

**AMS 315** PRODUCT DESCRIPTION



# AMS 315 PRODUCT DESCRIPTION

October 1982

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RECORD of REVISIONS			
REVISION	NOTES		
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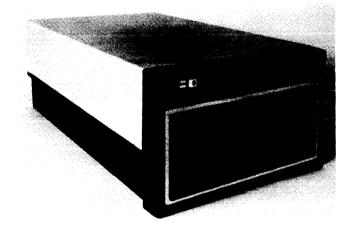
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# SECTION 1 INTRODUCTION

### 1.0 SCOPE

This manual contains the information necessary to interface the Advanced Marksman Series (AMS) 315 disk drive to a controller and ultimately to a computer system and provides the technical specifications for reference in OEM contracts.



### 1.1 RELATED DOCUMENTS

Companion documents on the AMS 315 disk drive include:

Figure 1-1. AMS 315 Disk Drive

AMS	315	Installation Manual	K
AMS	315	Technical Manual	K
AMS	315 M	aintenance Diagrams76236-703	K
		03 Exerciser Technical Manual	

### 1.2 GENERAL DESCRIPTION

The AMS 315 disk drive (Figure 1-1) is a low cost, high density, high performance modular disk storage unit uniquely suited to the OEM's requirements. The AMS 315 features the SMD (CDC compatible) interface or the Trident (CDS) interface. Data integrity superior to that found in past large disk systems is assured by the use of WINCHESTER style heads and media. System reliability is maximized by the sealed, contamination controlled disk compartment and the reduction in parts count inherent with WINCHESTER drives.

The AMS 315 consists of WINCHESTER type media, spindle with associated induction AC drive motor, linear motor positioner, read/write heads and servo head, recirculating air filtration system, signal processing circuits, logic control circuits, read/write circuits, servo control circuits and power supply.

### 1.2.1 Features

- 315 MB low cost, high performance storage
- WINCHESTER technology heads and media provide state-of-theart performance
- High speed start/stop head landing zones and a spindle motor brake maximize head and media life

- VFO data separator, standard
- Disks, heads, linear motor assembly and air filtering systems are all a part of a sealed assembly not requiring field maintenance
- No regularly scheduled preventive maintenance required

### 1.2.2 Mounting Configurations

- 1. Mounting attitudes for the Basic Drive without Enclosure: Horizontal.....spindle pulley down Vertical.....unit on side, motor on top
- 2. Mounting attitudes for the Drive with Enclosure: Horizontal mount only
- Enclosure

The enclosure, Figure 1.2, for use with the AMS 315 Disk Drive can be configured in any one of the following:

- Desk top enclosure
- Rack mounted (fixed)
- Slide mounted

The enclosure provides mounting for the sealed mechanical assembly, drive control boards, interface board and power supply. The AC distribution for the power supply is located on the back panel of the enclosure and an Operator Control Panel is located on the front. The enclosure also provides all necessary cooling required by the drive.

### 4. Rack Mount Slides

The AMS 315 enclosure can be ordered with a set of slides that mount between the enclosure and a standard REMTA rack and provides forward travel of the drive to extend clear of the rack for ease of maintenance and installation. The enclosure fits in a standard 19" x 30" rack.

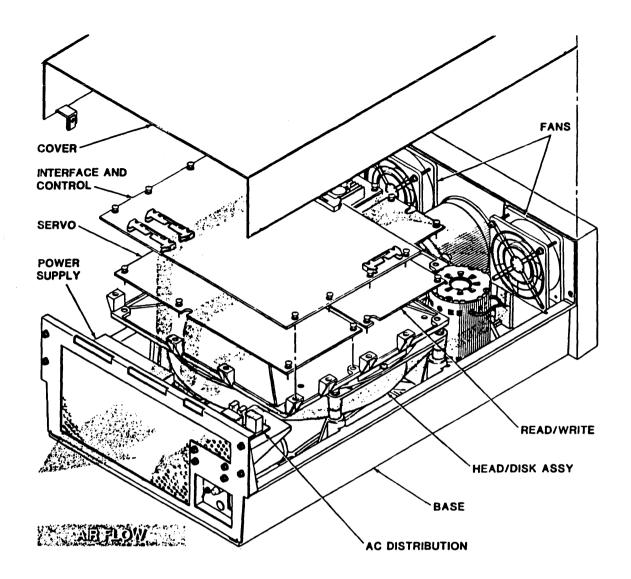


Figure 1-2. Enclosure with Drive

# SECTION 2 TECHNICAL CHARACTERISTICS

### 2.1 OPERATIONAL CHARACTERISTICS

# 2.1.1

Operational characteristics for the AMS 315 disk drive is listed in Table 2-1.

# TABLE 2-1. DISK DRIVE CHARACTERISTICS

Bytes per Track
Single Track Positioning Time
Recording Density
I/O Transfer Rate
Recording CodeMFM Bit Serial Interface Code (data)NRZ Serial Positioning MethodLinear Motor
Start Time

# SECTION 3 RELIABILITY AND SERVICE LIFE

#### 3.0 RELIABILITY

### 3.0.1 MTBF - Meantime Between Failures

MTBF is defined by the expression:

MTBF= Operating Hours
No. of Equipment Failures

MTBF is defined as the expected number of operating hours between equipment failures. Operating hours relate to the total "AC Power On" hours less any maintenance time. Equipment failures are defined as malfunctions requiring repairs, adjustments or replacements on an unscheduled basis, i.e., emergency maintenance required because of hardware failure or substandard performance. Excluded is downtime or substandard performance due to operator error, adverse environment, power failure, controller failure, cable failures or malfunctions not caused by the drive.

The AMS 315 has a designed MTBF of 10,000 hours. The sealed mechanism alone has a designed MTBF of 25,000 plus hours.

### 3.0.2 MTTR - Mean Time to Repair

MTTR is defined as the time for an adequately trained and competent service man to diagnose and correct a malfunction at the subassembly level. The AMS 315 disk drives are designed so that the MTTR is less than 1/2 manhour. The sealed portion of the drive is not field repairable and must be returned to the factory or factory authorized repair center for repair in a special clean room environment.

### 3.0.3 Preventive Maintenance Time

No regularly scheduled preventive maintenance is required.

# 3.1 DATA INTEGRITY

### 3.1.1 Recoverable Errors

A recoverable error is one which may be corrected by no more than 9 attempts to read the record. Any combination of seek-write or seek-read is allowed without limitation. Data patterns and track positions do not affect data error rate performance. The recover-

able read error rate for the AMS 315 is less than one error in  $10^{10}\,$  bits read.

### 3.1.2 Non-Recoverable Errors

A non-recoverable error is one which remains after 9 attempts to read the record in which an error is located. The non-recoverable error rate for the AMS 315 is less than one in  $10^{13}$  bits read.

### 3.1.3 Access Errors

The access error rate is less than one in 10<sup>6</sup> seek executions.

### 3.1.4 Media

Century Data Systems guarantees no more than 6 errors per head on the AMS 315. Century Data Systems also guarantees cylinder zero (0), head zero (0) to be error free. This is based upon twelve data read passes over the entire surface. All media defects will be identified to the customer by a written notice attached to the disk drive.

# SECTION 4 FORMAT REQUIREMENTS

#### 4.1 GENERAL

To guarantee operations over the entire temperature range, allow for component tolerances and compensate for cable and controller delays, all disk drives must have a preamble and postamble attached to each sector. The amount of overhead is a function of the electrical and mechanical tolerances and the bit transfer rate as well as the system requirements. The preamble and postamble contain all zeros. The sync bit should be a minimum of one data 1 bit.

AMS 315 offers the user a choice of formatting schemes. Either electronic sectoring or address mark sectoring may be used for fixed length records. Address mark sectoring must be used for variable length records.

The format requirements outlined in this section are based on a maximum controller "turn-around" delay time of 300 nanoseconds, and drive-to-controller one way cable delay of 20 nanoseconds maximum.

### 4.2 ELECTRONIC SECTORING

Electronic sectoring derives the sector and index pulses from the dibits recorded on the servo track. The index pulse occurs once per revolution and is available on the INDEX line in the Bussed and Radial cables. The number of sector pulses is variable in one byte increments. They are available on the SECTOR line in the Bussed and Radial cables.

Figure 4-1 illustrates the component parts of this format and the minimum size of each area.

The formula for the maximum number of sectors per track for a given sector size is as follows:

$$n_{\text{max}} = \frac{\text{Track Length}}{L_{\text{OH}} + L_{\text{ID}} + L_{\text{D}}}$$

$$n_{\text{min}} = 3$$

 $n_{max}$  = maximum number of sectors  $n_{min}$  = minimum number of sectors Track Length = 20160 bytes  $L_{OH}$  = length of overhead field  $L_{ID}$  = length of sector ID  $L_{D}$  = length of sector data field

### 4.2.1 Format A:

Format A is the typical format used in most sector pulse oriented applications. The sector ID field remains unchanged and is not rewritten when the data field is updated.

 ${\rm L}_{OH}$  is 50 bytes for format A.  ${\rm L}_{ID}$  is a system design parameter. It typically contains the cylinder, track and sector address, flags and a check character.  ${\rm L}_{D}$  is also a system parameter and contains both the data field and check character field. Once  ${\rm L}_{ID}$  and  ${\rm L}_{D}$  are decided upon, they are added to the appropriate  ${\rm L}_{OH}$  to determine the total byte count of each sector. This number is then used in the calculation for the sector switches as outlined in the AMS 315 Installation Manual.

#### 4.2.2 Format B:

Some system applications call for the rewriting of the sector ID every time the data field is updated. If this is the case, the ID field can be considered as part of the data field and the VFO relock and second Sync field may be eliminated

### 4.3 ADDRESS MARK SECTORING

Address mark sectoring derives its reference from special patterns recorded on the data track.

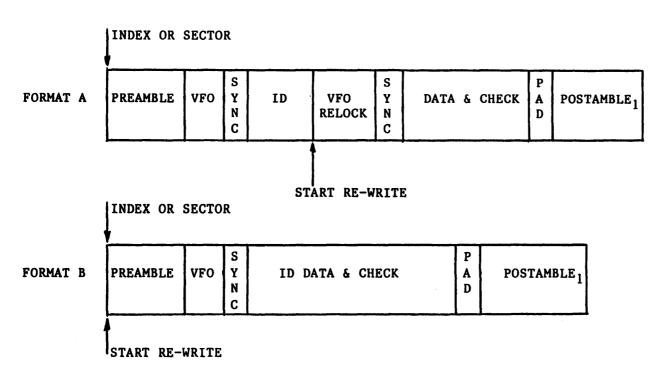
AMS 315 contains the necessary logic to generate and detect address marks. An I/O command generates the address marks. Another I/O command causes the drive to search for address marks. When one is detected, the Address Mark Detected signal is generated.

The index pulse is used to gain initial orientation. The index pulse is also a convenient means of denoting the end of a track in a multi-track read or write operation.

Address Mark sectoring for sequential read write operations is illustrated in Figure 4-2.

#### 4.3.1 Format C:

This format is the most common one used in address mark oriented applications. The sector ID field remains unchanged and is not rewritten when the data field is updated. Adjacent sectors can be processed consecutively.



Field	Contents	Bytes
Preamble	Zero's	16
VFO	Zero's	11
Sync	One's	*
ID	User Defined	Optional
VFO Relock (includes write splice)	Zero's	12
Data & Check	User Defined	Optional
PAD	One's or Zero's	1
Postamble <sub>l</sub>	Zero's	8
LOH = Overhead per Sector - Format A:		50
LOH = Overhead per Sector - Format B: * Length optional, l bit minimum		37

Figure 4-1. Electronic Sectoring Formats

### 4.3.2 Format D:

If the application calls for rewriting the sector ID field every time the data field is updated, the ID field can be considered as part of the data field and the VFO and first Sync field may be eliminated. Adjacent sectors can be processed consecutively.

### 4.3.3 Format E:

This format is designed for AM applications without the requirement of processing consecutive records.

#### 4.3.4 Format F:

If the ID field needs to be updated every time the data field is rewritten, further economy can be achieved by considering the ID field as part of the data field. The VFO and first Sync may be eliminated.

### 4.3.5 Track ID Field:

Certain AM applications call for a Track Header with an Track ID field at the beginning of each track. The use of such a track header is optional and details are outlined in Figure 4-4.

The formula for the maximum number of records per track for a given record size using Address Marks is:

$$n_{\text{max}} = \frac{L_{\text{OH}} + L_{\text{ID}} + L_{\text{D}}}{L_{\text{OH}} + L_{\text{ID}} + L_{\text{D}}}$$

Track Length = 20160 Bytes

Track Overhead = Format Dependent

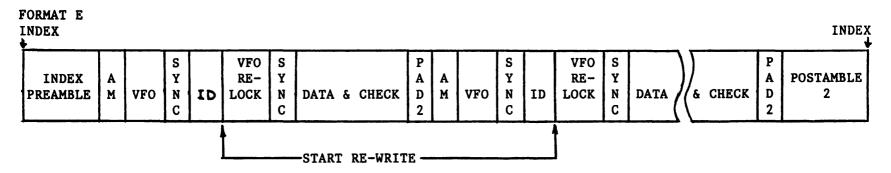
Track Header = Optional

LOH = Length of Overhead Field

LID = Length of ID Field

LD = Length of Sector Data Field

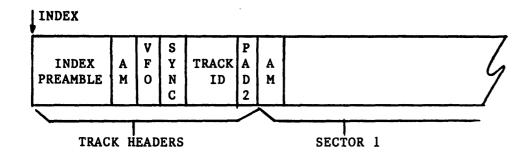
Figure 4-2. Address Mark Formats Sequential Records



FORMAT F INDEX												INDEX
INDEX PREAMBLE	A M	VFO RE- LOCK	S Y N C	ID, DATA & CHECK	P A D 2	A M	VFO RE- LOCK	S Y N C	ID DATA	ь снеск	P A D 2	POSTAMBLE 2
START OF RE-WRITE												

Field	Contents	Bytes
Index Preamble	Zero's	16
AM	Blank	3
VFO	Zero's	11
Sync	Zero's	***
ID	User Defined	Optional
VFO Relock (Includes Write Splice)	Zero's	12
Data & Check	User Defined	Optional
ID, Data & Check	User Defined	Optional
PAD2	Zero's	3
Postamble2 (Read Switching)	Zero's	14
PAD	One's or Zero's	1
LOH = Overhead per sector - Format	E	31
LOH = Overhead per sector - Format	F	19
Track Overhead		29
* Length optional, 1 bit minimum		

Figure 4-3. Address Mark Formats Interlaced Records



Field	Contents	Bytes
Index Preamble	Zero's	16
AM	Blank	3
VFO	Zero's	11
Sync	One's	*
Track ID	Optional	Optional
PAD2	Zero's	3
* Length options	1, 1 bit minimum	

Figure 4-4. Track Header Format (Optional)

# SECTION 5 CONTROLS AND INDICATORS

### 5.1 FRONT PANEL (FIGURE 5-1)

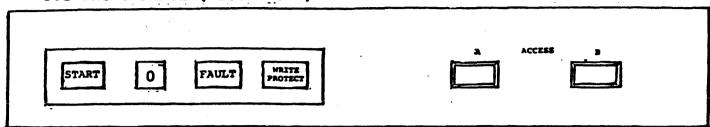


Figure 5-1. Operator Control Panel

### 5.1.1 Start/Stop Indicator/Switch

Operation of the START/STOP indicator/switch is depended on the position of the LOCAL/REMOTE switch (I/O & Control PWB).

When the LOCAL/REMOTE switch is in the LOCAL position, the START/STOP switch is used for sequencing the drive up and down. When placed in the START position (indicator lighted), the spindle motor is activated, provided there is no unsafe condition. When placed in the STOP position (indicator not lighted), the heads will be positioned at the landing zone and the spindle motor will be turned off, the dynamic brake will be activated and the disks will stop within 30 seconds.

When the LOCAL/REMOTE switch is in the REMOTE position, the START/STOP switch has to be in the START position for sequence signals PICK and HOLD to control the drive. When the START/STOP switch is in the STOP position, the drive will sequence down.

### 5.1.2 Ready Indicator/I.D.Plug (White)

This indicator/I.D. plug is used to select an address (0-15) for the drive. When the indicator is lighted, indicates the drive is up to speed and in an operational condition. This light will blink on and off while powering up or down. No plug installed is address 15.

### 5.1.3 Fault Indicator/Reset Button (Red)

This indicator, when lighted, indicates that "Fault" is active. Conditions for setting "FAULT" are defined in Section A.2.5. When depressed fault will reset if none of its set conditions are still active.

### 5.1.4 Write Protect Indicator/Switch

This indicator/switch, when not lighted, indicates all data operations are enabled. Pressing the switch, will light the indicator and indicate write operations are disabled (the drive is write protected).

### 5.1.5 Access A and Access B Switches

Access A and Access B switches are part of the dual access feature of the AMS 315, located on the Front Panel. Table 5-1 shows the uses of the switches.

Switch A	Switch B	
OFF OFF ON ON	ON .	Drive offline. Connected to Exerciser Drive connected to Controller B ONLY Drive connected to Controller A ONLY Drive connected to Controller A and B

TABLE 5-1. ACCESS A AND ACCESS B SWITCHES

### 5.2 REAR PANEL/INTERNAL

### 5.2.1 AC Switch

This switch is located on the AC distribution panel. The switch physically disconnects the AC from the drive.

### 5.2.2 Local/Remote Switch

This switch gives the user the option of either using or disregarding the PICK and HOLD signals. When the switch is in the LOCAL position it is not necessary to issue a PICK or HOLD signal. When it is in the REMOTE position PICK and HOLD signals must be issued from the control unit. The switch is located on the I/O & Control PWB.

### 5.2.3 Sector Switches

The Sector switches are located on the I/O & Control PWB and are used to set the total byte capacity for each sector on the disks. The binary weight for each switch position is etched on the board. Due to hardware design, the switches should be set for sector byte capacity minus two. The switches should be set using the following formula:

### 5.2.4 DC Power Indicators

Each of the five dc voltages (+24V, +12V, +5V, -12V, and -24V) has an LED mounted on the Servo Control PWB to indicate the presents

of the dc voltage. See Figure 5-2. When the LED's are lighted, it indicates that the dc voltages are present and within specifications. If a LED is not lighted, it indicates that the dc voltage is missing or below specifications.

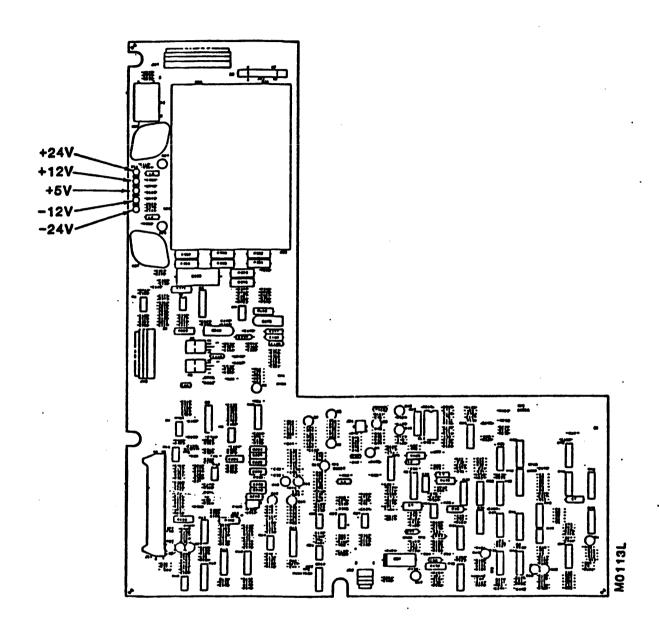


Figure 5-2. DC Voltage (LED) Indicators

# SECTION 6 ENVIRONMENTAL CHARACTERISTICS

### 6.1 TEMPERATURE

Equipment Operational:

 $50^{\circ}F$  to  $104^{\circ}F$  ( $10^{\circ}C$  to  $40^{\circ}C$ ) with a maximum

gradient of 18°F (10°C) per hour.

Equipment Non-Operational:

 $-40^{\circ}$ F to  $140^{\circ}$ F ( $-40^{\circ}$ C to  $50^{\circ}$ C)

Temperature Cycling:

No condensation shall result.

6.2 HUMIDITY

Equipment Operational

10% to 90% R.H. with a wet bulb temperature limit of 80°F(27°C)(provided there is no

condensation).

Equipment Non-Operational:

5% to 95% R.H., provided there is no conden-

sation.

6.3 ALTITUDE

Equipment Operational:

From 1000 feet below sea level to 10,000

feet above sea level.

Equipment Non-Operational:

From 1000 feet below sea level to 40,000

feet above sea level.

6.4 VIBRATION

Equipment Operational:

The AMS disk drive shall operate to specification without damage with peak displacement of .012 in. for the frequency

range of 20 Hz to 40 Hz and  $\pm 1g$  for the frequency range of 40 Hz to 500 Hz.

Equipment Non-Operational:

The equipment when packed for shipment shall withstand ±1.5g from 5 Hz to 500 Hz for one hour along each of the three mutually perpendicular axes, with a 20 minute sweep

time.

# 6.5 SHOCK

The equipment in non-operational status shall not suffer damage or fail to operate according to specifications, when subjected to 18 impact shocks of 5g (± 10%) consisting of 3 shocks along each direction of three mutually perpendicular axes. Each shock impulse shall be a half sine wave with a time duration of 11 ±1 millisecond.

# SECTION 7 PHYSICAL CHARACTERISTICS

# 7.1 PHYSICAL SIZE

# Basic Drive (No Enclosure)

Height	8.25 inches (203mm)
Width	16.5 inches (419mm)
Depth	24.25 inches (616mm)
Weight	65 pounds (24kg)
Shipping Weight	90 pounds (34kg)

# Enclosure (With Drive)

Height	10.5 inches
Width	19 inches
Depth	30 inches
Weight	115 pounds
Shipping Weight	135 pounds

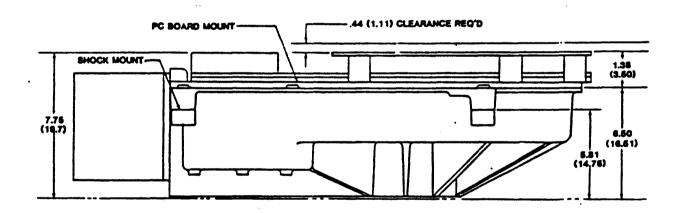


Figure 7-1A. AMS Basic Drive Dimensions (Side View)

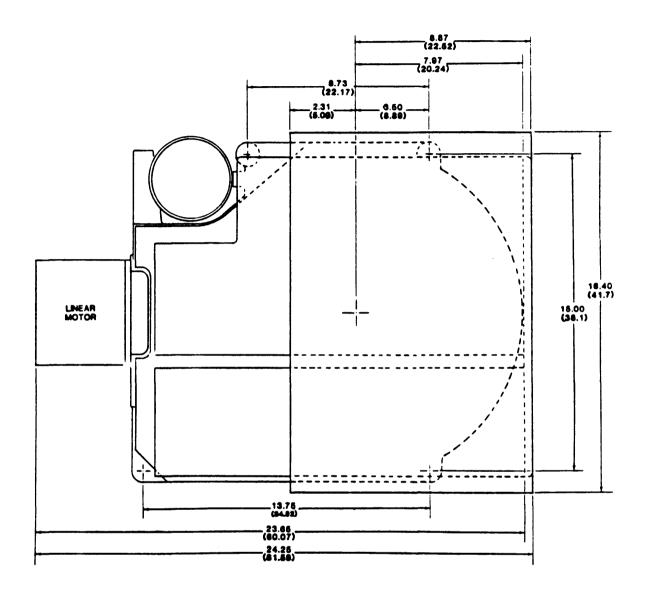


Figure 7-1B. AMS Basic Drive Dimensions (Side View)

# SECTION 8 POWER REQUIREMENTS

### 8.1 DRIVE WITH POWER SUPPLY

### 8.1.1 AC Power

100\*/115\*\*V (+10%,-15%),50/60 Hz (+0.6,-1.0 Hz)

Running: 4A Starting: 16A

200/220/240\*V (+10%,-15%),50 Hz (+0.5,-1.0 Hz)

Running: 3A Starting: 11A

\* Internal jumper must be changed

\*\* 115V available only for 60 Hz operation

### 8.1.2 DC Power

+24V, +7%

+12V, +3%

+5V, +1%

### 8.2 AC POWER CORD

## 8.2.1 120V, 15A, 60Hz

Power cord is 7.5 feet long and has a NEMA 5-15P plug.

# 8.2.2 100/220/240V, 50Hz

Power cord is 7 feet long and has a NEMA 5-16P plug.

# APPENDIX A SMD INTERFACE

# A.1 SIGNALS

# A.1.1 Radial Cable

Signal Name	Mnemonic	1/0	Description
Unit Selected	UNITSELECTM/ UNITSELECTP	0	When active this line indicates the drive is selected. This line will be active within 400 nanoseconds of the leading edge of unit select tag when the four unit select bits compare with the address of the drive and the degate switch is in the normal operating position.
Seek End	SEEKENDM/ SEEKENDP	0	When active this line indicates "ON CYLINDER" or "SEEK ERROR" (i.e., seek operation has terminated). If a cylinder address greater than 823 is issued "SEEK END" and "ON CYLINDER" will interrupt for 30 microseconds nominally.
Write Data	WRITEDATAM/ WRITEDATAP	I	This line carries NRZ write data to be written on the disks.
Servo Clock	SERVCLKP SERVCLKM/	0	This line transmits 9.68 MHz + the percent of speed variation. Clock phase is locked to the servo dibit pattern. Servo Clock is available to the controller at all times (not gated with Select) and is used to form Write Clock.
Read Data	RDDATAM RDDATAP	0	This line carries NRZ data recovered from the disk.
Read Clock	RDCLKP	0	This line transmits 9.68 MHz clock that is phase-locked to the recovered data. It is internally derived and is synchronized with the detected data.
Write Clock	WRTCLKP WRTCLKM/	I	This line is retransmitted "SERVO CLOCK".

# A.1.2 Bussed Cable

Signal Name	Mnemonic	1/0	Description
Unit Ready	UNITREADYP UNITREADYM/	0	When active this line indicates that the selected drive is up to speed, heads are loaded on the disk, and no fault condition exists.
On Cylinder	ONCYLINDERP ONCYLINDERM/	0	when active this line indicates the R/W heads are positioned on a track. ON CYLINDER goes inactive with any seek command. An offset command causes ON CYLINDER to go inactive for 2.5 microseconds nominally.
Index	INDEXP INDEXM/	0	When active indicates the start- ing point of a data track.INDEX is nominally 2.4 + 0.4 microseconds wide. Timing integrity is main- tained during seek operations.
Unit Select Tag	UNITSELO UNITSELO/	0	The leading edge of this tag gates the four unit select lines into the logical address compare circuit.
Unit Select 1,2,4,8	UNITSEL1,2,4 UNITSEL1/,2/, 4/,8/		These four lines are binary coded to select one of 16 logical units (0-15). The unit number is selected via an address selector plug inserted into the operator control panel. Removal of the plug is decoded as address 15. The operator must verify that no duplicate plugs are installed on the same control bus.
Tag 1 (Set Cylinder)	TAG 1 TAG 1/	I	When active the bus lines are decoded as the next cylinder address. TAG l is not to be issued if the drive is busy (not on cylinder).
Tag 2 (SET- HD Tag)		I	When active, Bus Lines 0 thru 4 are decoded as the next head add-ress. Bus 0 is the LSB.
Tag 3 (Control Tag		I	When active, bus lines are decoded as commands.

Signal Name	Mnemonic	I/O	Description
Sector Mark	SECTORP SECTORM/	0	When active indicates the start of a sector. The pulse is $1.25 \pm 0.8$ microseconds wide, with the leading edge occurring at beginning of a sector.
Seek Error	SEEKERRORP SEEKERRORM/	0	When active indicates that the unit was unable to complete a servo operation within 940 milliseconds or that a cylinder address greater than 822 was issued. It is rezero or manual restart.

The 10 bus lines are interpreted according to the current tag. The drive must be selected at least 200 nanoseconds before any bus lines are active. The bus lines must be active at least 200 nanoseconds before the tag line and 200 nanoseconds after the tag line. The tag lines must be active at least 800 nanoseconds. The 10 bus lines are decoded by the three tag lines as defined below:

Bus Bit	Tag l (Set Cyl) Cylinder Bit		Tag 3 (Control Select)
0	1	1	Write Gate
1	2	2	Read Gate
2	4	4	Servo Offset FWD
3	8	8	Servo Offset REV
4	16	16	Fault Clear
5	32		Address MK Enable
6	64		Return to Zero
7	128		
8	256		
9	512		Release (Dual Access)

There shall only be one tag line active at any given time. There shall be at least a 1.0 microsecond delay after the trailing edge of a tag signal before the leading edge of another tag.

Signal Name	Mnemonic	I/O	Description
Fault	FAULTP FAULTM/	0	When this line is active, a fault condition exists in the AMS 315. The following types of faults may be detected: a. DC Power b. Temperature c. Read/Write A fault condition will immediately inhibit writing to prevent data destruction. The DC Power fault indicates a below normal voltage

# Signal Name Mnemonic I/O Description

from the positive or negative power supplies. The temperature fault indicates the linear motor has over heated. The read/write fault indicates a fault was detected on the Read/Write PWB. This line may be cleared by CONTROL SELECT (Tag 3) and FAULT CLEAR (Bit 4), providing the fault no longer exists. Faults are stored in individual flip-flops as a maintenance aid, and may be cleared only by powering down DC power or clearing the fault by means of the FAULT CLEAR switch on the operator control panel.

# Address Mark AMDETP Found AMDETM/

O This line will be active for 9 microseconds maximum when an address mark is detected.

# Open Cable CABLEIN Detector CABLEIN/

I When active indicates an open bussed interface cable or loss of controller power. Drive receivers and transmitters are inhibited.

### Power PICK/ Sequence Pick

PICK signal is used to start Ι The one drive at a time when several drives are daisy chained together. PICK must be held active low for a minimum of 250 milliseconds after the signal HOLD is asserted if only one drive is under control. If several drives are daisy chained it is necessary to hold the signal PICK active low until all drives have powered up; this requirement exists because the signal PICK only passed down the chain after drive comes up to speed. Hence, PICK must be held active low for 20 (n) seconds when 'n' drives are daisy chained together.

### Power HOLD/ Sequence Hold

I The HOLD signal is used in conjunction with the PICK signal and must be held active low for the entire duration of time that a controller expects a drive to remain powered up. The HOLD signal simply loops from one drive to the next when a daisy chain configuration is employed; therefore, if the HOLD

### Signal Name Mnemonic I/O Description

signal is taken into an inactive high state by the controller, every drive in the daisy chain is sequenced down. Once a drive is sequenced down it is necessary to issue both the PICK and HOLD signals to cause a drive to sequence up.

# A.1.3 Tag 3 (Control Tag) Interpretations

### Bus 0 - WRITE GATE

This bit turns on the write circuits.

### Bus 1 - READ GATE

This bit turns on the read circuits. The leading edge of Read Gate instructs the data separator to synchronize on the following data which should be a previously written all zeros pattern in a gap.

### Bus 2 - SERVO OFFSET FORWARD (PLUS)

This bit will position the R/W heads off-track towards the spin-dle.

### Bus 3 - SERVO OFFSET REVERSE (MINUS)

This bit will position the R/W heads off-track away from the spindle.

### Bus 4 - FAULT CLEAR

This bit will reset the following fault conditions in the drive provides the condition is not currently active. A 100 nanosecond minimum pulse is required:

- a. Not ready and read or write
- b. Write and not on cylinder
- c. Offset and write
- d. Write and no DC write current
- e. Write and no write transitions
- f. Write and read only active

### Bus 5 - ADDRESS MARK ENABLE

When reading, this bit tells the data separator to look for an address mark. This bit must go inactive within 1.0 microseconds after the leading edge of "ADDRESS MARK FOUND". When writing, this bit tells the data separator to write an address mark (3 to 3.5 bytes of no transitions).

### Bus 6 - RETURN TO ZERO (RTZ)

This bit will reposition the heads to cylinder zero if the drive is up to speed. Rezero will reset 1) "Seek Incomplete", 2) an illegal cylinder address. A 100 nanosecond minimum pulse is required.

Bus 7 - (NOT USED) Bus 8 - (NOT USED)

### Bus 9 - RELEASE/PRIORITY SELECT (DUAL ACCESS)

Enabling this line will release Channel Reserve and Channel Priority Select Reserve in the AMS 315, making alternate channel access possible after selection by the other channel ceases. If the unit is desired to function with "Reserve Timer" feature, release will occur 500 ms (nominal) following the deselection of the AMS 315. Enabling Release will always clear Reserve and allow alternate channel access independent of the Reserve Timer feature. The Reserve Timer is enabled by means of a switch on the interface PWB. Inhibiting the Reserve Timer causes the AMS 315 to stay reserved until specifically released by the reserving channel. A unit is reserved immediately upon selection, but may be released any time after 500 ns following selection.

### A.2 CHARACTERISTICS (DESCRIPTION)

The AMS 315 disk drive interface characteristics may be divided into six areas:

Power Sequencing Positioning Data Handling Error Correction Fault Indication Recovery Times

### A.2.1 Power Sequencing

Figure A-1 illustrates the power sequence.

To power sequence up a single drive the controller issues two low active signals, PICK and HOLD simultaneously. The PICK signal may be dropped 250 milliseconds after HOLD is asserted. The drive comes up to speed and is on cylinder zero twenty seconds after the PICK and HOLD signals are issued. Once the drive is up to speed it monitors the HOLD signal. If the controller removes the HOLD signal the drive power sequences down and returns the heads to the landing zone.

### A.2.2 Positioning

The positioning logic moves the heads to the desired cylinder and selects the proper track. The sequence is illustrated in Figure

A-2. During the time the actuator is moving, the ON CYLINDER signal goes inactive. At the end of a seek, ON CYLINDER becomes true and SEEK END is then reset by the next seek command. If the seek is not finished within 945 milliseconds, the SEEK ERROR flag is set. If an illegal cylinder address is given SEEK ERROR status is set. If either of these conditions occur, a Rezero command must be given to clear the fault and re-establish a reference point.

### A.2.3 Data Handling

Before writing on a new drive the disk must be formatted. A format from Section 3 must be selected and the sector size decided upon. Figures A-3, A-4, and A-5 illustrate this procedure. Figures A-6 through A-14 illustrate reading and writing using both electronic and address mark sectoring.

### A.2.4 Error Correction

A method for recovering temporary errors is provided. The heads may be positioned slightly off track in either direction. Once an error is detected, three additional attempts should be made to read the record at zero offset. Then three attempts should be made with the heads offset in the forward direction and three attempts with reverse direction offset. If the error cannot be corrected by this procedure, it is considered a permanent error.

# A.2.5 Fault Indication

TABLE A-1 the fault conditions that will light the fault indicator on the Operator Control Panel:

LED INDICATORS\* 2 5 6 7 8 9 14 FAULT CONDITIONS 1 3 4 1 X Х Х Χ Χ X X 1 LINEAR MOTOR OVERTEMP Х 1 Х Х Х Χ Х Х DC VOLTAGE OUT OF SPEC Х 1 Х Х 1 Х Х Χ  $\mathbf{X} \mathbf{X}$ Х 1 PWR AMP FAIL DURING PWR-UP 1 х х Х X X X Χ X 1 FAULT ON R/W PWB X Χ Х Х 1 X XΧ X 1 READ NOT ON CYLINDER Х 1 1 X Х Х Χ Х Χ 1 WRITE IN READ ONLY MODE Х Х Х X 1 Х 1 Х WRITE IN OFFSET OR NOT ON CYL Х 1 X X Х Χ Х 1 0 0 X 1 WRITE DURING UPPER THRESHOLD X Х Х Х Х Х Χ 1 ERROR DURING SEEK OPERATION 1 = ON ; O = OFF ; X = DON'T CARE

TABLE A-1. FAULT (MAINTENANCE) INDICATORS

<sup>\*</sup> LED Indicators (Fault) will be mounted on the final I/O and Control PWB.

If an error condition is no longer present, the fault indicator may be reset by: Fault Reset Switch, Tag 3 and Bus 4 or a Unit Restart.

### A.2.6 Recovery Times

- a) Drive must be ready, and HAR not changed at least 10 microseconds before read and 5 microseconds before write.
- b) Switching from write to read a 10 microsecond delay is required.
- c) Switching from not reading to reading, good data will be at the interface within 5 microseconds.
- d) Switching from not writing or reading to writing, good data will be written within 1 microsecond.

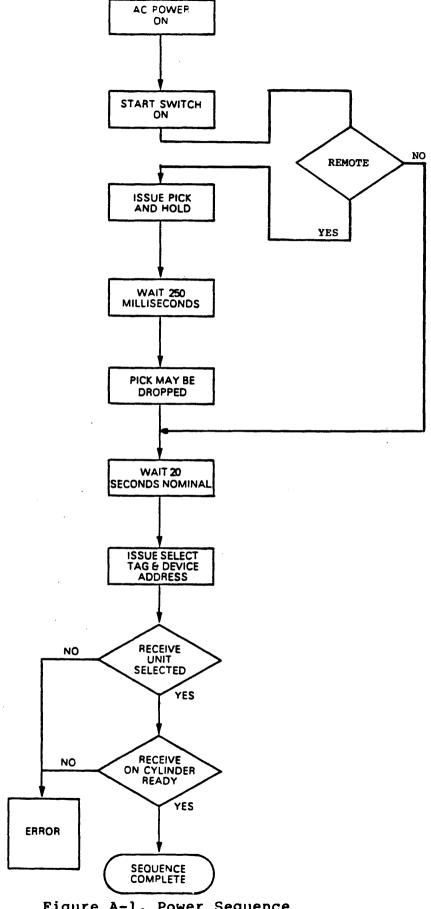


Figure A-1. Power Sequence

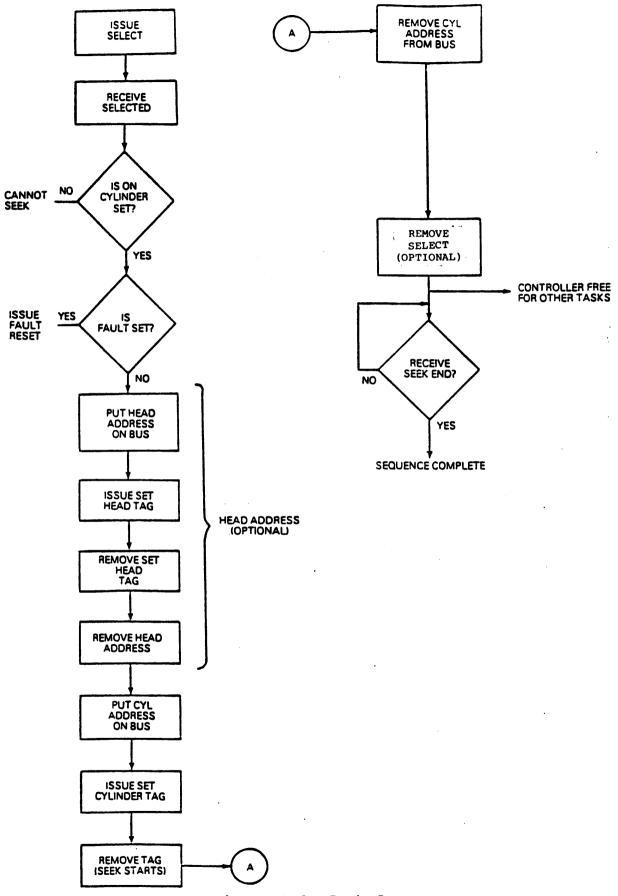


Figure A-2. Seek Sequence

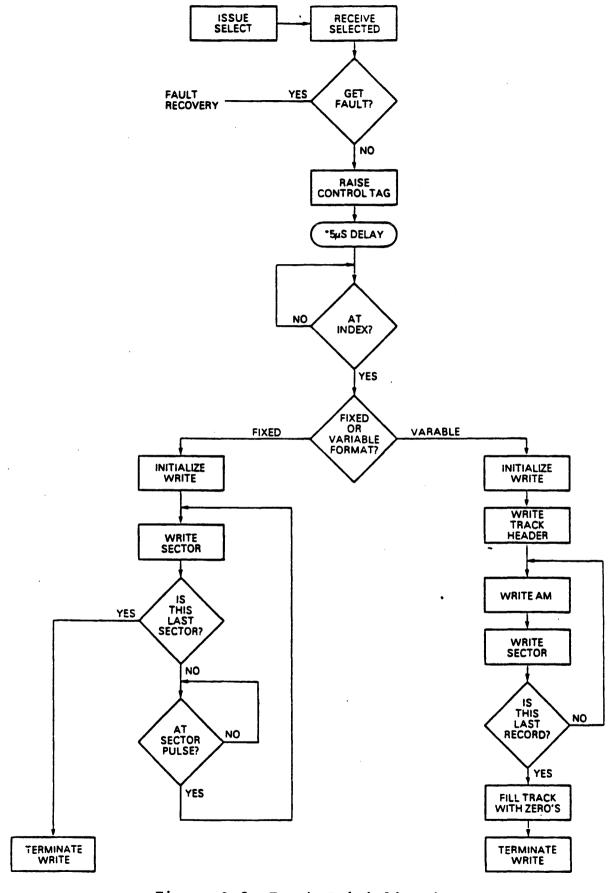
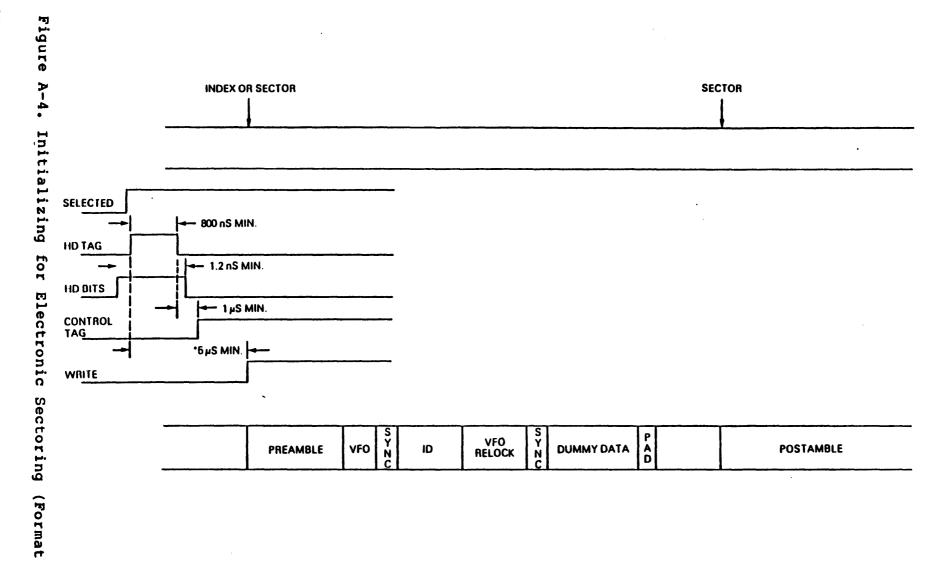
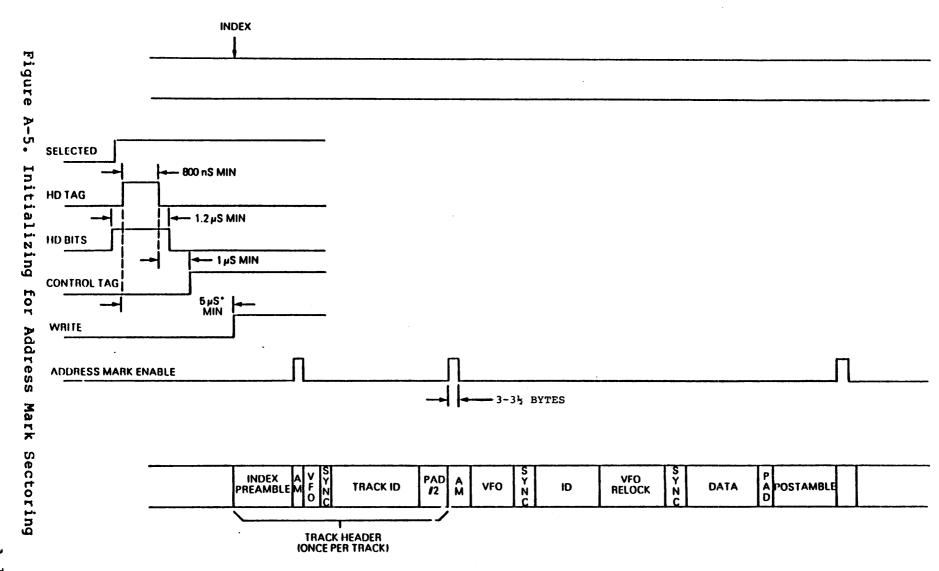


Figure A-3. Track Initialization





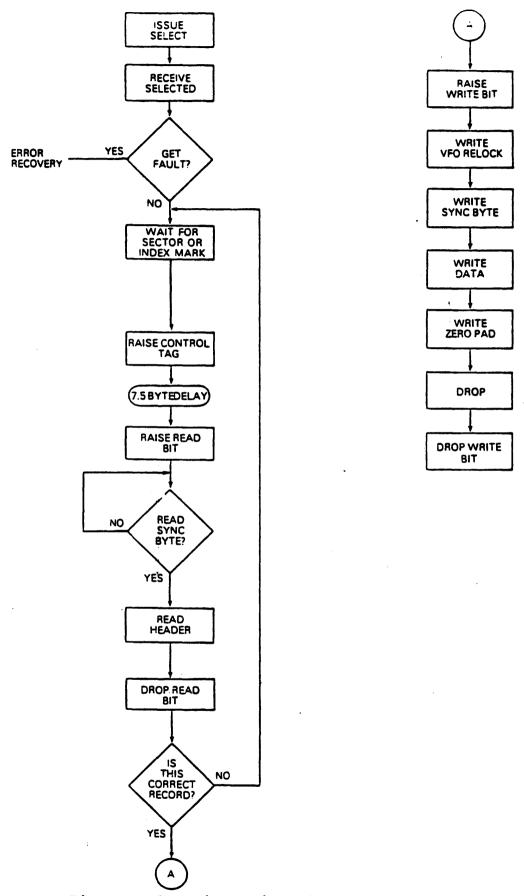
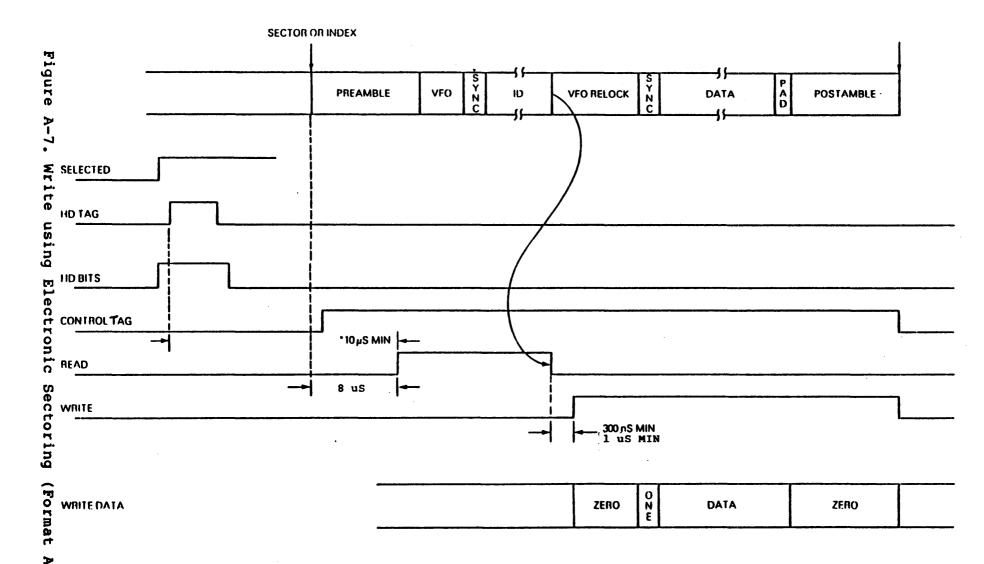


Figure A-6. Write using Electronic Sectoring



A-15

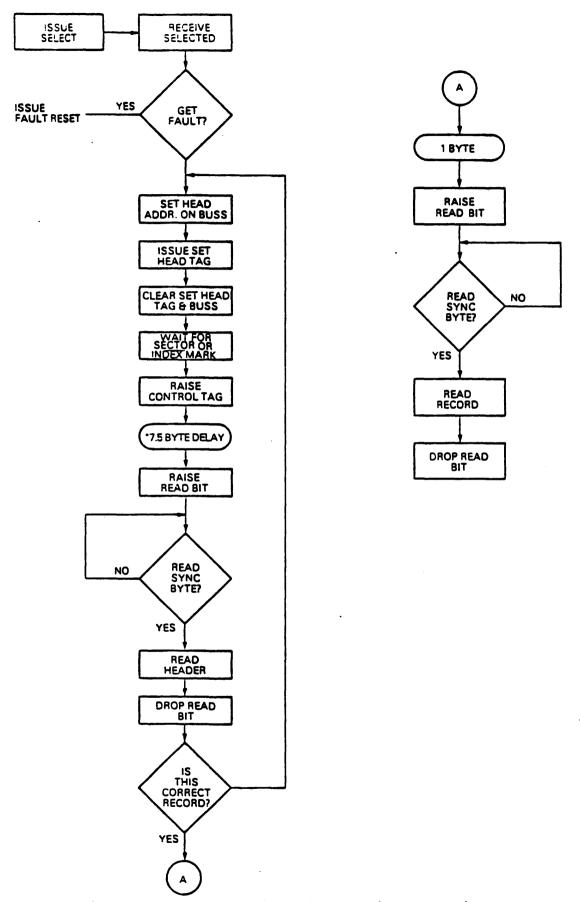
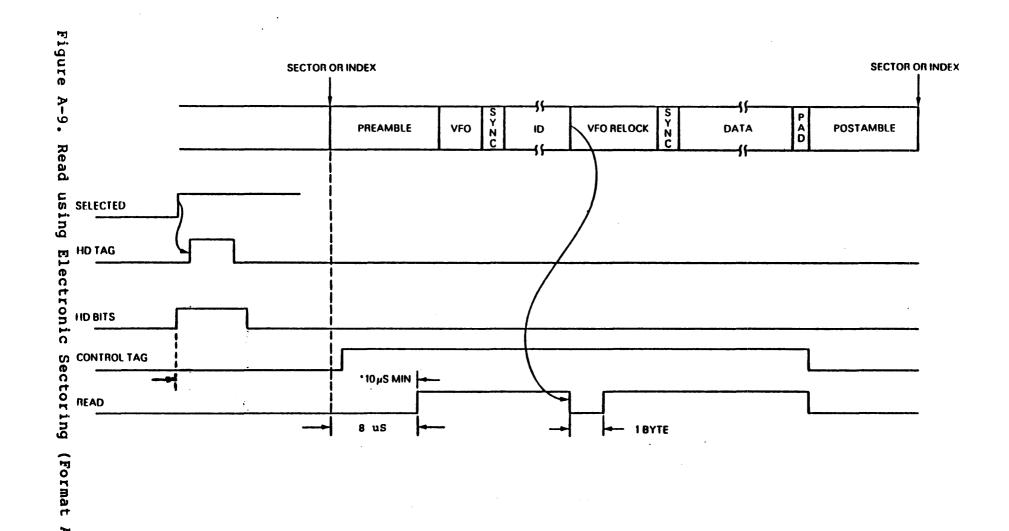


Figure A-8. Read using Electronic Sectoring



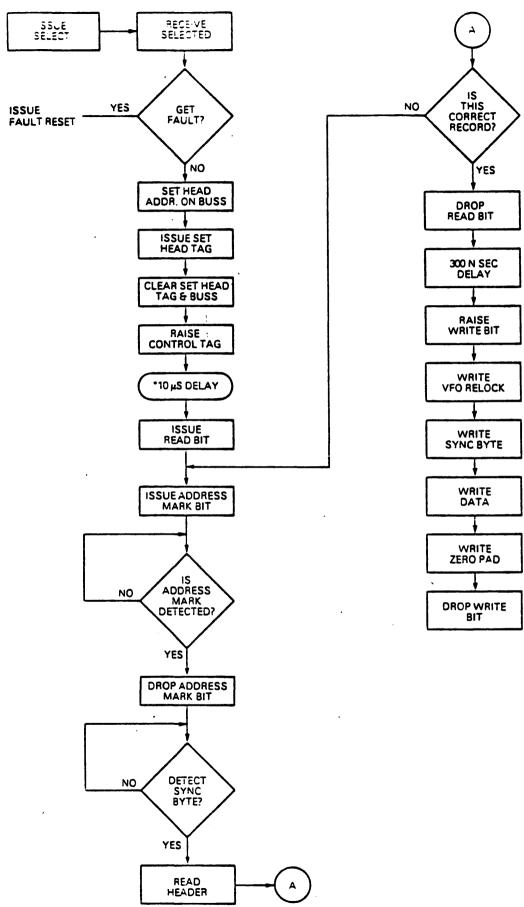
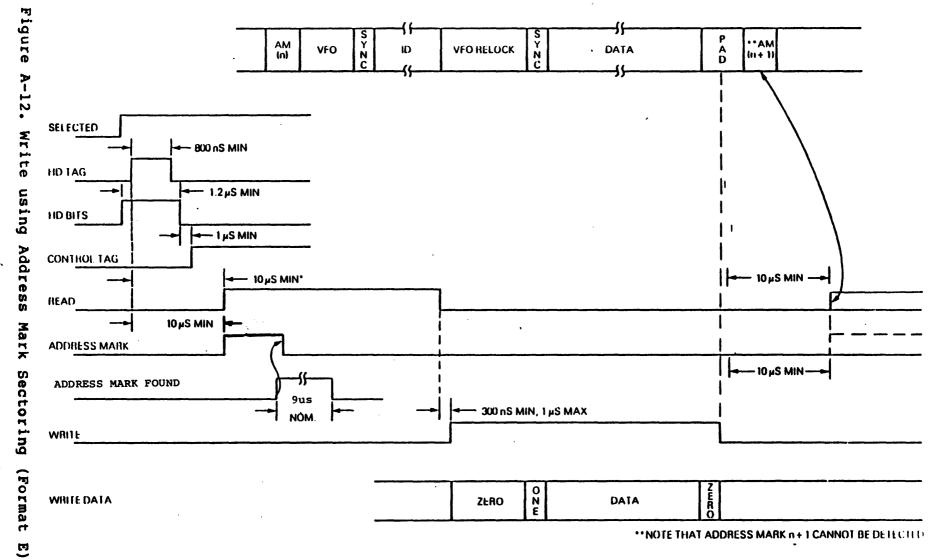
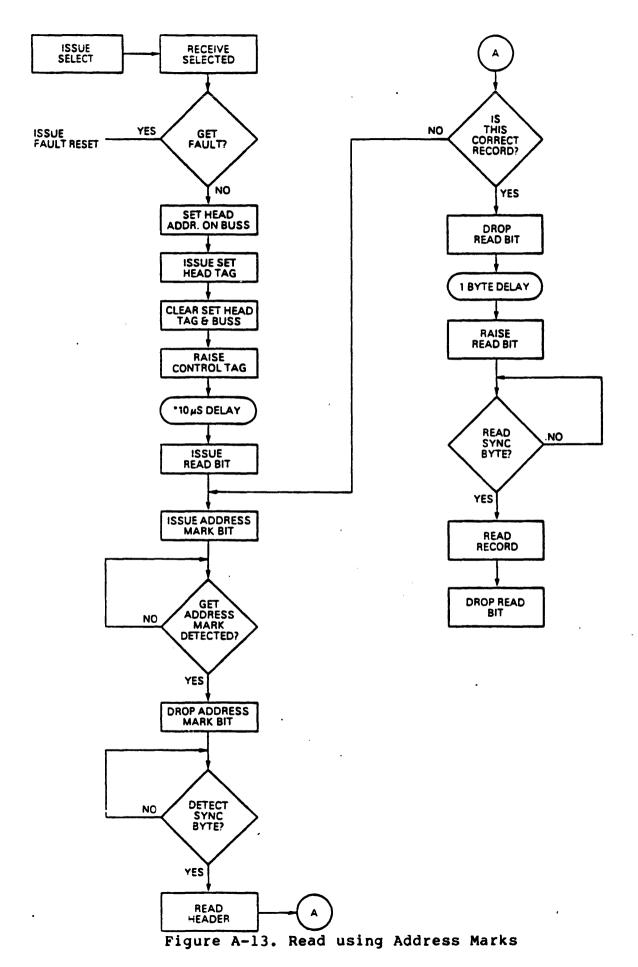
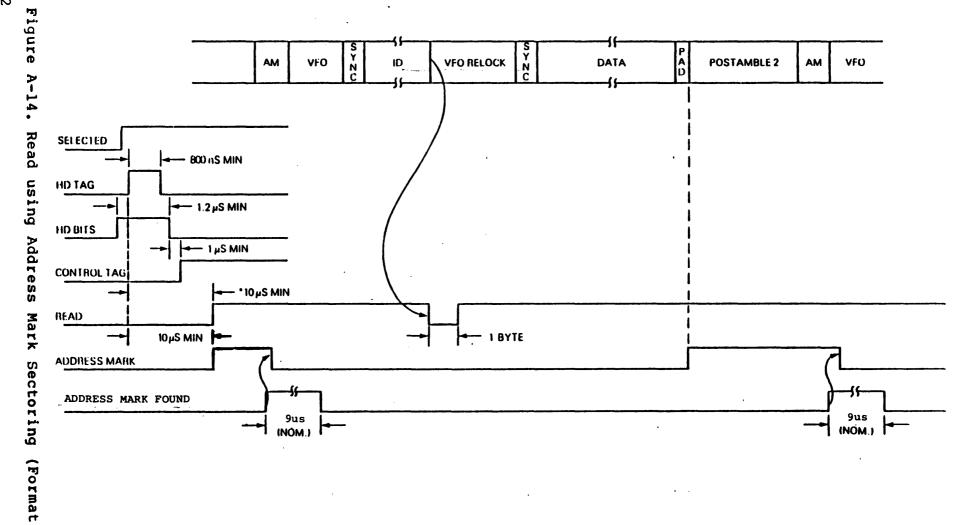


Figure A-10. Write using Address Marks





C



## A.3 SIGNAL LEVELS AND CABLES

#### WARNING

The pin number designators for the ANSI SMD interface follow the designation shown below.

>1	31	>1	14
2	32	2	15
3	33	3	16
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
29	59	12	25
30	60	13	26

60 Pin Connector 26 Pin Connector

The Century Data Systems pin number designators follow the designation shown below.

>1	2	>1	2
3	4	3	4
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
57	58	23	24
59	60	25	26

60 Pin Connector 26 Pin Connector

## A.3.1 Radial or Data Cable (Table A-2)

Туре	26 Conductor, flat cable with ground plane and
	drain wire.
Part Numbers	CDS 21565-015
	CDC 775643XX
Wire Size	No. 28 AWG, 7 strand
Impedance	130 OHM, + 15 OHM
Termination	82 OHMs + 5% (See Figure A-15)
High Level	OV (Ground)
Low Level	-0.3V (+0.1V)
Logical States	P Line High; M Line Low - Logical 1
	P Line Low; M Line High - Logical O
Maximum Cable	
Length	50 Feet

TABLE A-2. RADIAL (B) CABLE CONNECTOR AND PINS

CDS Pin Active Low			Pin nment Active High	Signal Name	Source
15 3 5 9 11 19 18 23 25	14 2 6 8 12 20 17 22 26 1 4 7 10 13 16 21 24	8 2 3 5 6 10 22 12 13	20 14 16 17 19 23 9 24 26 7 18 1 15 4 21 11 25	WRITE DATA SERVO CLOCK READ DATA READ CLOCK WRITE CLOCK SEEK END UNIT SELECTED INDEX SECTOR Ground Ground Ground Ground Ground Ground Ground Ground	CONTROLLER DRIVE DRIVE CONTROLLER DRIVE DRIVE DRIVE DRIVE DRIVE

# A.3.2 Bussed or Signal Cable (Table A-3)

Туре	50 Conductor, Flat Cable
Part Number	CDS 21564-015
	CDC 775642XX
Wire Size	28 AWG, 7 strand
Impedance	105 OHM, +10%
Termination	56 OHM (See Figure 6-16)
High Level	OV (Ground)
Low Level	
Logical States	P Line High; M Line Low - Logical 1
	P Line Low; M Line High - Logical O
Maximum Cable	
Length	100 Feet. Cumulative (All drives on the BUS)

TABLE A-3. BUS (A) CABLE CONNECTOR AND PINS

CDS Pin	Number	ANSI Pi Assignme			
Active Low	Active High	Active Low	Active High	Signal Name	Source
43	44	22	52	UNIT SELECT TAG	CONTROLLER
1	2	1	31	TAG 1 (SET CYLINDER)	CONTROLLER
	4	2 3	32	TAG 2 (SETHDTAG)	CONTROLLER
3 5 7	6	3	33	TAG 3 (CONTROL TAG)	CONTROLLER
	8	4	34	BUS BIT 0	CONTROLLER
9	10	5	35	BUS BIT 1	CONTROLLER
11	12	6	36	BUS BIT 2	CONTROLLER
13	14	7	37	BUS BIT 3	CONTROLLER
<b>1</b> 5	16	8	38	BUS BIT 4	CONTROLLER
17	18	9	39	BUS BIT 5	CONTROLLER
19	20	10	40	BUS BIT 6	CONTROLLER
21	22	11	41	BUS BIT 7	CONTROLLER
23	24	12	42	BUS BIT 8	CONTROLLER
<b>2</b> 5	26	13	43	BUS BIT 9	CONTROLLER
45	46	23	53	UNIT SELECT 1	CONTROLLER
47	48	24	54	UNIT SELECT 2	CONTROLLER
51	52	26	56	UNIT SELECT 4	CONTROLLER
<b>5</b> 3	54	27	57	UNIT SELECT 8	CONTROLLER
<b>3</b> 5	36	18	48	INDEX	DRIVE
49	50	25	55	SECTOR	DRIVE
29	30	15	45	FAULT	DRIVE
31	32	16	46	SEEK ERROR	DRIVE
<b>3</b> 3	34	17	47	ON CYLINDER	DRIVE
27	28	14	44	OPEN CABLE DETECTOR	CONTROLLER
37	38	19	49	UNIT READY	DRIVE
39	40	20	50	ADDRESS MARK FOUND	DRIVE
55	56	28	58	WRITE PROTECTED	DRIVE
	57		29	POWER SEQUENCE PICK	CONTROLLER
	58		59	POWER SEQUENCE HOLD	CONTROLLER
<b>5</b> 9	60	30	60	GROUND	
41	42	21	51	BUSY	DRIVE

#### A.3.3 Recommended Line Receivers and Drivers

Line Receivers: Motorola MC3450 MC3452 Ind. Standard SN75107A

SN75108A

Line Drivers: Motorola MC3453 Ind. Standard SN75110J

## A.3.4 Mating Conectors

Bus (Signal) Connector (Flat) CDS P/N 95363-060 Radial (Data) Connector (Flat) CDS P/N 95363-025 Terminator (Flat) CDS P/N 19315-001

## A.3.5 DC CABLE

Each drive is provided with a #6-32 ground stud for connection to the system ground. A minimum #8 wire is recommended for DC cable.

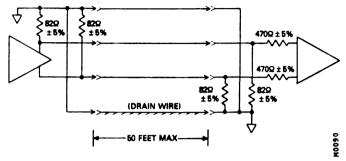


Figure A-15. Recommended Driver/Receiver Cable Termination Circuit for Read/Write Data and Clock

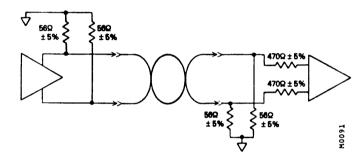


Figure A-16. Recommended Driver/Receiver Cable Termination Circuit for Bussed (Signal)
Cable

RADIAL CABLE

Figure A-17. System Cabling Diagram

#### A.4 DUAL ACCESS

#### A.4.1 Description

The Dual Access feature contains the interface and control electronics that allow drive or a group of drives to be selectively connected to two control units. The interface electronics provide separate line receivers and line drivers for each control unit. The control electronics implement a "Hardware interlock" allowing one control unit to be connected to a drive at any one time. The logical state of the interlock, controlled either by manual switches or control unit selection, assures that an operation is started and completed on a drive without interference from the second control unit. Once a control unit is connected through the dual access interface, all common disk operations are allowed as specified for the standard drive. When a control unit is not connected to a drive through the dual access, all drive commands are ignored.

#### A.4.2 Configuration

The access switches on the I/O & Control PwB provide separate enable switches for each access. The switches are used to configure which control unit(s) can access the drive. Internally, each access can be forced to be connected to its associated control unit or completely disabled. With both switches enabled, the drive is configured for automatic operation and connection can be made by either control unit. Table A-4. lists the configurations established from the four functional states of the two switches.

State	Access A	Access B	Configuration
1	ON	ON	Automatic
2	ON	OFF	Manual (Forced Connec-
3	OFF	ON	tion to A) Manual(Forced Connec- tion to B)
4	OFF	OFF	Degated

Table A-4. Dual Access Switch Configurations

#### A.4.3 Functional Operation

If two control units are dynamically sharing a disk drive through automatic control, operation is controlled by the control unit request signals, the enable switches, and the failsafe timer. The operation of the enable switches overrides the other controls. A control unit becomes connected under the following conditions:

- 1. One request signal is asserted and the other access request signal is reset. This is the normal mechanism.
- 2. One request signal is asserted and the other access has

been disconnected due to a time out condition. This is the failsafe mechanism.

In both of the above cases, an attention interrupt wil occur when a control unit becomes connected. In addition an interrupt will be generated as specified by the standard interface as long as the access is connected.

The following mechanisms could be used to establish the current state of the dual access interlock:

A control unit asserts its request line whenever access is desired. It then selects the drive and checks for the online status. If the drive is being used by the other control unit the drive would indicate offline. The control unit would then deselect the drive and wait for the attention interrupt. The interrupt would occur when control unit was connected to the drive. Once a control unit is connected, it would keep its request signal asserted as long as the drive is required. An alternate approach would be once access is requested, the control unit and system software could monitor the request signal from the other control unit and the attention line. The other control unit request line active and the absence of an attention interrupt could identify a busy condition. Under normal operation the drive should never be disconnected in a not ready state. This could result in a double interrupt to a requesting control unit not yet connected. Once connected to a drive, a control unit should always examine the ready status before beginning another operation.

The drive's response of the selected line ensures a control unit that the enable switch has not been placed to the "Off" position.

### A.4.4 Failsafe Timer

A control unit retains access to a drive once access is granted until it deactivates the request line or until 10 seconds have elapsed with no activity (no tag line activity) and with the other control unit requesting access. For example, if the control unit, C.U.B., has requested access while the drive is connected to C.U.A., the drive would assert the "Request From Other Control Unit" line to C.U.A., indicating that C.U.B. has requested access to the drive. Simultaneously, the failsafe timer is started to monitor activity of C.U.A. tag lines. C.U.A. must reset the timer (i.e., by pulsing one of the three drive tag lines) before the timer times out; otherwise, the drive will disconnect from C.U.A. without further notice. C.U.B. is now connected to the drive and the time out condition for C.U.A. reset. In all cases the control Funits shall be responsible to maintain an activity level within the limit specified by the timer.

**NOTE:** The 10 second time delay is the nominal time delay provided on all drives. The time delay is jumper-selectable from 670ms to 39 sec.

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