ADAM

THE COMPLETE DISK DRIVE

PROPRIETARY NOTICE

The purpose of this document is to provide the user of MPI`s 5.25 Inch Slimline Series Disk Drives with adequately detailed information necessary to properly install, configure, and operate the equiptment supplied. Every effort has been made to keep the information contained in this document current & accurate. However, no guarantee is given or implied that the guide is error free, or that it is accurate with regard to any partictular specification

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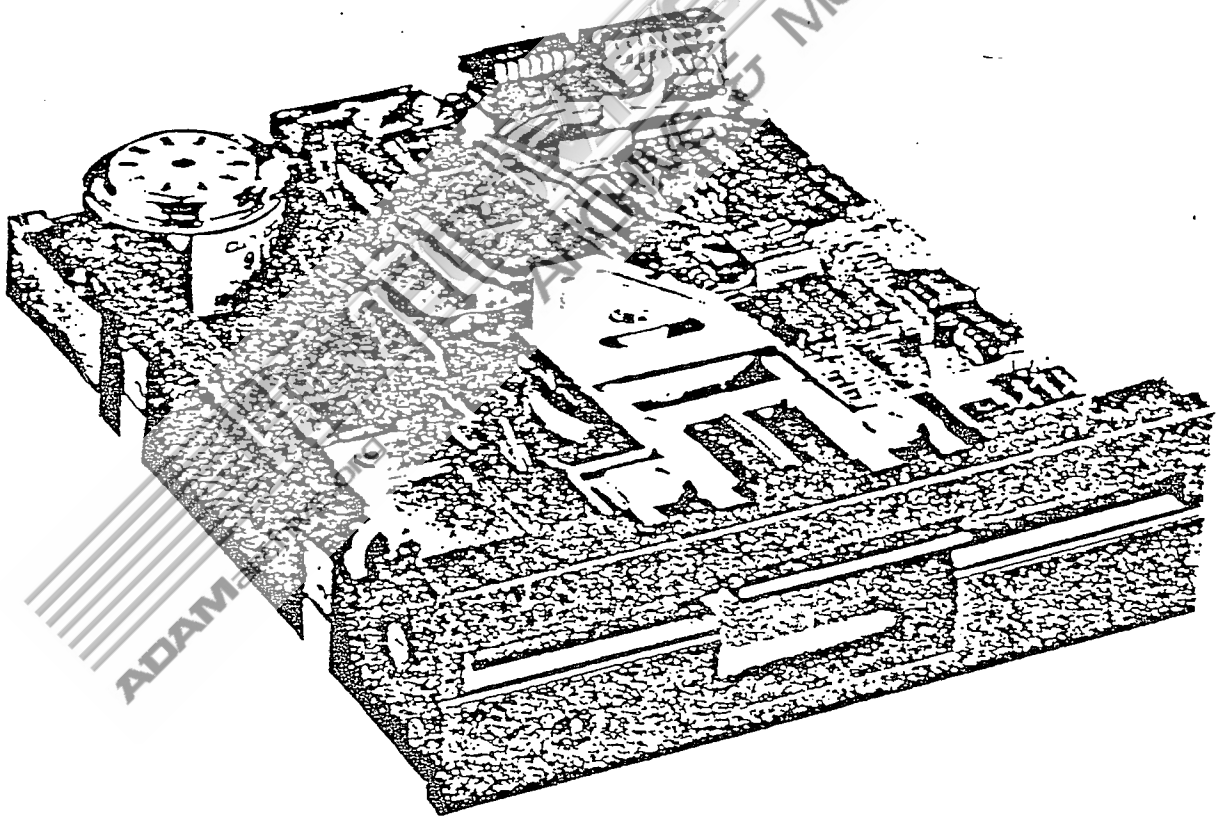

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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

This product manual provides the information necessary to properly install, configure, operate, and maintain the Micro Peripherals Inc. 5.25" Slimline™ Series drives. This series of disk drives includes the Model 501, 502, 501C, 502C, 901, and 902.

A high level of commonality exists between these drives, therefore the following descriptions will generally apply to all models. Unique features of each model will be identified and individually described, as appropriate.

NOTE

For ease of explanation, flexible disk drives discussed in this documentation will be referred to as the 5.25" Slimline™ Series unless differentiation is necessary.

Contained in this section is a physical and functional description, and specifications of each model. Contents and sectional arrangement of this document are as listed:

Section 1	–	General Description
Section 2	–	Installation and Operation
Section 3	–	Theory of Operation
Section 4	–	Maintenance
Section 5	–	Troubleshooting
Section 6	–	Optional Configuration
Appendix A	–	Recommended Spare Parts List
Appendix B	–	Schematics

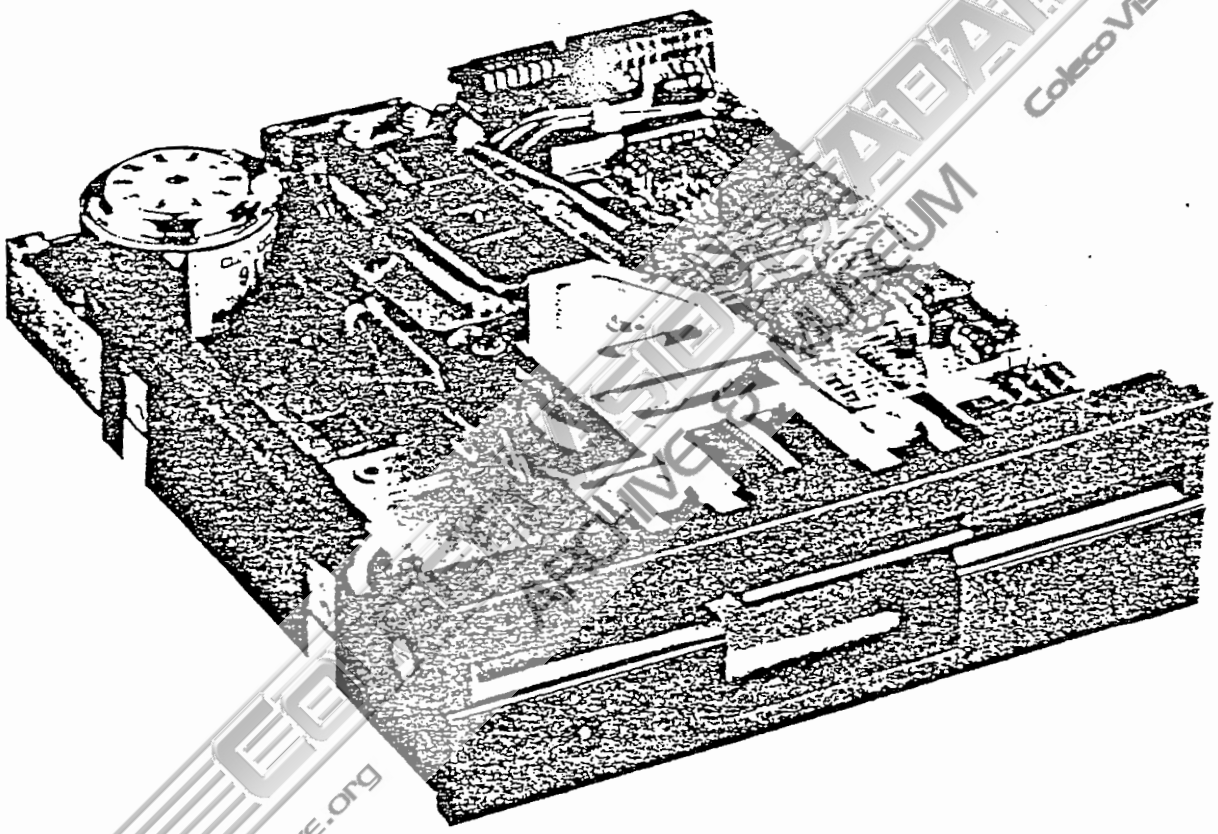


Figure 1-1: 5.25" Slimline Series Drive

1.2 PURPOSE OF EQUIPMENT

The ultra-compact 5.25" Slimline™ Series Disk Drives are high-speed, random access devices which store data on and retrieve data from an oxide coated mylar diskette that is 5.25 inches (133.35 mm) in diameter. It provides a highly reliable and compact solution to problems of low-cost data storage.

Typically, floppy disk drives are used with intelligent terminal controllers, microcomputers, word processing systems, data communications systems, error logging, microprogram loading, and point-of-sale terminals. The unique half-height profile of this series lends itself particularly well to applications where the absolute minimum space is provided. These applications include mounting under keyboards and CRT's as well as portable microcomputer systems. Also, this series allows 2 drives to be placed in the space of one standard height drive, thus doubling storage capacity with no increase in space requirements.

The 5.25" Slimline™ Series disk drives are available in a standard, high performance "industrial" version (501, 502, 901, 902) and a lower cost/performance version (501C, 502C). The 5.25" Slimline™ Series disk drives are fully compatable with the industry standard ANSI interface, and use industry standard 5.25" single and double sided diskettes.

1.3 PHYSICAL DESCRIPTION

The mechanical components of the drive consist of an aluminum chassis, on which is mounted a spindle and DC spindle motor; a stepper motor drive coupled to MPI's patented split band positioner for moving the magnetic head assembly; a cone/clutch assembly for centering and holding the recording media under operation; and the servo and control logic printed circuit boards. Access for diskette loading is at the front of the drive.

The series 500 drives are 48 TPI and the series 900 drives are 96 TPI. All drives are single or double density utilizing state of the art tunnel-erase manganese zinc heads.

1.4 FUNCTIONAL DESCRIPTION

The 5.25" Slimline™ Series is self-contained and requires no operator intervention during operation. The drive consists of a media-rotating system, a head-load and positioning system, and a write/erase and read system.

When the front door is opened, access is provided for the insertion of a diskette. The diskette is accurately positioned by chassis guides and their backstops. Closing the front door activates the cone/clutch system, resulting in centering of the diskette and clamping it to the spindle hub. The spindle hub is driven at a constant speed of 300 RPM by a servo-controlled DC motor in a closed-loop system.

When the drive is in operation, it is important that the head-to-media relationship be controlled. This is accomplished by the head-load system when the door is closed. The media is pressed against the lower head from the opposite

side by a felt pad (in Models 501, 501C, and 901) or the upper head (in Models 502, 502C, 902) with a force of approximately 17 grams. The head(s) is referenced to the index sensor and the spindle hub.

The recording head(s) is positioned over the correct track by means of a four-phase stepper motor and direct-drive band mechanism, and its associated electronics. A one-step movement causes a one-track movement. With this band positioning system, very high step rates can be accomplished.

When a Write Protected diskette is inserted, the write protect sensor normally disables the write/erase circuits in the drive. When writing, a 0.013 inch (nominal) data track is recorded for a 48 tpi drive, or a 0.00525 inch for a 96 tpi, followed by a tunnel erase which trims the track down to 0.012 inch (nominal) for 48 tpi or 0.005 inch for 96 tpi.

1.5 SPECIFICATION SUMMARY

This section provides mechanical and electrical specifications and information relevant in understanding the characteristics of the MPI 5.25" Slimline™ Series Flexible Disk Drive.

1.5.1 Capacity Specifications (K BYTES)

MODEL	501	502	501C	502C	901	902
Single Density (unformatted)						
Per Disk	125	250	125	250	250	500
Per Track	3.13	3.13	3.13	3.13	3.13	3.13
Double Density (unformatted)						
Per Disk	250	500	250	500	500	1000
Per Track	6.25	6.25	6.25	6.25	6.25	6.25

1.5.2 Functional Specifications

Tracks	40	80	40	80	80	160
Track Density (TPI)	48	48	48	48	96	96
Recording Density (BPI)						
Single Density	2768	2938	2768	2938	2768	2938
Double Density	5536	5876	5536	5876	5536	5876
Access Time (milliseconds)						
Track to Track	6	6	20	20	3	3
Average (standard)	85	85	272	272	85	85
Average (optional with head load solenoid)	97	97	N/A	N/A	97	97

MODEL	All 5.25" Slimline™ Series Drives
Head Settling Time	15ms
Head Load Time	35ms
Standard	0ms
With Optional Head Load Solenoid	35ms
Rotational Speed (RPM)	300 ±1 1/2%
Average Latency	100ms
Transfer Rate	
Single Density	125K bits/sec
Double Density	250K bits/sec
Encoding Method	FM,MFM,M^2FM
Power-Up-Delay	0.5sec
Interfacing	Industry/ANSI compatible

1.5.3, Physical Specifications

Environmental	
Operating Temperature	Dry Bulb 40°F to 115°F (4.4°C to 46.1°C)
	Wet Bulb 79°F maximum (26°C maximum)
Non-Operating Temperature	Dry Bulb -40°F to 160°F (-40°C to 71°C)
	Wet Bulb 86°F maximum (30°C maximum)
Operating Humidity	20% to 80% (non-condensing)
Non-Operating Humidity	5% to 95% (non-condensing)
Operating Altitude	-500 to 10,000 FT(-152.4 to 3,048m)
Non-Operating Altitude	-1000 to 50,000 FT(-304.8 to 15,240m)
Vibration (operating)	5 to 500Hz, 0.5G for 48 tpi drives
	5 to 500Hz, 0.3G for 96 tpi drives
Electrical	
DC Power	+12V ±5%,0.9 Amp (1.5 Amp surge) 0.2v ripple
	+5V ±5%,0.6 Amp, 0.1v ripple
Power Dissipation	14W operation; 8W standby
Mechanical	
Height	1.70 in.(43.2mm)
Width	5.79 in.(147.1mm)
Length	7.50 in.(190.6mm)
Weight	2.2 lbs.(1.0kg)

Media Requirements	
Diskette	Industry Compatible, 5 1/4in.
Sectoring	Soft; 10,16
Type	Single or Double Sided Single or Double Density

1.5.4 Reliability Specifications

MTBF	9,200 hours (@ 25% duty cycle)
MTTR	0.5 hours
Design Life	5 years
Media Life	3×10^6 passes/track
Media Insertions	Greater than 30,000
Data Integrity	
Soft Errors	1 per 10^9 bits read
Hard Errors	1 per 10^{12} bits read
Seek Errors	1 per 10^6 seeks
Head Life	20,000 Hours Contact Time
UL and CSA Approved	

SECTION 2

INSTALLATION AND OPERATION

2.1 INTRODUCTION

This section provides mounting information and procedures necessary for proper installation and operation of the 5.25" Slimline™ Series Disk Drives.

2.2 UNPACKING

CAUTION

During unpacking, care must be exercised to ensure that all tools are non-magnetic and do not inflict damage to the unit.

As the unit is unpacked, inspect it for possible shipping damage. All claims for this type of damage should be filed promptly with the transporter involved. If a claim is filed for damages, save the original packing material. Most packing material may be reuseable if reasonable care is used in unpacking. If reshipment is required, be sure to insert the shipping diskette that was shipped with the unit and close the door. Unpack the drive as follows:

A. Remove external packing material carefully.

B. Remove the drive from the container.

C. Remove shipping diskette.

D. Ensure that front access door opens and closes, and that the head-load arm (see figure 4-1) raises when door is opened.

E. Check the control logic and servo PCBA's for loose connectors.

F. Ensure that drive hub manually rotates freely.

G. Ensure that stepper motor/head carriage assembly is not binding at any point by gently moving carriage back and forth.

2.3 INSTALLATION

Due to its unusually small size and light-weight, the 5.25" Slimline™ Series can be installed or mounted in any convenient location or position. However, the drive must be installed in a location that will prevent the I/O cable from exceeding ten feet in length.

2.4 MOUNTING PRECAUTIONS

Because the flexible disk drive is a precision device in which certain critical internal alignments must be maintained, it is important that the mounting scheme does not introduce significant stress on the drive. In addition, mounting schemes involving more than two hard mounting points should be avoided. Slide mounting generally satisfies the stress mounting requirements for the drive, as long as adjustable brackets or resilient members are used to accommodate tolerances. Figure 2-1 shows all pertinent dimensions for mounting the 5.25" Slimline™ Series drives.

NOTE

Any mounting scheme in which the drive is part of the structural integrity of the enclosure is not permitted.

2.5 DUST COVER

Since the flexible disk drive is not provided with a dust cover, the design of an enclosure should incorporate a means to prevent direct ingress of loose items, e.g., dust, paper punch waste, etc.

2.6 COOLING

Heat dissipation from a single disk drive is normally less than 15 watts (40 Btu/Hr). When the drive is mounted so that the components have access to free flow of air, normal convection cooling allows operation over the specified temperature range. When the drive is mounted in a confined environment, air flow may have to be provided to maintain specified air temperatures in the vicinity of the motors, PCBA, and the diskette.

2.7 CABLE REQUIREMENTS

The electrical interface between the 5.25" Slimline™ Series and the controller is accomplished by two connectors. The first connector, J1, is a

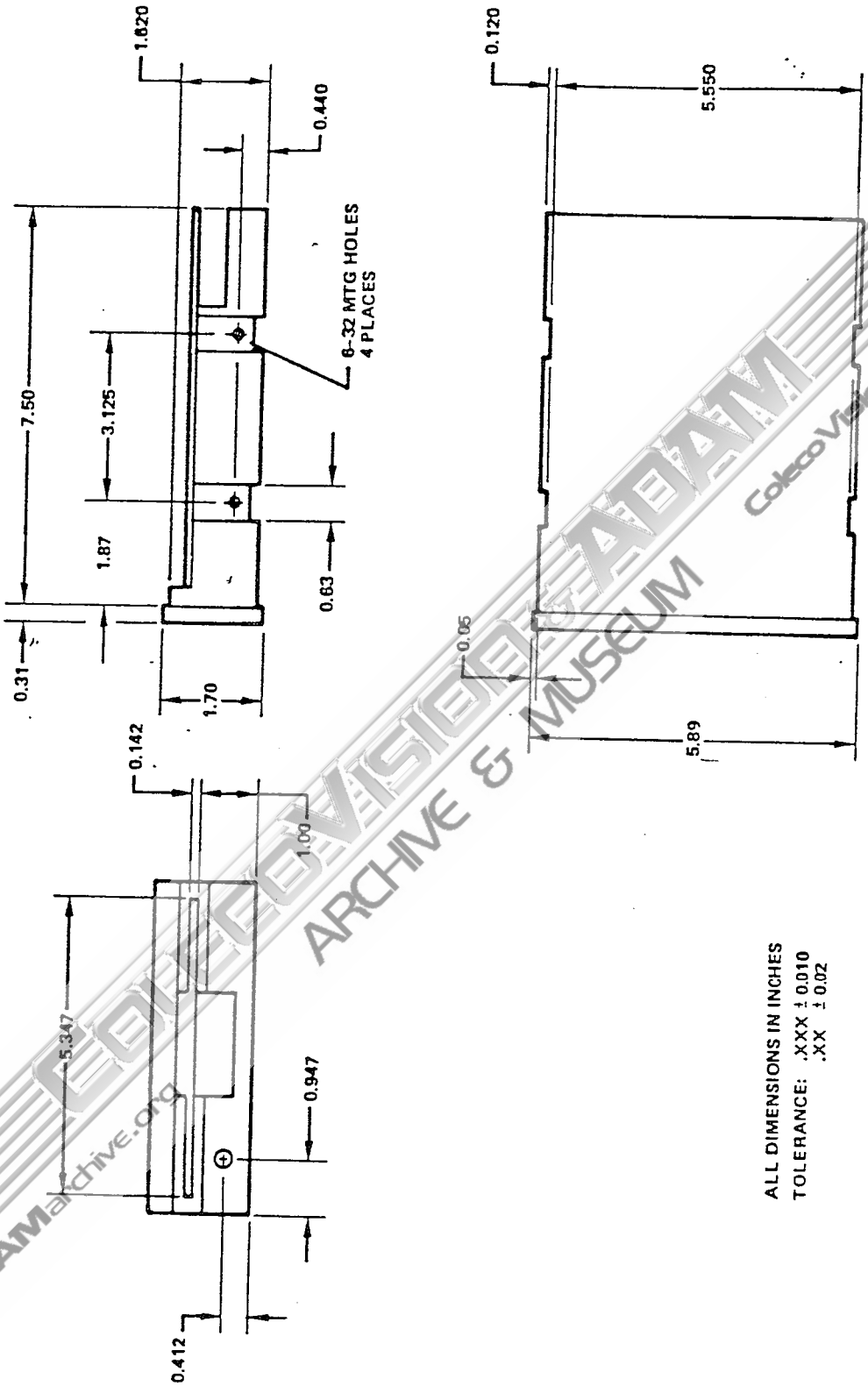


Figure 2-1: Mounting Dimensions

36 pin edge connector and provides the signal interface. A slot is provided between pins 4 and 6 for keying the connector. The maximum cable length from connector to connector should be 10 feet (3 meters). Refer to table 2-1 for cable connector part number and attachment, and figure 3-4 for dimensions. Figure 3-2 provides information relative to the connector pin/signal assignments for the I/O cable.

The second connector, J2, provides DC power to the drive and is mounted on the non-component side of the control logic PCBA. The drive uses +12v and +5v DC. Paragraph 1.5.3 outlines the voltage and current requirements. The recommended mating connector, P2, is Amp P/N 1-480424-0 using Amp pins P/N 60619-1.

Table 2-1: Recommended Connectors — P1

TYPE OF CABLE	MANUFACTURER	CONNECTOR P/N	CONTACT P/N
Twisted Pair, 26	AMP	583717-5	1-583616-1
Flat Cable	3M "Scotchflex"	3463-0001	N.A.

2.8 OPERATIONAL PROCEDURES

The 5.25" Slimline™ Series was designed for easy operation with a wide range of operator oriented applications. The drive is under direct control of the interface and power sources. No special start-up procedures are necessary. Secure both power and I/O connectors prior to loading a diskette.

2.8.1 Diskette Loading

The diskette is a flexible disk enclosed in a plastic jacket. The interior of the jacket contains a liner which is specially designed to clean the disk. Figure 2-2 shows the proper way of loading the diskette into the drive. To load a diskette, depress the latch, insert the diskette with the label facing out and close the access door. This will align the diskette on the drive spindle. The diskette can be loaded or unloaded with power on and the spindle rotating. When not in use the diskette should be stored in the envelope.

2.8.2 Diskette Care and Handling

To get the best performance from your diskettes and to protect the information you need, it's best to keep to the following rules:

A. Return the diskette to it's storage envelope whenever it is removed from the drive.

B. Keep the diskette away from magnetic fields and from ferro-magnetic materials which might become magnetized. Strong magnetic fields can distort recorded data on the diskette. Keep diskettes away from telephones.

C. Replace storage envelopes when they become worn, cracked or distorted. Envelopes are designed to protect the diskette.

D. Do not write on the plastic jacket with a lead pencil or ball-point pen. Use a felt tip pen.

E. Do not expose the diskette to heat or sunlight or to an unclean environment.

F. Head contamination or dirt can damage the disk.

G. Do not touch or attempt to clean the disk surface. Abrasions may cause loss of stored data.

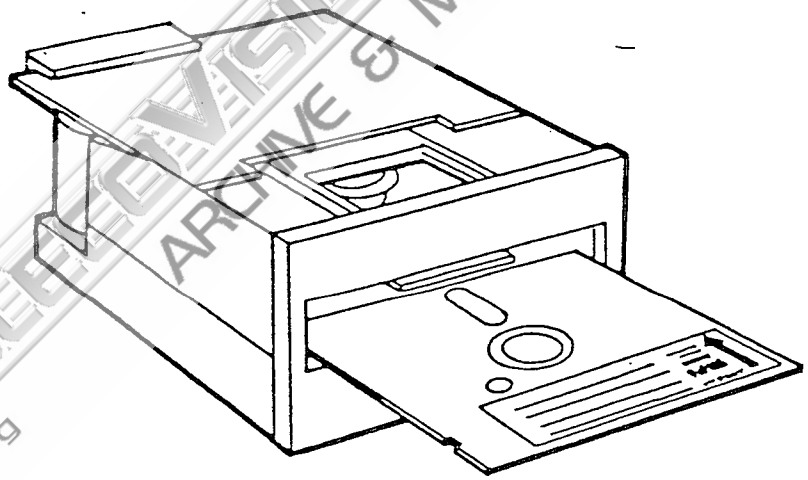


Figure 2-2: Diskette Orientation

2.8.3 Write Protected Diskette

Most diskettes today incorporate a write protect feature so your system cannot accidentally write over or destroy valuable information contained on your diskette.

The write protect feature is deactivated by the hole in the diskette as shown in figure 2-3. When the hole is covered it is write protected, when the hole is uncovered writing is allowed. For write protection, the hole is covered by placing a tab over the front of the hole and folding over the tab to cover the rear of the hole. By removing the tab the diskette can once again be write enabled.

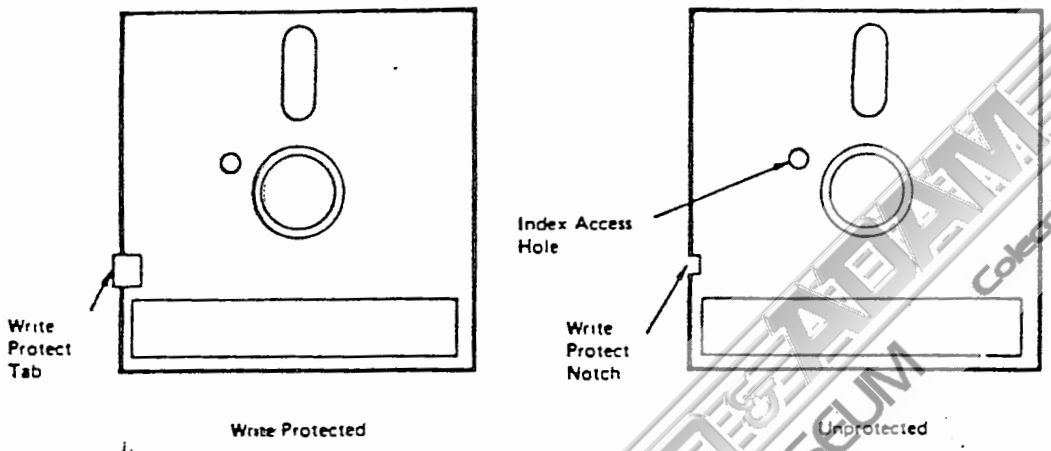


Figure 2-3: Write Protected Diskette

SECTION 3

THEORY OF OPERATION

3.1 INTRODUCTION

This section contains information on the electrical interface, diskette formatting, and a physical description of the 5.25" Slimline™ Series Disk Drives. The text is referenced to block and timing diagrams in this section. The organization of material in this section is as follows:

A. The electrical interface requirements between the host system and the 5.25" Slimline™ Series Drives.

B. A physical description of the electronics and mechanics of the disk drive.

C. Information pertaining to data encoding and recovery.

Table 3-1 is a section index and lists the topics discussed and their location within this section.

Table 3-1: Section Index

Topic	Paragraph
Electrical Interface	3.2
Physical Description	3.3
Data Encoding and Recovery	3.4

3.2 ELECTRICAL INTERFACE

Interface connections are made thru two cables, the power cable and signal or I/O cable. The following paragraphs will describe each line on the interface cable. Refer to figures 3-2 and 3-3 for connector pin assignments, and figure 3-4 for connector dimensions.

All lines on the signal interface are digital (TTL open collector) in nature and provide either input signals to the drive or output status and data to the

controller. Each line is paired with a ground line. All output lines are open collector outputs and must be properly terminated at the controller end. The signal interface cable should be a 36 wire flat ribbon cable no more than 10 feet in length.

3.2.1 Line Termination

Figure 3-1 is the recommended driver/receiver circuit for all interface signals (connector J1). A signal on an input line will be received by a 74LS14 receiver at the drive and should be driven by a 7438 driver or equivalent by the user system. Likewise, an output signal from the drive will be driven by a 7438 and should be received by a 74LS14 or equivalent at the user system. All input signals are terminated directly by either a 150 ohm to +5v or a 220/330 ohm resistor network. In multiple drive systems using daisy chain connections, all input lines should be terminated only at the last drive, while in star scheme connections, each individual drive should be terminated properly.

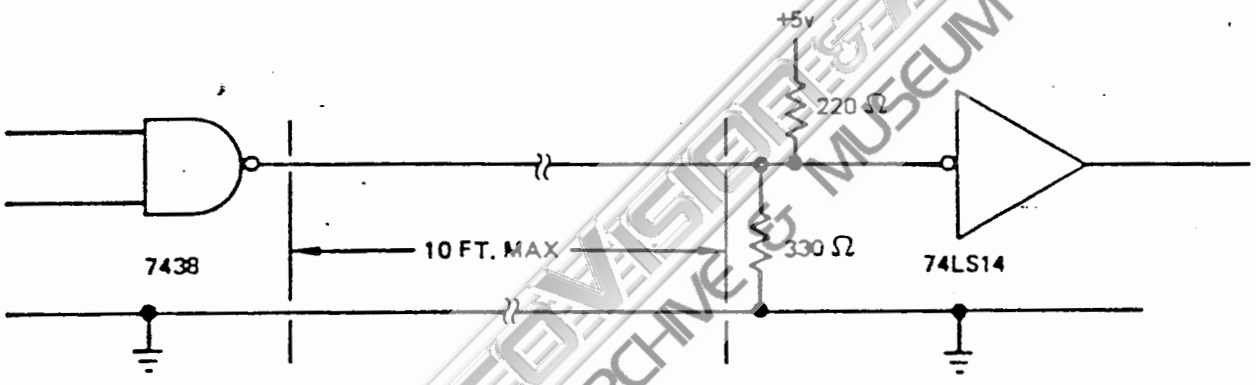


Figure 3-1: Control Signals Driver/Receiver Combination

3.2.2 Input Lines

In multiple drive systems all input lines will go to all drives but only the selected drive will respond to these signals. A drive can be selected by a user assigned jumper installation in the drive and by activating the corresponding Drive Select input line. Input signal lines have the following specifications:

A. Active or true = logical zero (0.0V to .4V)

B. Inactive or false = logical one (2.5V to 5.25V)

C. Input impedance = 150 ohm or 132 ohm for 220/330 termination.

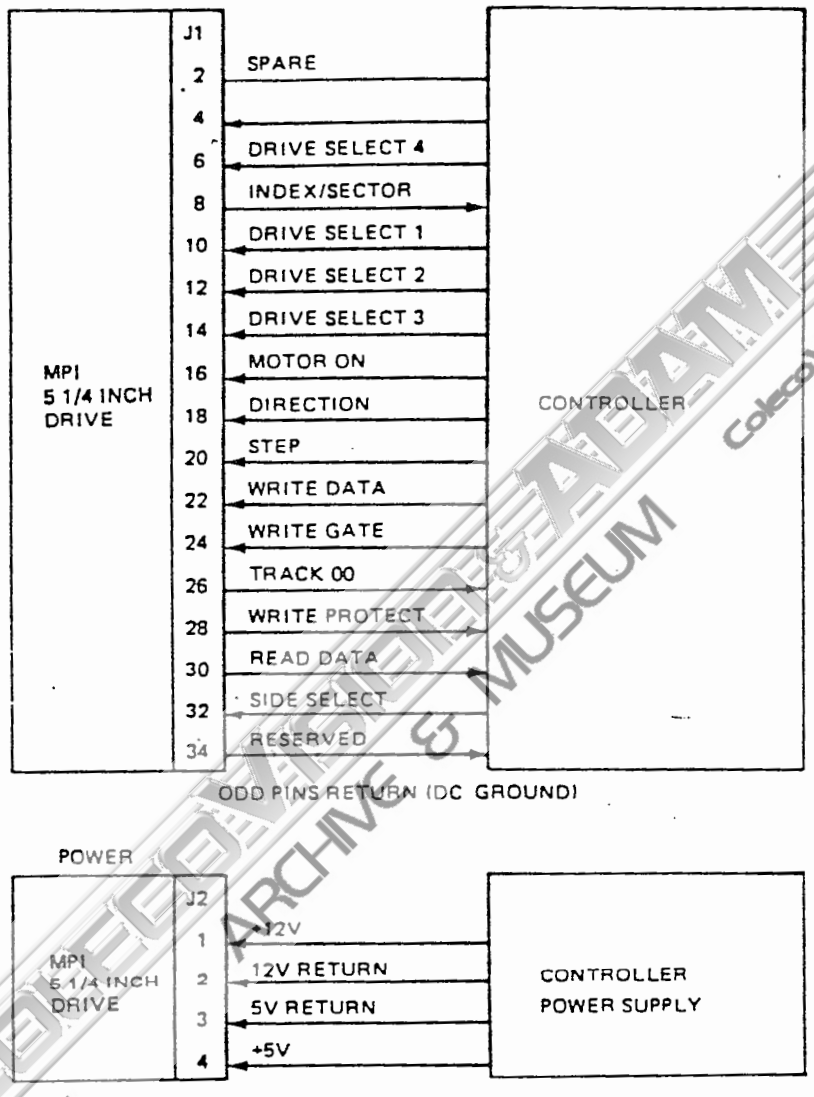
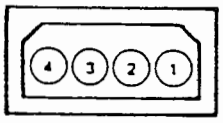


Figure 3-2: Interface Signals



Pin 1 +12V DC
Pin 2 12V Return
Pin 3 5V Return
Pin 4 +5V DC

Figure 3-3: DC Power Connector, J2

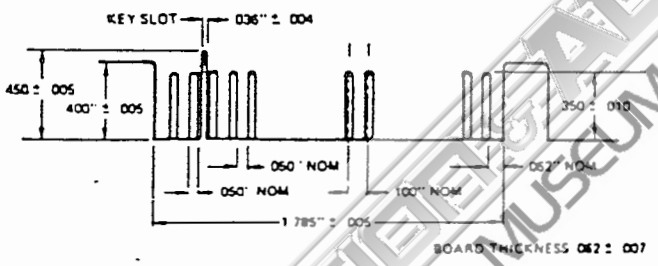


Figure 3-4: J1 Connector Dimensions

3.2.2.1 Drive Select 1-4

The DRIVE SELECT lines provide a means of selecting and deselecting the drives. Four separate DRIVE SELECT lines are provided so that up to four drives may be connected to a single controller. Jumpers 1-2, 3-4, 5-6, and 7-8 correspond to DRIVE SELECT 1, 2, 3, and 4, respectively. By placing only one of these jumpers in each drive, only one drive will be selected when activating any one of the DRIVE SELECT lines.

When the signal level is true (low), the disk drive electronics are activated, the head is loaded, and the drive is conditioned to respond to step or read/write commands. When the signal level is false (high), the input control lines and output status lines are disabled. A SELECT line must remain stable in the true (low) state until the execution of a step or read/write command is completed.

3.2.2.2 Motor On

This input is provided to extend the life of the DC spindle motor. The motor should be turned off if no activity is required

after 10 revolutions of the diskette. A minimum of 0.5 seconds is required before performing a read or write after the MOTOR ON line is activated (see figures 3-6 and 3-8).

3.2.2.3 Direction Select

The direction of motion of the Read/Write head is defined by the state of this input line. A true (low) level defines direction as "IN" (towards center of the disk); a false (high) level defines the direction as "OUT" (see figure 3-5).

3.2.2.4 Step

A single pulse on this input will move the Read/Write head one track in or out, dependent on the state of the DIRECTION SELECT line. The motion of the head is initiated on the trailing edge of STEP pulse. A minimum of a 0.2 us pulse width at a maximum frequency of 333 Hz for 96 tpi (3ms track to track); 167 Hz for 48 tpi (6ms track to track) should be maintained to assure step integrity (see figure 3-5).

3.2.2.5 Write Gate

When true, this input line permits writing of data. When inactive, it permits transmitting data to the controller. Allow a minimum of 1 ms after dropping WRITE GATE before expecting valid READ DATA (see figures 3-8 and 3-10).

3.2.2.6 Write Data

The frequency of the WRITE DATA is dependent upon the encoding scheme used, the density option exercised, and the data pattern to be written. The write oscillator frequency stability should be held to 0.1%. The data pulse width should be a minimum of 0.2 us and a maximum of 3.5 us wide. WRITE DATA is effective when WRITE GATE is true. It is recommended that the leading edge of the first WRITE DATA pulse occur no sooner than 4 us and no later than 8 us after the leading edge of the WRITE GATE true signal. The WRITE GATE false signal should occur no sooner than 4 us and no later than 8 us after the last data pulse. (see figures 3-8 and 3-9)

3.2.2.7 Side Select

This input is used to select either the upper or lower head. A 35 usec delay should be allowed for the read amp to recover after a head select event occurs. Only then will valid data be present. (For Models 501, 501C, and 901, this line should always be high.)

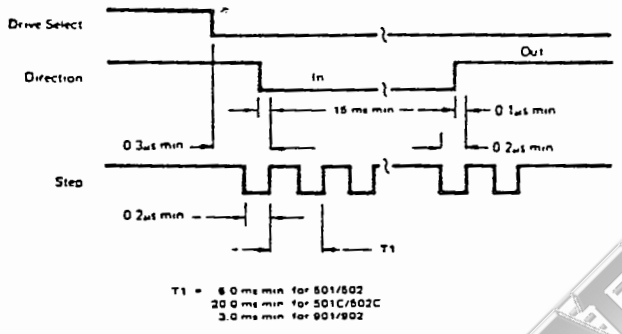


Figure 3-5: Track Access Timing

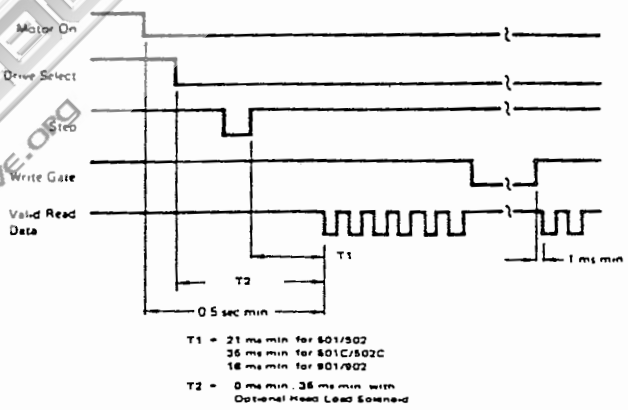
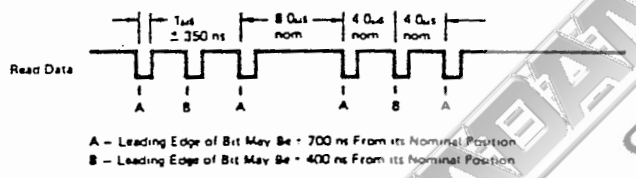
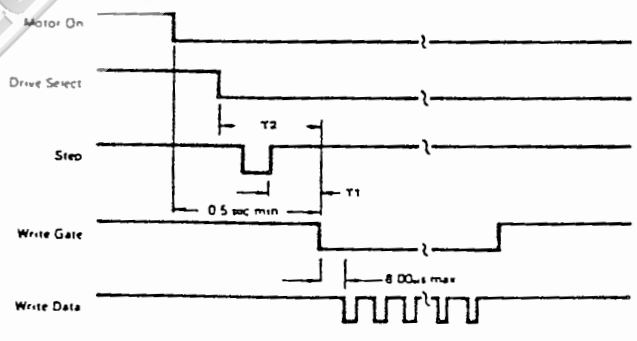


Figure 3-6: Read Initiate Timing



A – Leading Edge of Bit May Be ± 700 ns From its Nominal Position
B – Leading Edge of Bit May Be ± 400 ns From its Nominal Position

Figure 3-7: Read Signal Timing



T1 = 21 ms min for 801/802
26 ms min for 801C/802C
18 ms min for 901/902
T2 = 0 ms min 36 ms min with
Optional Head Load Solenoid

Figure 3-8: Write Initiate Timing

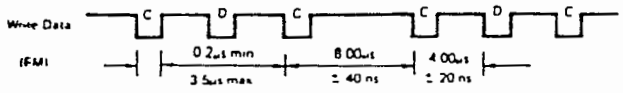


Figure 3-9: Write Data Timing

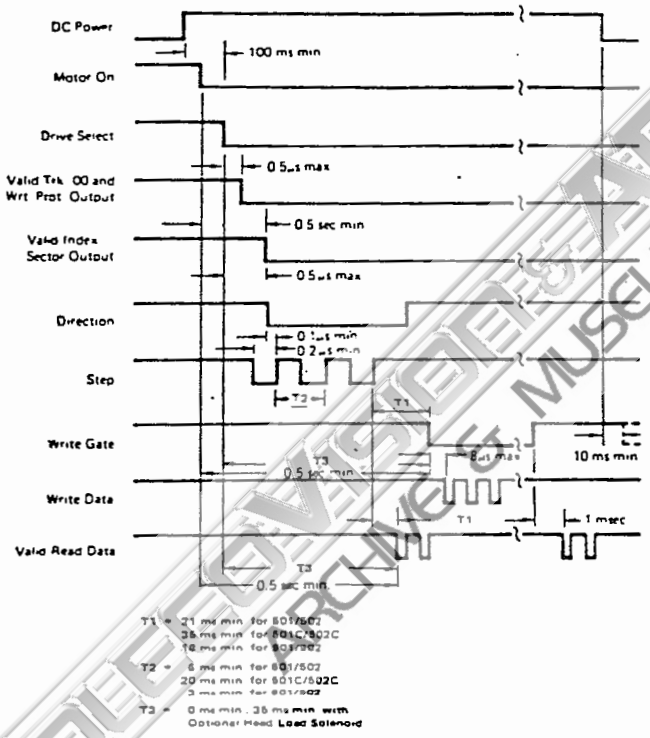


Figure 3-10: General Control Timing

3.2.2.8 In Use (Alternate Input)

This line is connected to a driver which is reserved for custom features.

3.2.3 Output Signals

The control output signals are driven with an open-collector which is capable of sinking a maximum of 48 ma current at logical zero. Logical zero is a true state with a maximum voltage of 0.4V measured at the driver. When the line driver is in a logical one or false state, the collector cutoff current is a maximum of 250 ua.

3.2.3.1 Track 00

This output, when true, indicates that the Read/Write head(s) are located over TRACK 00.

3.2.3.2 Index/Sector

When utilizing a soft-sectored diskette, an INDEX pulse is transmitted to the controller once every revolution indicating the beginning of a track. If a hard-sectored diskette is utilized, one SECTOR pulse for every sector in addition to one INDEX pulse per revolution will be transmitted to the controller. (Reference figures 3-11 and 3-12 for timing) Note that figure 3-12 is for a 16 hard-sector diskette.

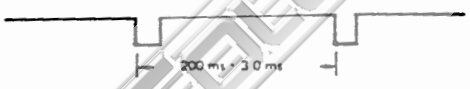


Figure 3-11: Index/Sector Timing (soft sector)

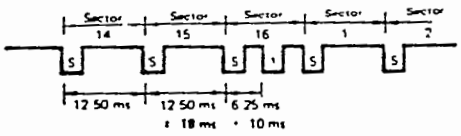


Figure 3-12: Index/Sector Timing (hard sector)

3.2.3.3 Write Protect

This interface signal is provided by the drive to give the user an indication that a write protected or read-only diskette has been installed (see figure 2-6). This output is false when the diskette is not write protected. This line may easily be used as a Disk Installed Indicator, if only write protected disks are used.

3.2.3.4 Read Data

This output represents digitized data as detected by the drive electronics. Information transmitted will be in the encoding scheme used. Pulse width of both clock and data bits will be 1 usec $\pm$350 nsec. The leading edge of each READ DATA pulse represents the true position of the flux transition on the recording media.

3.3 FUNCTIONAL CHARACTERISTICS

The 5.25" Slimline™ Series disk drives consists of read/write and control electronics, a speed control servo mechanism, a drive mechanism and a track positioning mechanism. The Models 501, 501C, and 901 have one read/write head and utilize a single sided diskette. The Models 502, 502C, and 902 have two read/write heads and use either a standard two-sided or single sided diskette. The 5.25" Slimline™ Series can interpret and generate control signals, move the read/write heads to the desired position, and read and write data. The stepper motor/metal band actuator moves the carriage assembly to position the read/write heads on the desired track.

Figure 3-13 is a functional block diagram of the following mechanical and electrical components of the disk drive:

A. Head positioning control

B. Track 00 sensor

C. Spindle drive control

D. Index sensor

E. Head load mechanism

F. Side selection

G. Data recording and retrieving

1. Write protect sensor
2. Write/erase control
3. Data recording
4. Data reading

3.3.1 Head Positioning Control

The head positioning circuit is comprised of a four-phase stepper motor, a pulley, and metal band combination for converting rotational to linear motion. The pulley/band is attached to the head carriage. Signals from the motor control PCBA drive the stepper motor which, through the pulley/band, move the head carriage

assembly. The motor control PCBA responds to signals from the control logic PCBA.

The four-phase stepper motor operates in a "two-phase on" mode for all series drives. One step of the motor equals a one-track linear motion of the head(s). This one-to-one ratio results in high positioning accuracy and high step rates. When positioned at Track 00 the correct phases on are 4 and 1. To move the head(s) toward the center of the diskette, with the DIRECTION line high, the correct phase sequence is as shown in table 3-2.

Table 3-2: Stepper Motor Phase Sequence

TRACK	PHASES ON
00	4 and 1
01	1 and 2
02	2 and 3
03	3 and 4
04	4 and 1

3.3.2 Track 00 Sensor

The track 00 sensor comprises a light source (LED) and a phototransistor positioned on either side of a shutter mounted on the head carriage assembly. The output of this photo detector connects to a conditioning circuit that converts the output of the phototransistor to TTL levels. When the head positioning logic positions the head over track 00, the output of the conditioning circuit is a low-true logic level on the TRACK 00 interface line. This signal also inhibits the stepper motor circuitry from responding to any "step out" command.

3.3.3 Spindle Drive Control

The spindle is rotated, via a belt, by a DC motor/tachometer combination. The electronics for speed control takes timing information from the tachometer (A), compares it with a reference time (B), and generates a driving voltage for the spindle motor proportional to the difference between (A) and (B). When the MOTOR ON interface line is true the control circuit allows the motor to come up to speed. The control circuit also includes a section that disables the motor drive in case of no tachometer output for approximately 150 ms (possible indication of a binding spindle or motor). The diskette is centered and held on the spindle hub by a clamping mechanism which actuates in conjunction with the front door.

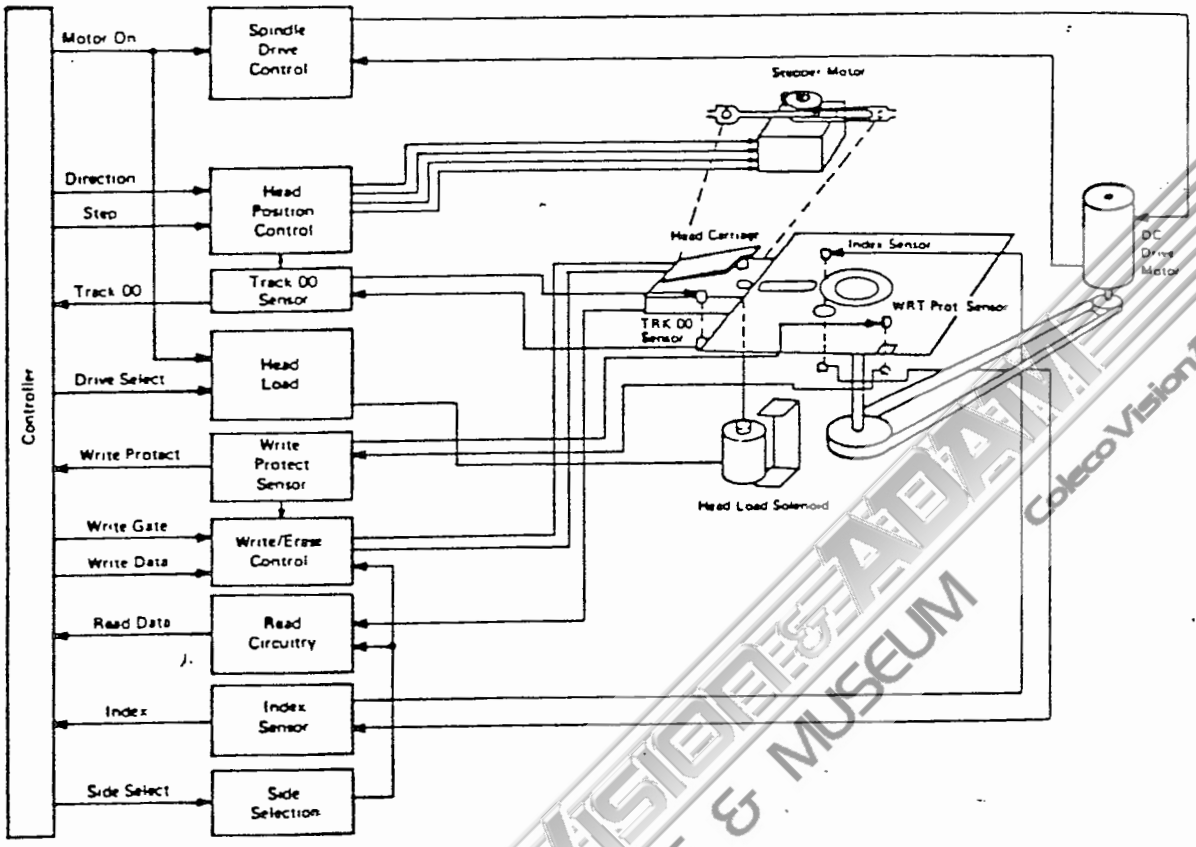


Figure 3-13: Functional Block Diagram

3.3.4 Index Sensor

The LED and phototransistor in the index sensor photo detector are mounted on opposite sides of the index hole in the diskette. The index hole acts as the shutter. When the light beam from the LED passes through the diskette hole and strikes the phototransistor, the output of the phototransistor, through a conditioning circuit, generates a low true logic level on the INDEX interface line. The position of the phototransistor is adjustable.

3.3.5 Head Load Mechanism

The head load mechanism is an optional device and consists of a head load solenoid and a head load solenoid driver. The interface logic may be connected to energize the solenoid via either DRIVE SELECT or MOTOR ON interface signals. Activating the solenoid causes the diskette to be pressed against a fixed platen. A spring-loaded load arm with a felt pad (Models 501, 501C, and 901)

or upper head (Models 502, 502C, and 902) opposite the lower head will press the diskette against the lower head. This load arm is lifted when the front access door is opened regardless of the state of the solenoid. In the standard drive the head(s) is loaded automatically whenever the door is closed.

3.3.6 Side Selection

The Models 502, 502C, and 902 disk drives have two read/write heads; one on each side of the diskette. Therefore, prior to the read or write process the desired "side" (head) of the diskette must be selected. Interface signal SIDE SELECT controls a decoder that enables the read/write amplifiers for either head zero (lower head) or head one (upper head).

3.3.7 Data Recording and Retrieving

The drive uses tunnel-erase head(s). The erase gap follows the write/read gap in the head assembly. The erase gap erases the edges of the written track to provide a guard band between tracks to allow for positioning tolerances among drives. The recording and retrieving electronics consist of:

A. Write current source

B. Steering circuit

C. Erase driver

D. Read amplifier

E. Differentiator

F. Cross-over detector

G. Pulse generator

3.3.7.1 Data Recording

To record digital data, current is passed through the winding on the write/read head core which sets up a flux field across the write/read gap. This orients the iron oxide particles on the diskette surface underneath the gap to the same polarity. The direction of the flux field is a function of the polarity of the write current. Data is written by reversing the current through the head. Each flux reversal represents a data bit. The head(s) in the drive uses a center-tapped write/read winding, where the current reversal is accomplished by steering the current through one or the other of the two halves of the winding. Figure 3-14 shows the basic recording technique. The following conditions must be accomplished by the user before the recording can begin:

A. Spindle speed must be stabilized. This condition will exist 0.5 seconds after the MOTOR ON command is issued.

B. Head/media must be stabilized subsequent to the HEAD LOAD command. This requires 35 ms in drives equipped with a head load solenoid (see figure 3-10).

C. Head must be settled subsequent to the STEP command (see figure 3-8).

The preceding conditions may be overlapped. It is recommended that the first WRITE DATA command be within 4 to 8 microseconds after WRITE GATE goes true, and the last WRITE DATA command be within 4 to 8 microseconds before WRITE GATE goes false (see figure 3-8).

3.3.7.2 Data Retrieving

The retrieving (read) electronics comprises the following elements:

A. Read amplifier

B. Linear filter

C. Differentiator

D. Cross-over detector

E. Digital filter

F. Pulse shaper

Before reading can begin, several conditions must be established by the user system. First, the same conditions applicable to data recording must be met. Additionally, if the previous operation was writing, 1 millisecond must be allowed after termination of WRITE GATE to allow for erase and circuit-settling time (see figure 3-6). Figure 3-15 shows wave forms in the read sequence. The head generates a wave form with peaks corresponding to the flux transitions. This wave form is amplified, fed through a low-pass filter, and then differentiated to make the peaks occur at zero cross-over. The read signal is next fed to a cross-over detector, which generates a pulse for each zero cross-over. These pulses are fed through a digital filter which removes false pulses. Finally, the pulse shaper generates a 1 microsecond pulse corresponding to each flux transition. This composite read data is sent to the user interface via the READ DATA line.

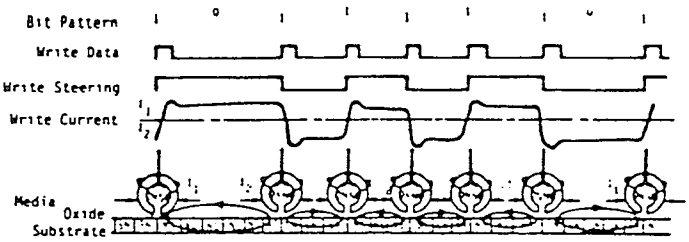


Figure 3-14: Basic Recording Technique

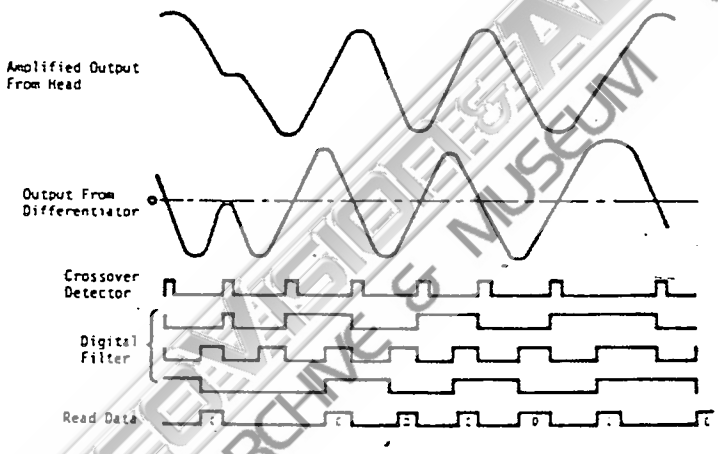


Figure 3-15: Wave Forms in Read Sequence

3.4 DATA ENCODING AND RECOVERY

This section provides applications information relevant to the recording and recovery of data with the 5.25" Slimline™ Series Drives. The most common methods for encoding data are described in the following paragraphs. Table 3-3 shows a comparison of these encoding techniques.

NOTE

Timing diagrams (figures 3-16, 3-17, and 3-18) show data as "low true".

3.4.1 FM Encoding

FM (frequency modulation) encoding has the following rules:

A. A data bit, if it is a "1", occurs at the center of the bit cell.

B. A clock bit occurs at the start of the bit cell.

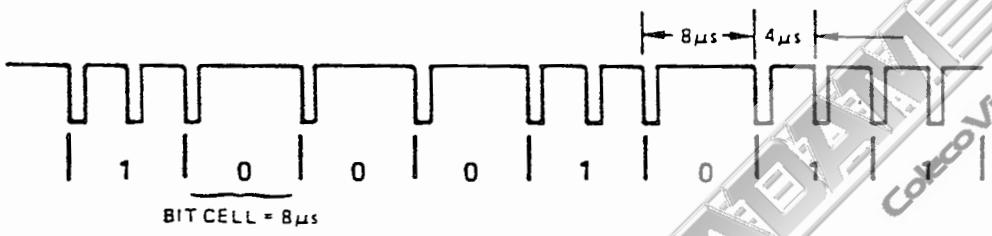


Figure 3-16: FM Encoding

3.4.2 MFM Encoding

MFM (modified FM) encoding has the following rules:

A. A data bit, if it is a "1", occurs at the center of the bit cell.

B. A clock bit occurs at the start of the bit cell, but only if no data bit occurred in the previous bit cell and no data bit will occur in the current bit cell.

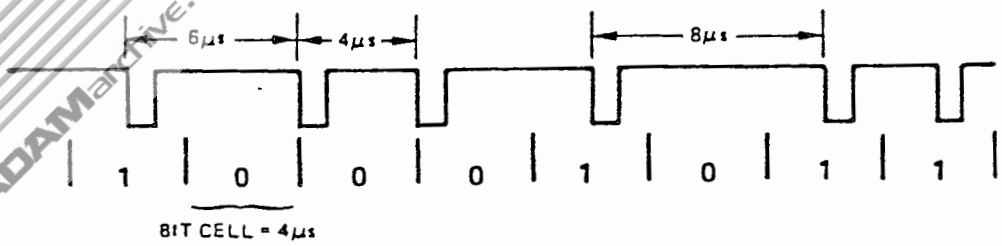


Figure 3-17: MFM Encoding

3.4.3 M²FM Encoding

M^2FM (modified MFM) encoding has the following rules:

A. A data bit, if it is a "1", occurs at the center of the bit cell.

B. A clock bit occurs at the start of the bit cell, but only if neither a data bit nor a clock bit occurred in the previous bit cell and no data bit will occur in the current bit cell.

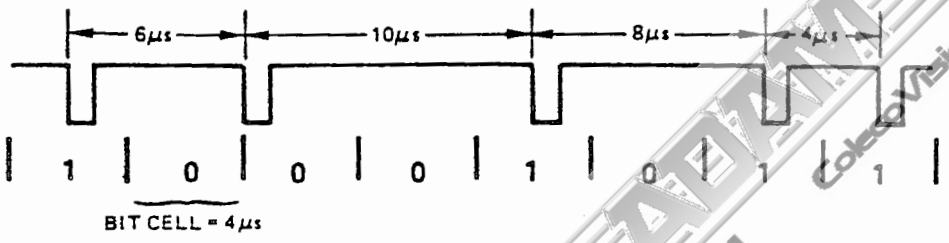


Figure 3-18: M²FM Encoding

3.4.4 Data Recovery

Data recovery refers to the retrieving of data from the flexible diskette. The following paragraphs describe the problems associated with data recovery and methods to ensure data reliability.

3.4.4.1 Bit Shift

Bit shift refers to the displacement of a bit, as detected by the drive, from its nominal position. Several causes of bit shift are R/W head resolution, media resolution, diskette speed variation, and signal-to-noise ratio of read head output. Any data separation technique used must have a read window of at least 1.5 us to handle this bit shift.

3.4.4.2 Write Precompensation

Certain data patterns cause more bit shift than other patterns. This bit shift is predictable and can thus be partially compensated for. For example, if it is known that a bit will be shifted by 500 ns when it is read back, then the bit can be deliberately written 200 ns early. This would give a bit shift of about 300 ns when it is read back. This method of reducing bit shift is called write precompensation.

Bit shift is greater on the inner tracks of the diskette than on the outer tracks, making write precompensation necessary only on the inner tracks. Write precomp of 125 to 250 ns should be used on tracks 18 through 39 for series 500 drives, and tracks 36 through 79 for series 900 drives. Table 3-3 shows which encoding methods require the use of write precompensation.

3.4.4.3 Data Separation

Data separation refers to the separating of the composite data coming from the drive into separate clock and separate data bits.

For FM recording, a one-shot data separator is quite sufficient. For double density recording, a phase-lock-loop (PLL) data separator should be used. There is another method of data separation, the digital counter method. This method is a very poor approximation of a PLL. It has a theoretical read window of only 1.0 us which, as per paragraph 3.4.4.1, is not sufficient to handle bit shift.

In MFM recording, data bits and clock bits are subject to the same amount of bit shift. A PLL separator with a 50% data window and a 50% clock window should be used.

In M^2FM recording, data bits are subject to more bit shift than clock bits. A PLL separator with a 60% data window and a 40% clock window should be used.

3.4.5 Track Format

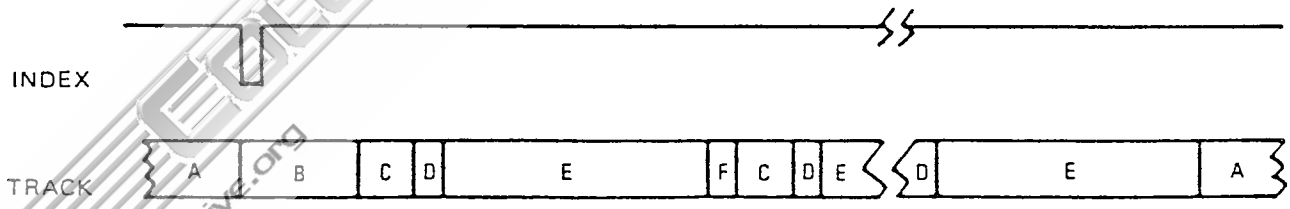
When determining the track format to be used, the following timing restraints should be considered (see Figure 3-19).

A. Postamble: The postamble period must be at least 3 ms to allow for spindle speed variation of ± 1 1/2%.

B. Data Gap: The data gap period must be at least 1.2 ms to allow for tunnel erase turn off time.

Table 3-3: Comparison of Encoding Techniques

Encoding Technique	FM	MFM	M^{2}FM
Bit Cell Time	8 µs	4 µs	4 µs
Possible pulse spacing	4 µs	4 µs	4 µs
	8 µs	6 µs	6 µs
		8 µs	8 µs
			10 µs
Frequency components of read signal	125 KHz	125 KHz	125 KHz
	62.5 KHz	93.75 KHz	93.75 KHz
		62.5 KHz	62.5 KHz
			50 KHz
Encoder complexity	Simple	Moderate	Moderate
Write precompensation needed	No	Yes	Yes
Data separator recommended	One-shot	PLO(50-50 window)	PLO(60-40 window)
Data separator complexity	Simple	Moderate	Moderate



A – Postamble
B – Preamble
C – ID Record
D – ID Gap
E – Data Record
F – Data Gap

Figure 3-19: Typical Track Format

SECTION 4

MAINTENANCE

4.1 INTRODUCTION

This section contains preventive maintenance procedures, component removal/replacement procedures, and adjustment and measurement procedures. The material is referenced to drawings located throughout the text, a spare parts list located in Appendix A, and drawings and schematics located in Appendix B. Adjustment procedures will be required if parts are changed due to malfunction and measurements should be made periodically to ensure data quality or if malfunctions are suspected. It is recommended that a master alignment diskette be kept and that each alignment be verified to the master.

Table 4-1: Section Index

Topic	Paragraph
General Information	4.2
Preventive Maintenance	4.3
Recommended Tools and Test Equipment	4.4
Removal/Replacement Procedures	4.5
Adjustment Procedures	4.6
Measurement Procedures	4.7

4.2 GENERAL INFORMATION

The following statements are applicable to all facets of drive maintenance:

A. Do not remove any components or the printed circuit boards or connect or disconnect any plugs while power is applied to the drive.

B. Component-location instructions are referenced as viewed from the front of the drive.

C. Female connectors that carry signals internal to the drive slip over pins of the male connectors. Most of the connectors are keyed so that they cannot be plugged into the wrong receptacle. However, they can be inserted upside down. For positioning accuracy one side of the female connectors is slotted with so-called "windows" over the pins. Installation instructions are given to install the connectors with the window side facing a certain direction, i.e., toward the chassis, away from the chassis, etc.

D. Do not use magnetic tools within the drive.

E. Instructions are given to "remove screws or replace screws"; it is understood that flat washers, lock washers, and shims (where required) are also to be removed and, more importantly, replaced. It is important to always replace the exact quantity of washers and shims that were removed and in the same order.

4.3 PREVENTIVE MAINTENANCE

The only recommended preventive maintenance to ensure optimum performance of the disk drive is periodic cleaning of the read/write head(s) and inspection of the head load pad.

4.3.1 Read/Write Head(s) and Load Pad Inspection

Inspect the load pad (or top head) for excessive oxide, using a dental mirror.

CAUTION

Do not move the upper head arm any further than is allowed by the door in its open position.

To clean the head(s) use a lint-free cloth or a cotton swab moistened with either methyl alcohol or 91% Isopropyl alcohol. Wipe the head(s) carefully to remove all accumulated oxide and dirt. Dry the head(s) using a lint-free cloth. If cleaning the head(s) does not improve operation, refer to the troubleshooting section. If head(s) are damaged or worn, refer to the head/carriage replacement procedure (paragraph 4.5.13). If head load pad is dirty or worn, refer to head load pad replacement procedure (paragraph 4.5.15).

4.4 RECOMMENDED TOOLS AND TEST EQUIPMENT

The following list of tools and test equipment are recommended for the removal/replacement procedures and the adjustment and measurement procedures in this section.

4.4.1 Removal/Replacement

A. Wire cutters

B. Needlenose pliers with serrated jaws

C. Phillips head screwdriver, No. 0 and No. 1

D. Phillips head torque screwdriver, No. 0 set to 20 inch-ounces

E. Phillips head torque screwdriver, No. 1 set to 30 inch-ounces

F. Allen driver; #0, #2, #4, #6

G. Dental mirror

H. Nut driver; #2

I. Bent nose tweezers

J. Slot head screwdriver

4.4.2 Adjustment and Measurement

A. Oscilloscope, dual trace, with channel "add" and external sync capability

B. Read/write (scratch) diskette

C. CE alignment diskette;

MPI P/N	42000-001	500 Series Single Side
	42001-001	500 Series Dual Side
	42002-001	900 Series Single Side
	42003-001	900 Series Dual Side

D. Phillips head screwdrivers, No. 0 and No. 1

E. Phillips head torque screwdriver, No. 0 set to 2.0 inch-ounces

4.5 REMOVAL/REPLACEMENT PROCEDURES

The following material gives sequential instructions for removing and replacing major components of the disk drive. Table 4-2 lists the removal/

replacement procedures contained in this section. Figures 4-1 and 4-2 are top and bottom views of the disk drive that identify the components referenced in the replacement instructions given. The appropriate paragraph should be referenced and read in its entirety before performing any of these procedures.

4.5.1 Printed Circuit Board Assemblies (PCBA)

There are two printed circuit board assemblies in the 5.25" Slimline™ Series. The Control Electronics PCBA is located on top of the drive and the Motor Control PCBA is located under the drive. To remove the printed circuit boards (PCBAs) proceed as follows:

Table 4-2: Removal/Replacement Procedures

Procedure	Paragraph
Printed Circuit Board Assemblies (PCBA)	4.5.1
Front Panel Bezel and Activity LED	4.5.2
Right-Hand Guide/Write Protect Assembly	4.5.3
Left-Hand Guide Assembly	4.5.4
Cone Assembly	4.5.5
Carrier Assembly	4.5.6
Drive Motor	4.5.7
Track 00	4.5.8
Door Latch Mechanism	4.5.9
Hub, Bearings and Spindle Pulley	4.5.10
Stepper Band	4.5.11
Stepper Motor	4.5.12
Head/Carriage Assembly	4.5.13
Ejector Assembly	4.5.14
Head Load Pad	4.5.15

(TO BE SUPPLIED)

Figure 4-1: Top View of Drive

(TO BE SUPPLIED)

Figure 4-2: Bottom View of Drive

4.5.1.1 Control Electronics PCBA

A. From the top side of the drive remove the I/O connector and DC power connector.

B. Remove connector P3B (also P3A on Models 502, 502C, and 902) and P2A. Grip the connector not the cables when removing.

C. Remove the single PCBA screw.

D. Lift the PCBA slightly off the drive and disconnect connector P2B from underside of board.

E. Remove the PCBA from drive.

To replace the Control Electronics PCBA perform the preceding steps in the reverse order.

4.5.1.2 Motor Control PCBA

A. From the bottom of the drive, remove connectors P1 thru P4 (refer to figure 4-2).

B. Remove the four PCBA screws.

C. Remove connector P5.

D. Remove PCBA from drive.

To replace the Motor Control PCBA perform the preceding steps in the reverse order. Reference figure 4-2 for connector orientation.

4.5.2 Front Panel Bezel and Activity LED

To replace the activity indicator it is necessary to remove the bezel. To remove the bezel proceed as follows.

A. Open door to free bezel.

B. Remove the Motor Control PCBA (refer to paragraph 4.5.1.2).

C. Remove the four screws (two from each side) which secure bezel to drive. Note that the metal screws go in the bottom holes.

D. Pull bezel forward and remove from drive. Do not lose the two shims from each side of bezel.

E. Remove the female connector from the activity LED.

To replace the bezel perform the preceding steps in the reverse order.

4.5.2.1 Activity LED Ren

To replace th .vity LED proceed as follows. Figure 4-3 shows the activit ndicator mounting hardware:

A. Remove beze (refer to paragraph 4.5.2).

B. Remove connector from LED.

C. Loosen activity indicator ring around activity indicator clip and pry off.

D. From the front of the bezel, press LED out of the holder. This removes the LED.

4.5.2.2 Activity LED Installation

To install the activity LED proceed as follows:

A. Perform the steps in paragraph 4.5.2.1.

B. Press LED into clip in bezel from rear of bezel until it snaps in.

C. Hold LED clip with fingers and fit ring over rear part of clip. Press ring until it is flush against bezel.

D. Fit female connector over LED leads with green wire connected to longest LED lead.

E. Install bezel to drive chassis and guide assemblies (refer to paragraph 4.5.2).

4.5.3 Right-Hand Guide/Write Protect Assembly

The write protect sensor is an integral part of the right-hand guide. To remove this assembly proceed as follows:

A. From the bottom of drive, unplug the connector to the write protect sensor (refer to figure 4-2).

B. Remove the screw which secures the right-hand guide to the bezel.

C. Remove the two (2) screws holding the guide to the drive chassis.

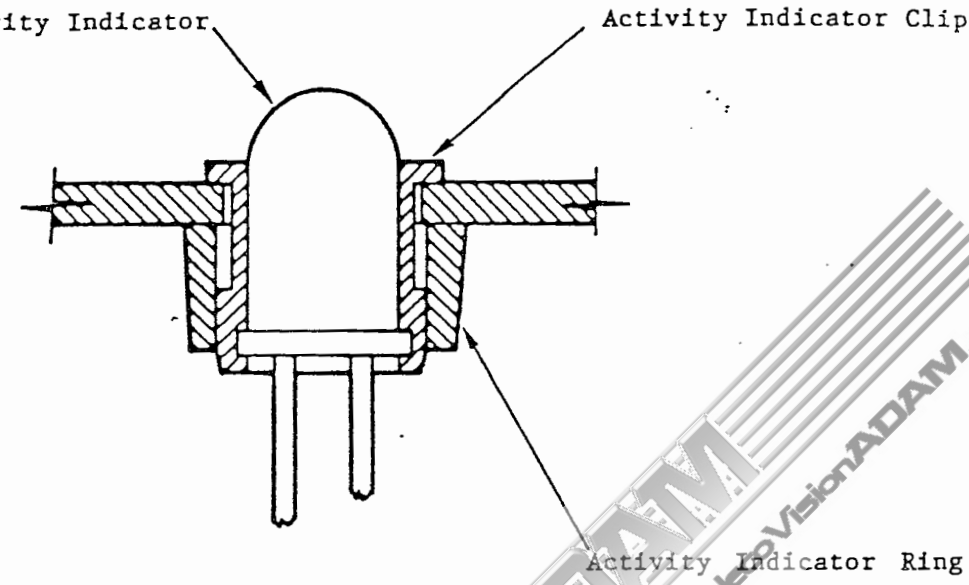


Figure 4-3: Activity Indicator Assembly

D. The guide is now free of the drive assembly. Retrieve the bezel/guide shim.

E. Unplug the connector from the write protect LED.

F. Remove the wires from the connector and replace the guide/-write protect assembly.

To replace the right-hand guide assembly perform the preceding steps A. through F. in the reverse order. Be sure that:

A. The windows in the write protect LED connector face toward the guide, when installed, and the green wire goes to the longest LED lead.

B. Wires to the write protect LED are routed through the guide and pressed firmly into the connector contacts.

4.5.4 Left-Hand Guide Assembly

To remove the left-hand guide assembly proceed as follows:

A. Remove the Control Electronics PCBA (refer to paragraph 4.5.1.1).

B. Remove the screw which secures the left-hand guide to the bezel.

C. Remove the two (2) screws holding the guide to the drive chassis.

D. The guide is now free of the drive assembly. Retrieve the bezel/guide shim.

To replace the left-hand guide assembly perform the preceding steps "A" through "D" in the reverse order. Ensure that the ejector spring is positioned properly on the guide.

4.5.5 Cone Assembly

The cone assembly fits within the drive spindle assembly and is attached to the carrier assembly. To properly remove the cone the carrier assembly must be removed. Follow the instructions given in paragraph 4.5.6, steps "A" through "J" only, to remove the carrier assembly.

To replace the cone assembly perform the steps listed in paragraph 4.5.6 in the reverse order starting with step "J".

4.5.6 Carrier Assembly

The carrier assembly lifts the cone from the spindle and the upper arm from the disk media when the door is opened. To remove this assembly proceed as follows:

A. Be sure the door is closed.

B. Remove the Control Electronics PCBA (refer to paragraph 4.5.1.1).

C. Cut the tie-wrap which secures the harness to the carrier assembly.

D. Unscrew the right-hand guide and unplug the write protect sensor assembly (refer to paragraph 4.5.3).

E. Remove the two (2) screws from the rear of the carrier assembly which secures the carrier to the drive chassis mounting posts.

F. Remove the bezel (refer to paragraph 4.5.2).

G. Remove the door button and spring (refer to paragraph 4.5.9).

H. Move the head/carriage assembly to the inner most track.

I. Lift the carrier assembly up slowly while gently turning the front of carrier toward the location of the right-hand guide until it is free of the head/carriage assembly.

CAUTION

Do not lift the carrier straight up. The upper step of the upper head arm rests on top of the carrier assembly. Lifting carriage straight up may damage the head assembly.

J. Remove the snap ring from the top of the carrier to remove the cone assembly and head lift mechanism.

K. Remove the index sensor, pressure pad, ejector latch release, and both carrier hinges.

L. The carrier is now free.

To install the carrier assembly perform the preceding steps in the reverse order. Ensure that the head carriage moves freely before tightening the screw securing the carrier assembly to the drive.

4.5.7 Drive Motor (Belt Drive)

To remove the drive motor, proceed as follows:

A. Remove the drive belt.

B. Remove the two (2) drive motor mounting screws from the bottom of the drive chassis.

C. Cut tie wraps holding drive motor wires in harness and remove connector from the motor control PCBA.

D. Drive motor is now free.

To replace the drive motor proceed as follows:

A. Mount motor so that motor wires exit the motor toward the center of drive chassis.

B. Be sure that the wire harness is not pinched between the motor and the chassis and install and tighten the two motor screws.

C. Plug the drive motor connector into the motor control PCBA and tie wrap motor wires into wire harness.

D. Install drive belt.

4.5.8 Track 00 Sensor

To remove the track 00 sensor proceed as follows:

A. Remove the connectors to the sensor and LED.

B. Remove the screw holding the sensor assembly to the drive chassis.

C. Sensor is now free.

To replace the track 00 sensor perform the preceding steps in the reverse order. Do not tighten screws until adjustment procedures referenced in Table 4-3 are performed. Note that when replacing the connectors, the green wire goes to the longest lead of the LED and the black wire goes to the longest lead of the sensor.

4.5.9 Door Latch Mechanism

To remove the door latch mechanism proceed as follows:

A. Remove bezel (refer to paragraph 4.5.2).

B. Slide door latch from carrier. Be careful not to lose the spring and washer.

To replace the door latch mechanism perform the preceding steps in the reverse order.

4.5.10 Hub, Bearings and Spindle Pulley

To remove the spindle pulley proceed as follows:

A. Turn drive up side down and remove the spindle drive belt.

B. Remove the spindle pulley mounting screw.

C. The spindle pulley is now free. Be careful not to lose the washers located between the spindle pulley and bearing.

To remove the hub complete the preceding steps then proceed with the following:

A. Remove the bezel (refer to paragraph 4.5.2).

B. Position the head/carriage assembly to track zero (extreme rear of drive).

C. Carefully lift the carrier assembly while pulling up on the hub until the hub shaft clears the spindle bearing.

NOTE

The band mounting clip hole is offset. Install the clip so that the part which extends over the carriage assembly is resting on it.

E. Hold band firmly against head/carriage assembly and install screw in front of band but do not tighten.

F. Pull band tight (about 4 lbs) against head/carriage assembly and tighten screw in front of assembly. Move carriage forward and backward; ensure that there is no band crinkle (uneven tension) and there is no contact with chassis.

NOTE

Band can be tensioned by inserting a bent paper clip in the hole at the front of the band and then pulling to remove band slack.

G. Tighten the band/pulley screw.

H. Screws should be tightened with torque screwdriver to 35 inch-ounces.

4.5.12 Stepper Motor

To remove the stepper motor proceed as follows:

A. Remove the Control Electronics PCBA (refer to paragraph 4.5.1.1).

B. Remove the front stepper band screw.

C. Remove the band/pulley screw.

D. Unplug the motor from the motor control PCBA.

E. Remove the two stepper motor screws from the bottom of the drive chassis.

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B. Remove ejector latch release (if necessary) from carrier by removing screw and sliding latch release off carrier assembly.

C. Remove ejector from drive chassis by removing the screw and lifting ejector and spring off the drive chassis mounting post.

To replace the ejector assembly, perform the preceding steps in the reverse order. Be sure ejector spring is tensioned when installed.

4.5.15 Head Load Pad Assembly

To replace the head load pad assembly in Model 501, 501C, and 901 drives, proceed as follows:

A. Manually position head/carriage assembly all the way to the rear of the drive (Track 00); be sure to push carriage not the upper arm.

B. Open door.

C. Grip upper arm.

D. With bent nose tweezers, squeeze the plastic pieces of the head load pad which protrude through the upper arm and press until it drops out of the upper arm.

To replace the pad assembly proceed as follows:

A. Hold pad assembly with bent nose tweezers centered underneath hole in upper arm.

B. Close door.

C. Press lightly on upper arm to engage pad assembly; remove tweezers.

D. Press on upper arm until pad assembly snaps into place.

CAUTION

Do not move the upper head arm any further than is allowed by the door in its open position.

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E. With power on loosen the stepper motor mounting screws on bottom of drive and rotate the motor so that the "cat's eye" pattern appears on the scope and adjacent lobes are within 70% amplitude. Tighten mounting screws. Command a return to track 00 and then step back to track 16 for series 500 or 32 for series 900 drives to verify proper alignment. Command a seek to track 32 for series 500 or 64 for series 900 drives and then step back to track 16 for series 500 or 32 for series 900 drives to verify proper alignment.

4.6.2 Index-To-Data Alignment

To perform the index-to-data alignment perform the following steps in the order listed:

A. Verify the radial-track alignment (refer to paragraph 4.6.1) then move the head to track 01.

B. Set the oscilloscope to 200mV/cm; 50us/division.

C. The index sensor mounting screws are located at the bottom of the drive in the recessed area. Loosen the two screws and slide the sensor such that the oscilloscope picture shows a data pattern starting 200 ±75 microseconds from the start of the trace.

D. Using a 20 inch-ounce torque screwdriver, tighten the screws carefully so that no variations in the oscilloscope display occur.

4.6.3 Track 00 Sensor Alignment

To align the track 00 sensor perform the following steps in the order listed.

A. Apply power to the disk drive and select drive.

B. Verify the radial-track alignment (refer to paragraph 4.6.1).

C. Connect channel A probe to connector J4-7 of motor control PCBA; set oscilloscope trigger to INTERNAL/AUTO.

D. Loosen the track 00 sensor mounting screw and adjust the sensor for the conditions in steps "E" and "F" following.

E. When the carriage is positioned over track 00, 01 and 02, the signal at J4-7 should be at 0.5 volts (maximum).

F. Command a step-in to track 03. Signal at J4-7 should go to +4.0 volts minimum.

G. Tighten the sensor mounting screws.

COLECO RFI-1 KIT

A small but important addition to your ADAM Family Computer System or Expansion Module #3 . . . . . .

The Federal Communications Commission (FCC) provides interference standards for computers and other electronic equipment. Your ADAM Family Computer was designed to meet those FCC standards.

Now, with the addition of peripheral devices to your ADAM Family Computer System, RFI-1 sleeves must also be added to maintain those interference-acceptable levels and to assure continued FCC certification.

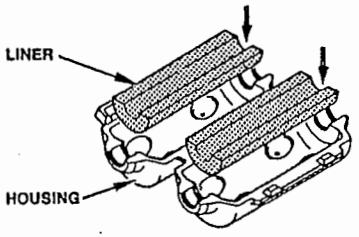
Coleco provides the RFI-1 Kit for this purpose. The RFI-1 Kit contains one large sleeve for the printer and several small sleeves for the remaining peripheral devices and controllers. The sleeves are shown, installed on the ADAM system, in the illustration below.

How to install . . .

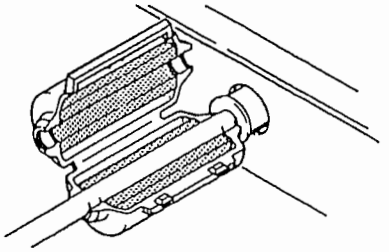
Before you connect the peripherals to your ADAM Memory Console, install the sleeves on the cables.

WARNING: Whenever you are handling or installing cables for your ADAM, turn the ON/OFF switch on the back of the printer to OFF and unplug the power cord from the electrical wall outlet.

- If, during shipping, the liners became separated from the housings, please reinstall the liners into the housing. The liners are FRAGILE: use care when handling.
- Place the small sleeves around the peripheral and controller cables, butting each sleeve against the ADAM connector.
- Place the large sleeve around the printer cable — approximately 2 inches from the connector.
- Close the sleeves over the cables, being careful that the liners don't become unseated. Now apply some pressure, until you feel the closures "snap."

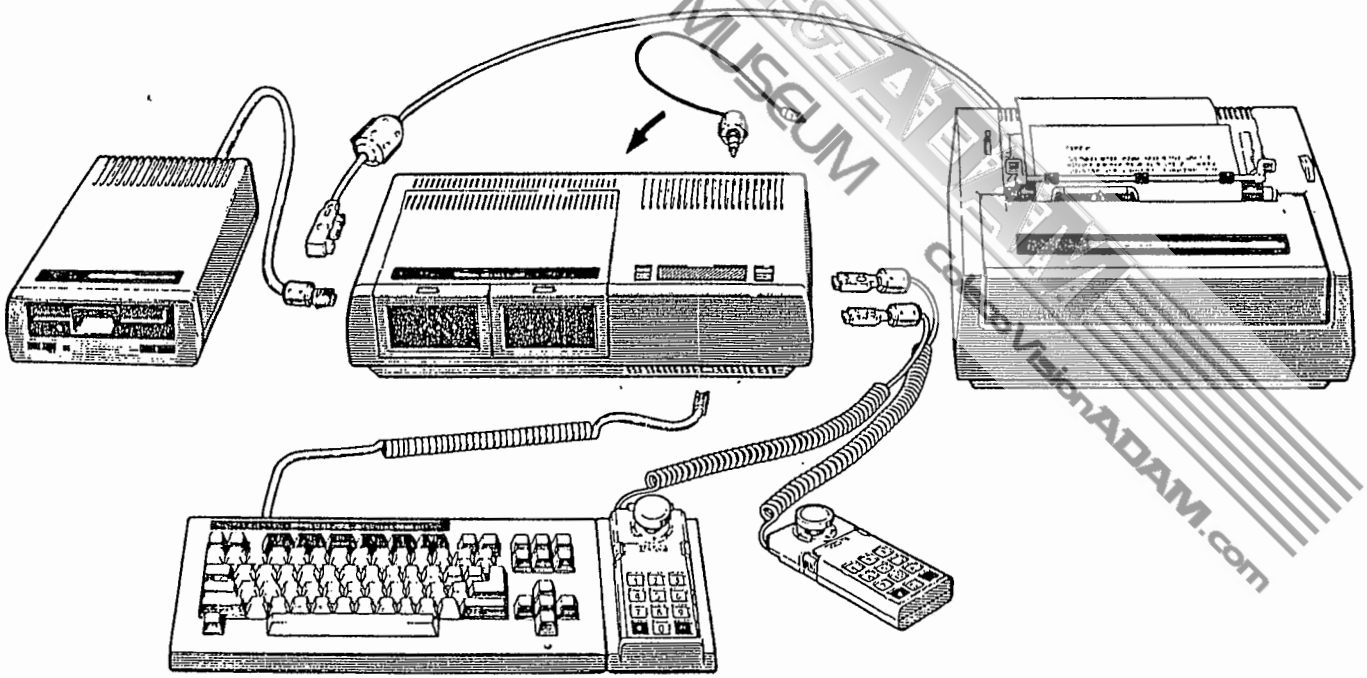


REINSTALLING LINER INTO SLEEVE



INSTALLING SLEEVE ON CABLE

Note: When you are using special controllers (Roller or Super Action), remove the sleeves from the controller and place them on the other special controller cables. When you are using a monitor rather than a television, remove the sleeve from the television cable and place it on the monitor cable.



2. Replace the ejector and ejector release mechanism.

4.7 MEASUREMENT PROCEDURES

The following list of measurement procedures should be made periodically to ensure data quality or if malfunctions are suspected:

A. Compliance Measurement

B. Erase Measurement

C. High Frequency Playback Measurement

4.7.1 Compliance Measurement

To measure compliance perform the following steps in the order listed:

A. Apply power to the disk drive and select drive.

B. Step head(s) to track 39 in series 500 drives and track 79 in series 900 drives.

C. Write a 1F pattern (62.5 kilohertz) on the entire track.

D. Connect oscilloscope probes to TP2 and TP3 as in the radial-track alignment procedure, paragraph 4.6.1.

E. Apply a 15 gram load to the upper arm directly above the load pad. If the amplitude observed on the oscilloscope increases by more than 10% the drive has poor compliance.

4.7.2 Erase Measurement

To measure the effectiveness of the erase, perform the following steps in the order listed.

A. Apply power to the disk drive and select drive.

B. Step the head(s) to track 32 in series 500 drives and track 64 in series 900 drives.

C. Write a 1F pattern (62.5 Kilohertz) on the entire track.

D. Connect oscilloscope to TP2 and TP3 as described in the radial-track alignment procedure, paragraph 4.6.1.

E. Connect a jumper from ground to gate U7 pin 7.

F. Step back and forth across track 32 for series 500 drives and track 64 for series 900 drives for about 15 seconds.

APPENDIX A

RECOMMENDED SPARE PARTS LIST

PART NUMBER	DESCRIPTION	MODEL	NOTES
29026-001	Logic, R/W PCB Assembly	All	
29027-002	Stepper Motor Control PCB Assembly (Std)	501/502	1
29030-001	Stepper Motor Control PCB Assembly (Std)	501/502	
35121-002	Stepper Motor Assembly	501/502	1
35121-003	Stepper Motor Assembly	901/902	
35125-001	Drive Motor Assembly	501/502	
65518-001	Drive Motor Assembly (incl. PCBA)	901/902	4
35145-001	Head Carriage Assembly	501	
35145-002	Head Carriage Assembly	901	
35146-001	Head Carriage Assembly	502	
35146-002	Head Carriage Assembly	902	
27053-001	Stepper Band	All	
35116-001	Right Hand Guide Assembly	All	2
21097-001	Left Hand Guide Assembly	All	
32017-001	Index Diode Cable Assembly	All	
35128-001	Track 00 Switch Assembly	All	
35129-001	Index Photo Sensor Assembly	All	
21098-001	Cone	All	
50000-005	Bearing	All	
40022-001	Spindle Pulley	501/502	
59000-001	Diskette Load Pad	All	
27116-001	Ejector Latch	All	
35023-001	Head Load Pad Assembly (felt)	501/901	
27111-001	Ejector Bracket	All	
50502-001	Drive Belt	501/502	
21109-001	Bezel	All	
21094-001	Latch	All	
35026-001	Activity Indicator Assembly	All	
35121-001	Stepper Motor Assembly (optional)	501/502	1
64009-001	Head Load Solenoid (optional)	502/902	3
42000-001	C.E. Alignment Diskette	501	
42001-001	C.E. Alignment Diskette	502	
42002-001	C.E. Alignment Diskette	901	
42003-001	C.E. Alignment Diskette	902	
29027-001	Motor Control PCB Assembly (Optional)	501/502	1

APPENDIX B

DRAWINGS AND SCHEMATICS