GENERAL DESCRIPTION 1

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
PHYSICAL		
Size	Dimensions	See Space Requirements in section 3
	Weight (Drive Only)	27.2 kg (60.0 lb)
	Weight (Power Supply Only)	5.4 kg (12.0 lb)
Recording	Total Capacity (Unformatted)	80 megabytes
	Bytes per track	20 160 bytes
	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
PERFORMANCE		
Transfer rate	Disk speed at 3600 r/min	9.677 MHz (1.2 megabytes/sec)
Latency		Latency is time to reach a particular track address after positioning is complete.
	Average	8.33 milliseconds (disk rotation speed at 3600 r/min)
	Maximum	16.83 milliseconds (disk rotation speed at 3564 r/min)
Recording	Mode	2-7 code
	Density	9994 bits per inch (inner track)
Seek Time	Full	55 milliseconds maximum
	Average	30 milliseconds
	Single Track	7 milliseconds maximum
Start Time		60 seconds typical 70 seconds maximum
Stop Time	START switch off	25 seconds typical 35 seconds maximum
	Power loss	90 seconds typical

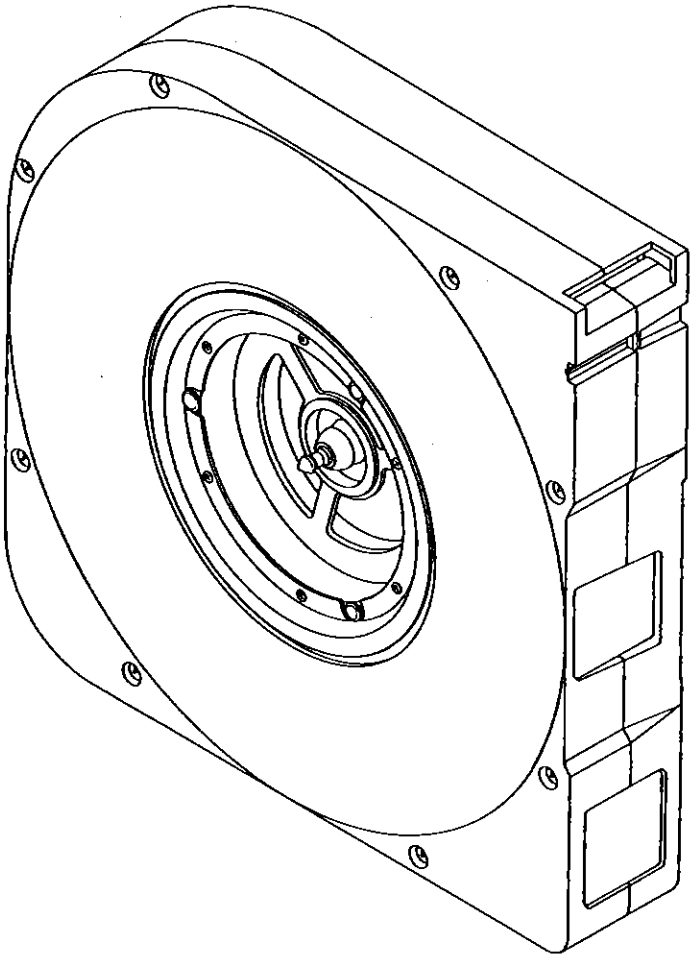

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Figure 1-1. Drive Data Pack

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 power supply, which receives its input power from the site main power source. The power supply is shipped as an option with the drive.

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

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

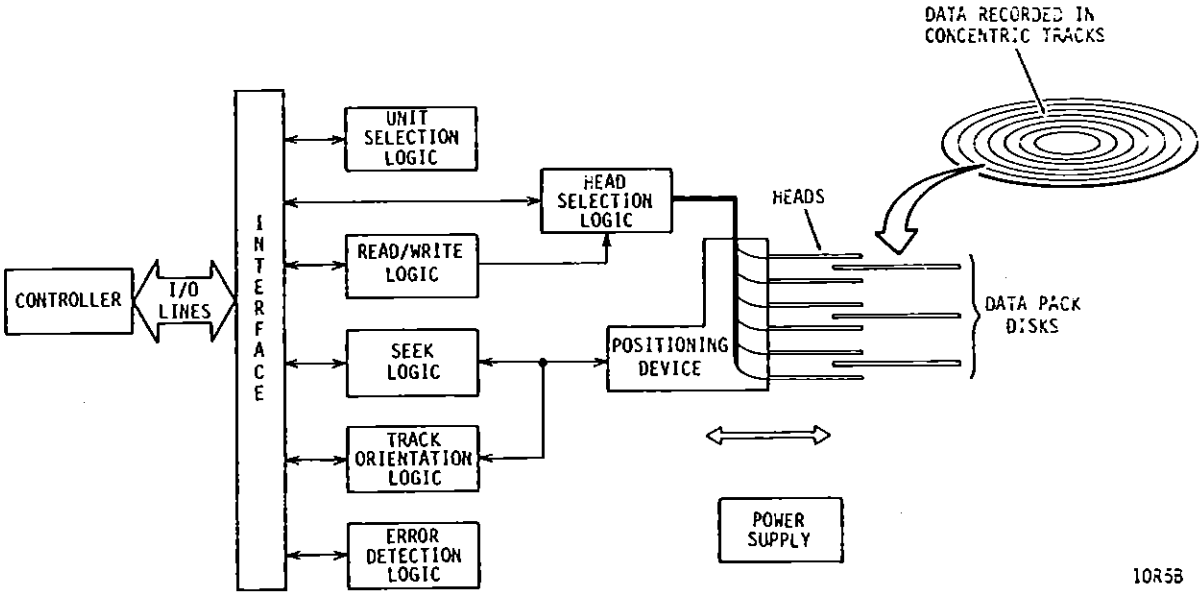


Figure 1-2. Drive Functional Block Diagram

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

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

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

The drive front panel contains the operator controls 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.

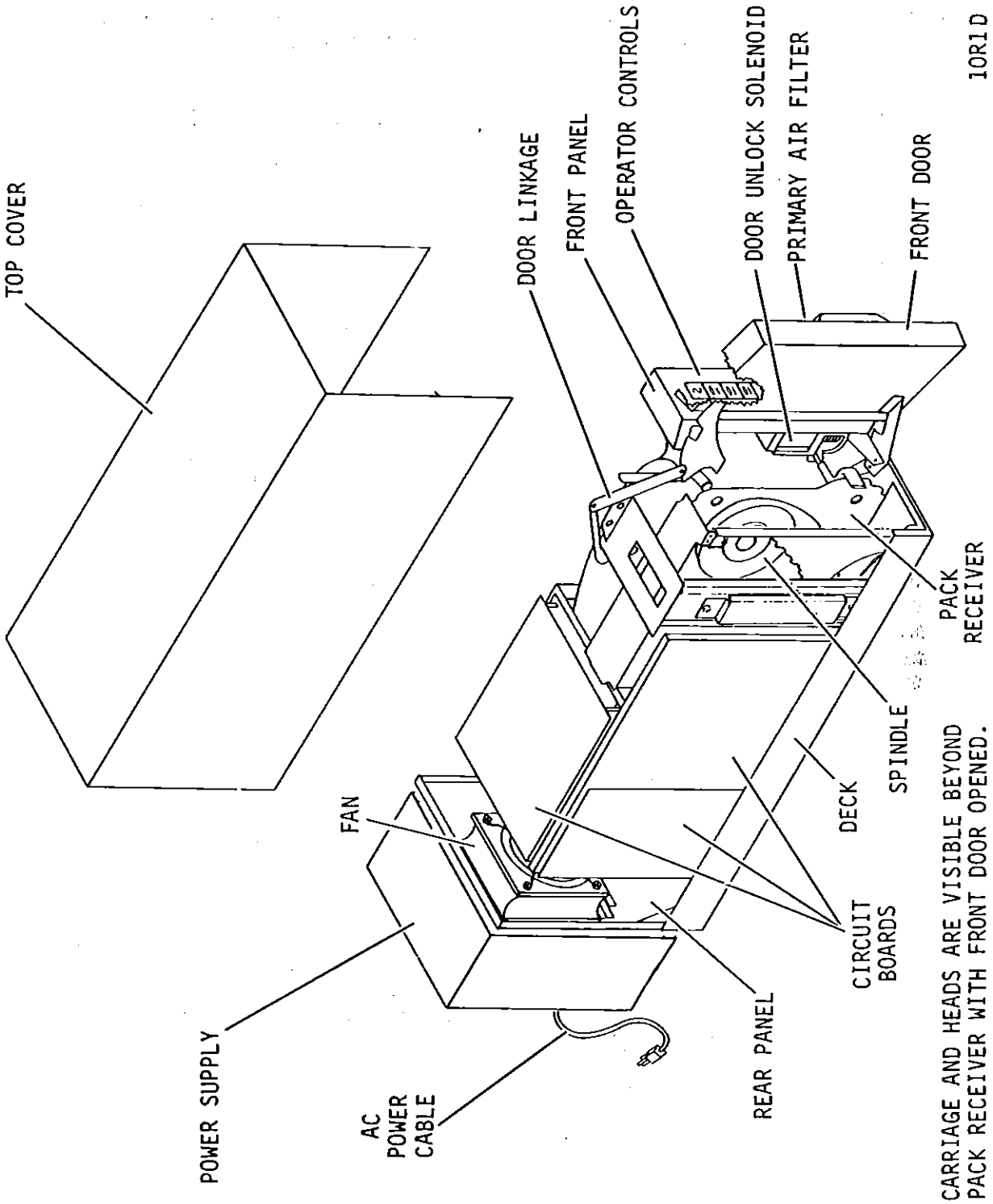


Figure 1-3. Drive Major Assemblies

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

EQUIPMENT IDENTIFICATION

General

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

Equipment Identification Number

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

EXAMPLE:

The equipment identifier indicates the basic functional capabilities of the drive.

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

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

Series Code

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

Part Number

The equipment identification label on the power supply lists three numbers: the equipment package part number, the CDA number, and the power supply number. The equipment package part number 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.

EQUIPMENT CONFIGURATION LOG

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

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

MANUAL TO EQUIPMENT LEVEL CORRELATION

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

SECTION 2

OPERATION

OPERATION 2

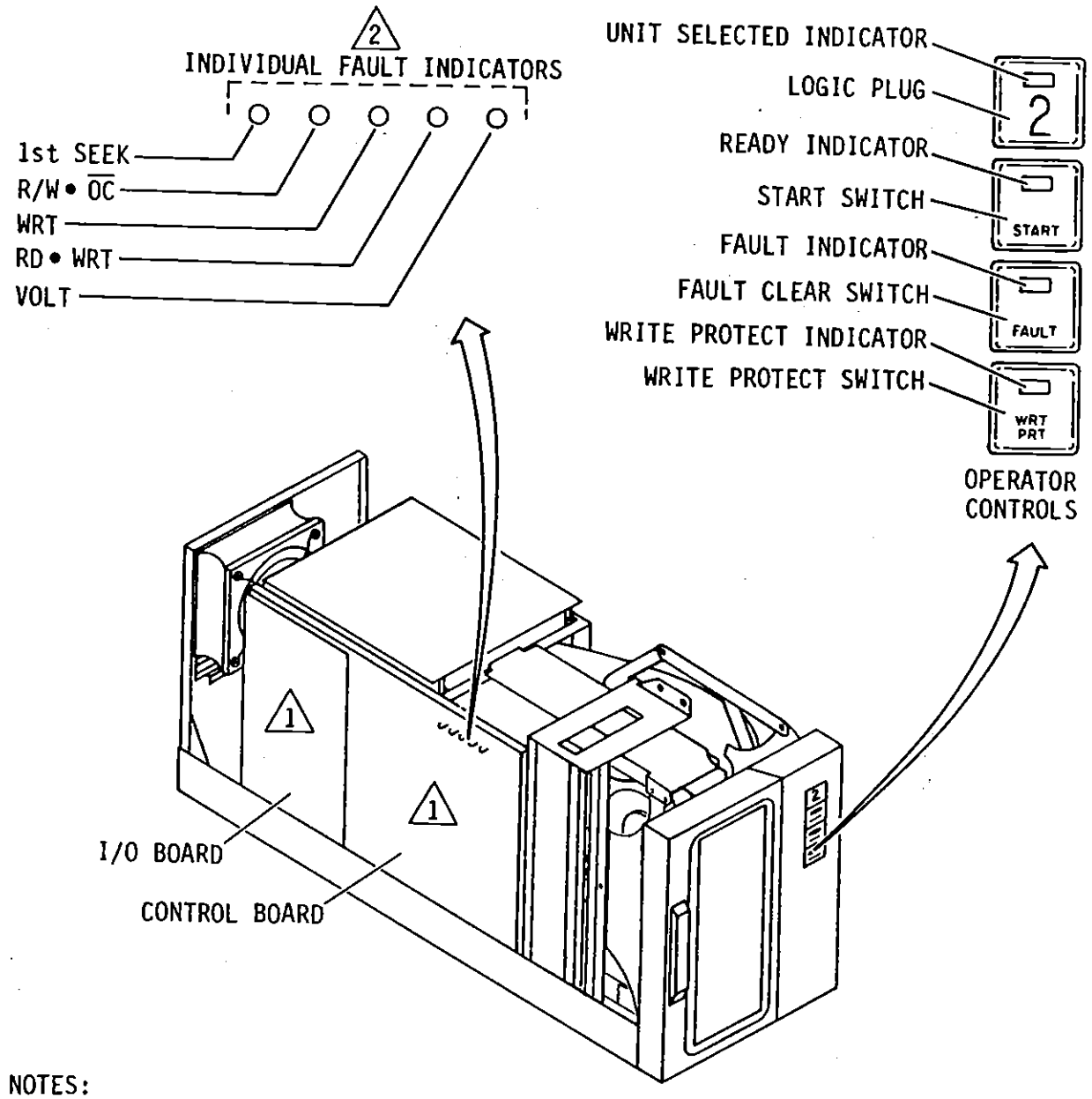
INTRODUCTION

This section provides the information and instructions to operate the drive. It is arranged as follows:

- Switches and Indicators -- locates and describes the switches and indicators used for normal drive operation.
- Operating Instructions -- describes procedures for operating the drive.
- Filter Replacement and Cleaning -- describes filter maintenance for the drive operator.

SWITCHES AND INDICATORS

Switches and indicators used by the operator are on the power supply, on the drive operator panel, and on the control board. Figure 2-1 shows these switches and indicators, and they are described in table 2-1. Refer to section 3 for information on switches that are not normally used by the drive operator.



NOTES:

1. SWITCHES LOCATED ON CIRCUIT BOARDS ARE ILLUSTRATED IN SECTION 3
2. INDIVIDUAL FAULT INDICATORS ARE VISIBLE THROUGH OPENINGS ON TOP COVER

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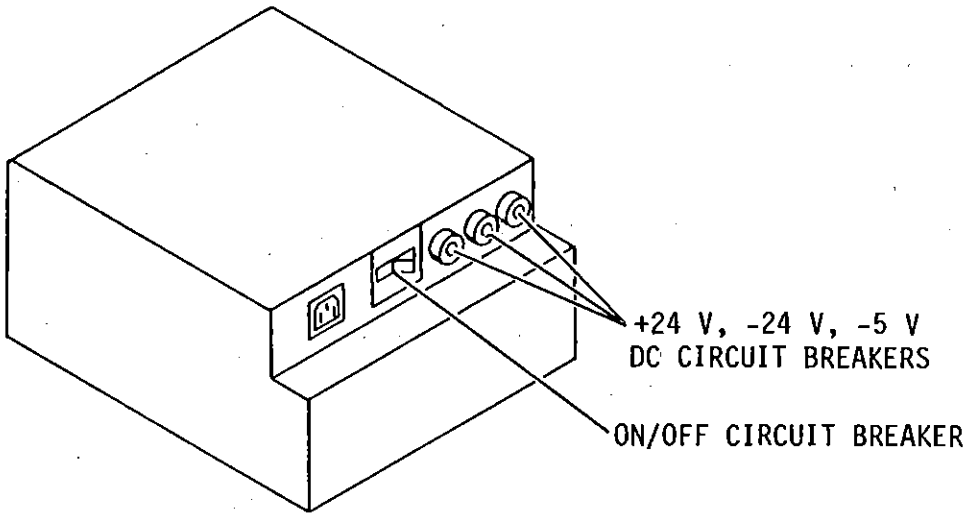
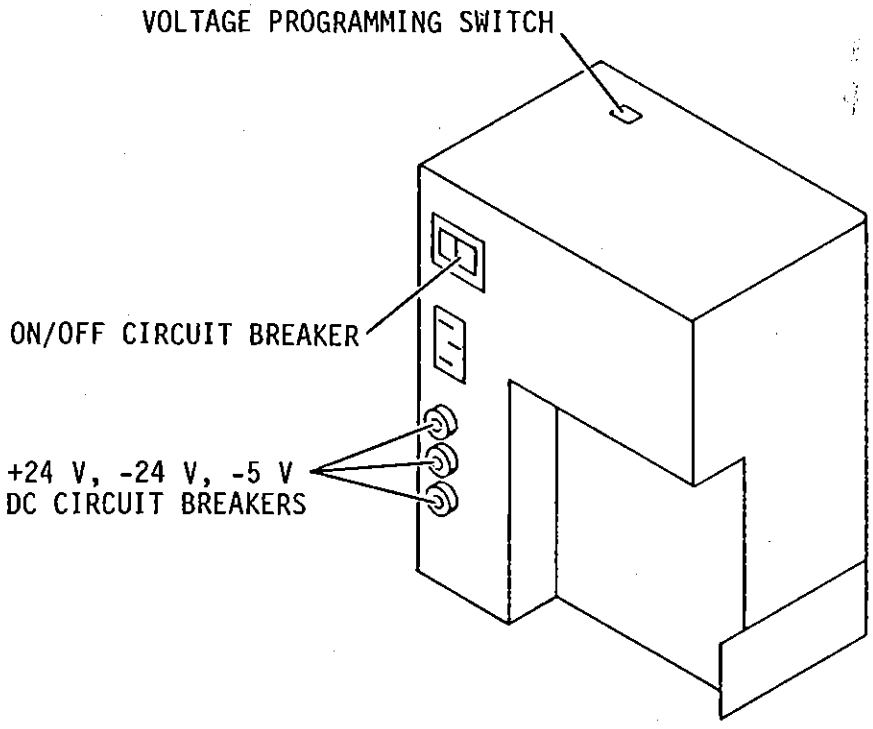
Figure 2-1. Switches and Indicators (Sheet 1 of 3)



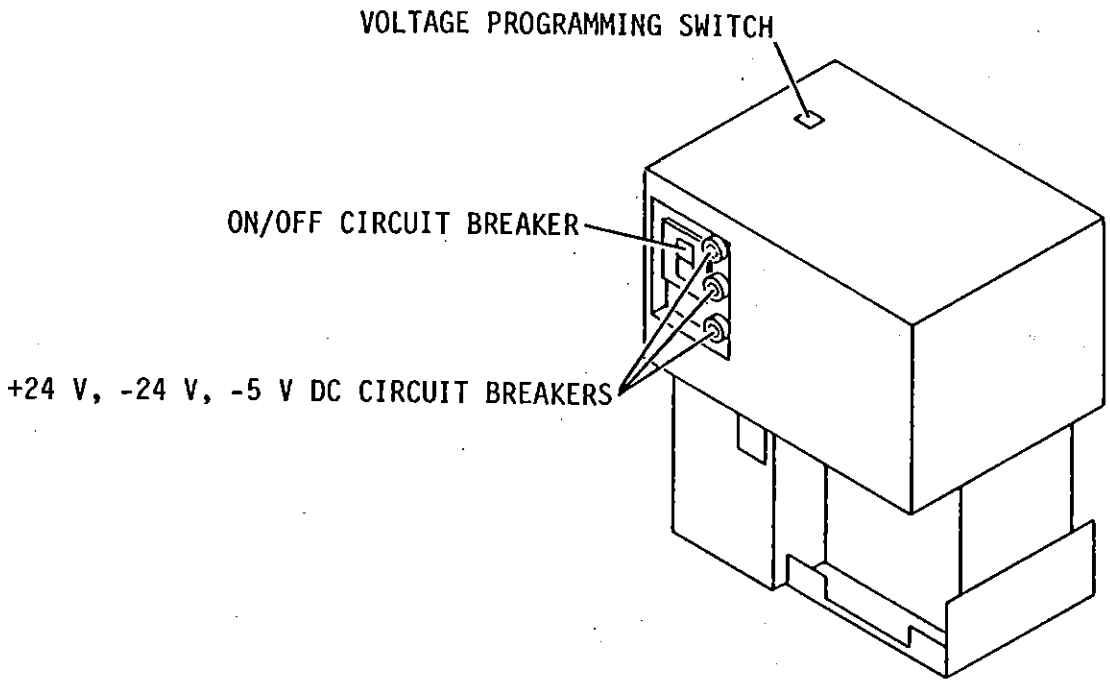
REMOTE POWER SUPPLY (P/N 728965XX)



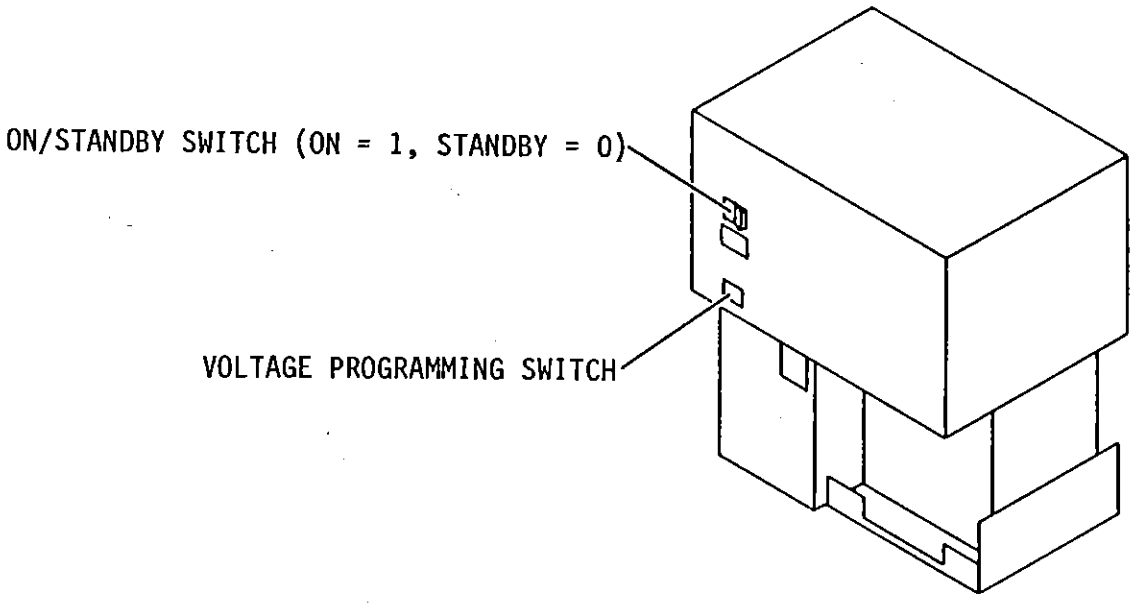
INTEGRAL POWER SUPPLY (P/N 81542300)

11D636

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



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



INTEGRAL POWER SUPPLY (P/N 81542304)

11D637

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

TABLE 2-1. DRIVE SWITCHES AND INDICATORS

Switch or Indicator	Function
POWER SUPPLY	
ON (1)/STANDBY (0) Switch (on newer integral supplies) and ON/OFF Circuit Breaker (on other supplies)	Applies dc operating voltages to the drive electronics and fan.
-24 V Circuit Breaker*	Protects the -24 V supply. To reset circuit breaker, press in pop-out element.
+24 V Circuit Breaker*	Protects the +24 V supply. To reset circuit breaker, press in pop-out element.
-5 V Circuit Breaker*	Protects the -5 V supply. To reset circuit breaker, press in pop-out element.
	The +5 and +40 V supplies are protected by current-limiting circuitry in the power supply.
Voltage Programming Switch	Refer to Power Supply Voltage Conversion procedure in section 3.
OPERATOR PANEL	
Logic Plug/Unit Selected Indicator	The logic plug activates switches that establish the logical address of the device. Logic plugs are available with numbers 0 through 15. The Unit Selected indicator is lit if drive is selected.

*Not found on all power supplies. Newer power supplies are internally protected.

Table Continued on Next Page

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

Switch or Indicator	Function
OPERATOR PANEL (Contd)	
START Switch/ Ready Indicator	The START switch has alternate action, in for Start and out for Stop, and it contains the Ready indicator. Pressing the START switch to the Start position enables the power on sequence. The Ready indicator flashes until the disks are up to speed, the heads are loaded, and there are no fault conditions. The Ready indicator is on steadily with power on complete. Pressing the START switch to release it from the Start position causes the Ready indicator to flash until disk rotation has stopped.
FAULT Indicator/ Fault Clear Switch	The FAULT indicator is inside the Fault Clear switch and lights if certain faults exist within the drive. It is turned off by any of the following (provided that the fault condition(s) no longer exist): • Pressing the Fault Clear switch • Fault Clear command from the controller • Reapplying power to the drive
WRT PRT Switch/Indicator	The operation of the WRT PRT 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 WRT PRT indicator.
Table Continued on Next Page	

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

Switch or Indicator	Function
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.

OPERATING INSTRUCTIONS

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

This procedure describes how to turn on the drive. It is assumed that dc power is supplied to the drive because power supply switch/circuit breaker 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 on the I/O board was set in the Local position, the power on sequence begins immediately.

    - If the Local/Remote switch was set in the Remote position, the power on sequence begins when power sequence ground is available from the controller.

3. Observe that Ready indicator (located in START switch) flashes, indicating that power on 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 on sequence is now complete, and the drive is ready to receive commands from the controller.

POWER OFF PROCEDURE

This procedure describes how to turn off the drive.

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

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

3. Observe that Ready indicator goes off within 35 seconds, indicating that power off is complete.

With power off 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 switch/circuit breaker is left ON to continue supplying dc power to the drive.

DATA PACK HANDLING AND STORAGE

CAUTION

Always remove the data pack when the drive is moved from one location to another. Failure to do so could cause damage to heads and data pack.

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. Do not stack the data packs. Take care to prevent stored packs from falling, sliding, or bumping. Packs stored on edge should be restrained so they can't fall over.

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

NOTE

Contact your CDC account sales representative for data pack part numbers.

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, power supply switch/circuit breaker 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.

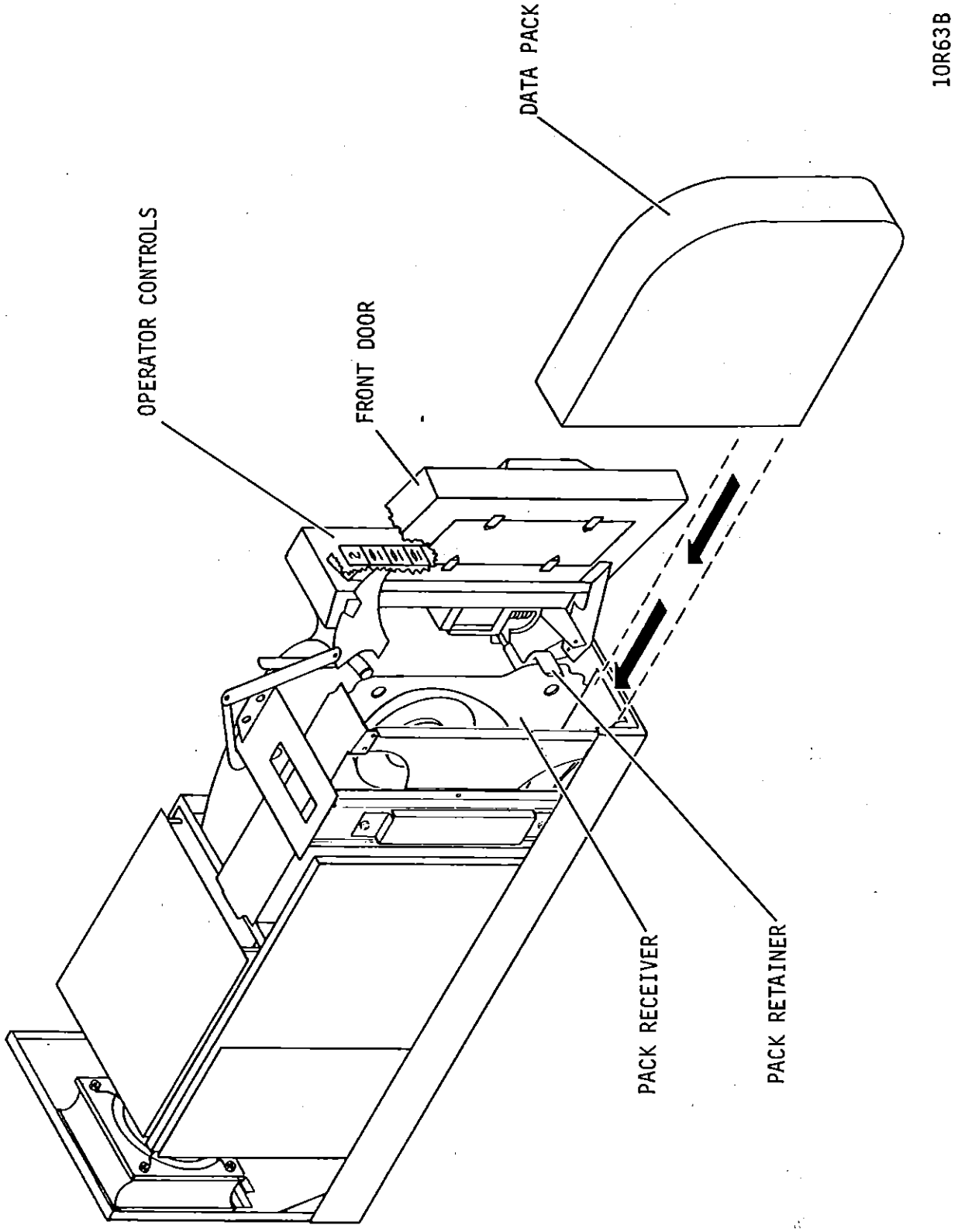


Figure 2-2. Data Pack Installation and Removal

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.

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, power supply switch/circuit breaker must be switched ON. If front door still will not open, 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

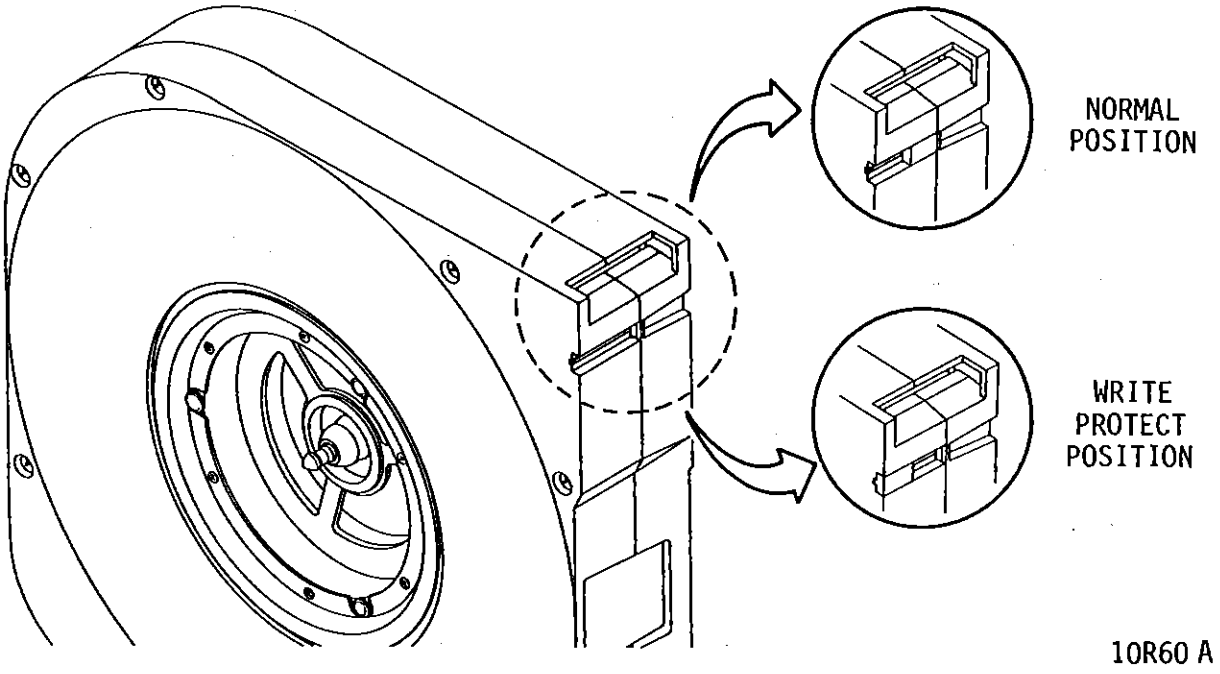


Figure 2-3. Write Protect Tab

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.

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.

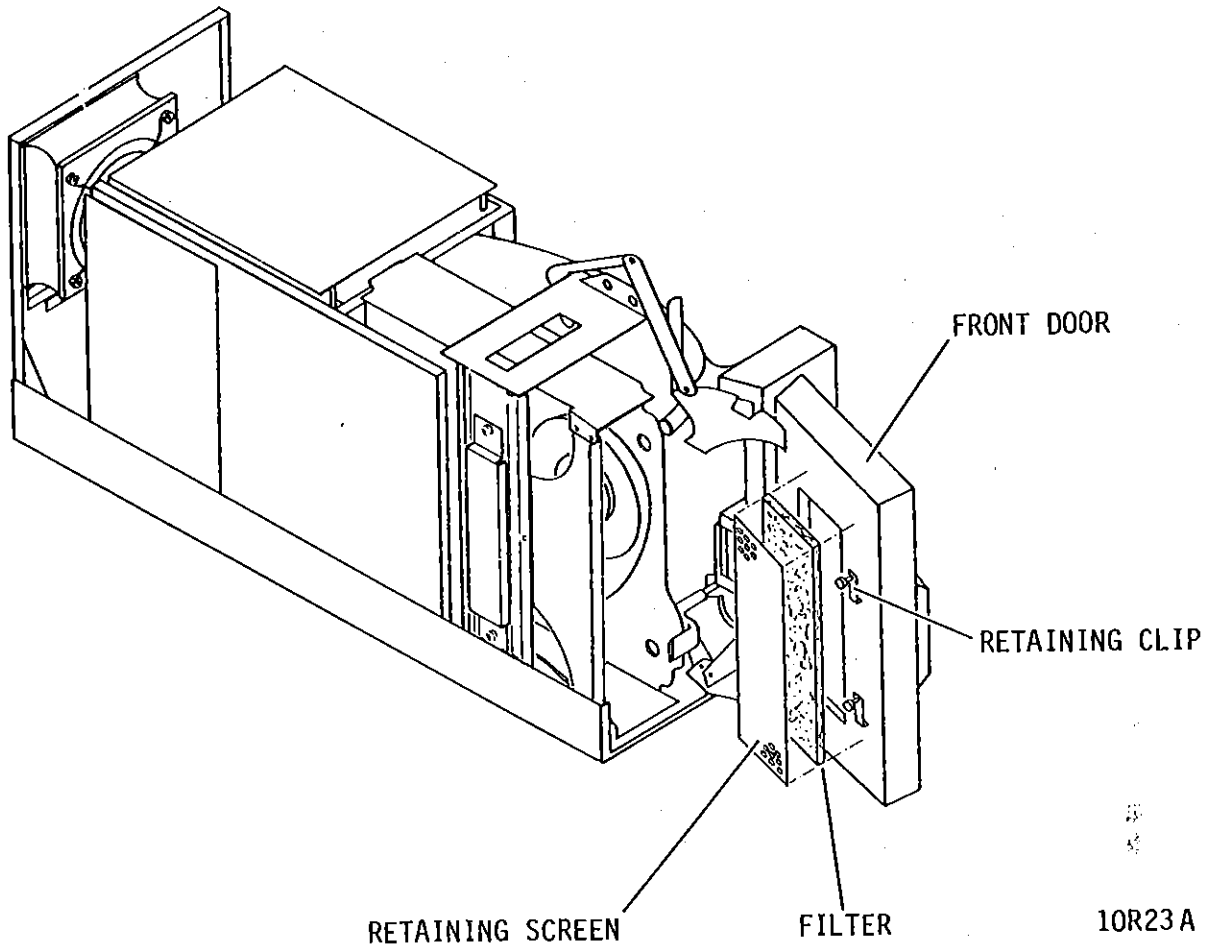


Figure 2-4. Primary Air Filter Replacement (S/C 01)

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.

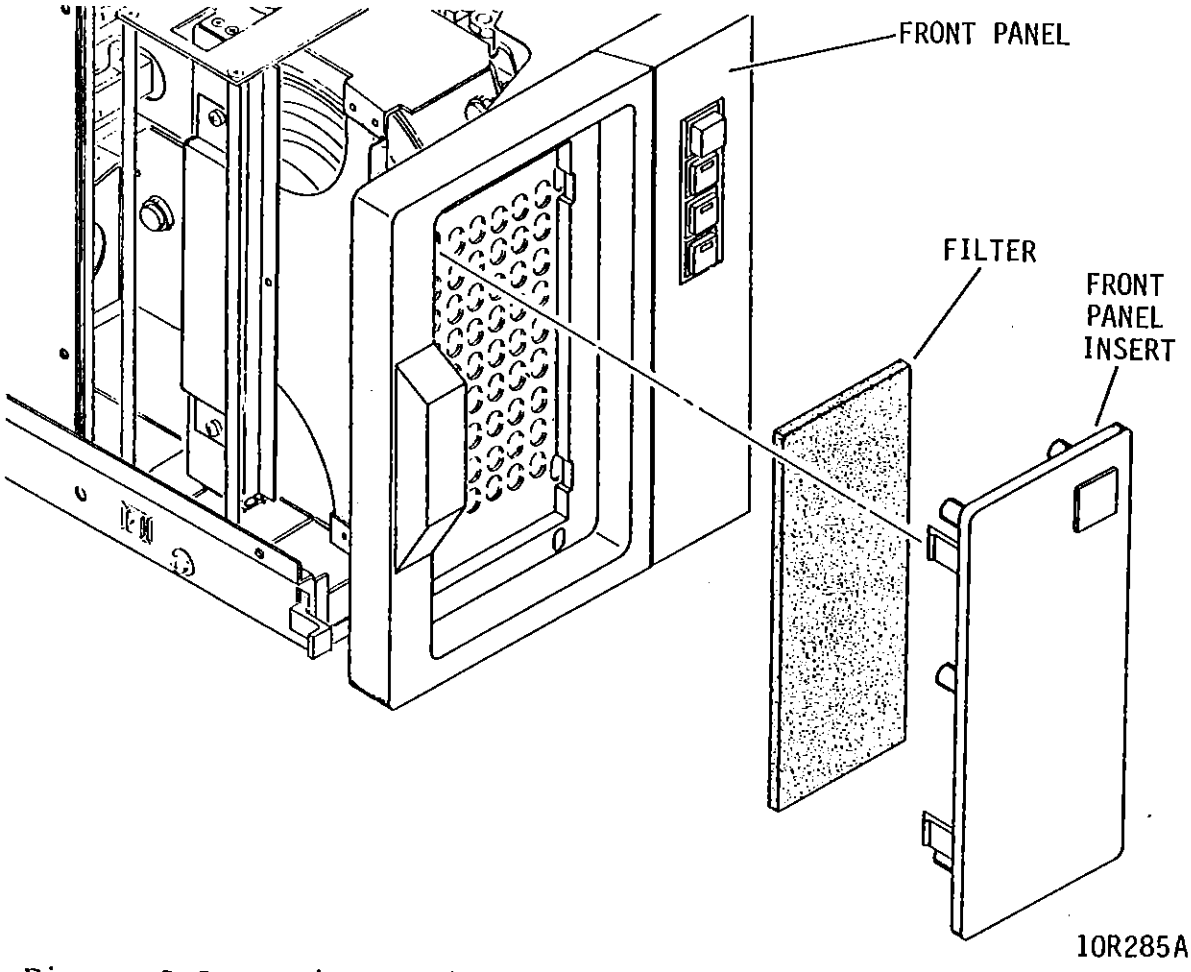


Figure 2-5. Primary Air Filter Replacement (S/C 02 and Above)

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.

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

INSTALLATION AND CHECKOUT

INSTALLATION AND CHECKOUT 3

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 any circuit boards.

ENVIRONMENTAL REQUIREMENTS

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

TABLE 3-1. ENVIRONMENTAL REQUIREMENTS

Conditions	Characteristics	Specifications
TEMPERATURE		
Storage	Range	-10 to 50°C (14 to 122°F)
	Maximum change per hour	15°C (27°F)
Transit	Range	-40 to 60°C (-40 to 140°F)
	Maximum change per hour	20°C (36°F)
Operating	Range	10 to 45°C (50 to 114°F)
	Maximum change per hour	10°C (18°F)

Table Continued on Next Page

TABLE 3-1. ENVIRONMENTAL REQUIREMENTS (Contd)

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

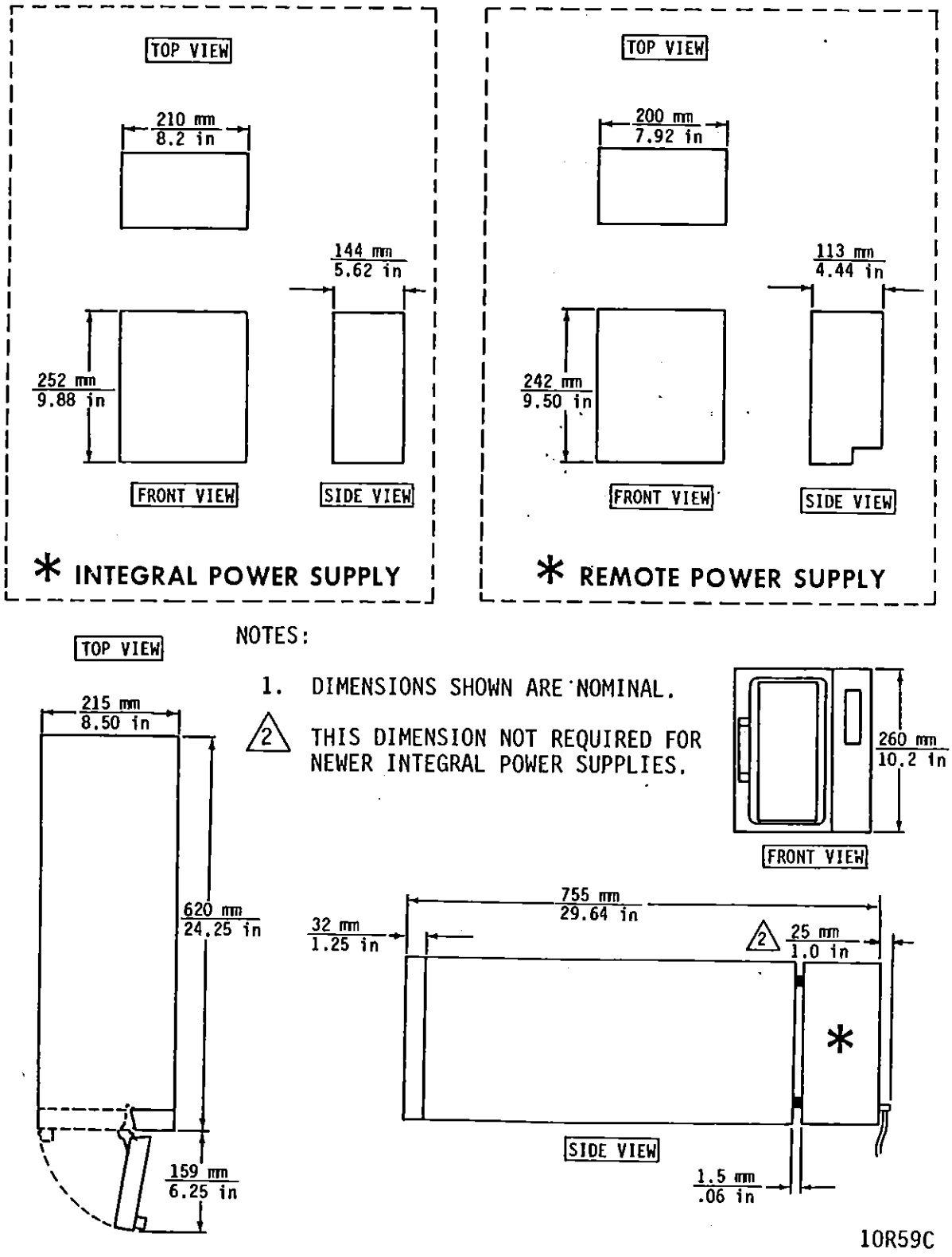


Figure 3-1. Drive Space Requirements

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

POWER REQUIREMENTS

WARNING

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

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

GROUNDING REQUIREMENTS

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

Safety Grounding

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

TABLE 3-2. NORMAL POWER REQUIREMENTS

Specifications	Values	
	100/120 V ac	208/240 V ac
Voltage Range	87 to 128 V	179 to 256 V
Nominal Line Frequency	50/60 Hz	50/60 Hz
Frequency Range	48.0 to 62.0 Hz	48.0 to 62.0 Hz
Phase Requirements	Single Phase	Single Phase
Power Consumed*		
Integral Pwr Sup	0.237 kW	0.241 kW
Remote Pwr Sup	0.244 kW	0.236 kW
Line Current*		
Integral Pwr Sup	3.5 A	2.1 A
Remote Pwr Sup	2.8 A	1.6 A
Power Factor*		
Integral Pwr Sup	0.68	0.56
Remote Pwr Sup	0.73	0.69
Start Up Current	See figure 3-2.	See figure 3-2.
*Measured when disks are rotating and carriage is moving.		

TABLE 3-3. AC CORD SET MINIMUM RATINGS

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

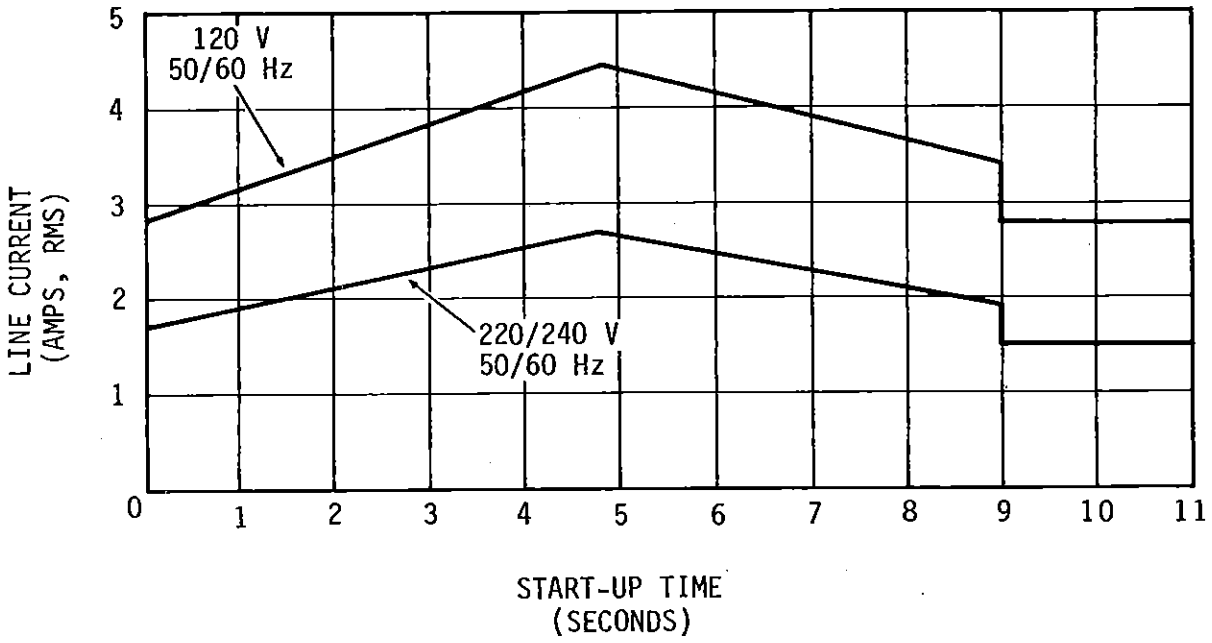


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Figure 3-2. Line Current Versus Start-up Time

System Grounding

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

INTERFACE REQUIREMENTS

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

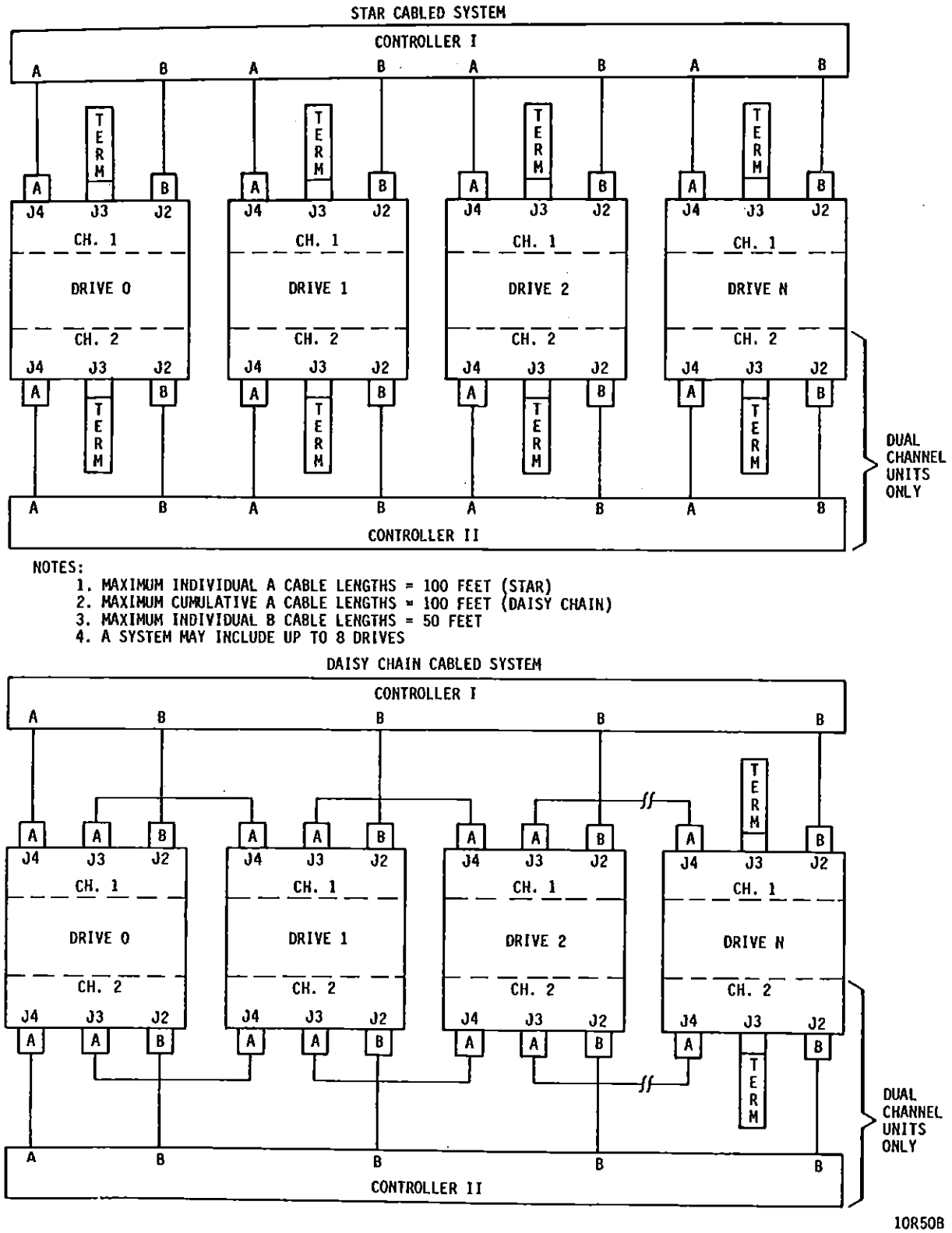


Figure 3-3. System Cabling

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.

FINAL UNPACKAGING AND INSPECTION

GENERAL

WARNING

Always remove the data pack when the drive is moved from one location to another. Failure to do so could cause damage to heads and data pack.

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

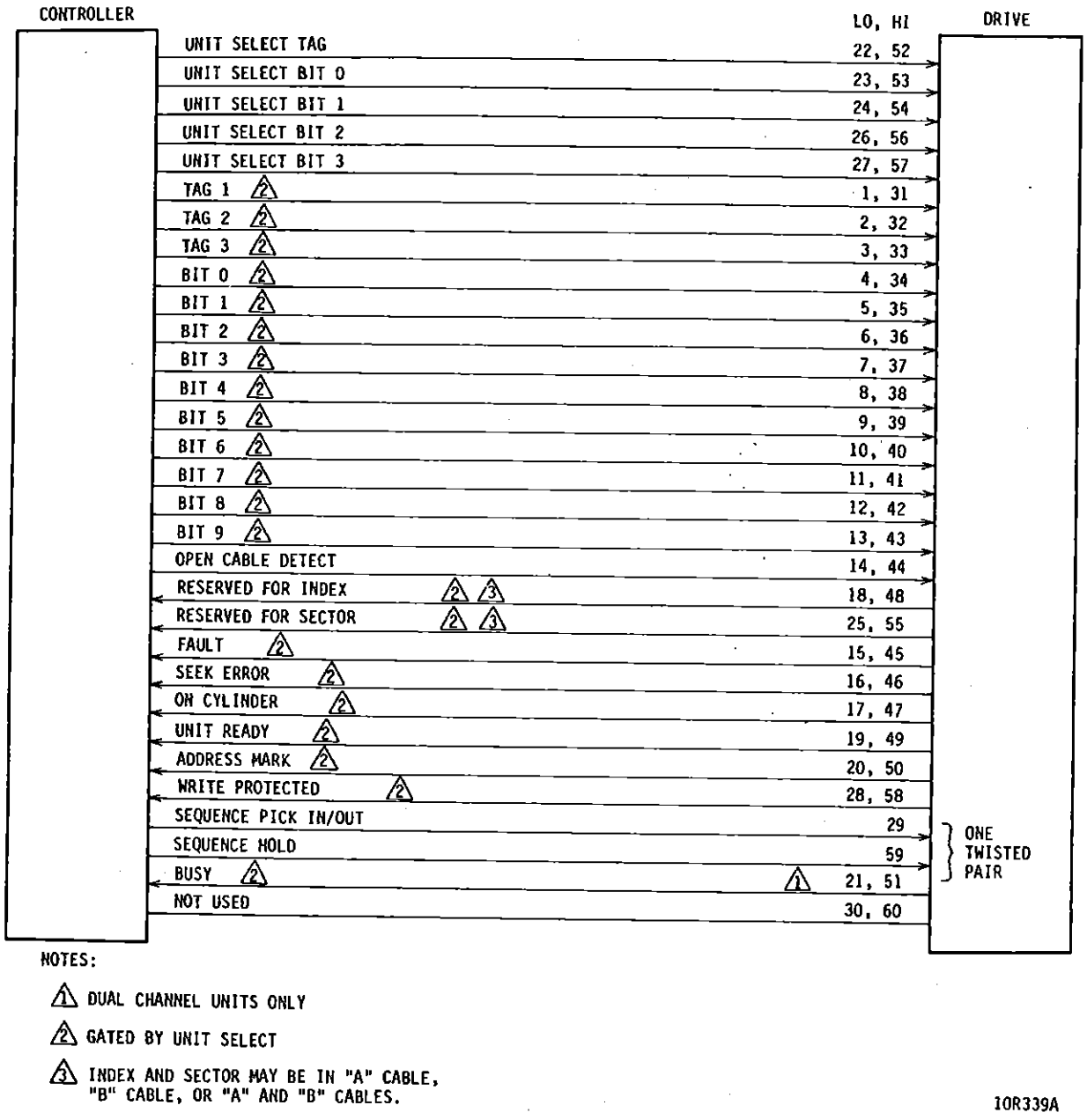
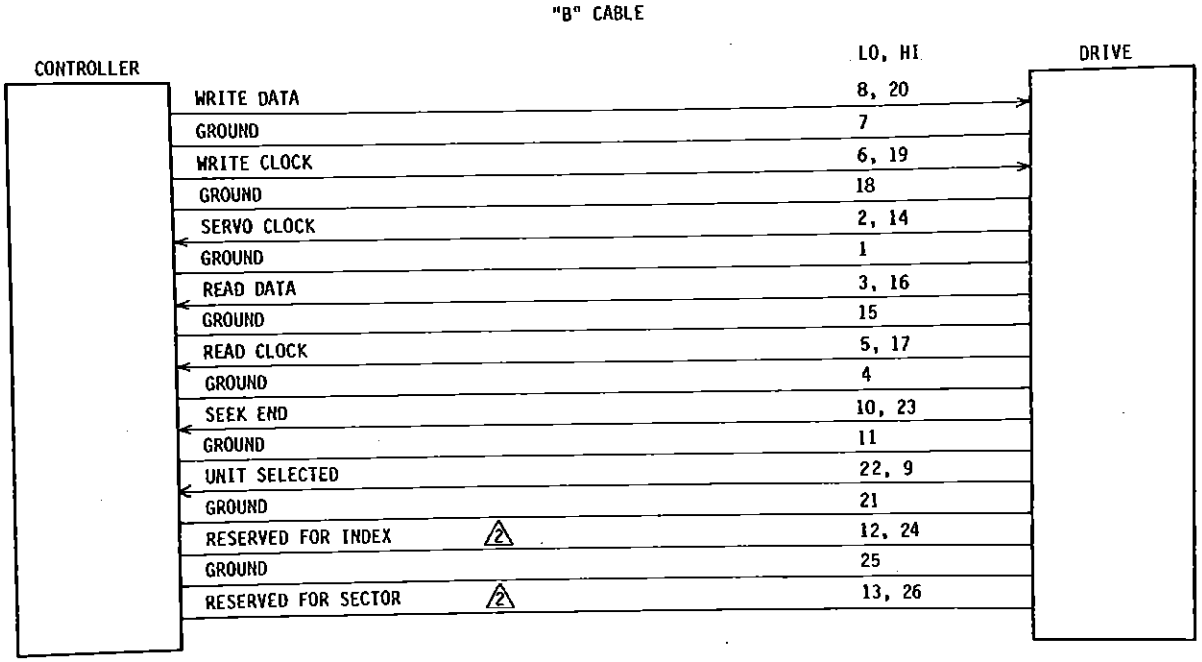


Figure 3-4. A Cable



NOTES:

1 NO SIGNALS GATED BY UNIT SELECTED.

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

10R340

Figure 3-5. B Cable

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 (if applicable).
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
- Remote Power Supply Bracket Installation
- Power Supply Voltage Conversion
- System I/O Cabling
- System Grounding and Interconnect Cabling
- Mounting Remote Power Supply in Rack
- Setting Circuit Board Switches.

MOUNTING DRIVE IN RACK

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

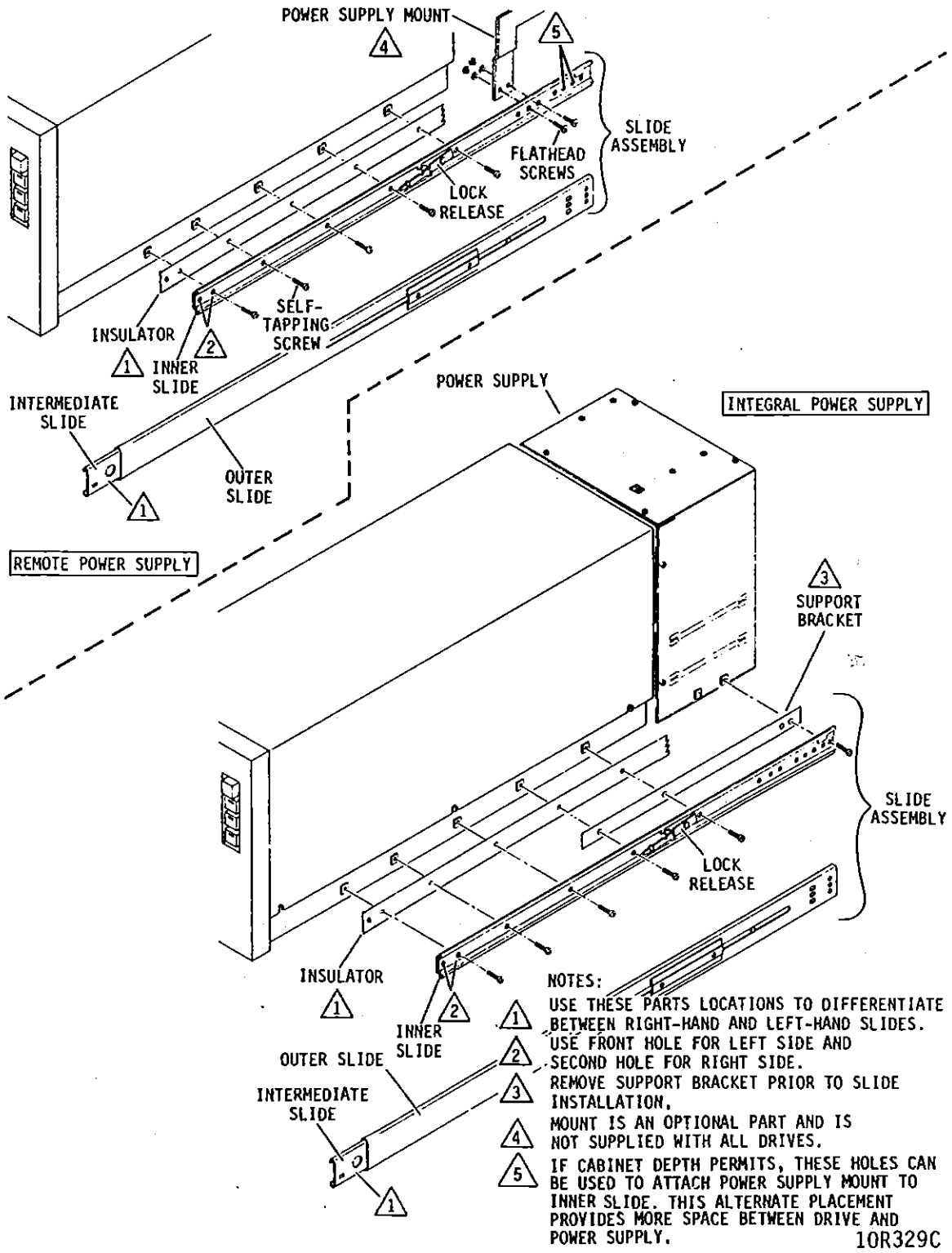


Figure 3-6. Drive Installation

NOTE

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

Drive Installation (Integral Power Supply)

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

2. Remove mounting screws from slide hardware kit.

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

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

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

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

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

8. Disengage shipping locks by turning shipping lock screws (accessed through holes in right side of top cover) fully counterclockwise. Remove shipping lock instruction tag, with shipping clip attached, from front of drive.

Drive Installation (Remote Power Supply)

1. Remove mounting screws from slide hardware kit.

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

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

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

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

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

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

8. Disengage shipping locks by turning shipping lock screws (accessed through holes in right side of top cover) fully counterclockwise. Remove shipping lock instruction tag, with shipping clip attached, from front of drive.

REMOTE POWER SUPPLY BRACKET INSTALLATION

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

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

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

POWER SUPPLY VOLTAGE CONVERSION

The power supply is configured before shipment to operate in one of two ranges of ac input voltages. The equipment label on the power supply indicates the voltage range selected prior to shipment. The voltage range for drives with the integral power supply is determined by setting the voltage programming switch to the desired range. The voltage range for drives with the remote power supply is determined by: 1) on older supplies, which voltage programming plug is installed inside the power supply, or 2) on newer supplies, setting the voltage program-

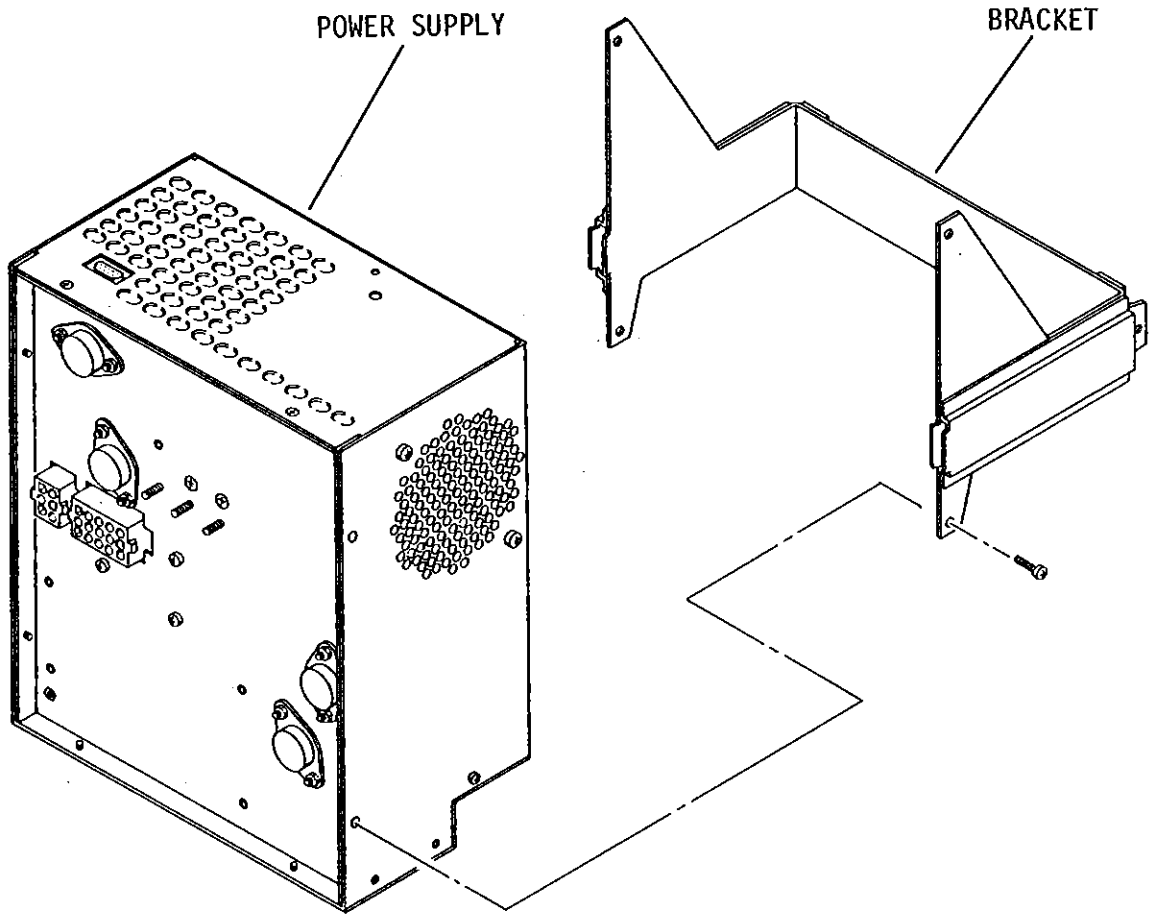


Figure 3-7. Remote Power Supply Bracket Installation

ming switch to the desired range. The ac power cord must be replaced if the voltage range is changed. Either order a CDC cord (see figure 3-8 and the parts data section) or select a commercially available cord per the specifications in table 3-3.

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

NOTE

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

2. Change voltage programming switch to desired setting.

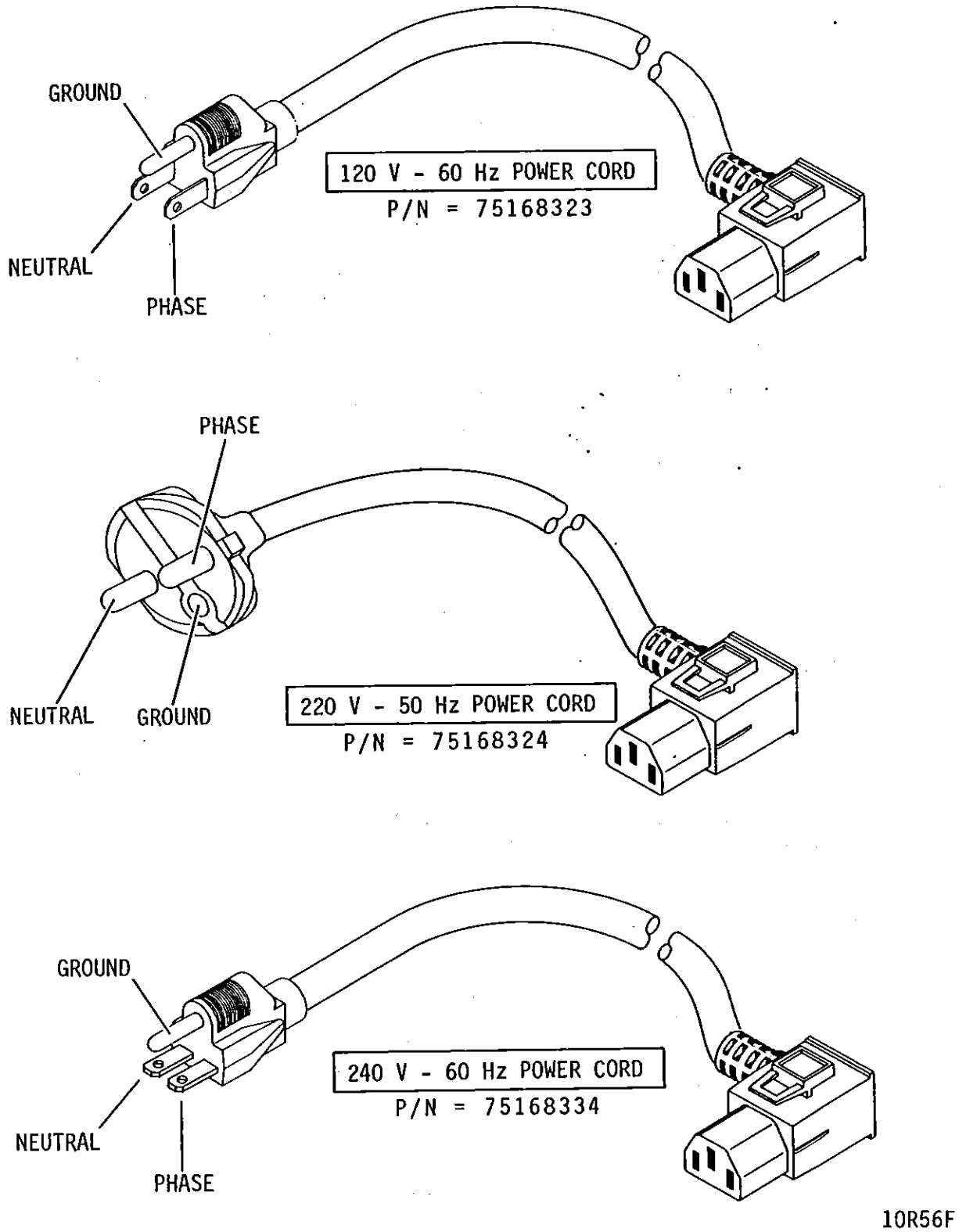


Figure 3-8. AC Power Cables

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

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

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

CAUTION

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

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

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

NOTE

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

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

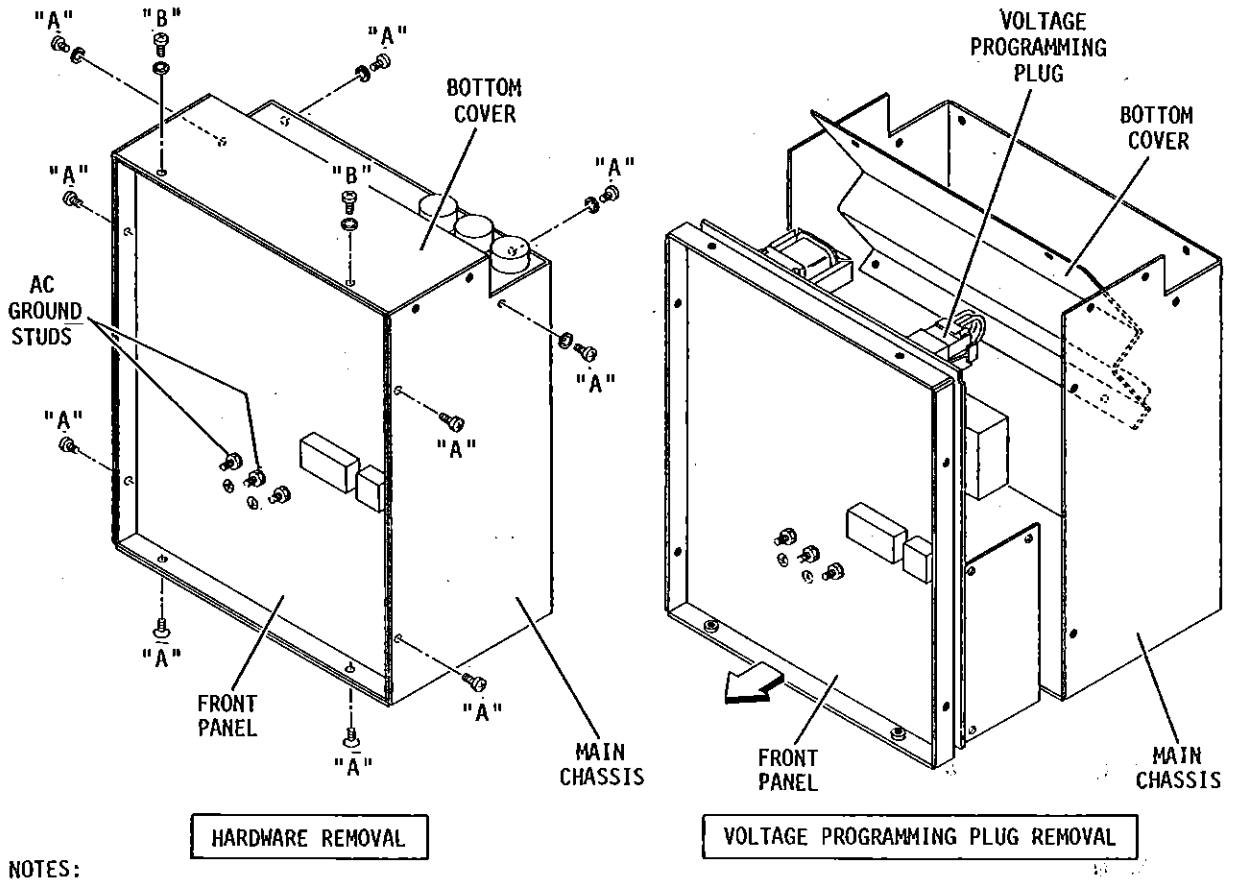
   f. Align bottom cover with front panel and replace attaching hardware (designated "B").

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

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

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

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



NOTES:

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

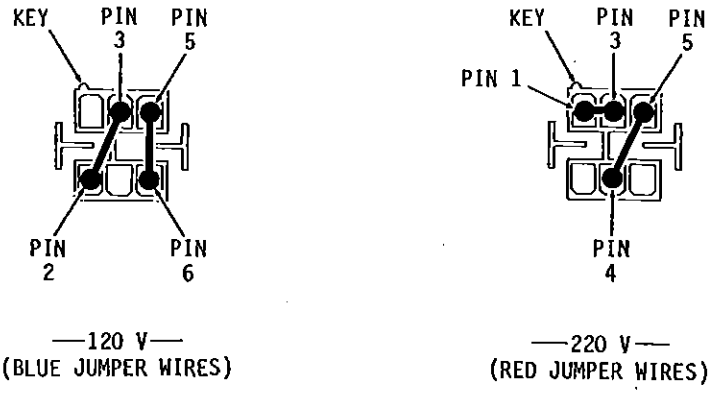


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Figure 3-9. Voltage Conversion (Older Remote Power Supplies)

SYSTEM I/O CABLING

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

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

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

1. Remove I/O shield from I/O plate (see figure 3-10).

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

NOTE

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

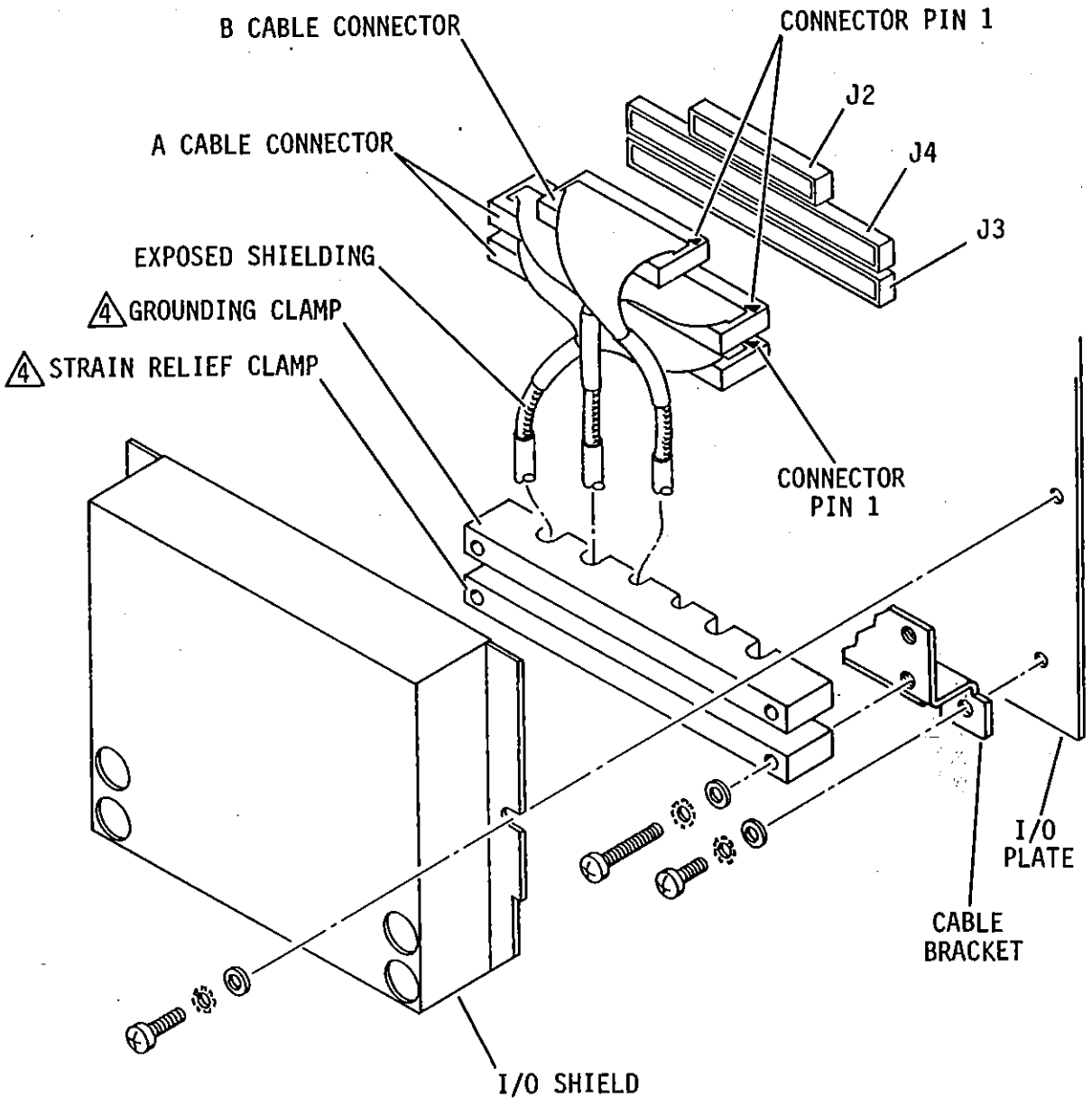
3. Connect B cables from controller to connector J2 on each drive.

NOTE

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

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

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



NOTES:

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

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

11D13F

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

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

   - all drives in a star system.
   - last drive in a daisy chain system.

NOTE

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

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

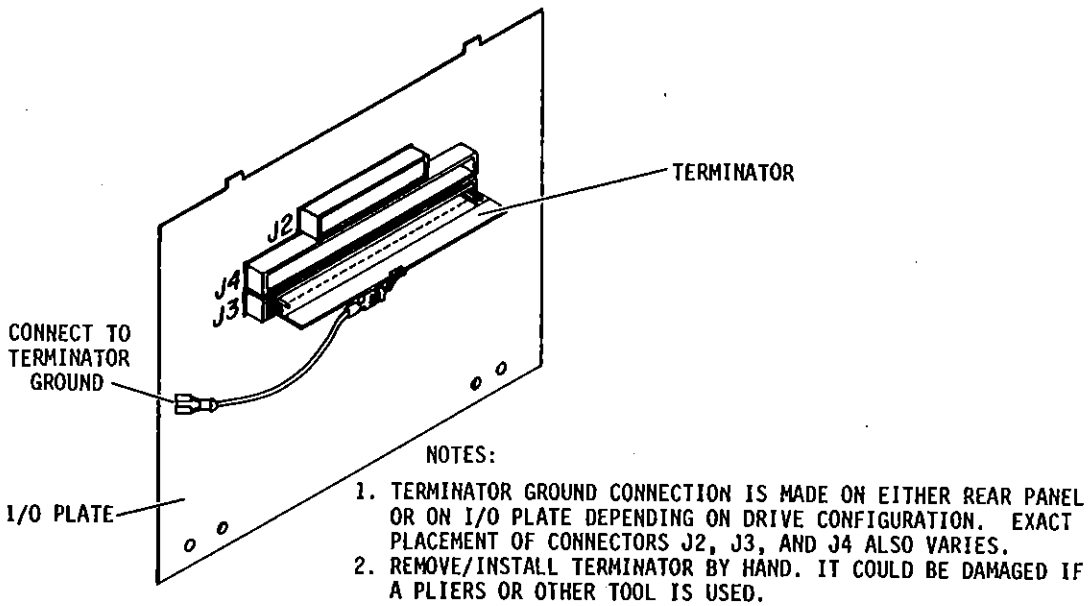


Figure 3-11. Terminator Installation (Typical)

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

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

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

11. Install I/O shield on I/O plate with attaching hardware.

SYSTEM GROUNDING AND INTERCONNECT CABLING

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

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

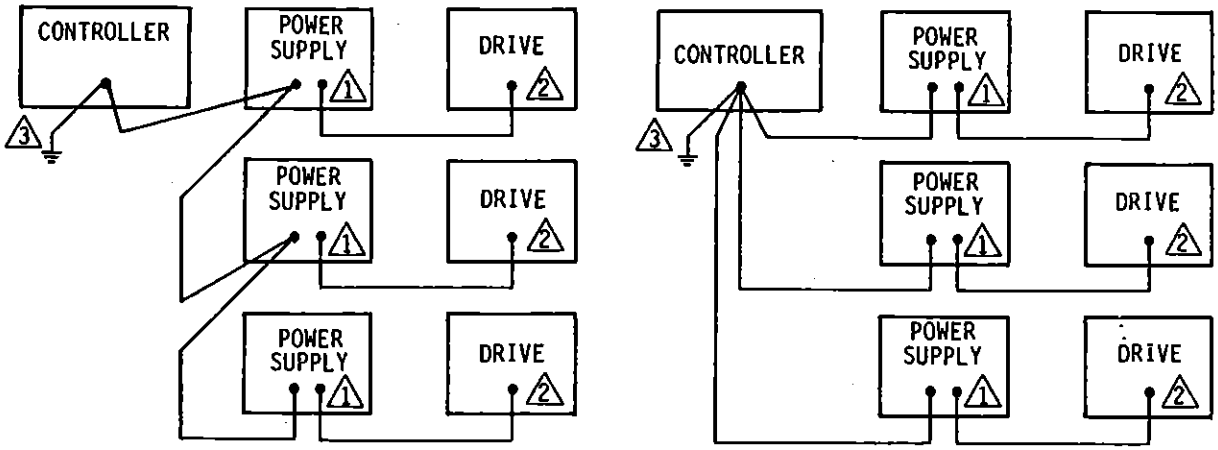
Star Grounding Procedure

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

1. Prepare ground straps as follows:

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

      - Controller to earth ground
      - Controller to each power supply



DAISY CHAIN CONFIGURATION

STAR CONFIGURATION

NOTES:

1. GROUND CONNECTIONS TO POWER SUPPLY USE STUDS MARKED ⏚. THERE MUST BE NO CONNECTION TO STUD MARKED "± 5V RET."
2. DRIVE IS GROUNDED AT "DC GND" SCREW ON DRIVE REAR PANEL.

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

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

3. EARTH GROUND CONNECTION

11D15A

Figure 3-12. System Grounding Diagram

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

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

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

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

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

NOTE

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

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

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

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

NOTE

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

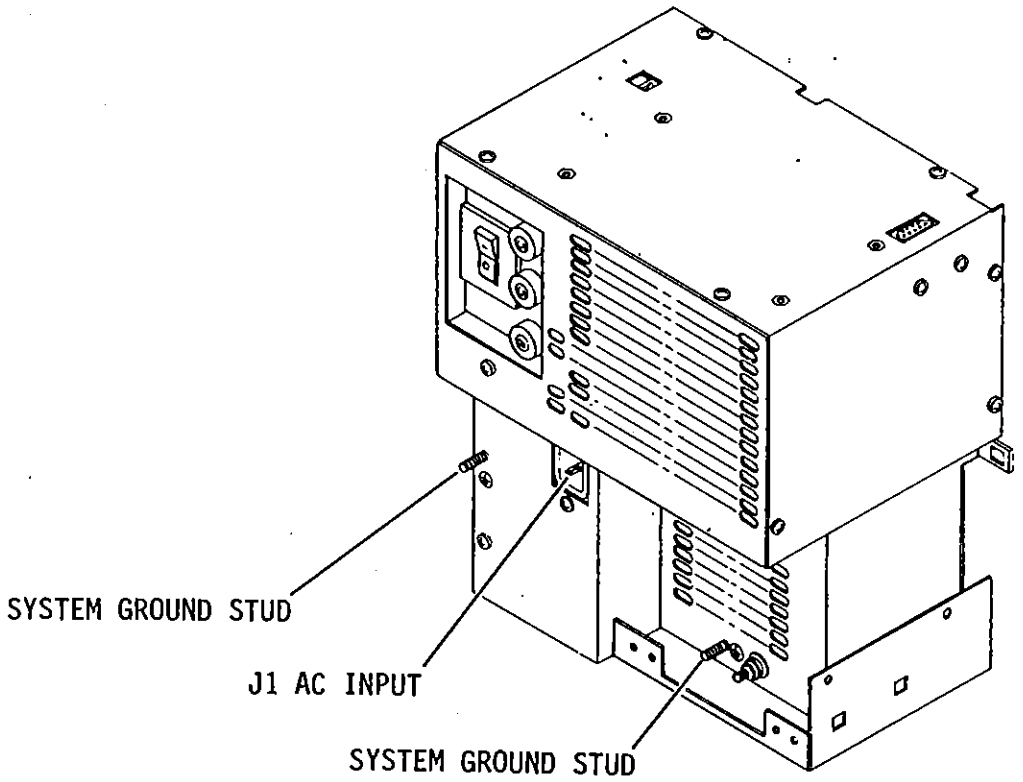
4. Referring to figure 3-9, attach a ground strap from controller to each power supply as follows:

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

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

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

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



NOTE:

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

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

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

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

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

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

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

NOTES:

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

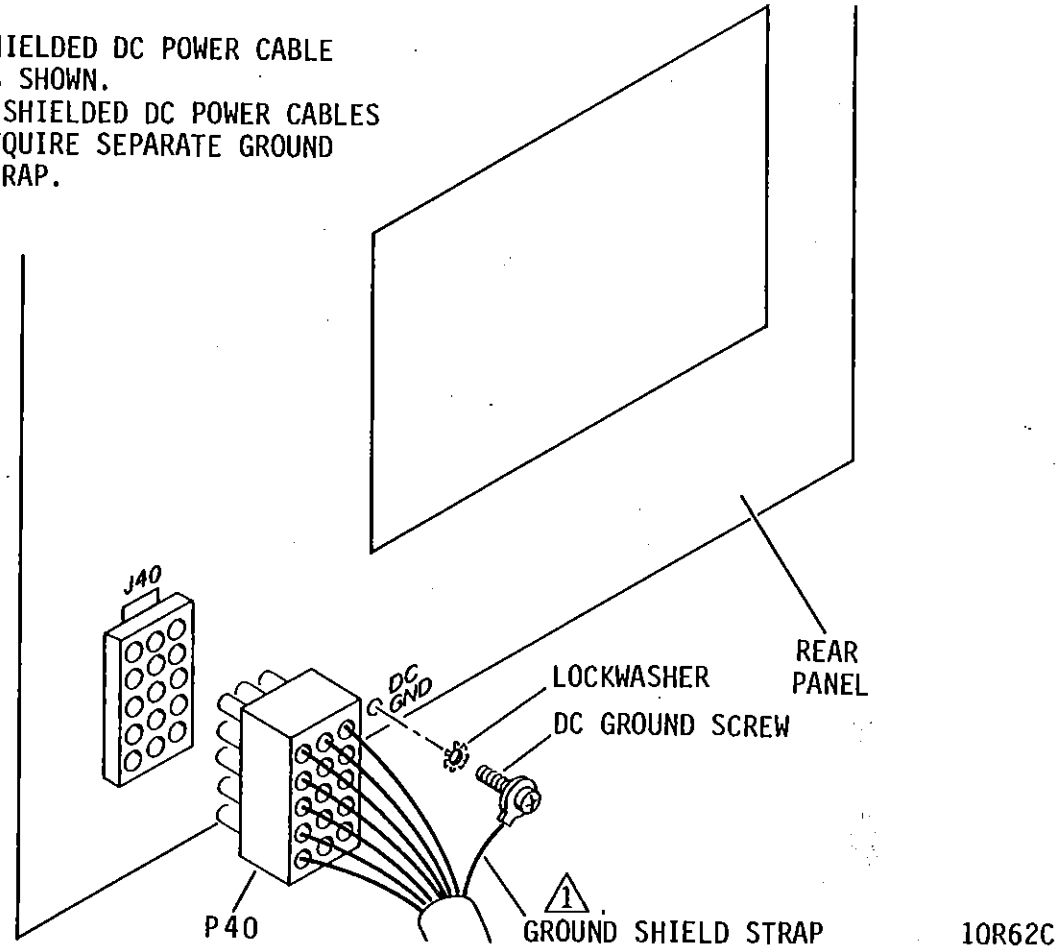

Figure 3-14. Drive Grounding (Remote Power Supply)

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

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

f. Reinstall screw in rear panel of drive.

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

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

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

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

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

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

f. Reinstall screw in rear panel of drive.

Daisy Chain Grounding Procedure

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

1. Prepare ground straps as follows:

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

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

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

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

   a. Connect two ground straps to controller ground terminal.

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

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

NOTE

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

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

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

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

NOTE

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

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

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

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

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

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

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

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

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

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

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

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

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

f. Reinstall screw in rear panel of drive.

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

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

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

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

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

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

f. Reinstall screw in rear panel of drive.

MOUNTING REMOTE POWER SUPPLY IN RACK

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

NOTE

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

Units Without Mounting Bracket

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

2. Support power supply above drive.

NOTE

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

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

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

Units With Mounting Bracket

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

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

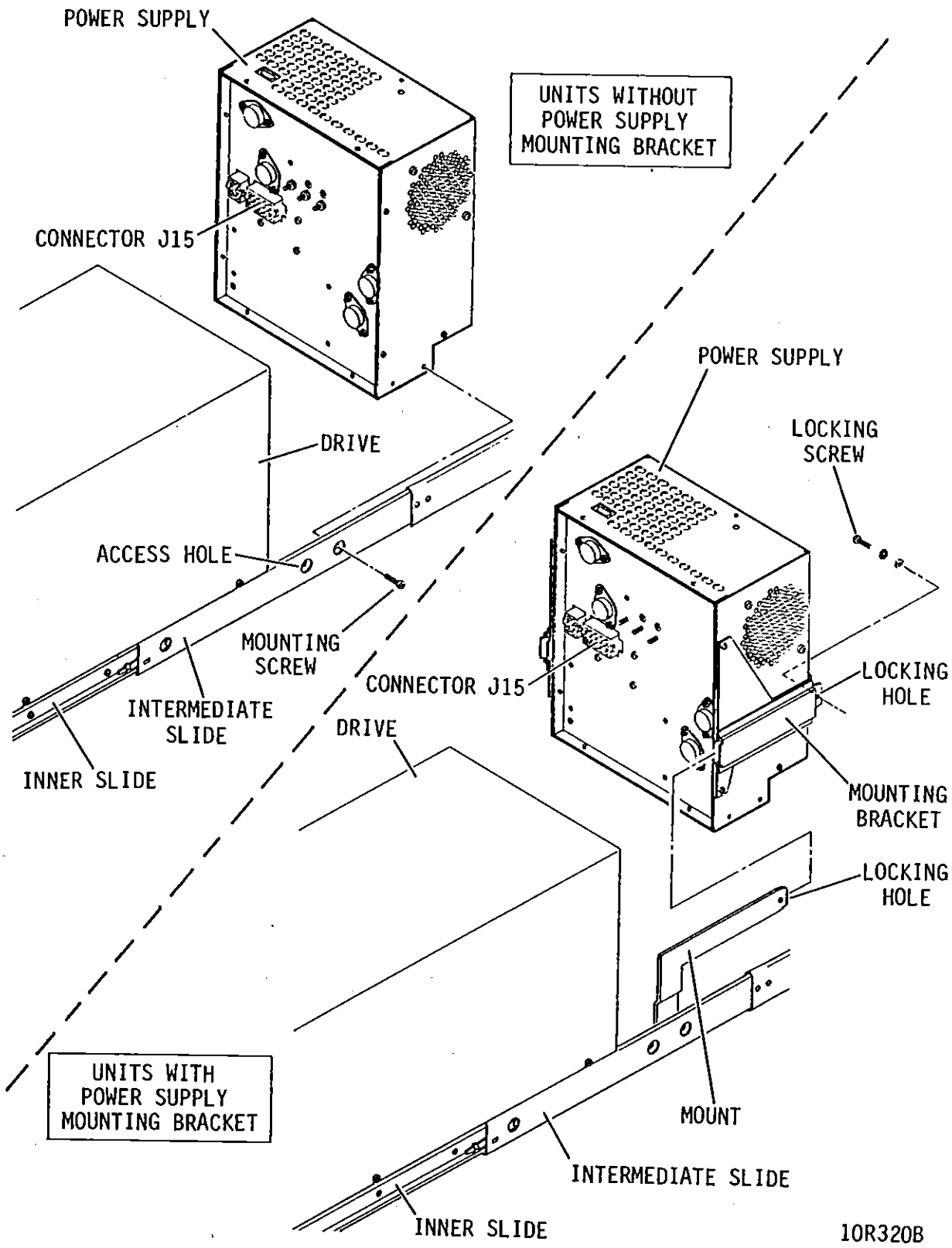

Figure 3-15. Installing Remote Power Supply on Slides

SETTING CIRCUIT BOARD SWITCHES

The I/O and control circuit boards inside the drive contain a number of switches that must be set correctly for normal operation of the drive. Figures 3-16 through 3-19 identify these switches and give their locations on the circuit boards.

You may encounter two types of switches. Refer to figure 3-20 for an illustration of these switches and how to set them. Rocker switches are actuated by pressing one end of the actuator or the other (rocking it) to turn the switch on (closed) or off (open). Slide switches are actuated by sliding the actuator one way or the other to turn the switch on or off. Use a slender ball point pen, a straightened paper clip, or any similar object to change switch settings. Do not use a lead pencil point as it may break off and lodge in the switch, or cause the switch to malfunction.

Figures 3-16 through 3-19 give the correct settings for normal drive operation for all switches except the sector select switches. Setting the sector select switches is discussed in the following paragraphs.

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

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

Recommended Method for Sector Switch Settings

Refer to the subsystem reference manual to determine the number of sectors required by the controller. There is a choice of either 806 kHz or 1.2 MHz sector clock frequency (except that drives with BPEX or DPEX control boards do not have 1.2 MHz capability). See figure 3-19 for location of sector clock jumper, which determines sector clock frequency. Table 3-4

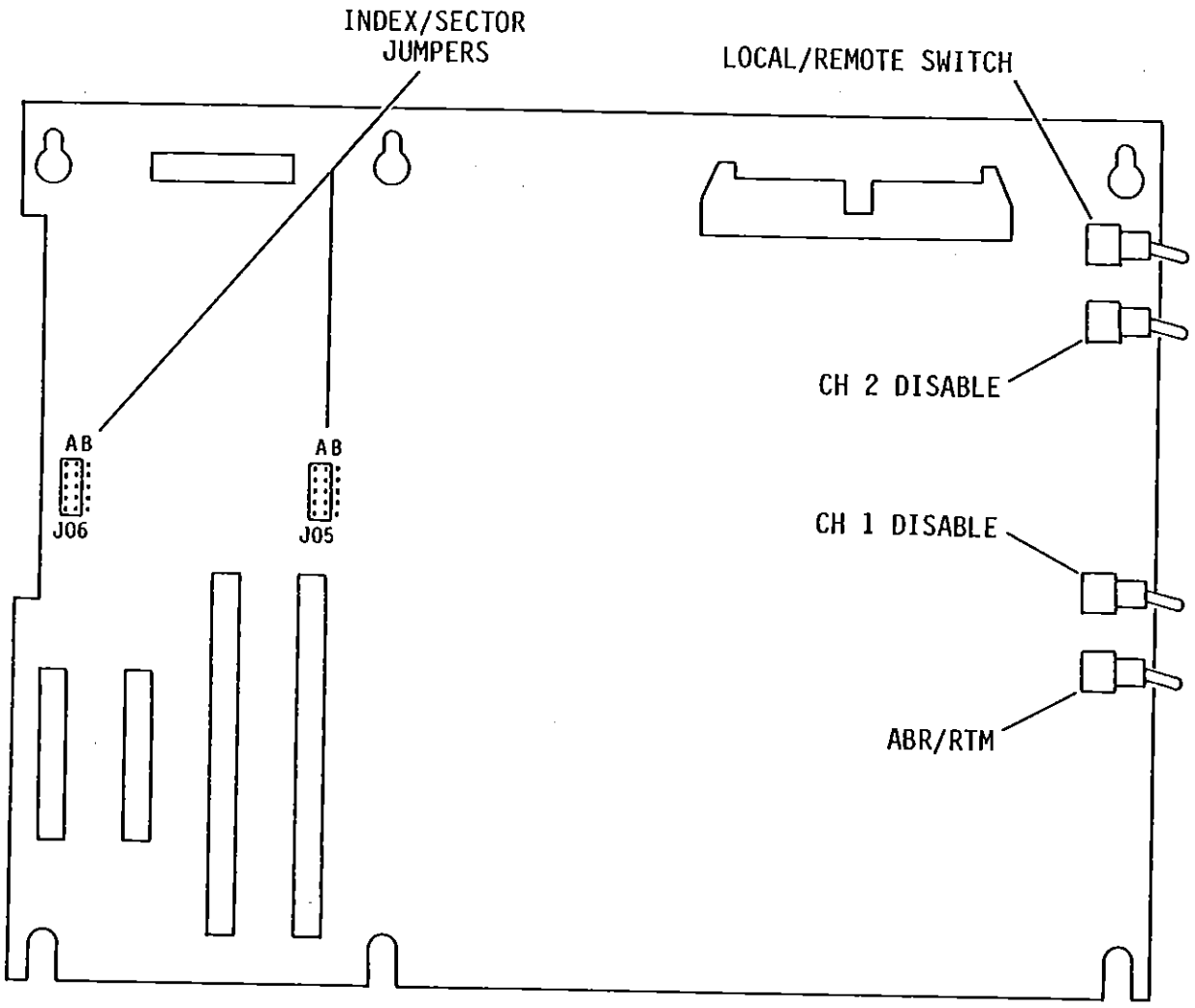

Figure 3-16. Switch Settings on AEDN/CEDN I/O Boards
(Sheet 1 of 2)

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

Figure 3-16. Switch Settings on AEDN/CEDN I/O Boards (Sheet 2)

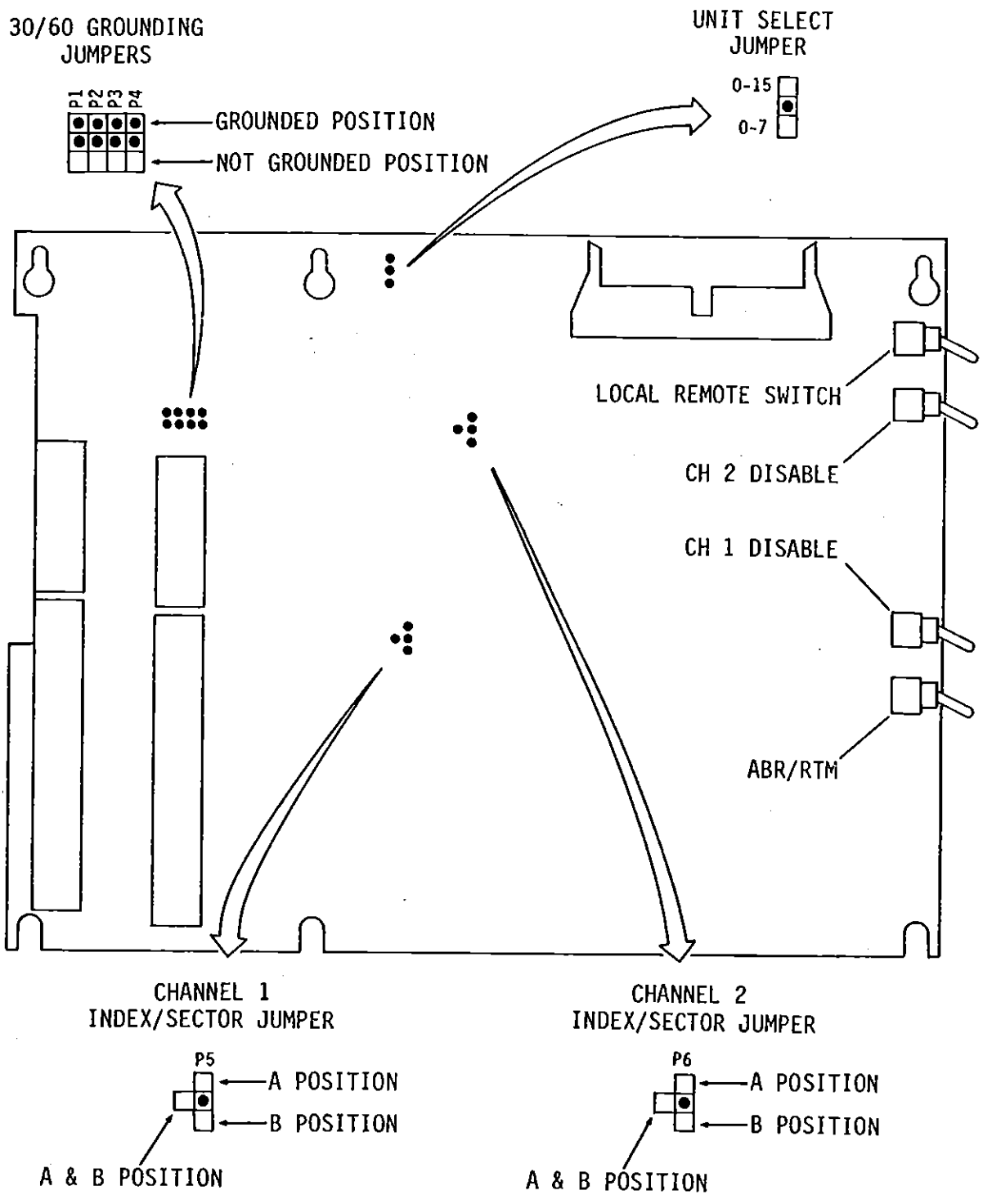

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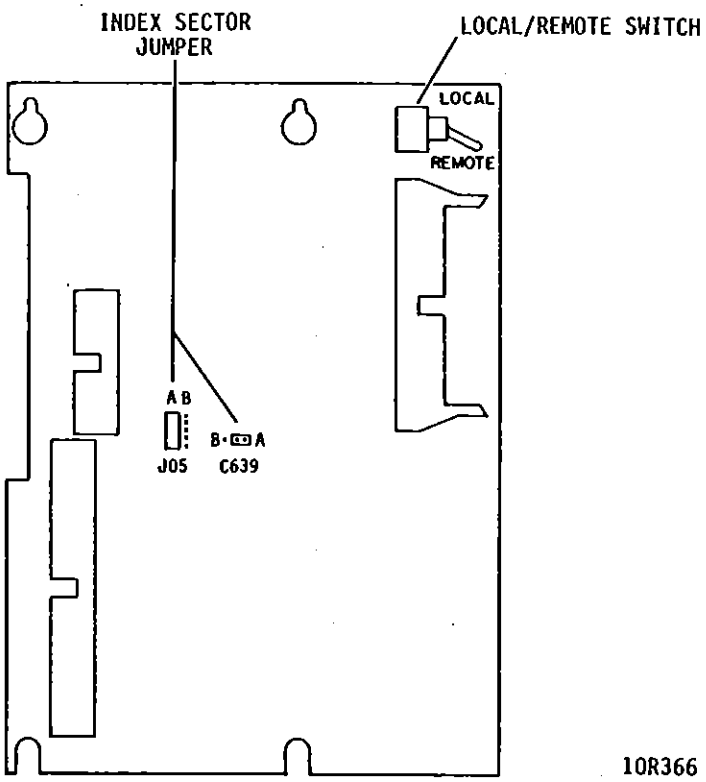
Figure 3-17. Switch Settings on DEDN I/O Board (Sheet 1 of 2)

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

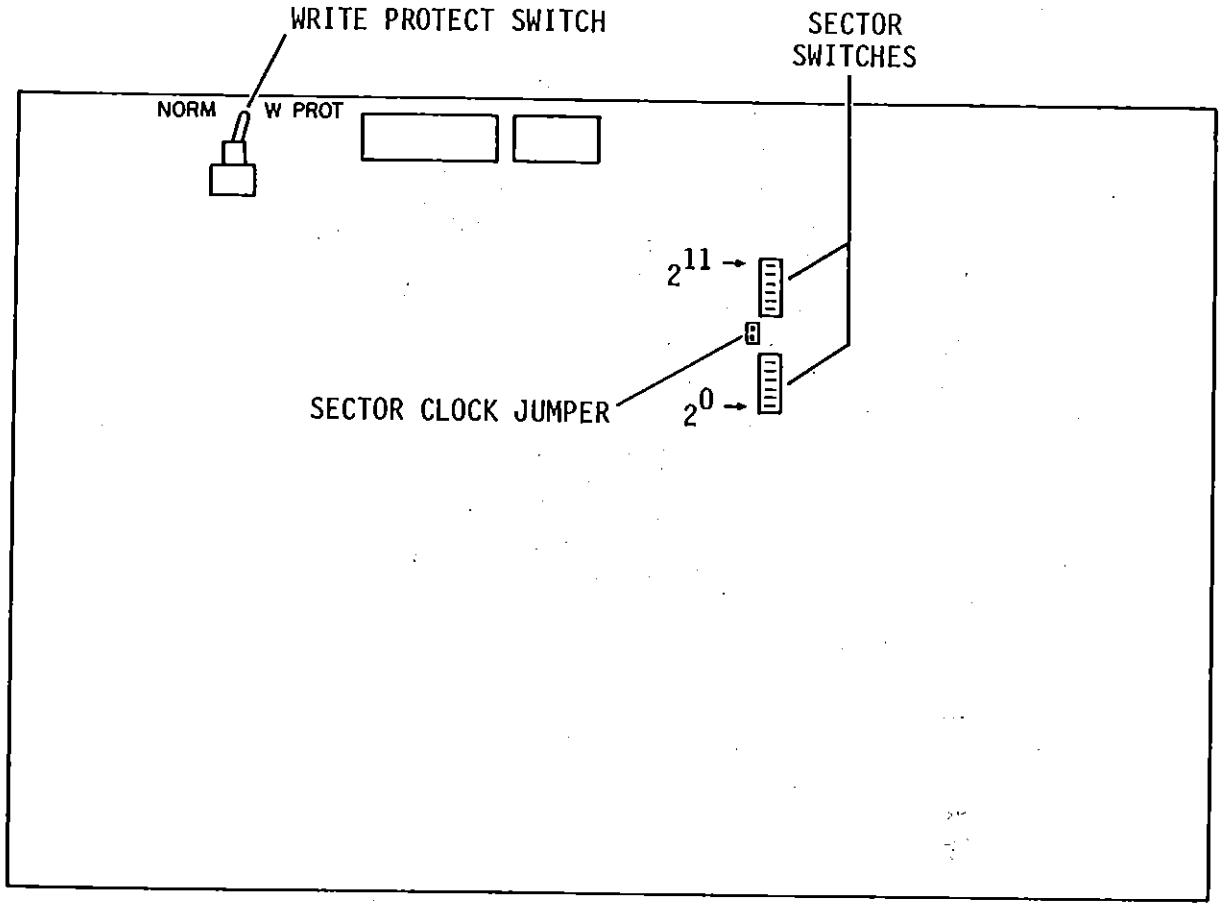
Figure 3-17. Switch Settings on DEDN I/O Board (Sheet 2)



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

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

Figure 3-18. Switch Settings on _EBN I/O Board



SWITCH	SETTING	DESCRIPTION
Sector switches		See discussion on setting circuit board switches.
Write Protect	NORM	Normal.
	W PROT	Write Protect.
Sector Clock Jumper*	Jumper removed	Sector clock frequency is 806 KHz.
	Jumper installed	Sector clock frequency is 1.2 MHz.
*Older boards without jumper do not have 1.2 MHz capability.		

Figure 3-19. Switch Settings on _PEX Control Board

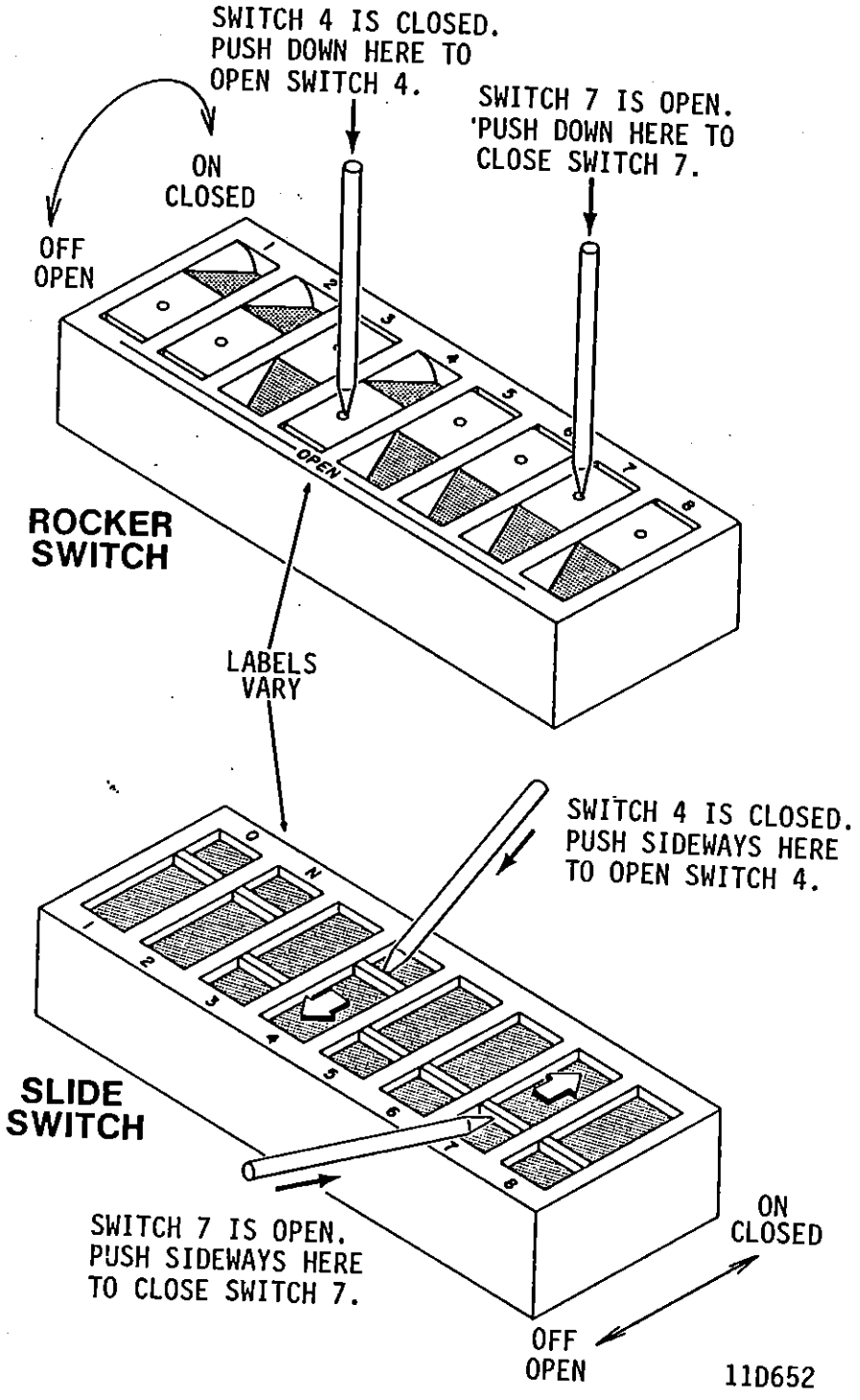


Figure 3-20. How to Set DIP Switches

shows sector switch settings for the 806 kHz sector clock. Across from the number of sectors listed in the table is a row of Cs and Os. C represents the Closed (On) position of the sector switch. O represents the Open (Off) position of the sector switch. Set the switches to the positions designated in the table while referring to figure 3-20 for an illustration of the switch positions.

The switch settings listed in table 3-4 have been determined from a formula. Use of this formula is demonstrated below to provide the user with an additional tool for determining sector switch settings. The text also provides a formula for setting sector switches for the 1.2 MHz Sector Clock. Examples showing how to calculate the number of bytes in a sector are also provided.

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 with an 806 kHz Sector Clock:

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

NOTE

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

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

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

Here is an example of determining the switch settings for selecting 63 sectors (806 kHz Sector Clock):

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

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

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

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

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

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

- Add 1 to the selected clock pulses: 212 + 1 = 213.
- Multiply this number by the number of bytes per clock pulse (1.5) to find the number of bytes per sector: 213 X 1.5 = 319.5

The 1.2 MHz Sector Clock option increases by half the number of clock pulses per track (20 160). This clock allows the drive user an alternate formula for generating a specific number of sectors per track or bytes per sector. Here is an example of determining the switch settings for selecting 33 sectors with a 1.2 MHz Sector Clock:

$$\text{Selected Clock Pulses} = \left(\frac{20\ 160}{33} - 1\right) = (610.9 - 1) = 609.9$$

If there is a remainder, it should be ignored. In this case, the number of selected clock pulses becomes 609.

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

Selected clock pulses	609
Clock pulses selected by switch 9	512
(Difference)	97
Clock pulses selected by switch 6	64
(Difference)	33
Clock pulses selected by switch 5	32
(Difference)	1
Clock pulses selected by switch 0	1
(Difference)	0

Thus, placing switches 0, 5, 6, and 9 in the Closed (On) position selects 33 sectors. Since a remainder existed in the calculation formula, an additional sector pulse is present just before index.

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

- Add 1 to the selected clock pulses: 609 + 1 = 610.
- Multiply this number by the number of bytes per clock pulse (1.0) to find the number of bytes per sector: 610 X 1.0 = 610

Alternate Method for Sector Switch Settings

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

Here is an example of determining the switch settings for selecting 63 sectors (use 20 160 clock pulses if 1.2 MHz Sector Clock is selected):

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

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

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

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

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

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

- Add 1 to the selected clock pulses: 213 + 1 = 214
- Multiply this number by the number of bytes per clock pulse (1.5) to find the number of bytes per sector: 214 X 1.5 = 321.0

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

- Multiply the number of bytes per sector (calculated above) by 62 (the number of full-length sectors): 321 X 62 = 19 902
- Subtract this number from the number of bytes per track (20 160) to find the number of bytes in the 63rd sector: 20 160 - 19 902 = 258

TABLE 3-4. SECTOR SELECT SWITCH SETTINGS - 806 kHz

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
28	C	C	C	C	C	O	C	C	C	O	O	O

Table Continued on Next Page

TABLE 3-4. SECTOR SELECT SWITCH SETTINGS - 806 kHz (Contd)

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

Table Continued on Next Page

TABLE 3-4. SECTOR SELECT SWITCH SETTINGS - 806 kHz (Contd)

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

Table Continued on Next Page

TABLE 3-4. SECTOR SELECT SWITCH SETTINGS - 806 kHz (Contd)

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

Table Continued on Next Page

TABLE 3-4. SECTOR SELECT SWITCH SETTINGS - 806 kHz (Contd)

Number of Sectors	Switch Number											
	0	1	2	3	4	5	6	7	8	9	10	11
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	O	O	O
123	O	O	C	C	O	C	C	O	O	O	O	O
124	C	C	O	C	O	C	C	O	O	O	O	O
125	O	C	O	C	O	C	C	O	O	O	O	O
126	C	O	O	C	O	C	C	O	O	O	O	O
127	O	O	O	C	O	C	C	O	O	O	O	O
128	O	O	O	C	O	C	C	O	O	O	O	O

Note: C = Closed (On) position; O = Open (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 power supply switch/circuit breaker 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.