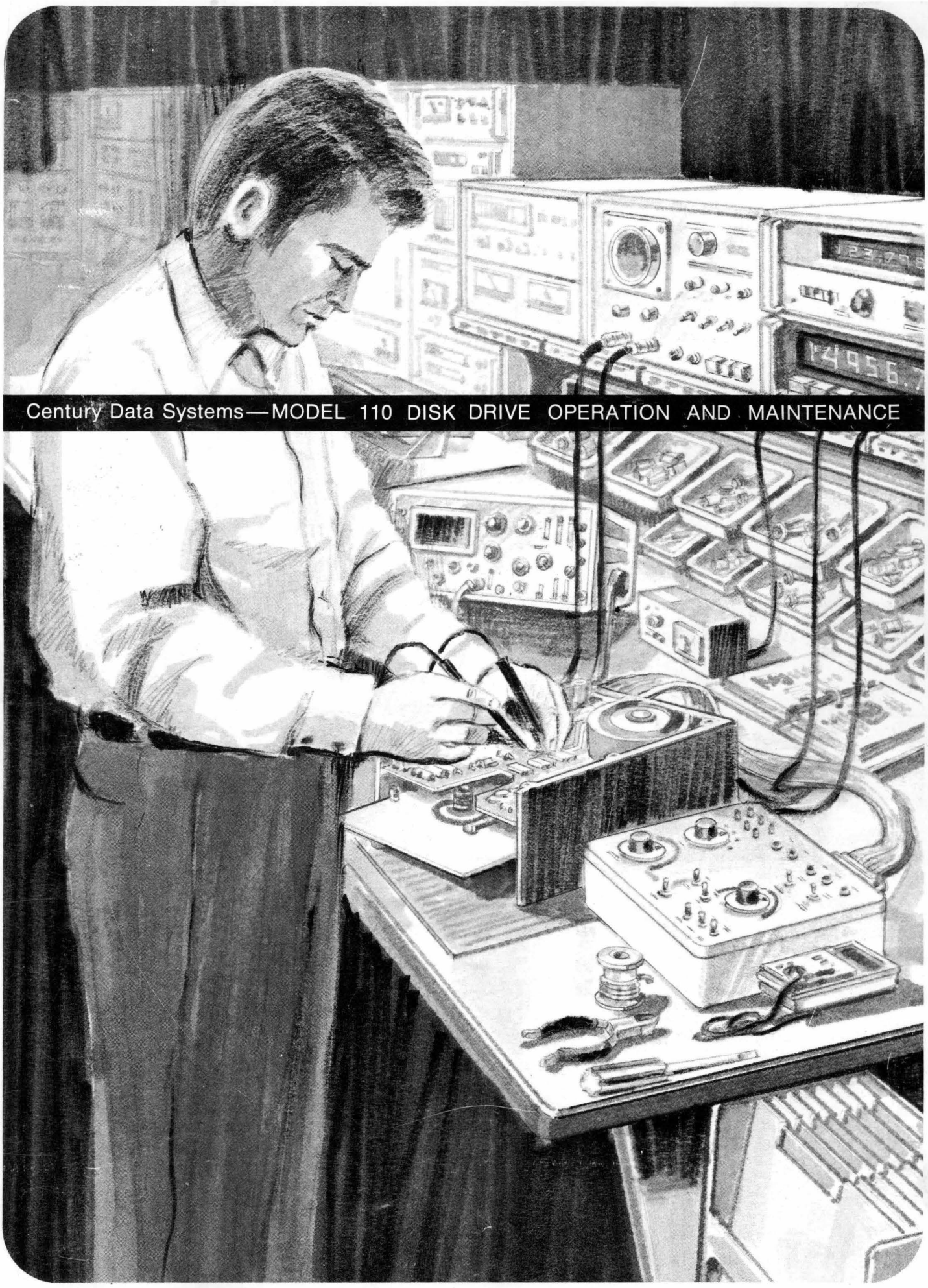
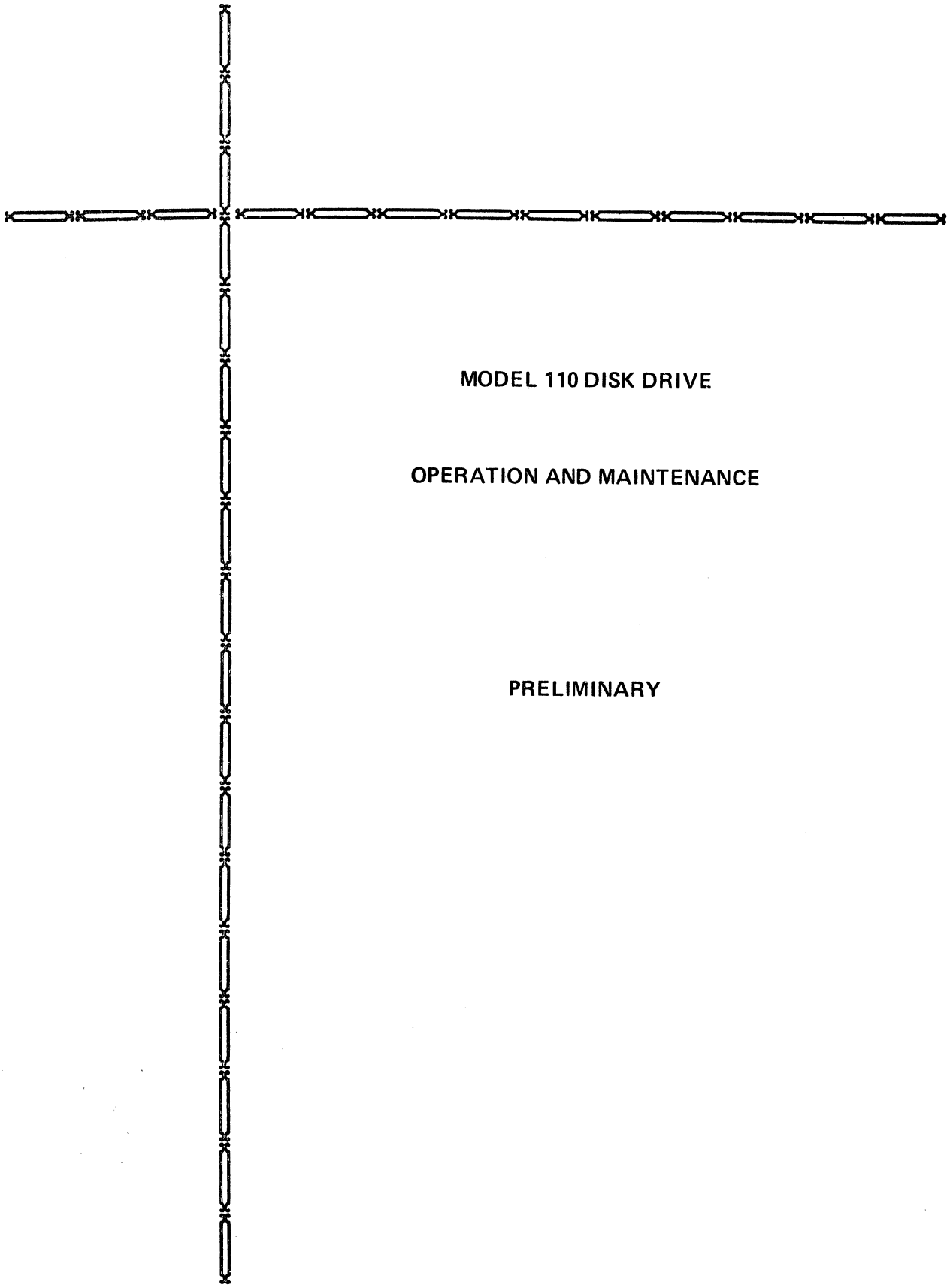


Century Data Systems—MODEL 110 DISK DRIVE OPERATION AND MAINTENANCE



MODEL 110 DISK DRIVE

OPERATION AND MAINTENANCE

PRELIMINARY

Printed in U.S.A.

OM110-573-P1-300

RECORD OF REVISIONS	
REVISION	NOTES
P	PRELIMINARY ISSUE
P1 (5-16-73)	Updated to include latest design changes and spec changes

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (continued)

LIST OF TABLES

LIST OF TABLES (Continued)

SECTION 1
INTRODUCTION

GENERAL

This manual contains procedures and descriptive material to aid personnel in operation, maintenance and repair of the Model 110 Disk Drive (Figure 1-1).

SCOPE

This manual is intended as a guide for those personnel directly involved with the operation, maintenance and repair of the disk drive.

The operation portion is divided into two sections:

- Section 2 - Daily Operation
- Section 3 - Operator Maintenance

The maintenance portion is divided into four sections:

- Section 4 - Theory of Operation
- Section 5 - Preventive Maintenance
- Section 6 - Maintenance Aids
- Section 7 - Adjustments and Parts Replacement

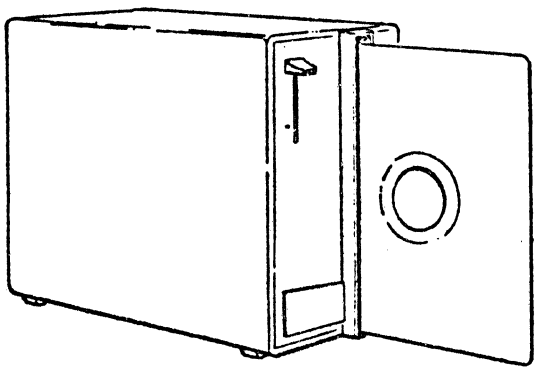


Figure 1-1. Model 110 Disk Drive

RELATED MANUALS

Installation and Parts Manual (IP110)

Interface Specifications (CDS110)

DESCRIPTION

The Model 110 Disk Drive is a compact, random-access, removable disk unit intended for use in applications such as:

- Initial Control Program Load
- Microprogram Storage Backup
- Diagnostic Microprogram Storage
- Auxiliary, Low Cost Data or Control Storage

The drive comprises a drive mechanism, recording head, head actuator and associated electronics. The drive is connected to the host system by signal and power cables with addressing, function requests, data formatting and power supplied by the host system.

The Model 110 Disk Drive can either be rack-mounted or placed on a desk top. Data is magnetically recorded on and read from the ferro-oxide surface of an interchangeable, flexible disk cartridge.

SPECIFICATIONS

A list of the principal specifications is provided in tables:

- Table 1-1 Physical and Environmental
- Table 1-2 Performance
- Table 1-3 Power Requirement
- Table 1-4 Interface Requirements
- Table 1-5 Input Signal Characteristics
- Table 1-6 Output Signal Characteristics

Table 1-1. Physical and Environmental

Specification	Characteristics	
Drive Unit Overall Dimensions	Width Height	4.90 inches max. 8.40 inches max.
Weight	Operating Shipping	16 pounds 18 pounds
Heat Dissipation (Operating)	540 BTU/Hr.	
Retma Rack Overall Dimensions		
Two Disk Drives	Height Width Depth	5.25 inches max. 19.00 inches max. 14.20 inches max.
Three Disk Drives	Height Width Depth	8.75 inches max. 19.00 inches max. 14.20 inches max.
Relative Humidity		
Operating:	Disk Drive: 15 to 95% R.H. (without condensation).	
Non-operating:	Drive: 5 to 98% R.H. (without condensation).	
Temperature		
Operating:	32° to 122°F (0° to 50°C) with a maximum gradient of 20°F per hour.	
Non-operating:	Minus 30°F to 140°F (-34° to +60°C).	

Table 1-2. Performance Specifications

Specifications	Characteristics	
Total Unformatted Capacity (nominal speed and frequency)	Bits per Track	22,528 (2,816 bytes)
	Bits per Disk	1,441,792
Data Storage Capacity (Sector format; actual value depends on user format)	Bits per Track	20,480 (2,560 bytes)
	Bits per Disk	1,310,720 (163,840 bytes)
	Recording Method	Bit serial, single moving head, single recording surface
Data Parameters		
Coding	Interface allows user option. Double frequency recommended.	
Bit Frequency	33.8K Hz - nominal	
Recording Density	1061 (outer track) to 1692 (inner track) bits per inch nominal	
Recording Head	Read-Write-Erase (Straddle-Erase)	
Track Density		
Tracks Per Inch	64 Tracks (plus 1 spare); track center-to-center spacing nominally 0.020 inch; data track width nominally 0.010 inch.	
Positioning Mechanism		
Actuator	Stepping Motor	
Detent	Electrical (holding current)	

Table 1-2. Performance Specifications (continued)

Specifications	Characteristics
Positioning Mechanism (cont.)	
Access Time	6 milliseconds per step. A maximum of 34 milliseconds additional time is required for the last step.
Head Load Time	60 milliseconds
Head Position Sensors	2 electro-optical sensors on outer track 00 and inner track 64 (65 tracks) generate signals used to constrain positioner within 65 tracks recording band. Track limit position signals also available at interface (reference paragraph "Interface Signal Lines").
Drive Motor	
Disk Rotational Speed	90 RPM $\pm$ 2.5%; 667 millisecond latency (full revolution)
Motor Start Time	20 seconds maximum
Instantaneous Speed Variation	$\pm$ 1.5%
Sector/Index	
Sectors	8
Index	1
Write	
Cartridge Hole Sense	Covering hole enables write capability. Status signal available at interface.
Media	
Type	Interchangeable, flexible disk cartridge

Table 1-2. Performance Specifications (continued)

Specifications	Characteristics
Media (continued)	
Disk	7.5 inch diameter, approximate 5 mil thickness.
Cartridge Dimensions	8.00 x 8.00 x 0.75 inches (approx.)
CDS Part Number	98758-001
Reliability and Maintainability	
Error Rate	Less than 1 in 10^8 bits read
MTBF	Greater than 3000 hours
MTTR	Less than 20 minutes

Table 1-3. Power Requirements

Specification	Characteristics
Disk Drive Motor	115vac, 10%, 1-phase, 60 Hz. 0.7 amp rms run current 1.3 amp rms start current or 208vac, 10%, 1-phase, 50 Hz. 0.35 amp rms run current 0.6 amp rms start current or 230vac, 10%, 1-phase, 60 Hz. 0.41 amp rms run current 0.7 amp rms start current

Table 1-3. Power Requirements (continued)

Specifications	Characteristics
Stepper and solenoid	+24vdc, ±10%, @1.0 amp
Circuitry	+12vdc, ± 5%, @ 0.2 amps -12vdc, ± 5%, @ 0.1 amps + 5vdc, ± 5%, @ 1.0 amps with exerciser

Table 1-4. Interface Requirements

Specifications	Characteristics
Logic Levels	
High	+5.5V V +2.2V
Low	+0.4V V 0.0V
	All inputs and outputs use standard TTL gates
Signal Cable	
Length	20 feet maximum
Type	Twisted pairs (40 pair)
Conductor Size	#24 or #26 AWG
Twist per foot	30

Table 1-5. Drive Input Signal Characteristics

Name	Characteristics and Remarks
WRITE ENABLE	To enable the write and straddle erase amplifiers, this line shall be continuously held low by a gate capable of sinking 1.6 ma. An open or high level line inhibits writing and straddle erasing.
WRITE CLOCKS	This line shall have a low quiescent level. Write clocks shall be 1μsec ±10% high-level pulses which are applied to the clock input of the TTL JK Flip Flop used for Write Control. Current through the head write winding changes direction of the trailing edge of these pulses.
WRITE DATA-J and WRITE DATA-K	These two lines are the data inputs to the TTL JK Flip Flop used for write control. A low level is false and an open or high line is true. Open lines on both WRITE DATA-J and WRITE DATA-K allow the Write Control Flip Flop to change state for each applied WRITE CLOCKS pulse. This configuration is used for frequency doubling encoding. Proper application of write data to these two lines in synchronism with the WRITE CLOCKS allow the user the option of employing his choice of data encoding methods.
STEP IN	This line shall have a low quiescent level. A 1 μsec ±10% high-level pulse on this line causes the recording head to move one track position, from lower to high numbered tracks. The maximum step rate is 167 steps/sec (0.006 sec/step).
STEP OUT	This line has the same characteristics as STEP IN except that each pulse moves the head one track position from higher to lwer numbered tracks.
HEAD LOAD	A low (sink 1.6ma) level on this line moves the disk against the head. The head is not engaged when +24 vdc power is not applied. A manual cartridge loading interlock overrides the head load signal whenever the cartridge loading lever is in the RELEASE position.

Table 1-6. Drive Output Signal Characteristics

Name	Characteristics and Remarks
READ DATA PULSES	This line has a low quiescent level. A 600 nanosecond wide high-level pulse is outputted for each flux transition previously recorded on the disk. This read output is provided for frequency doubling coding.
READ DATA LEVELS	This output is a differentiated and squared signal read from the disk. It is provided for use with coding methods other than frequency doubling.
INVERTED READ DATA LEVELS	Same as READ DATA LEVELS except inverted.
SECTOR PULSES	This output line has a high quiescent level. The beginning of each of the 8 data sectors on the disk media is indicated on this line by an 80-microsecond wide low-level pulse. This pulse is generated at the leading edge of the sector hole on the media and occurs 8 times per disk revolution.
INDEX PULSES	This output line has a high quiescent level. Disk index position is indicated by an 80-microsecond wide low-level pulse generated once per disk revolution. This pulse is generated from the index hole on the media and occurs time coincident with the sector pulse representing Sector 00.
WRITE PROTECT	A low level indicated that the cartridge has its write protect hole uncovered and therefore the drive is inhibited from writing.
OFFTRACK BELOW 00	A low level indicates that the head is positioned below Track 00. At this position the stepper motor is inhibited from further outward radial movement (will not respond to STEP OUT inputs).
TRACK 00	A low level indicates that the head is positioned over track 00. At this position, the stepper motor is inhibited from further outward radial movement (will not respond to STEP OUT inputs).
ABOVE 63	A low level indicates that the head is positioned at Track 64 or above. At this position the stepper motor is inhibited from further inward radial movement (will not respond the STEP IN inputs).

Table 1-6. Drive Output Signal Characteristics (continued)

Name	Characteristics and Remarks
READY	A low level indicates that: 1. AC and DC power are on. 2. Cartridge is present. 3. Motor speed is greater than 96% of nominal speed.
+5VDC	For use by Exerciser CDS2100

DASH NUMBER DIFFERENCIES

The Model 110 Disk Drive is available for three different ac voltages. These different units are identified by dash numbers as follows:

- Model 110-001 115vac, 1-phase, 60Hertz
- Model 110-002 208vac, 1-phase, 50Hertz
- Model 110-003 230vac, 1-phase, 60Hertz

Any differencies in the logic and internal connections are given in Section 7.

This manual was written for the Model 110-001.

SECTION 2
OPERATION

GENERAL

This section contains information necessary for daily operation of the disk drive.

Disk Cartridge Description

The disk drive uses a removable, flexible disk, enclosed in a cartridge (Figure 2-1).

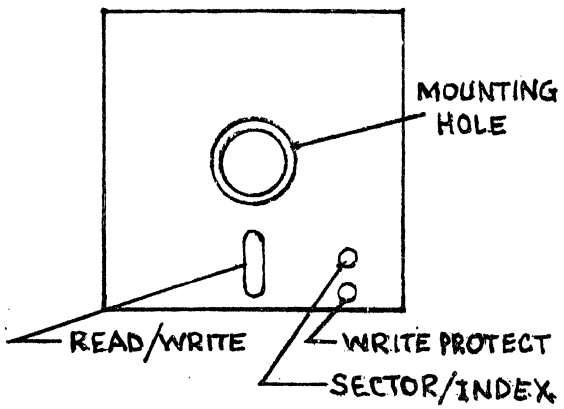


Figure 2-1. Disk Cartridge

The cartridge is 8.00 x 8.00 x 0.075 inches. The disk is exposed through three of the four openings in the cartridge. The center circular opening is for loading, where a rotating hub can grip the disk, causing it to rotate within the cartridge.

When the cartridge is loaded, the read/write head assembly is positioned over the elongated opening (bottom-center). The upper of the two holes (bottom-right) is used to detect index (1) and sector (8) holes on the disk. The bottom hole is used to write protect the disk.

DAILY OPERATION

Disk cartridge storage and handling as well as correct operator procedures are important for error-free daily operation of the disk drive.

Disk Cartridge Storage and Handling

Disk cartridges should be stored in an environment that is clean and free from all magnetic influences.

Disk cartridge shall be in the same temperature and humidity environment as the disk drive for a minimum of two hours prior to use.
Return to protective envelop when not is use.

Never place heavy objects on the disk cartridge.

Never touch the disk, through the cartridge opening, when handling.

Never write on cartridge (use labels).

Never clean the disk.

Disk Cartridge Loading and Unloading

Correct loading of the disk cartridge is vital to the proper operation of the disk drive.

Figure 2-2 shows the proper location of the disk cartridge openings for loading.

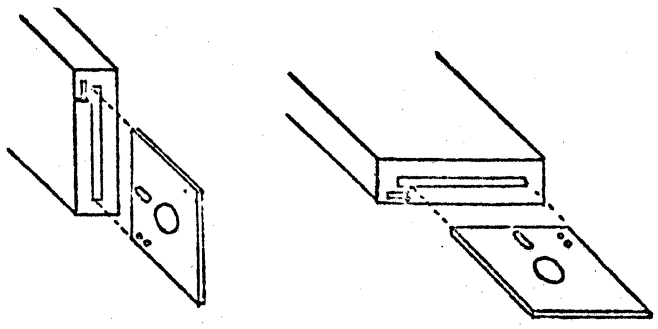


Figure 2-2. Disk Cartridge Load Position

Procedures for loading and unloading the disk cartridge are given in Tables 2-1 and 2-2.

Table 2-1. Disk Cartridge Loading

Step	Action	Remarks
1	Place front panel cartridge load lever in release position.	Releases rotating hub and allows disk cartridge loading.
2	Inset disk cartridge.	Cartridge slides into slot until resting on bottom. (approx. 1/2 inch remains outside slot).
3	Return cartridge load lever to engage position	Hub presses disk against drive spindle and with drive motor running disk rotates.

Table 2-2. Disk Cartridge Unloading

Step	Action	Remarks
1	Move front panel cartridge load lever to release	Move rotating hub away from disk and spindle.
2	Lift disk cartridge from slot.	Removes disk cartridge for storage.

Disk Cartridge Write Protect

Loading the disk cartridge with the write protect hole uncovered will allow the system to read the disk only. The disk is write protected.

To perform a write operation, the write protect hole must be covered before the disk cartridge is loaded. Opaque material can be used to cover the hole.

SECTION 3
OPERATOR MAINTENANCE

GENERAL

The operator maintenance required to ensure optimum performance of the disk drive is highly influenced by the environment conditions and the type of use that the unit is subjected to. Periodic checks, visual inspection and cleanliness are the basis for the following operator maintenance procedures.

RECOMMENDED TOOLS AND EQUIPMENT

A list of recommended tools, documents and cleaning material is provided in Table 3-1.

Table 3-1. Recommended Tools and Material

Category	Description
Document	Model 110 Interface Specifications
Tools	Common Hand Tools Flashlight Inspection Mirror (Dental type)
Cleaning Material	Head Cleaning Cartridge (#98778) Commercial Cleaner (Detergent)

CLEANLINESS

The Model 110 Disk Drive is designed for use in commercial and industrial environments. However, optimum performance can be expected when used in a computer room environment with the resultant air cleanliness normally found in such locations.

Dust and other airborne contaminants are a major threat to the operating life of the media and drive recording and positioning system.

External Cleaning

a. Daily - using a soft dry cloth, clean the external surfaces of the disk drive.

b. Weekly - external surfaces should be cleaned with a soft cloth dampened with a commercial cleaner (detergent). Ensure that any residue is cleaned away.

Read/Write Head Cleaning

The read/write head shall be cleaned weekly or after eight operating hours, whichever occurs first.

To clean the read/write head, proceed as follows:

a. Load head cleaning cartridge, CDS 98778.

b. Apply ac power.

c. Load head.

CAUTION

Disk should not be rotated more than 10-15 revolutions, 7-10 seconds, with head loaded.

d. Unload head.

e. Turn off ac power.

f. Remove head cleaning cartridge.

Air Filter

The disk drive is equipped with an air filter to clean the air moving through the drive.

The disk drive air filter is located at the rear to ensure that clean air passes through the drive during operation. A clogged filter will cause the drive to overheat.

a. Weekly - inspect air filter and replace if clogged (Figure 3-1).

b. Semi-annual - replace air filter (Figure 3-1).

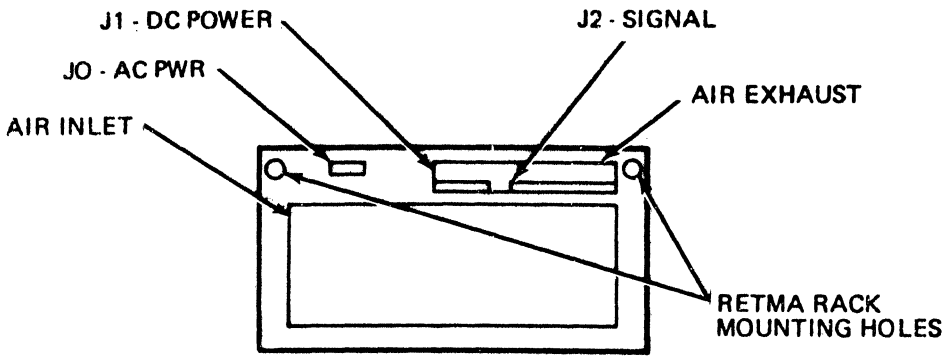


Figure 3-1. Air Filter

Troubleshooting

During daily operation of the disk drive, if the system indicates a malfunction certain operator procedures should be followed before calling maintenance personnel

System indicating malfunctions will be one of two types.

- Not Ready
- Data Errors

Figure 3-2 shows flow diagrams of the operator troubleshooting procedures, for both malfunctions.

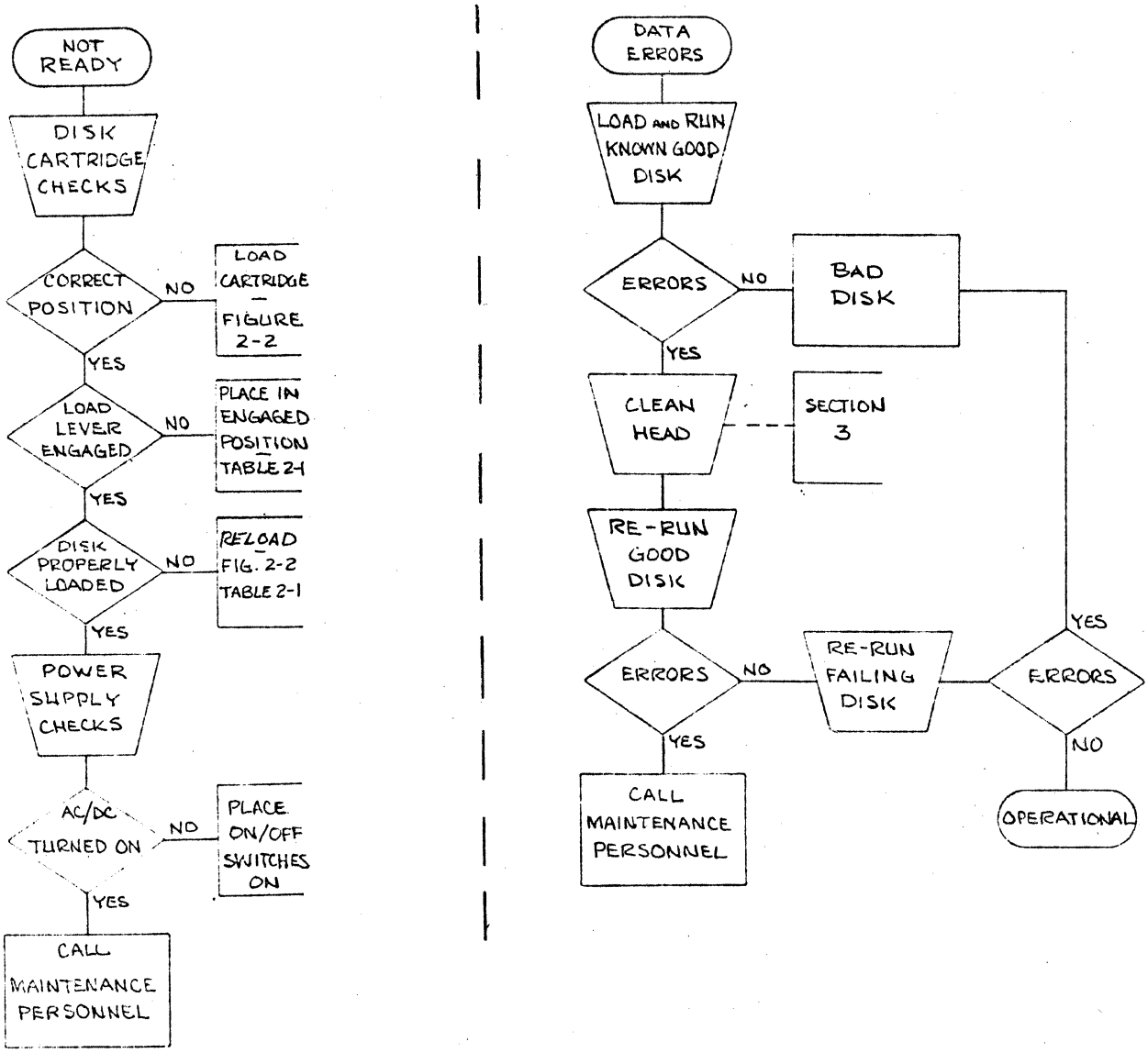


Figure 3-2. Troubleshooting Sequences

SECTION 4

THEORY OF OPERATION

GENERAL

The general block diagram, Figure 4-1, shows the major sections of the desk drive.

- Read/Write System
- Positioning System
- Control System

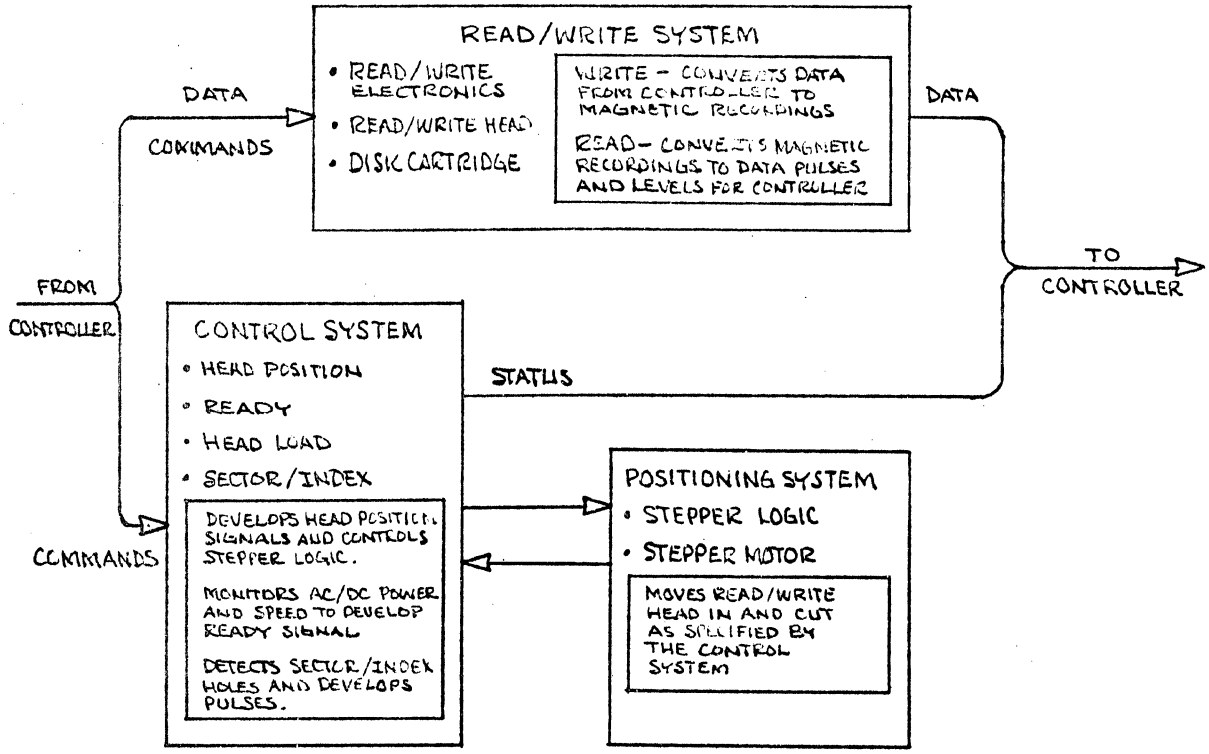


Figure 4-1. Model 110 Disk Drive, General Block Diagram

The following paragraphs provide a general description of the disk drive and highlight the significant electro-mechanical areas.

Read/Write System

The read/write system includes the disk cartridge, read/write head and associated logic.

Disk Cartridge

The disk cartridge is 8.00 x 8.00 x 0.75 inches and is so constructed that the disk is free to rotate within the cartridge (Figure 4-2).

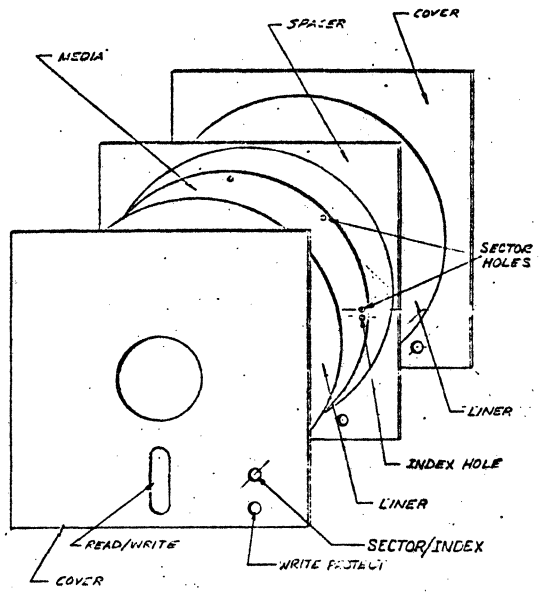


Figure 4-2. Disk Cartridge Construction

The media, disk, is polyester with an oxide coating on the recording side and a lubricant on the nonrecording side. During operation, the disk rotates at 90 rpm.

There is one index and eight, equally spaced, sector holes in the disk which are electro-optically detected through the opening to the cartridge (Figure 4-2).

Data is recorded, through the cartridge opening, by magnetizing digital bit patterns in concentric circles (tracks) on the recording surface.

Tracks are numbered 00 through 63, beginning with the track nearest the outer edge of the disk. An inner track (64) is provided as a spare.

Read/Write Head Operation

The read/write head is essentially an electromagnet that can concentrate a high magnetizing force over a very small area of the adjacent recording surface. When recording, the flux field is alternated to magnetize the disk with the desired bit pattern.

The read/write head also contains a straddle-erase electromagnet; the function of which is to erase the edges of the recorded track just written. The width of the track is narrowed to approximately 0.0085-inch by this erase method to minimize interference and crosstalk between tracks (Figure 4-3).

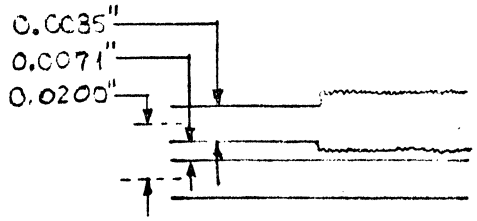


Figure 4-3. Record Track

When reading, the read/write electromagnet operates as a sensor. A flux reversal in the recorded track induces a voltage across the electromagnet coils. This voltage is amplified and conditioned to recover the recorded information.

Positioning System

The read/write head assembly is mounted on two shafts. One shaft (way) is stationary and acts as a guide. The other is the armature of a stepper motor having a helix groove (Figure 4-4).

A step command causes the motor's armature to rotate 30 degrees, moving the head assembly from one track position to the next.

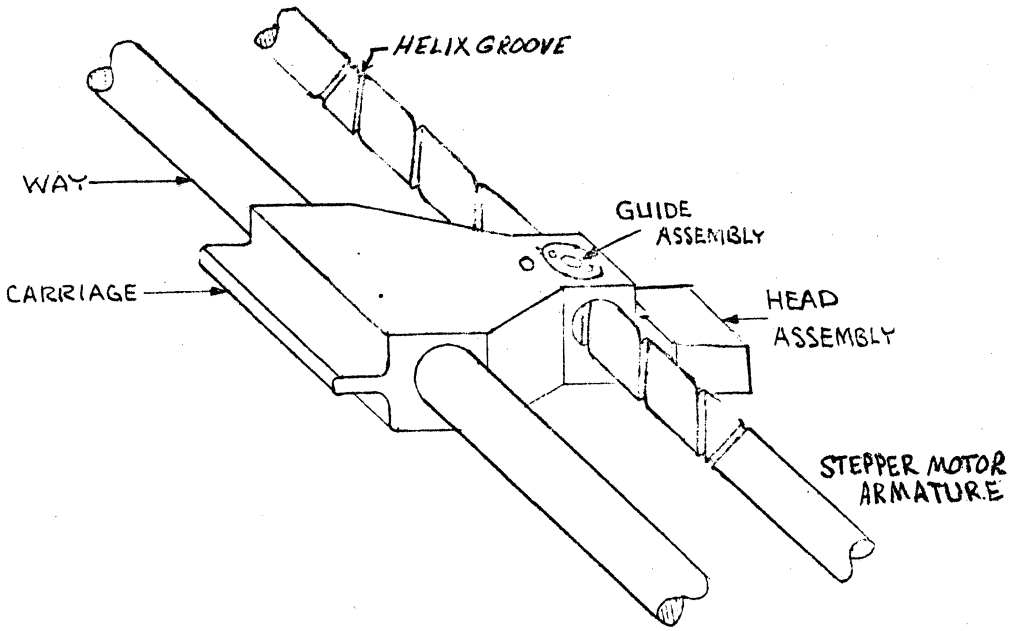


Figure 4-4. Head Assembly Mounting

Control System

The control system continuously monitors and controls disk drive operations, providing the following status signals to the controller:

- Ready
- Sector/Index Pulses
- Off-Track Below Track 00
- Track 00
- Above Track 63
- Write Protect

Ready - A low signal indicates the disk drive is operational. Not ready (high level) will be signalled if a loss in ac power, dc power or slow disk speed is detected.

Sector/Index Pulses - A light emitting diode and photo-transistor are used to detect the index and sector holes in the disk. A 80μsec low level pulse is developed and sent to the controller for each hole detected.

Off-Track Below Track 00 - A low signal indicated the head assembly is positioned outside the track area and requires step-in commands to position it correctly.

Track 00- Indicates the head assembly is positioned over track 00.

Above Track 63 - Indicates the head assembly has stepped in and is positioned over the spare track 64 and requires step-out commands to reposition it.

Disk Drive Hub and Motor

The disk drive hub is mounted on the deck plate and is driven by 115, 208 or 230 vac drive motor. The hub and motor are coupled by a pulley and belt system (Figure 4-5) designed to provide a disk rotational speed 90 rpm.

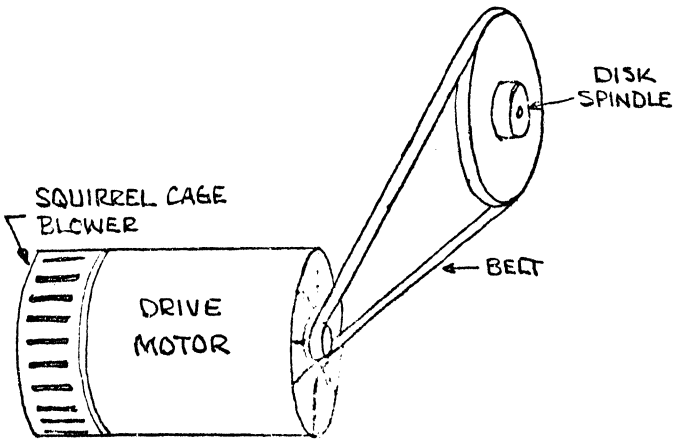


Figure 4-5. Drive System

Centering Cone

The centering cone assembly is used to press the inner portion of the disk against the drive hub, causing it to rotate with the hub. The centering cone is engaged and disengaged by means of the handle on the front panel of the disk drive (Figure 4-6).

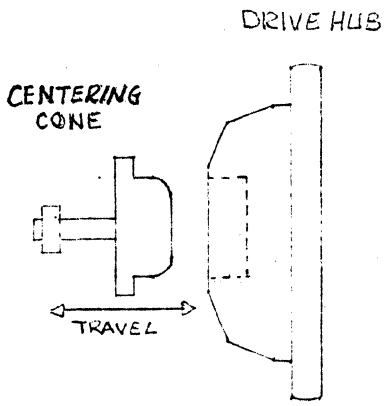


Figure 4-6. Centering Cone

FUNCTIONAL DESCRIPTION

The Model 110 Disk Drive is designed to operate completely under control of the system. Changing disk cartridges being the only operator function.

Figure 4-7 is a functional disk block diagram showing what must be furnished by the system (IN) and what the drive furnishes to the system (OUT).

Disk drive operations can be divided into the following functional sequences:

- Power Up and First Seek
- Program Seek
- Data Transfer
- Power Down

Power Up and First Seek

The power up and first seek sequence is performed to position the read/write head over track 00 in preparation for disk drive program controlled operations.

The controller initiates the sequence by setting all interface command signals to their false state and applying ac and dc power to the drive.

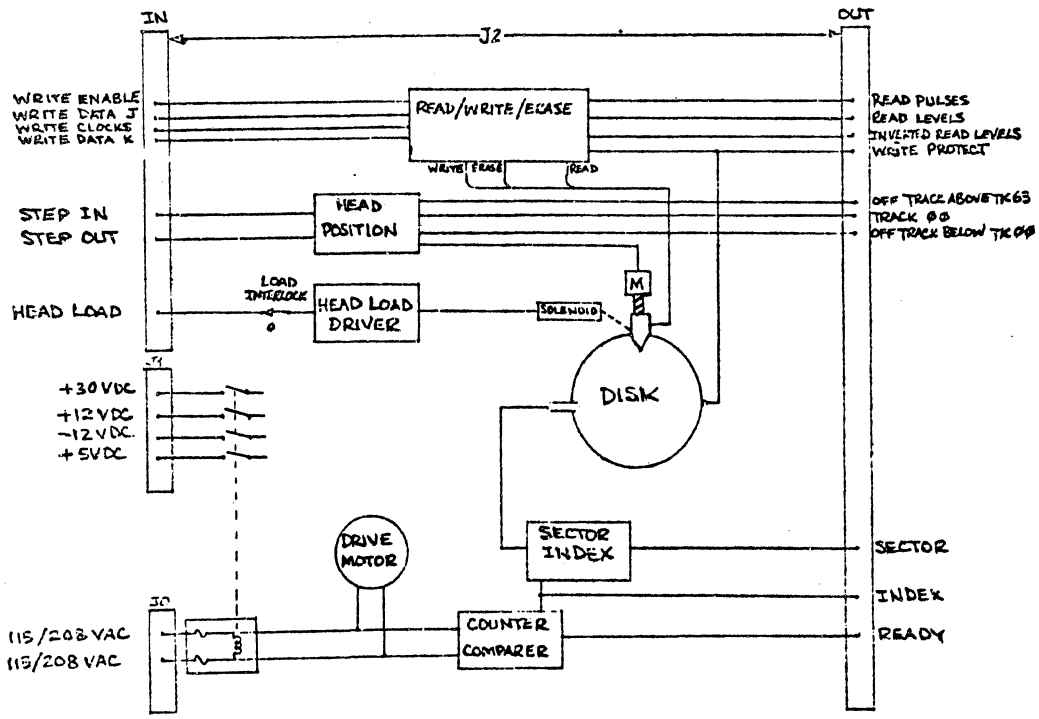


Figure 4-7. Functional Block Diagram

With power applied, the controller monitors the head position signals. If track ØØ or below track ØØ signals is true, the controller issues 8-10 step in commands and then step out commands until track ØØ signal goes true. This prevents the positioning system from positioning on a half track.

Step in commands are given if off-track below track 00 is true and step out commands if the signal is false.

When track 00 signal goes true, the read/write head is positioned over track 00 and the sequence is completed.

Program Seek

The purpose of the program seek sequence is to position the read/write head over the track required by the next read or write operation.

The controller should be designed to determine how many tracks separate the present head location from the desired location and in which direction to move.

If the move is to a higher numbered track, the controller initiates a program seek by issuing step in commands.

If the move is to a lower numbered track, step out commands are given.

The sequence terminates when the controller has issued the number of step commands equal to the track separation.

Data Transfer

A data transfer operation can be initiated by the controller after a seek operation.

The transfer operation is initiated with the disk drive in a ready condition and the controller setting the LOAD HEAD signal to its true, low level, state. The drive also provides sector and index pulses that may be used as synchronization pulses.

60 milliseconds after head load goes true, allowing the head to position itself on the disk surface, the drive is ready for data transfer. To terminate a data transfer operation, the controller sets LOAD HEAD to its false state and then removes ac power to the drive motor.

Write Operation

To initiate the write operation, the controller sets write enable signal to its true state and starts transferring formatted write information to the drive in serial.

The drive write circuits converts the serial information to head drive current, causing the disk surface to be magnetized in the write information format.

The straddle erase circuit provides a constant dc current to erase the edges of the recorded track. This provides track separation and eliminates track crosstalk.

To terminate a write operation, the controller sets the write enable signal to the false state.

Read Operation

The disk drive is continuously doing a read operation when the head is loaded and write enable is held in the false state.

A read operation immediately following a write operation requires a 400 micro-second read circuit stablization period after write enable goes false.

The controller may terminate a read operation one of three ways:

a. Stops storing data provided at the interface by the drive.

b. Initiate a write operation.

c. Initiate a data transfer termination.

Power Off

At the conclusion of the disk drive operations, the controller should initiate a power-off sequence.

The controller sets all command interface signals to their false states.

The controller removes all power to the drive.

LOGIC CONVENTIONS

The Model 110 Disk Drive uses 5-Volt TTL Logic mostly where a voltage more positive than +2.0 volts (turn-on threshold) is considered as a logical high and a voltage more negative than +0.8 volts (turn-off threshold) is considered as a logical low. Figure 4-8 shows the logical high and low ranges for both input and output signals.

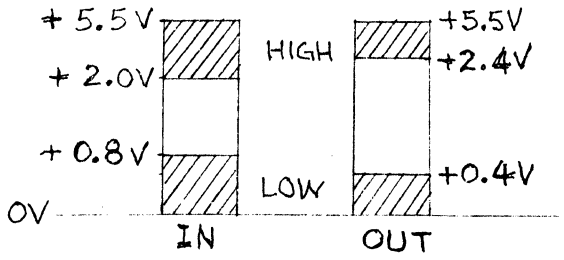
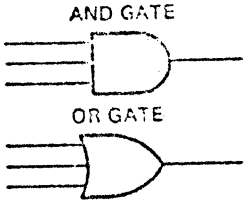
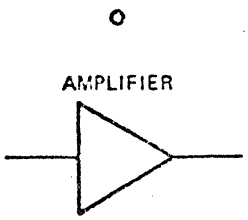


Figure 4-8. Logic Levels

The following conventions are provided to aid in understanding the symbology used in this manual.



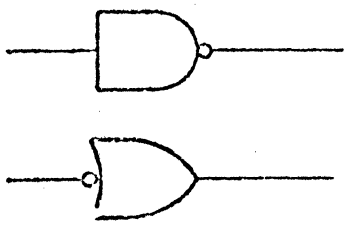
- The output is high if any only if all inputs are high
- The output is high if any input is high

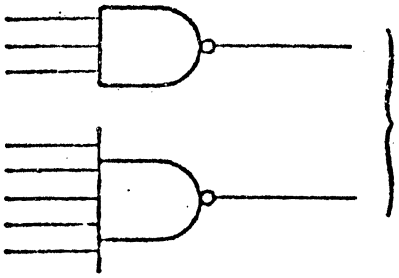
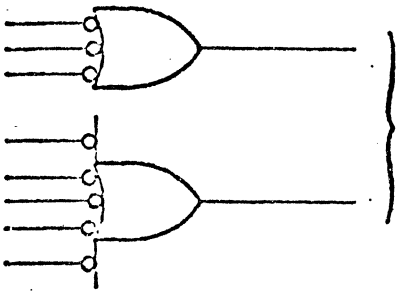
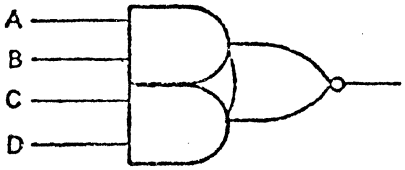
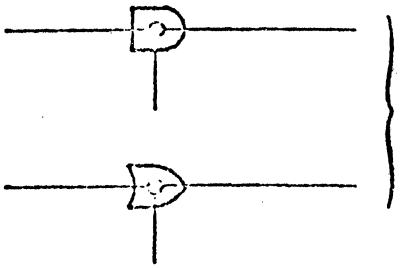
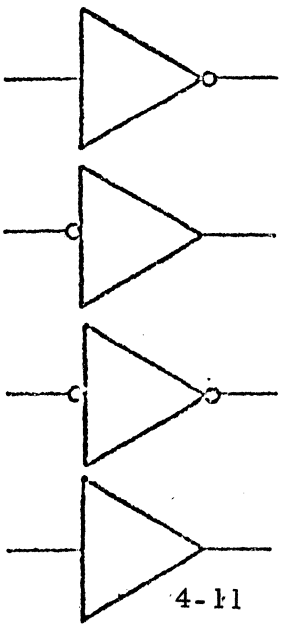


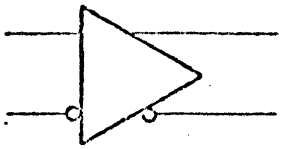
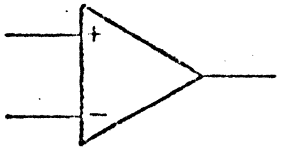
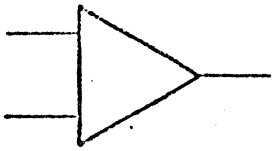
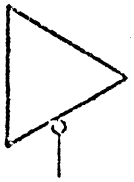
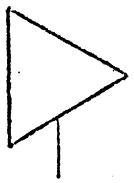
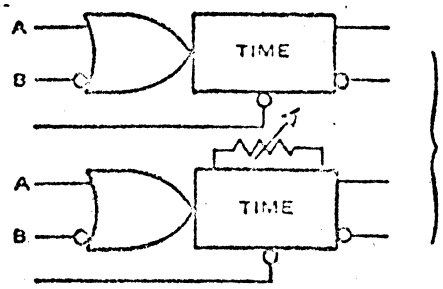
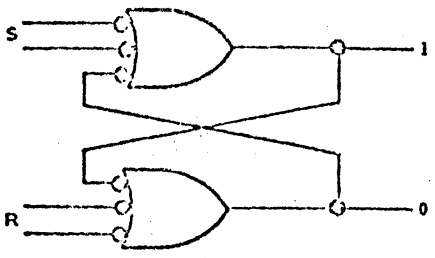
- A circle placed adjacent to a logic symbol indicates that a logic low is the significant state
- The absence of a circle indicates that a logic high is the significant state
- Output level is the same as input level.

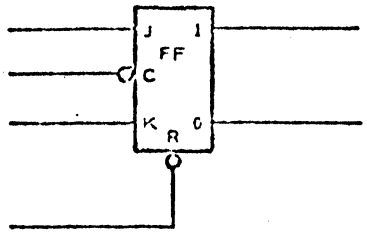
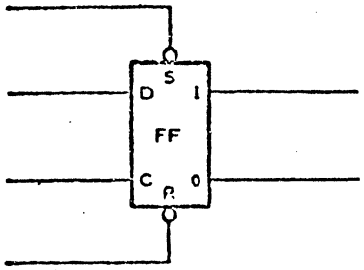
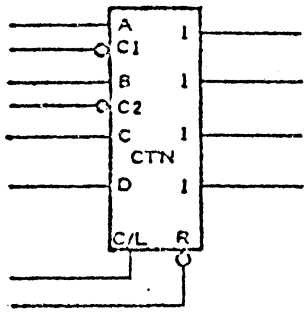
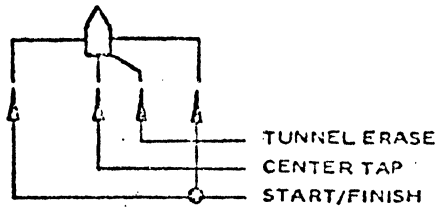
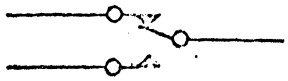
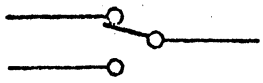
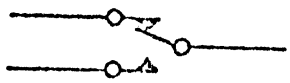
LOGIC SYMBOLOGY

The following logic symbology is used throughout this manual:

Logic Function	Logic Symbol	Definition
Inverter		High in, low out Low in, high out

Logic Function	Logic Symbol	Definition
3-Input NAND GATE		All highs in, low out Any low in, high out
Multiple-Input NAND Gate		
3-Input NOR Gate		Any low in, high out All highs in, low out
Multiple-Input NOR Gate		
2-Input AND-NOR Gate		High A B or high C D, low out Low A + B and C + D, high out
Wired AND		Outputs of separate functions wired together to form an AND or OR function
Wired OR		
Line Receivers Line Drivers Relay Drivers Lamp Drivers		High in, low out Low in, high out Low in, low out High in, high out

Logic Function	Logic Symbol	Definition
Amplifiers		Differential
		Operational
		Schmitt Trigger, Comparator
		Low enable
		High enable
One-Shots (Output pulse duration determined by External R/C)		IC One-Shot A input low, output pulse triggered by negative-going B input. B input high, output pulse triggered by positive-going A input Low reset interrupts timing cycle
Cross-Coupled Latch		Either set input low, latch sets One set and reset input low, both outputs high Either reset input low, latch resets

Logic Function	Logic Symbol	Definition
J-K Flip-Flop		J input high and K input low, 1 output goes high when clock goes low J input low and K input high, 1 output goes low when clock goes low 0 output complements 1 output. J and K inputs both high, flip-flop toggles when clock goes low Direct reset input low, flip-flop resets without clock
D Flip-Flop		Clock goes high, 1 output follows data (D) input. 0 output complements 1 output Direct set input low, flip-flop set Direct reset input low, flip-flop resets
Counter		Operator as 4-bit counter when A output connected to clock C2 Data input presets counter when count/load input goes low A binary count is made each time clock C1 goes low, with count/load input high All outputs go low when reset goes low, regardless of clock inputs
Read/Write Head		Read, write and erase head
Contacts (Switches and Relays)		Spring-loaded, momentary contact (microswitches, etc.)
All contacts shown in the normally closed position		Locking contact (toggle, etc.)
		Relays

DETAILED DESCRIPTION

All descriptions include text-related logic diagrams and flow and timing diagrams (where applicable). The flow and timing diagrams are included at the end of functional descriptions and are intended to serve as a summary of previously described functions. In addition, simplified schematic diagrams are provided for circuit analysis.

The detailed description is divided into the following areas:

- Control System
- Positioning System
- Read/Write System

Control System

The control system is made up of the following four logic circuits:

- Sector/Index
- Ready
- Head Position
- Write Protect

Sector/Index

The purpose of the sector/index logic is to detect 1 index and 8 equally spaced sector holes each revolution of the disk and develop sector and index pulses for the controller. The sector/index logic will be divided into two parts for analysis:

- Detection and Shaping
- Pulse Development and Separation

Detection and Shaping

Sector and Index holes are detected by a light-emitting diode and photo-transistor. The detect signal is shaped by a Schmidt Trigger. Use Figure 4-9 for circuit analysis.

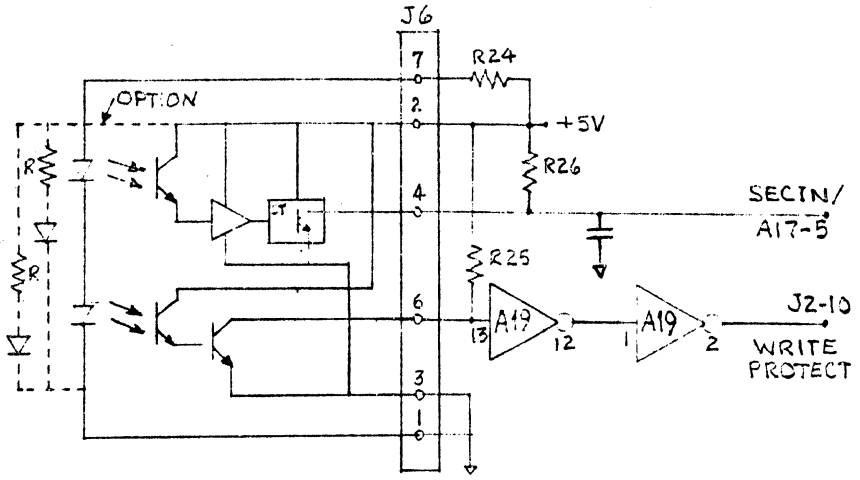


Figure 4-9. Detection and Shaping

When power is applied, the L.E.D. continuously emits infrared light.

When the holes on the rotating disk pass the top L. E. D., light passes through and strikes the light sensitive base of the associated photo transistor, causing it to conduct.

When the photo-transistor conducts, a positive voltage is transferred to the input of the amplifier, and its output goes high.

This high input to the Schmidt Trigger causes its output, which is normally high, to go sharply low.

Pulse Development and Separation - Figure 4-10 will be used for analysis of the pulse development and separation logic.

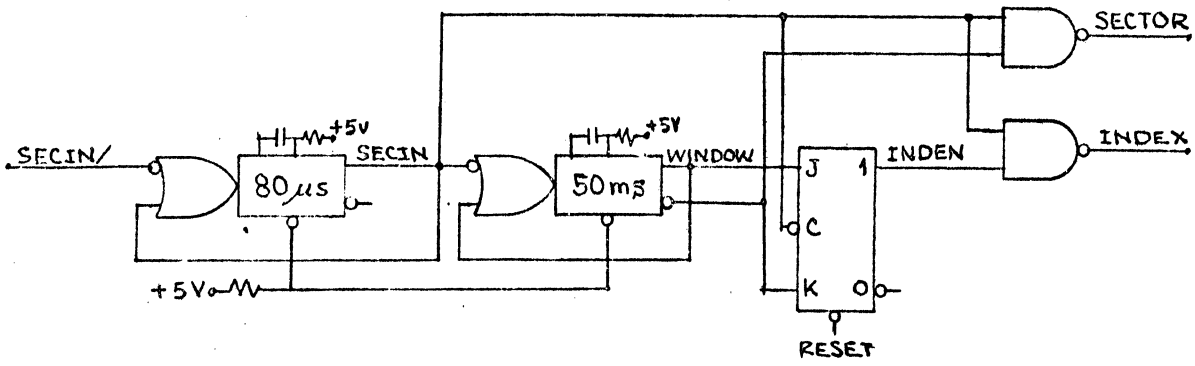


Figure 4-10. Pulse Development and Separation

Secin and window one-shots are configured for non-retriggerable operation.

The leading edge of the negative pulse, SECIN/, triggers SECIN one-shot. An 80 micro-second positive pulse, SECIN, is developed for each trigger and is used in four ways:

- Disables one-shot, Secin, input
- Trailing edge triggers WINDOW one-shot
- Trailing edge clocks INDEN flip-flop
- Input to SECTOR and INDEX output NAND gates

The sector output NAND gate is enabled by the normally high output of WINDOW one-shot and with trailing edge triggering of WINDOW, a 80-micro-second, negative, SECTOR pulse is generated each time SECIN one-shot triggers.

The INDEX output NAND gate only produces a negative pulse output when enabled by INDEN flip-flop being set.

Setting the INDEN flip-flop requires a SECIN clock pulse while WINDOW is high.

Figure 4-11 shows a timing diagram of the sector/index logic.

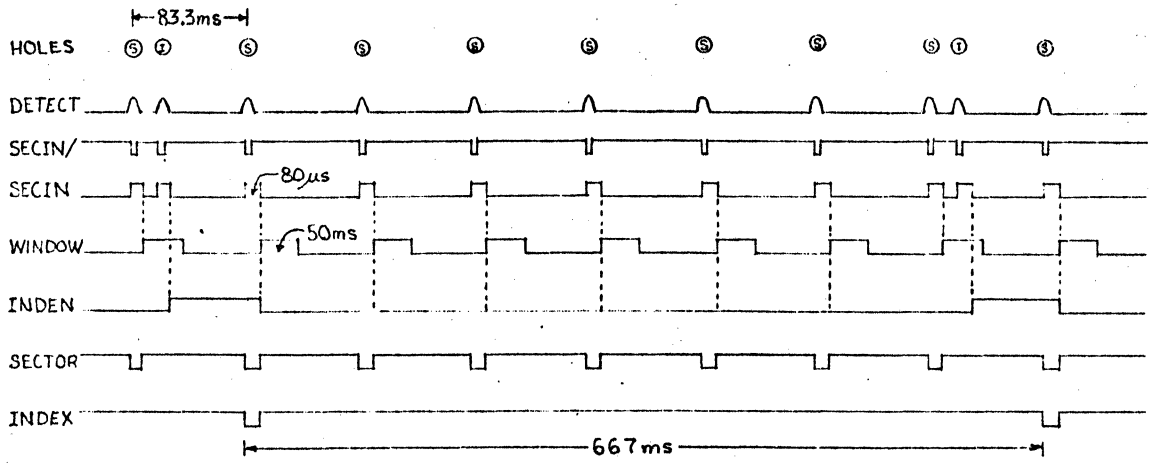


Figure 4-11. Sector/Index Timing Diagram

Ready

The purpose of the ready logic is to develop an output signal when ac and dc power are present and the disk is at operating speed. Disk speed is compared with a time reference, based on the ac power frequency.

The ready logic will be divided into three parts for analysis:

- Pulse Generator
- Counter
- Comparator

Pulse Generator - Analysis of the pulse generator portion of the ready logic will use Figure 4-12.

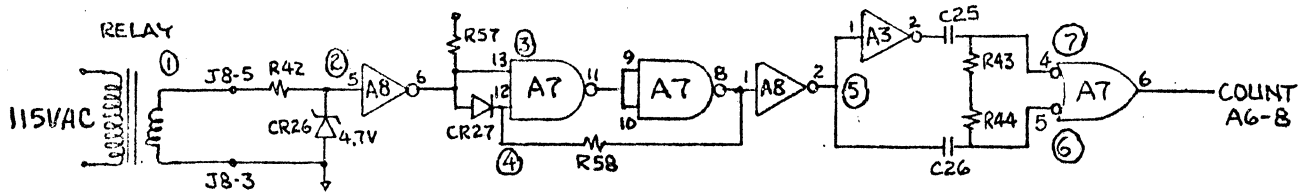


Figure 4-12. Ready (Pulse Generator)

Ac power input, (1) of Figure 4-12, comes from a transformer which reduces its amplitude to approximately 6 volts.

Zener diode, CR26 and series resistor, R42 limits the input, A8-5, to 4.7 volt positive signals, (2).

The slow rise and fall time of inverter output, A8-6, may cause the NAND gate, A7-11, to oscillate during switching time. To prevent these oscillations, diode, CR27, and the positive feedback loop has been added to input, A7-12. Inverter output A7-8, is inverted, (5). This signal is inverted and differentiated by C25 and R43. The signal is also differentiated, without inversion, by C26 and R44.

The differentiated, 180-degree out-of-phase, signals are inputs to the NOR gate, A7-5.

The negative going signal across R43 or R44 causes a positive signal at the gate output, A7-6. The pulse train is the clock for the counter

Figure 4-13 is a timing diagram for the pulse generator.

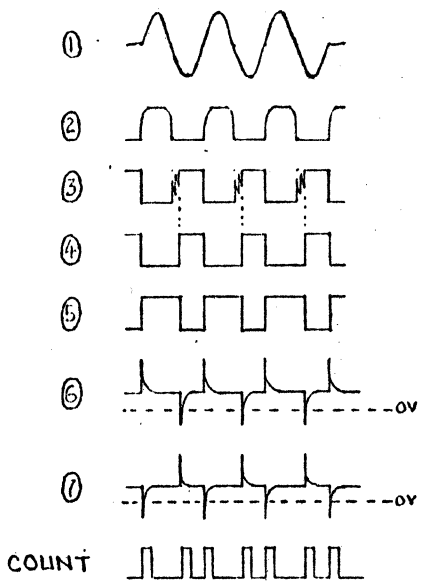


Figure 4-13. Ready (Pulse Generator) Timing Diagram

Counter - The counter, synchronized by every other index pulse, counts the ac alterations, COUNT, producing a time based output.

Two high speed monolithic counters, each consisting of four dc coupled, master-slave flip-flops are internally interconnected to provide a divide-by-two and a divide-by-eight counter.

Figure 4-14 shows the counter logic and will be used for analysis.

By externally connecting the output (A) of the first internal flip-flop to the input (C2) of the second internal flip-flop, the counters divide-by-sixteen.

The input to the first counter is the pulse train, COUNT, from the pulse generator. The divide-by-sixteen output (D) is the input to the second counter.

The time for two revolutions of the disk, at operating speed, is 1334 milliseconds. By selecting the correct outputs, from the two counters, low speed can be detected.

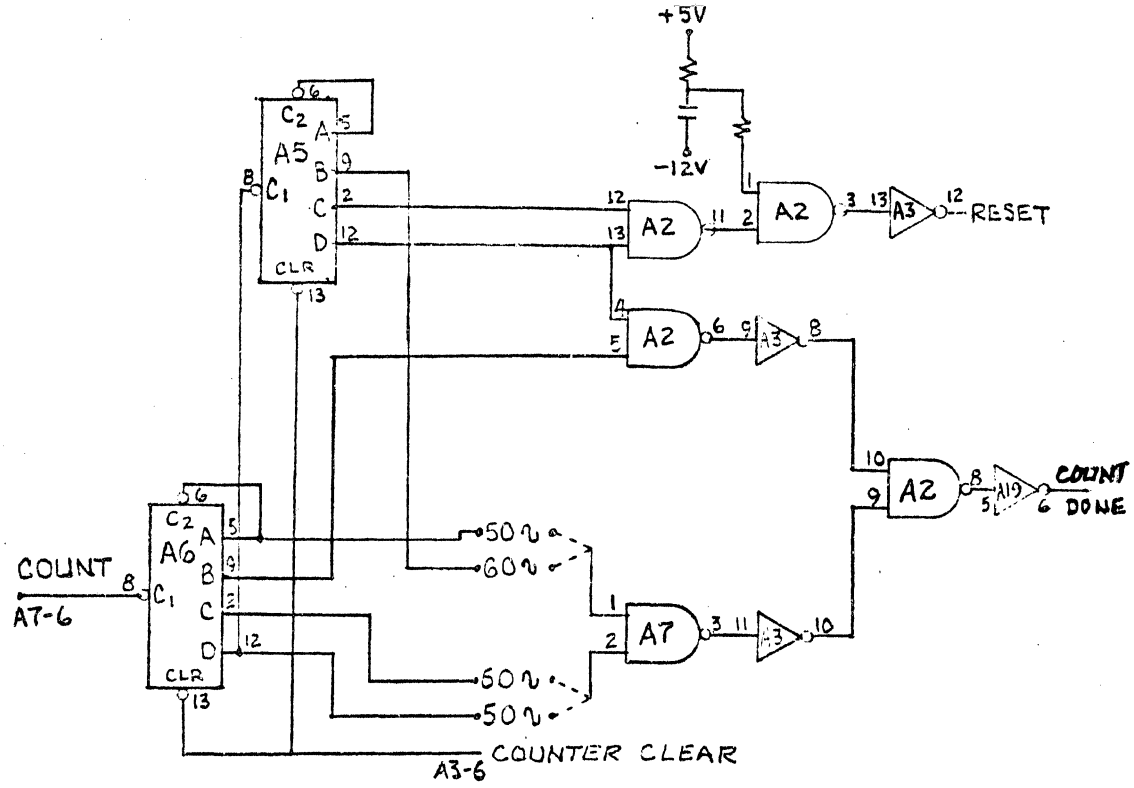


Figure 4-14. Ready (Counter)

Counter one's B output and counter two's D output are AND-ed, inverted and used as one timing input, A2-10, to the output NAND gate.

The other timing input, A2-9, is obtained by anding and inverting two other outputs from the counters. Frequency of the ac power determines which two, as follows:

- 50 cycle - Counter one outputs A and D
- 60 cycle - Counter one output C
  Counter two output B

When both timing inputs to the output NAND gate go high, the output signal, goes low. Inverter A19 clocks the COUNT DONE HOLD flip-flop in the comparator section causing it to set.

COUNTER CLEAR, from the comparator, is used to reset both counters.

The signal RESET, A3-12, is used to dc reset the READY, COMPARE, and INDEN flip-flops and causes COUNT CLEAR to reset the counters during power up and with the loss of INDEX pulses.

During power up, RESET is held low until C28 charges.

During operation, if the "C" and "D" output of counter A5 go high, RESET goes low.

Comparator - the time relationship of the rotating disk's index pulse and the time reference signal, COUNT DONE, are compared to generate a READY signal for the controller.

Figure 4-15 will be used for analysis.

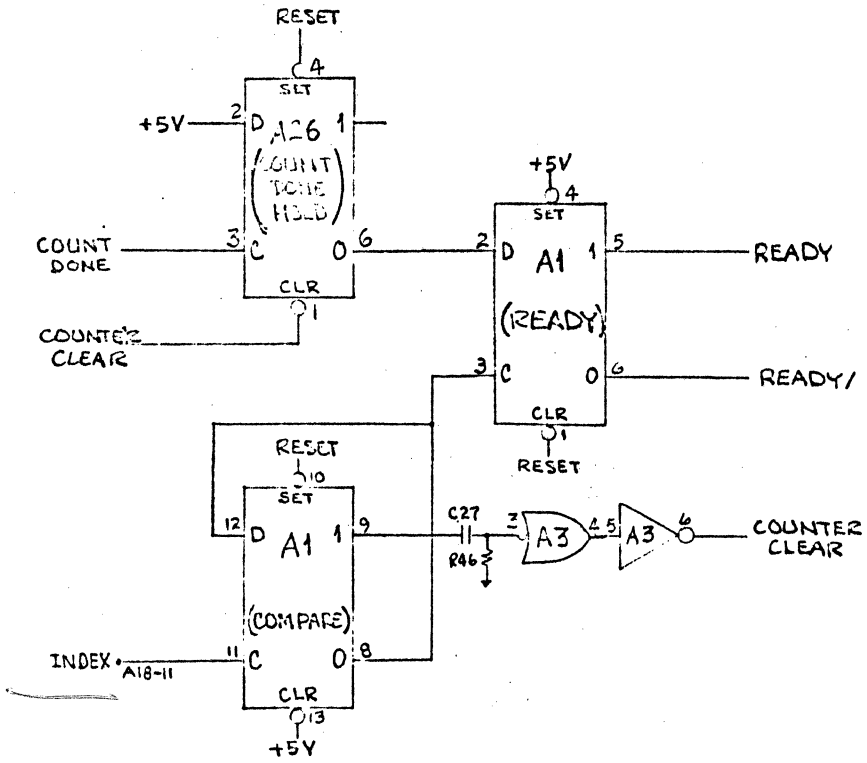


Figure 4-15. Ready (Comparator)

The Count Done Hold and Compare flip-flops are initally placed in the set state by the RESET signal. Ready flip-flop is initially reset by the same signal.

With the Compare flip-flop set, C27 charges through R46 and signal COUNTER CLEAR is high.

The leading edge of the first index pulse will reset the Compare flip-flop causing:

a. Signal COUNTER CLEAR to go low, resetting the counters in the counter section of ready and resets Count Done Hold flip-flop.

b. Clocks the Ready flip-flop with Count Done Hold flip-flop initially in the set state, ready flip-flop stays in the reset state.

Index pulses continue to clock the Compare flip-flop causing it to toggle. Each time it is reset, Ready flip-flop is clocked.

If the Compare flip-flop clocks ready after signal COUNT DONE clocks and sets Count Done Hold flip-flop, Ready flip-flop will reset signalling a NOT READY condition.

If during operation, the disk stopped, the READY flip-flop could not be reset because there are no index pulses. Refer to Figure 4-14.

This false ready condition is prevented by counter two outputs "C" and "D". With no index pulses the counters continue to count and when counter two outputs C and D both are high, NAND gate output, A2-11 goes low. This results in RESET going low and the READY flip-flop is dc reset, indicating NOT READY.

Figure 4-16 is a timing diagram for the ready comparator.

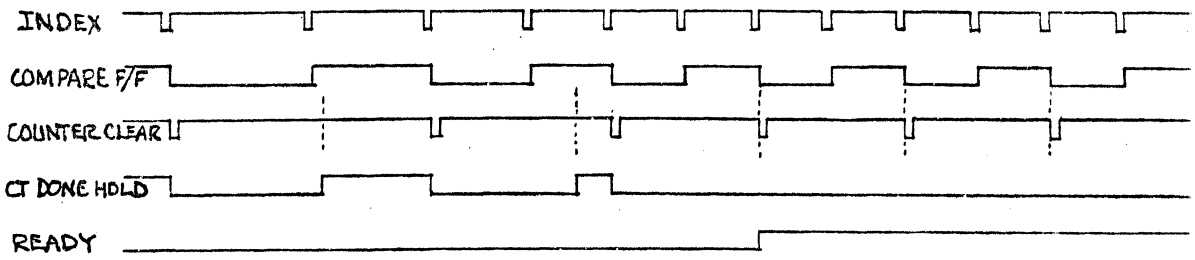


Figure 4-16. Ready (Comparator) Timing Diagram

Head Position

The purpose of the head position logic in the control system is two-fold. It generates head position signals for use by the controller and controls the conditions under which the head positioning logic is allowed to move the head.

Figure 4-17 and 4-18 will be used to analyze the head position limit-signal logic.

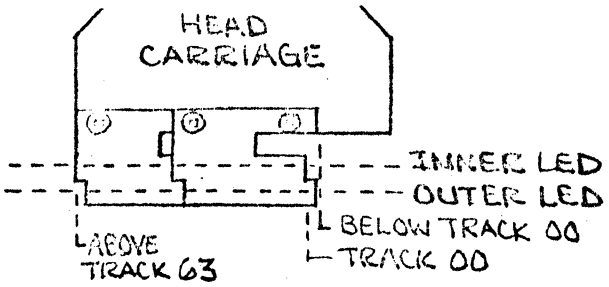


Figure 4-17. Head Position Detection

The slide, Figure 4-17, is attached to and moves with the read/write head assembly.

The slide moves through the detection assembly, passing between two light-emitting diodes (L. E. D.) and their associated photo-transistors (P-T).

Figure 4-18 shows the head position limit-signal generation logic.

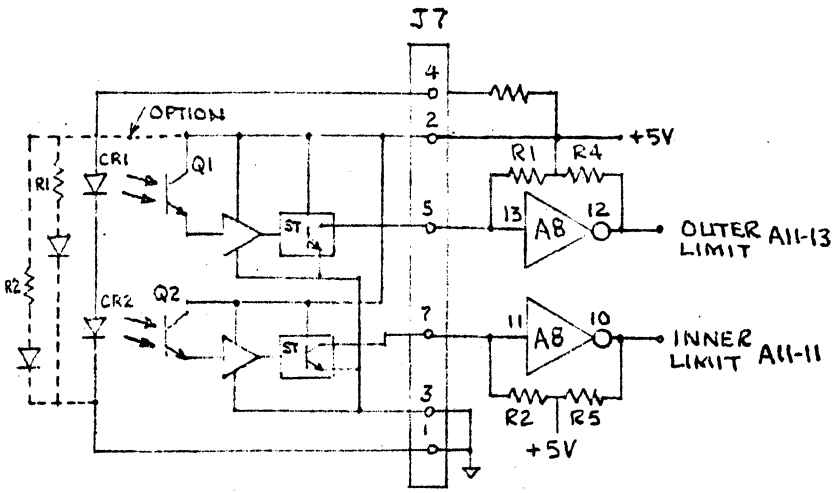


Figure 4-18. Head Position Limit-Signal Generation

The photo-transistors, Q1 and Q2, will only conduct if the light from the L. E. D.'s CR1 and CR2, strikes their bases.

The logic for both the outer and inner limit signals are identical and only the outer limit logic will be analyzed.

Light from light-emitting diode, CR1, strikes the base of the photo-transistor, Q1, causing it to conduct.

Q1 conducting causes the amplifiers output to go high and Schmidt Trigger's output to go sharply low. This low going signal is inverted by INVERTER A8 and sent to another Schmidt Trigger for further shaping.

The output signal, A8-12, is OUTER LIMIT and is sent to A11-13, head position control logic.

The limit signals are used to generate the head position interface signals and the head position control signals.

Figure 4-19 shows the logic used.

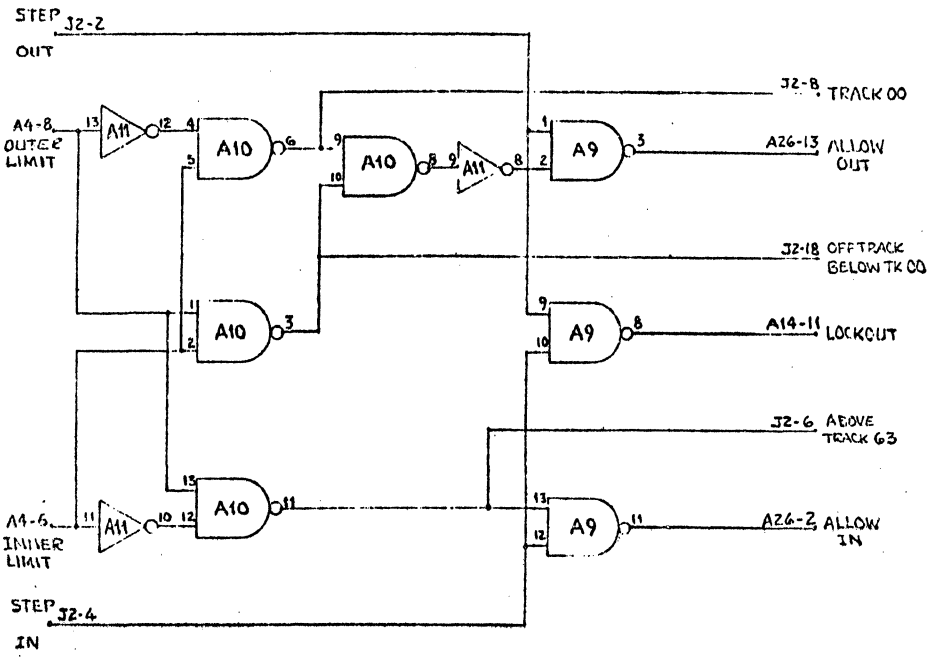


Figure 4-19. Interface and Control Signal Generation

Table 4-1 shows the limit signal levels necessary to generate low-active interface signals.

Table 4-1. Interface Signals

	OUTER	INNER
BELOW TK 00	HIGH	HIGH
TRACK 00	LOW	HIGH
ABOVE TK 63	HIGH	LOW

The controller inputs either a Step-in or Step-out signal for head positioning. These signals are one microsecond positive pulses.

The output signals, ALLOW OUT, LOCKOUT and ALLOW IN are control signals to the stepper drive logic and determine whether the head assembly will be repositioned.

If INNER LIMIT signal is high, output signal ALLOW OUT will not respond to a STEP OUT command.

If INNER LIMIT signal is low and OUTER LIMIT signal is high, output signal ALLOW IN will not respond to a STEP IN command.

Write Protect

The purpose of the write protect logic is to inhibit the write and erase logic from destroying data on the disk cartridge accidentally.

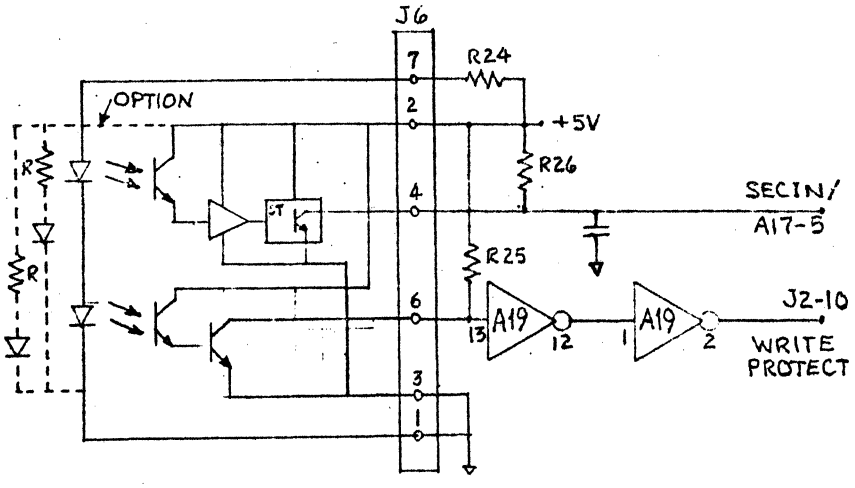


Figure 4-20. Write Protect Logic

The infrared light from the light-emitting diode strikes the base of the photo-transistor whenever the disk cartridge is loaded with the write protect hole uncovered. This causes the photo transistor conduct forward biasing the following transistor which also conducts, presenting a low level input, A19-13 to the inverter.

Write Protect, interface signal is low when the disk cartridge write protect hole is uncovered and write operations are prohibited.

Head Positioning System

The purpose of the head positioning system is to move the read/write head assembly toward or away from the center of the disk upon receipt of a direction and move signal from the control system.

For the purpose of analysis, the head positioning system will be divided into three parts as follows:

- Positioning Motor (Stepper)
- Carriage, Way and Helix
- Positioning Drive Logic

Positioning Motor (Stepper)

The drive power required to position the read/write head assembly is obtained by using a stepper motor.

The motor's armature rotation, used for positioning, is obtained in steps by driving current through different sections of the field windings.

Figure 4-21 is a simplified drawing of the stepper motor's field windings.

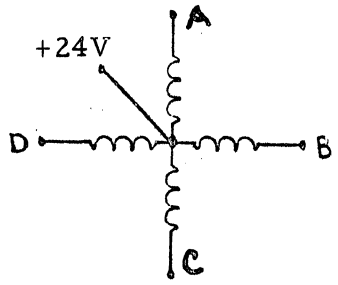


Figure 4-21. Stepper Motor Field Windings (simplified)

The four field windings are so wound that when current is changed from one winding to the next, the armature rotates fifteen degrees.

Current through a field winding sets up a strong magnetic field; the armature, which has a variable reluctance, is caused to align itself with this field, furnishing the least reluctance to the flux.

If current is moved from winding A (Figure 4-22) to winding B, the armature will rotate 15 degrees clockwise. Moving current from winding A to winding D causes a 15 degree rotation counterclockwise.

Carriage, Way and Helix

The read/write head assembly is mounted on the carriage which slides back and forth on the way.

Figure 4-22 shows the carriage, way and helix.

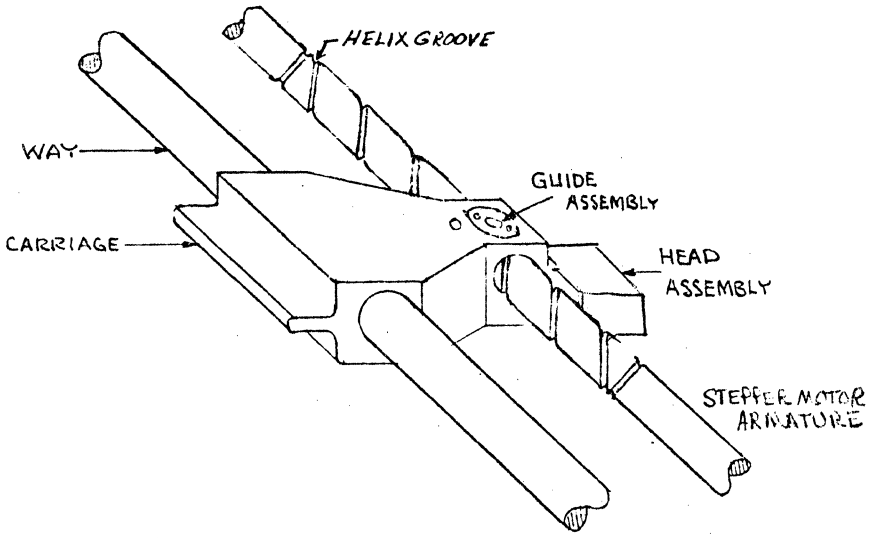


Figure 4-22. Carriage, Way and Helix

A stylus in the carriage guide assembly rides in the helix groove (Figure 4-23).

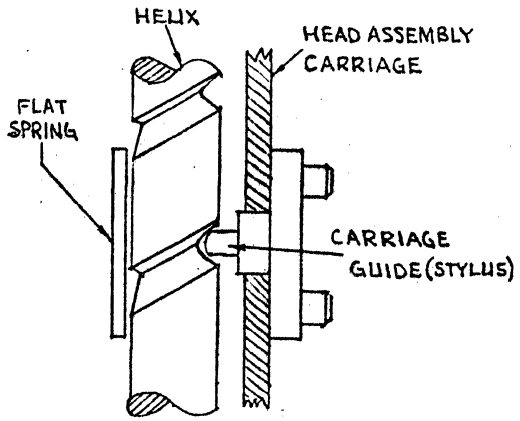


Figure 4-23. Carriage Guide Assembly

The angle of the helix groove causes the head assembly to move along the way, 0.010-Inch for each 15 degrees of rotation.

Positioning Drive Logic

The positioning drive logic furnishes current to the stepper motor field windings.

Figure 4-24 will be used to analyze the drive logic.

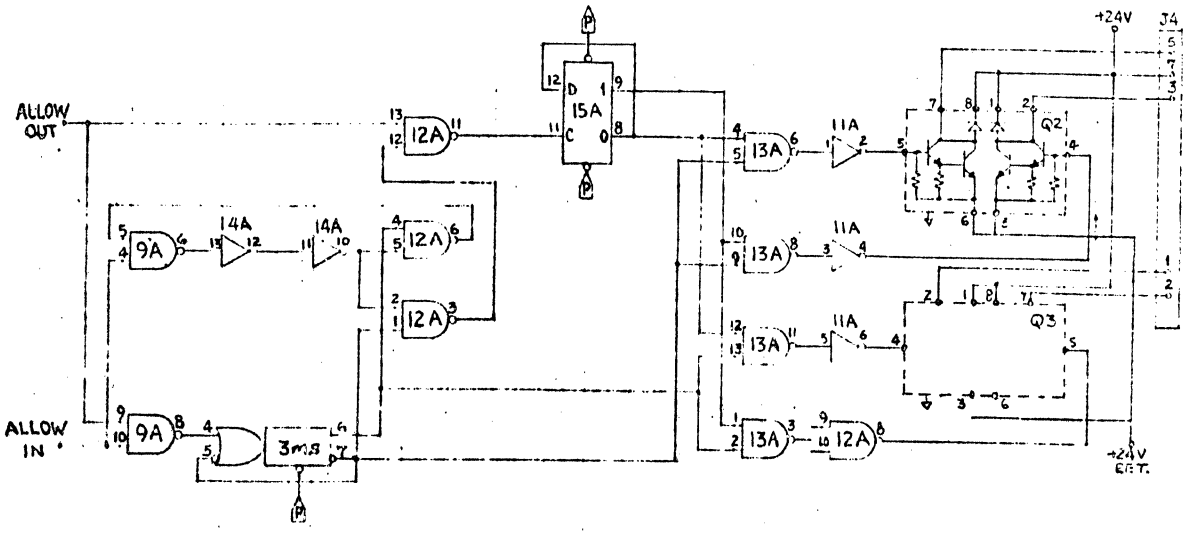


Figure 4-24. Positioning Drive Logic

To provide stability and accuracy, drive current is moved twice, to move the head assembly one track position.

This two step positioning is accomplished by toggling the D flip-flop (15A) and firing the 3-millisecond one-shot.

Drive current moves from one-field winding to the next on the leading and trailing edge of the one-shot output.

Figure 4-25 is a timing diagram showing stepping action.

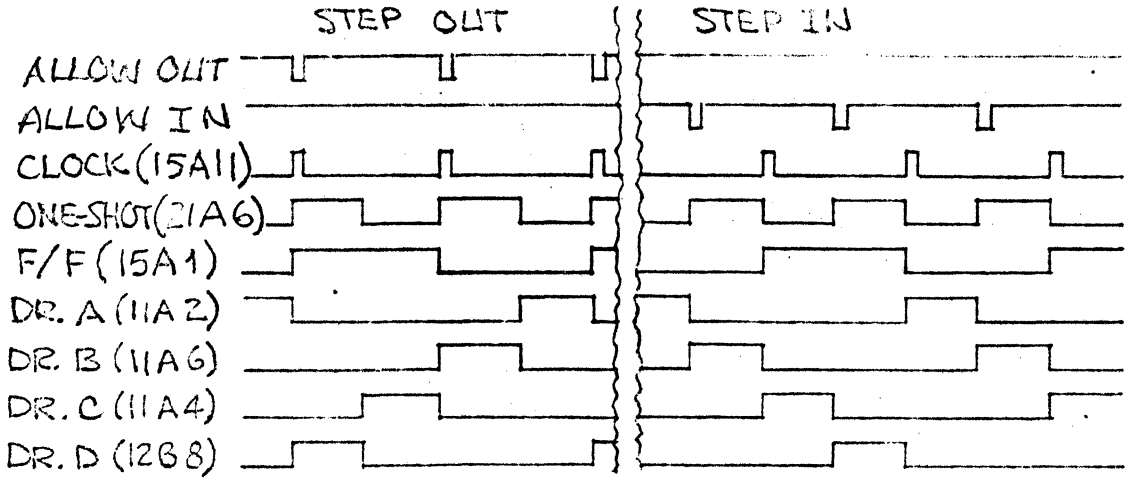


Figure 4-25. Positioning Timing Diagram

Figure 4-26 shows one of the current drivers.

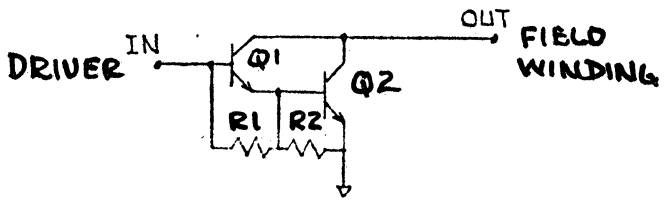


Figure 4-26. Current Driver

With the input to Q1 high, Q1 conducts from ground through R2 and the field winding to +24V. The positive potential at the top of R2 causes Q2 to conduct from ground through the field winding to +24V. This condition continues as long as Q1's input stays high.

The high current through the field winding develops a strong magnetic field to cause the armature to rotate.

Read/Write System

The read/write system provides a means of reading or recording data on the surface of a rotating disk.

For purposes of analysis, the read/write system will be divided into the following sections:

- Write Logic
- Erase Logic
- Read/Write Head
- Read Logic

Write Logic

The write logic, under the proper conditions, accepts pre-formatted digital information from the controller and records it on the disk surface using the write head.

The conditions necessary for the disk drive to perform a write operation are:

- Disk drive ready
- Write enabled
- Disk cartridge not write protected

Figure 4-27 shows the write logic.

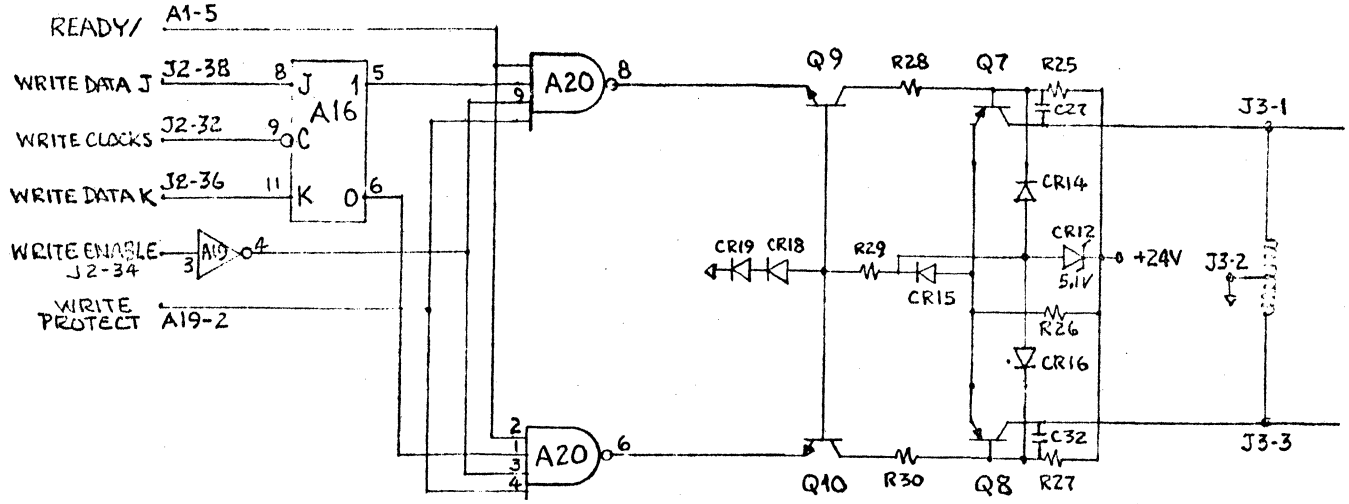


Figure 4-27. Write Logic (Simplified)

The method of data encoding used by the controller determines how it will be presented to the write logic.

Using the frequency doubling method, signal lines write data J and write data K are normally held high and the write clock line carries both data and clock.

With the J and K inputs to the flip-flop held high, it will change states at each negative transition of the clock.

A low output from the upper NAND gate (Figure 4-28) will occur when the flip-flop is set and the disk drive is ready, write enabled and not write protected.

When enabled and the flip-flop is reset, the bottom NAND gate has a low output.

When the upper NAND gate's output, A20-8, goes low, Q9 conducts. Q9 collector current forward biases Q7 by making its base less positive than its emitter and it conducts through half the read/write head.

When the bottom NAND gate's output, A20-6, goes low, Q10 and Q8 conduct and current flows through the other half of the read/write head.

Since the read logic input circuitry is across the read/write head, resistance is added to prevent any shunting effect on the write current.

R44, R45, and R46 are placed in series across the read/write head.

Erase Logic

The read/write head contains a straddle erase winding which is energized during all write operations.

The purpose of the erase logic is to supply a dc current to the erase head during write operations and for an extra 440 microseconds after write operation completions.

Figure 4-29 shows the erase logic.

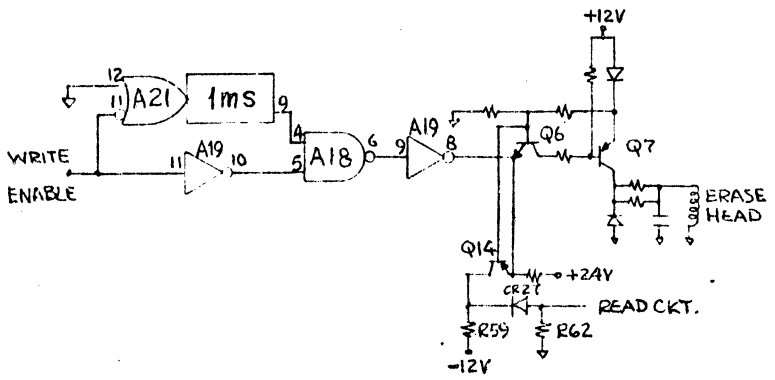


Figure 4-28. Straddle Erase Logic

Prior to the write operation, the input signal, (WRITE ENABLE) is low and the one-shot has not been triggered. Both inputs to the NAND gate are high, producing a low output, A18-6, causing the output A19-8 to be high. Both Q6 and Q7 are cut off and there is no current through the erase head.

When the write operation is initiated, (WRITE ENABLE) goes high causing the bottom input, A18-5 to go low.

The high NAND gate output causes the inverter output, A19-8 to go low and Q6 goes into conduction.

The voltage drop across Q6's collector resistors, lowers Q7's base potential and Q7 conducts up through the erase head.

When the write operation terminates, (WRITE ENABLE) goes low, triggering the one-shot. The upper input, A18-4 goes low and erase current continues to flow. Erase current stops when the one-shot times out.

The extra erase time is necessary because of the relative position of the write and erase heads in respect to disk rotation (Figure 4-30).

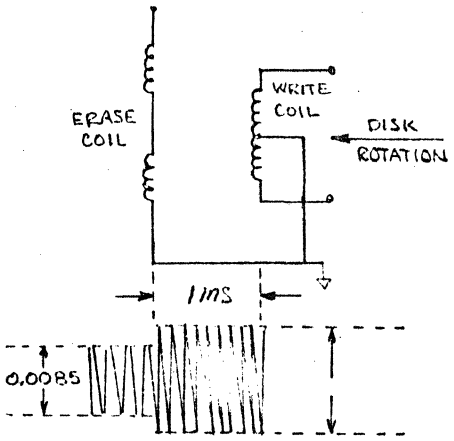


Figure 4-29. Write and Erase Head Positions

Q14 is used to develop gate potential for Q15 and Q16, FET's in the read circuit input.

During a write operation, Q14 is cut-off by Q6 conducting. This allows approximately a -11volts to be developed across R62.

During a read operation Q14 conducts and zero volts is felt across R62.

Read/Write Head

The head assembly records and reproduces data at a nominal density of 1061 BPI (outer track) and 1692 BPI (inner track), assuming a double frequency recording technique. At the specified rotational speed of the disk (90RPM±2.5%) the frequency of operation is 16.9 KHZ for an "all O's" pattern and 33.8 KHZ for "all 1's" pattern. The nominal time between flux reversals is 29.6 microseconds (all O's pattern) or 14.8 microseconds (all 1's pattern).

In operation the disk is loaded in contact against the head by means of force pads on the opposite side of the disk.

The radial track density is 64 tracks per inch, or 0.020 inch track to track. To achieve this track density, the head utilizes a "straddle erase" feature which trims the written track to a nominal width of 0.0085 inch.

The recording head (Figure 4-30) consists of two coils wound on a split ferrite core.

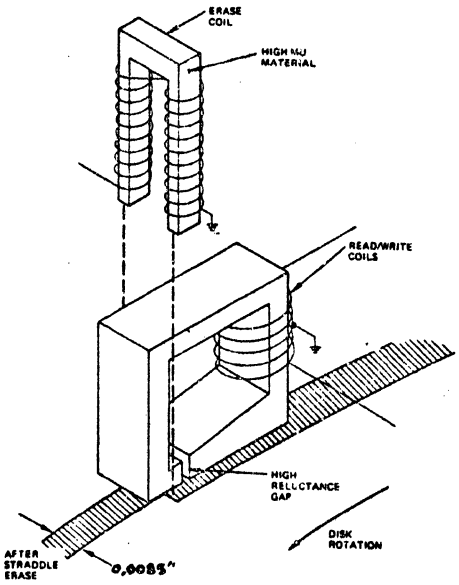


Figure 4-30. Read/Write Head

The erase coil is physically loacated behind the write coil, with respect to disk rotation.

Read Logic

If WRITE ENABLE is false (high level at the interface) and the loaded disk is rotating with the head loaded, the disk drive is reading.

The simplified read logic diagram shown in Figure 4-31 will be used for analysis.

A small voltage is induced in the read head coil each time a reversal of the magnetic field, on the surface of the disk, passes under the head.

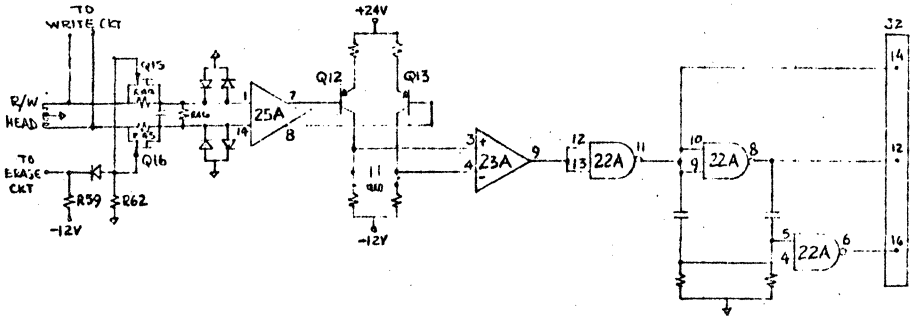


Figure 4-31. Read Logic (Simplified)

To develop this voltage, the input resistance for the read pre-amplifier, 25A, must be reduced.

During a read operation, the voltage across R62 is zero, causing FET's Q15 and Q16 to conduct.

With Q15 and Q16 conducting R44 and R45 are removed from the circuit, allowing the input signal to be developed across R46.

This voltage is inputed to pre-amplifier 25A as two signals 180-degrees out-of-phase. The pre-amplifier's outputs are fed to peak detectors Q12 and Q13.

The peak detectors shift the phase forward 90-degrees and sends them to comparator 23A.

The comparator 23A compares and shapes the signals to that its output is a positive pulse train whose transitions occur at the same time as the detected magnetic field reversals on the disk.

The pulse train inputed to NAND gate, 22A, pins 12 and 13 are limited to +5 volts amplitude. The output, pin 11, is presented to the interface cable connector, J2, pin 14 as Read Data Levels.

The pulse train, 22A11, is, (1), sent to pulse shaping NAND gate, 22A4 and, (2) inverted and sent to 22A5.

Interface cable connector J2-12 is Inverted Read Data Levels from NAND gate 22A8.

J2-16 is Read Data Pulse, used with double frequency techniques.

SECTION 5
PREVENTIVE MAINTENANCE

GENERAL

The Model 110 Disk Drive is designed and constructed to provide a minimum useful life of five years or 15,000 operating hours before factory overhaul or parts replacement are required.

To ensure optimum performance of the disk drive, periodic checks and visual inspections should be performed.

Daily, weekly and monthly checks and tasks have been listed under operator maintanance (Section 3).

The checks listed in this section should be performed by maintenance personnel semiannually.

VISUAL INSPECTION

The first step in any preventive maintenance schedule is careful and thorough visual inspection for signs of dirt, wear, cracks, binds, loose connections or loose hardware. Performing the preventive maintenance for any of these problems will greatly extend equipment life.

CLEANLINESS

The second step in preventive maintenance is cleanliness. A clean internal and external environment will enhance equipment life and appearance. Dirt and grime not only look bad but also cause wear. An unclean disk drive is extremely detrimental to the read/write head cartridge, the disk and data storage capability.

The importance of visual inspection and cleanliness of the disk drive cannot be over-emphasized. Many problems need never occur if cleanliness is observed.

It is recommended that maintenance personnel read each procedure thoroughly prior to performing that procedure and to perform grouped procedures concurrently.

SEMIANNUAL PREVENTIVE MAINTENANCE PROCEDURES

The following tasks are to be accomplished semiannually:

- Check the read/write head; inspect and clean if necessary
- Clean disk drive internally
- Change the air filter
- Check drive system
- Check head positioning system
- Check read/write system

Materials required to perform these tasks are:

- Freon TF
- 91% isoprophyl alcohol
- Tongue depressers or cotton-tipped swabs (Q-tips)
- Inspection mirror - (dental)
- High intensity lamp (flashlight)
- Soft lint-free cloth (gauze)
- Commercial cleaner (soft detergent)
- Voltohmmeter (VOM)
- Oscilloscope
- Disk Drive Exerciser - Model 2000 or Control Unit in-Line Diagnostics

Read/Write Head

During the preventive maintenance procedures, the read/write head should be inspected for the following conditions:

- Scratches and grooves
- Oxide buildup
- Residue buildup

- Fingerprints and other oil-like stains

CAUTION

Do not touch the head surface with the inspection tools. Clean head ONLY if dirty.

To inspect and clean the read/write head proceed as follows:

a. Turn all power off to the disk drive and remove both side covers.

b. Unscrew module board and lay down out of the way.

c. Unplug read/write cable from J3 on back of module board (Figure 5. 1)

d. Unscrew read/write head assembly from head carriage and remove.

e. Utilizing a light source, inspect the read/write head for any indication of damage or contamination.

f. If read/write has any indication of damage, it must be replaced.

CAUTION

Do not adjust head alignment.
It is factory adjusted.

g. If the read/write head has any indication of contamination, it must be cleaned.

h. Saturate clean swab with alcohol, shake off excess and clean head pad surface.

i. Using lint-free cloth, wipe head pad surface dry.

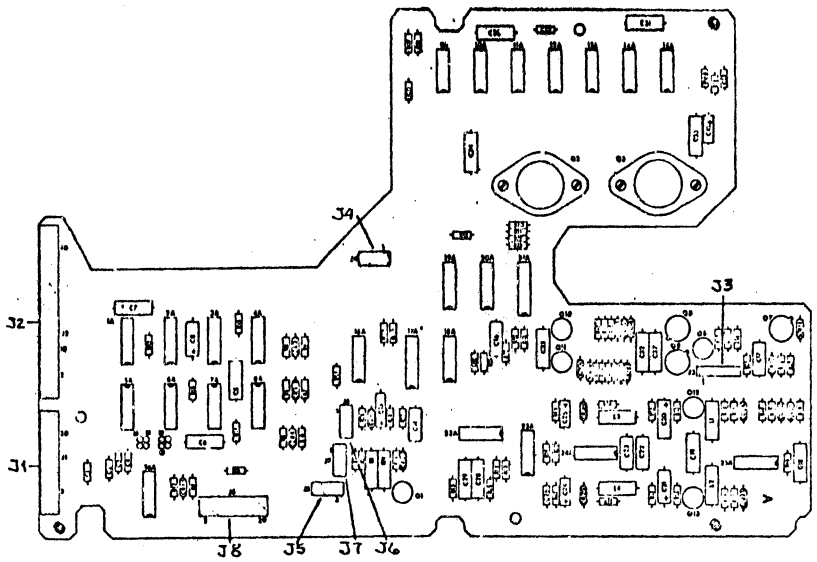


Figure 5-1. Interconnecting Cable Location

j. Re-inspect head surface to ensure head is clean and there is no residue.

k. After removal of heavy oxide, clean head with Freon TF to remove all residue.

l. To replace read/write head assembly, reverse procedure.

Internal Cleanliness

a. Remove both side access covers.

b. Inspect and remove any accumulation of dirt and dust.

Air Filter

a. Remove air filter from back cover. Replace filter.

Drive System

a. Remove both side access covers.

b. Inspect drive belt for signs of wear.

c. If the drive belt shows any signs of wear, it must be replaced. Refer to Section 7, Drive Belt Replacement.

d. Inspect the cartridge load lever and hub action for any signs of wear or binding.

e. If hub does not detent when lever is in release position, assembly must be replaced. Refer to Section 7, Hub and Load Lever Replacement.

f. Place a scratch disk cartridge in the load slot.

g. With the cartridge load lever in the engage position, the hub should be spring-loaded against the disk. If not, refer to Section 7, Hub and Load Lever Replacement.

WARNING

Exercise extreme care when side covers are removed and power is applied. Ac Control module board has voltages hazardous to personnel.

h. Apply power to disk drive and measure input voltages listed in Table 5-1.

i. With a scratch disk cartridge loaded, Load Lever engaged, and power applied, connect oscilloscope in accordance with information given below. Check sector pulses.

Table 5-1. Power Input Voltages

Voltage	Pin
115/208 VAC	J0-1 J0-3
+24 VDC	J1-2 J1-4 J1-6
+12 VDC	J1-8
+ 5 VDC	J1-10
-12 VDC	J1-12

PROG Sector Pulse Width Check

SYNC Int. Neg.

CHAN 1V A18-8 Sector Pulse

CHAN 2

MODE CHAN 1 only

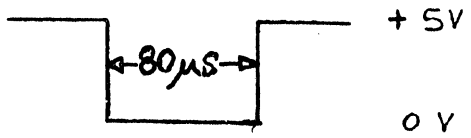


Figure 5-2. Sector Pulse Width Check

j. If sector pulse is not 80 microseconds wide, refer to Section 7, Sector Optical Switch Assembly Replacement.

k. Connect oscilloscope in accordance with information given below.

PROG Sector Pulse Period Check

SYNC Int. Neg.

CHAN 1 1V A18-8 Sector Pulse

CHAN 2

MODE CHAN 1 only

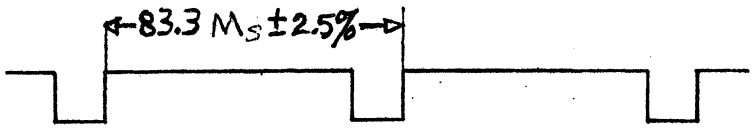


Figure 5-3. Sector Pulse Period Check

a. If sector pulse period is not 83.3 milliseconds ±2.5%, refer to Section 7, Drive System Checks and Replacement.

Head Positioning System

There are two methods of checking the head positioning system.

- On-Line (System)
- Off-Line (Exerciser)

On-Line

a. Remove both side access covers.

b. Load CE disk cartridge.

c. System to perform the following functions:

(1) Apply power to disk drive and check for ready.

(2) When ready, step to track 34.

(3) Load head.

d. Connect oscilloscope in accordance to information given below.

PROG	Read Track 34				
SYNC	Ext.	Pos	2μs	A18-11	INDEX
CHAN	1	AC		POS. END. C24	
CHAN	2				
MODE	CHAN 1 only				

NOTE

The amplitude of the negative swing of the first sinewave and the positive swing of the second are equal, ±20%.

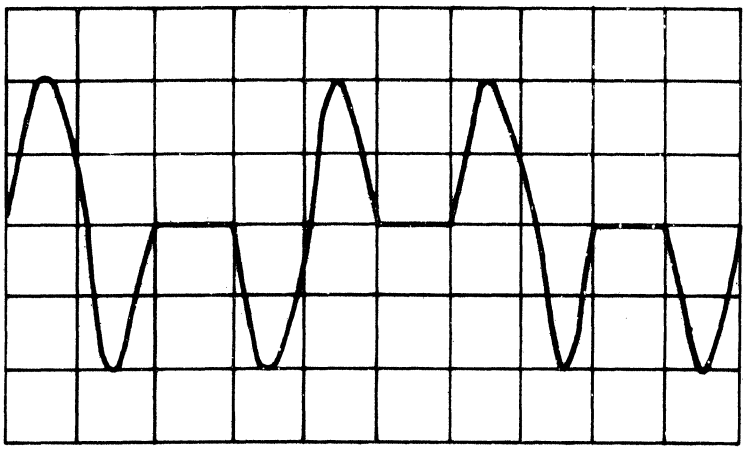


Figure 5-4. Read/Write Head Position Check

If this check or subsequent checks are not correct, refer to Head Positioning Adjustment, Section 7.

e. With correct waveform, system issues 34 step-out commands, track ØØ.

f. Connect oscilloscope as follows:

PROG	Head Positioning Check			
SYNC	Int. Auto			
CHAN	1	2V	DC	Bottom of R6 OUTER LIMIT
CHAN	2	2V	DC	Bottom of R7 INNER LIMIT
MODE	ALT.			

g. Oscilloscope channel 1 is 0-volts and channel 2 is +5-volts.

h. System issues one step-out command, Below Track ØØ, and channel 1 and channel 2 are +5-volts.

i. System issues 65 step-in commands, Above Track 63, and channel 1 is +5-volts, channel 2 is 0-volts.

Off Line Disk Drive Exerciser (Model 2100)

The disk drive exerciser must be used if maintenance is to be performed off-line.

Figure 5-5 shows the front panel of the Model 2100 Disk Drive Exerciser and Table 5-2 gives the Function of each switch, indicator, and test point.

a. Turn all power off to disk drive and remove both side covers.

b. Remove interface Signal cable from J2 and plug in the exerciser.

WARNING

Exercise extreme care when side covers are removed and power is applied. Ac Control module board has voltages hazardous to personnel.

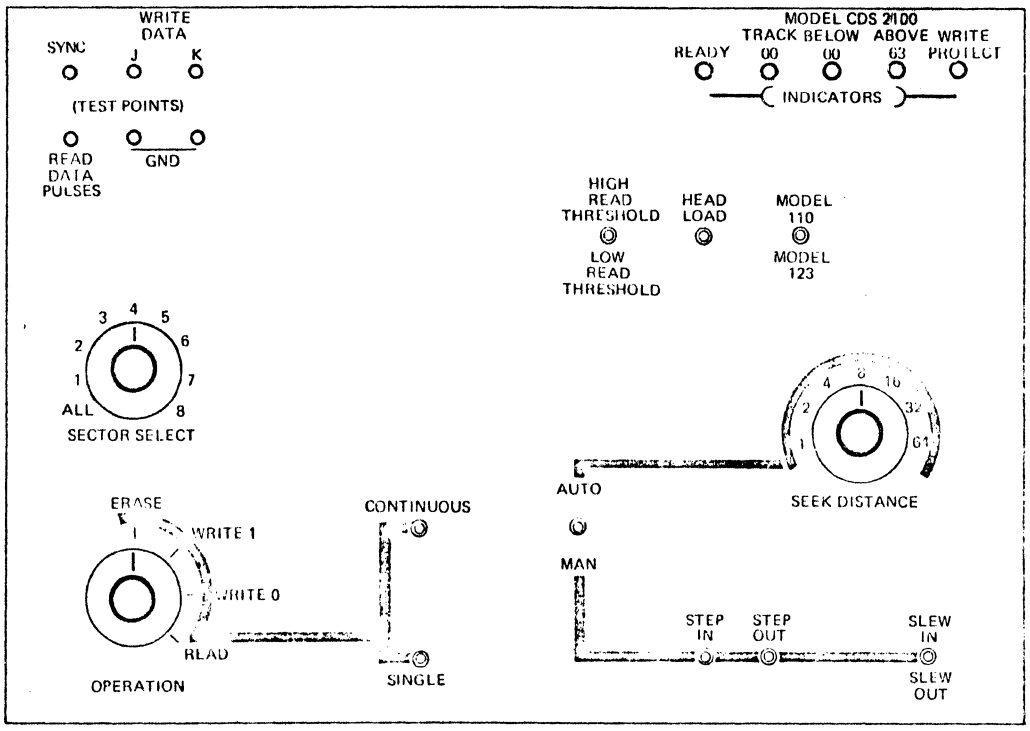


Figure 5-5. Model 2100 Disk Drive Exerciser

Table 5-2. Exerciser Switch, Indicator, and Test Point Functions

SWITCH, INDICATOR OR TEST POINT	FUNCTION
OPERATION	Rotory Switch. Selects operation to be performed.
SECTOR SELECT	Rotory Switch. Selects portion of media operation that is to be performed.
SINGLE	Momentary switch. Depressing switch causes selected operation to be performed once.
CONTINUOUS	Two position switch. Center position is the off position. "Up" position causes the selected operation to be performed continueously.

SWITCH, INDICATOR OR TEST POINT	FUNCTION
AUTO/MAN	Two Position Switch. Man position enables "Step" and "Slew" switches for manual operation of head positioning. "Auto" Position cause continuous head positioning according to position of "Seek Distance" switch.
SEEK DISTANCE	Rotary Switch. Selects what distance (number of tracks) for each seek operation.
STEP IN	Momentary Switch. Enabled when "Auto/Man" switch is in "Man" position. One "Step In" signal for each depression of switch.
STEP OUT	Same as Step In. (Opposite direction)
SLEW IN	Two Position, Momentary Switch. Enabled when "Auto/Man" switch is in "Man" position. When moved to "In", head is stepped in as long as switch is held.
SLEW OUT	Same as Slew In. (Opposite direction)
110/123	Two position switch. Set for Model Disk Drive Exerciser is to be used with.
HEAD LOAD	Two Position Switch. Center position unloads the Read/Write head. "Up" position loads the Read/Write head.
READ THRESHOLD	Not used with Model 110.
INDICATORS	When lighted.
READY	Disk Drive is in the ready condition.
TRACK ØØ	Head is positioned over Track ØØ.
BELOW ØØ	Head is positioned off track below Track ØØ.
ABOVE 63	Head is positioned off track above Track 63. (Positioned over spare Track 64).

SWITCH, INDICATOR OR TEST POINT	FUNCTION
WRITE PROTECT	Write Protected.
TEST POINTS:	
SYNC	Sync Pulses depends on Setting of Sector Select. "All" sectors there is no sync pulse. For other selections, Sync pulse is sector pulse of selected sector.
READ DATA PULSES	Monitor Read Data Pulses from Disk Drive.
WRITE DATA J&K	Allows Write Patterns other than all zeros or ones.
GRD	Provides common ground for test equipment and Disk Drive.

c. Set exerciser switches as follows:

- AUTO/MAN - MAN
- HEAD LOAD - OFF
- MODEL 110/MODEL 123 - MODEL 110

d. Turn power on to disk drive.

e. Observe positioning indicators, on exerciser, and proceed as follows:

1. Below Track ØØ indicator on, step-in until indicator goes out and Track ØØ indicator lights.
2. Above Track 63 indicator on or all position indicators off slew-out until Track ØØ indicator lights.
3. Track ØØ indicator on proceed to next step.

Slew-in until Below Track ØØ indicator goes out and Above Track 63 indicator lights.

g. Set SEEK DISTANCE, on exerciser, to 64.

h. Set AUTO/MAN to AUTO and observe Track ØØ and above Track 63 indicators alternately light.

i. Set AUTO/MAN to MAN and Step-out to track ØØ.

j. Step-in to Track 34, and connect oscilloscope as follows:

PROG	Head Alignment	
SYNC	Ext. Pos.	A18-11 Index
CHAN 1		Pos. End. C-24
CHAN 2		
MODE	CHAN 1 only	

k. Load CE Disk Cartridge and set LOAD HEAD switch, on exerciser, to on.

l. Observe oscilloscope pattern (Figure 5-6).

NOTE

The amplitude of the negative swing of the first sine wave and the positive swing of the second are equal ±20%.

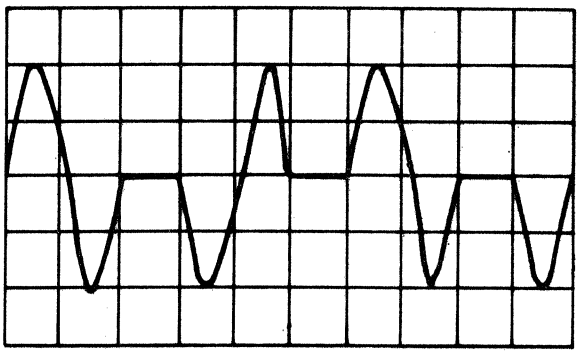


Figure 5-6. Head Alignment (Track 34)

n. Set LOAD HEAD to off and turn all power off.

o. Unload CE Disk Cartridge, disconnect exerciser from J2 and connect signal cable.

p. Replace side covers.

SECTION 6
MAINTENANCE AIDS

GENERAL

The information contained in this section of the maintenance manual is intended to provide a guide to logical and comprehensive troubleshooting sequences for maintenance personnel involved in maintaining the disk drive.

Maintenance troubleshooting procedures are broken into general sequences:

- Ready
- First Seek
- Data

The troubleshooting sequences are given in the form of flow diagrams. Each decision block shows an area of the operation to be evaluated and what is to be checked in that area. A manual reference is included in case the check procedure is unknown.

READY

The first two check-areas listed in the troubleshooting sequence (Figure 6-1) are operator maintenance checks and are included only as reference.

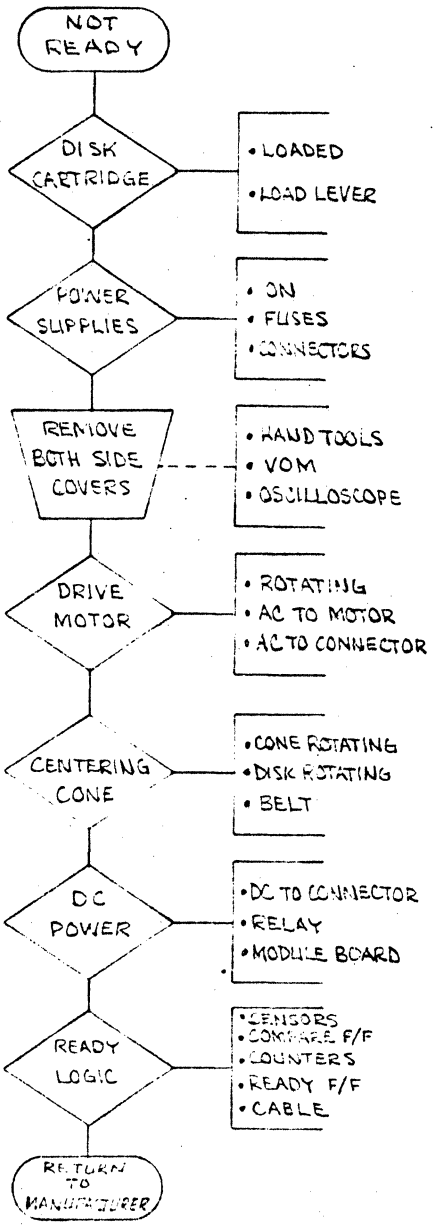


Figure 6-1. Ready Troubleshooting Sequence

FIRST SEEK

At initial power-up time, the system performs a first seek operation to position the read/write head assembly at track 00.

If the first seek operation is unsuccessful, the troubleshooting flow diagram given in Figure 6-2, will aid in isolating the problem.

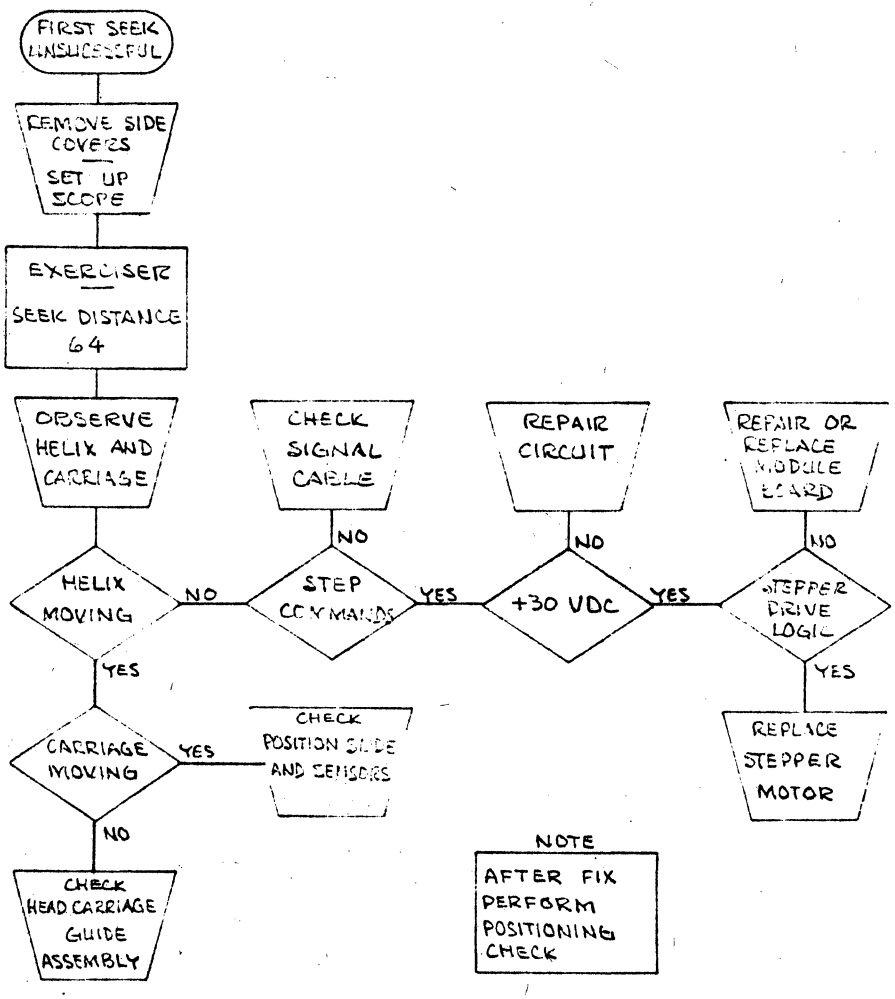


Figure 6-2. First Seek Troubleshooting Sequence

Data

During normal operations, the controller should check all read data for errors. If data errors are detected, the troubleshooting flow diagrams in Figure 6-3 will aid in isolating the problem.

The first two check areas should be performed by the operator.

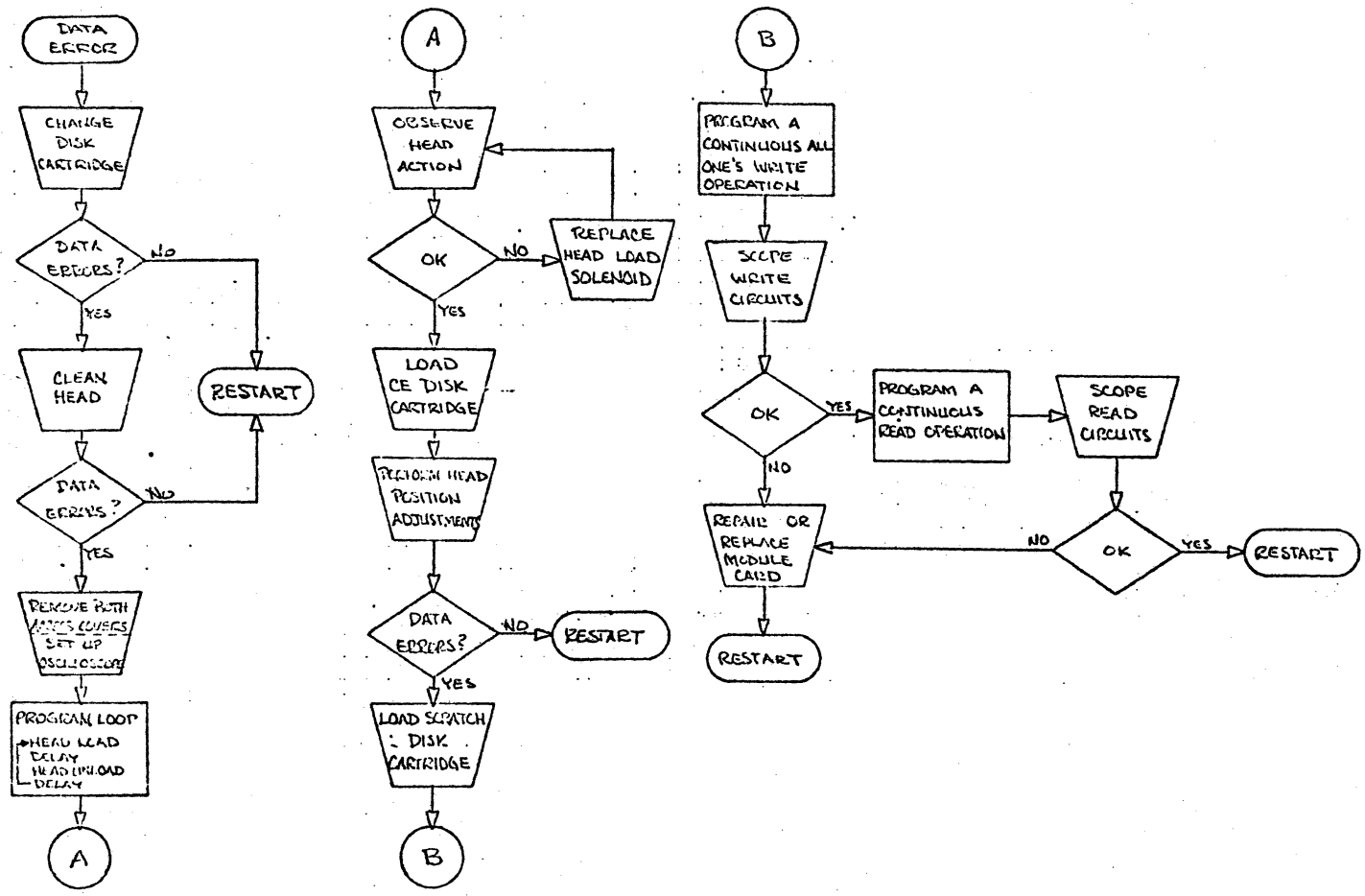


Figure 6-3. Data Error Troubleshooting Sequence

SECTION 7
CHECKS, ADJUSTMENTS, AND REPLACEMENTS

GENERAL

This section contains the procedures for performing operational checks, alignments and adjustments, and removal and replacements for the Model 110 Disk Drive.

NOTE

It is recommended that maintenance personnel read the entire check, adjustment, or replacement procedure prior to performing the procedure.

Plugs and Jacks

There are nine plugs and jacks used with the disk drive. The function of each is listed in Table 7-1, and their location is shown in Figure 7-1.

PLUG/JACK	FUNCTION
0	Ac - Interface
1	Dc - Interface
2	Signal-Interface
3	R/W Head
4	Stepper Motor
5	Head Load Solenoid and Interlock
6	Sector/Index/Write Protect
7	Head Positioning
8	Dc - Internal

Table 7-1. Plugs and Jacks

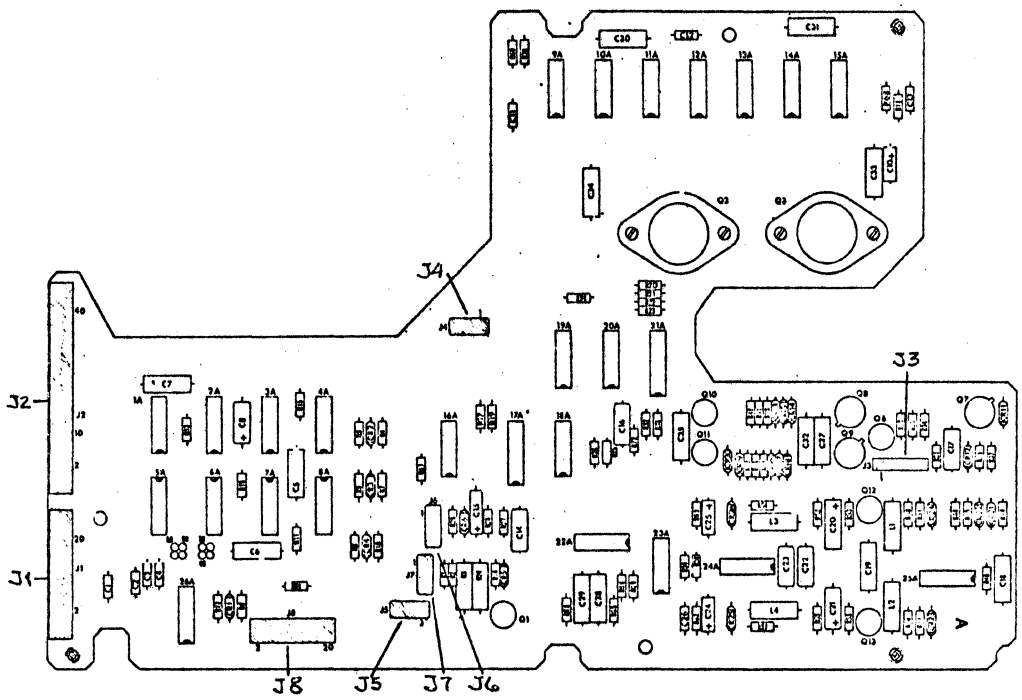


Figure 7-1. Interconnecting Cable Locations

POWER

Ac and dc power, for the disk drive, is supplied by the customer. The following voltages are to be provided:

- 115-60Hz, 208-50Hz, or 230-60Hz 1-phase
- +24 vdc
- +12 vdc
- -12 vdc
- + 5 vdc

All dc voltages are routed through the contacts of the ac relay, K1.

Voltage Checks

Perform voltage checks as follows:

a. Turn all power off to disk drive.

b. Remove ac plug (PO) at rear of unit and P1 Figure 7-1).

WARNING

Exercise extreme care when side covers are removed and power is applied. Ac Control module board has voltages hazardous to personnel.

c. Turn power on to disk drive and measure voltages in accordance with Tables 7-2 and 7-3.

Table 7-2. Ac Voltage Checks (PØ)

NOMINAL OUT	MAXIMUM OUT	MINIMUM OUT	PIN	GROUND PIN
115/208/230	126/229/253	104/187/217	1	2
115/208/230	126/229/253	104/187/217	3	2

Table 7.3 Dc Voltage Checks (P1)

NOMINAL OUT	MAXIMUM OUT	MINIMUM OUT	PIN	GROUND PIN
+24	26.4	21.4	2, 4, 6	14, 16
+12	12.6	11.4	8	1, 3, 5, 7
+ 5	5.25	4.75	10	9, 11, 13, 15
-12	12.6	11.4	12	17, 19

d. Turn all power off and plug in both plugs.

e. Turn all power on and measure dc voltages at J8 (Figure 7-1 and 7-2) in accordance with Table 7-4.

f. Turn ac power off and measure dc voltages in accordance with Table 7-4.

Fuse Replacement (Figure 7-3)

a. Turn all power off to disk drive and remove right side cover.

b. Snap off fuse cover.

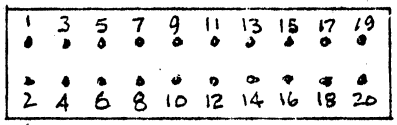


Figure 7-2. J8 Pin Location

Table 7.4. Dc Voltage Checks (J8)

PIN	GROUND PIN	VOLTAGE AC ON	VOLTAGE AC OFF
7, 8, 9, 10		+24	+24
20		+12	+12
19		+12	0
11, 12, 13, 14	1, 2	+24	0
16		-12	-12
18		+ 5	+ 5
17		+ 5	0
15		-12	0

c. Remove fuses from fuse holders.

CAUTION

Be sure replacement fuses have the same voltage and current rating as those being replaced.

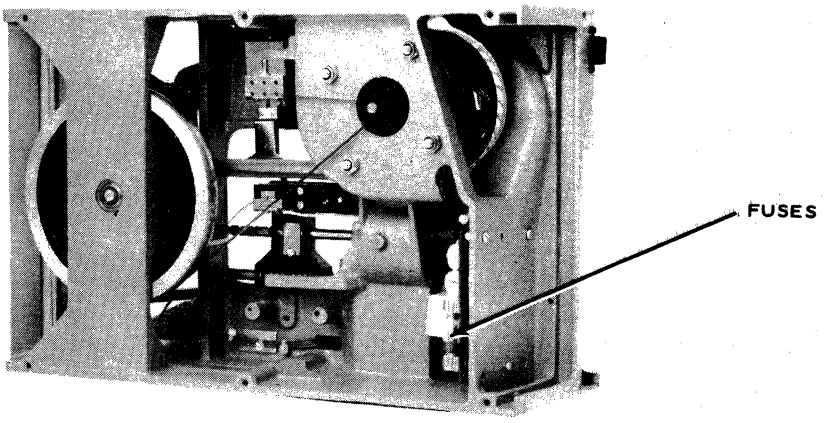


Figure 7-3. Fuse Location

d. To replace fuses, reverse procedure.

Ac Control Board Replacement

a. Turn off all power to disk drive, remove ac cable.

b. Remove right side cover and air filter from rear of unit.

c. Remove three screws holding ac relay board, Figure 7-4.

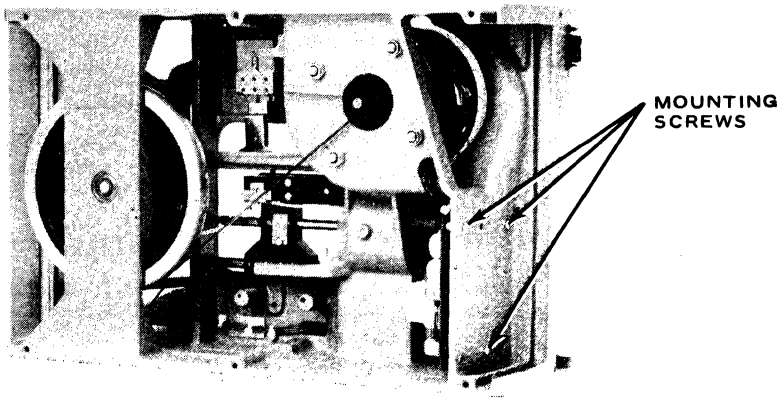


Figure 7-4. Ac Control Board Mounting Screws

d. Slide relay board part way out right side, unplug P1, disconnect drive motor, and ac input wires (Figure 7-5).

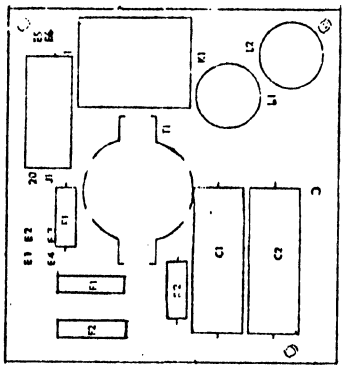


Figure 7-5. Ac Control Board

e. Remove ac control board.

f. To install replacement ac relay board, reverse procedure.

DRIVE SYSTEM

The drive system consists of the following assemblies:

- Drive Motor
- Drive Belt
- Centering Cone and Load Lever
- Drive Hub and Assembly
- Sector/Index Tower

Drive System Checks

Perform drive system checks as follows:

a. Turn all power off to disk drive and remove both side covers.

b. Inspect drive belt for signs of wear.

c. Inspect cartridge load mechanism and centering cone action for any signs of wear or binding.

d. Insure centering cone shaft remains at top of ramp when handle is in release position (Figure 7-6).

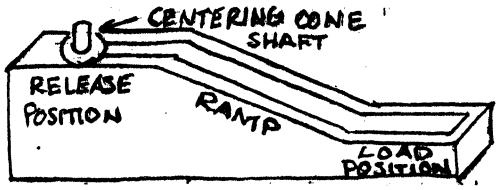


Figure 7-6. Centering Cone Shaft Ramp

e. With scratch disk loaded, place handle in engage position.

f. Observe Centering Cone is spring-loaded against disk.

g. Place ohmmeter across load head interlock (microswitch), Figure 7-7. Ohmmeter measures open with load handle in load position and short with handle in release position.

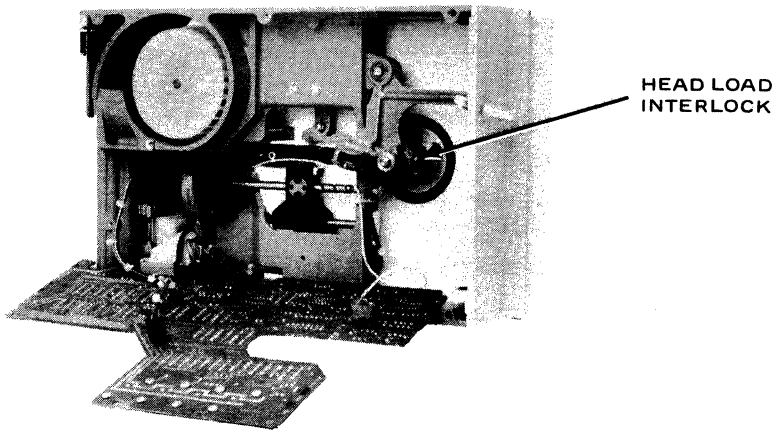


Figure 7-7. Head Load Interlock

h. With scratch disk loaded, load lever engaged, and power applied, connect oscilloscope in accordance with information given below.

PROG	Sector Pulse Width Check				
SYNC	Int.	Neg	20 μs		
CHAN 1	2V	DC		A18-8	Sector Pulse
CHAN 2					
MODE	CHAN 1 only				

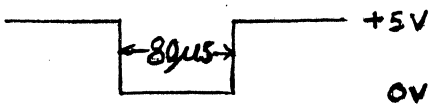


Figure 7-8. Sector Pulse Width Check

i. Connect oscilloscope in accordance with information given below.

PROG	Sector Pulse Period Check				
SYNC	Int.	Neg	10 ms		
CHAN 1	2V	DC		A18-8	Sector Pulse
CHAN 2					
MODE	CHAN 1 only				

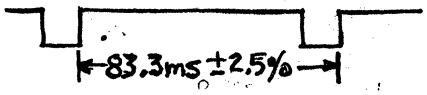


Figure 7-9. Sector Pulse Period Check

j. With scratch disk loaded and up to operating speed, connect oscilloscope in accordance with information given below. Observe READY signal goes positive when Load Lever is placed in the RELEASE position and READY goes negative when Load Lever is placed in the ENGAGED position and the disk is back to operating speed.

PROG	Ready Check	
SYNC	Int.	
CHAN 1	1V	A1-6 Ready
CHAN 2		
MODE	CHAN 1 only	

Drive Belt Replacement

a. Turn off all power to disk drive and remove right side covers.

b. Place Load Lever in RELEASE position and remove disk cartridge.

c. From right side, remove drive belt from drive motor shaft.

d. Push drive belt off pulley and remove between Drive Hub and Centering Cone.

e. To install replacement belt, reverse procedure.

Drive Motor Replacement

a. Turn off all power to disk drive and remove both side covers.

b. Unscrew module board and swing out of the way.

c. Disconnect motor leads from Ac Relay Board.

d. Remove four mounting nuts, right side, Figure 7-10.

e. Remove motor from left side, feeding leads through grommet.

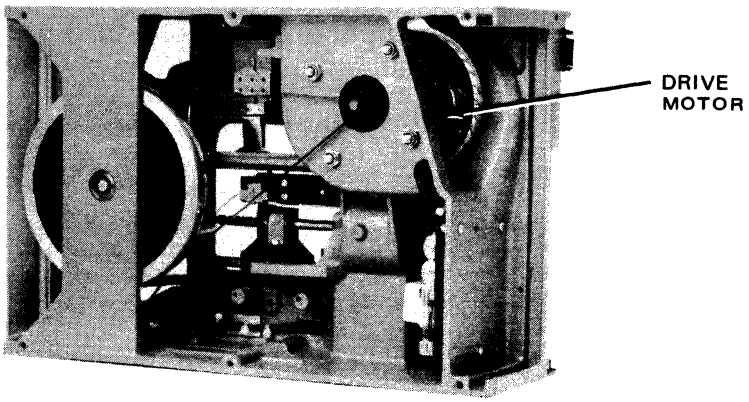


Figure 7-10. Drive Motor

f. If replacement motor does not have a squirrel cage, remove old one as follows:

1. Loosen hex screw holding squirrel cage to motor shaft.
2. Pull squirrel cage off motor shaft.
3. Install squirrel cage on replacement motor by reversing procedure (Figure 7-11).

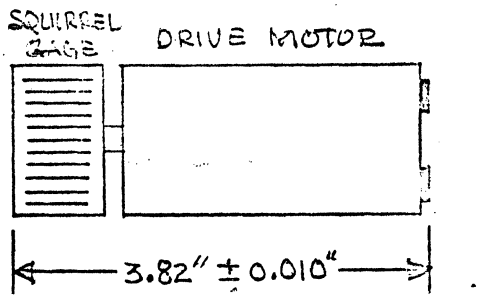


Figure 7-11. Squirrel Cage Mounting Distance

g. To mount replacement motor, reverse procedure.

Load Lever Replacement (Figure 7-12).

a. Turn all power off to disk drive and remove left side cover.
b. Unscrew module board and swing out of the way.
c. Remove screw holding panel handle and remove handle.
d. Remove wave spring and thrust washer.

e. Remove grip ring and center cone shaft head.

f. Remove Load Lever.

g. To mount replacement, reverse procedure.

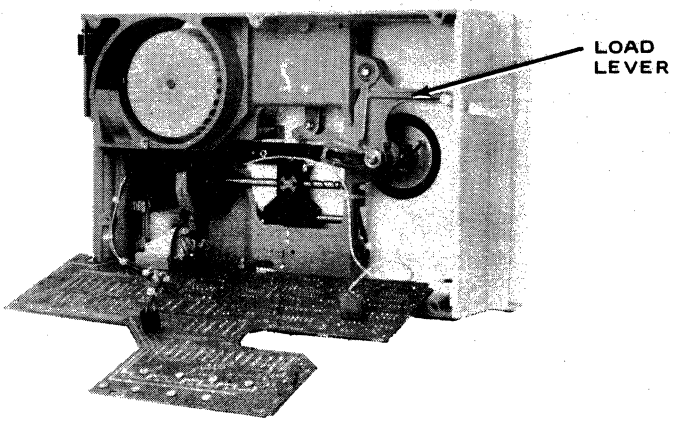


Figure 7-12. Load Lever

Centering Cone Replacement (Figure 7-13)

CAUTION

This replacement requires the Centering Cone special tool. If tool is not available, DO NOT attempt, return to manufacturer.

a. Turn all power off to disk drive.

b. Perform Load Lever Replacement procedure.

c. Unscrew load interlock microswitch and lay down out of way.

d. With special tool, compress centering cone spring.

e. Remove "E" ring and bearing.

f. Carefully release spring and remove centering cone.

g. To mount replacement, reverse procedure.

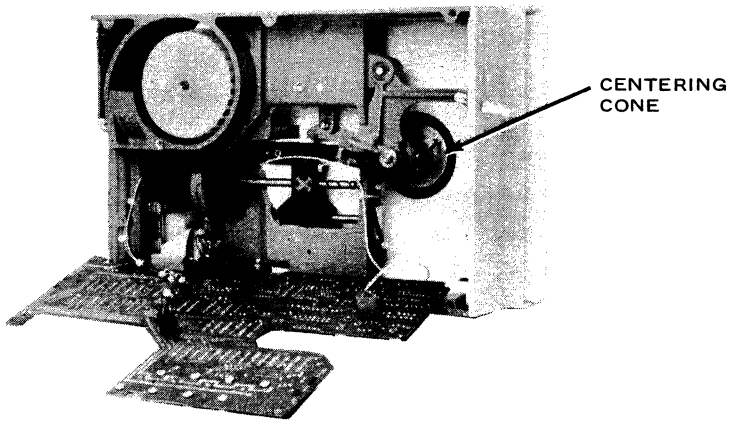


Figure 7-13. Centering Cone

Drive Hub Replacement

CAUTION

This replacement requires Centering Cone special tool. If tool is not available, DO NOT attempt, return to manufacturer.

a. Turn all power off to disk drive.

b. Perform Centering Cone Replacement procedure.

c. Remove Drive Belt.

d. Unscrew two screws, located at center of Drive Hub, and remove Drive Hub.

To mount replacement, reverse procedure.

Spindle Assembly Replacement

CAUTION

This replacement requires the Centering Cone special tool. If tool is not available, DO NOT attempt, return to manufacturer.

a. Turn all power off to disk drive and remove right side cover.

b. Perform Drive Hub Replacement procedure.

c. Loosen hex set screw and remove Drive Hub Assembly. Figure 7-14.

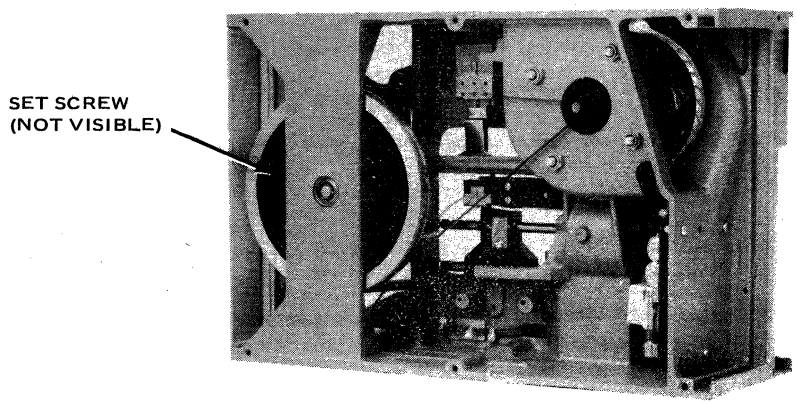


Figure 7-14. Drive Hub Assembly Set Screw

d. To mount replacement, reverse procedure.

NOTE

Use Loctite on hex set screw when replacing.

Sector Optical Switch Assembly Check

CAUTION

Head Position Check and Adjustment, if necessary, must be done prior to performing this check.

a. Turn all power off to disk drive and remove both side covers.

b. Unscrew module board and swing out of the way.

c. Disconnect interface signal cable from J2 and connect exerciser with initial switch settings as follows:

- 110/123 to 110
- AUTO/MAN to MAN
- HEAD LOAD to OFF
- MODE to READ

d. Turn all power on to disk drive and step to track ØØ.

WARNING

Exercise extreme care when side covers are removed and power is applied. Ac control module board has voltages hazardous to personnel.

e. Press STEP IN switch once to position head assembly over track Ø1.

f. Load CE Disk Cartridge.

g. When exerciser indicates drive is READY (indicator lighted), set HEAD LOAD switch ON.

h. Connect oscilloscope in accordance with the following information:

PROG	Radial Alignment Check (Figure 7-15)		
SYNC	Ext. Pos.		A18-11 Index Pulse
CHAN 1	1	Ac	Pos. End of C-24 Data Burst
CHAN 2			A18-8 Sector Pulse
MODE	CHOP		

NOTE

Leading edge of the Sector Pulse is 100^{+20}_{-10}µs from last negative swing of data burst.

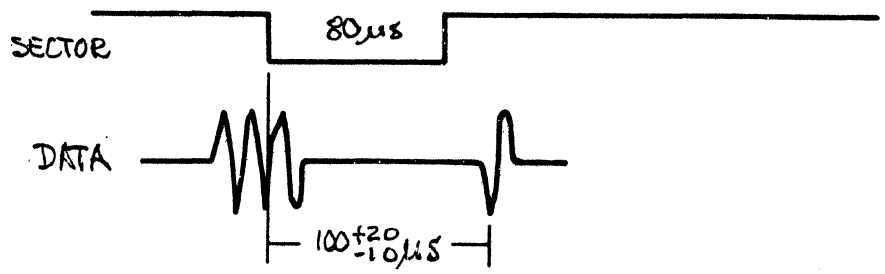


Figure 7-15. Radial Alignment Check

i. Set HEAD LOAD switch OFF and unload CE Disk Cartridge.

j. Turn all power off to disk drive.

k. If this check fails, replace Sector Optical Assembly.

Sector Optical Switch Assembly Replacement (Figure 7-15)

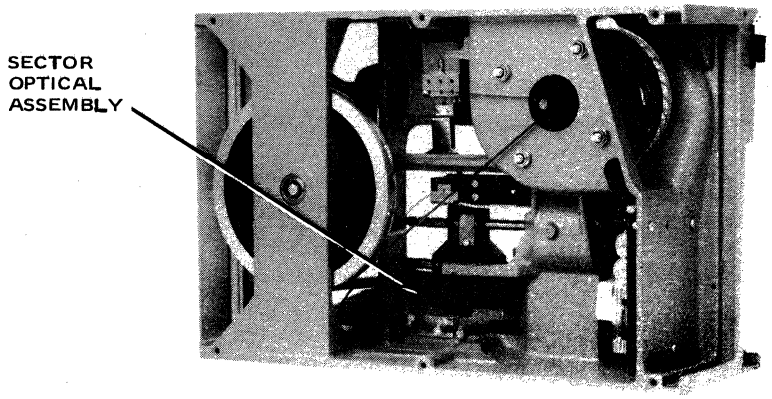


Figure 7-16. Sector Optical Switch Assembly

a. Turn all power off to disk drive and remove both side covers.

b. Unscrew module board and unplug J6 (Figure 7-1).

c. Remove assembly's holding screw.

d. Cut tie-wraps holding assembly's cable and carefully lift out assembly.

CAUTION

During installation, tye-wraps must be placed in same position from which removed.

e. To mount replacement, reverse procedure.

NOTE

Be sure assembly's guide pin is placed in guide pin hole.

POSITIONING SYSTEM

The positioning system consists of the following assemblies:

- Track Optical Switch Assembly
- Read/Write Head Carriage Assembly
- Stepper Motor

Positioning Checks

a. Turn all power off to disk drive.

b. Remove Interface Signal Cable from J2, back of disk drive, and plug in exerciser.

c. Turn all power on to disk drive and observe position indicator lights on exerciser (Figure 5-1).

d. If no position indicator lights are on, proceed as follows:

   1. Place AUTO/MAN switch on exerciser to MAN position.
   2. Press STEP OUT switch once and observe TRACK ØØ indicator.
   3. If TRACK ØØ indicator lights, read/write head is positioned over track ØØ, proceed to step 5.
   4. If TRACK ØØ indicator did not light, repeat step 4-b until it does light, and then proceed to step 5.

e. Hold SLEWIN switch in ON position (up) until ABOVE TRACK 63 indicator comes on.

f. Place SEEK DISTANCE switch to "64" and AUTO/MAN switch to AUTO.

g. Observe TRACK ØØ and ABOVE TRACK 63 indicators alternately turn on.

h. Place AUTO/MAN switch in MAN position and SLEW OUT switch on (down) until TRACK ØØ indicator lights.

i. Press STEP IN switch 34 times to position read/write head over track 34.

j. Load CE Disk Cartridge and remove both side covers.

k. Set SECTOR SELECT switch to sector indicated on CE Disk Cartridge.

WARNING

Exercise extreme care when side covers are removed and power is applied. Ac Control module board has voltages hazardous to personnel.

l. Place LOAD HEAD switch ON (up) and OPERATION switch to READ.

m. Connect oscilloscope in accordance with the following information:

PROG	Position Check		
SYNC	Ext.	Pos	SYNC (Exerciser) SECTOR
CHAN	1	AC	Positive End of C24
CHAN	2		
MODE	CHAN 1 only		

NOTE

Amplitude of the negative swing of first sinewave and positive swing of second sinewave are within 20% of each other.

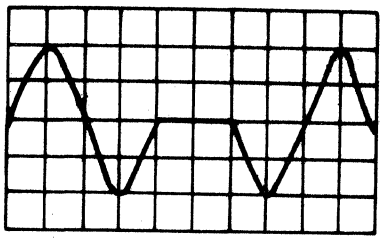


Figure 7-17. Head Position Check

n. Unload head and remove all power from disk drive.

o. Disconnect exerciser and connect interface signal cable.

p. Remove CE Disk Cartridge and replace side covers.

Positioning Adjustment

a. Turn off all power to disk drive and remove both side covers.

b. Unscrew module board and swing out of the way.

c. Remove interface signal cable from J2 and connect exerciser.

d. Turn on all power to disk drive.

e. Set exerciser switches as follows:

- AUTO/MAN to MAN
- OPERATION to READ
- HEAD LOAD to OFF
- 110/123 to 110

f. Step until head assembly is positioned over track ØØ, indicated by the TRACK ØØ indicator being lighted.

g. Depress the STEP IN switch 34 times to position read/write head over track 34.

h. Load CE Disk Cartridge.

i. When READY indicator lights, set HEAD LOAD switch ON.

WARNING

Exercise extreme care when side covers are removed and power is applied. Ac control module board has voltages hazardous to personnel.

j. Connect oscilloscope according to the following information.

PROG	Position Alignment			
SYNC	Ext.	Pos	A18-11	Index
CHAN	1	Ac	Positive	End of C24
CHAN	2			
MODE	CHAN 1 only			

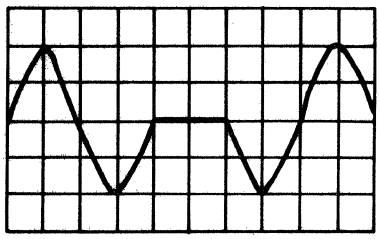


Figure 7-18. Head Position Alignment

k. Loosen, do not remove, the stepper motor mounting bracket (Figure 7-19).

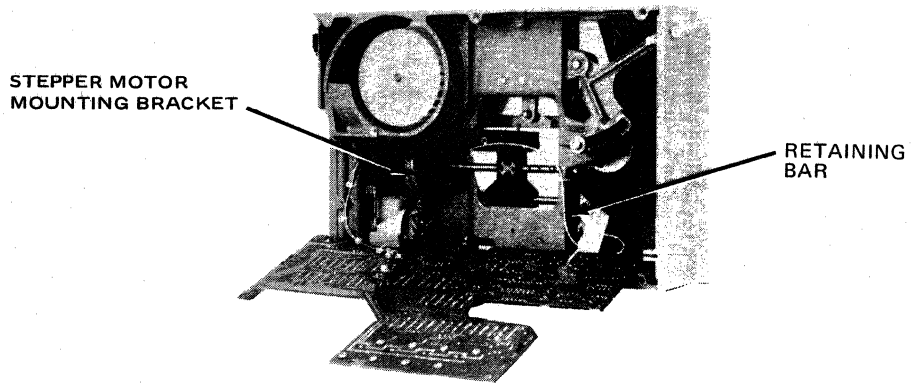


Figure 7-19. Stepper Motor Mounting Bracket

l. Carefully rotate stepper motor until amplitudes of negative swing of first sinewave and positive swing of second sinewave are within 20% of each other.

m. Tighten stepper motor mounting bracket.

n. Press STEP OUT switch 34 times to position head assembly over track 00.

o. If TRACK 00 indicator is not lighted, loosen set screws "A" and "B" on head carriage (Figure 7-20) and adjust slide until TRACK 00 indicator lights.

p. Tighten set screws "A" and "B".

q. Press STEP OUT switch once and observe BELOW TRACK 00 indicator lights and TRACK 00 indicator goes out.

r. If BELOW TRACK 00 indicator is not lighted loosen set screws "A" and "B" and readjust slide.

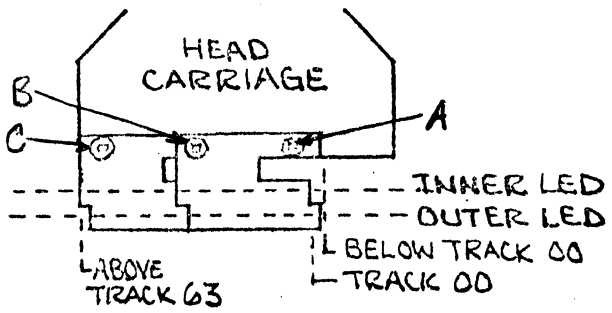


Figure 7-20. Position Adjustment

s. Press STEP IN switch once and repeat procedure step 0.

t. Press STEP IN switch 64 times.

u. If ABOVE TRACK 63 indicator is not lighted, loosen set screws "B" and "C" (Figure 7-20) and adjust slide until indicator lights.

v. Tighten set screws "B" and "C".

w. Press STEP OUT 30 times and verify positioning by performing procedure steps i, n, o and q.

x. Repeat complete procedure if positioning is not correct.

y. Place HEAD LOAD switch OFF.

z. Remove CE Disk Cartridge and turn all power off to disk drive.

aa. Disconnect exercisers and connect interface signal cable.

bb. Replace module board and side covers.

Positioning Slide Replacement

a. Turn off all power to disk drive and remove right side cover.

b. Manually move head carriage to clear positioning slide from Track Optical Switch assembly (Figure 7-21).

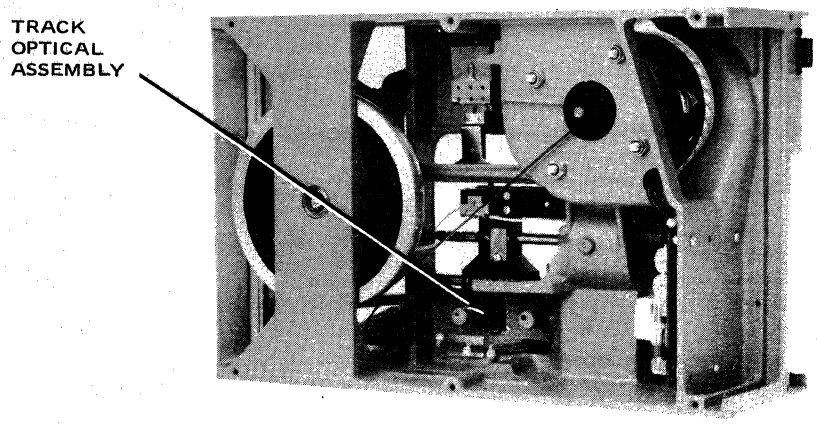


Figure 7-21. Track Optical Switch Assembly

c. Remove set screws "A" and "C" (Figure 7-20).

d. Remove set screw "B" and lift slide out.

e. To replace, reverse procedure.

NOTE

When slide is replaced, position adjustment is necessary.

Track Optical Switch Assembly Replacement (Figure 7-21)

a. Turn off all power to disk drive and remove both side covers.

b. Unscrew module board and unplug P7 from J7 (Figure 7-1).

c. Remove Sector Optical Switch Assembly holding screw and swing assembly out of way.

d. Remove retaining bar (Figure 7-19) and slide head carriage assembly guide bar free.

e. Remove Track Optical Switch Assembly holding screw.

f. Cut tie-wrap from cable and carefully lift assembly out.

CAUTION

When removing and replacing track assembly care must be taken not to place strain on carriage and read/write head assemblies.

g. To mount replacement, reverse procedure.

NOTE

Be sure assembly guide pin is inserted in guide pin hole and carriage positioning slide is in switch assembly.

Stylus Replacement (Figure 7-22)

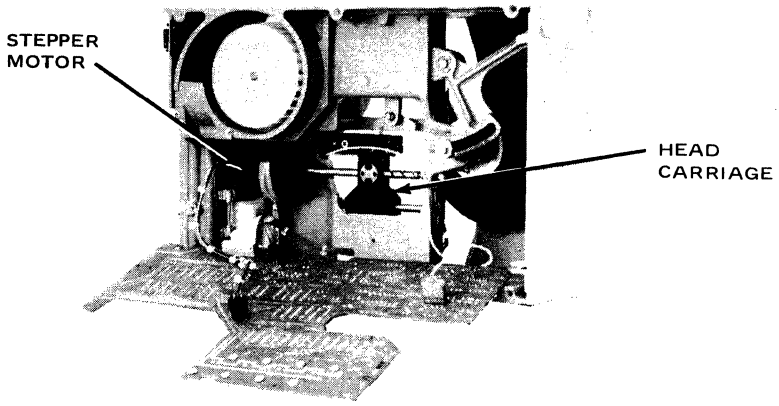


Figure 7-22. Stepper Motor and Head Carriage

a. Turn off all power to disk drive and remove left side cover.

b. Unscrew module board and swing out of the way.

c. Remove two hex screws and lift out stylus.

d. To mount replacement, reverse procedure.

Stepper Motor and Head Carriage Replacement

a. Turn all power off to disk drive and remove both side covers.

b. Perform Read/Write Head Assembly removal.

c. Remove P4 from J4 on module board (Figure 7-1).

d. Remove retaining bar and slide guide rod out (Figure 7-22).

e. Remove holding screw and lift out stepper motor clamp (Figure 7-22).

f. Disconnect drive motor from the Ac Control Board.

g. Cut tie-wraps holding stepper motor cable. Note: Tye-wraps must be replaced in original position during re-installation.

h. Carefully lift stepper motor outward, to free guide pin, and slide toward back of unit, to free helix.

i. Carefully remove Stepper Motor and Head Carriage Assembly

CAUTION

When removing carriage assembly care must be taken not to bind Track Optical Switch Assembly.

j. To mount replacement, reverse procedure.

READ/WRITE HEAD ASSEMBLY

Read/Write Head Assembly Check

a. Turn all power off to disk drive and remove left side cover.

b. Disconnect interface signal cable from J2 and connect disk drive exerciser (Figure 7-1), with initial switch setting as follows:

- 110/123 - 110
- AUTO/MAN - MAN
- HEAD LOAD - OFF
- SECTOR SELECT - ALL
- OPERATION - WRITE 1

c. Unscrew module board and swing out of the way.

d. Turn all power on to disk drive and step to track ØØ.

WARNING

Exercise extreme care when side covers are removed and power is applied. Ac control module board has voltages hazardous to personnel.

e. Load scratch disk cartridge.

f. When exerciser indicates drive is READY, set HEAD LOAD switch on.

g. Press SINGLE switch once.

h. Connect oscilloscope in accordance with information contained in Figure 7-23.

PROG	Read/Write Head Check
SYNC	INT. Pos. 5-μs
CHAN	1 AC 10mv 25A-1 Read Preamp Input
CHAN	2
MODE	CHAN 1 only

NOTE

Replace Read/Write Head Assembly if minimum peak-to-peak amplitudes are not obtained.

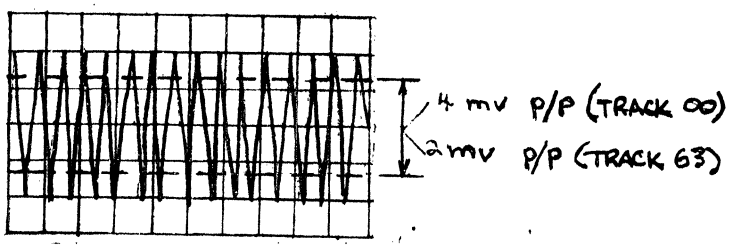


Figure 7-23. Read/Write Head Check No. 1

i. Press SLEW IN switch until ABOVE TRACK 63 indicator lights.

j. Press STEP OUT switch once.

k. Press SINGLE switch once.

l. Minimum peak-to-peak amplitude for observed signal on oscilloscope is 2 mv (Figure 7-23).

m. Set OPERATION switch to WRITE O.

n. Press SINGLE switch once.

o. Connect oscilloscope in accordance with information contained in Figure 7-24.

PROG	Read/Write Head Check
SYNC	INT POS 50μs
CHAN	1 AC 20mv 25A-1 Read Preamp Input
CHAN	2
MODE	CHAN 1 only

NOTE

Replace Read/Write Head Assembly if minimum peak-to-peak amplitudes are not obtained.

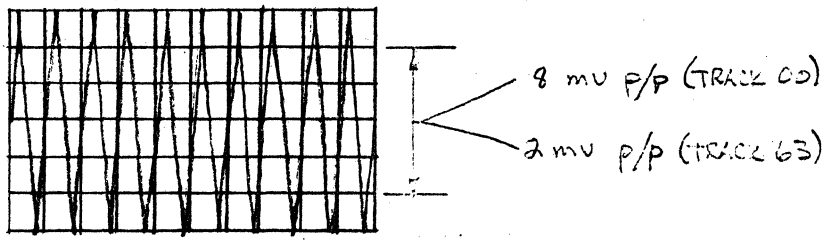


Figure 7-24. Read/Write Head Check No. 2

p. Press SLEW OUT switch until TRACK ØØ indicator lights.

q. Press SINGLE switch once.

r. Minimum peak-to-peak amplitude for observed signal on oscilloscope is 2mv (Figure 7-24).

s. Set HEAD LOAD switch OFF and turn all power off to disk drive.

t. Disconnect exerciser and connect interface signal cable.

u. Replace module board and both side covers.

Read/Write Head Assembly Replacement

a. Turn all power off to disk drive and remove both side covers.

b. Unscrew module board and unplug P3 from J3 (Figure 7-1).

c. Cut tie-wraps holding read/write cable.

CAUTION

When replacing, tie-wraps must be placed in original positions and a loop must be put in cable. Allow enough cable so head assembly can travel full distance required.

d. Remove screw holding head assembly to carriage assembly (Figure 7-25).

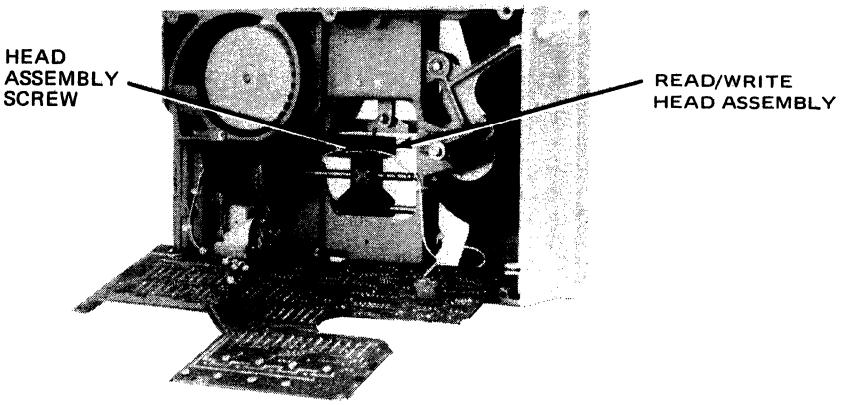


Figure 7-25. Read/Write Head Assembly

NOTE

When mounting head assembly to carriage, assembly must be held tight against the bale while tightening the holding screw (Figure 7-26).

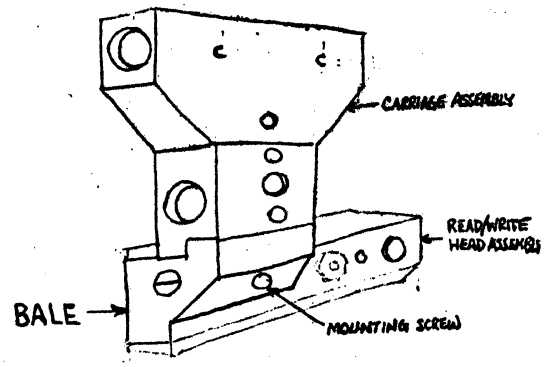


Figure 7-26. Mounting R/W Head Assembly

e. To mount replacement, reverse procedure.

CAUTION

Do not make any adjustments to the Read/ Write Head Assembly. Adjustments are set at factory.

Head Load Solenoid and Interlock Replacement (Figure 7-27)

a. Turn all power off to disk drive and remove both side covers.

b. Unscrew module board and unplug P5 from J5 (Figure 7-1).

c. Remove two holding screws from Interlock microswitch and two holding screws from Load Solenoid.

d. Cut tie-wraps are placed in original position when mounting replacement.

e. Remove solenoid and interlock.

f. To mount replacement, reverse porcedure.

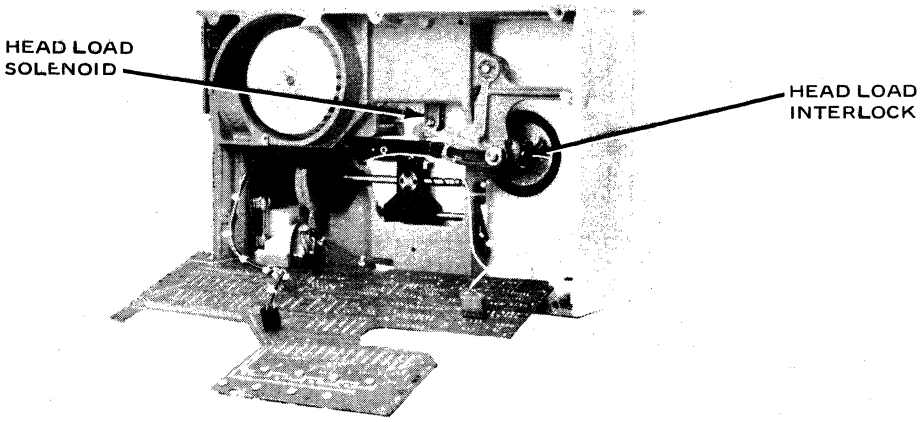


Figure 7-27. Head Load Solenoid and Interlock

MODEL 110-002 DIFFERENCIES

If either the Ac Control or Data and Control module board is replaced or another dash number is to be modified to operate on 230 vac, 1-phase, 60 Hertz, the following connections should be checked:

Ac Control Board

Relay, K1, and transformer, T1, must be placed in series to operate at this voltage.

a. Remove connections if present, E2 and E3 and E1 and E4.

b. Make connection E1 and E3 (Figure 7-28).

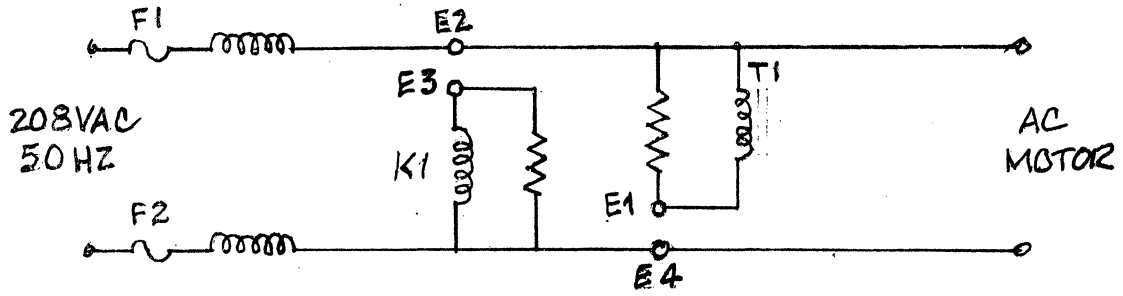


Figure 7-28. Ac Control Board E4 Schematic (Simplified)

Data and Control Board (Figure 7-1)

Verify that the READY logic is connected for 50 Hertz operation as follows:

a. Remove connections 6A2 to 7A2 and 5A9 to 7A1.

b. Make connections 6A5 to 7A1 and 6A12 to 7A2.

MODEL 110-003 DIFFERENCIES

Ac Control Board

If the Ac Control Board is replaced or another dash number is to be modified to operate on Z08 vac, 1-phase, 50 Hertz, the following connections should be checked.

Relay, K1, and transformer, T-I, must be placed in series to operate at this voltage (Figure 7-28).

a. Remove connections E2 and E3 and E1 to E4.

b. Make connection E1 to E3.

Drive Motor Pulley

When the drive motor is replaced, insure, the drive motor pulley is installed on the motor shaft.

SECTION 8

LOGIC AND SCHEMATIC DIAGRAMS

This section contains logic and schematic diagrams to aid personnel involved in maintaining the disk drive. Electrical and electronic symbology used are in accordance with standard practices.

a. Interconnecting Block Diagram

b. Ac Control Module Board Layout

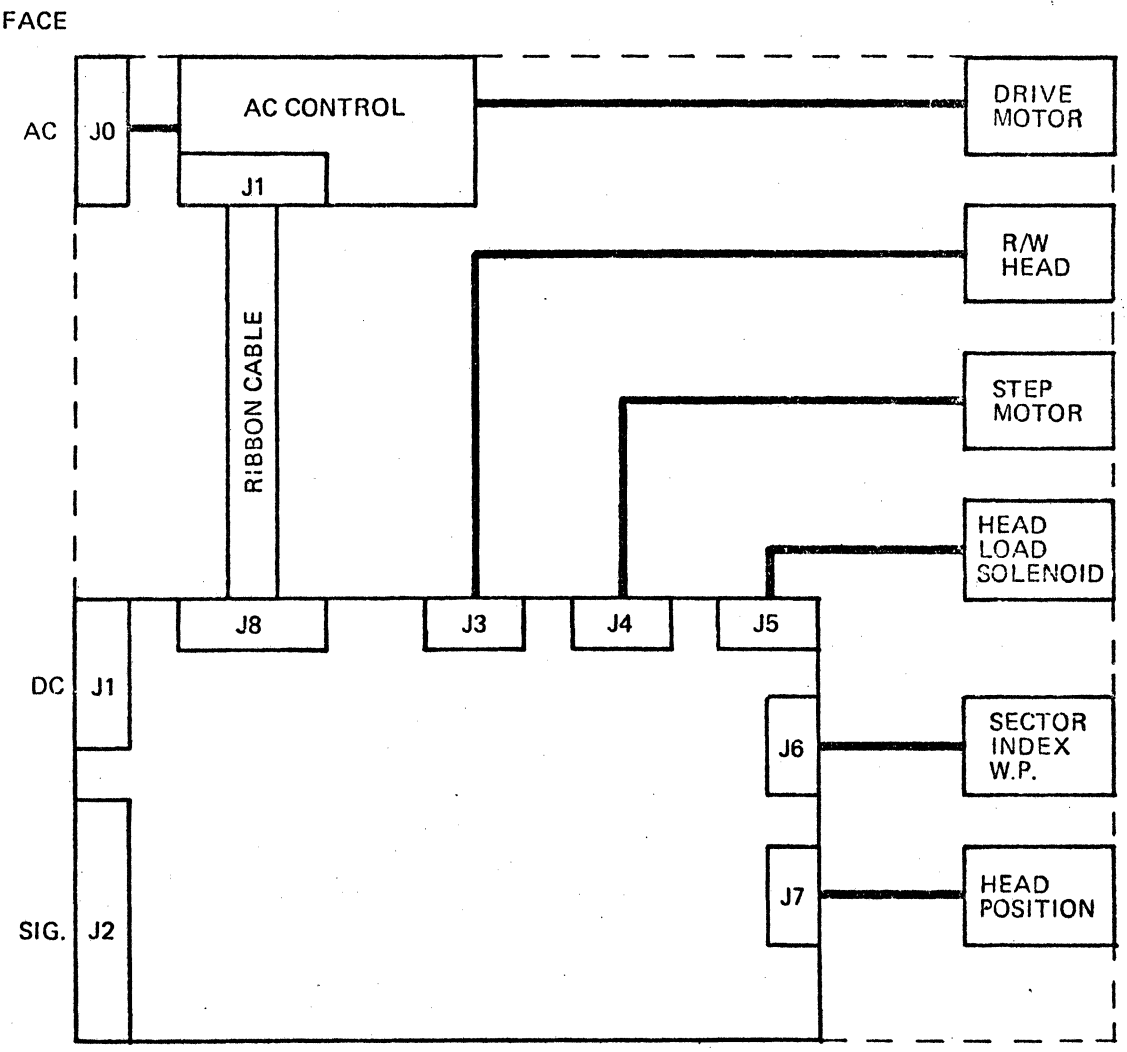
c. Data and Control Module Board Layout

d. Ac Control Schematic, No. 99765

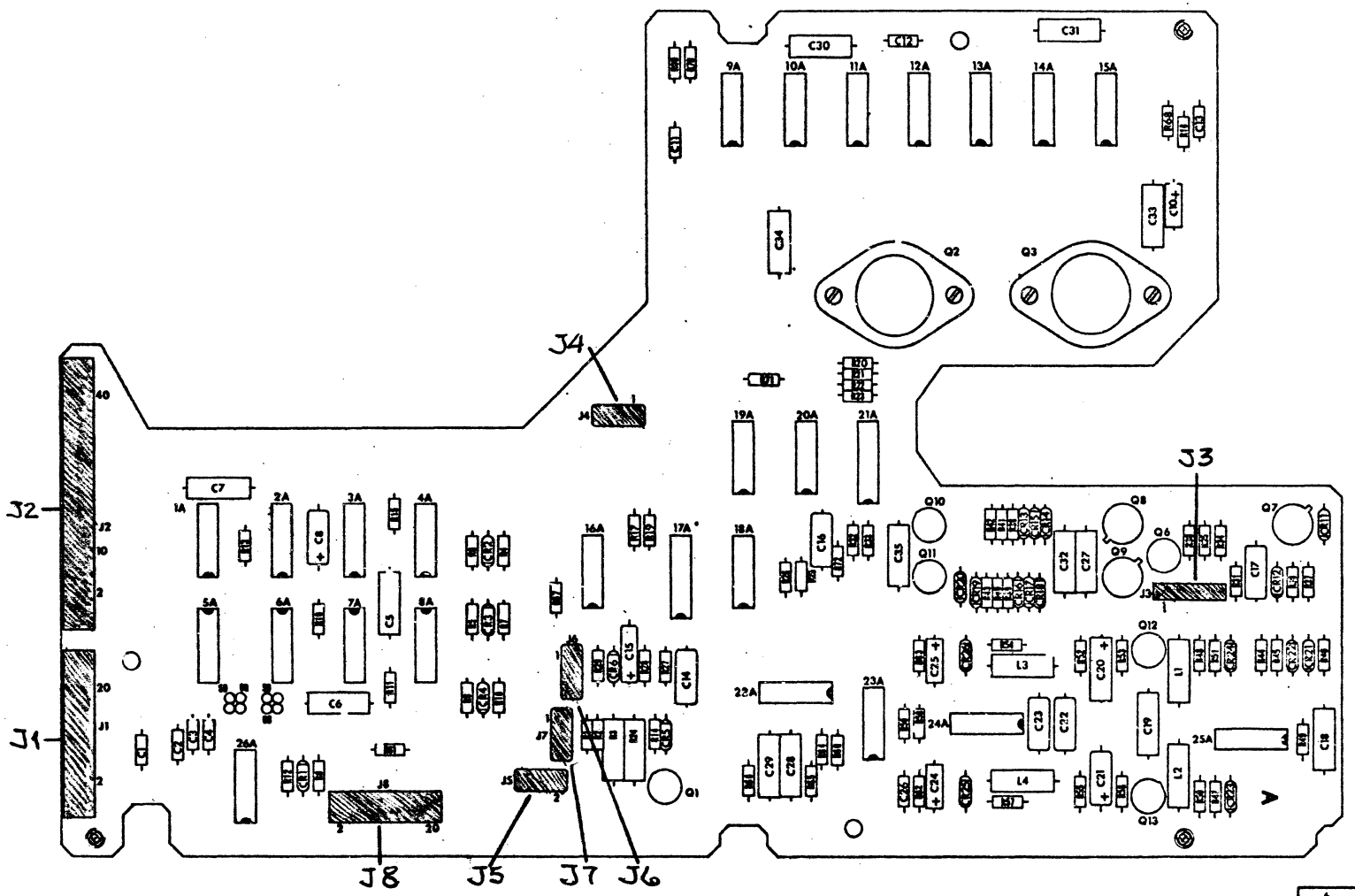
e. Data and Control Schematic (2 Sheets), No. 10130

f. Schematic & Timing Diagram-Ready Circuit, No. 10141

g. Schematic & Timing Diagram-Sector/Index, No. 10142

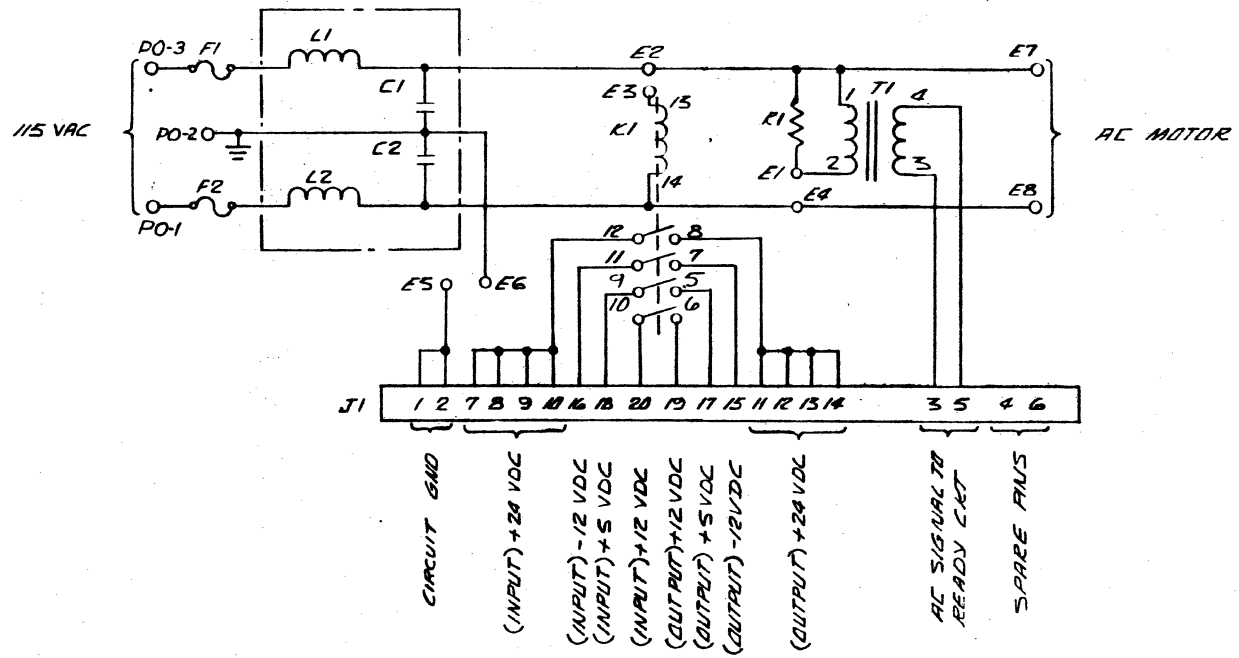


Interconnecting Block Diagram



Ac Control Module Board Layout

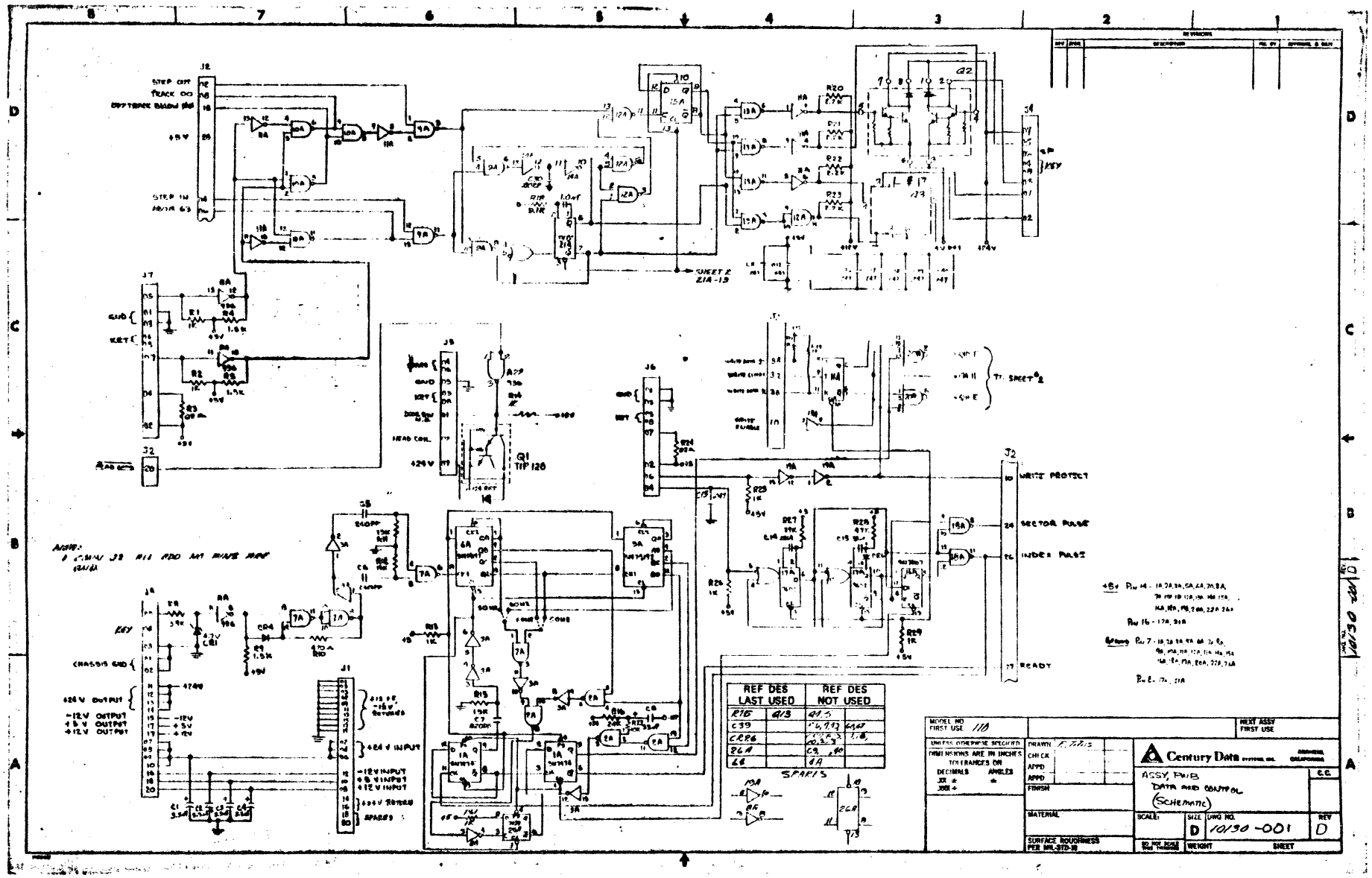
REVISIONS				
REV	ZONE	DESCRIPTION	INC BY	APPROVAL & DATE
		SEE SHT 1		

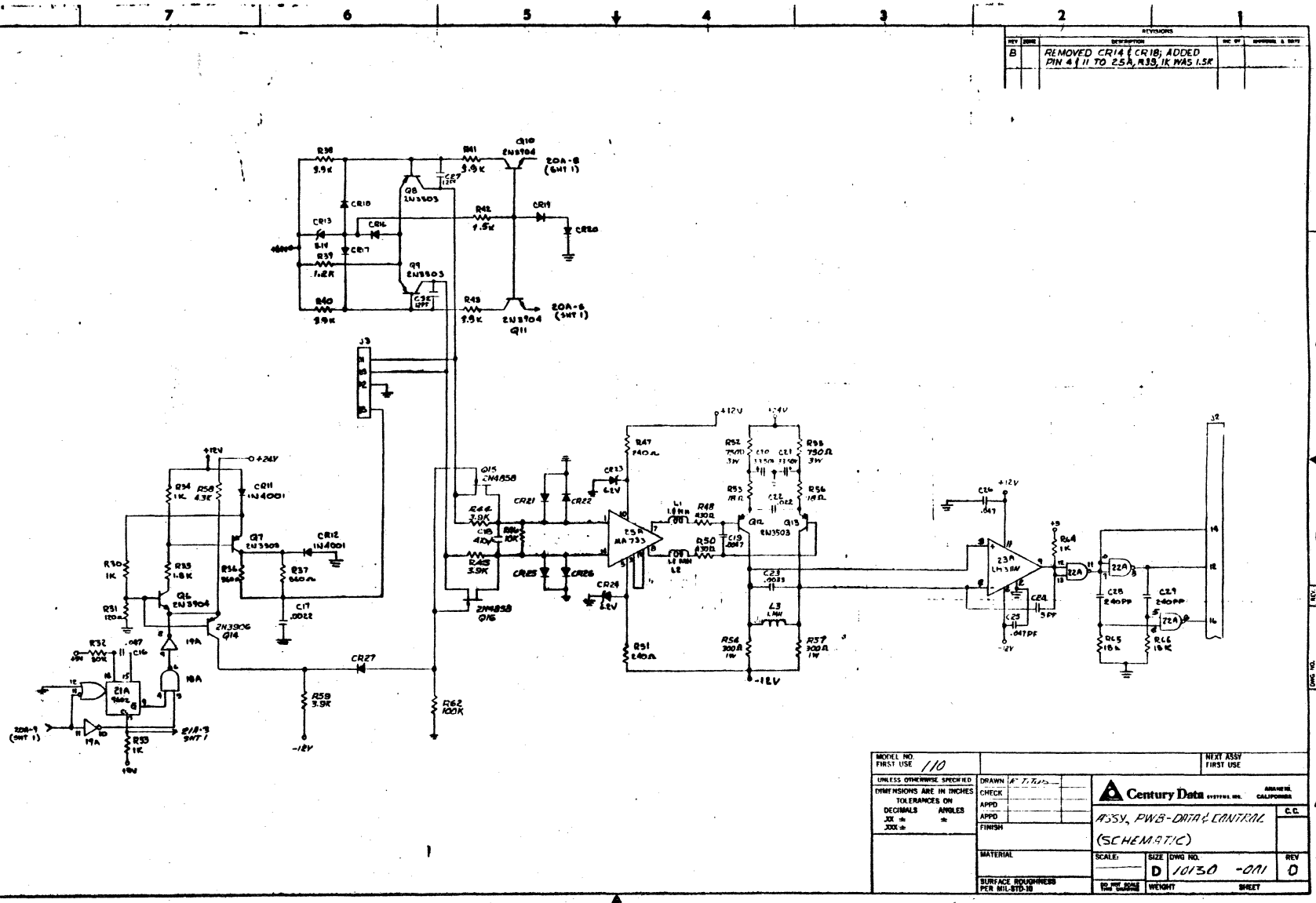


MODEL NO. 110 FIRST USE			NEXT ASSY FIRST USE 99844-XXX
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ANGLES XX ± — ± — XXX ± —	DRAWN R. TITUS CHECK APPD GUSTAFSON 11-26-71 APPD FINISH MATERIAL SURFACE ROUGHNESS PER MIL-STD-10	Century Data SYSTEMS, INC. ANAHEIM, CALIFORNIA	C.C.
		ASSY, PWB-AC CONTROL (SCHEMATIC)	
		SCALE: — SIZE C DWG NO. 99765-XXX REV D	
		DO NOT SCALE THIS DRAWING WEIGHT SHEET 5 OF 5	

DWG NO. 99765-XXX REV D

8-4

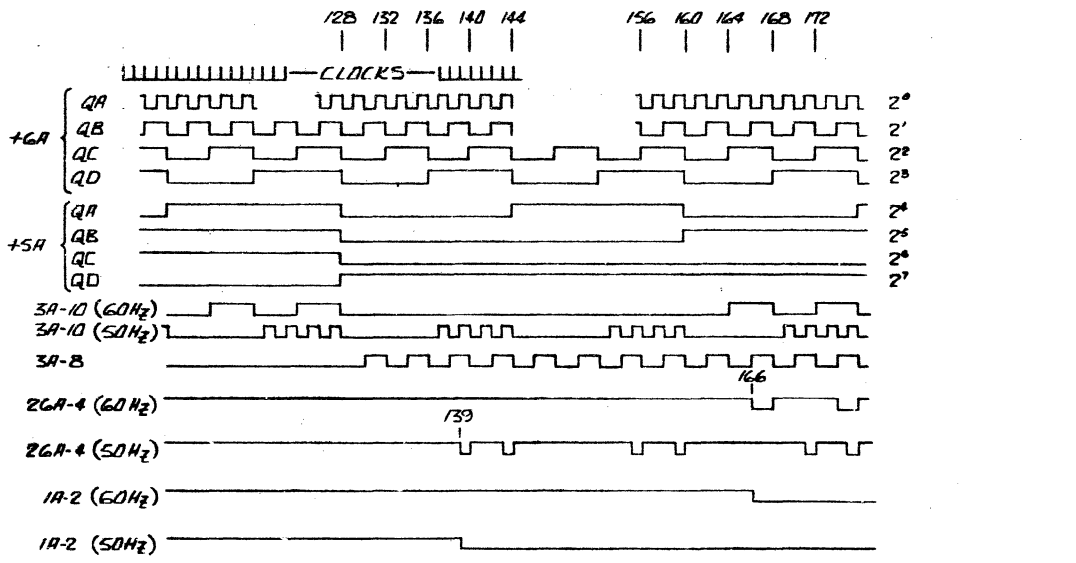

Century Data
ASSY, PWB
DATA AND CONTROL
(SCHEMATIC)
10130-001
D
MODEL NO
FIRST USE 110
NEXT ASSY
FIRST USE
REF DES LAST USED
REF DES NOT USED
SPARES
SHEET 2
SHEET 3
WRITE PROTECT
SECTOR PULSE
INDEX PULSE
READY
STEP OUT
STEP IN
TRACK 00
+5V
+24V
+12V
-12V
CHASSIS GND
Q1 TIP 126

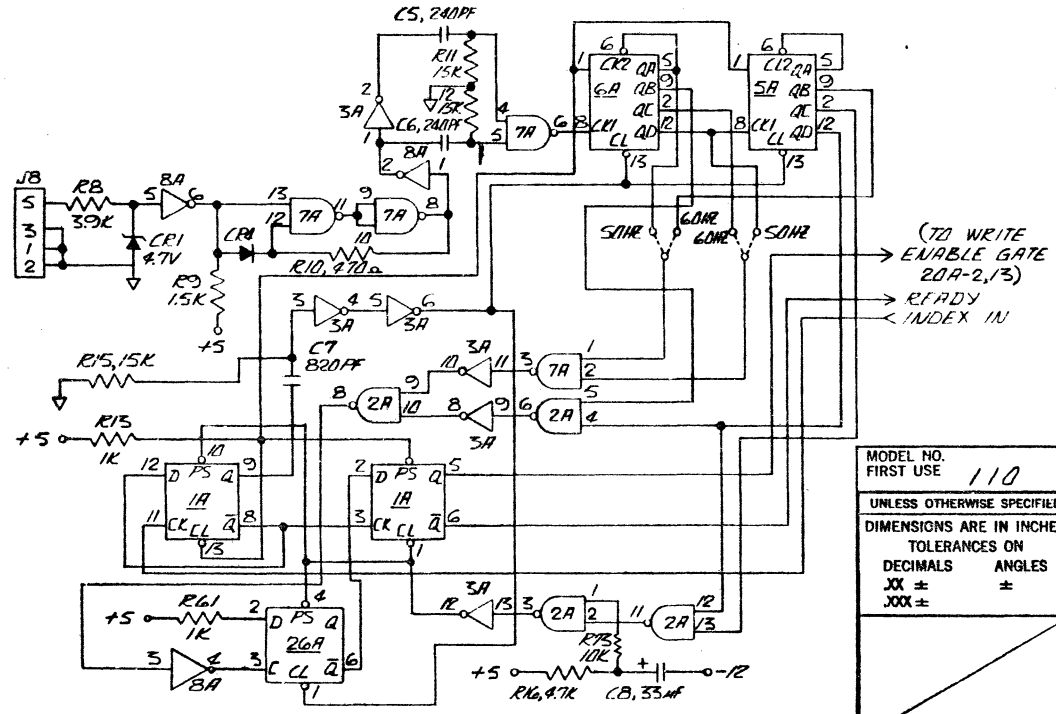


MODEL NO FIRST USE 110			NEXT ASSY FIRST USE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .XXX ± ANGLES ±	DRAWN		Century Data SYSTEMS INC. ANAHEIM, CALIFORNIA
	CHECK		
	APPD		
	APPD		
	FINISH		ASSY, PWB-DATA CONTROL (SCHEMATIC) C.C.
	MATERIAL		SCALE: SIZE D DWG NO. 10130-011 REV D
SURFACE ROUGHNESS PER MIL-STD-10	DO NOT SCALE THIS DRAWING	WEIGHT	SHEET

9-8

DWG NO. 10130-011 REV D





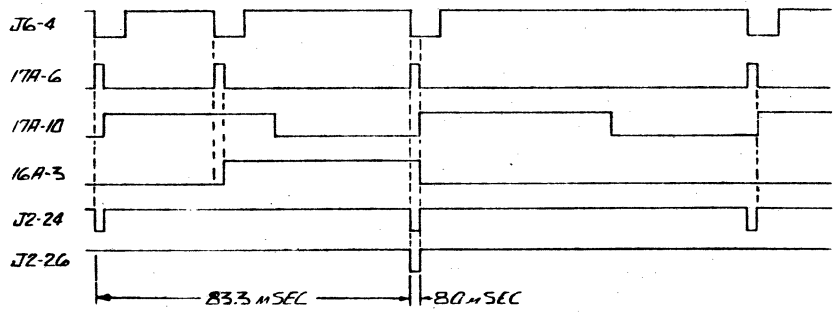
REVISIONS				
REV	ZONE	DESCRIPTION	INC BY	APPROVAL & DATE

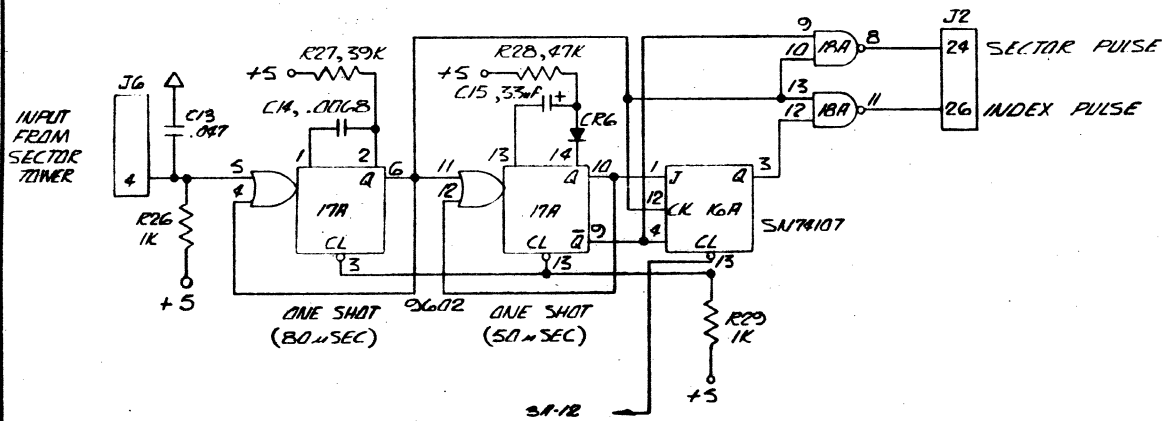
MODEL NO. FIRST USE 110		NEXT ASSY FIRST USE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .XXX ± ANGLES ±	DRAWN R. Tetsu 11-20-72	Century Data SYSTEMS, INC. ANAHEIM, CALIFORNIA
	CHECK	SCHEMATIC & TIMING DIAGRAM FLOPPY DISC (READY CIRCUIT) C.C.
	APPD	
	APPD	
	FINISH	
	MATERIAL	SCALE: SIZE C DWG NO. 10141 -001 REV A
	SURFACE ROUGHNESS PER MIL-STD-10	DO NOT SCALE THIS DRAWING WEIGHT SHEET

REV A | DWG NO. 10141-001 | B

REVISIONS				
REV	ZONE	DESCRIPTION	INC BY	APPROVAL & DATE

TIMING DIAGRAM





MODEL NO. FIRST USE 110			NEXT ASSY FIRST USE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .XXX ± ANGLES ±	DRAWN R. T. Tus 10-20-72 CHECK APPD APPD FINISH MATERIAL SURFACE ROUGHNESS PER MIL-STD-10	Century Data SYSTEMS, INC. ANAHEIM, CALIFORNIA	C.C.
		SCHEMATIC & TIMING DIAGRAM FLOPPY DISC SECTOR/INDEX	
		SCALE: — SIZE C DWG NO. 10142 -001 REV A	
		DO NOT SCALE THIS DRAWING WEIGHT SHEET 1 OF 1	

DWG NO. 10142-001 REV A

Century Data SYSTEMS INC. 1270 NORTH KRAEMER BOULEVARD ▪ ANAHEIM, CALIFORNIA 92806

Century Data Systems—MODEL 110 DISK DRIVE OPERATION AND MAINTENANCE

Printed in U.S.A.