MAGNETIC PERIPHERALS, INC.
a Control Data Company

PRODUCT SPECIFICATION

FOR

9715 FIXED STORAGE DRIVE

300 MB

DOCUMENT NO. 64401400
REV A NOVEMBER 1985

MAGNETIC PERIPHERALS INC
a Control Data Company

ENGINEERING SPECIFICATION

TWIN CITIES DISK DIVISION

SPEC 64401400
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PAGE 1 of 33

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Released

TABLE OF CONTENTS

TABLE OF CONTENTS (cont)

ILLUSTRATIONS

1.0 SCOPE

This document describes the MAGNETIC PERIPHERALS INC. 9715-300 Fixed Storage Drive (FSD) and its available configurations.

2.0 APPLICABLE DOCUMENTS

SPEC 64712400 - SMD-O Interface Specification
DWG 93913853 - FSD Mechanical Interface Remote Supply
DWG 73485800 - FSD Mechanical Interface Integral Supply
PUBL 83324760 - Hardware Maintenance Manual Volume 1
PUBL 83325530 - Hardware Maintenance Manual Volume 2
PUBL 83323340 - Hardware Maintenance Manual Volume 3
UL 478 - Electronic Data Processing Units and Systems
CSA 22.2 154 - Data Processing Equipment
VDE 0806 - Regulations for Electric Motor Operated Appliances
VDE 0871 - Radio Frequency Interference

3.0 GENERAL DESCRIPTION

3.1 Equipment Definition

The FSD-300 Drive is a 3600 rpm, 9.67 MHz bit transfer rate, random access, fixed-media disk drive consisting of a direct coupled dc brushless drive motor with digital speed control brake, switching type power supply, and a Disk Module incorporating thin film heads. The logic package utilizes both low-power Schottky, I^2L and ECL technology and contains electonic printed wiring boards with extensive use of Large Scale Integration (LSI). All read/write, fault, transmitter/receiver and microprocessor controlled servo electronics are contained within the logic package. The drive is designed to be rack mounted in either domestic or European enclosures. See Figure 1 for Major Component Placement and Figure 2 for the plan view.

The Module assembly contains the disks, heads, actuator, dc motor, and air filters, all of which are sealed to minimize the effects of environmental contamination. See Figure 3 for head disk scheme.

Several features to enhance system integrity are included. They are phase-locked data separation, NRZ to MFM code data conversion, fixed and variable sectoring (Address Mark), and daisy-chain interface capability.

The FSD is available in 6 basic configurations as follows:

DRIVE CONFIG-URATION (1)	INTERFACE	POWER SUPPLY (2)		I/O CHANNELS (3)	
	SMD-0	INTEGRAL	REMOTE	1	2
1	X	X		X	
2	X	X			X
3	X		X	X	
4	X		X		X
5	X	None		X	
6	X	None			X

(1) These configurations may be modified with the following:

Optional Colors - The basic FSD colors are CDC Imperial Blue and Light Grey. Any customer requested special color combinations can be provided.

Slide Mounts - Slide Mounts are available to allow each FSD to be independently moved forward in its rack mount.

Side By Side Rack Mounts - Mounting kits are available to support slide mounts for a single FSD in a 19 inch rack or 2 FSDs side by side in a 19 inch rack.

Drives are factory shipped with index and sector in the "A" cable but may be modified in the field to put index and sector in the "B" cable or in both "A" and "B" cables.

(2) The power supply can be externally set for the following nominal input voltage/frequency combinations (see 10.1):

100 V thru 120 V in either 50 or 60 Hz
208 V thru 240 V in either 50 or 60 Hz

Power supplies have ac power cords with appropriate plugs.

The FSD may be purchased with no power supply

(3) Drives are available in either single or dual channel. Single channel units may be field converted to dual channel by installing SPO TBD .

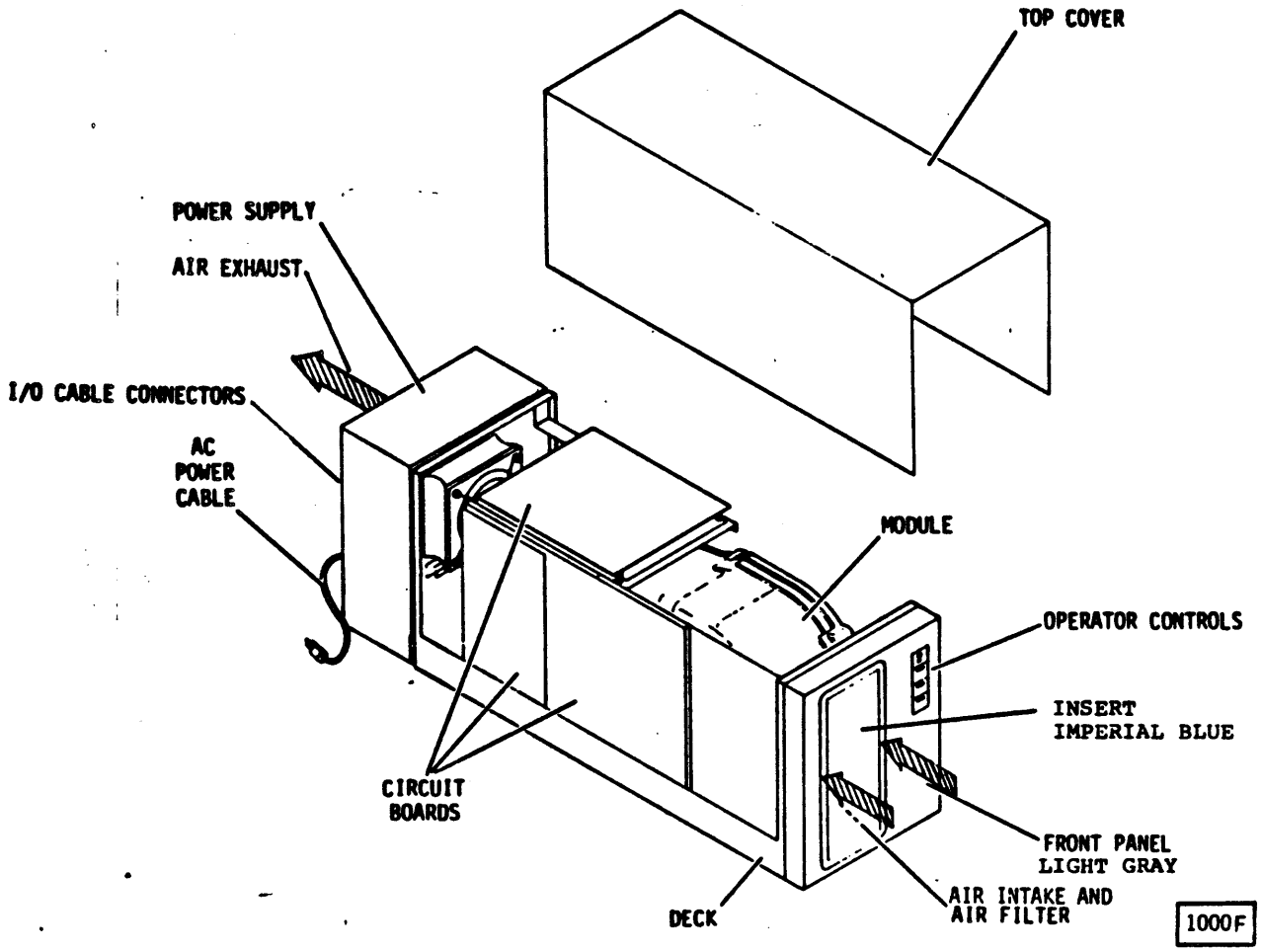


FIGURE 1A. MAJOR COMPONENT PLACEMENT WITH INTEGRAL POWER SUPPLY

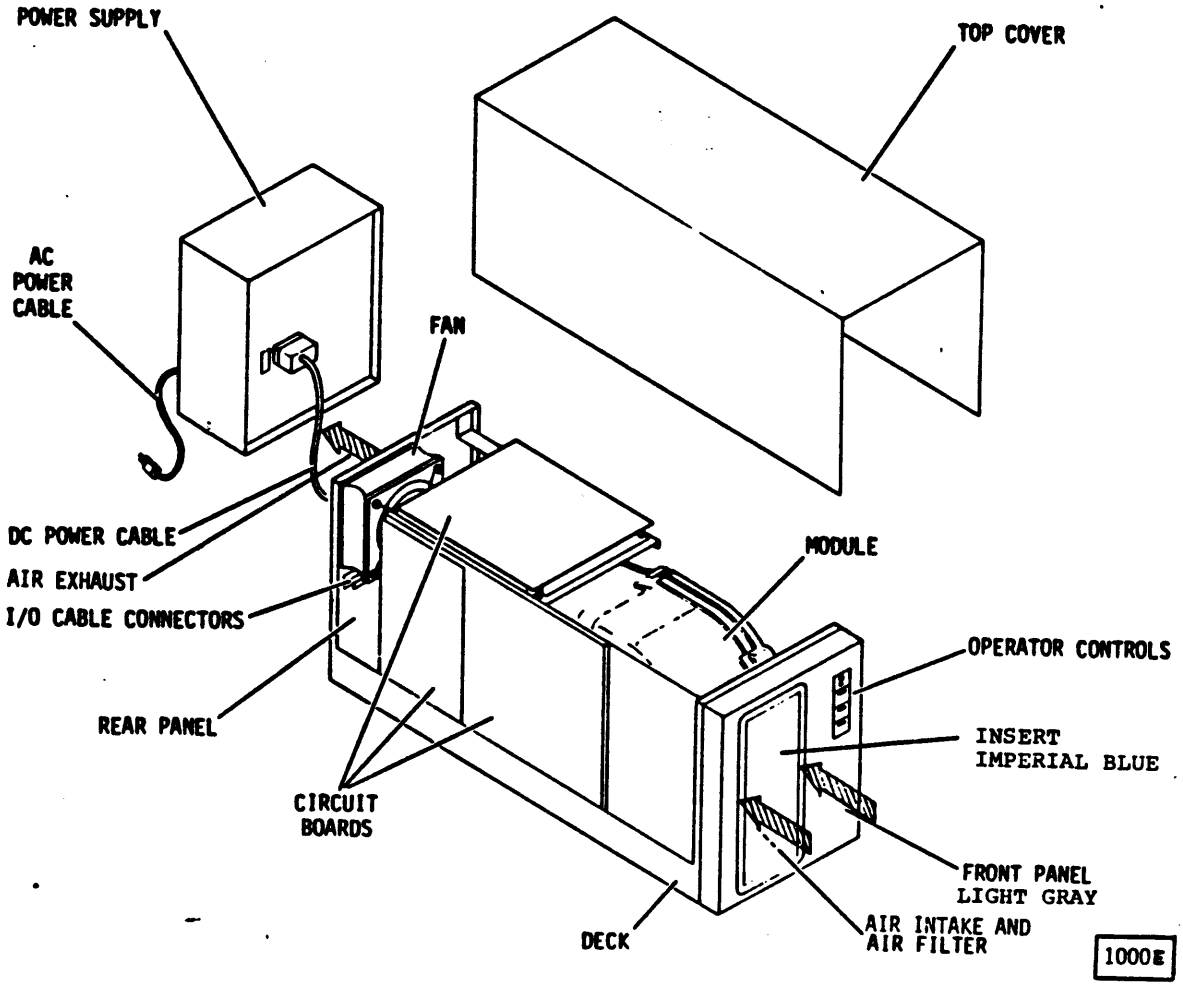
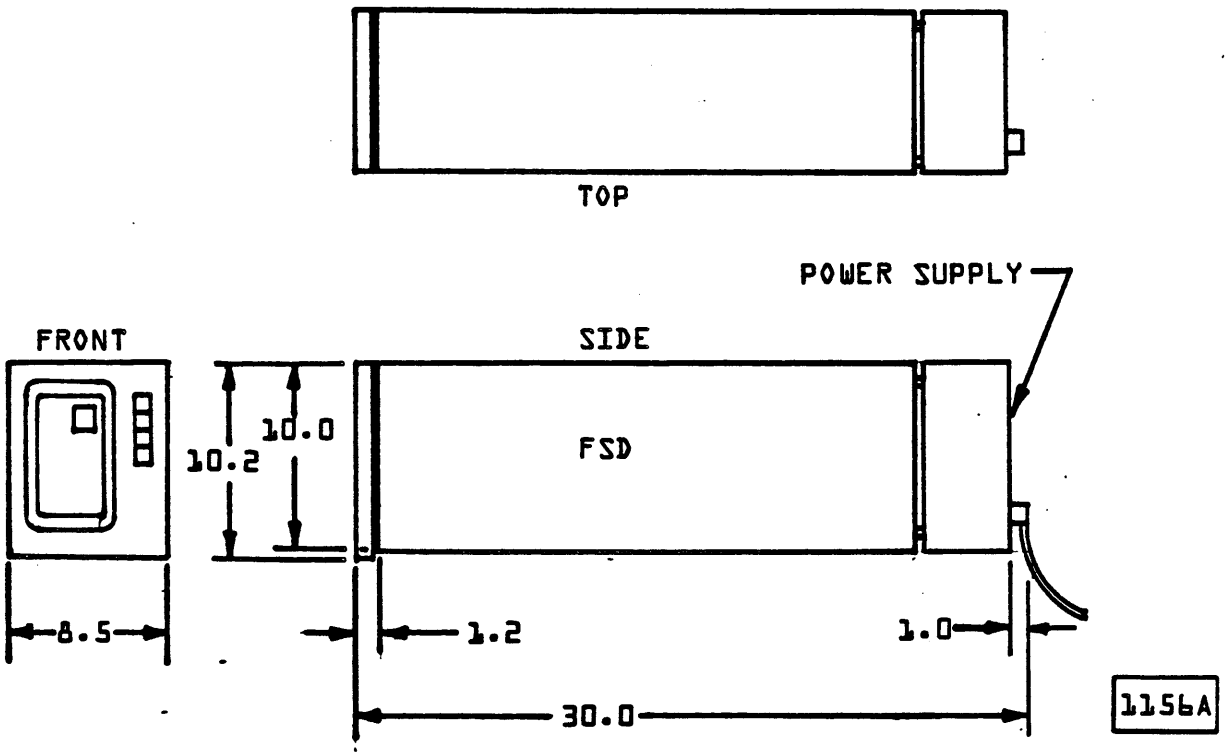
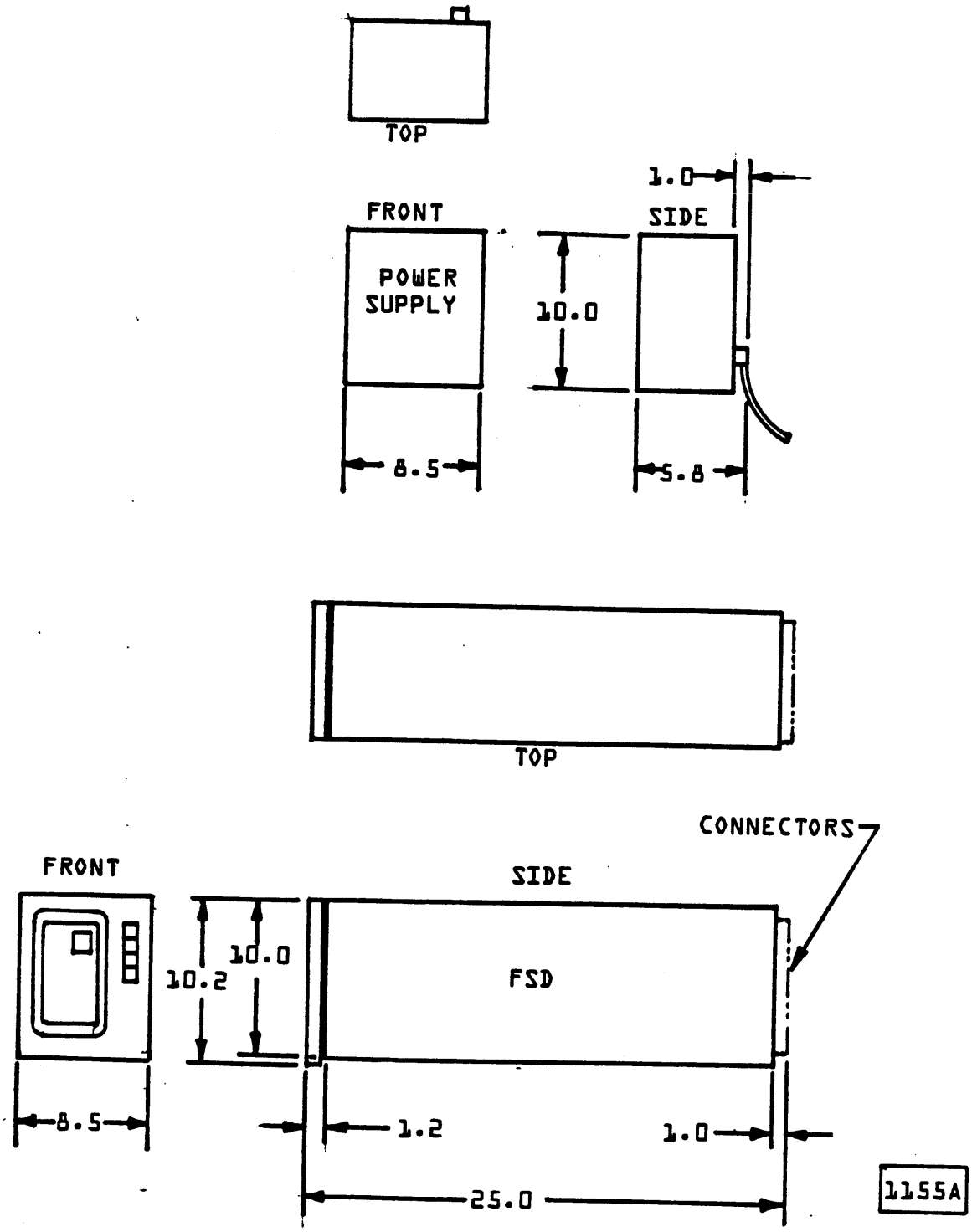


FIGURE 1B. MAJOR COMPONENT PLACEMENT WITH REMOTE POWER SUPPLY



DIMENSIONS ARE NOMINAL AND INTENDED FOR SITE PLANNING USE ONLY

FIGURE 2A. PLAN VIEW WITH INTEGRAL POWER SUPPLY



DIMENSIONS ARE NOMINAL AND INTENDED FOR SITE PLANNING USE ONLY

FIGURE 2B. PLAN VIEW WITH REMOTE POWER SUPPLY

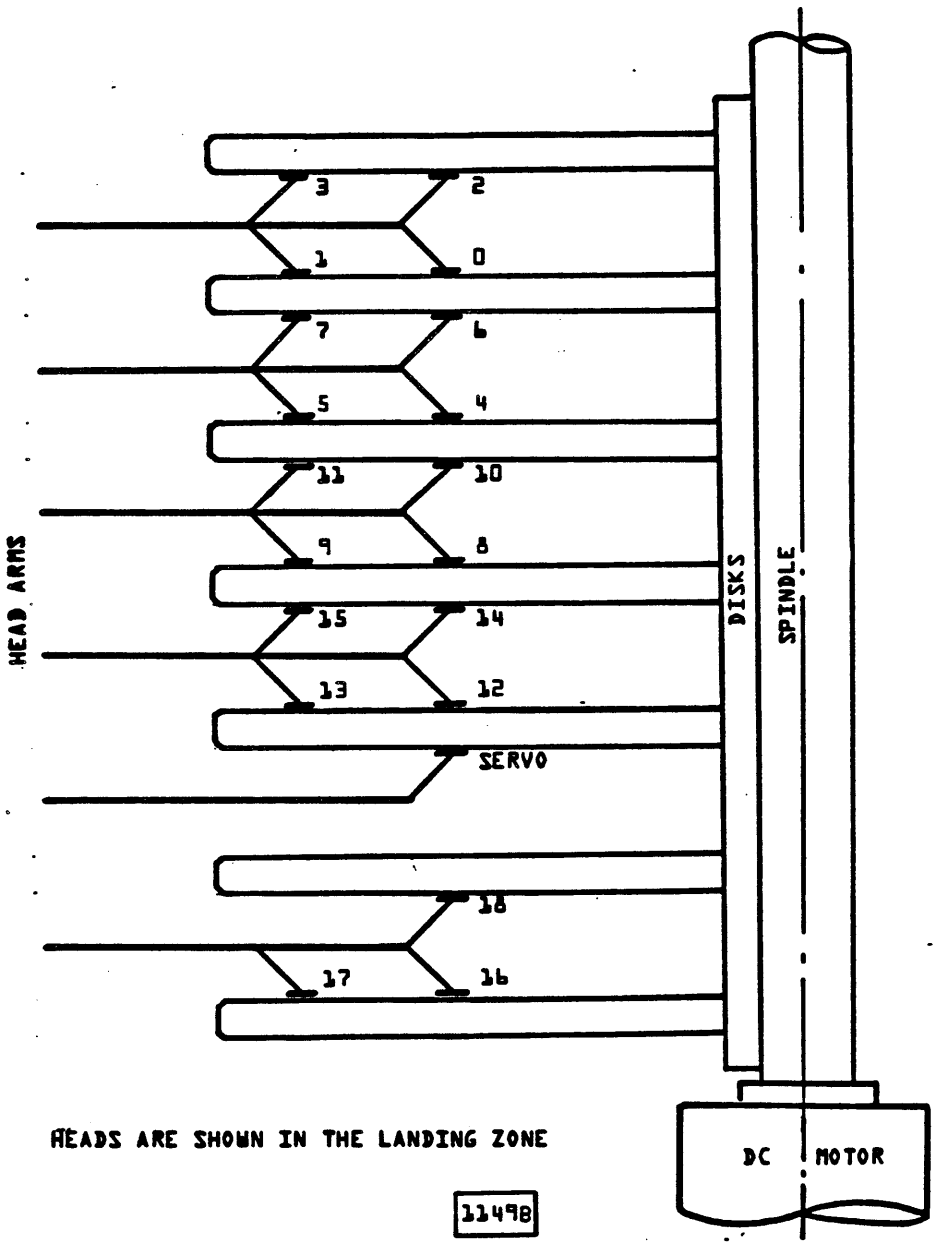


FIGURE 3. HEAD DISK SCHEME

3.2 Accessory and Supply Items

Accessories and supplies are not included with the units but must be purchased separately (see Table 1).

TABLE 1. ACCESSORY AND SUPPLY ITEMS

DESCRIPTION	QUANTITY REQUIRED	NOTE	PART NO
Illuminated Logic Plugs Numbers 0 thru 7 (black) Numbers 8 thru 15 (black)	One per drive	1	 15181751→58 15181663→70
Right Hand Slides 24 Inch 30 Inch	One per drive	2	 8173759X 7315793X
Left Hand Slides 24 Inch 30 Inch	One per drive	2	 8173759X 7315793X
Mounting Kit 2X	1 per 2 drives or 1 per drive and filler panel	3	812445XX
Mounting Kit Filler Panel	As required with Mounting Kit	4	926788XX
9968 PFTU		5	730863XX
TB216 Field Exerciser		5	82338800
Remote Power Supply	One per drive		728965XX
DC Remote Power Supply Cable	One per drive	6	939918XX

NOTES:

1. Last digit denotes lens tab. Logic plugs 0 thru 3 (tabs 1 thru 4) are provided with each drive.
2. Last digit indicates the current production units.
3. Last two digits indicate the current production units.
4. Last two digits denotes special colors.
5. Quantity as required for regional maintenance.
6. Last two digits denote cable length for remote power supply. See Table 2 for cable length.

TABLE 2. DC REMOTE POWER SUPPLY CABLE LENGTHS AND TABS

CABLE TABS 939918XX	00	01	02	03	04	05	06	07	08	
CABLE LENGTH IN FEET			1	5	8					

4.0 PERFORMANCE

4.1 Access-to-Data Characteristics

4.1.1 Positioning Times

All positioning times are measured from initiating a seek to the On Cylinder condition.

The nominal zero track seek time is 30 µs. The maximum RTZ time is 1 s.

The maximum average single track positioning time is <5 ms. Single track positioning time is defined as the time to move between any pair of adjacent tracks.

The typical average positioning time is less than 20 ms. This is defined as the time taken to make all possible moves divided by the number of all possible moves (see Figure 4).

The maximum positioning time is 45 ms. This is defined as the time to move the head from track 0 to track 823.

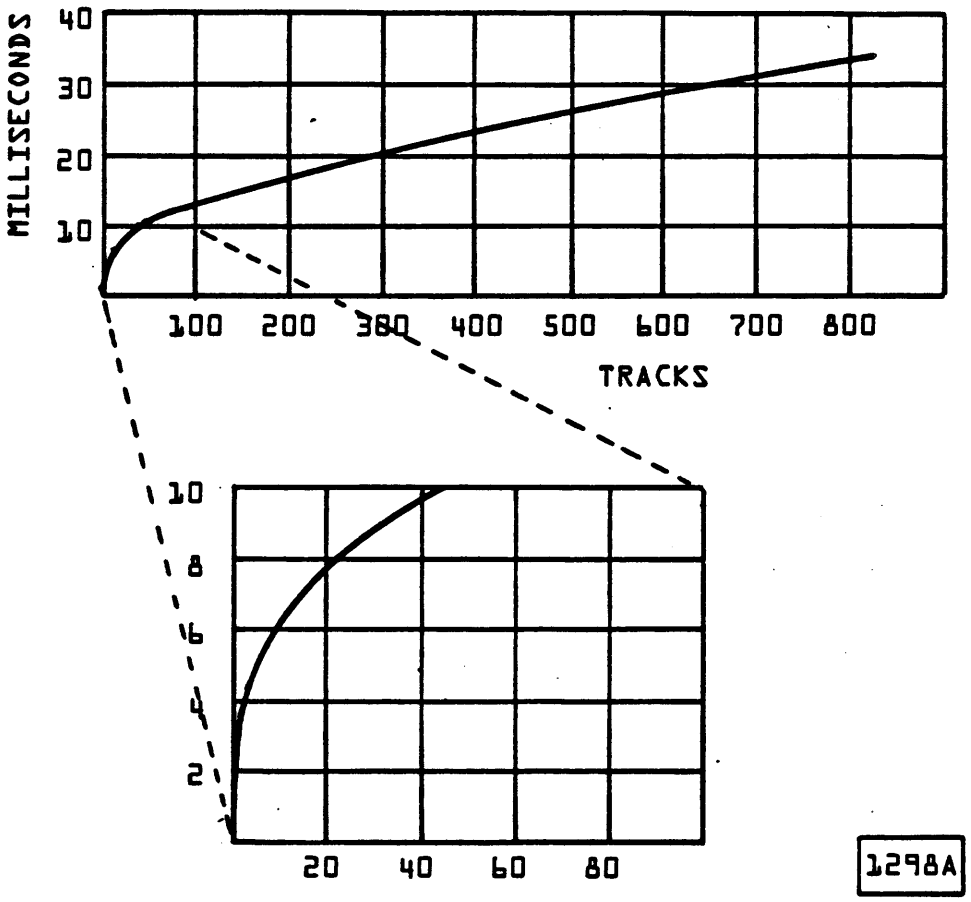


FIGURE 4. TYPICAL SEEK PROFILE

4.1.2 Latency Time

The average latency time is 8.33 ms, based on a nominal disk speed of 3600 rpm.

The maximum latency time is 16.83 ms, based on a minimum disk speed of 3564 rpm (see 5.4).

Latency time is defined as the time required to reach a particular track location after positioning is complete.

4.1.3 Read Initialization Time

Between the deselection of one head and the selection of another head, there is a 5 µs delay within the Drive due to circuit characteristics. The time from the initiation of a head change until data can be read with a selected head without error is 24 µs maximum (5 µs for head selection, 10 µs for read amplifier stabilization, and 9 µs for phase lock synchronization).

4.1.4 Write-to-Read Recovery Time

Assuming head selection is stabilized, the minimum time lapse before Read Gate can be enabled after switching the Write Gate off is 7 us.

4.1.5 Read-to-Write Recovery Time

Assuming head selection is stabilized, the minimum time lapse from dropping Read Gate to enabling Write Gate is 0.3 us.

4.2 Data Capacity

The data capacity specified is based on the number of eight-bit bytes that are recorded on a track. The unsectored capacity below does not include an allowance for tolerance gaps.

Heads	19
Bytes Per Track	20 160
Bytes Per Cylinder	383 040
Bytes Per Spindle	315 241 920
Cylinders Per Unit	823

4.3 Data Transfer Rate

The nominal bit transfer rate is 9.67 MHz.

4.4 Error Rates

The following error rates assume that the drive is being operated within its specification. Errors caused by media defects or equipment failures are excluded.

4.4.1 Read Errors

Read error rates are based on the fact that all data has been verified as written correctly and all media defects have been flagged.

1. Recoverable Error Rate = 1 in 10^{10}

   The recoverable error rate is the number of errors encountered which are recoverable within 27 retries as a function of the number of bits transferred (three retries at each data strobe and carriage offset).

2. Unrecoverable Error Rate = 1 in 10^{12}

   An unrecoverable read error is one which cannot be read correctly within 27 retries (three retries at each combination of data strobe and carriage offset).

4.4.2 Write Errors

Unrecoverable write errors are those which cannot be corrected within three attempts at writing the record with a read verify after each attempt.

Write errors can occur as a result of the following:

- write data not being presented correctly
- media defects
- equipment malfunction

As such, write errors are not predictable as a function of the number of bits passed.

An unrecoverable write error that occurrs because of a Drive equipment malfunction is classified as a failure affecting MTBF.

4.4.3 Media Defects

A media defect is a physical characteristic of the media which results in a repetitive read error when a properly adjusted unit is operated within specific operating conditions. Valid data must not be written over known media defects; therefore, sector/track deallocation or skip displacement techniques must be utilized.

Media Defect Characteristics

- The maximum number of media defects in the module is 232.
- The maximum number of defective tracks in the module is 33.

A defective track is defined as a track having any of the following:

1. False address marks
2. Any defect greater than 100 bits long.
3. Two or more defects
4. Defect in the logging area as defined by 4.4.5 (2 and 3).

NOTE: The term "Defective Track" is a quality indicator only and may not be user-defective when error correction, de-allocation and/or skipping techniques are used.

Media Defect Free Areas are defined as follows:

1. Cylinder 0, head 0 and 1
2. Logging areas to the extent defined in the rules 4.4.5

4.4.4 Media Defect Logging Information

All modules have a flaw map attached which lists the following information:

1. Head
2. Cylinder
3. Location (bytes from leading edge of Index to beginning of defect)
4. Length (bits)

In addition, the modules will be formatted at the factory with standard external format written in decimal notation (see 4.4.5 for format rules). This format is divided into 2 parts. The first part is a sectored format and is normally included in the first 56 bytes following Index. The second part is an address mark format and is normally included in the next 49 bytes following Index.

4.4.5 Format Rules (See Figure 5)

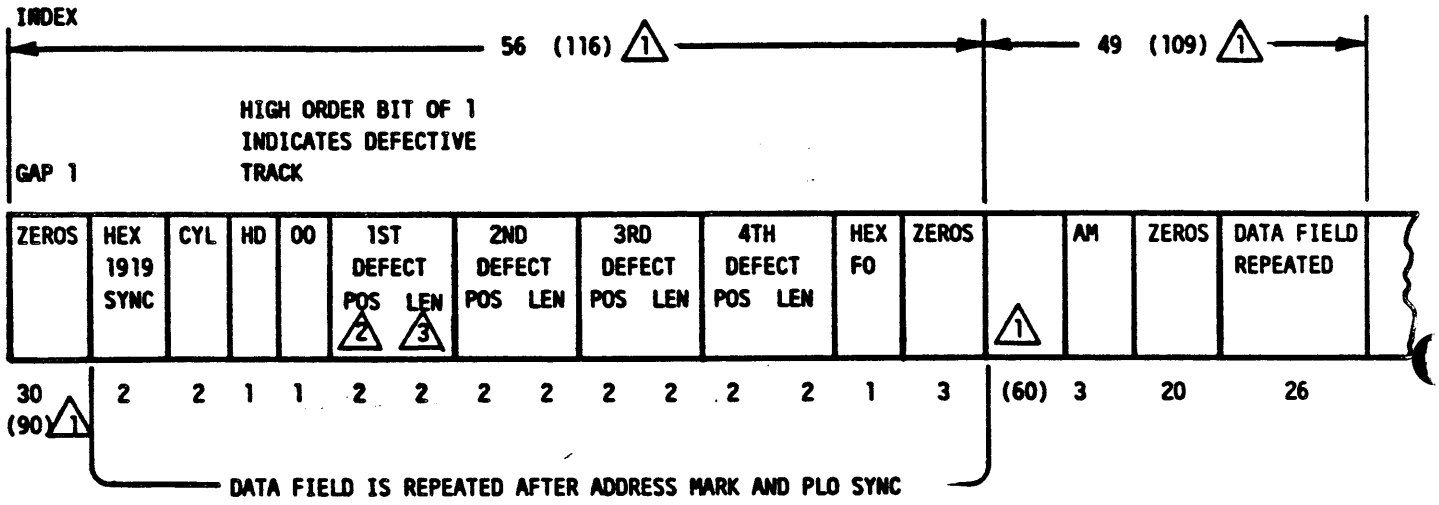
1. More than one defect on a track causes it to be flagged as a defective track (see Rule 4). The first four media flaws are logged. If more than four defects have been detected, HEX FF will be written after the fourth defect information. See Figure 5.

2. If the beginning of a defect is located between 15 and 56 bytes after Index, 60 bytes of zeros are added to gap 1 (90 bytes total). In this case, if any part of a defect is between bytes 70 and 165, the track is flagged defective.

3. If the beginning of a defect is between 56 and 106 bytes after Index, 60 bytes of zeros are added immediately before the address mark. In this case, if any part of a defect is between bytes 116 and 155, the track is flagged defective.

4. If a defective track is established according to Rules 1, 2, or 3 above, the high order bit of the first cylinder bytes is set to 1. Remaining information may or may not be valid.

5. The media flaws for each track are encoded within the data field of the external format (see Figure 5).



NOTES:

1. DEFECT SKIPPED.
2. POSITION OF DEFECT IS IN BYTES FROM LEADING EDGE OF INDEX ±1 BYTE.
3. LENGTH OF DEFECT IS IN BITS ±1 BIT.
4. UNUSED DEFECT LOCATIONS ARE ALL ZEROS.
5. ALL TIMING IS FROM LEADING EDGE OF INDEX

11500

1425A-4

FIGURE 5. FSD STANDARD EXTERNAL FORMAT

4.4.6 Environmental Errors

When operating a low effective data transfer rate; e.g., random access of single short records, the effective error rate may be expected to exceed the above limits due to external environmental interference. The resulting recoverable read error rate is less than one error in eight hours of operation.

4.4.7 Access Errors

There is no more than one positioning error in 10^6 seeks.

4.5 Data Security

Under normal controller I/O operation, the drive will write only that pattern present on the write data lines. Both drive Selected and On Cylinder must be true before a valid write operation can be completed. Data is protected by inhibiting Write Gate in all fault conditions including a loss of On Cylinder, Seek Error or low dc voltage. This is accomplished by switching off the voltage required to write and/or performing an emergency retract of the Read/Write heads.

Under an ac power failure while performing a write operation, the data will be valid on all tracks except the sector/record on which the read/write heads were writing at the time of the ac power failure.

4.6 Stop Time

The time to stop the spindle after the START/STOP switch has been turned off is typically 35 seconds, 45 seconds maximum.

4.7 Start Time

The time for the drive to be in the Ready state after the START/STOP switch has been depressed is typically 35 seconds, 45 seconds maximum.

4.8 Power Sequencing

The length of delay of the power-up sequence is determined by the logical unit number plug (address plug) in increments of 5 seconds. A logical unit "0" drive has no delay; a logical unit "4" drive delays power up by 20 seconds.

NOTE: If other type drives (MMD, SMD, FMD, RSD, or FSD-160) physically follow a FSD-300 drive in a daisy-chain configuration, two drives will start at the same time. If starting current surge is therefore excessive, the other drives must be physically placed at the beginning of the daisy-chain.

5.0 RECORDING CHARACTERISTICS

5.1 Recording

Mode: MFM Code

Density:
(Inner Track) ~~15 040~~ 10400 bpi nominal
(Outer Track) ~~9 167~~ 6111 bpi nominal

5.2 Disk

Total number:	7
Servo surface:	1
Data surfaces used:	10
Data tracks per surface:	1646
Track spacing in inches:	0.00096 nominal
Tracks per inch:	1040

5.3 Heads

Servo head:	1
Recording heads:	19
Read/Write width in inches: (No erase gap)	0.00078 nominal

5.4 Spindle

The spindle speed is 3600 ±36 rpm. These limits represent ±1% of nominal.

6.0 INTERFACE

The FSD-300 uses the 10 MHz SMD-0 Interface (see SPEC 64712400).

6.1 I/O Card Switches and Lights

Local/Remote Switch	A customer select switch, which allows power-on in the off-line mode (local) or power-on control from the controller (remote).
SMD-0/SMD-E Option Switch	Not Used (see 6.2)
Normal Cylinder ADR/ Extended Cylinder ADR	Not Used
Channel 1 Enable/Disable (Dual Channel Only)	A switch to disable Channel 1 or allow Channel 1 to be selected.
Channel 2 Enable/Disable (Dual Channel Only)	A switch to disable Channel 2 or allow Channel 2 to be selected.
Index and Sector Select Switches	A set of switches to place the sector and index on the "A" cable alone, "B" cable alone, or both the "A" and "B" cables.
ABR/RTM Switch (Dual Channel Only)	In the ABR (Absolute Reserve) position, once the drive is selected, it must be released in order for Reserve (Busy) to drop. In the RTM (Reserved Timer Mode) position, once the drive is selected, Reserve (Busy) will drop after 500 ms.
Channel 1 Select Light (Dual Channel Only)	Indicates Channel 1 is selected.
Channel 2 Select Light (Dual Channel Only)	Indicates Channel 2 is selected.
Channel 1 Reserved Light (Dual Channel Only)	Indicates Channel 1 is reserved.
Channel 2 Reserved Light (Dual Channel Only)	Indicates Channel 2 is reserved.

6.2 SMD-E/SMD-O Interface Option

Although the Interface Option switch exists on the I/O board, SMD-E I/O is not available on the drive.

6.3 Extended Cylinder Addressing Capacity

Although the Extended Cylinder Address Switch exists on the I/O board, Extended Cylinder Addressing is not available on the drive.

6.4 Single or Dual Channel Operation (Dual Channel I/O Only)

Two switches are provided on the dual channel interface to allow the following operating modes:

OPERATING MODE	CH 1 ENABLE/ DISABLE SW	CH 2 ENABLE/ DISABLE SW
Both Channels Enabled	Open	Open
Enable Channel 1 Only	Open	Closed
Enable Channel 2 Only	Closed	Open
Both Channels Disabled	Closed	Closed

At the time of shipment, factory setting for Single Channel Drives is Channel 1 Enabled, and the factory setting for a Dual Channel Drives is Both Channels Enabled.

6.5 Index and Sector Select

A set of switches are provided to allow the Index and Sector to be transmitted on the "A" cable, "B" cable, or both the "A" and "B" cables. The dual channel interface provides 2 sets of switches for this purpose.

The Index and Sector are factory set for the "A" cable at the time of shipment.

6.6 Index Pulse Width

The Index pulse width is 2.5 ±0.3 µs.

7.0 CONTROLS AND INDICATORS

7.1 Operator Panel

The unit contains a front panel with a logic plug and an amber indicator, a START/STOP switch/indicator, a FAULT/CLEAR switch/indicator, and a WRITE PROTECT switch/indicator.

NAME	TYPE		FUNCTION
	LIGHT	SW	
LOGIC PLUG (REMOVABLE)	X	X	Establishes Logical Address of the device. Amber indicator when lit indicates unit is selected.
START/STOP	X	X	Indicator is on when the drive is Ready. Indicator blinks when START is activated until drive is Ready. Indicator blinks when STOP is depressed until disk rotation is stopped.
FAULT/CLEAR	X	X	Indicates any Fault condition. The switch clears the Fault condition if that Fault no longer is present.
WRITE PROTECT	X	X	Indicator is on when the Drive's write circuits are disabled. Write Protect is activated by a jumper located in the logic assembly or on the front panel.

7.2 Jumpers and Fault Indicators

NAME	TYPE		FUNCTION
	LIGHT	JUMPER	
WRITE	X		Indicates that a Write fault had occurred.
HEAD SELECT	X	X	Indicates that no heads are selected or multiple heads are selected.
WRITE AND READ	X		Indicates write and read conditions existed simultaneously.
WRITE OR READ AND OFF CYL	X		Indicates write or read conditions existed during a seek operation (off cylinder).
VOLTAGE	X		Indicates a below normal voltage had existed.
MPU/FIRST SEEK FAULT	X		Indicates drive failed first seek/load attempt.
WRITE PROTECT		X	Enables write protection circuitry.

Microprocessor readout status and the indicators listed above are located behind the front panel insert on the fault display card. As a customer option, a write protect jumper may be located on the control card and a head select jumper on the R/W card.

See the hardware maintenance manual for more information.

8.0 PHYSICAL SPECIFICATIONS

Nominal dimensions of the FSD Drive and Power Supply are shown on the plan view of Figure 2.

The drive with internal power supply weighs approximately 82 lbs.

The drive without internal power supply weighs approximately 70 lbs.

The remote power supply weighs approximately 12 lbs.

9.0 RELIABILITY AND SERVICE GOALS

9.1 Mean Time Between Failure (Drive and Power Supply)

The mature design MTBF for the drive operating within normal ambient environment is 30,000 hours. The MTBF shall exceed 14,000 hours for units manufactured in the first six months of production, 18,000 hours for units manufactured in the following year, and 30,000 hours after this 18 month period.

The following expression defines MTBF:

$$\text{MTBF} = \frac{\text{Estimated Operating Hours (Power On)}}{\text{No. of Equipment Failures}}$$

Estimated operating hours means total hours less any maintenance time. Equipment failures mean any stoppage or substandard performance of the equipment because of equipment malfunction, excluding stoppages or substandard performance caused by operator error, adverse environment, power failure, controller failure, cable failure, or other failure not caused by the equipment. To establish a meaningful MTBF, operating hours must be greater than 6000 hours per drive and must include field performance data from representative sites.

For the purpose of this specification, equipment failures are defined as those failures necessitating repairs, adjustments or replacement on an unscheduled basis.

9.2 Mean Time to Repair

The mean time to repair does not exceed 0.5 hours; it is defined as the time for an adequately trained and competent serviceman to diagnose and correct a malfunction.

9.3 Preventive Maintenance Time

No scheduled maintenance is required other than coarse filter cleaning by the operator.

9.4 Service Life

The FSD is designed and constructed to provide a useful life of five years before factory overhaul or replacement is required. Repair or replacement of major parts will be permitted during the lifetime.

10.0 INSTALLATION AND MAINTENANCE

Required connections to the device are power (dependent upon variation selected), signal cables and a system ground consistent with installation manuals. The only physical requirement is adequate clearances for maintenance and air intake/exhaust.

10.1 Power Requirements

10.1.1 Primary Power Requirements (Remote Power Supply)

The typical primary power requirements for the optional remote power supply are shown in Table 3A. Start up current is shown in Figure 6A.

TABLE 3A. PRIMARY POWER REQUIREMENTS (REMOTE POWER SUPPLY)

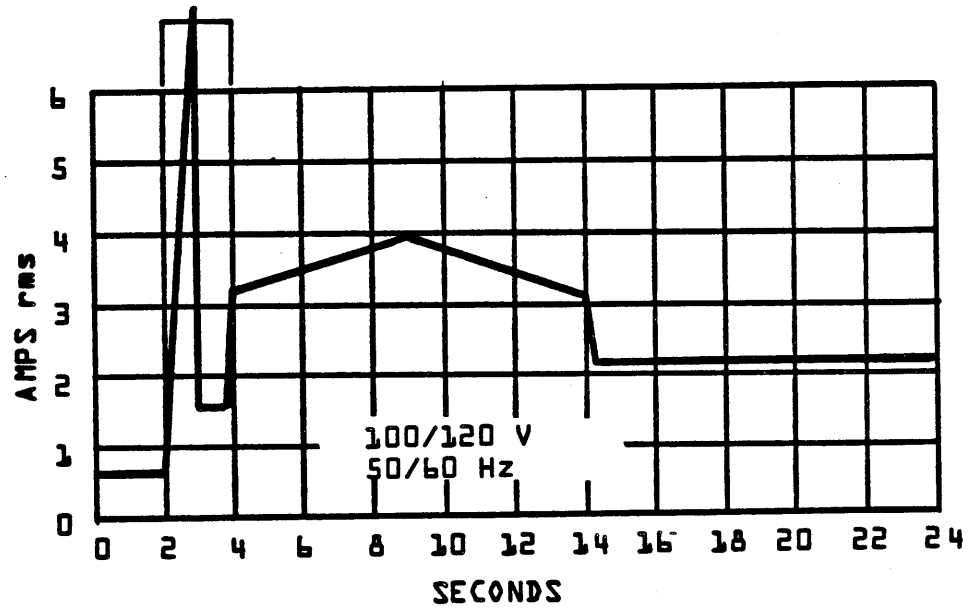
FREQUENCY			VOLTAGE			DISKS AND CARRIAGE IN MOTION			
NOM	MIN	MAX	NOM	MIN	MAX	LINE CURRENT AMPS	ENERGY CONSUMPTION KW	HEAT DISSIPATION BTU/H	POWER FACTOR
50 THRU 60	48	62	100 THRU 120	87	128	3.4	0.260	886	0.712
			208 THRU 240	180	256	2.1	0.252	860	0.659

10.1.2 Primary Power Requirements (Intregal Power Supply)

The typical primary power requirements for the intregal power supply are shown in Table 3B. Start up current is shown in Figure 6B.

TABLE 3B. PRIMARY POWER REQUIREMENTS (INTEGRAL POWER SUPPLY)

FREQUENCY			VOLTAGE			DISKS AND CARRIAGE IN MOTION			
NOM	MIN	MAX	NOM	MIN	MAX	LINE CURRENT AMPS	ENERGY CONSUMPTION KW	HEAT DISSIPATION BTU/H	POWER FACTOR
50 THRU 60	48	62	100 THRU 120	87	128	3.95	.225	886	0.57
			208 THRU 240	180	256	2.25	0.230	860	0.49



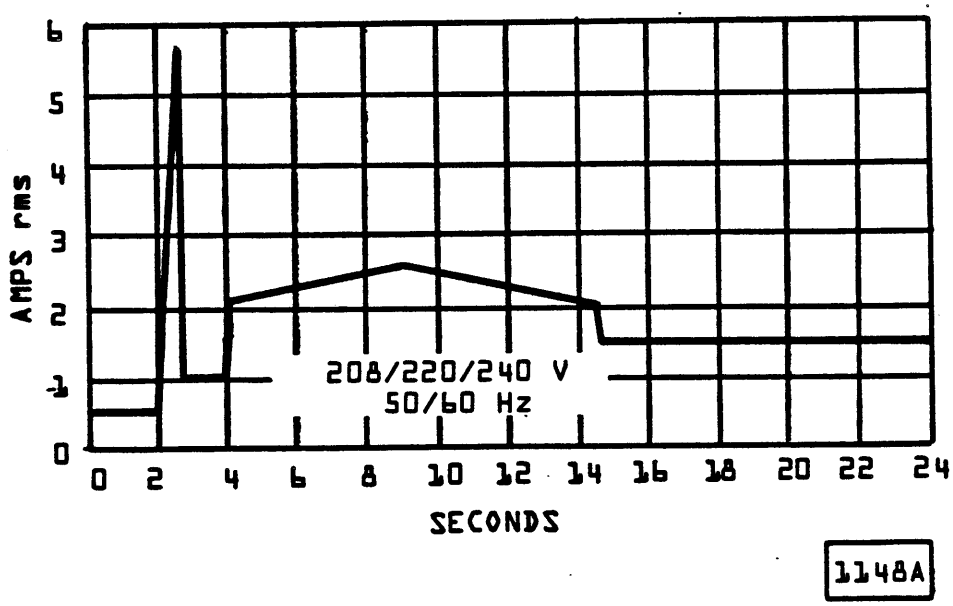
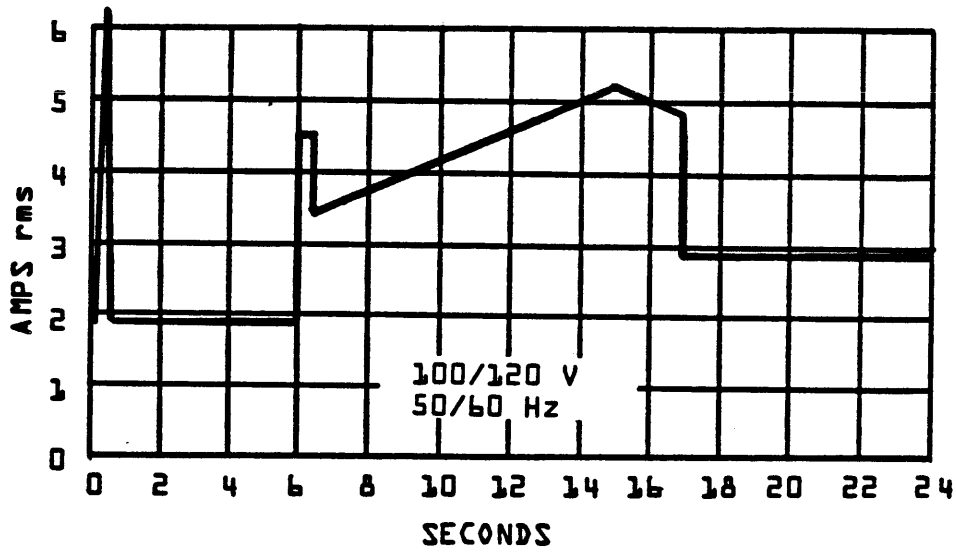


FIGURE 6A. REMOTE POWER SUPPLY LINE CURRENT VERSUS START-UP TIME



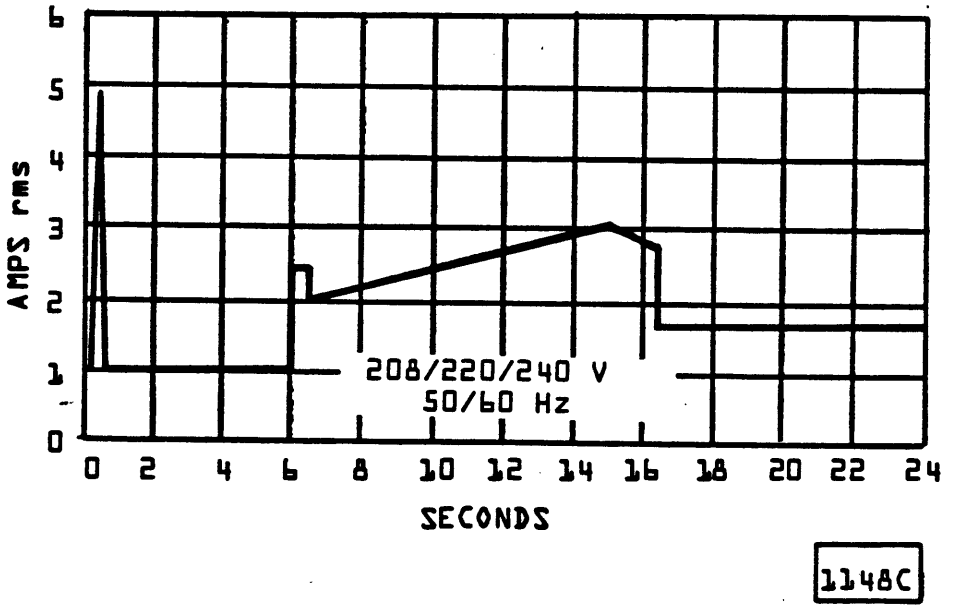
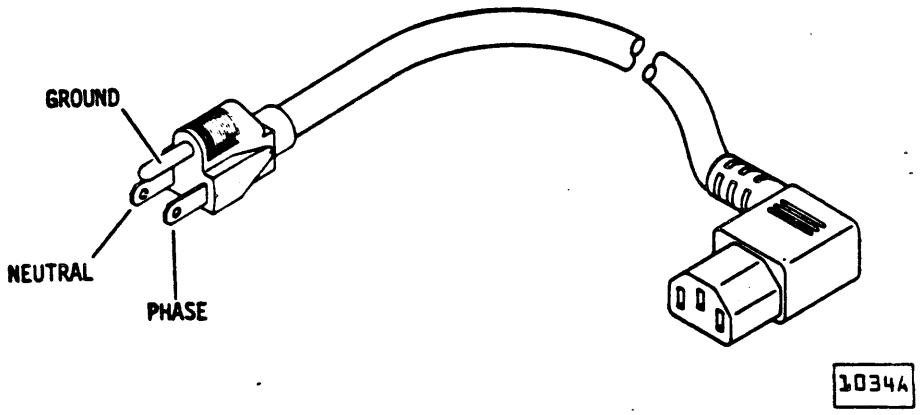


FIGURE 6B. INTEGRAL POWER SUPPLY LINE CURRENT VERSUS START-UP TIME

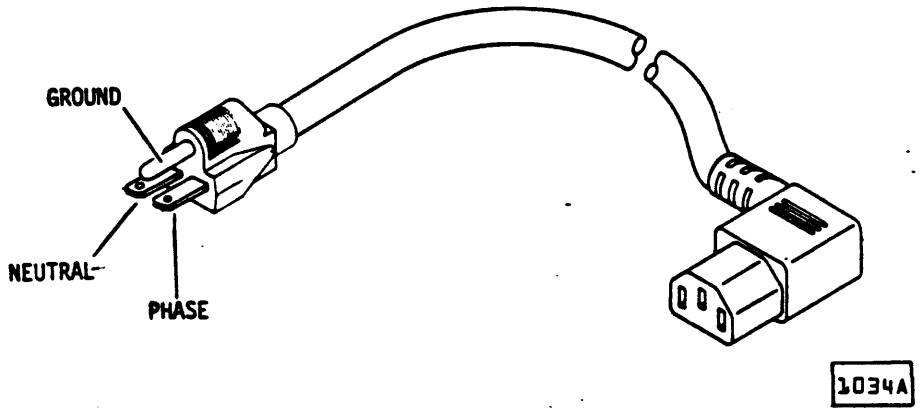
10.1.2 AC Power Connector

10.1.2.1 60 Hz

A connector/cord assembly is furnished with each 60 Hz FSD drive in the configuration of Figure 7.



A. 100/120 V POWER CORD



B. 208/220/240 V POWER CORD

FIGURE 7. 60 HZ POWER CONNECTORS

10.1.2.2 50 Hz

A connector/cord assembly is furnished with each 50 Hz FSD drive in the configuration of Figure 8.

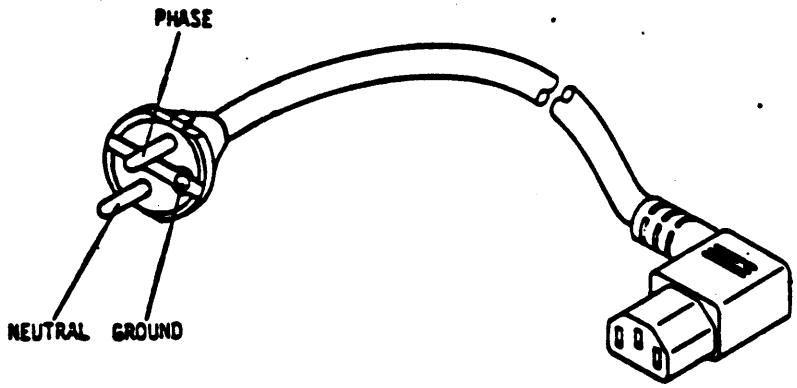


FIGURE 8. 50 HZ POWER CONNECTOR

10.2 Grounding Requirements for the Remote Power Supply

Grounding between the drive and power supply is accomplished with a shielded dc power cable if the cable is longer than 1 foot in length. The 1 foot power cable is not shielded and an additional ground strap must be used in lieu of the shield. The ac stud on the power supply is connected to the dc ground screw on the drive. The dc stud on the power supply is not connected to anything. Detailed instructions are in the Hardware Maintenance Manual.

10.3 Environmental Limits

The FSD drive complies with FCC and VDE Class A emission requirements.

10.3.1 Operating Environment

The unit will operate to Specifications when subjected to the following:

Temperature	~~50~~ 59°F to 104°F with a maximum change of 18°F per hour.
Humidity	20% to 80% relative with a maximum change of 10% per hour. No condensation.
Barometric Pressure	105 kPa to 69 kPa (-983 ft to 10,000 ft)
Shock	5 g's for 11 ms, half sine wave, any axis.
Vibration	Sinusoidal vibration of 0.5 g's from 5 to 500 Hz.

During operation, shock and/or vibration caused system errors which are recoverable/resetable via the interface controlled signals, are allowed.

10.3.2 Non-Operating Environment (Unpackaged)

The unit, in the unpacked condition, with power off, will withstand the following without damage:

Temperature	14°F to 122°F with a maximum change of 27°F per hour.
Humidity	10% to 90% relative. No condensation.
Barometric Pressure	105 kPa to 69 kPa (-983 ft to 10,000 ft)
Shock	15 g's for 11 ms, half sine wave, any axis.
Vibration	Sinusoidal vibration of 0.5 g's from 5 to 500 Hz.

10.3.3 Storage/Transit Environment (Packaged)

Packaged in its shipping container, the unit will withstand the following without damage:

Temperature	-40°F to 140°F with a maximum change of 36°F per hour.
Humidity	5% to 95% relative. No condensation.
Barometric Pressure	105 kPa to 69 kPa (-983 ft to 10,000 ft)
Shock	See transit drop.
Vibration	Sinusoidal vibration of 0.5 g's from 5 to 500 Hz.

10.3.4 Transit Drop

Packaged units will withstand 18 in. drops.

10.4 Cabinet Design Consideration

The internal Cabinet temperature must not exceed the specified operating temperature; i.e., the envelope of the drive must not exceed 50°F to 104°F.

10.5 Air Flow

The enclosure must provide an exhaust opening for the fan air flow across the electronics, motor, and power supply.

An open inlet and exhaust area of 20 square inches for each module can be used as a nominal design figure for the enclosure. The ideal location for the exhaust opening is a rear position on the top panel, the second choice would be a top position on the rear panel. The openings, especially if on the top panel, should be louvered, baffled or screened to prevent debris from being dropped into the unit.

An open bottom on the enclosure which allows air to enter around the base and be exhausted at the top of the cabinet will promote a natural air flow through the cabinet which will aid the air flow from the fan.