10125607	WASHER, #10	
24	17901510	SCREW, PHH, 6-32 x 1/2	
25	10125605	WASHER, #6	
	93920481	CLAMP (for flat cables)	
26	Optional	TERMINATOR	
27	Optional	"A" CABLE, External	
28	Optional	"B" CABLE, External	

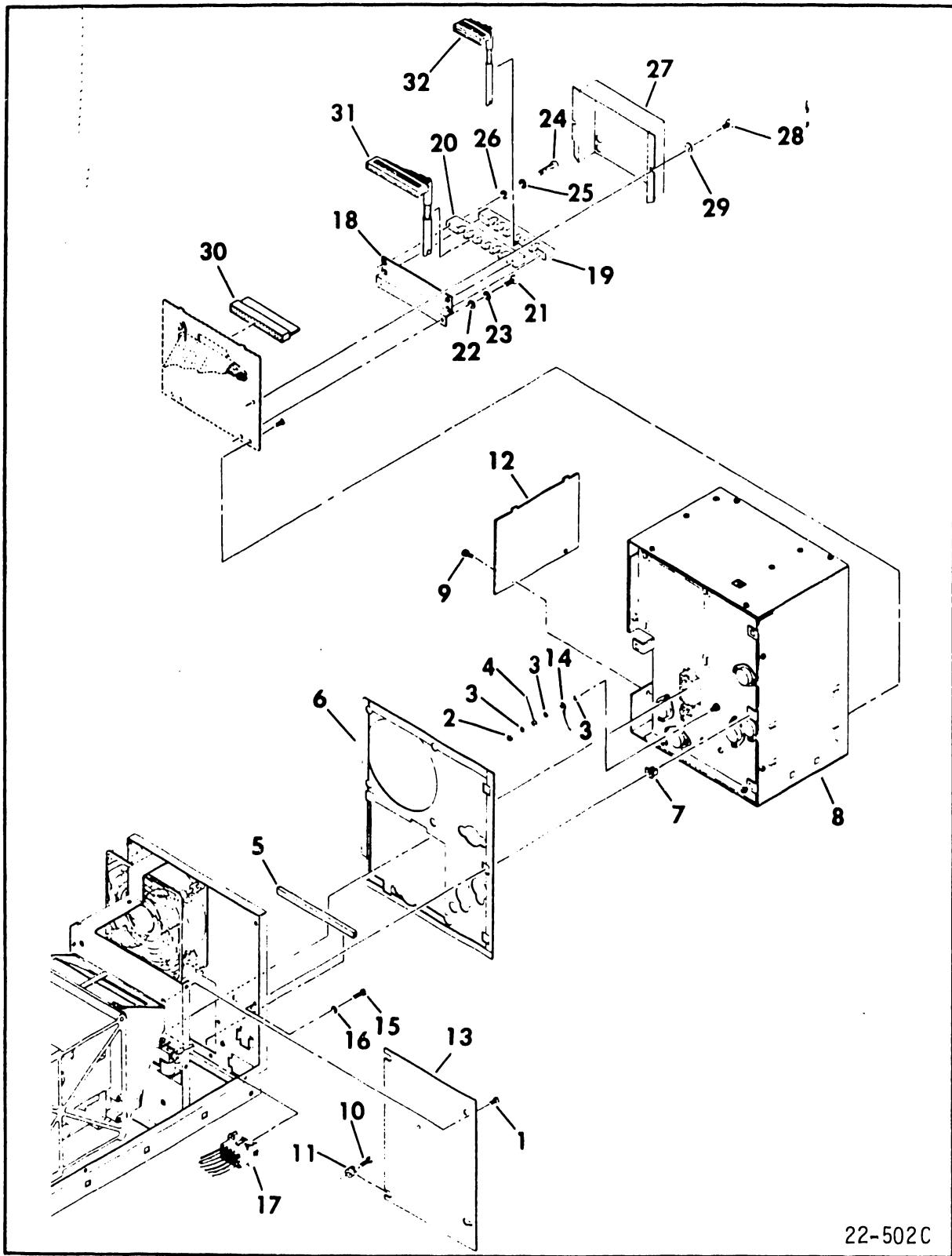
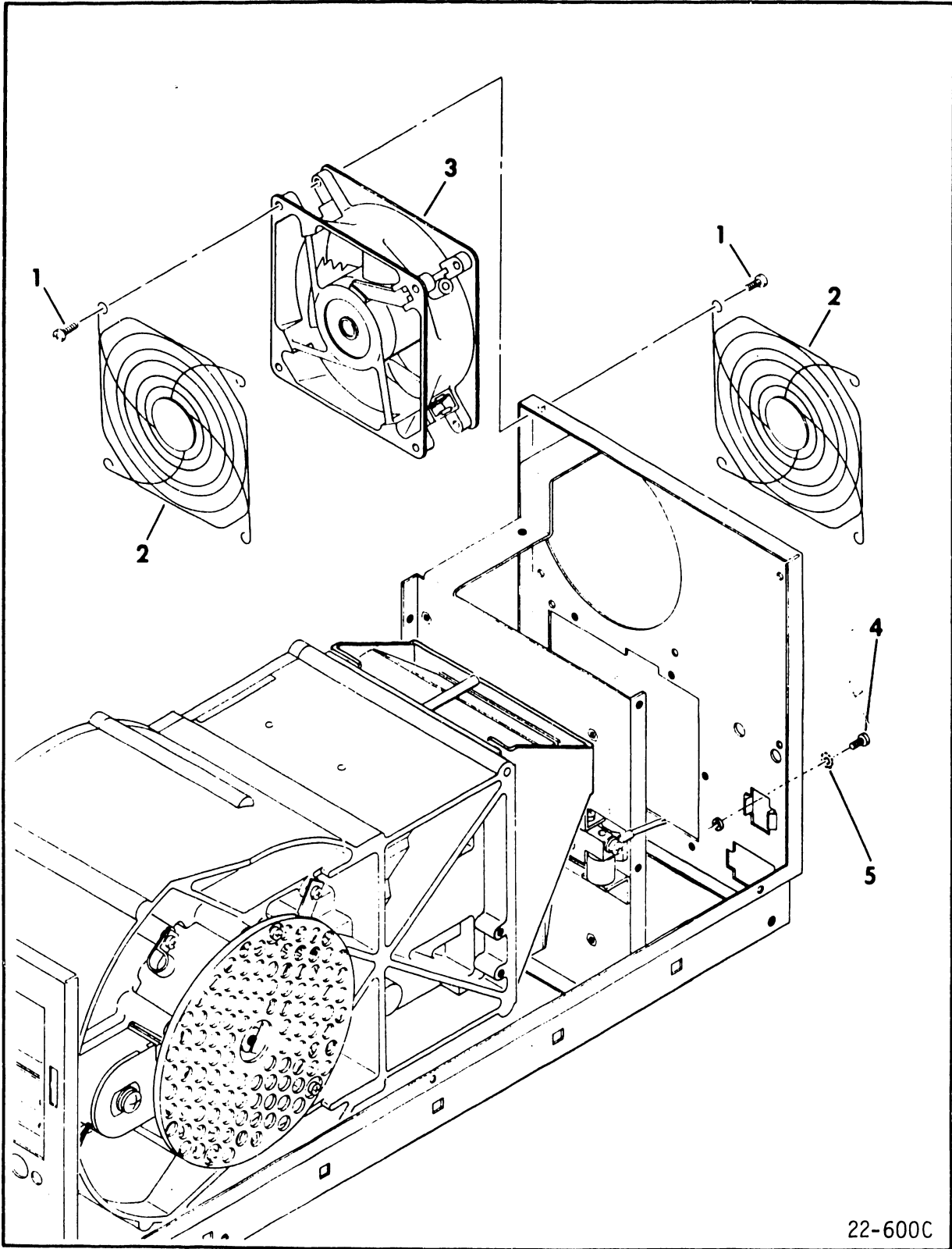


Figure 4-6 (Drives With Integral Power Supply).

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	10127111	SCREW, PHH, 6-32 x 1/4	
2	10125108	NUT, Hex, 10-32	
3	10126403	LOCKWASHER, #10	
4	76376380	GROUND CABLE	See Note 1
4	76376382	GROUND CABLE	See Note 2
5	94060003	CHANNEL, Rubber	
6	92475850	GASKET, RF	
7	72854290	NUT, Square	
8	Spare	POWER SUPPLY, Integral	
9	17901508	SCREW, PHH, 6-32 x 1/4	
10	10127114	SCREW, PHH, 6-32 x 1/2	
11	92723601	SPACER	
12	76376370	PLATE, Cover	
13	Spare	_SWX (MOT SPD & PWR AMP) BOARD	
14	94281477	GROUND CABLE	
15	94375825	SCREW, PHH, 8-16 x 1/2	
16	10125607	WASHER, #10	
17	Spare	DC POWER CABLE (P15/P35)	
	92353801	I/O CABLE CLAMP KIT	See Note 1
18	72851240	BRACKET, Cable	
19	72851231	CLAMP, Strain Relief	
20	72851230	CLAMP, Grounding	
21	17901510	SCREW, PHH, 6-32 x 1/2	
22	10125605	WASHER, #6	
23	10126401	LOCKWASHER, #6	
24	10127146	SCREW, PHH, 10-32 x 7/8	
25	10126403	LOCKWASHER, #10	
26	10125607	WASHER, #10	
	93920481	CLAMP (for flat cables)	
27	92070380	SHIELD, I/O	
28	10127113	SCREW, PHH, 6-32 x 3/8	
29	10125605	WASHER, #6	
30	Optional	TERMINATOR	
31	Optional	"A" CABLE, I/O	
32	Optional	"B" CABLE, I/O	

Note 1: Used on all drives except PA5N1C.

Note 2: Used on PA5N1C drive only.



22-600C

Figure 4-7.

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	17901518	SCREW, PHH, 8-32 x 5/8	
2	94375408	GUARD, Finger	
3	Spare	FAN ASSEMBLY	
4	10127141	SCREW, PHH, 10-32 x 5/16	
5	10126403	LOCKWASHER, #10	

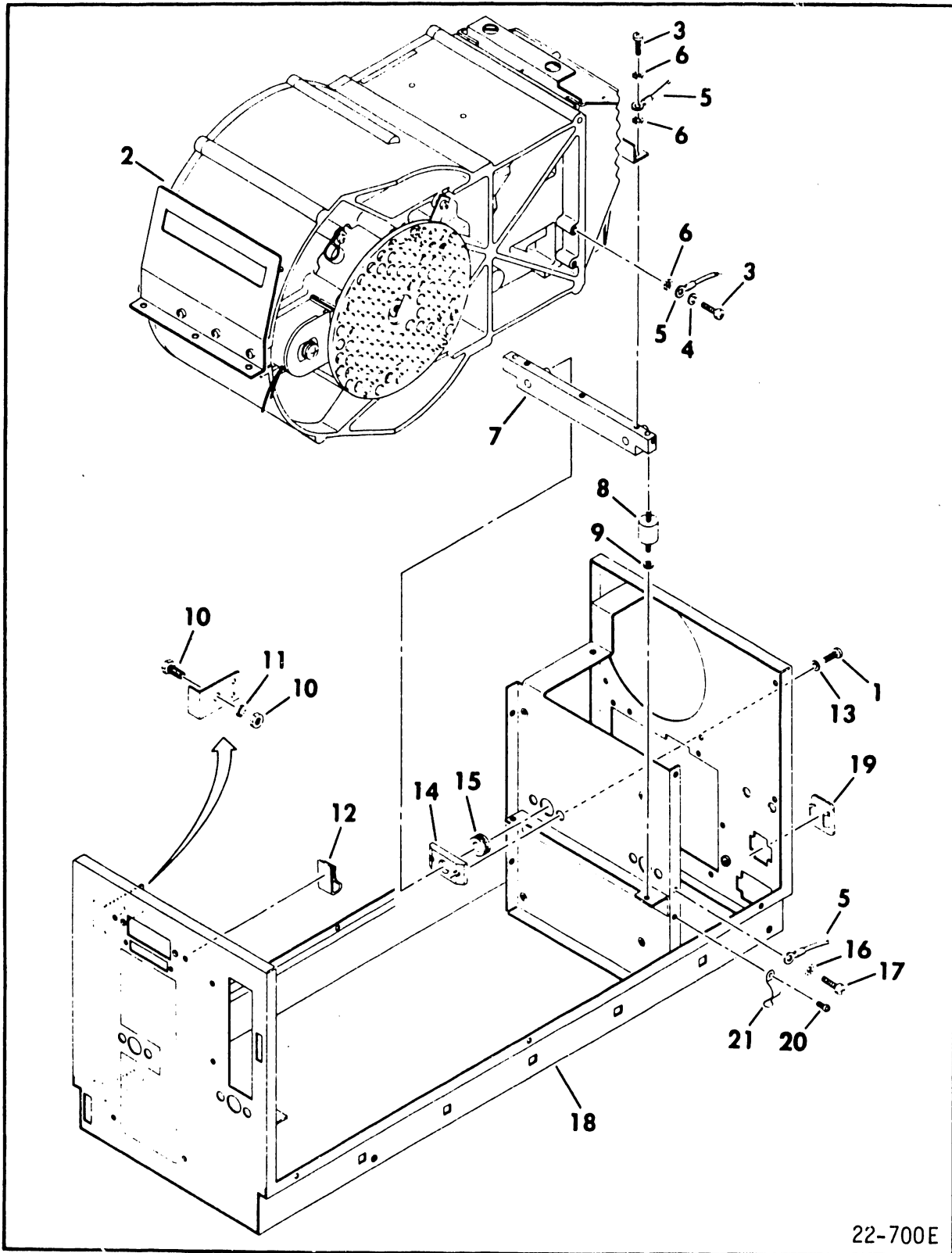


Figure 4-8.

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	10127141	SCREW, PHH, 10-32 x 5/16	
2	Spare	MODULE ASSEMBLY	340 MB Units
2	Spare	MODULE ASSEMBLY	515 MB Units
3	10127114	SCREW, PHH, 6-32 x 1/2	
4	10125803	LOCKWASHER, #6	
5	94231477	GROUND CABLE	
6	10126401	LOCKWASHER, #6	
7	72859940	RETAINER, Shipping	
8	93568014	SHOCK MOUNT	
9	10125607	WASHER, #10	
10	93879001	JACK, Banana	
11	10126106	LOCKWASHER, 1/4	
12	94241019	CLIP, Cable	
13	10125607	WASHER, #10	
14	72859950	RETAINER	
15	72855912	GROMMET	
16	10126402	LOCKWASHER, #8	
17	10127120	SCREW, PHH, 8-32 x 1/4	
18	72857451	BASE	
19	92555290	COVER, Connector Cutout	
20	10127111	SCREW, PHH, 6-32 x 1/4	See Note 1
21	93148609	CLIP, Tension	See Note 1

Note 1: Used on drives with remote power supply only.

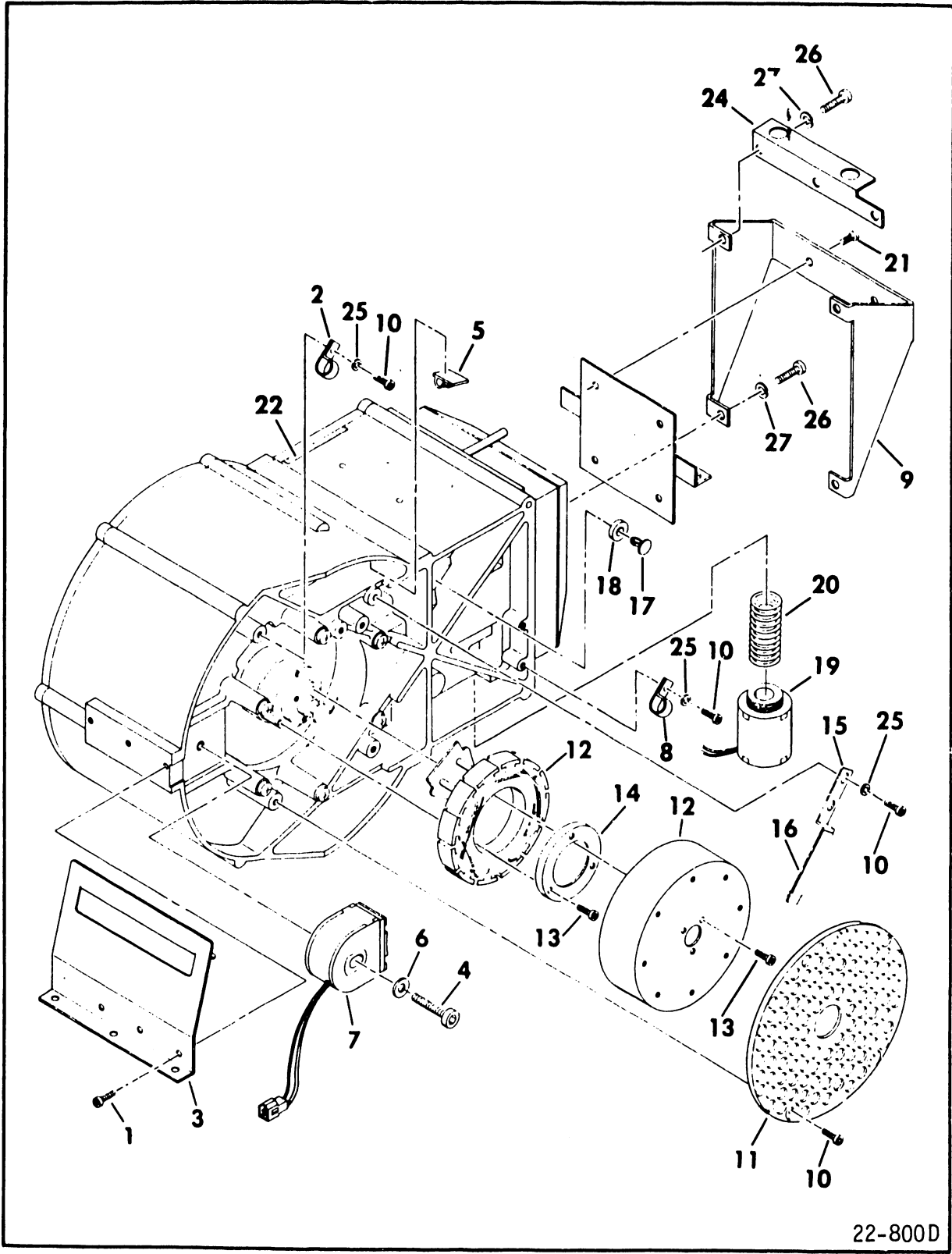


Figure 4-9.

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	10126233	SCREW, Socket Hd, 10-24 x 3/8	
2	92602003	CLAMP, Cable	
3	72855730	SUPPORT	
4	10126259	SCREW, Socket Hd, 1/4-20 x 1 1/4	
5	94241019	CLIP	
6	10125608	WASHER, 1/4	
7	Spare	BRAKE ASSEMBLY	
8	92602004	CLAMP, Cable	
9	95138480	SUPPORT, Cover	
10	10126218	SCREW, Socket Hd, 6-32 x 3/8	
11	72856000	SHIELD, Motor	
12	Spare	MOTOR AND CABLE ASSEMBLY	
13	92727200	SCREW, Socket Hd, 6-32 x 3/8	
14	72850900	CLAMP, Motor	
15	Spare	GROUND SPRING ASSEMBLY	
16	73157960	TAPE	
17	94387809	CLIP, Plastic	
18	73005100	PLUG	
19	Spare	SOLENOID AND CONNECTOR ASSEMBLY	
20	72855722	SPRING, Compression	
21	92727238	SCREW, Socket Hd, 8-32 x 3/8	See Note 1
21	10127131	SCREW, Socket Hd, 10-24 x 3/8	See Note 2
22	92122310	TAPE, Foam	
23	72855770	SUPPORT, Cover	See Note 1
23	95259410	SUPPORT, Cover	See Note 2
24	93148606	HANDLE, Module	See Note 3
25	10125605	WASHER #6	
26	10126256	SCREW, Socket Hd, 1/4-20 x 3/4	
27	10125806	WASHER, 1/4	

Note 1: Used only on S/C 03 & Blw drives without ECO 05752 installed.

Note 2: Used only on S/C 04 & Abv drives, and on drives with ECO 05752 installed.

Note 3: Not used on early model drives.

TABLE 4-2. MANUFACTURER'S RECOMMENDED SPARE PARTS

DESCRIPTION/NOTES	PART NUMBER	REPLACE- MENT PART NUMBER
CONTROL PANEL ASSEMBLY		
Type 1	54330905	17190500
Type 2	17190500	17190500
LOGIC PLUG KIT (PA5N1C only)	81397702	81397702
FILTER, Primary	72852571	72852571
_UQX (FAULT DISPLAY) BOARD		
BUQX--S/C 05 & Blw	54384501	54384503
DUQX--S/C 06 & Abv	54384503	54384503
AC POWER CABLE (P01)		
All drives except PA5G1B/G, PA5G2B/E	75168315	75168315
PA5G1B/G, PA5G2B/E	75168321	75168321
DC POWER CABLE (P15/P40)(Remote P/S Drives)	92081500	92081500
POWER SUPPLY, Remote		
S/C 03 & Blw	72896502	72896503
S/C 04 & Abv	72896503	72896503
"A" CABLE (Channel 1), Internal		
PA5G1D, PA5N1B	92439606	92439606
PA5G2D, PA5N2B	92439607	92439607
PA5N1C	92439609	92439609
"A" CABLE (Channel 2), Internal		
PA5G2D, PA5N2B	92439608	92439608
"B" CABLE (Channel 1), Internal		
PA5G1D, PA5N1B	92246306	92246306
PA5G2D, PA5N2B	92246307	92246307
PA5N1C	92246309	92246309
"B" CABLE (Channel 2), Internal		
PA5G2D, PA5N2B	92246308	92246308
AVCX (CONTROL) BOARD	54389301	54389301
_SYX (I/O) BOARD (Single Channel Drives)		
BSYX--S/C 05 & Blw	54368101	54368103
DSYX--S/C 06 & Abv	54368103	54368103
_TQX (I/O) BOARD (Dual Channel Drives)		
BTQX--S/C 04 & Blw	54374901	54374903
DTQX--S/C 05 & Abv	54374903	54374903
_SVX (MOTHER) BOARD		
BSVX--S/C 03 & Blw	54366901	54366902
CSVX--S/C 04 & Abv	54366902	54366902
_UGX (R/W) BOARD (340 MB)		
BUGX--S/C 04 & Blw	54381301	54381302
CUGX--S/C 05 & Abv	54381302	54381302
_VHX/_SUX (R/W) BOARD (515 MB)		
CSUX--S/C 04 & Blw	54366502	54391300
AVHX--S/C 05 & Abv	54391300	54391300

Table Continued on Next Page

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

DESCRIPTION/NOTES	PART NUMBER	REPLACE- MENT PART NUMBER
"A" CABLE (Channel 1), Internal PA5G1A/B/C, PA5G2B, PA5N1A	92439600	92439600
PA5G2A, PA5N2A	92439601	92439601
"A" CABLE (Channel 2), Internal PA5G2A, PA5N2A	92439602	92439602
"B" CABLE (Channel 1), Internal PA5G1A/B/C, PA5G2B, PA5N1A	92246300	92246300
PA5G2A, PA5N2A	92246301	92246301
"B" CABLE (Channel 2), Internal PA5G2A, PA5N2A	92246302	92246302
SWX (MOTOR SPD & PWR AMP) BOARD		
BSWX--S/C 01	54367301	54367302
CSWX--S/C 02 & Abv	54367302	54367302
POWER SUPPLY, Integral	81542300	81542300
DC POWER CABLE(P15/35)(Integral P/S Drives)	80547301	80547301
FAN ASSEMBLY	81235102	81235102
MODULE ASSEMBLY (340 MB UNITS)		
PA5G1A/PA5G2A/PA5G1D/PA5G2D/G	73090400	73090400
PA5G1B/G, PA5G2E	73090401	73090401
PA5G1C	73090402	73090402
MODULE ASSEMBLY (515 MB UNITS)		
All except PA5N1C/D, PA5N2E	73089100	73089100
PA5N1C	73089101	73089101
PA5N1D/PA5N2E	73089102	73089102
BRAKE ASSEMBLY	72856100	72856100
MOTOR AND CABLE ASSEMBLY	94231900	94231900
GROUND SPRING ASSEMBLY	72854200	72854200
SOLENOID AND CONNECTOR ASSEMBLY	93012800	93012800

TABLE 4-3. ACCESSORIES

PART NUMBER	DESCRIPTION
12263496	STATIC GROUND WRIST STRAP, 6 1/2 to 8 inch wrist
12263632	STATIC GROUND WRIST STRAP, up to 6 1/2 inch wrist
12263424	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)
94356700	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

APPENDIX
A
CROSS
REFERENCE
LIST

Recommended Spares List/Vendor Cross Reference by Wang Part No.

<u>DESCRIPTION</u>	<u>WANG PART NO.</u>	<u>VENDOR PART NO.</u>
Power Supply Assembly.....	726-6942.....	81542300
Terminator.....	726-6953.....	93270700
PWA FPBX - Operator Control Panel.....	726-6975.....	54330905
PWA CSUX - R/W Board.....	726-6976.....	54366502
PWA CSVX - Motherboard.....	726-6977.....	54366902
PWA CSWX - Motor Speed & Power Amp.....	726-6978.....	54367302
PWA BSYX - I/O.....	726-6979.....	54368101
PWA DUQX - Fault Display.....	726-6980.....	54384503
PWA FSXX - Control Board.....	726-6981.....	54389302
Filter, Air Primary.....	726-6982.....	72852570
Spring, Ground.....	726-6983.....	72854200
Brake/Conn. Assembly.....	726-6984.....	72856100
Head Disk Assembly.....	726-6986.....	73089100
Power Cord.....	726-6987.....	75168315
Fan.....	726-6988.....	81235102
Cable Assembly, 26.....	726-6989.....	92246300
Cable Assembly, 60.....	726-6990.....	92439600
Solenoid & Connector Assembly.....	726-6991.....	93012800
Cable Assembly, DC Distribution.....	726-6992.....	93991803
Motor And Cable Assembly.....	726-6993.....	94231900

Special Tools

<u>DESCRIPTION</u>	<u>WANG PART NO.</u>	<u>VENDOR PART NO.</u>
TB-216A FTU Upgrade.....	727-0323.....	SPO-68872-1

Recommended Spares List/Vendor Cross Reference by Vendor Part No.

<u>DESCRIPTION</u>	<u>VENDOR PART NO.</u>	<u>WANG PART NO.</u>
PWA FPBX - Operator Control Panel.....	54330905.....	726-6975
PWA CSUX - R/W Board.....	54366502.....	726-6976
PWA CSVX - Motherboard.....	54366902.....	726-6977
PWA CSWX - Motor Speed & Power Amp.....	54367302.....	726-6978
PWA BSYX - I/O.....	54368101.....	726-6979
PWA DUQX - Fault Display.....	54384503.....	726-6980
PWA FSXX - Control Board.....	54389302.....	726-6981
Filter, Air Primary.....	72852570.....	726-6982
Spring, Ground.....	72854200.....	726-6983
Brake/Conn. Assembly.....	72856100.....	726-6984
Head Disk Assembly.....	73089100.....	726-6986
Power Cord.....	75168315.....	726-6987
Fan.....	81235102.....	726-6988
Power Supply Assembly.....	81542300.....	726-6942
Cable Assembly, 26.....	92246300.....	726-6989
Cable Assembly, 60.....	92439600.....	726-6990
Solenoid & Connector Assembly.....	93012800.....	726-6991
Terminator.....	93270700.....	726-6953
Cable Assembly, DC Distribution.....	93991803.....	726-6992
Motor And Cable Assembly.....	94231900.....	726-6993

Special Tools

<u>DESCRIPTION</u>	<u>VENDOR PART NO.</u>	<u>WANG PART NO.</u>
TB-216A FTU Upgrade.....	SPO-68872-1.....	727-0323

WANG

LABORATORIES, INC

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851. TEL (617) 459-5000. TWX 710 343 6769. TELEX 94 7421

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