

**WANG**

3106

**CONTROL DATA CORPORATION  
REMOVABLE STORAGE DRIVE  
GENERAL DESCRIPTION  
INSTALLATION/PARTS DATA**

**Models:**

**PA3A1  
PA3A2**

**Volume 1**

**Customer Engineering Reprint  
Product Maintenance Manual**

**741-1491**

PREFACE

The purpose of this manual is to provide the Wang-trained Customer Engineer (CE) with instructions to operate, troubleshoot, and repair the Removable Storage Drive.

First Edition (June, 1984)

This is the first reprint of Control Data Corporation's RSD, Volume 1. The material in this document may only be used for the purpose stated in the Preface. Updates and/or changes to this document will be published as Product Update Bulletins (PUB's) or subsequent editions.

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**CUSTOMER ENGINEERING**

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LABORATORIES, INC

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

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**CDC® REMOVABLE STORAGE DRIVE**

**PA3A1**

**PA3A2**

**GENERAL DESCRIPTION**

**OPERATION**

**INSTALLATION AND CHECKOUT**

**PARTS DATA**

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**Volume 1**

**HARDWARE MAINTENANCE MANUAL**

# REVISION RECORD

REVISION	DESCRIPTION
01 (04-20-82)	Preliminary Release
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A (04-07-83)	Original release. Documents Series Codes 01, 02, 03, and 04 units. This edition obsoletes all previous editions.
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REVISION LETTERS I, O, Q  
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Address comments concerning this  
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Control Data Corporation  
Twin City Disk Division  
Customer Documentation Dept.  
7725 Washington Avenue So.  
Edina, Mn 55435

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or use Comment Sheet in the back  
of this manual.

# MANUAL TO EQUIPMENT LEVEL CORRELATION

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This manual reflects the equipment configurations listed below.

**EXPLANATION:** Locate the equipment type and series code number, as shown on the equipment FCO 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 FCO log, then this manual accurately reflects the equipment.

This correlation sheet also applies to the following related manuals:

Pub. No. 83324490 Rev. C  
Pub. No. 83324630 Rev. E

EQUIPMENT TYPE	SERIES CODE	WITH FCOs	COMMENTS
PA3A1/PA3A2	01	None	
	02	None	
	03	None	
	04	None	
	05	None	
	06	None	
	07	None	

# LIST OF EFFECTIVE PAGES

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Sheet 1 of 2

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4-12	B	Rtn Env	-
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## PREFACE

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This manual contains maintenance information for the CONTROL DATA® PA3A1 and PA3A2 Removable Storage Drives (RSDs). It provides instructions to all personnel who operate the RSD and to customer engineers who install and check out the RSD. Customer engineers who troubleshoot and repair RSDs 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 RSD 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>
83324480	PA3A1/PA3A2 Hardware Maintenance Manual, Volume 1
83324490	PA3A1/PA3A2 Hardware Maintenance Manual, Volume 2 (contains theory of operation and maintenance)
83324630	PA3A1/PA3A2 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)

## WARNING

To ensure the integrity of safety features built into these drives, installation and maintenance must be performed only by qualified service personnel using designated CDC/MPI parts. Also, in case of fire or other emergency, isolate the drives from main power by disconnecting the drive power plugs from their site power receptacles. In situations where pulling the plugs is not possible or practical, use the system main power disconnect to isolate the drives from main power.

## WARNUNG

Um das einwandfreie Funktionieren der eingebauten Schutzvorrichtungen zu gewährleisten, darf die Installation und Wartung nur von qualifiziertem Service-Personal unter Verwendung von Original CDC/MPI Teilen durchgeführt werden. Beim Ausbrechen von Feuer oder in anderen Notfällen ist die Verbindung zum Hauptstromnetz dadurch zu unterbrechen, dass die Stecker der Antriebe aus den Steckdosen gezogen werden. Sollte dies nicht möglich oder unpraktisch sein, ist der Hauptstromunterbrecher des Systems zu bedienen, um die Antriebe vom Hauptstromnetz zu trennen.

## WARNING

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

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## CONFIGURATION CHART

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EQUIPMENT NUMBER*	INTERFACE	DATA CAPACITY (MB)
PA3A1A	Single Channel	80
PA3A1B	Single Channel	80
PA3A2A	Dual Channel	80

\* Refer to Section 4 for equipment package listings that include painted parts, power supply voltages, 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**

---

## INTRODUCTION

The Control Data PA3A1/PA3A2 Removable Storage Drives (RSDs) are high speed, random access digital data storage devices that connect to a central processor through a controller. The total data storage capacity of the drive is 80 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:

- Data Storage Medium -- Describes the data pack which is the medium used to store the data.
- 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.

## DATA STORAGE MEDIUM

The data storage medium for the drive is a data pack, consisting of three disks, center-mounted on a hub and housed in a sealed plastic case (see figure 1-1). When installed in the drive, two ports open automatically to allow the heads to enter and clean air to circulate through the data pack. The data pack is portable and interchangeable between drives.

The disk pack has a total of six usable surfaces, each coated with a layer of magnetic oxide and related binders and adhesives. One of these surfaces, referred to as the servo surface, contains information prerecorded at the factory. This surface is used by the drive to generate position information and various timing signals. The remaining five surfaces can be used by the system for data storage and are referred to as data surfaces.

Refer to the operation section of this manual for information about data pack handling.

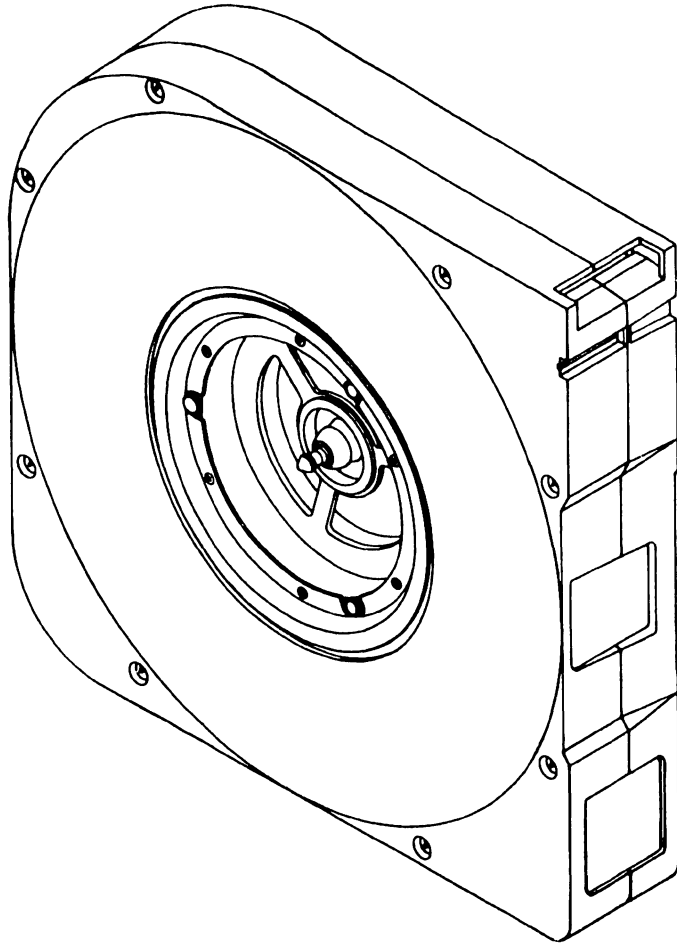
TABLE 1-1. DRIVE SPECIFICATIONS

Characteristics	Conditions	Specifications
<b>PHYSICAL</b>		
Size (Drive Only)	Height	26.0 cm (10.2 in)
	Width	21.5 cm (8.5 in)
	Length	62.0 cm (24.25 in)
	Weight	27.2 kg (60.0 lbs)
Size (Optional Power Supply Only)	Height	24.0 cm (9.5 in)
	Width	20.0 cm (7.9 in)
	Length	11.3 cm (4.4 in)
	Weight	4.5 kg (10.0 lb)
Recording	Total Capacity (Formatted)	80 megabytes
	Number of disks	3
	Movable data heads	5
	Servo Heads	1
	Tracks per inch	543
	Physical heads per surface	1
	Logical cylinders per head/disk assy	823 (0-822)
Table Continued on Next Page		

TABLE 1-1. DRIVE SPECIFICATIONS (Contd)

Characteristics	Conditions	Specifications
<b>PERFORMANCE</b>		
Transfer rate	Disk speed at 3600 r/min	9.677 MHz (1 209 625 bytes/sec)
Latency		Latency is time to reach a particular track address after positioning is com- plete.
	Average	8.33 milliseconds (disk rotation speed at 3600 r/min)
	Maximum	16.83 milliseconds (disk rotation speed at 3564 r/min)
Recording	Mode	2-7 code
	Density	9994 bits per inch (inner track)
Seek Time	Full	55 milliseconds maxi- mum
	Average	30 milliseconds
	Single Track	7 milliseconds maximum
Start Time		60 seconds maximum
Stop Time	START switch off	35 seconds maximum
	Power loss	90 seconds typical





10R3A

**Figure 1-1. Drive Data Pack**

### **EQUIPMENT FUNCTIONAL DESCRIPTION**

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

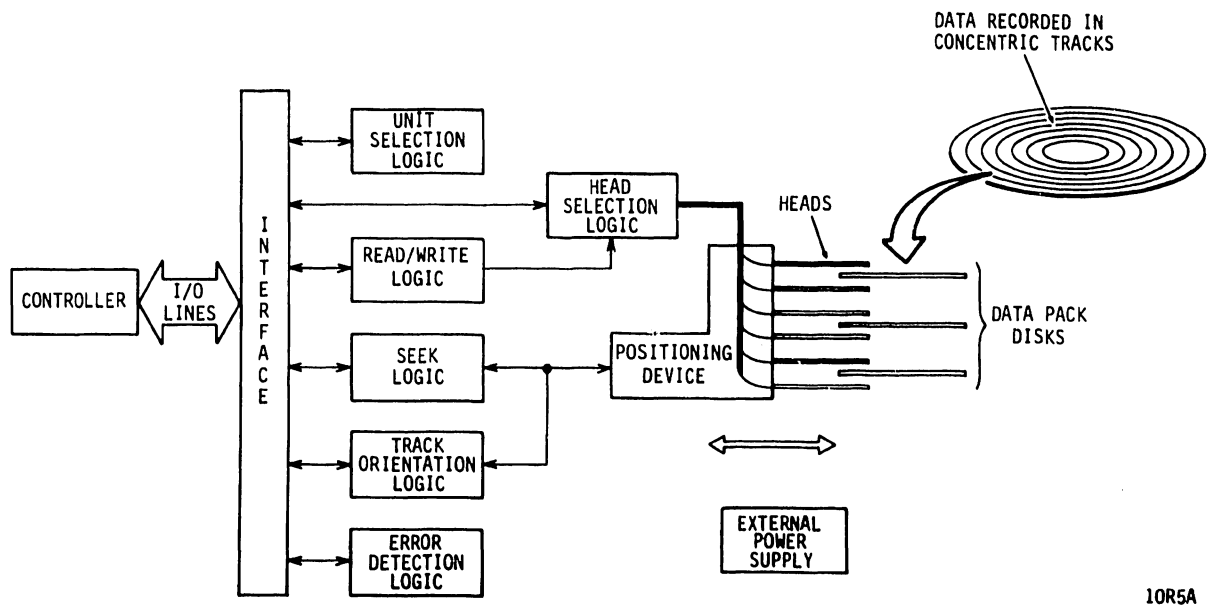
All functions performed by the drive are done under direction of the controller. The controller communicates with the drive via the interface which consists of a number of I/O lines carrying the necessary signals to and from the drive.

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

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 data pack disks. There is a separate head for each disk surface in the data pack, and the heads are positioned in such a way that data is written in concentric tracks around the disk surfaces (see figure 1-2).

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.



10R5A

Figure 1-2. 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 data pack, and transmits it to the controller. During a write operation, the drive receives data from the controller, processes it and writes it on the data pack.

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 RSD. The components mentioned in this discussion are identified in figure 1-3.

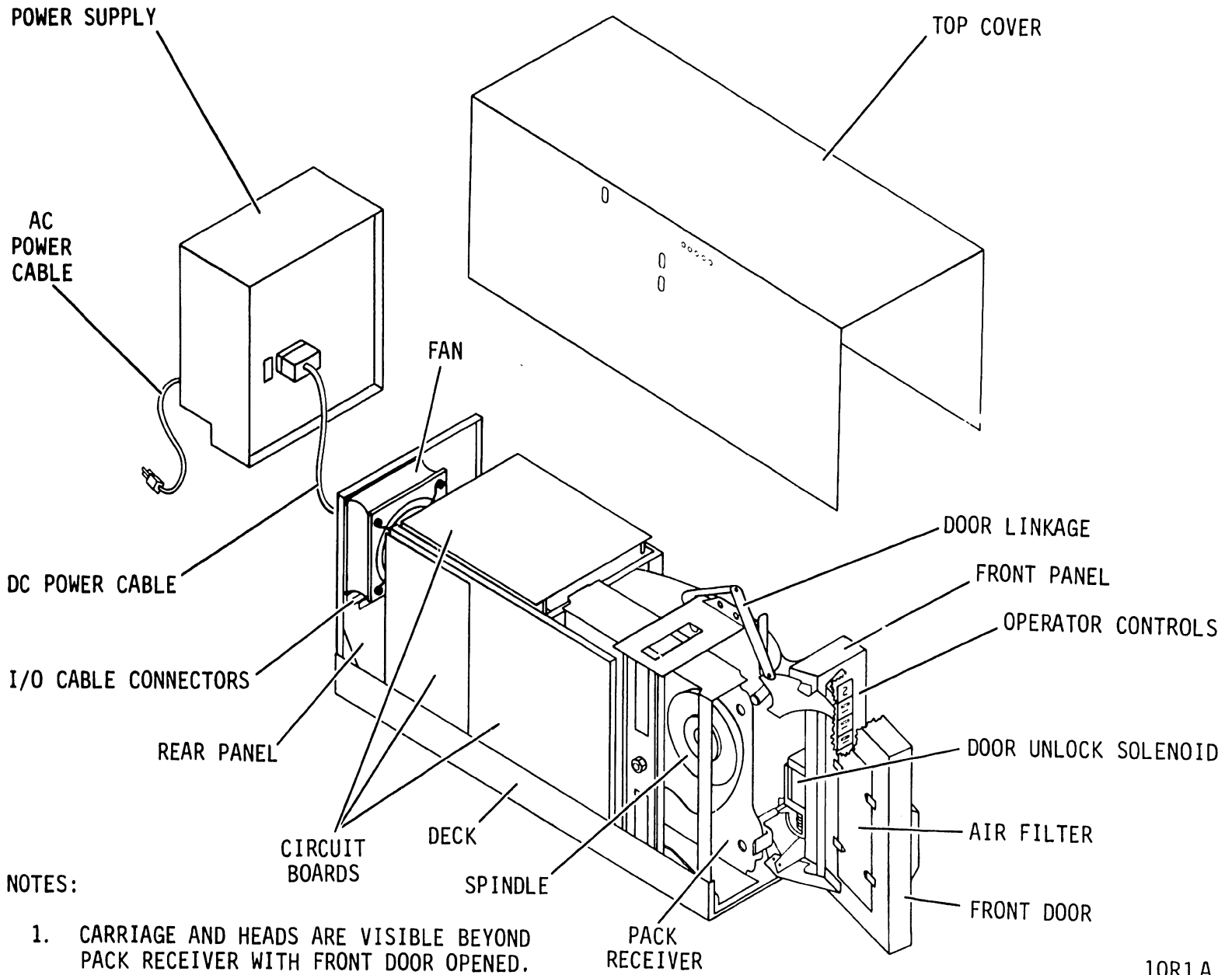
An RSD installation requires a drive, interconnecting cabling, and a power supply which is supplied as an option. Site power enters the power supply via the ac power cable. The power supply develops the dc voltages required by the drive. These voltages are supplied to the drive by the dc power cable, which connects at the rear panel of the drive. Other rear panel connectors are provided for the interface cabling and for system grounding.

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 the front door. 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 front door can be opened when the door unlock solenoid is energized to permit installation of a data pack into the pack receiver.

Closing the front door engages the data pack hub to the spindle so that the drive motor can rotate the data pack disks. In this position, the data pack is part of a closed-loop circulation of clean air. This air circulation, driven by an impeller on the drive motor, passes through an absolute filter and follows a closed path past the actuator and through the data pack to purge air impurities from the pack.

Figure 1-3. Drive Major Assemblies



The actuator, which is located behind the pack receiver, positions the heads over the disk surfaces in the data pack. 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 slide on parallel rails to move the heads accurately across the disk surfaces. There are six heads, a servo head to control actuator positioning and five data heads used for data transfers to and from the disks.

In addition, the drive has interconnected circuit boards that contain the electronics required for drive operation.

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 FCO 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, FCO log, and manual to equipment correlation.

## **EQUIPMENT IDENTIFICATION**

### **General**

The equipment is identified by labels attached to the rear of 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 specifies the complete list of parts shipped with the drive, including the drive, power supply, colored panels, and mounting hardware. The CDA (Complete Drive Assembly) number is the part number for 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.

## **FCO 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 FCO log that accompanies each machine. The FCO log is located on a metal panel to the right of the control board. It is visible when the cover is removed from the drive. 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 FCO log be kept current by the person installing the FCO.

## **MANUAL TO EQUIPMENT 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 FCO log if all the FCOs have also been installed in the machine.

**SECTION**

**2**

**OPERA-**

**TION**



---

## 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
- 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.

### FRONT PANEL

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

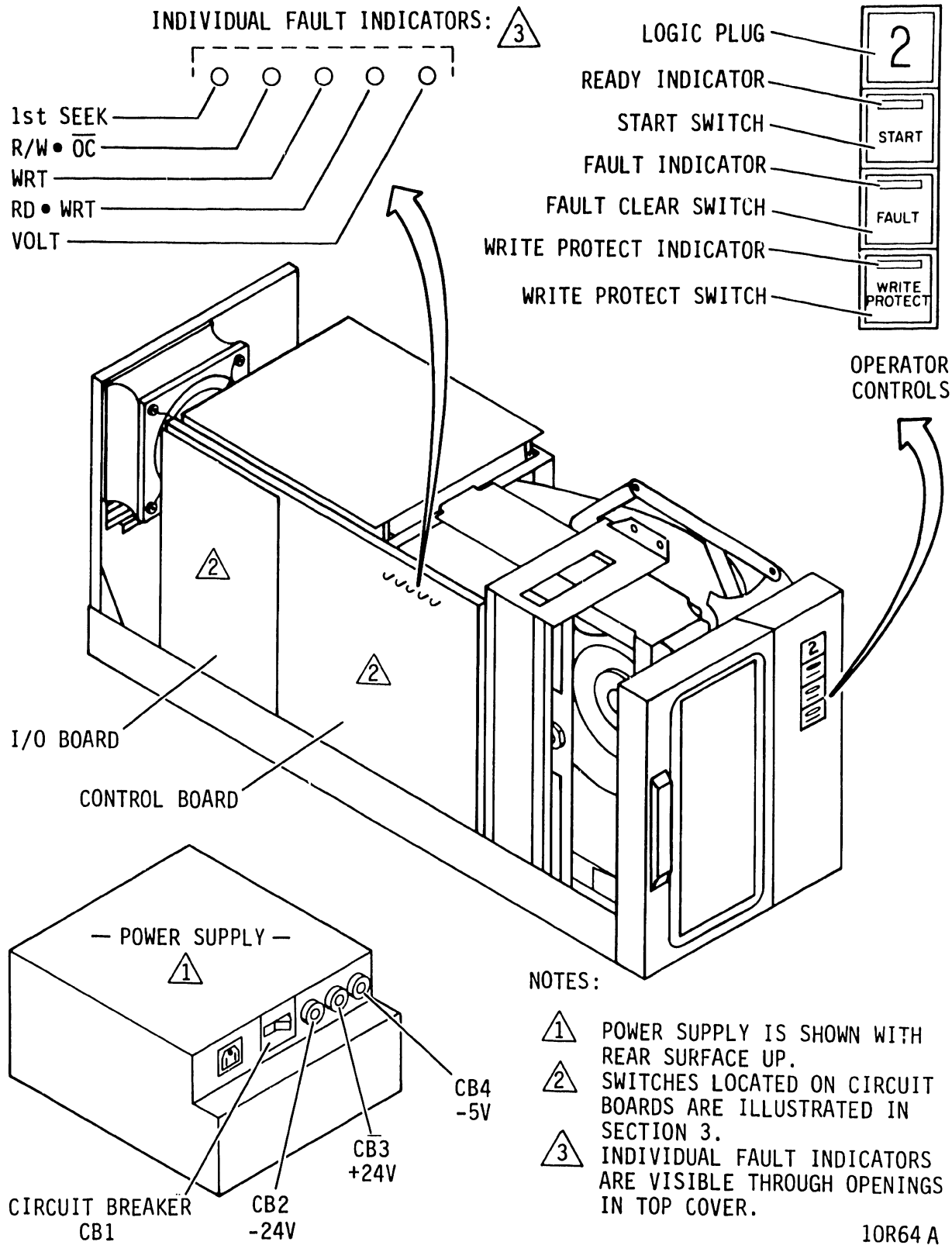


Figure 2-1. Switches and Indicators

## CONTROL BOARD

The control board contains switches which are set during drive installation and indicators which are used for maintenance purposes. 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 external 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.
CB2 (-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 (Contd)	
WRITE PROTECT Switch/Indicator	The operation of the WRITE PROTECT switch, the write protect tab on the data pack, or the W PROT switch on the control board places the drive in the write protected mode (preventing write operations) and lights the WRITE PROTECT indicator.
CONTROL BOARD	
W PROT/NORM (Write Protect) Switch	Placing the switch in the W PROT position prevents the drive from performing write operations. The switch must be returned to the NORM position to enable write operations.
1st SEEK Indicator	Indicates drive failed first seek/load attempt.
R/W· $\overline{OC}$ Indicator	Indicates write or read conditions existed during a seek operation (an off cylinder condition).
WRT Indicator	Indicates that a write fault has occurred.
RD·WRT Indicator	Indicates that a write and a read command had existed simultaneously.
VOLT Indicator	Indicates a below normal voltage existed.
Table Continued on Next Page	

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

Switch or Indicator	Function
CONTROL BOARD (Contd)	
Sector Select Switches	Allow the dividing of the disk into specific segments or sectors. The switch settings determine the number of sectors per track.
I/O BOARD	
LOCAL/REMOTE Switch	Controls whether the drive can be powered up from the drive (LOCAL) or controller (REMOTE). In both switch positions, power up requires turning ON CB1 and pressing the START switch; however, in REMOTE position, a power sequence signal must come from the controller.

## OPERATING INSTRUCTIONS

### GENERAL

Operating instructions are presented in the following sequence:

- Power On Procedure
- Power Off Procedure
- Data Pack Handling and Storage
- Data Pack Installation
- Data Pack Removal
- Data Pack Write Protection

## 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. Ensure that a data pack is installed and that front door is closed. Drive will not operate unless both conditions are met. Refer to Data Pack Installation procedure given later in this section.
2. Press START switch to engage it in Start position. If the LOCAL/REMOTE switch was set in the REMOTE position during drive installation, the power up sequence continues when power sequence ground is available from the controller. If it was set in the LOCAL position, the power up sequence begins immediately.
3. Observe that Ready indicator (located in START switch) flashes, indicating that power up is in progress.
4. Observe that Ready indicator lights steadily within 60 seconds, indicating that disks are up to speed and heads are loaded.
5. 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 after 35 seconds, indicating that power down is complete.

With power down complete, the heads are unloaded and the disks are not rotating. If desired, the data pack can be removed (refer to Data Pack Removal procedure given later in this section). Normally, power supply circuit breaker CB1 is left ON to continue supplying dc power to the drive.

## DATA PACK HANDLING AND STORAGE

Data packs for the drive can be stored either on edge or flat. When storing the data packs flat, make sure that the hub cavity faces down to prevent contamination of components located in the hub cavity. Stacking the data packs is permissible.

It is advisable to store data packs in the same environment as the drive so that they are stabilized to the drive temperature prior to installation. When bringing a data pack into the drive environment, allow at least one hour for the data pack to stabilize to the ambient temperature of the drive environment before installing it in the drive.

## DATA PACK INSTALLATION

This procedure describes data pack installation for the drive. Data packs can be removed or installed only when power has been applied to the drive and when the Ready indicator is not on. Refer to figure 2-2 when performing the following steps:

1. Press START switch if Ready indicator is on and wait until Ready indicator stops flashing.

### NOTE

If front door will not open in next step, circuit breaker CBI on external power supply must be switched ON.

2. Pull door handle to open front door.
3. Position data pack according to labels on data pack housing prior to insertion into drive.

### NOTE

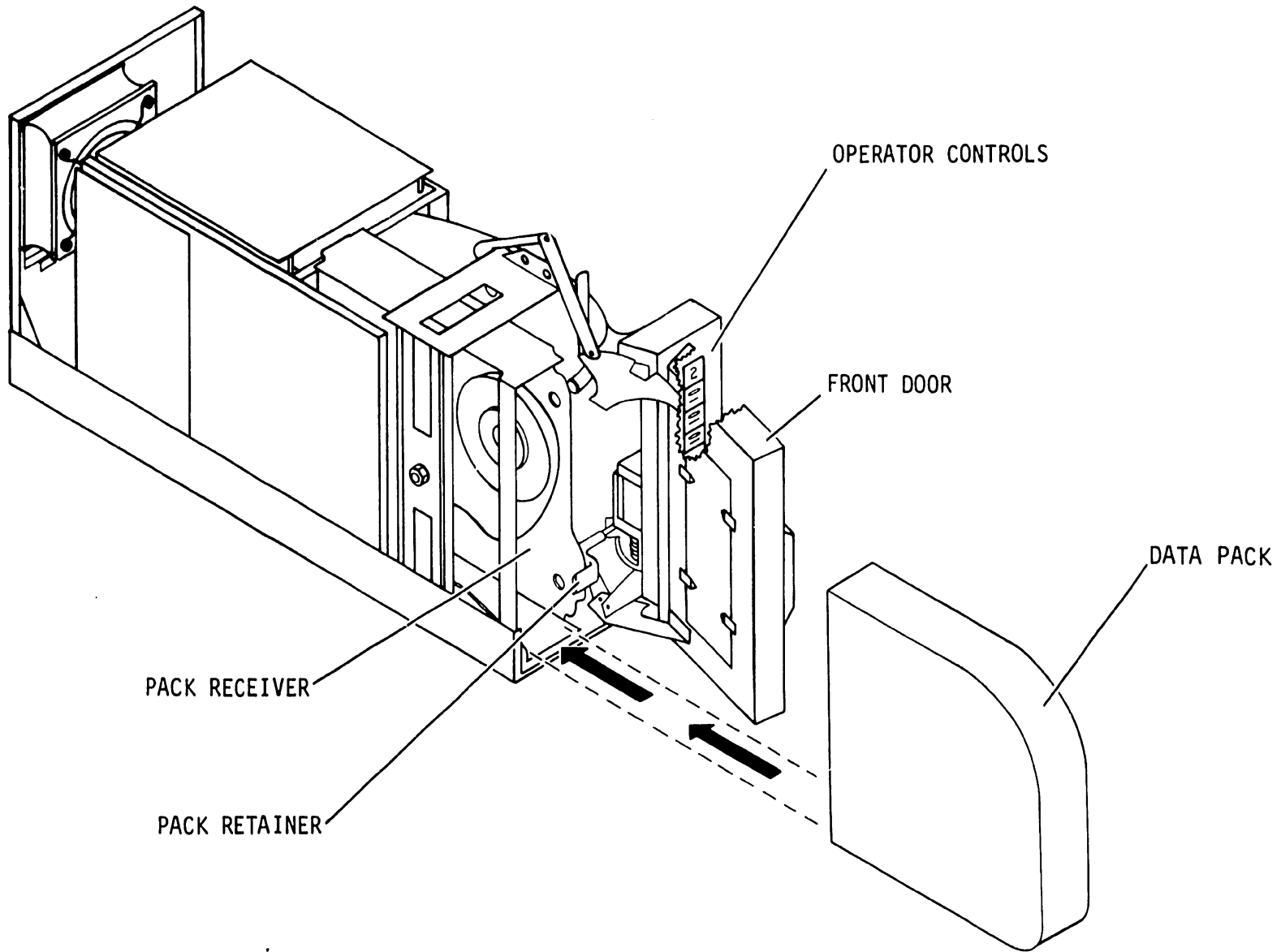
If the following step is unsuccessful, check labels on data pack housing to ensure that data pack is inserted with correct orientation.

4. Slide data pack into pack receiver. Observe that pack retainer secures data pack when it is fully inserted into pack receiver.
5. Close front door.

With data pack installed and front door closed, drive can be powered up. Refer to instructions in Power On Procedure.



Figure 2-2. Data Pack Installation and Removal



## DATA PACK REMOVAL

This procedure describes data pack removal for the drive. Data packs can be removed or installed only when power has been applied to the drive and when the Ready indicator is not on. Refer to figure 2-2 when performing the following steps:

1. Press START switch if Ready indicator is on and wait until Ready indicator stops flashing.

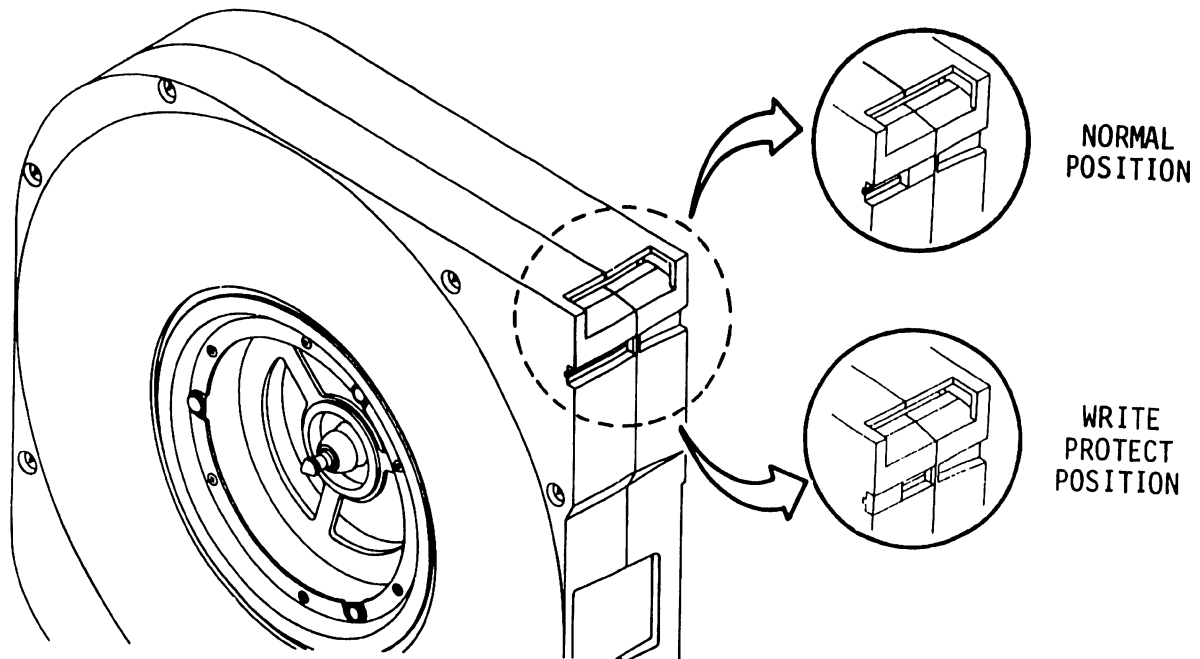
### NOTE

If front door will not open in next step, circuit breaker CB1 on external power supply must be switched ON. If front door will not open when CB1 is ON, a problem exists that requires the attention of qualified maintenance personnel.

2. Pull door handle to open front door. Observe that pack retainer releases data pack and data pack partially ejects when door is opened fully.
3. Slide data pack out of pack receiver. Refer to Data Pack Handling and Storage for information on storing data packs.
4. Close front door.

## DATA PACK WRITE PROTECTION

The position of the write protect tab on a data pack determines whether or not the drive can write new data on that data pack. Figure 2-3 identifies both tab positions. Sliding the tab into the write protect position inhibits write operations with that data pack. When a write-protected data pack is installed in the drive, the WRITE PROTECT indicator lights, and existing data stored on that data pack cannot be altered. Returning the tab to the normal position enables write operations with that data pack.



10R60 A

Figure 2-3. Write Protect Tab

## PRIMARY FILTER REPLACEMENT AND CLEANING

### GENERAL

The primary air filter must be clean to ensure proper air circulation through the drive. The filter is mounted on the front door, as shown in figures 2-4 and 2-5. 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.

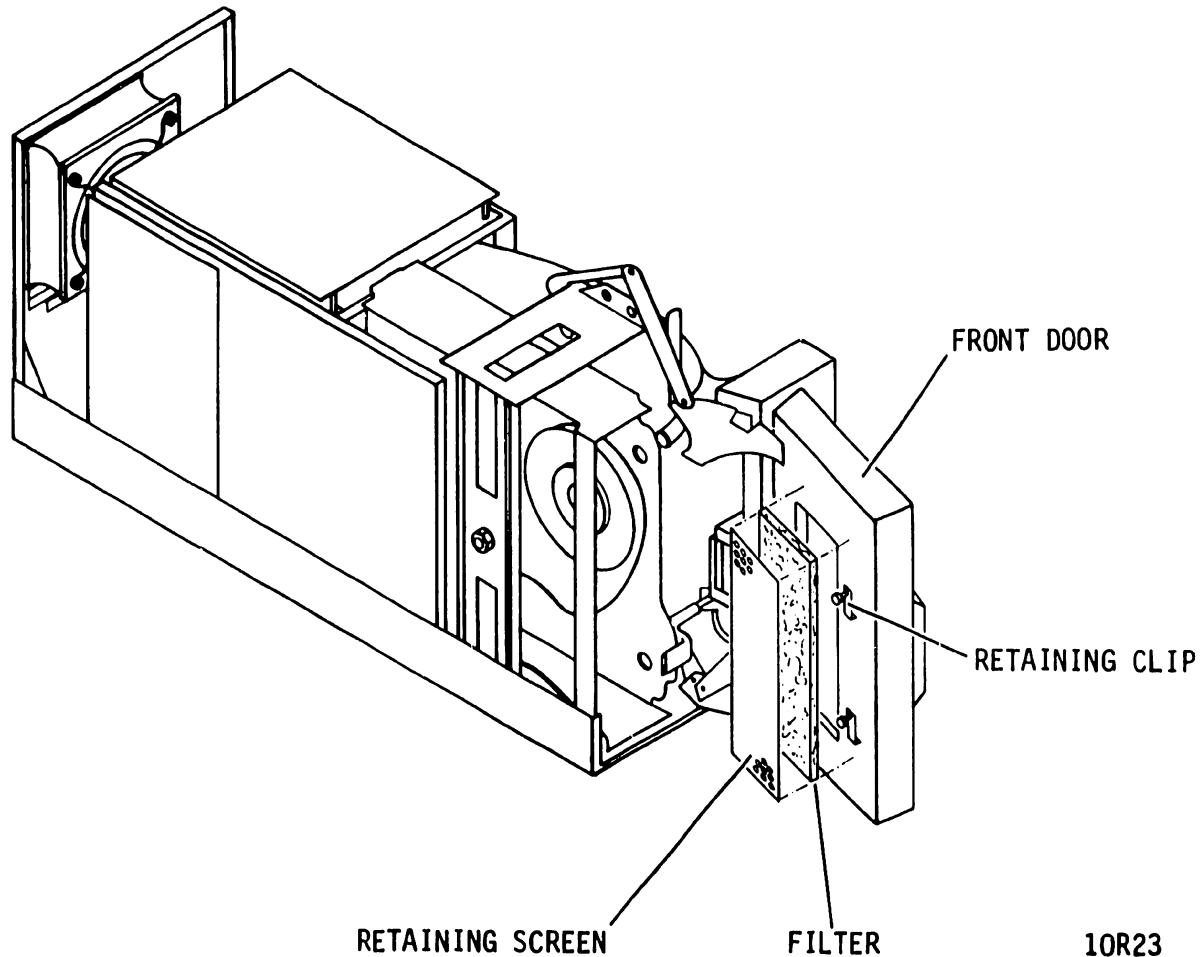


Figure 2-4. Primary Air Filter Replacement (S/C 01)

#### FILTER REPLACEMENT (S/C 01)

1. Perform Data Pack Removal procedure to open front door and remove pack. Leave front door open to gain access to filter.
2. Loosen hardware securing filter, retaining screen, and retaining clips.
3. Rotate retaining clips and remove retaining screen and old filter.
4. Place retaining screen and new filter in position against front door, and secure them with retaining clips and attaching hardware.
5. Reinstall data pack (if desired) and close front door.

## FILTER CLEANING (S/C 01)

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

1. Perform Data Pack Removal procedure to open front door and remove pack. Leave front door open to gain access to filter.
2. Loosen hardware securing filter, retaining screen, and retaining clips.
3. Rotate retaining clips and remove retaining screen and filter.
4. Clean filter by agitating in solution of water and mild detergent.
5. Rinse filter thoroughly with clean running water and allow to dry.
6. Place retaining screen and filter in position against front door, and secure them with retaining clips and attaching hardware.
7. Reinstall data pack (if desired) and close front door.

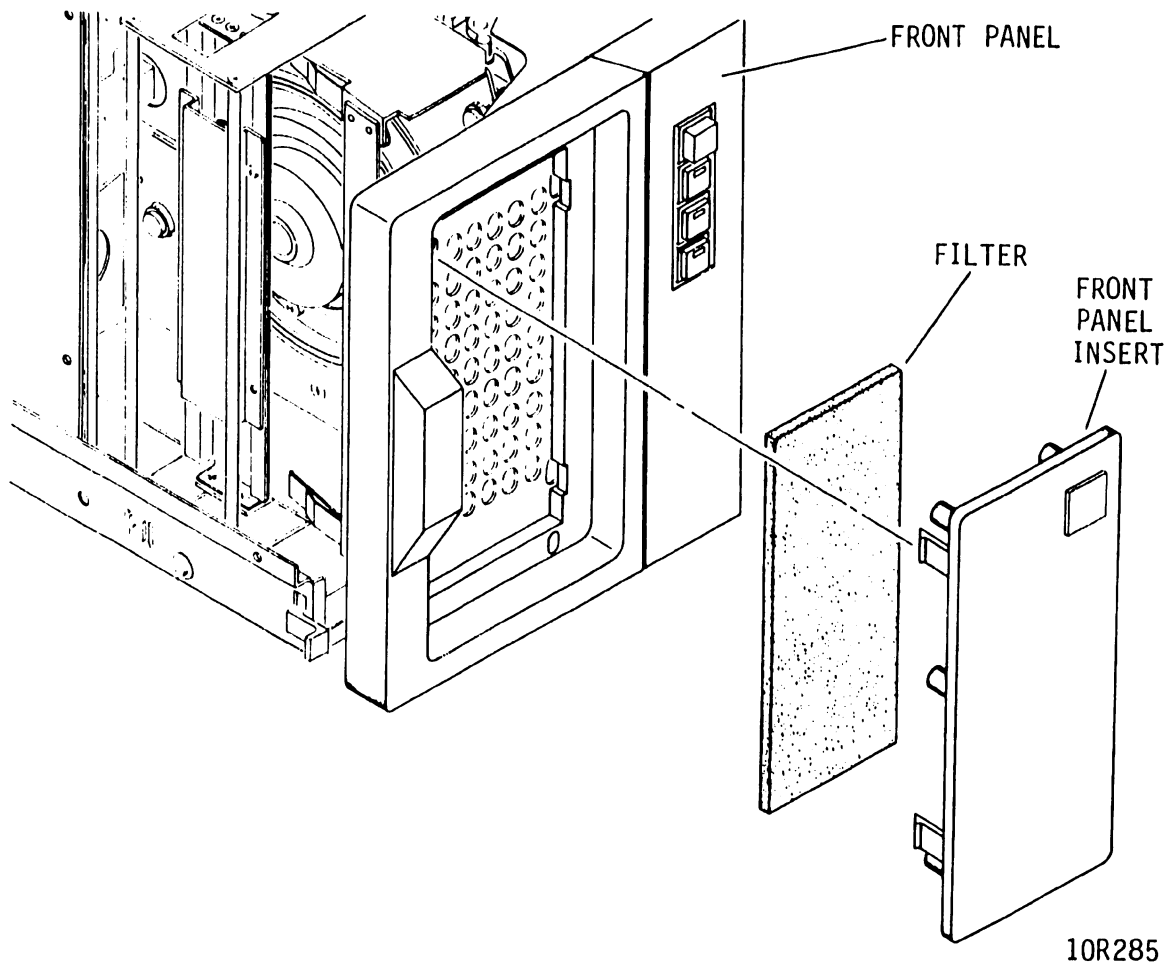


Figure 2-5. Primary Air Filter Replacement (S/C 02 and Above)

#### FILTER REPLACEMENT (S/C 02 AND ABOVE)

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 (S/C 02 AND ABOVE)

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**



---

## 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 jack 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 the PEX Control Board.

### ENVIRONMENTAL REQUIREMENTS

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

TABLE 3-1. ENVIRONMENTAL REQUIREMENTS

Characteristics	Conditions	Specifications
<b>TEMPERATURE</b>		
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)

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

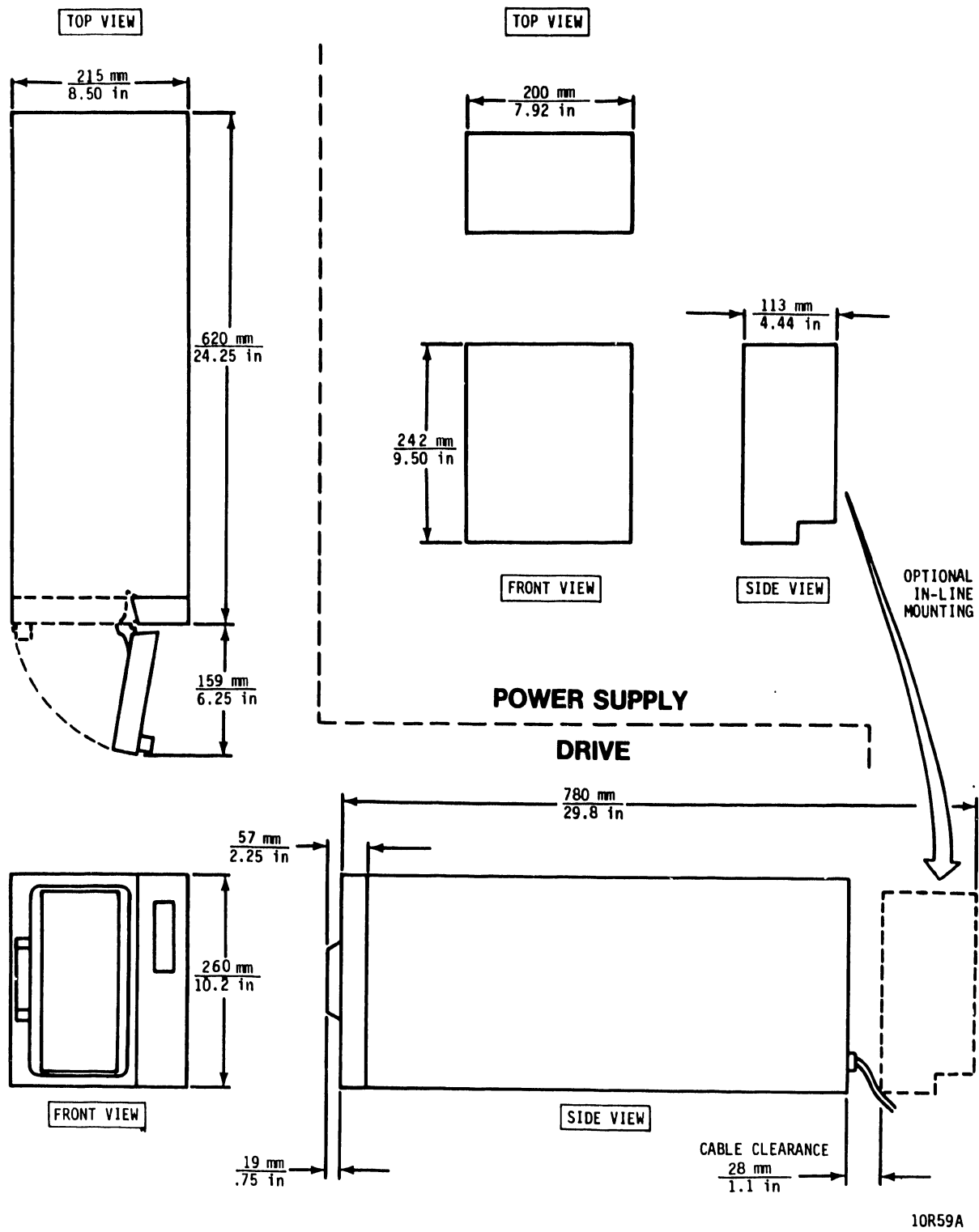


Figure 3-1. Drive Space Requirements

The combined mass of the drive and power supply is 31.7 kg (70 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

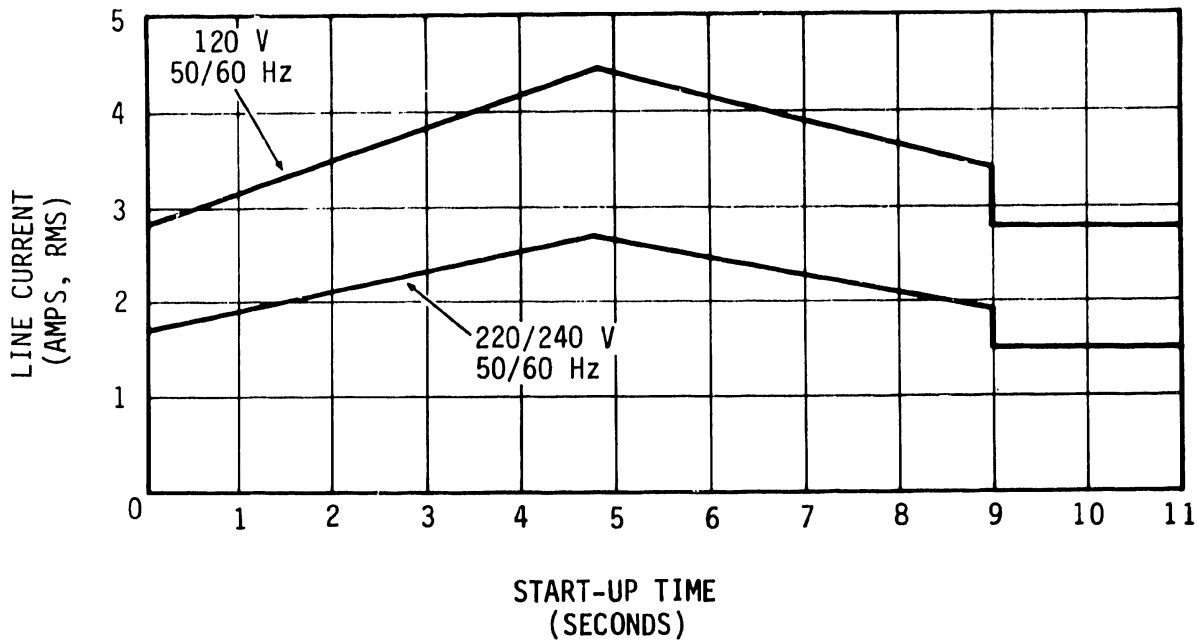
### Normal Requirements

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

TABLE 3-2. NORMAL POWER REQUIREMENTS

Specifications	Values - Low Voltage	Values - High Voltage
Nominal Voltage	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*	0.244 kW	0.236 kW
Line Current*	2.8 A	1.6 A
Power Factor*	0.73	0.69
Start Up Current	See figure 3-2.	See figure 3-2.

\*Measured when disks are rotating and carriage is moving.



10R83B

Figure 3-2. Line Current Versus Startup Time

**WARNING**

If power to the unit originates from a 3-phase, 4-wire, wye circuit 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 3-2.1. 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 3-2.2.

### 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 3-2.1 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 3-2.2 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	80%
7 through 24	70%
25 through 42	60%
43 and above	50%
* 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 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 configuration.

## INTERFACE REQUIREMENTS

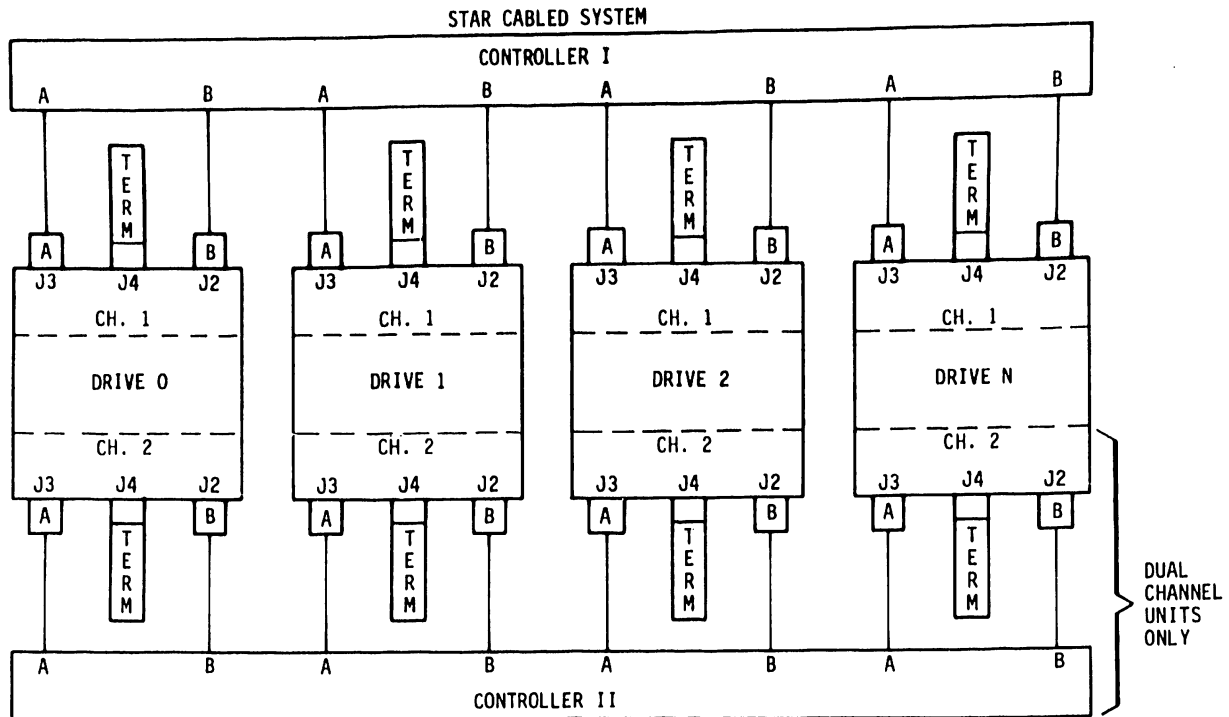
An important part of site preparation is planning the layout and routing of I/O cables. The I/O cables are designated as A and B cables. The I/O A cables may be connected in either a star or daisy chain configuration as shown in figure 3-3. Each configuration calls for the use of terminators; these too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

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

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

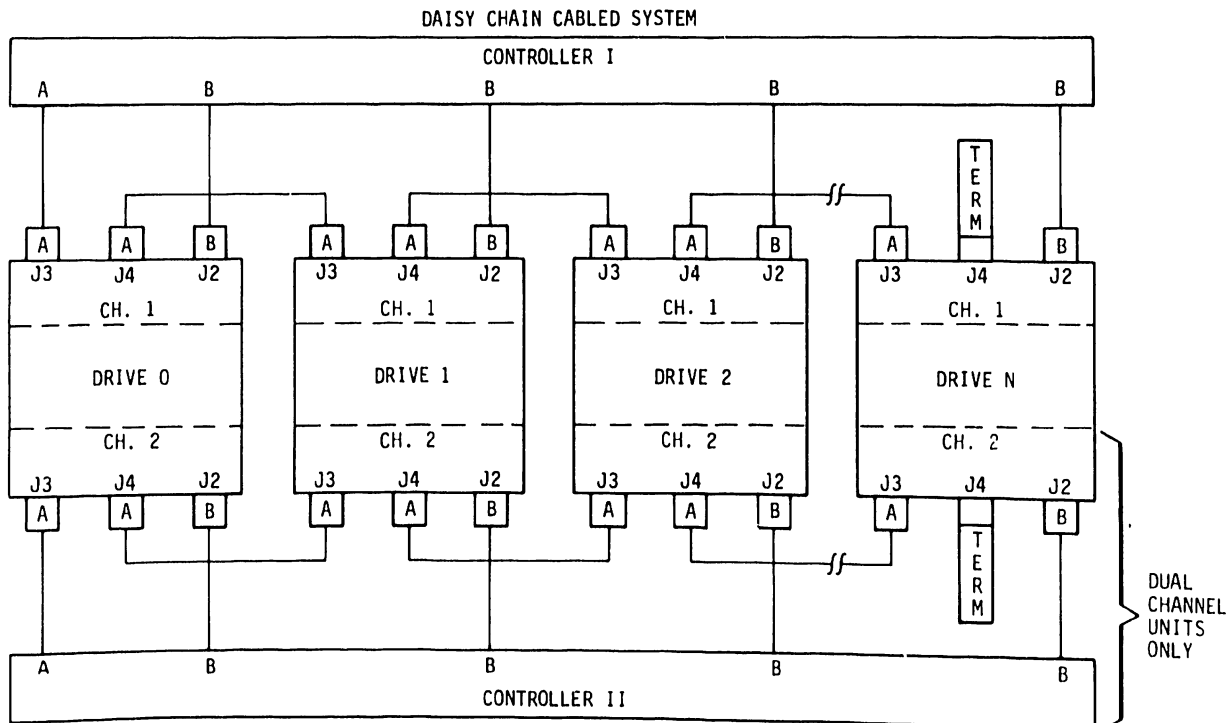
In estimating the I/O cables needed for an installation, decide which configuration will be used and allow sufficient length to permit extension of rack-mounted drives. Limitations on I/O cable lengths may influence system layout. The maximum length for each B cable is 15.3 m (50 ft). Each star system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

Figure 3-4 shows the pin assignments and signal names for the A cable. Figure 3-5 shows the pin assignments and signal names for the B cable. Detailed information about interface lines is given in section 1 of the Hardware Maintenance Manual, Volume 2.



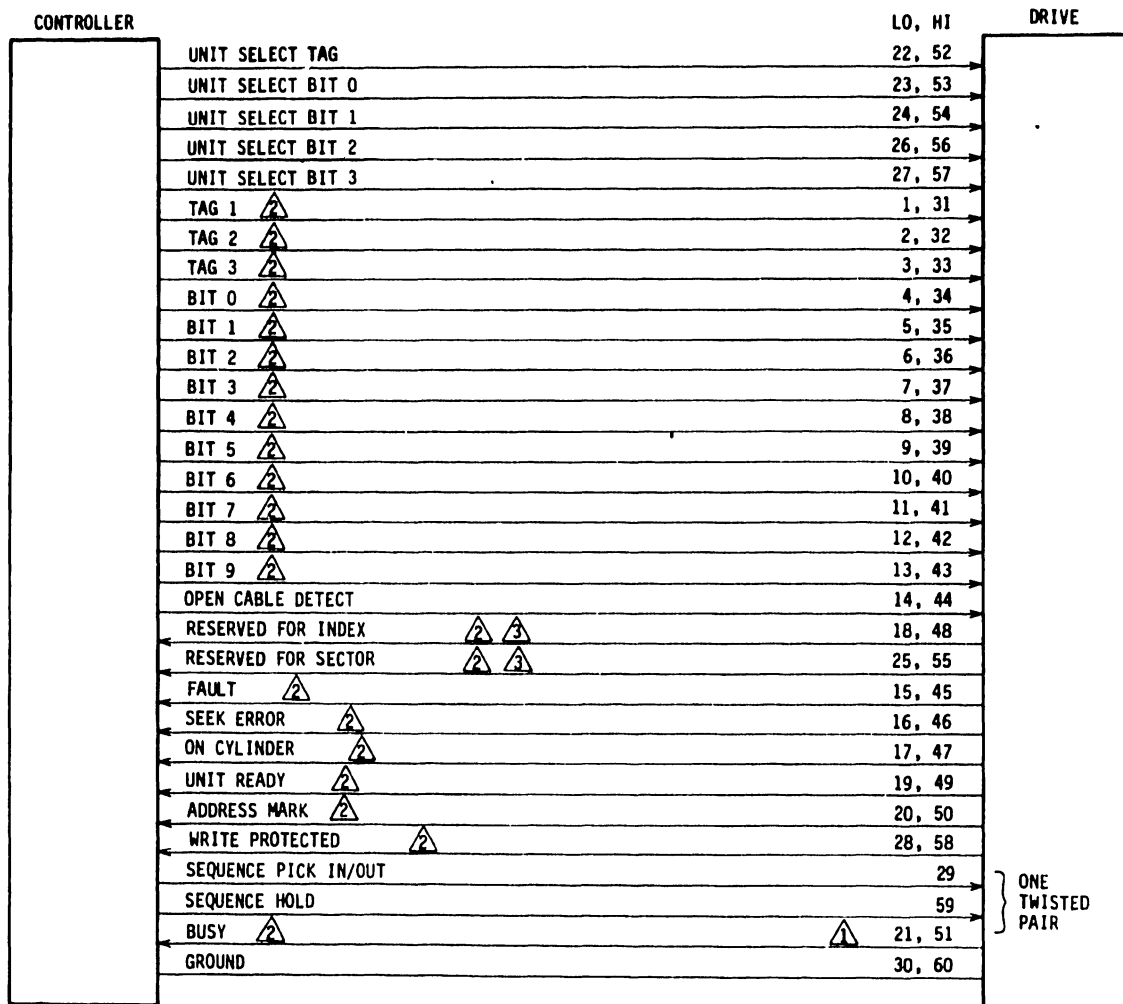
**NOTES:**

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



10R50A

**Figure 3-3. System Cabling**



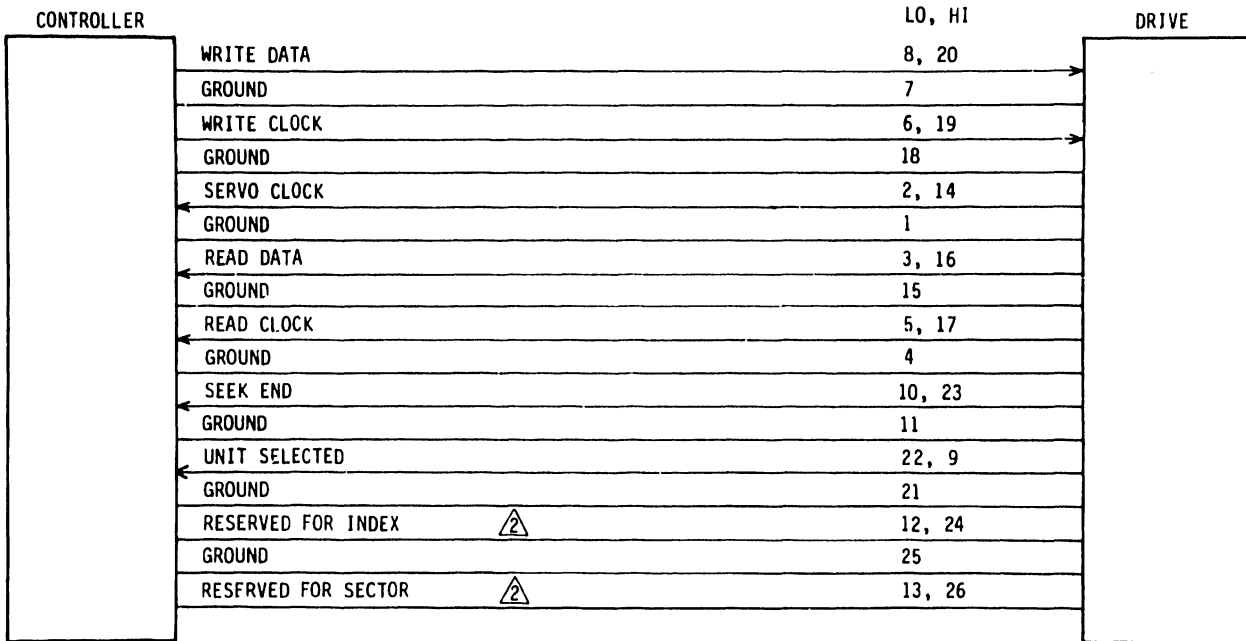
NOTES:

- 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

**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.
3. Remove package containing ac and dc power cables.
4. Remove plastic dust cover from around drive.
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 all components of the drive 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
- Power Supply Voltage Conversion
- Power Supply Bracket Installation
- System I/O Cabling
- System Grounding and Interconnect Cabling
- Mounting 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).

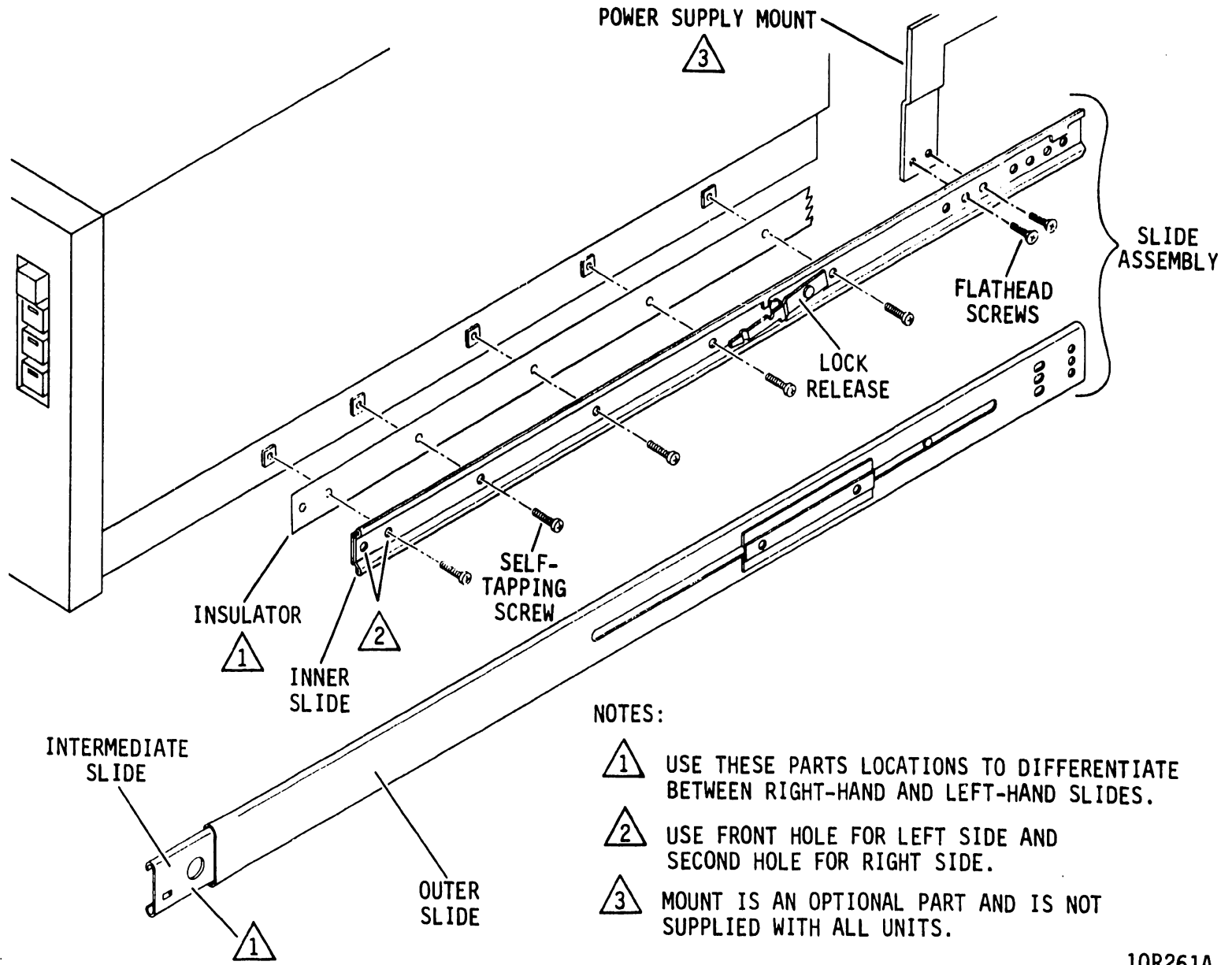
Slide assemblies are supplied with the drive as a slide-mounting option. The slide assemblies permit inline mounting of the drive and power supply. With the slides fully extended, both units are positioned beyond the front surface of the rack for ease of maintenance. The following procedure provides instructions for attaching the drive to the slides. Figure 3-6 shows how the right-hand slide assembly attaches to the drive.

### NOTE

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

1. Remove mounting screws from slide hardware kit.
2. Disengage inner slide from intermediate and outer slides of each slide assembly by pressing lock release and pulling out inner slide.
3. Install inner slides and insulators on drive with mounting hardware (refer to figure 3-6).
4. Install power supply mounts (if supplied) on inner slides with flat head screws.
5. Mount right-hand and left-hand outer slides of slide assemblies in rack in accordance with user requirements.
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.
8. Disengage shipping locks by turning shipping lock screws fully counterclockwise. These screws are accessed through holes in right side of top cover.

Figure 3-6. Drive Installation



NOTES:

- 1** USE THESE PARTS LOCATIONS TO DIFFERENTIATE BETWEEN RIGHT-HAND AND LEFT-HAND SLIDES.
- 2** USE FRONT HOLE FOR LEFT SIDE AND SECOND HOLE FOR RIGHT SIDE.
- 3** MOUNT IS AN OPTIONAL PART AND IS NOT SUPPLIED WITH ALL UNITS.

## POWER SUPPLY VOLTAGE CONVERSION

The power supply is configured before shipment to operate in one of two ranges of ac input voltages. The voltage range is determined by which voltage programming plug is installed inside the power supply. The equipment label on the power supply indicates the voltage range selected prior to shipment. The voltage programming plug for the second voltage range is attached to the outside of the power supply to allow voltage conversion. The procedure for voltage conversion involves only the power supply and requires replacing both the voltage programming plug and the ac power cable. Refer to figure 3-7 and to the Parts Data section for information about ordering the replacement ac power cable. The following procedure describes how to perform the voltage conversion.

1. Ensure that ac power cable is disconnected from power supply.
2. Remove attaching hardware (designated "A" in figure 3-8) from power supply.
3. 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.

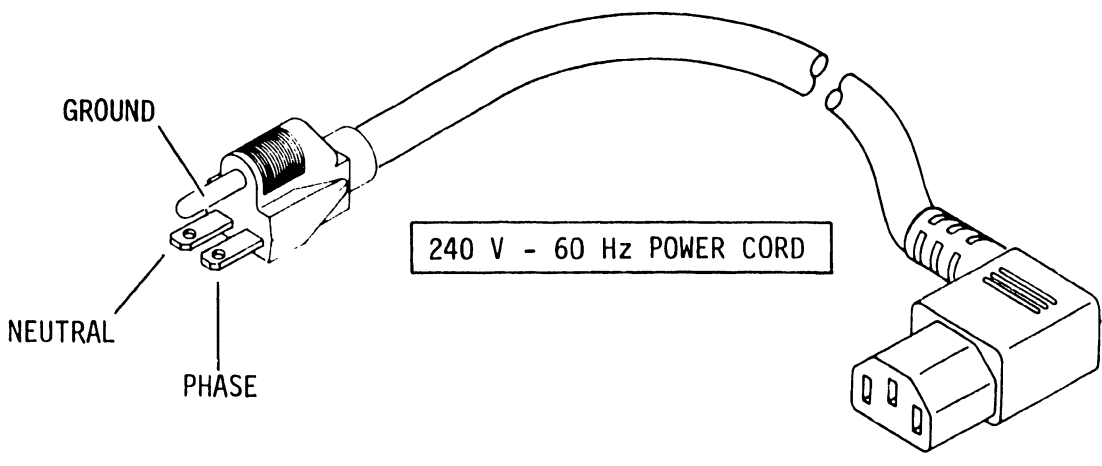
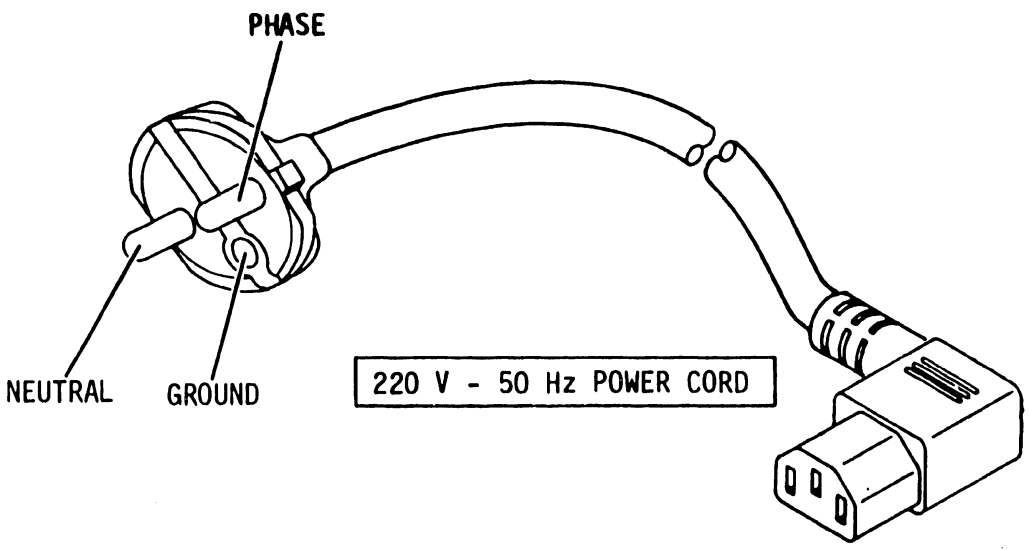
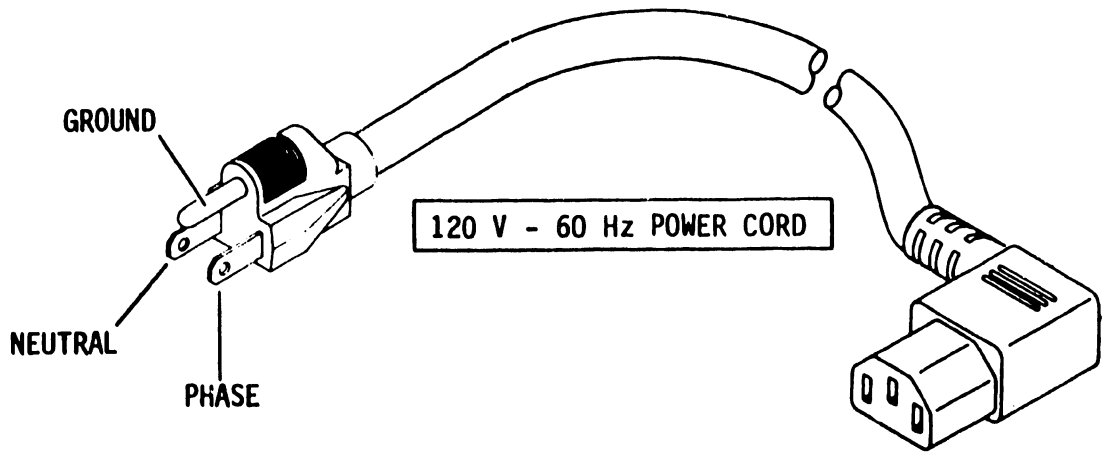
4. Slide bottom cover and front panel away from main chassis without straining internal wiring.
5. Remove attaching hardware (designated "B") and tilt bottom cover away from front panel to expose voltage programming plug.

### 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.

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

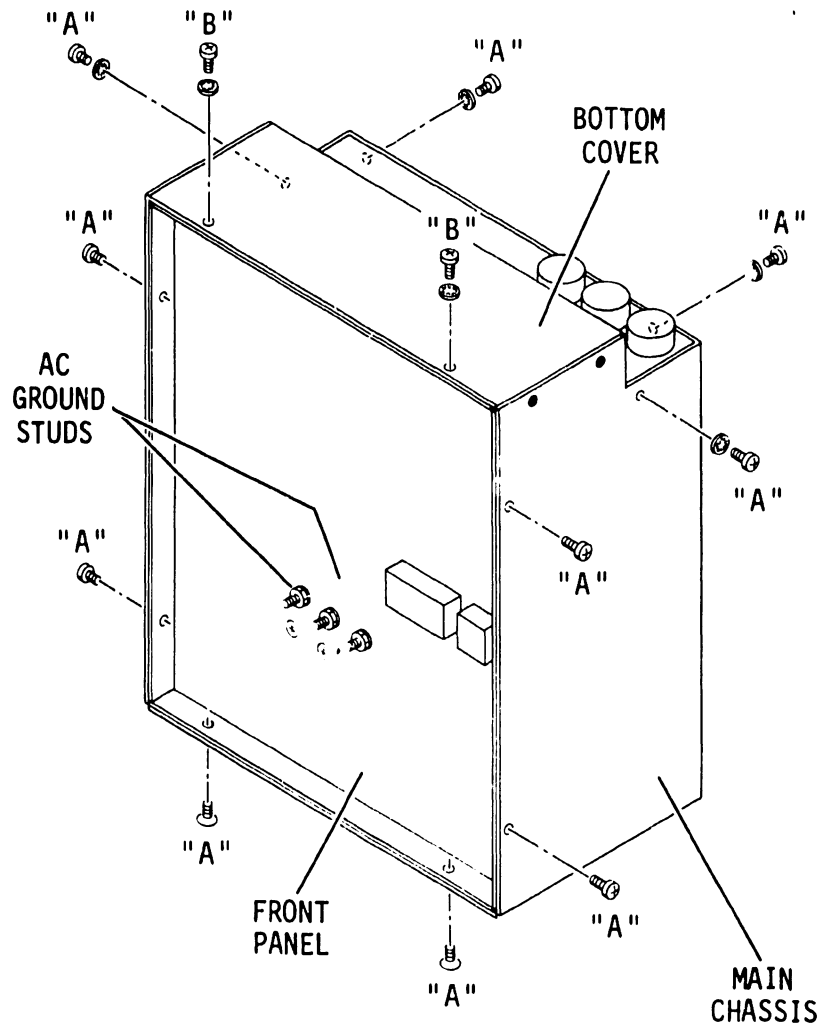




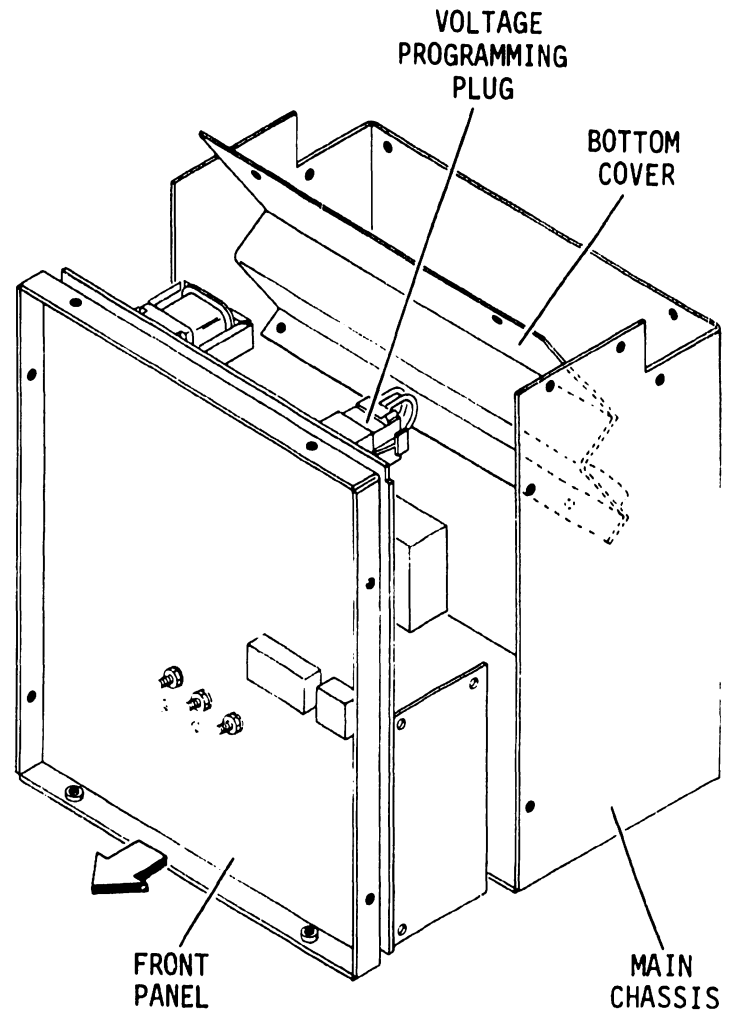
10R56B

Figure 3-7. AC Power Cables

Figure 3-8. Power Supply Voltage Conversion



HARDWARE REMOVAL



VOLTAGE PROGRAMMING PLUG REMOVAL

NOTES:

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

7. Align bottom cover with front panel and replace attaching hardware (designated "B").
8. Slide bottom cover and front panel back into alignment with main chassis.
9. Install hardware (designated "A") to attach bottom cover and front panel to main chassis.
10. Modify equipment label to reflect new ac operating voltage range for power supply.
11. Replace existing ac power cable with the ac power cable specified for new operating voltage.

### **POWER SUPPLY BRACKET INSTALLATION**

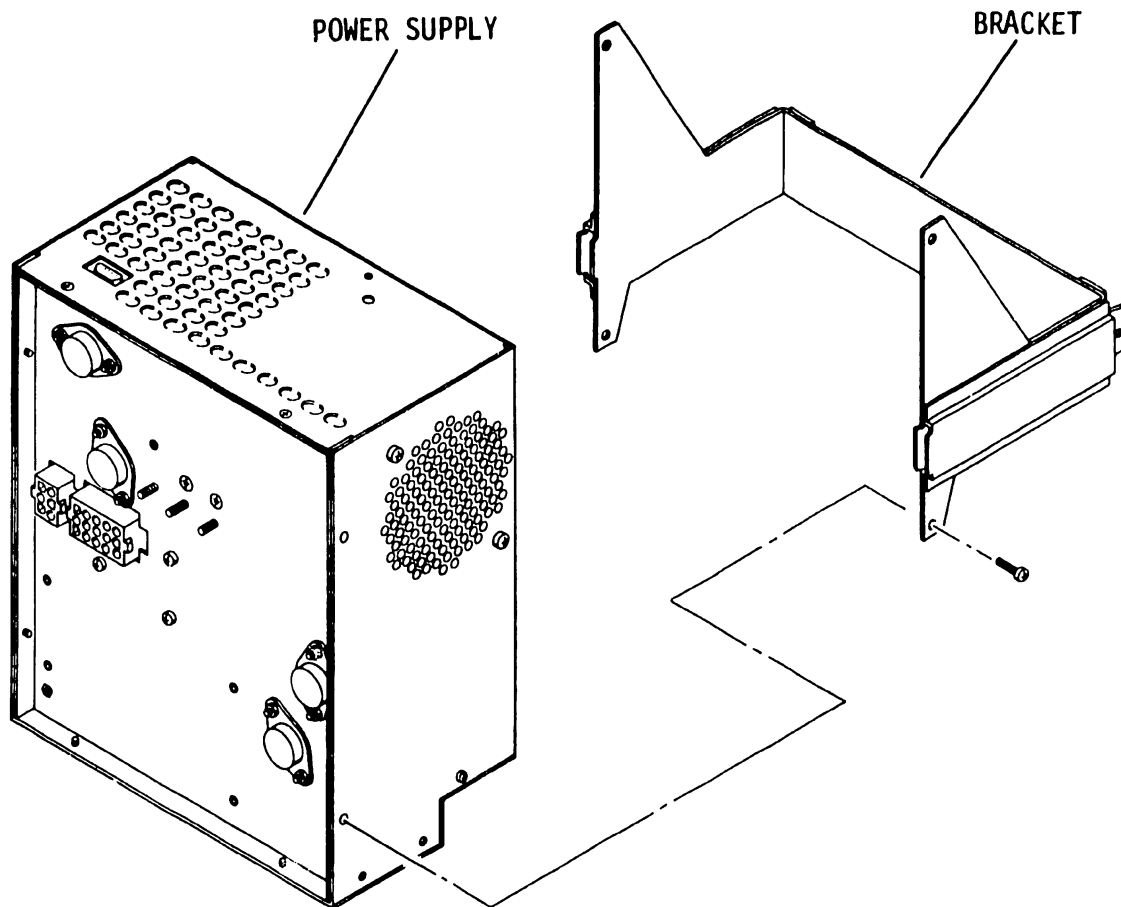
Power supply brackets are supplied as an option on newer units. Power supplies on older units are attached directly to the slide assemblies and do not use a bracket.

1. Refer to figure 3-9 and remove and discard 4 screws from power supply where bracket attaches.
2. Attach bracket to power supply by aligning with vacated holes and installing four 6-32 x 3/8 screws supplied with hardware kit.

### **SYSTEM I/O CABLING**

This procedure describes how to connect the I/O cables and terminators. 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 3-10 shows where the I/O cables are connected on the rear panel of the drive. In installations where the 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.



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Figure 3-9. Power Supply Bracket Installation

1. Install cable bracket on rear panel below I/O cable plate with attaching hardware (refer to figure 3-10).

NOTE

Steps 2 through 7 apply to single channel drives and must be repeated for dual channel drives. The I/O cable plate on dual channel drive has two sets of connectors: 1J2, 1J3, and 1J4 for channel 1; and 2J2, 2J3, and 2J4 for channel 2.

2. Connect B cable from controller to drive connector J2 on rear panel.

NOTE

Steps 3 and 4 apply only to drives using star I/O cabling configuration.

3. Connect A cable from controller to drive connector J4 on rear panel.
4. Install terminator on drive connector J3 and make terminator ground connection at rear panel connector (see figure 3-11).

NOTE

Steps 5 through 7 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.

5. Connect A cable to drive connector J4 on rear panel either from controller or from connector J3 on upstream drive.

NOTE

If drive is not last in daisy chain, perform step 6. If drive is last in daisy chain, perform step 7.

6. Connect another A cable from drive connector J3 to connector J4 on downstream drive.
7. Install terminator on drive connector J3 and make terminator ground connection at rear panel connector (see figure 3-11).

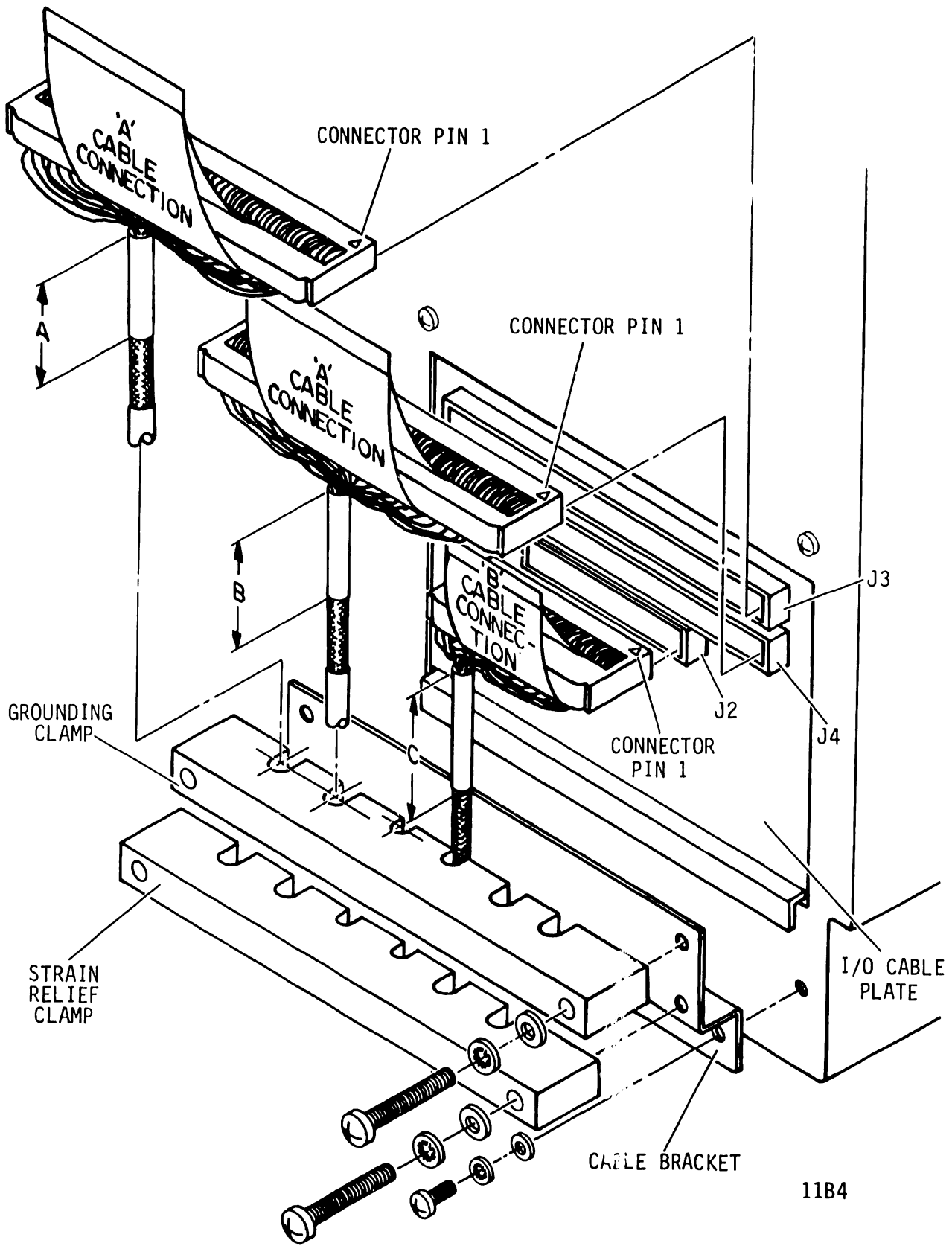


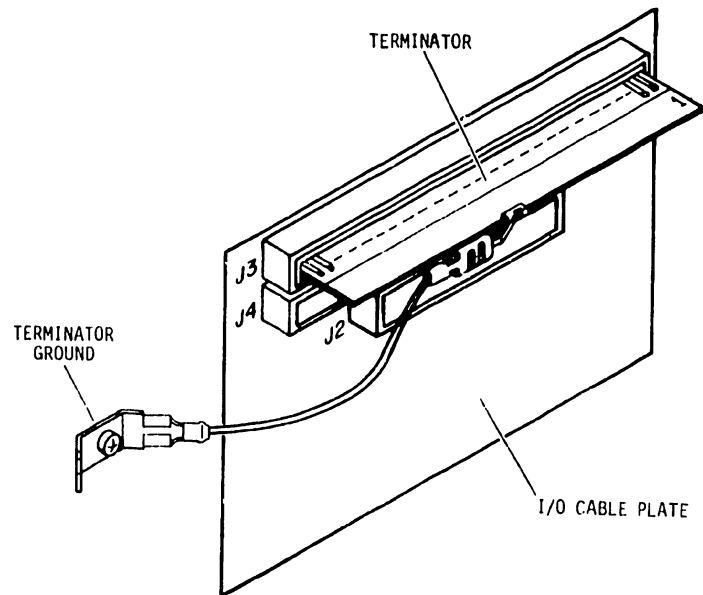
Figure 3-10. I/O Cable Attachment

8. Strip heat shrink tubing from all cables as follows so that bare shielding will be in contact with grounding clamp:
  - a. Remove heat shrink tubing located approximately 2 inches from end of insulation on A cables (dimension "A" and "B" in figure 3-10).
  - b. Remove heat shrink tubing located approximately 1 1/4 inches from end of insulation on B cables (dimension "C" in figure 3-10).

**NOTE**

In the next step ensure that bare shielding is in contact with grounding clamp. It may be necessary to strip additional insulation from cables.

9. Install grounding clamp (P/N 72851231 is stamped on part) onto cable bracket with cables positioned as shown in figure 3-10.



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Figure 3-11. Terminator Assembly

10. Apply electrical tape over any exposed bare shielding.
11. Install strain relief clamp (P/N 72851230 is stamped on part) onto cable bracket with cables positioned as shown in figure 3-10.

## SYSTEM GROUNDING AND INTERCONNECT CABLING

This section contains instructions on grounding the system and interconnecting the 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. This procedure describes how to ground the system in a star configuration as shown in figure 3-12. In this configuration, ground straps connect the controller ground to each power supply in the system. Interconnect cabling, supplied with each drive, connects case ground on each drive to case ground on its power supply. Refer to Accessories in Section 4 for grounding accessories part numbers.

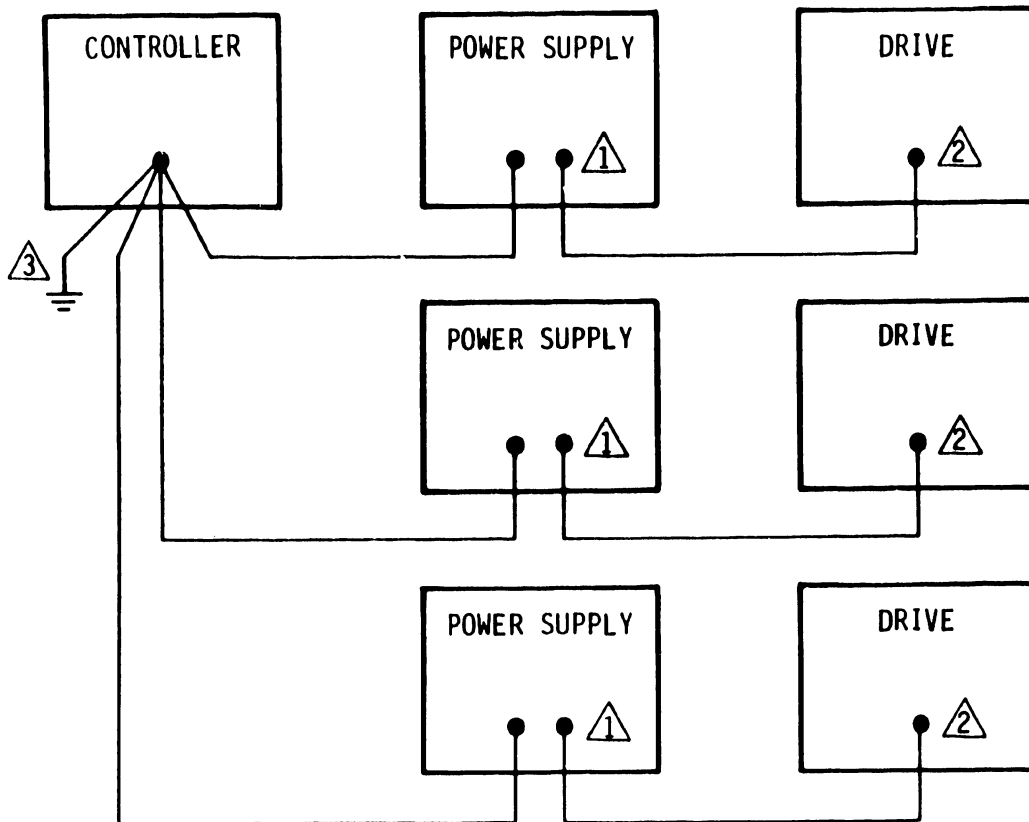
1. Prepare ground straps as follows:
  - a. Allowing sufficient length for drive extension, cut ground straps to length needed for the following connections:
    - Controller to earth ground
    - Controller to each power supply
  - b. Strip back vinyl coating at both ends of each ground strap.
  - c. Crimp and solder terminal lugs to both ends of each ground strap.
2. Referring to figure 3-12, connect ground straps to controller as follows:
  - a. Connect one strap between controller ground terminal and earth ground.
  - b. Connect one end of each ground strap to controller ground terminal. Route these straps to area where power supplies will be installed.

### NOTE

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



3. Referring to figure 3-8, attach one ground strap to case ground on 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.
4. Identify whether dc power cable has a ground shield strap attached at each end. If it does, proceed with step 5. Otherwise, skip to step 6.
5. Referring to figures 3-12 and 3-13, 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.
6. Referring to figures 3-12 and 3-13, 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.



NOTES:

- ① GROUND CONNECTIONS TO POWER SUPPLY USE STUDS MARKED  $\text{⏏}$ . THERE MUST BE NO CONNECTION TO STUD MARKED "+ 5V RET."
- ② DRIVE IS GROUNDED AT "DC GND" SCREW ON DRIVE REAR PANEL. 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 3-12. System Grounding Diagram

NOTES:

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

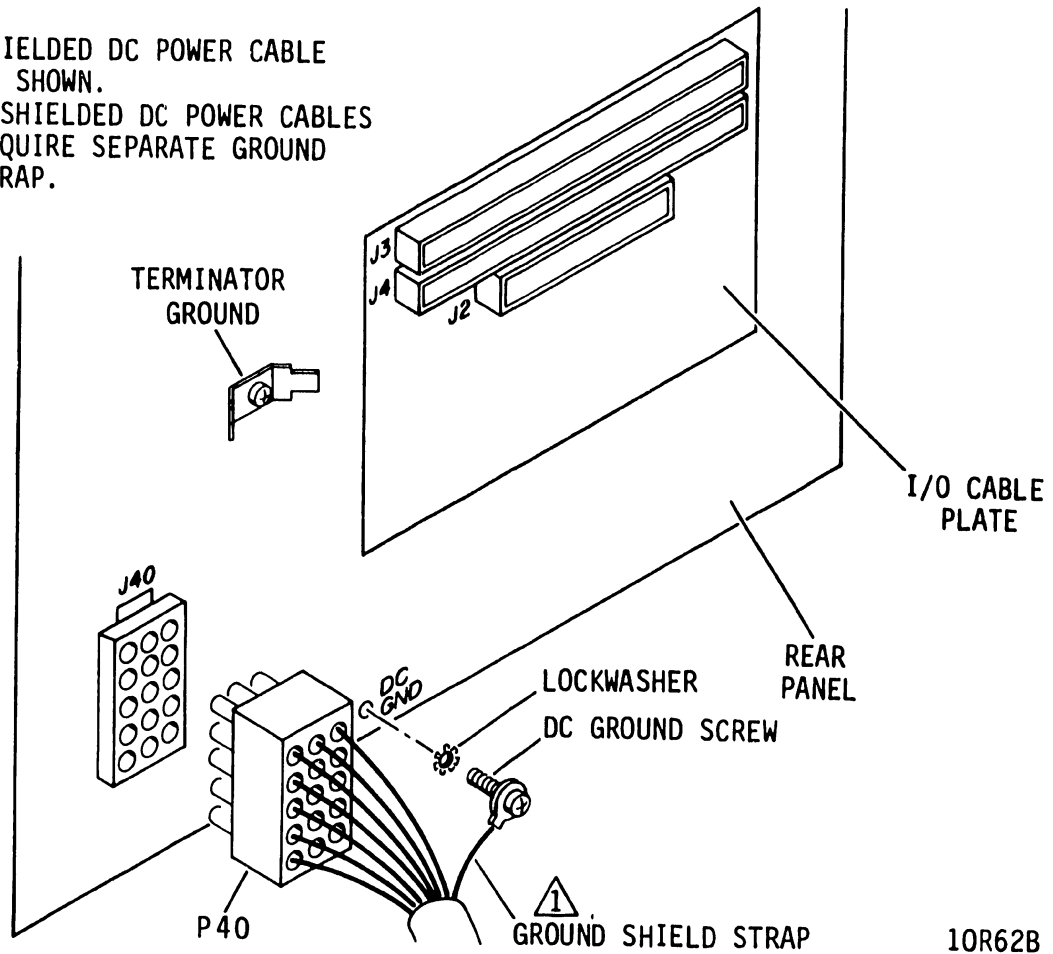


Figure 3-13. Drive Interconnect Wiring

- 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 POWER SUPPLY IN RACK**

The following procedure provides instructions for mounting the power supply behind the drive on the slide assemblies and connecting the ac power cable to the supply. Power supplies on older units are mounted directly on the slide assemblies and do not use a mounting bracket. A second person is needed to support the power supply while the mounting hardware is being installed. Power supplies on newer units are attached with a bracket and mounts. Figure 3-7 shows the ac power cable provided with the power supply.

### **NOTE**

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

### **Units Without Mounting Bracket**

1. Extend drive from rack to the full extension allowed by slide assemblies.
2. Support power supply above drive.

### **NOTE**

At full slide extension, power supply mounting holes in inner slide are accessible through clearance holes in intermediate slide, as shown in figure 3-14.

3. Attach power supply to inner slides with screws provided in slide hardware kit.
4. Connect ac power cable to AC INPUT connector J1 and to site ac power source.

### **Units With Mounting Bracket**

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

2. Position power supply so that mounts and matching slots in bracket are aligned as shown in figure 3-14. Slide power supply toward drive until locking holes in bracket aligns with locking holes in mounts.
3. Secure power supply bracket to mounts with 8-32 x 5/16 screws, washers, and lockwashers.
4. Connect ac power cable to AC INPUT connector J1 and to site ac power source.

### SETTING CIRCUIT BOARD SWITCHES

The circuit boards inside the drive contain a number of switches that must be set correctly for normal operation of the drive. Figures 3-15 and 3-16 identify these switches 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. With the exception of the Index/Sector Jumper Plug and W PROT switch, all settings can be performed without removing the cover from the drive. Setting the sector select switches is discussed separately in the following paragraphs.

Figures 3-15 and 3-16 show 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 \_PEX board and appear as in figure 3-17.

Refer to the subsystem reference manual to determine the number of sectors required by the controller; then locate that number in table 3-3. 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 3-17 for an illustration of the switch positions.

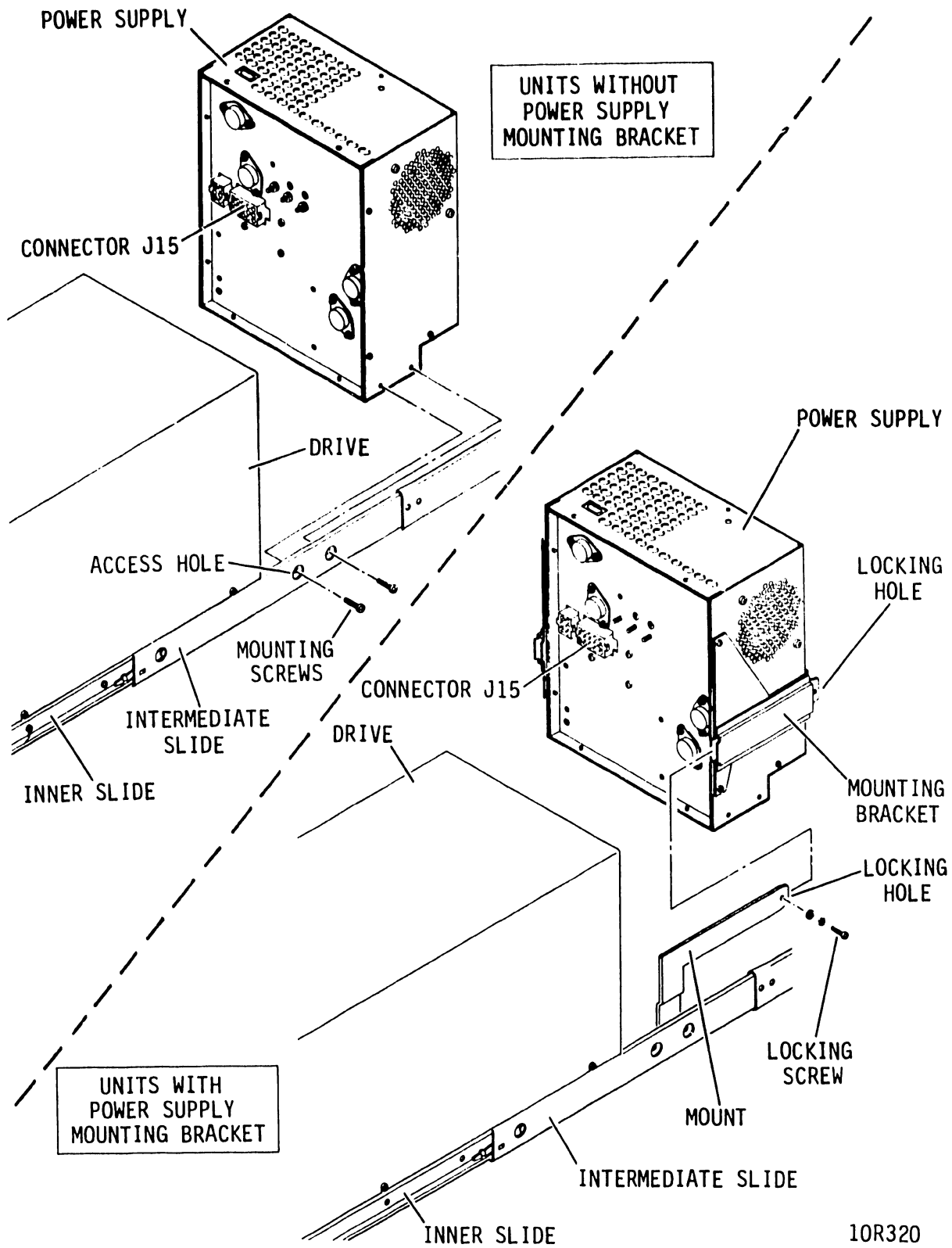
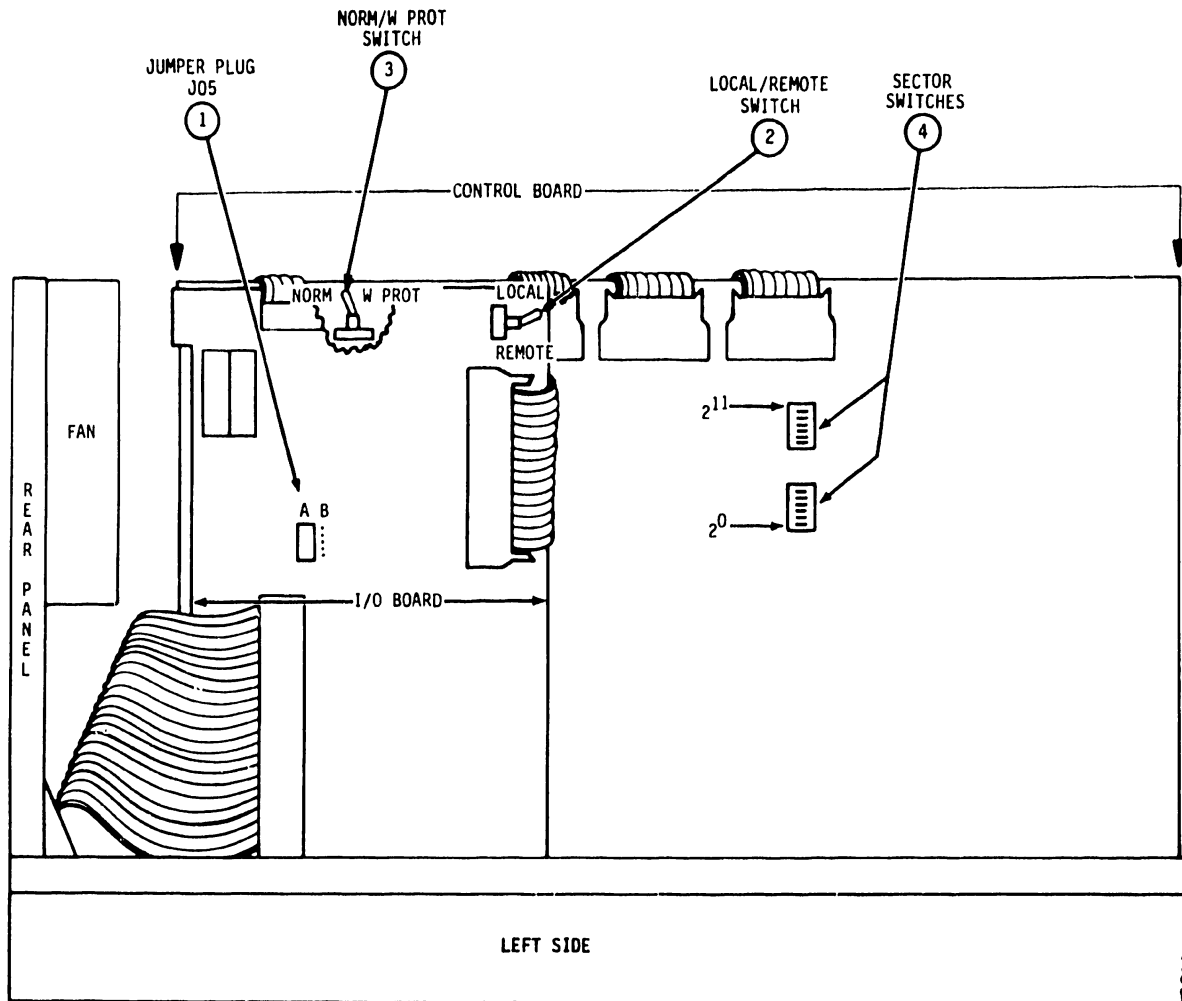


Figure 3-14. Installing Power Supply on Slides



INDEX	SWITCH	SETTING
-------	--------	---------

ON I/O BOARD:

① INDEX/SECTOR JUMPER PLUG 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 DEPENDENT ON CONTROLLER.

ON CONTROL BOARD:

③ NORM/W PROT NORM

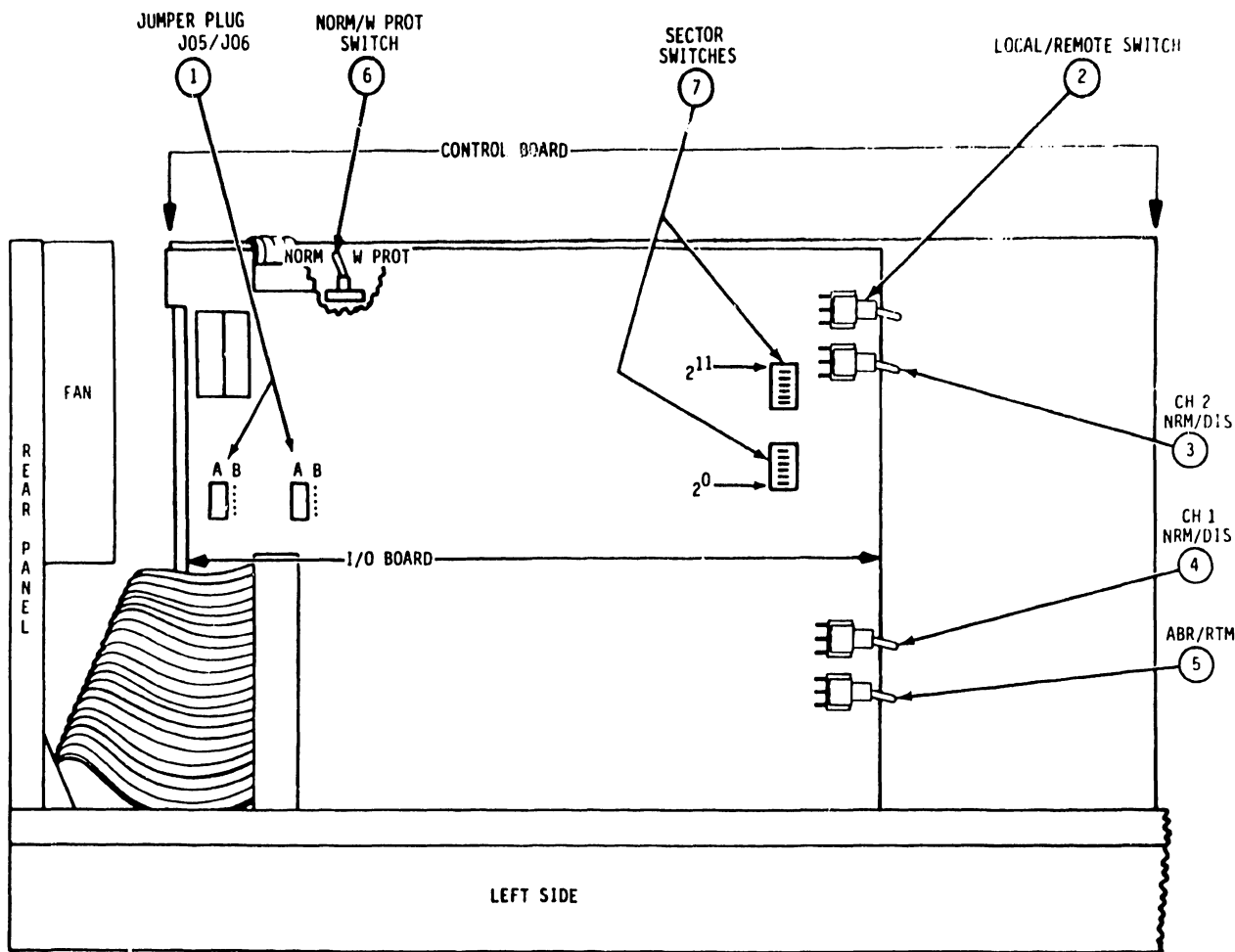
④  SECTOR SWITCHES SEE DISCUSSION ON SETTING SECTOR SELECT SWITCHES.

NOTES:

 THESE SWITCHES CAN BE SET THROUGH LABELLED OPENINGS IN TOP COVER.

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Figure 3-15. Single Channel Drive Switch Settings



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 DEPENDENT ON CONTROLLER.
③	CH 2 NRM/DIS	NORM
④	CH 1 NRM/DIS	NORM
⑤	ABR/RTM	ABR (ABSOLUTE RESERVE): DRIVE REMAINS RESERVED UNTIL IT RECEIVES RELEASE OR PRIORITY SELECT COMMAND. RTM (RESERVE TIME OUT): DRIVE IS RELEASED FROM RESERVED CONDITION APPROXIMATELY 500 MS AFTER BEING DESELECTED.

ON CONTROL BOARD:

⑥	NORM/W PROT	NORM
⑦	⚠ SECTOR SWITCHES	SEE DISCUSSION ON SETTING SECTOR SELECT SWITCHES.

NOTES:

⚠ THESE SWITCHES CAN BE SET THROUGH LABELLED OPENINGS IN TOP COVER.

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Figure 3-16. Dual Channel Drive Switch Settings



The switch settings listed in table 3-3 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:

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

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 <sup>0</sup>	1
1	2 <sup>1</sup>	2
2	2 <sup>2</sup>	4
3	2 <sup>3</sup>	8
4	2 <sup>4</sup>	16
5	2 <sup>5</sup>	32
6	2 <sup>6</sup>	64
7	2 <sup>7</sup>	128
8	2 <sup>8</sup>	256
9	2 <sup>9</sup>	512
10	2 <sup>10</sup>	1024
11	2 <sup>11</sup>	2048

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

$$\text{Total Sector Clock Pulses} = \frac{13\,440}{63} - 1 = 212$$

NOTE

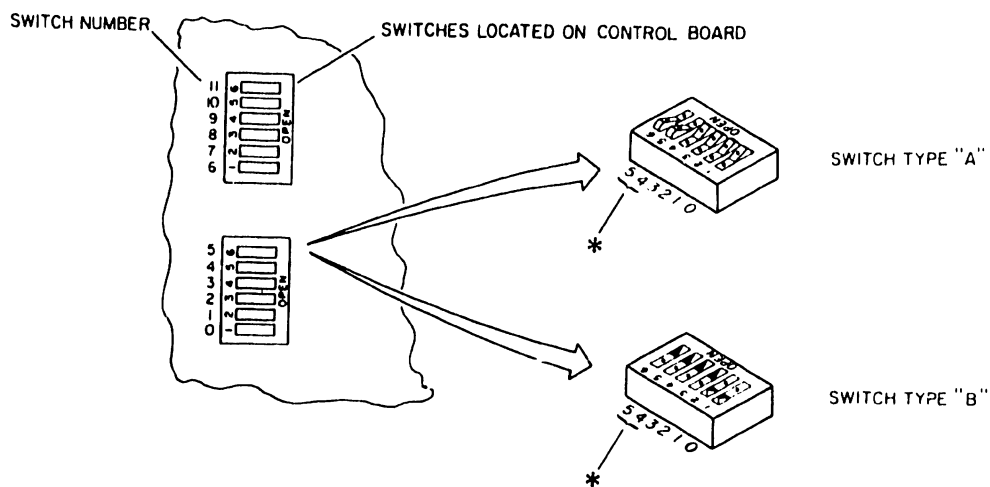
Remainder is ignored.

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

Total clock pulses per sector	212
Clock pulses selected by switch 7	128
(Difference)	84
Clock pulses selected by switch 6	54
(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 of 212 clock pulses per sector. Since a remainder existed in the calculation formula, an additional "short" sector of 21 Sector Clock Pulses (806 kHz) will be present just before index.

## ROCKER-TYPE SWITCHES

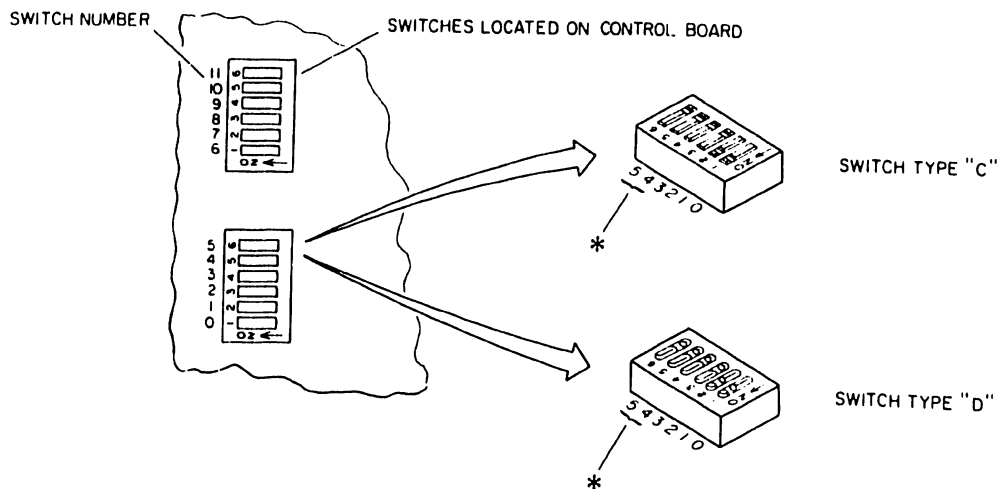


### ROCKER-TYPE SWITCHES:

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

\* SWITCHES 4 AND 5 SHOWN IN OPEN POSITION

## SLIDE-TYPE SWITCHES



### SLIDE - TYPE SWITCHES:

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

\* SWITCHES 4 AND 5 SHOWN IN OFF POSITION

10R55

Figure 3-17. Miniature Switches

TABLE 3-3. 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
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

Table Continued on Next Page

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

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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
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

Table Continued on Next Page

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

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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
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

Table Continued on Next Page

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

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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
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

Table Continued on Next Page

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

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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
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	C	O	O
123	O	O	C	C	O	C	C	O	O	O	O	O

Table Continued on Next Page



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

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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.

### CHECKOUT

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

1. Install logic plug in operator panel. Logic plug for each drive in a system must have a unique number.
2. Set LOCAL/REMOTE switch to LOCAL position. Switch is accessible through opening in left side of cover.
3. Set circuit breaker CBI at rear of power supply in ON position, and observe that the drive cooling fan operates.
4. Install a data pack in drive (see Operation section of this manual), 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 60 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.
7. Return drive to normal operating position in equipment rack.
8. Drive is now ready for on-line operation.

**SECTION**

**4**

**PARTS**

**DATA**

---

## 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.
- REPLACEABLE PART NUMBER - Contains the interchangeable replacement part number.

### **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 1

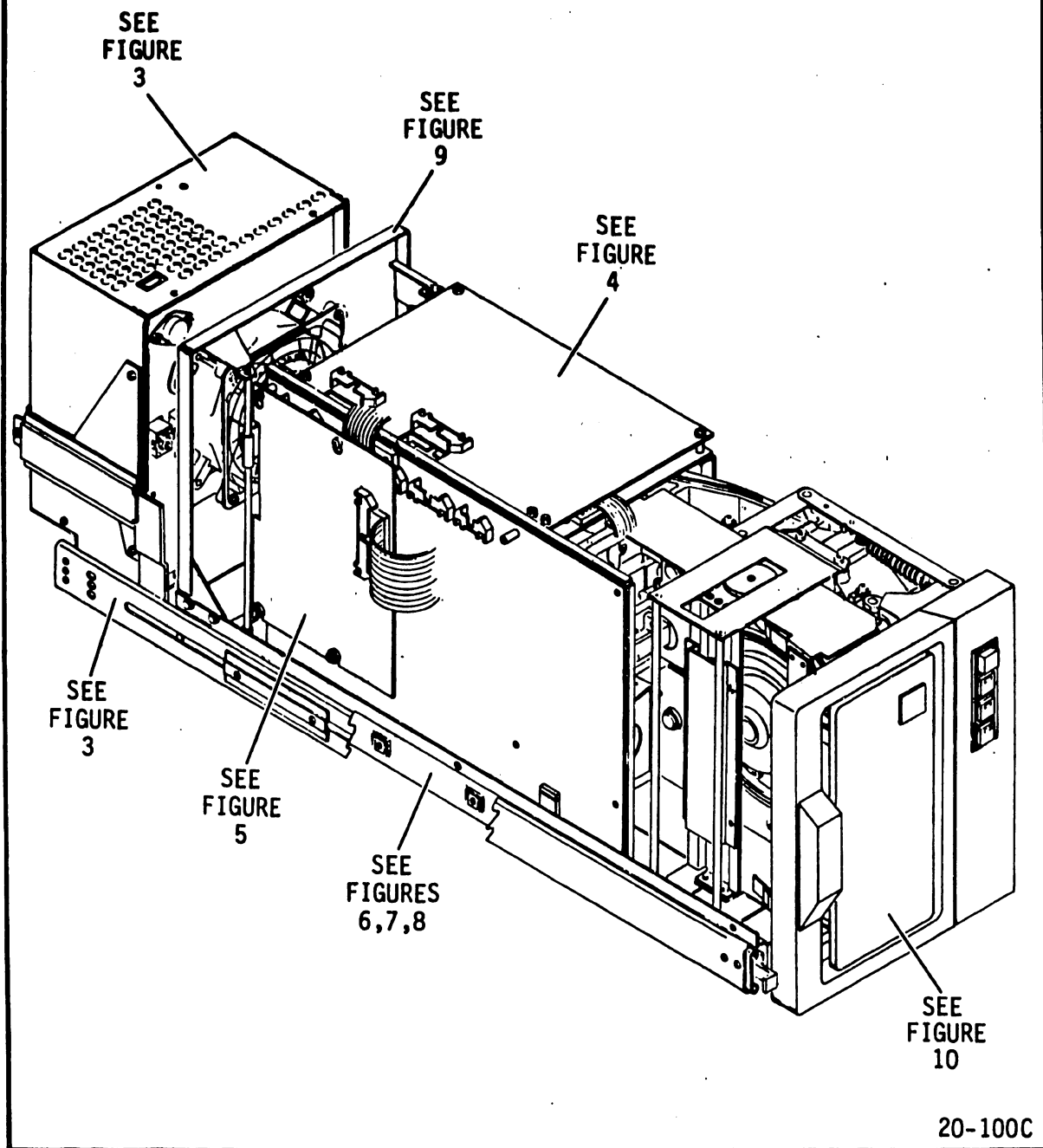


Figure 4-1

# LOCATOR 2

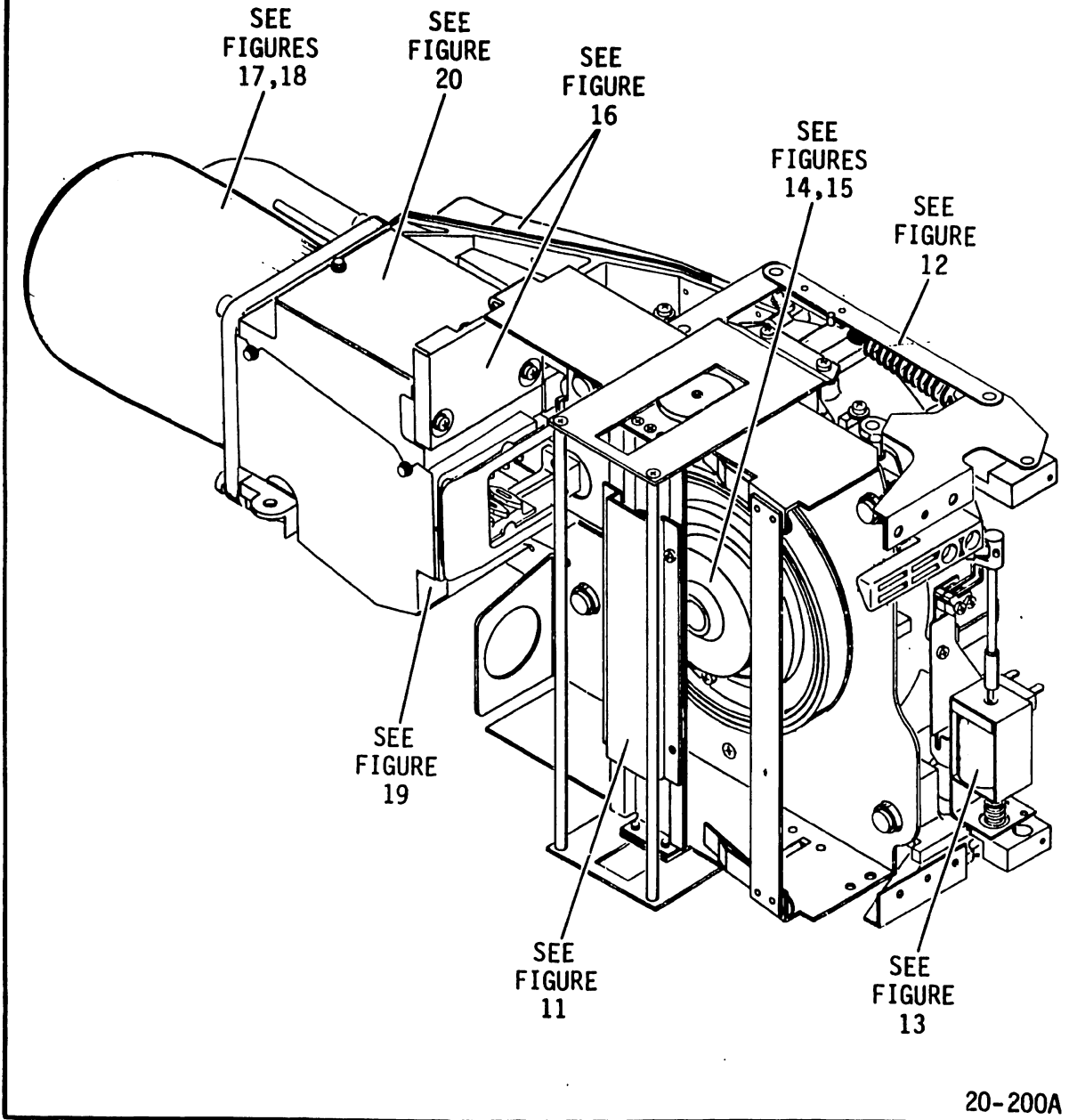
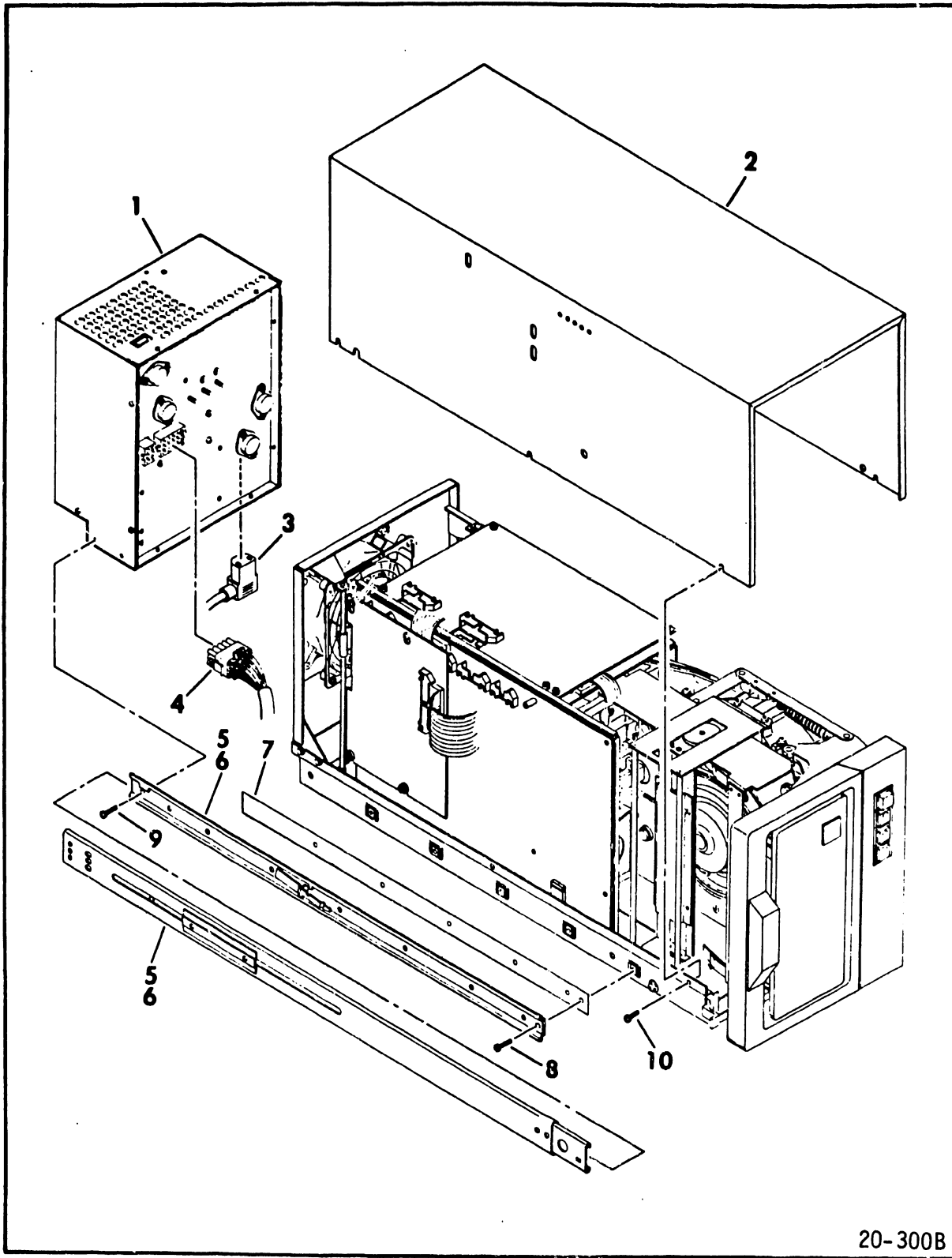


Figure 4-2



20-300B

Figure 4-3 (Older Units)



INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Optional/ Spare	POWER SUPPLY ASSEMBLY	
2	75038380	COVER, Top	PA3A1 units only
2	75038390	COVER, Top	PA3A2 units only
3	Optional	AC POWER CABLE (P01)	
4	Optional	DC POWER CABLE (P40)	
5	Optional	SLIDE ASSEMBLY, LH	
6	Optional	SLIDE ASSEMBLY, RH	
7	93263420	INSULATOR, Slide	
8	94375825	SCREW, PHH, 8-16 x 1/2	
9	Optional	SCREW, PHH, 8-32 x 1/2	
10	10127111	SCREW, PHH, 6-32 x 1/4	

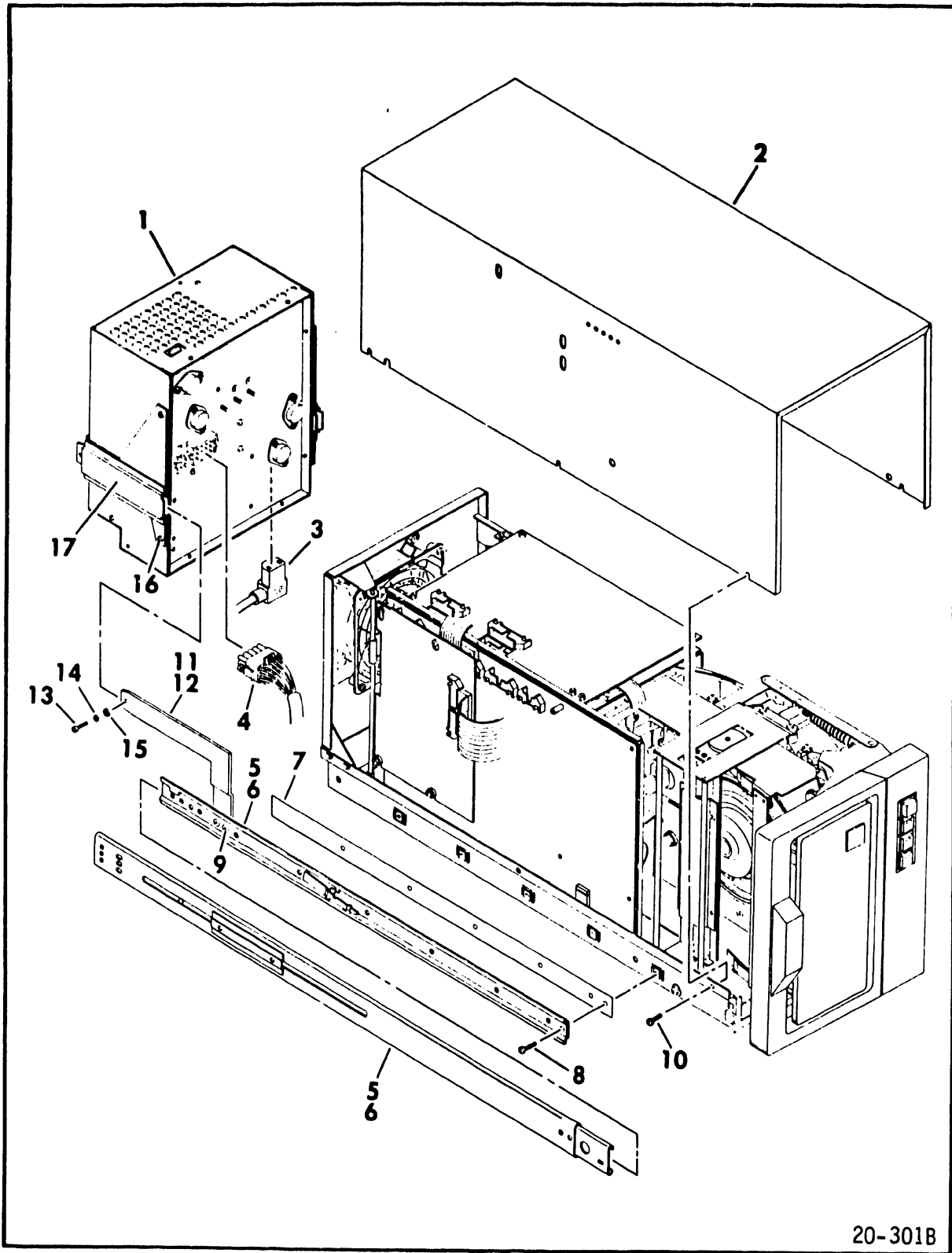
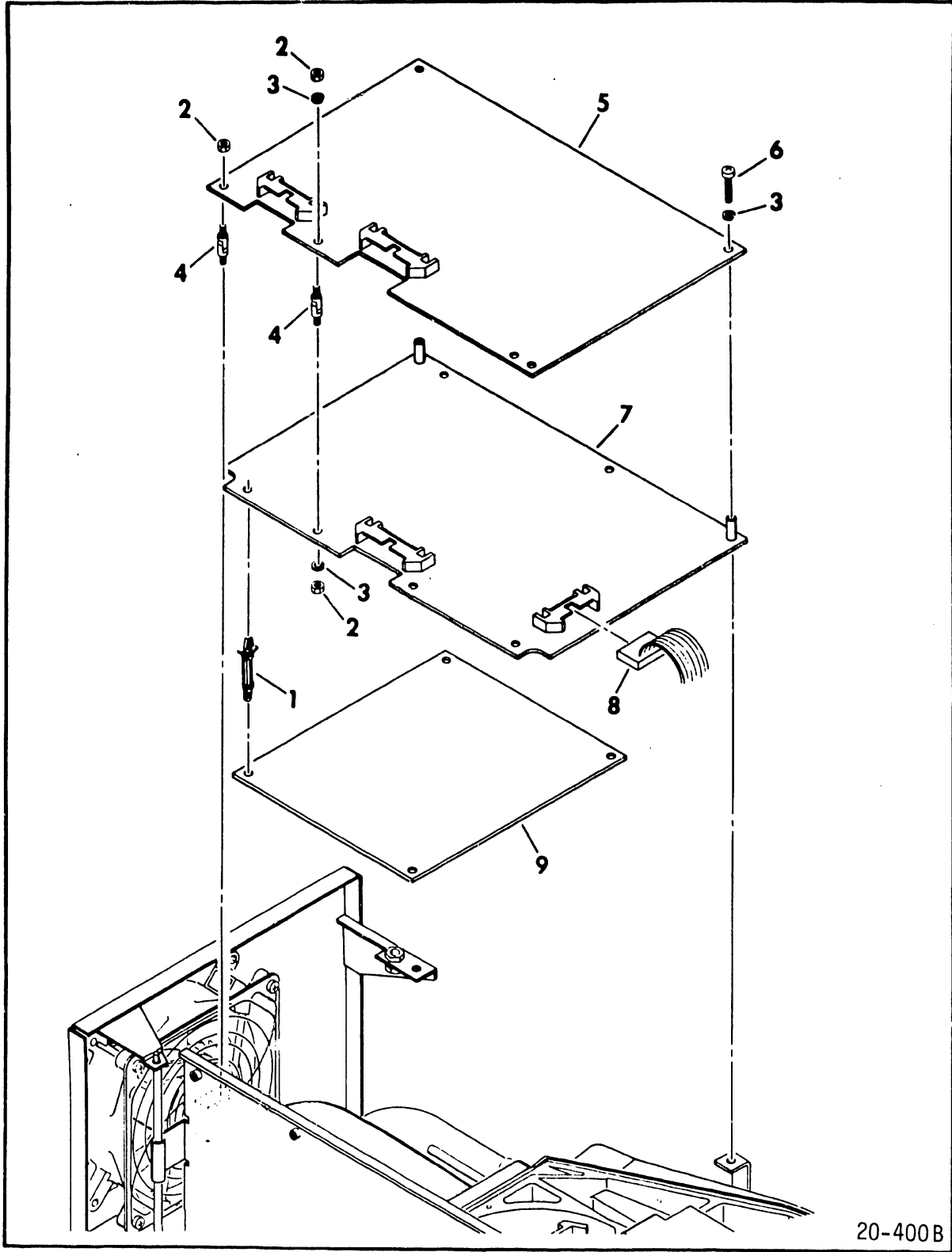


Figure 4-3 (Newer Units)

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Optional/ Spare	POWER SUPPLY ASSEMBLY	
2	75038380	COVER, Top	PA3A1 Units only
2	75038390	COVER, Top	PA3A2 Units only
3	Optional	AC POWER CABLE (P01)	
4	Optional	DC POWER CABLE (P40)	
5	Optional	SLIDE ASSEMBLY, LH	
6	Optional	SLIDE ASSEMBLY, RH	
7	93263420	INSULATOR, Slide	
8	94375825	SCREW, PHH, 8-16 x 1/2	
9	Optional	SCREW, PHH, 8-32 x 1/4	
10	10127111	SCREW, PHH, 6-32 x 1/4	
11	Optional	MOUNT, LH	
12	Optional	MOUNT, RH	
13	Optional	SCREW, PHH, 8-32 x 5/16	
14	Optional	LOCKWASHER, #8	
15	Optional	WASHER, #8	
16	Optional	SCREW, PHH, 6-32 x 3/8	
17	Optional	BRACKET, Mounting	



20-400B

Figure 4-4

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	94378801	SUPPORT, Circuit Board	
2	10125105	NUT, Hex. 6-32	
3	10125803	LOCKWASHER, #6	
4	47402261	STANDOFF, Hinged	
5	Spare	_PGX (READ/WRITE PLO's) BOARD	
6	10127117	SCREW, PHH, 6-32 x 7/8	
7	Spare	_PFX (DATA LATCH) BOARD	
8	92049800	READ/WRITE PREAMP CABLE ASSY	
9	Spare	_PDX (POWER AMP) BOARD	

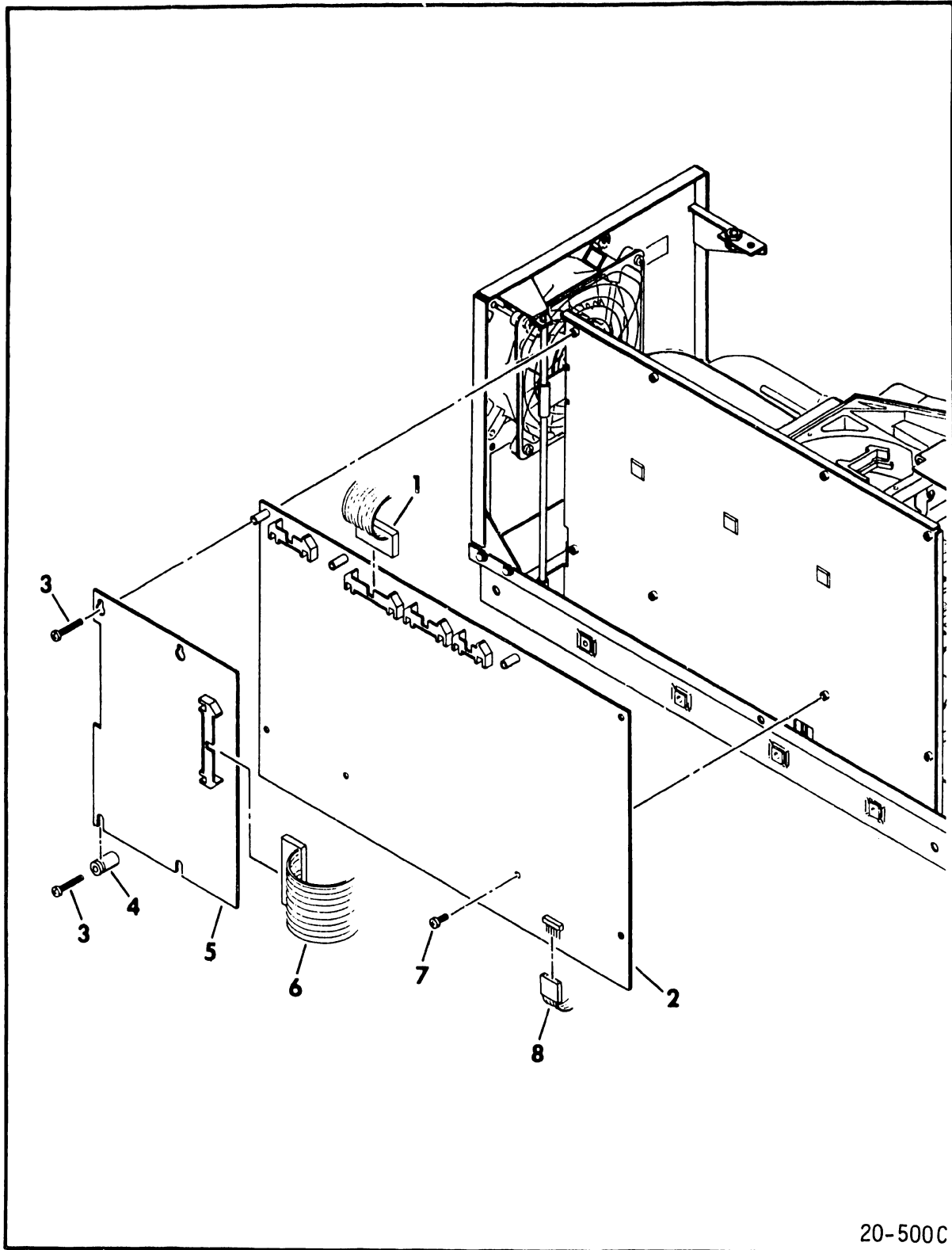


Figure 4-5

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	93458300	CABLE ASSEMBLY (P29/P30/P31)	
2	Spare	_PEX (CONTROL) BOARD	
3	10127117	SCREW, PHH, 6-32 x 7/8	
4	92555237	STANDOFF	
5	Spare	_EBN (I/O) BOARD	PA3A1 Units Only
5	Spare	_EDN (I/O) BOARD	PA3A2 Units Only
6	Spare	CABLE ASSEMBLY (P14/P20)	
7	10127111	SCREW, PHH, 6-32 x 1/4	
8	Spare	CABLE ASSEMBLY (P28/P34)	

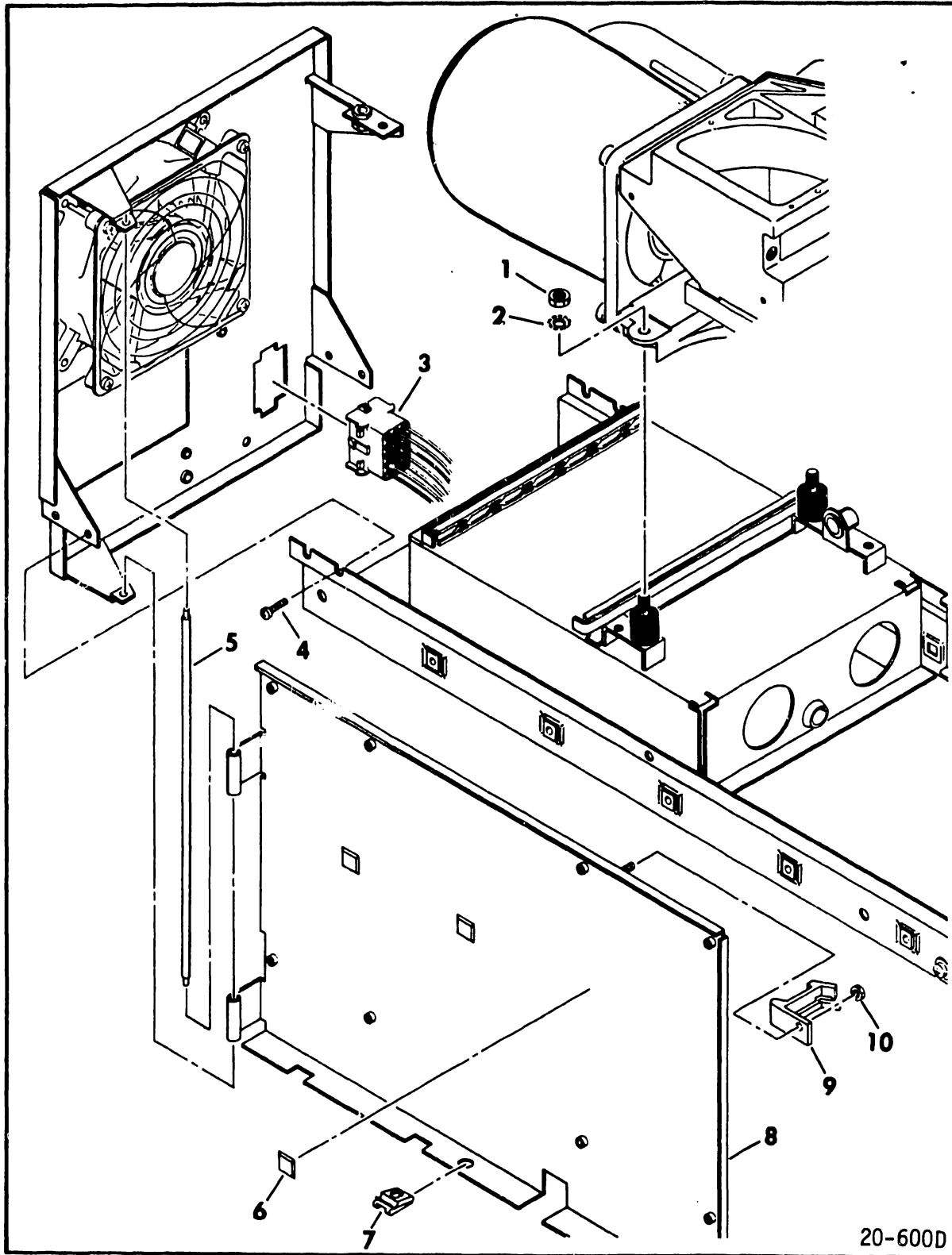
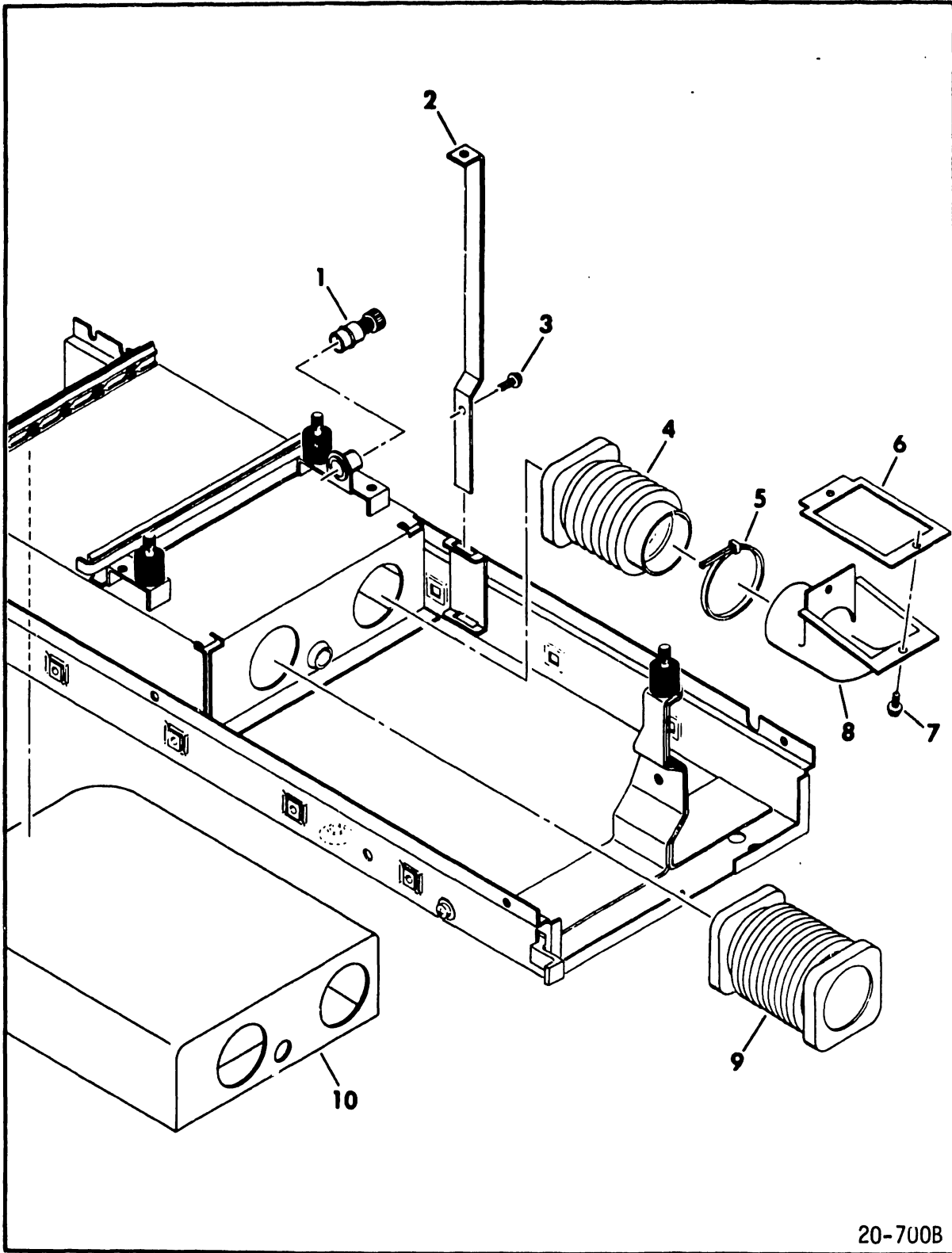


Figure 4-6



INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	10125301	NUT, Hex, 1/4-20	
2	10126404	LOCKWASHER, 1/4	
3	Spare	DC HARNESS (P19/P21/P22/P35/ P36/P37/P38/J40)	
4	10127111	SCREW, Washer Hd, 6-32 x 1/4	
5	93913858	HINGE, Pin	
6	51805802	BUMPER	
7	94317800	RETAINER	
8	75038383	PANEL, Support	
9	93148610	LATCH, Card	
10	92071008	NUT, Hex, 6-32	



20-700B

Figure 4-7

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	81400910	SCREW, Retractable	
2	93263408	SUPPORT, Logic Board	
3	93592158	SCREW, Washer Hd, 6-32 x 1/4	
4	92555201	DUCT, Air	
5	94277415	TY-WRAP	
6	93913854	GASKET	
7	93592158	SCREW, Washer Hd, 6-32 x 1/4	
8	93913857	DUCT, Air	
9	71869100	DUCT, Air	
10	Spare	FILTER, Absolute	

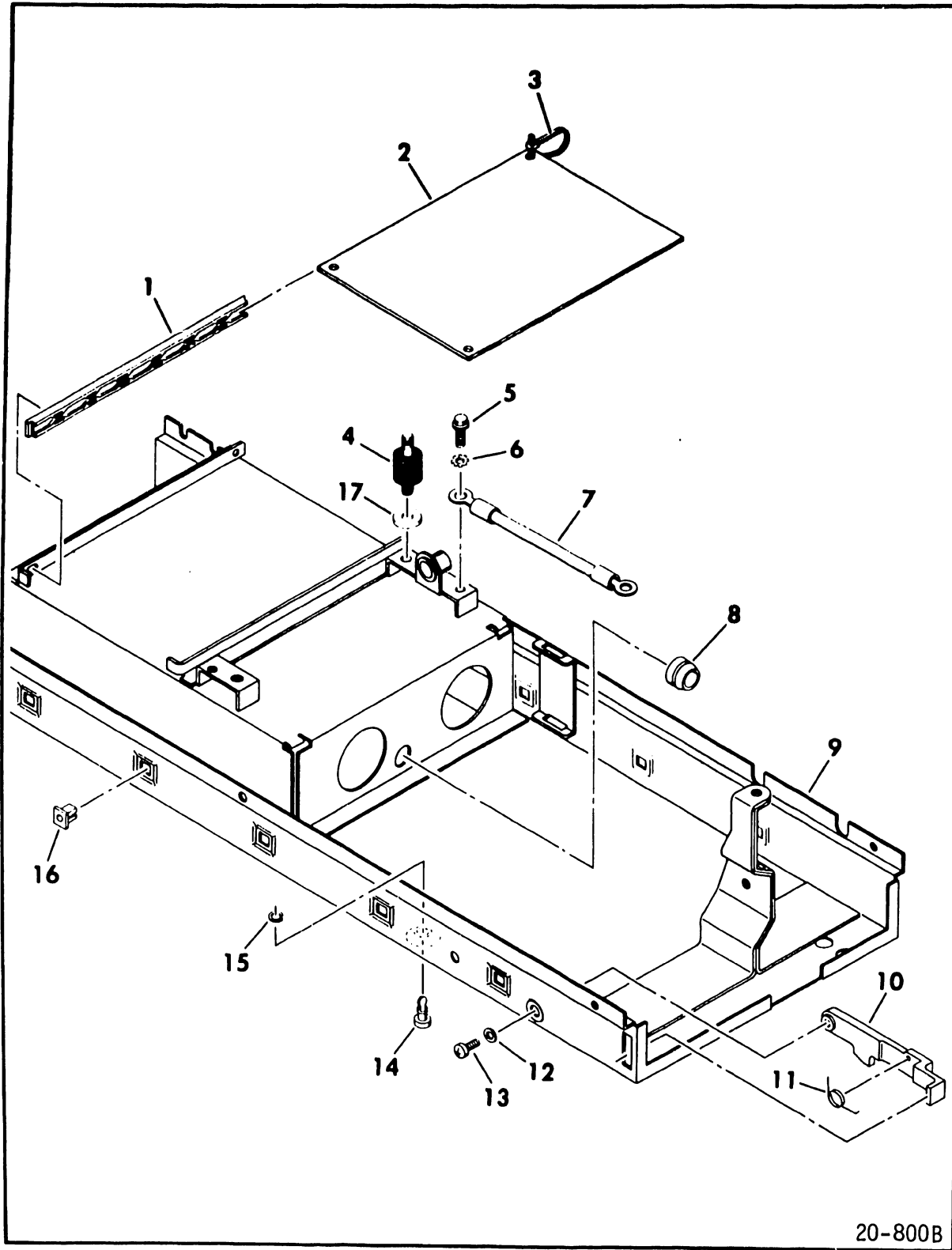


Figure 4-8

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	72856240	SLIDE	
2	Spare	_PMX (MOT SPD CONTROL) BOARD	
3	94277422	TY-WRAP	
4	93568013	MOUNT, Vibration	
5	93593238	SCREW, Washer Hd, 10-24 x 3/8	
6	10126403	LOCKWASHER, #10	
7	94281427	GROUND CABLE	
8	93913860	GROMMET	
9	93913876	BASE	
10	93913893	LATCH	See Note 1 below
11	93263415	SPRING	See Note 1 below
12	10125606	WASHER, #8	See Note 1 below
13	93749200	SCREW, PHH, 8-32 x 3/8	See Note 1 below
14	94317720	FASTENER	
15	94317900	RETAINER	
16	72854290	NUT, Square	
17	92777150	WASHER, Special, 1/4	Used on older units only

NOTE 1: Not used on PA3A1B

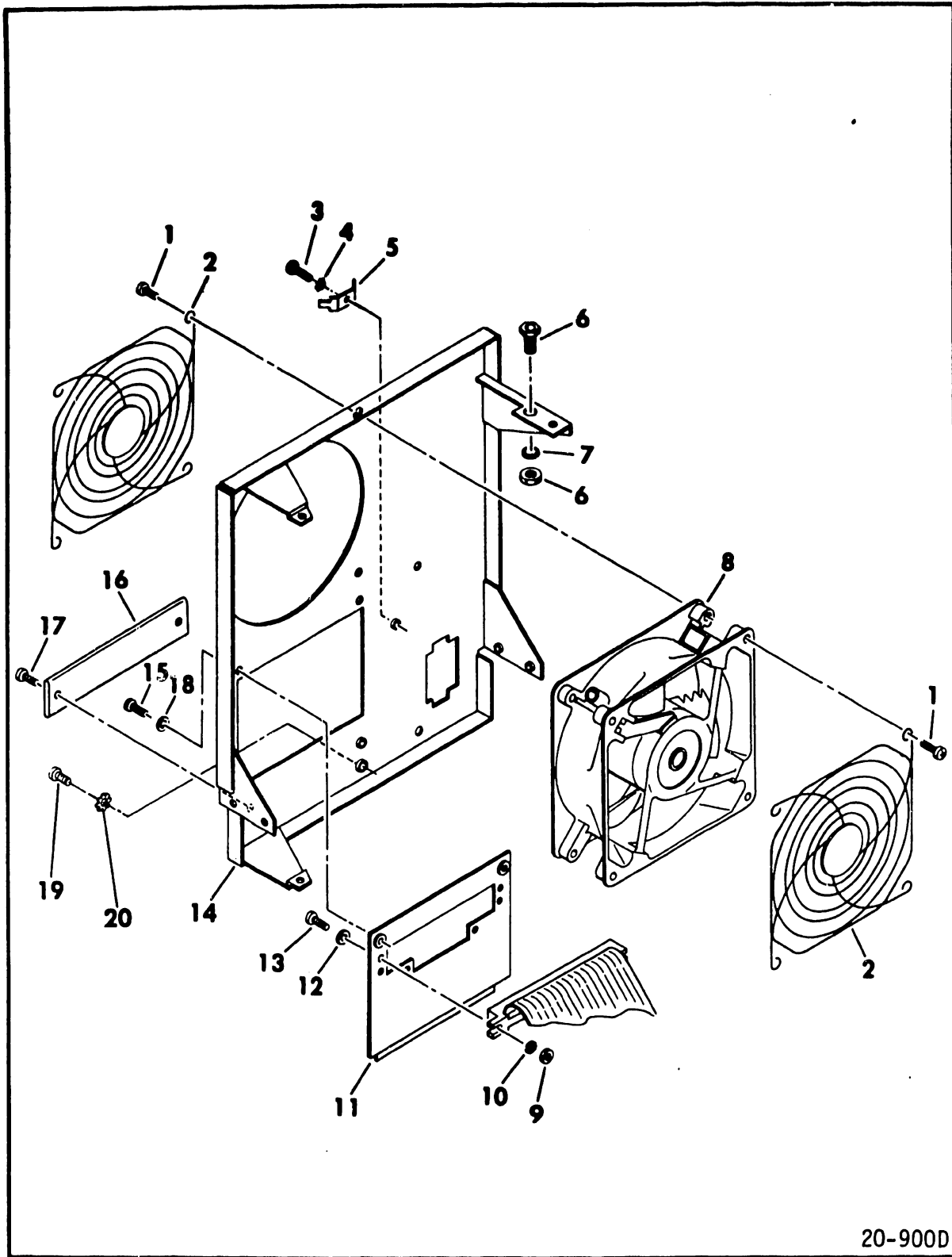


Figure 4-9

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	17901518	SCREW, PHH, 8-32 x 5/8	
2	94375408	FINGER GUARD, Fan	
3	10127111	SCREW, PHH, 6-32 x 1/4	
4	10126401	LOCKWASHER, #6	
5	94274113	TERMINAL	
6	93879001	JACK, Banana	
7	10126106	LOCKWASHER, 1/4	
8	Spare	FAN ASSEMBLY	
9	1012510	NUT, Hex, 4-40	
10	10125801	LOCKWASHER, #4	
11	72856520	PLATE, I/O	PA3A1 Units Only
11	72856521	PLATE, I/O	PA3A2 Units Only
12	10125603	WASHER, #4	
13	10127105	SCREW, PHH, 4-40 x 1/2	
14	93913859	PANEL, Rear	
15	10127111	SCREW, PHH, 6-32 x 1/4	
16	93920481	CLAMP, I/O Cable	
17	17901511	SCREW, PHH, 6-32 x 5/8	
18	10125803	LOCKWASHER, #6	
19	10127132	SCREW (GND), PHH, 10-24 x 1/2	
20	10126403	LOCKWASHER, #10	
	92353801	I/O CABLE CLAMP KIT	
	72851240	BRACKET, Cable	
	72851230	CLAMP, Strain Relief	
	72851231	CLAMP, Grounding	
	17901510	SCREW, PHH, 6-32 x 1/2	
	10125605	WASHER, #6	
	10126401	LOCKWASHER, #6	
	10127146	SCREW, PHH, 10-32 x 7/8	
	10126403	LOCKWASHER, #10	
	10125607	WASHER, #10	
	93920481	CLAMP (for flat cables)	

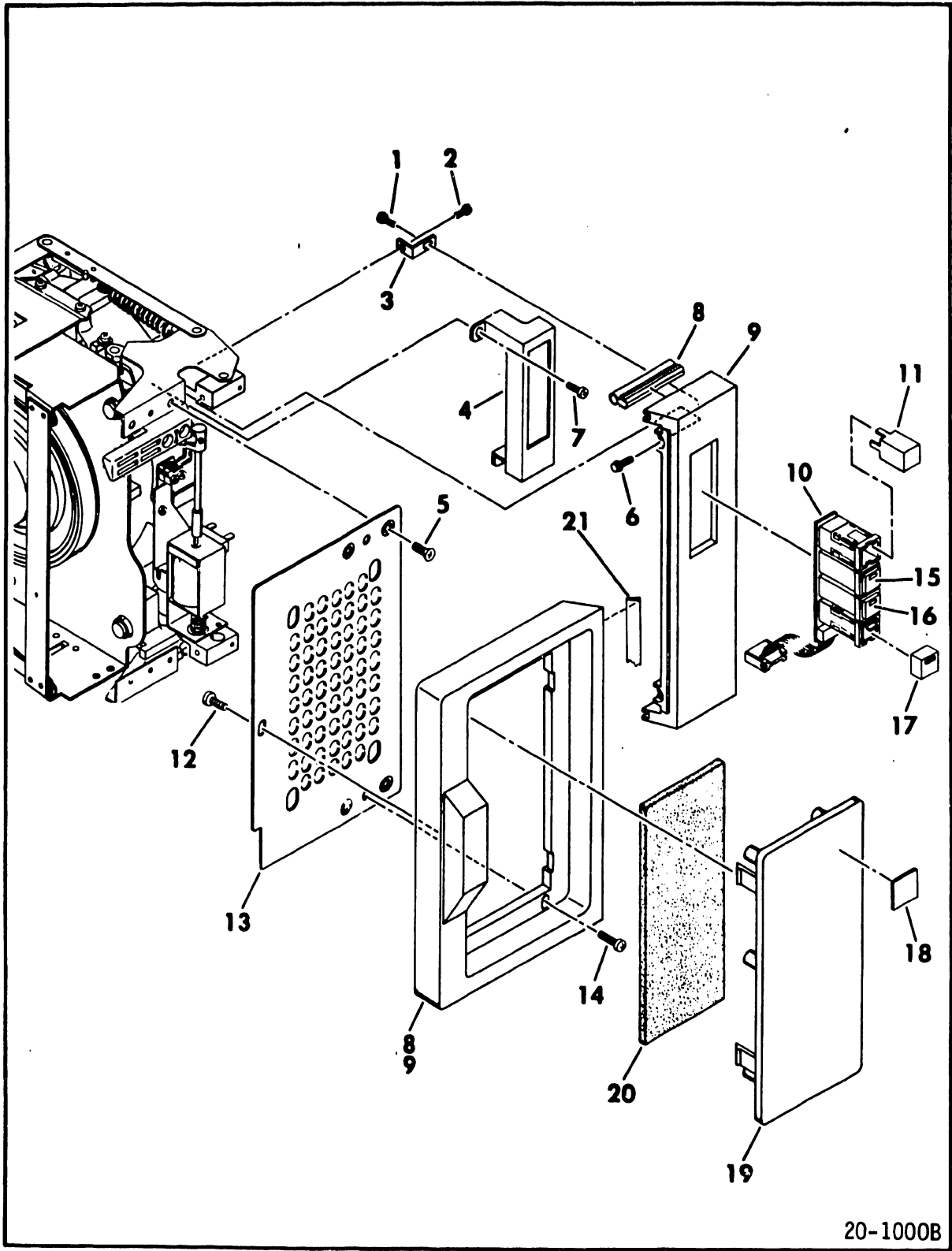
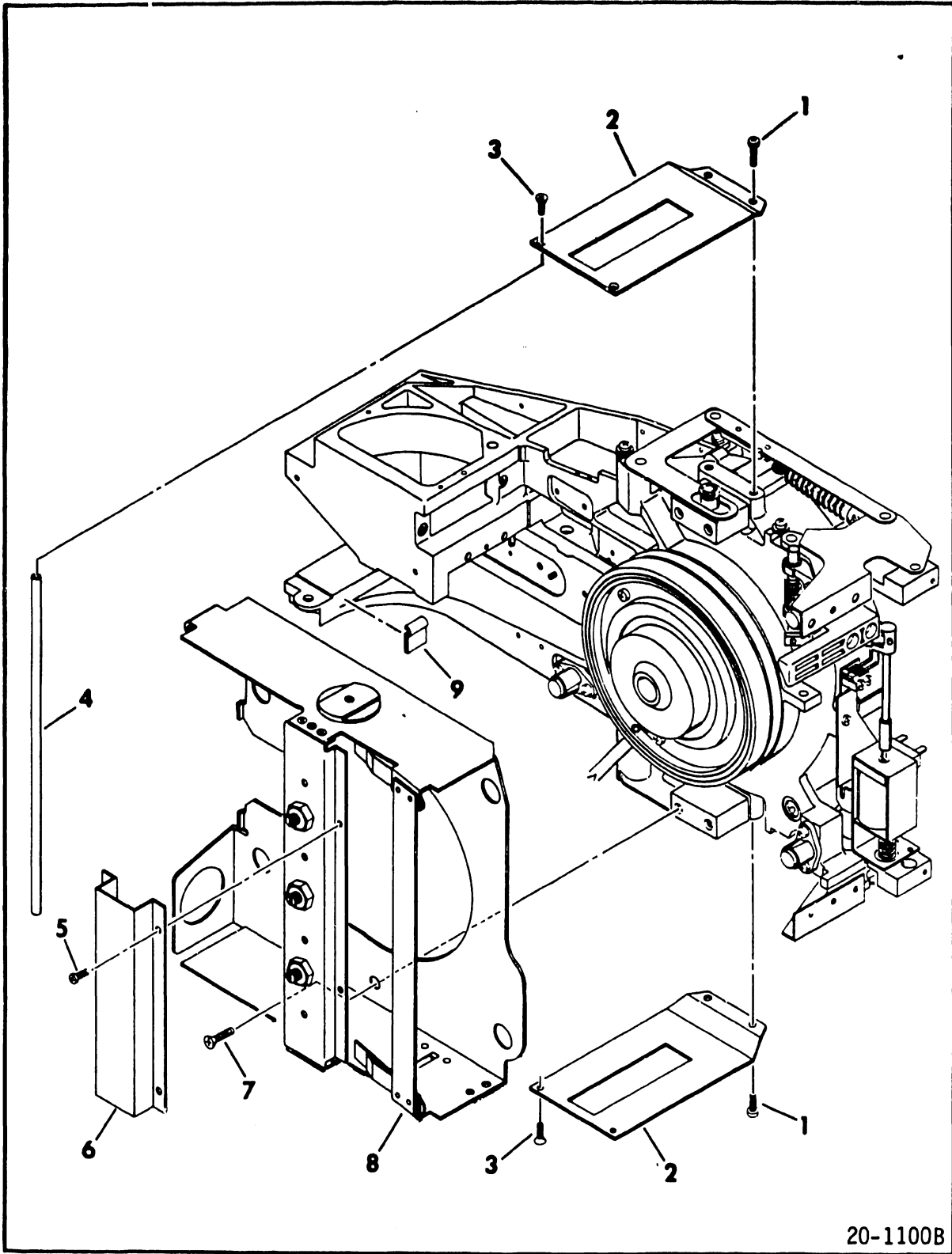


Figure 4-10



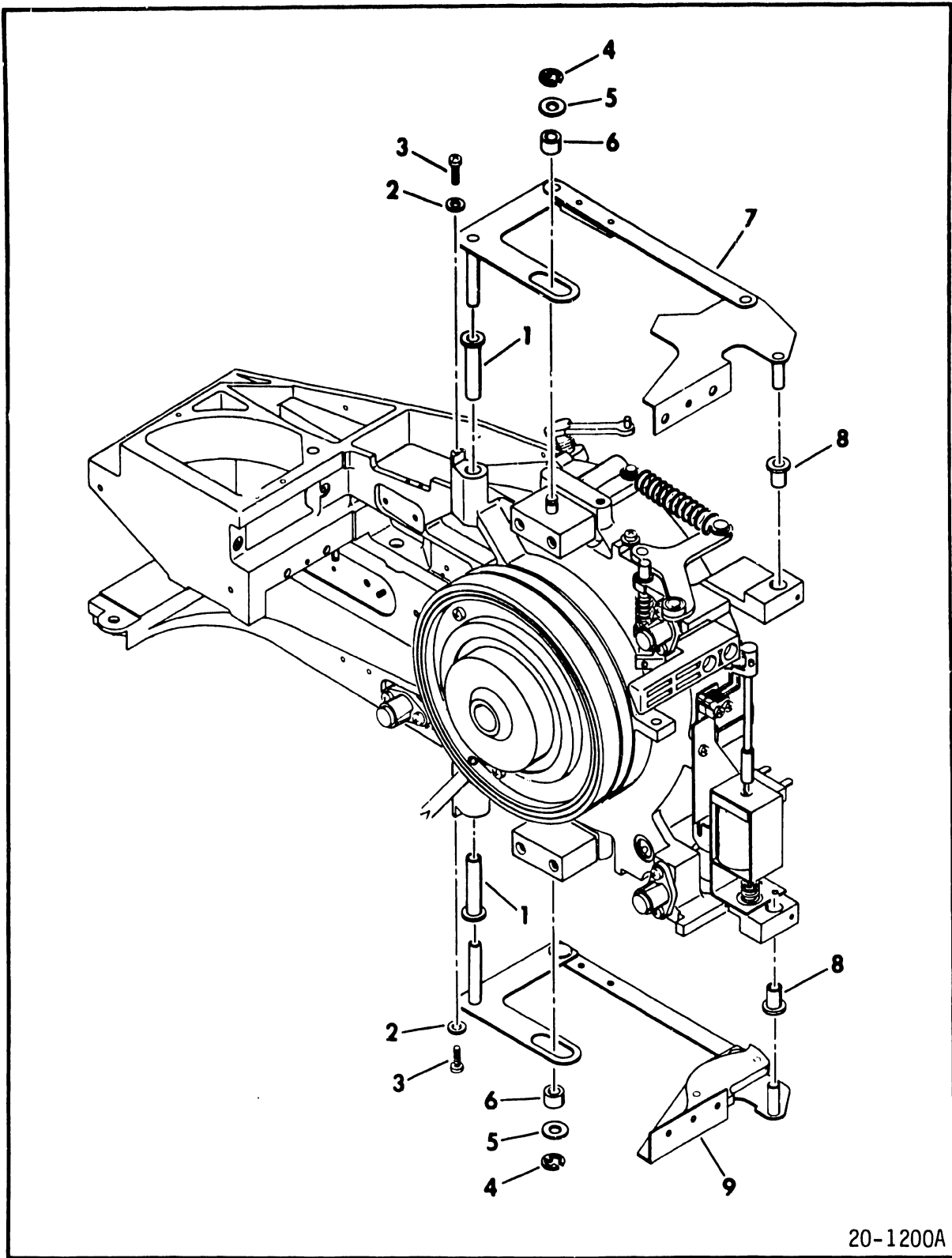
INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	93749164	SCREW, PHH, 6-32 x 1/4	
2	93593164	SCREW, Washer Hd, 6-32 x 1/2	
3	93263447	BRACKET, Upper, Control Panel	
4	93913880	BRACKET, Switch	
5	10125734	SCREW, PHH, 10-24 x 5/16	
6	93592162	SCREW, Washer Hd, 6-32 x 3/8	
7	17901509	SCREW, PHH, 6-32 x 3/8	
8	94377003	SEAL	S/C 02 & Abv
9	72860500	FRONT DOOR ASSEMBLY	S/C 01
9	Optional	FRONT DOOR ASSEMBLY	S/C 02 & Abv
10	Spare	_PBX (OPERATOR PANEL) ASSEMBLY	
11	94398817	LOGIC PLUG, "0"	
11	94398818	LOGIC PLUG, "1"	
11	94398819	LOGIC PLUG, "2"	
11	94398820	LOGIC PLUG, "3"	
12	93660111	SCREW, PHH, 10-32 x 3/8	
13	75038341	PLATE, Support	
14	10127134	SCREW, PHH, 10-24 x 3/4	
15	94394255	LENS, "START"	
16	94394256	LENS, "FAULT"	
17	94394257	LENS, "WRITE PROTECT"	
18	Optional	PRODUCT EMBLEM	
19	Optional	PANEL, Insert	
20	72852572	FILTER, Primary	
21	75038355	SEAL, Door	



20-1100B

Figure 4-11

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	93749240	SCREW, PHH, 10-24 x 1/2	
	81305102	SUPPORT BRACKET ASSEMBLY	
2	75038376	SUPPORT, Slide	
3	10125702	SCREW, PHH, 4-40 x 1/4	
4	72864300	ROD, Support, Slide	
5	93660005	SCREW, PHH, 4-40 x 1/4	
6	75038382	BRACKET, Pack Receiver	
7	10125724	SCREW, PHH, 8-32 x 3/8	
8	72860303	PACK RECEIVER	
9	80455500	CLIP	



20-1200A

Figure 4-12

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	41274010	BEARING, Flanged	
2	93564055	WASHER, Nylon	
3	10127111	SCREW, PHH, 6-32 x 1/4	
4	92033038	RETAINER, Ring	
5	93564054	WASHER, Nylon	
6	93715006	BEARING, Needle	
7	81763701	UPPER LINKAGE ASSEMBLY	
8	41274009	BEARING, Flanged	
9	70919801	LOWER LINKAGE ASSEMBLY	

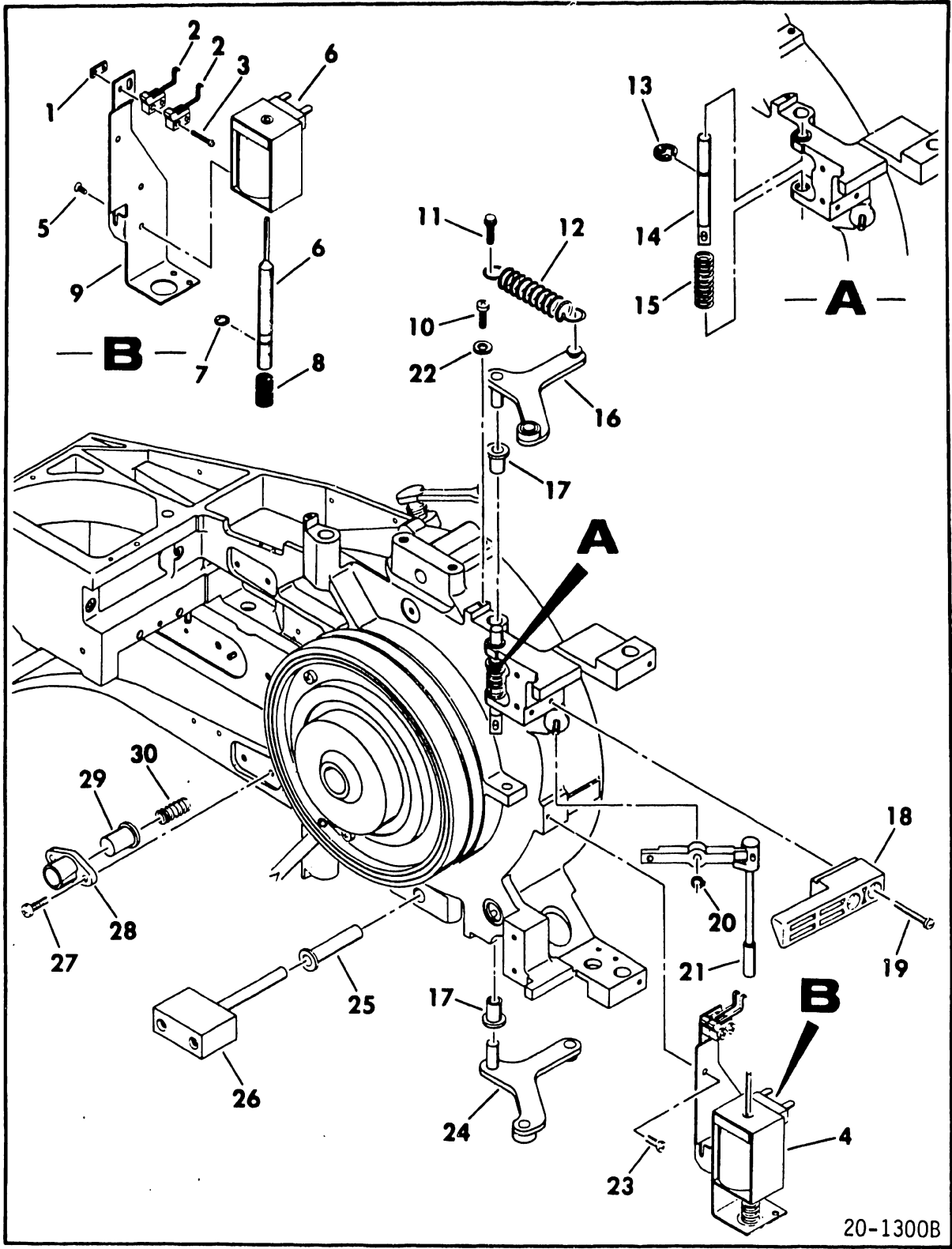
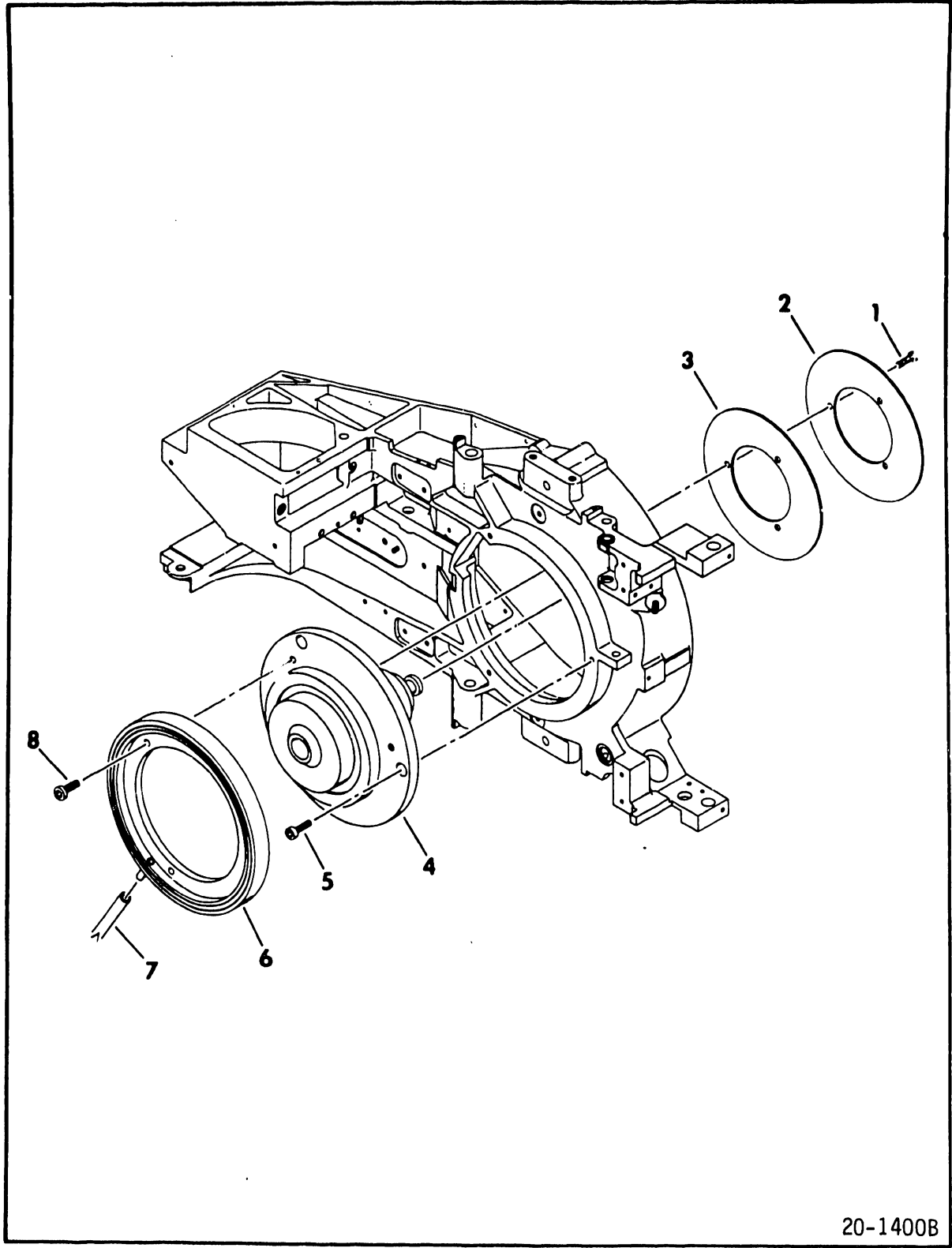


Figure 4-13

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	83292404	PLATE, Nut	
2	Spare	SWITCH	
3	10127315	SCREW, PHH, 2-56 x 5/8	
4	72860404	SOLENOID ASSEMBLY	
5	93749156	SCREW, PHH, 6-32 x 3/16	
6	Spare	SOLENOID, DC	
7	92033038	RETAINER, Ring	
8	83292703	SPRING, Compression	
9	93913889	BRACKET, Solenoid	
10	10127111	SCREW, PHH, 6-32 x 1/4	
11	93592160	SCREW, Washer Hd, 6-32 x 5/16	
12	94203786	SPRING, Extension	
13	92033038	RETAINER, Ring	
14	93263417	ROD, Lock, Door	
15	83292703	SPRING, Compression	
16	81417080	CAM, Upper, Door	
17	41274009	BEARING, Flanged	
18	75038300	LOCATOR, Pack	
19	93749172	SCREW, PHH, 6-32 x 1	
20	92033102	RETAINER, Ring	
21	80496501	PIVOT ARM ASSEMBLY	
22	93564055	WASHER, Nylon	
23	93749162	SCREW, PHH, 6-32 x 3/8	
24	81417081	CAM, Lower, Door	
25	41274010	BEARING, Flanged	
26	72867900	BLOCK, Guide	
27	10127114	SCREW, PHH, 6-32 x 1/2	
28	93263423	HOUSING, Pin	
29	93263422	PIN	
30	94205641	SPRING, Compression	

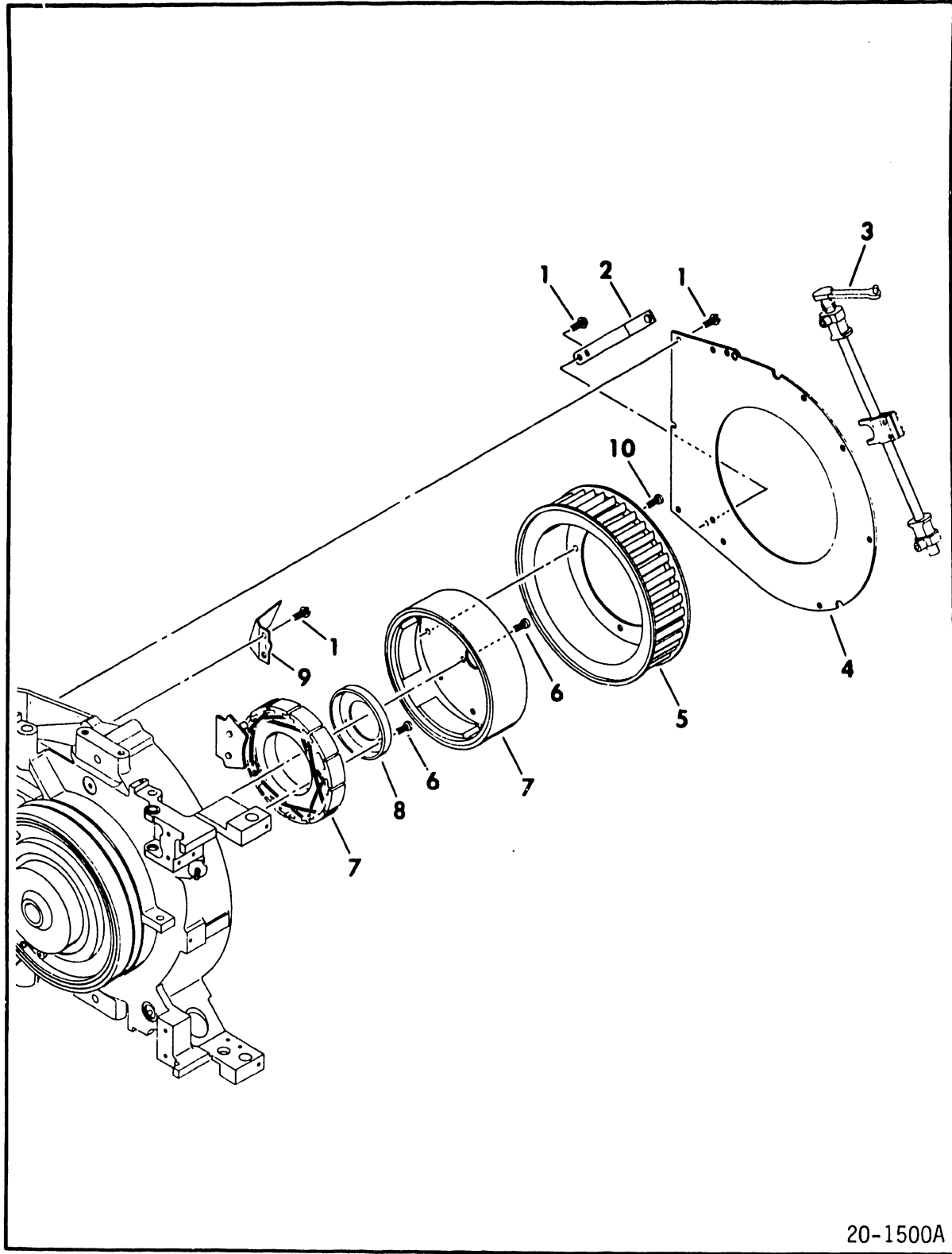


20-1400B

Figure 4-14



INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	10127113	SCREW, PHH, 6-32 x 3/8	
2	72868000	SHIELD, Shiny	
3	72868001	SHIELD, Dull	
4	Spare	SPINDLE ASSEMBLY	
5	10126234	SCREW, Socket Hd, 10-24 x 1/2	
6	93417400	PACK RECEIVER SUPPORT RING	
7	94165002	TUBING, Air	
8	92721240	SCREW, Socket Hd, 8-32 x 1/2	



20-1500A

Figure 4-15

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	93592160	SCREW, Washer Hd, 6-32 x 5/16	
2	Spare	GROUND SPRING, Spindle	
3	76434100	TRIP ROD ASSEMBLY	
4	75038308	COVER, Volute	
5	81860730	IMPELLER	
6	92743162	SCREW, PHH, 6-32 x 3/8	
7	Spare	MOTOR AND CABLE ASSEMBLY	
8	72850900	CLAMP, Motor	
9	93913871	CLAMP, Cable	
10	93660039	SCREW, PHH, 6-32 x 1/4	

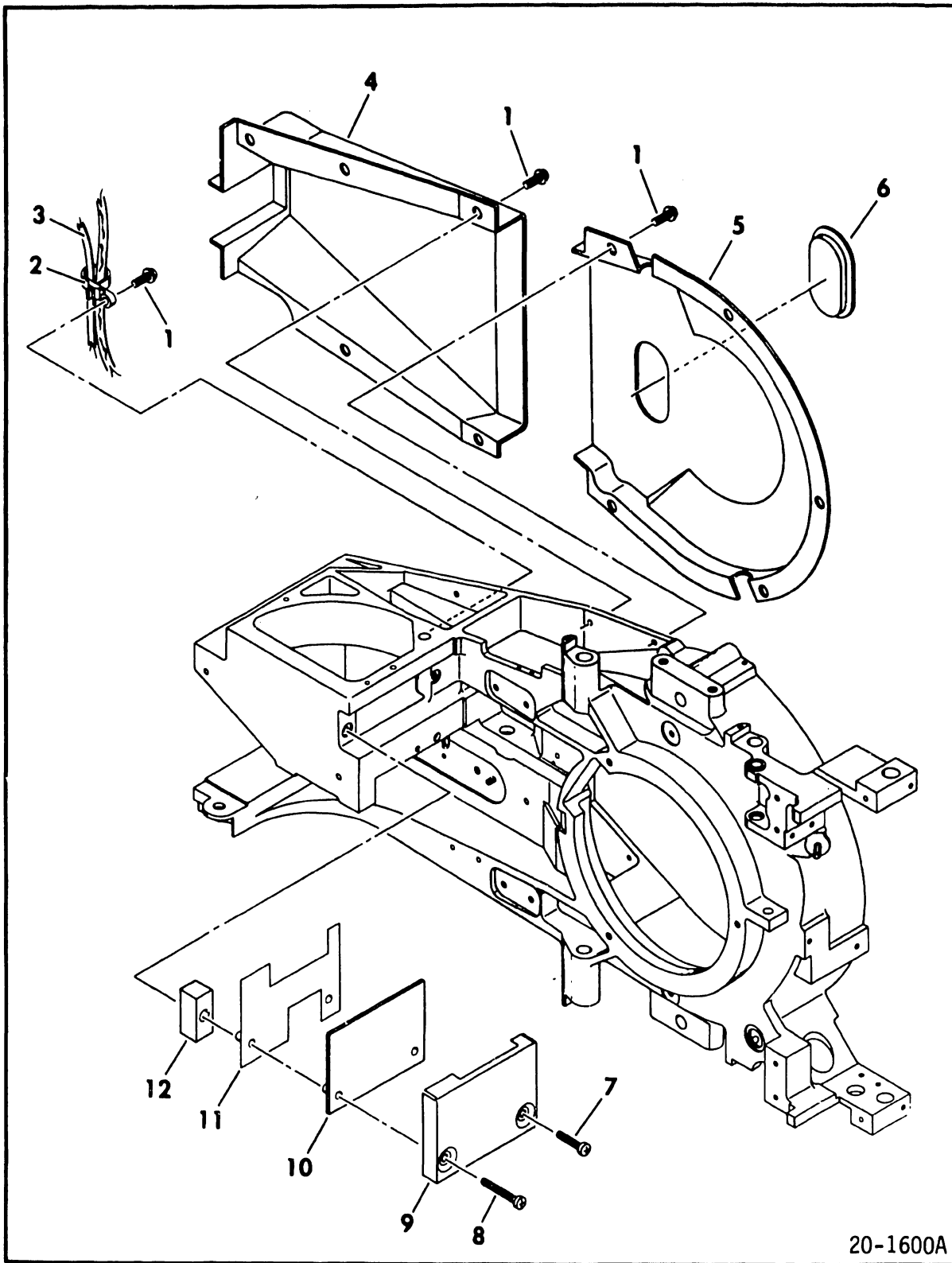
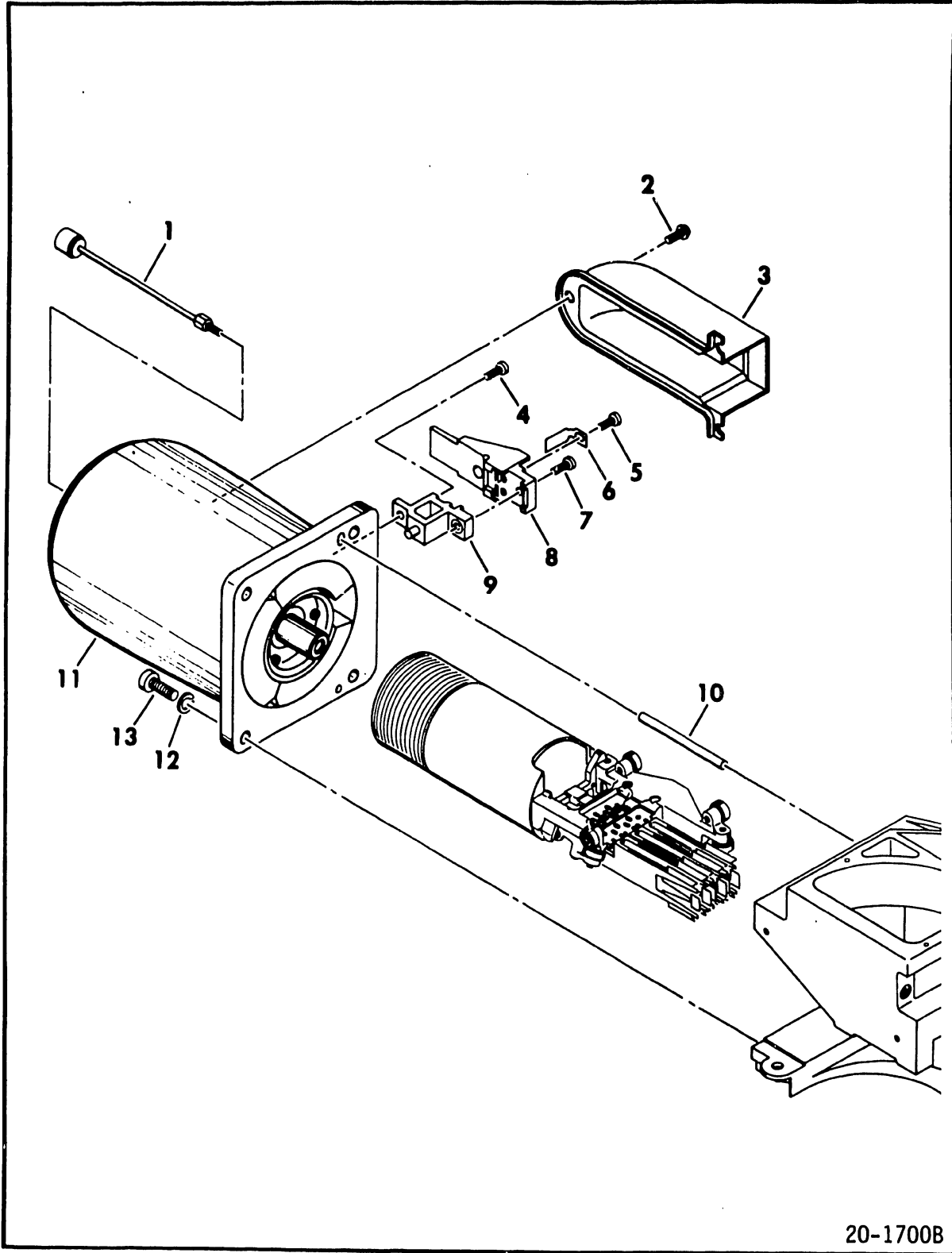


Figure 4-16

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	93592160	SCREW, Washer Hd, 6-32 x 5/16	
2	94277406	TY-WRAP	
3	94497000	VOICE COIL CABLE ASSEMBLY	
4	93263400	AIR COVER, Center	
5	93243425	AIR COVER, End	
6	92238700	PLUG, Button	
7	10127116	SCREW, PHH, 6-32 x 3/4	
8	10127118	SCREW, PHH, 6-32 x 1	
9	92555297	COVER, R/W Preamp Board	
10	Spare	_PCX (R/W PREAMP) BOARD	
11	92555298	SHIELD, R/W Preamp Board	
12	75151505	SEAL	



20-1700B

Figure 4-17

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	80559800	ROD ASSEMBLY	
2	93592160	SCREW, Washer Hd, 6-32 x 5/16	
3	75151504	AIR COVER, Magnet	
4	10127113	SCREW, PHH, 6-32 x 3/8	
5	10127111	SCREW, PHH, 6-32 x 1/4	
6	75151503	TERMINAL	
7	10127114	SCREW, PHH, 6-32 x 1/2	
8	72865100	CLAMP	
9	72865000	BLOCK, Mounting	
10	92021028	PIN, Dowel	
11	72861000	MAGNET ASSEMBLY	
12	10125806	LOCKWASHER, 1/4	
13	10126256	SCREW, Socket Hd, 1/4-20 x 3/4	

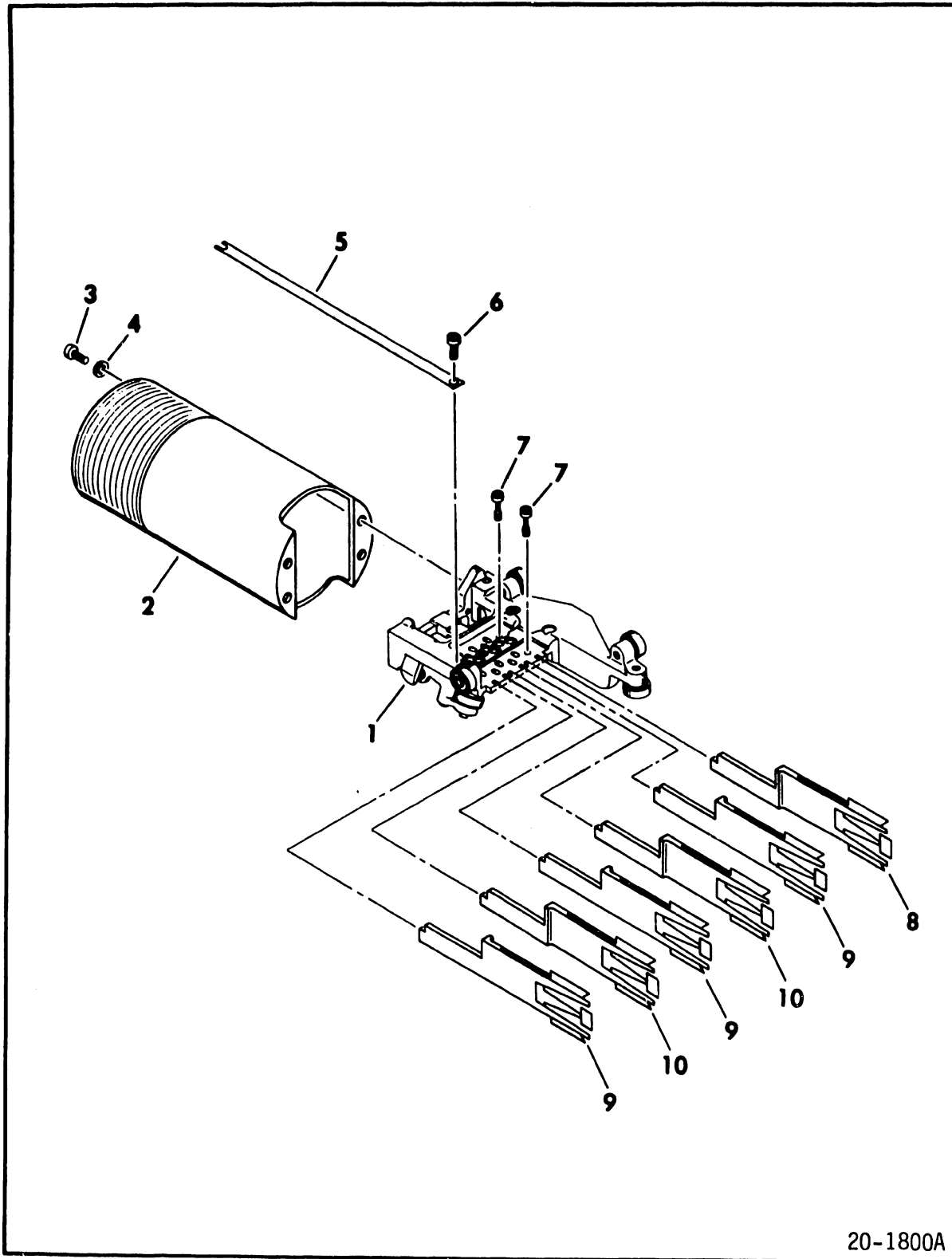
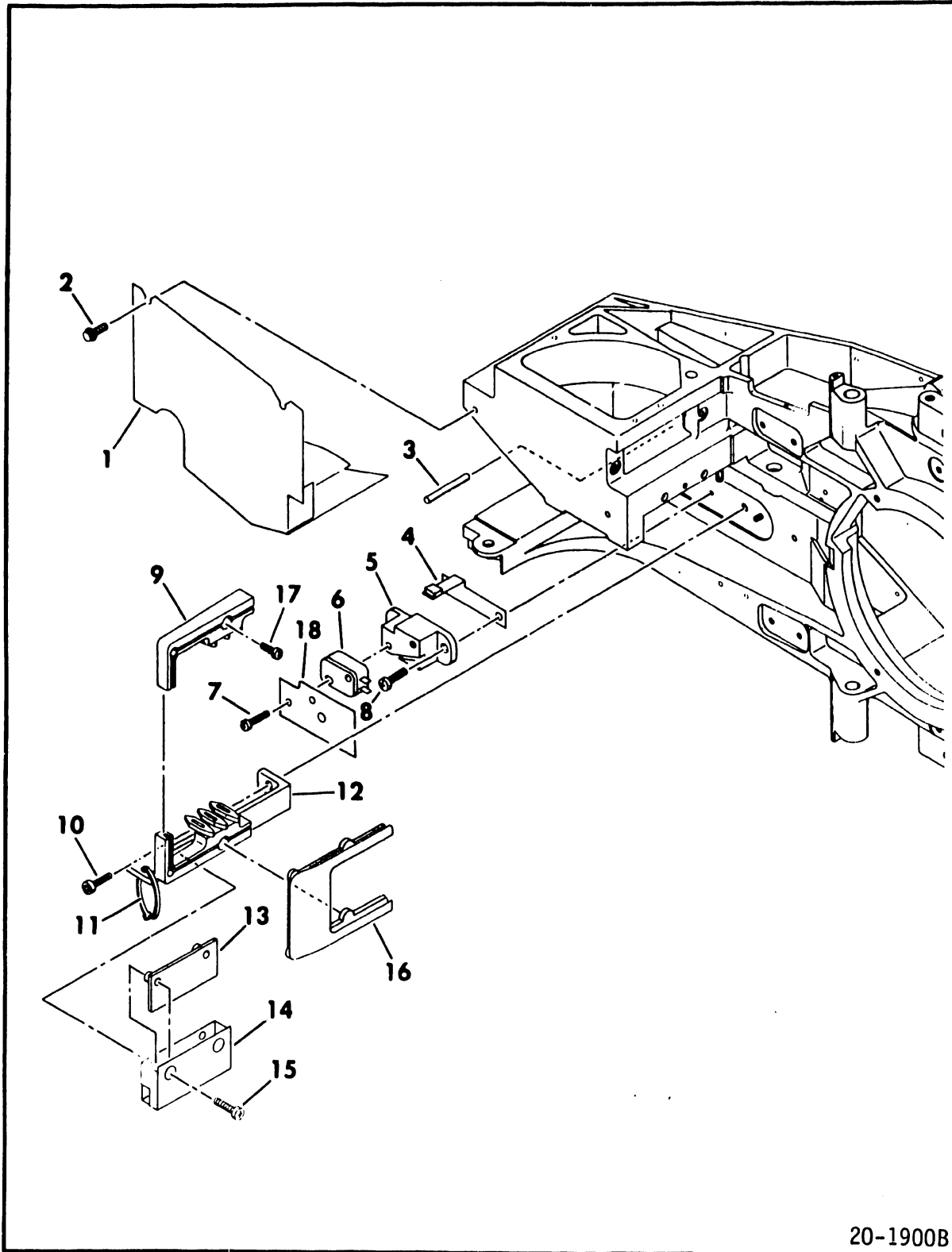


Figure 4-18



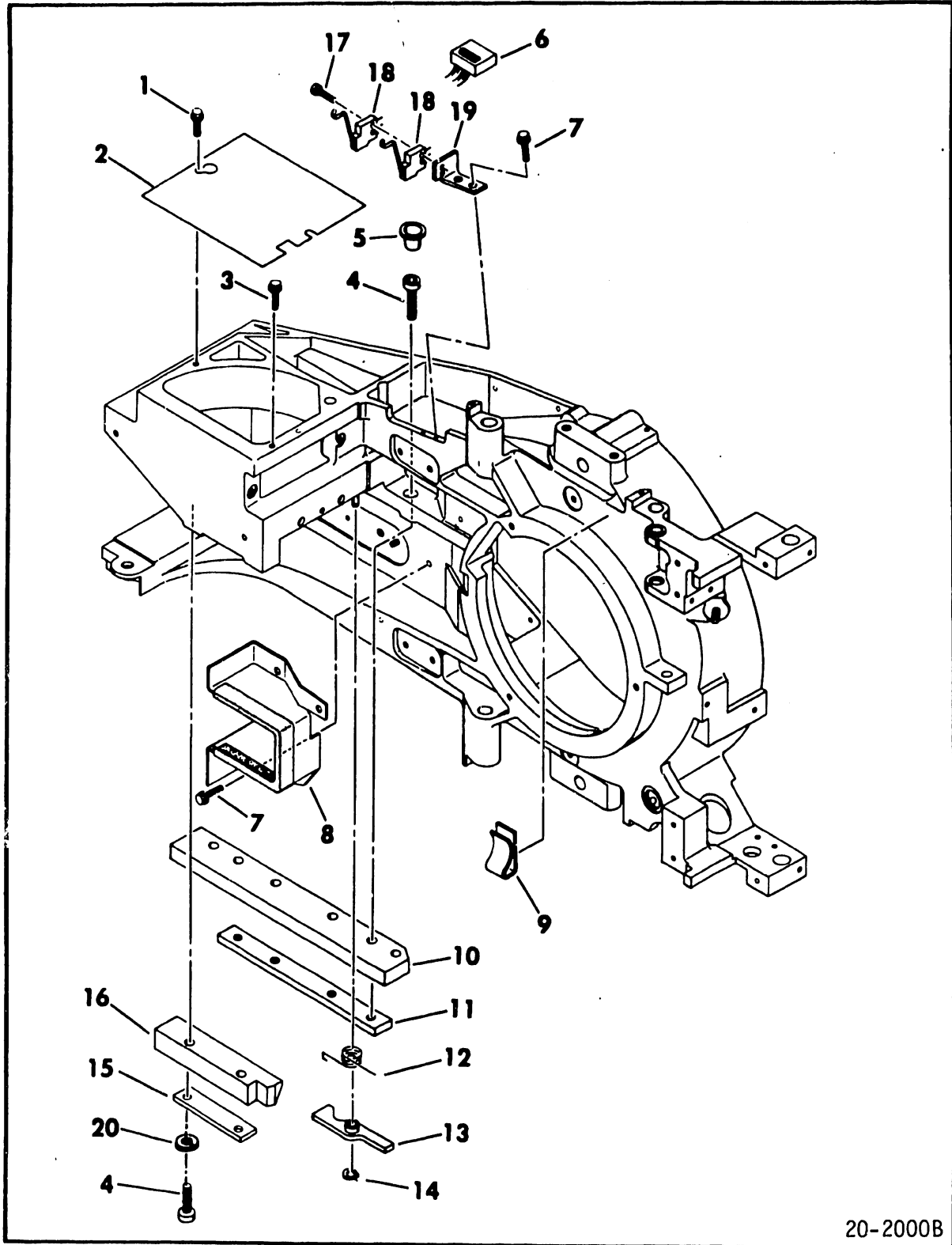
INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	Spare	CARRIAGE ASSEMBLY	
2	Spare	COIL AND LEAD ASSEMBLY	
3	10126213	SCREW, Socket Hd, 4-40 x 3/8	
4	10125603	WASHER, #4	
5	93263480	GROUND LEAD	
6	93592082	SCREW, Washer Hd, 4-40 x 1/4	
7	Spare	SCREW, Head Arm	
8	Spare	HEAD ARM ASSEMBLY, Servo	
9	Spare	HEAD ARM ASSEMBLY, Data Top	Heads 0,2,4
10	Spare	HEAD ARM ASSEMBLY, Data Bottom	Heads 1,3



20-1900B

Figure 4-19

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	93263419	AIR COVER, Side	
2	93592158	SCREW, Washer Hd, 6-32 x 1/4	
3	93913890	PIN, Carriage Stop	
4	75038379	ARM, Switch	
5	93913864	LOCK, Switch	
6	93786028	HEADS LOADED SWITCH	
7	10127105	SCREW, PHH, 4-40 x 1/2	
8	10127111	SCREW, PHH, 6-32 x 1/4	
9	83292371	CAM TOWER, Upper	
10	10126234	SCREW, Socket Hd, 10-24 x 1/2	
11	94277400	TY-WRAP	
12	92867400	CAM TOWER, Lower	
13	Spare	_UUN (SERVO PREAMP) BOARD	
14	72868900	COVER, Servo Preamp Board	
15	10127114	SCREW, PHH, 6-32 x 1/2	
16	92555219	GASKET, Rubber	
17	10127113	SCREW, PHH, 6-32 x 3/8	
18	75038345	SHIELD, Switch	



20-2000B

Figure 4-20

INDEX NO	PART NO	PART DESCRIPTION	NOTE
1	93592158	SCREW, Washer Hd, 6-32 x 1/4	
2	93263416	AIR COVER, Top	
3	93592082	SCREW, Washer Hd, 4-40 x 1/4	
4	10126237	SCREW, Socket Hd, 10-24 x 7/8	
5	94353217	PLUG	
6	81853300	INTERLOCK CABLE ASSEMBLY	
7	93592160	SCREW, Washer Hd, 6-32 x 5/16	
8	47010401	AIR BAFFLE AND SEAL ASSEMBLY	
9	94241019	CLIP, Cable	
10	Spare	RAIL, Lower	
11	93263424	PLATE, Rail, Lower	
12	93263401	SPRING, Torsion	
13	93263402	ARM, Carriage Lock	
14	92033004	RETAINER, Ring	
15	75038338	PLATE, Rail, Upper	
16	Spare	RAIL, Upper	
17	10127313	SCREW, PHH, 2-56 x 3/8	
18	Spare	SWITCH	
19	93263405	BRACKET	
20	10125805	LOCKWASHER, #10	











TABLE 4-2. MANUFACTURER'S RECOMMENDED SPARE PARTS

DESCRIPTION/NOTES	PART NUMBER	REPLACE MENT PART NUMBER
POWER SUPPLY ASSEMBLY		
S/C 04 & Blw	72896501	72896502
S/C 05 & Abv	72896502	72896502
_PGX (READ/WRITE PLO'S) BOARD		
DPGX--S/C 03 & Blw	54332904	54332907
FPGX--S/C 04-06	54332906	54332907
GPGX--S/C 07 & Abv	54332907	54332907
_PFX (DATA LATCH) BOARD		
BPFX--S/C 03 & Blw	54332501	54332503
CPFY--S/C 04 & Abv	54332503	54332503
BPDY (POWER AMP) BOARD	54331701	54331701
_PEX (CONTROL) BOARD		
BPEX--S/C 05 & Blw	54332101	54332103
DPEX--S/C 06 & Abv	54332102	54332103
_EBN (I/O) BOARD (PA3A1 units only)		
BEBN--S/C 03 & Blw	54020501	54020505
CEBN--S/C 04-05	54020502	54020505
EEBN--S/C 06 & Abv	54020505	54020505
AEDN (I/O) BOARD (PA3A2 units only)	54021300	54021300
CABLE ASSEMBLY P14/P20 (PA3A1 units only)	95276300	95276300
CABLE ASSEMBLY P14/P20 (PA3A2 units only)	95276301	95276301
CABLE ASSEMBLY (P28/P34)	81243100	81243100
DC HARNESS (P19/P21/P22/P35/P36/P37/P38/J40)		
S/C 05 & Blw	93151301	93151301
S/C 06 & Abv, & units with ECO 03308 installed	93151302	93151302
FILTER, Absolute	72868200	72868200
CPMX (MOTOR SPEED CONTROL) BOARD	54334902	54334902
FAN ASSEMBLY		
S/C 05 & Blw	81235100	81235100
S/C 06 & Abv, & units with ECO 03308 installed	81235101	81235101
CPBX (OPERATOR PANEL) ASSEMBLY	54330902	54330902
SWITCH	94364400	94364400
SOLENOID, DC	83292733	83292733
SPINDLE ASSEMBLY	72860101	72860101
GROUND SPRING	72865600	72865600
MOTOR AND CABLE ASSEMBLY	94231900	94231900
CPCX (R/W PREAMP) BOARD	54331302	54331302
CARRIAGE ASSEMBLY	72860201	72860201
COIL AND LEAD ASSEMBLY	72863000	72863000
SCREW, Head Arm	75017505	75017505
HEAD ARM ASSEMBLY, Servo	92773402	92773402
HEAD ARM ASSEMBLY, Data Top	92773401	92773401
HEAD ARM ASSEMBLY, Data Bottom	92773400	92773400
BUUN (SERVO PREAMP) BOARD	54007301	54007301
RAIL, Lower	72862800	72862800
RAIL, Upper	72862600	72862600
SWITCH	94364400	94364400

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)
94398821	LOGIC PLUG, "4"
94398822	LOGIC PLUG, "5"
94398823	LOGIC PLUG, "6"
94398824	LOGIC PLUG, "7"
93991802	DC POWER CABLE, 1 foot (0.3 metre) long
93991803	DC POWER CABLE, 5 foot (1.5 metre) long
93991804	DC POWER CABLE, 8 foot (2.4 metre) long

The following tables provide conversion between Wang and CDC part numbers.

RSD RECOMMENDED SPARES LIST BY VENDOR PART NUMBER

VENDOR P/N	WANG P/N	DESCRIPTION
54007301	726-6923	PWA BUUN Servo Pre-Amp
54020505	726-6924	PWA EEBN I/O
54330902	726-6925	PWA CPBX Operator Control Panel
54331302	726-6926	PWA CPCX R/W Pre-Amp
54331701	726-6927	PWA BPDY Power Amp
54332103	726-6928	PWA DPEX Main Logic
54332503	726-6929	PWA CPFY Data Latch
54332907	726-6930	PWA GPGX R/W Plo
54334902	726-6931	PWA CPMX Motor Control
72852572	726-6939	Filter, air primary
72860101	726-6933	Spindle Assembly
72860201	726-6934	Carriage Assembly
72862600	726-6935	Rail upper
72862800	726-6936	Rail lower
72863000	726-6937	Coil and Lead Assembly
72865600	726-6938	Spring Ground
72868200	726-6940	Filter, air absolute
75017505	726-6943	Screw, head arm
81235101	726-6932	Fan Assembly
81243100	726-6947	Cable assembly (servo J34)
81542300	726-6942	Power supply assembly
82392733	726-6945	Solenoid
92773400	726-6952	Head assembly, R/W lower
92773401	726-6949	Head arm assembly, R/W upper
92773402	726-6950	Head arm assembly, servo
93151303	726-6948	Cable assembly (distribution)
93270700	726-6953	Terminator
93786028	726-6954	Switch, heads loaded
94231900	726-6946	Motor and cable assembly
94364400	726-6951	Switch, pack in place
95276300	726-6944	Jumper cable(J14-J20)

SPECIAL TOOLS

1209-51	726-6966	Alignment pack
54026900	726-6955	AETN Head Alignment Card
54058100	726-6958	AJWN Servo status display card
75018805	726-9634	Head adjustment tool
76041700	726-6957	AETN Signal Cable
81787000	726-6959	AJWN Signal cable
92333500	726-6967	Head alignment kit
92555212	726-6960	Coil alignment tool
92555213	726-6963	Rail alignment fixture (upper)
92555215	726-6962	Rail alignment fixture (lower)
92774400	726-6956	AETN Power Cable

RSD RECOMMENDED SPARES LIST BY WANG PART NUMBER

WANG P/N	VENDOR P/N	DESCRIPTION
726-6923	54007301	PWA BUUN Servo Pre-Amp
726-6924	54020505	PWA EEBN I/O
726-6925	54330902	PWA CPBX Operator Control Panel
726-6926	54331302	PWA CPCX R/W Pre-Amp
726-6927	54331701	PWA BPDY Power Amp
726-6928	54332103	PWA DPEX Main Logic
726-6929	54332503	PWA CPFY Data Latch
726-6930	54332907	PWA GPGX R/W Plo
726-6931	54334902	PWA CPMX Motor Control
726-6932	81235101	Fan Assembly
726-6933	72860101	Spindle Assembly
726-6934	72860201	Carriage Assembly
726-6935	72862600	Rail upper
726-6936	72862800	Rail lower
726-6937	72863000	Coil and Lead Assembly
726-6938	72865600	Spring Ground
726-6939	72852572	Filter, air primary
726-6940	72868200	Filter, air absolute
726-6942	81542300	Power supply assembly
726-6943	75017505	Screw, head arm
726-6944	95276300	Jumper cable(J14-J20)
726-6945	82392733	Solenoid
726-6946	94231900	Motor and cable assembly
726-6947	81243100	Cable assembly (servo J34)
726-6948	93151303	Cable assembly (distribution)
726-6949	92773401	Head arm assembly, R/W upper
726-6950	92773402	Head arm assembly, servo
726-6951	94364400	Switch, pack in place
726-6952	92773400	Head assembly, R/W lower
726-6953	93270700	Terminator
726-6954	93786028	Switch, heads loaded

SPECIAL TOOLS

726-6955	54026900	AETN Head Alignment Card
726-6956	92774400	AETN Power Cable
726-6957	76041700	AETN Signal Cable
726-6958	54058100	AJWN Servo status display card
726-6959	81787000	AJWN Signal cable
726-6960	92555212	Coil alignment tool
726-6962	92555215	Rail alignment fixture (lower)
726-6963	92555213	Rail alignment fixture (upper)
726-6966	1209-51	Alignment pack
726-6967	92333500	Head alignment kit
726-9634	75018805	Head adjustment tool



LABORATORIES, INC.

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

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