

15 October, 1971
23 March 1972

P R E L I M I N A R Y
I O D I S C D R I V E
S E R I E S 2 0 0 2 T E C H N I C A L M A N U A L



IOMEC INC.
345 Mathew Street
Santa Clara, California 95050

In Reply, refer to
IOMEC 3-17, and the
change level listed
on the title page.

IOMEC 3-17, IODISC SERIES 2002 TECHNICAL MANUAL

This is the PRELIMINARY Technical Manual for the IODISC Series 2002 Disc Drive, to be used in lieu of the FINAL manual that will be published at a later date. When used with the Engineering Logic Diagrams furnished with individual drives, it provides sufficient information to operate and to maintain the drive.

This manual will be revised, amended, and corrected as information or designs change, until the FINAL manual is published. Corrections to, or comments on this manual are invited and should be addressed to:

Technical Publications Section
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It is further recommended that the IODISC Drive - Series 2001/2002 Interface Design Manual (IOMEC 12-26) be used in conjunction with this manual.

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Figure 1-1. IODISC Drive, Series 2002



SECTION 1
INTRODUCTION

1.1 GENERAL DESCRIPTION

The IODISC 2002 disc drive (Figure 1-1) is a low cost, random access mass storage device for use with small to medium size computers. When interfaced with a controller and power system, it becomes the heart of a disc data storage system.

The drive, with a removable disc in combination with a fixed disc, stores up to 48 million bits of information. Both discs are served by the same moving actuator mechanism which carries one read/write head for each disc surface (Figure 1-2). This design provides, on a single drive, the capability to interchange data between the removable cartridge and the fixed disc, through the computer. The removable storage medium is a single-disc cartridge permanently enclosed in the cartridge for protection against contamination and damage; the fixed disc is permanently mounted and sealed under the drive baseplate.

At operating speed, the heads are placed in flying position by a head load mechanism. An electromagnetically actuated carriage, controlled by a closed-loop servo moves the heads to any one of the 406 cylinders (203 per disc).

Mounted in the same enclosure and integral with the drive is an electronic assembly consisting of a single gate which contains Read/Write circuitry, servo electronics, and status sensing circuitry.

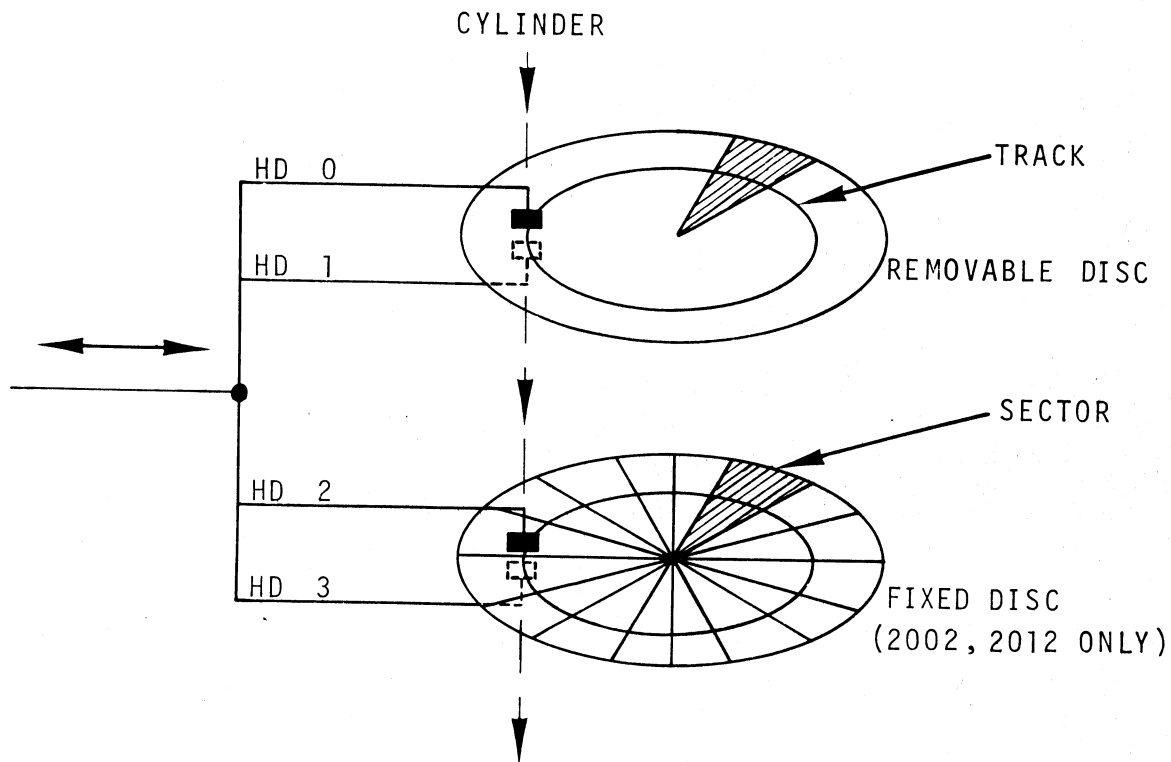


Figure 1-2. Disc Organization

1.2 PHYSICAL DESCRIPTION

The disc drive, including mounting slides, is contained within a case that may be mounted in a standard 19-inch rack. The air required to cool the electronic portions of the drive and keep the disc areas pressurized is drawn into the drive through the air intake located in the upper section of the front panel next to the operating controls.

A disc cartridge is inserted into the drive by opening the release handle, and sliding the cartridge into the drive. When the cartridge is properly loaded, the release handle is returned to its upright position and the access door is closed. When this is done and the proper controls activated, the cartridge release handle locks and the disc starts rotating.

The disc drive is mounted on its own slides, and, when the front panel is unscrewed, the drive can be extended for servicing. The filter chamber is also accessible for removal and replacement of the filter when the drive is extended.

The drive is built on a solid base plate that mounts the cartridge receiver, actuator, and drive motor in addition to the electronics gate and several smaller assemblies.

All drive inputs and outputs pass between the drive electronics and the drive case through flexible cables. All of these cables are routed through the case's rear panel. As shown in Figure 2-4, ac and dc power is brought to the drive through the power lines. All control signals and data transferred between the drive and using system go through the signal lines.

1.3 EQUIPMENT SUPPLIED

Table 1-1 lists the equipment supplied:

Table 1-1. Equipment Supplied

ITEM	IOMEK P/N
Disc Drive Assembly	2002
Disc, Fixed	(16 Sector) 9002-16
	or
	(24 Sector) 9002-24

1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

Table 1-2 lists equipment required to integrate the drive into a memory system, but is not supplied as part of the basic drive assembly:

Table 1-2. Equipment Required But Not Supplied

ITEM	FUNCTION
Disc Cartridge (16 or 24 Sector)	Data Storage Medium
Device Controller	Drive Controller
Channel Adapter	Interface between computer and Drive Controller
Interface Cable	Signal and Control Lines between Controller and Drive
Power Cable	Ac and dc power from power system to drive

Table 1-2. Equipment Required But Not Supplied (continued)

ITEM	FUNCTION
Power Supply	Provides sequenced on and off +5, +36, and -36 dc voltages to the drive
Cabinet, 19"	For mounting drive assembly

1.5 SPECIFICATIONS

Table 1-3 provides a source of quick-reference data for the drive:

Table 1-3. Specifications

<u>Capacity</u>		2001		2002		
	203 cylinders (includes 3 spares)			406 cylinders (6 spares)		
	406 tracks (includes 6 spares)			812 tracks (12 spares)		
	6,400 sectors (16-sector/track mode)			12,800 sectors (16 sector/track mode)		
	9,600 sectors (24 sector/track mode)			19,200 sectors (24 sector/track mode)		
<u>Drive</u>		2001		2002		
	Full Track	16-Sector/ Track	24-Sector/ Track	Full Track	16-Sector/ Track	24-Sector/ Track
Bits	24,060,800	20,480,000	19,814,400	48,121,600	40,960,000	39,628,800
Bytes	3,007,600	2,560,000	2,476,800	6,015,200	5,120,000	4,953,600
Words (16 bit)	1,503,800	1,280,000	1,238,400	3,007,600	2,560,000	2,476,800
<u>Cylinder</u>	Full Track	16 Sector	24 Sector			
bits	120,304	102,400	99,072			
bytes	15,038	12,800	12,384			
words (16-bit)	7,519	6,400	6,192			
<u>Track</u>	Full Track	16 Sector	24 Sector			
bits	60,000	51,200	49,536			
bytes	7,519	6,400	6,192			
words (16-bit)	3,759	3,200	3,096			
<u>Sector</u>						
bits	--	3,200	2,048			
bytes	--	400	256			
words (16-bit)	--	200	128			
<u>Access Times (Including Head Settling)</u>						
	track-to-track:		35 ms			
	average random move:		75 ms	for 2001;	95 ms	for 2002
	average rotation delay:		20 ms			

Table 1-3. Specifications (continued)

Recording Technology

bit density	--	2200 bpi (innermost track)
track density	--	100 tpi
recording format	--	double frequency
data transfer rate	--	1.5625 M bits/second (nominal)
clock frequency	--	3.125 M bits/second (nominal)
bit cell time	--	640 nanoseconds (nominal)
disc rotation speed	--	1,500 rpm
cartridge diameter	--	15"
disc diameter	--	14"
number of heads	--	2 for 2001, 4 for 2002

Power Requirements

AC:	100/115/208/230 Volts, 60Hz, Single Phase, 225 Watts
	100/115/220/240 Volts, 50Hz, 225 Watts (Optional)
	Surge current on start up < 15 amps (six sec.)
DC:	+5.0±1.0% Volts, 3.0 Amperes
	+36.0±1% Volts, 2.0 Amperes*
	-36.0±1% Volts, 2.0 Amperes*

*This supply must deliver a peak current of 3 amps for a 50 msec duration with a 33% duty cycle.

The above dc voltages must be applied and removed in the following sequence:

Power ON - The +5 and +36 volt lines may be brought up together followed by the -36 volts supply.

Power OFF - The -36 volts should drop first, followed by the +5 and +36 volt supplies. (The latter two may be dropped together.)

Maximum Ripple at Electronics Gate Bus

±36 Volt Supplies - 250 mvolts (DC to 100KHz)
100 mvolts (above 100KHz)

With optional DC power unit (includes power sequencer and line filter)

AC: 115 or 208/230 Vac, 60 Hz, single phase, 550 volt-amps

Access Mechanism

Actuator	electromagnetic voice coil motor
Detent	optical

Mounting

cast aluminum base plate with shock mounting

Environment

Temperature	
operating:	+15°C to +35°C (60°F to 95°F)
non-operating/power off:	-15°C to +71°C (5°F to 160°F)

Humidity (without condensation)	
operating:	8% to 80%
non-operating/power off:	0% to 95%

Shock and Vibration
frequencies less than
14 Hz:

0.01 inch peak-peak (sustained)
0.1 inch peak-peak (intermittent)

frequencies of 14 Hz
and greater:

0.1G peak (sustained over 5 seconds)
0.25G peak (intermittent)

Table 1-3. Specifications (continued)

Cooling: forced room air, ambient at installed location

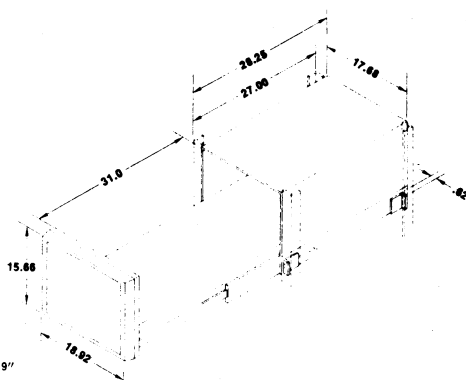
Air Circulation: 40 to 60 CFM (ducted)

General

Dimensions	Height	15.75 inches
	Width	17.75 inches
	Depth	28.50 inches
	Weight	145 pounds

NOTE: These are overall dimensions with covers which permit the drive to be mounted in a standard 19" X 30" electronic enclosure.

dimensions



SECTION 2

PREPARATION FOR USE AND RESHIPMENT

2.1 UNPACKING AND INSPECTION

The following unpackaging procedures outline the steps necessary when (1) the drive is shipped as a separate unit, and (2) when the drive is shipped in a complete system.

2.1.1 DRIVE SHIPPED AS A SEPARATE UNIT.

1. Remove all external packing. If unit is on pallet, care must be taken to avoid excessive shocks when removing drive.
2. Perform visual inspection of external portion of drive.

CAUTION

Drive assembly weighs approximately 150 pounds.

3. Set drive assembly on a bench.
4. Slide drive out of cover on the slides.
5. Remove rear black plastic cover by removing mounting screws.

6. Remove 4 slide assembly screws on each side of the cover that are accessible from inside; remove cover from slide assemblies.
7. Remove the 8 screws attaching each slide assembly to the drive subframe. Remove the slide assemblies. Keep screws separate from others for reuse later.
8. Remove the nut and washer from the left rear shock mount which protrudes through the base plate casting. Expose the bottom of the subframe and remove the nuts and washers from the 3 remaining shock mounts.
9. Remove plastic front door assembly by pulling at corners.
10. Remove the front black aluminum panel from the subframe by removing the 6 screws and pivoting the panel about the switches and laying it on top of the drive.

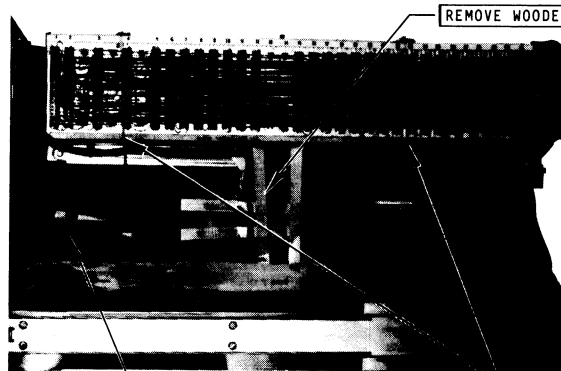
CAUTION

Before continuing, provide a 2 X 4 base to set the drive assembly on to protect from bottom damage.

11. Lift the drive from the subframe. The drive assembly should be set down with care to keep all weight off the spindle pulley, motor pulley, or any other component exposed on the underside of the casting.
 12. See paragraph 2.2 for the installation instructions.
- 2.1.2. DRIVE SHIPPED IN SYSTEM CABINET. (see Figure 2-1).
1. Remove all external packing. If unit is on a pallet, care must be taken to avoid excessive shocks when removing cabinet.
 2. Perform visual inspection on external portion of the cabinet.
 3. Remove plastic front trim cover by pulling at the corners.
 4. Remove four screws securing front panel to the tapped angles in the rack.
 5. Slide drive out.
 6. Remove block taped between the arms.

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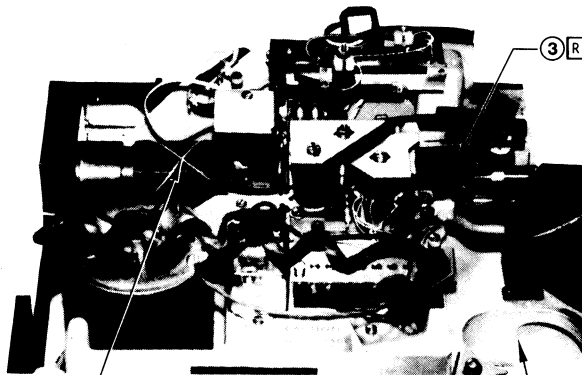
- ① REMOVE PLASTIC FRONT TRIM BY PULLING AT CORNERS
- ② REMOVE 4 SCREWS SECURING FRONT PANEL TO THE TAPED ANGLES



REMOVE WOODEN BLOCK BETWEEN "A" GATE AND BASEPLATE

REMOVE TAPE HOLDING CARTRIDGE RECEIVER TO BASEPLATE

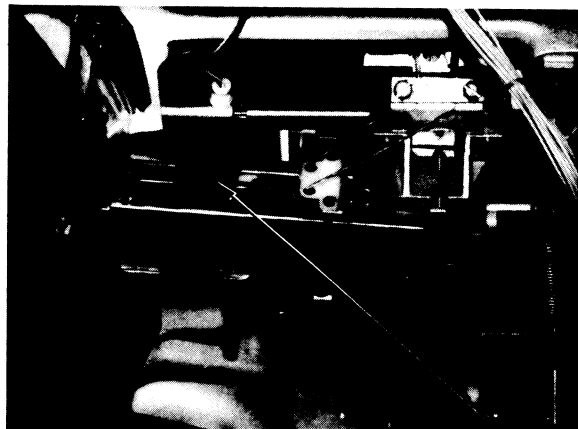
REMOVE TWINE HOLDING "A" GATE IN DOWN POSITION



③ REMOVE BLOCK TAPED BETWEEN UPPER HEAD-ARMS

REMOVE TWINE HOLDING CARRIAGE IN HOME POSITION

④ REMOVE VINYL TAPE FROM AIR PASSAGE VENT



REMOVE TAPED BLOCK FROM LOWER SET OF ARMS

Figure 2-1. Unpacking Instructions

7. Remove vinyl tape from air passage vent on base casting.
8. Install air filter.
9. If unit has been shipped by air, remove shipping clamps from baseplate.

NOTE

In the following step, the bottom metal cover must be removed to allow removal of lower arm block.

10. Remove the taped block from lower set of arms.
11. Inspect heads to verify disc is properly centered between them.
12. Remove twine holding carriage in home position.
13. Remove twine holding A-Gate in down position.
14. Remove tape holding cartridge receiver to baseplate.
15. Perform general inspection for damaged or loose parts.

2.1.3 INSTALLATION INSPECTION. Upon receipt of a drive unit, visually inspect as follows:

1. Remove front cover and four securing screws and extend drive.
2. Inspect interior for loose wiring, dirt, or other physical defects.
3. Verify that all PC cards are firmly seated.
4. Inspect air inlets and outlets for obstructions.
5. Inspect air input filter for cleanliness.
6. Inspect drive belt for proper tension (see Maintenance Section).

2.2 INSTALLATION

2.2.1 INSTALLATION INSTRUCTIONS. This paragraph contains the instructions required to install the disc drive unit in the standard IOMEC rack cabinet.

1. Mount the slide assemblies with the upper screw hole 23 holes below the top of the cabinet.

NOTE

Lightly tighten the mounting screws after setting the slide assemblies into the enclosure. Rear angle brackets are mounted incorrectly for packaging purposes. Remove them and orient them properly. Do not fully tighten mounting screws at this time.

2. Extend each slide forward to accept the subframe. Attach the subframe to the slides using the same screws previously removed. Push subframe back into enclosure and adjust the spacing between the slide supports and the adjacent tapped vertical angle on each side (front and rear) so that it is equal in all four locations.

3. Tighten the two screws in each tapped angle to secure the slide assemblies and subframe to the enclosure and the two screws mounting the rear angle brackets to the slide assembly.
4. Slide the subframe out of the enclosure until the slide locks engage. Check to make sure that the slides are free running.
5. Attach the cover assembly to the slide supports with the eight screws previously removed.
6. Replace the black plastic rear cover using 3 of the previously removed screws on the right side (as viewed from the rear).

WARNING

If a multi-drive system, before installing drive in the cabinet, ensure upper drive is in the normal operating position (closed). If not, the cabinet could topple causing serious injuries.

7. With the subframe extended, replace the drive assembly and secure to the subframe using the nuts and lock washers previously removed from the shock mounts.
8. Reinstall the front black panel on the subframe, using the six screws previously removed.

9. Reinstall plastic front door assembly.
10. Remove block between the head-arms (upper and lower).
11. Remove twine holding carriage in home position.
12. Remove the tape holding the receiver to baseplate.
13. Remove the twine, wooden block, and tape holding the A Gate in the down position.
14. Remove air filter and gasket from box. Remove tape from baseplate hole and plastic from air duct. Install air filter on drive.
15. Perform general inspection for damaged or loose parts.
16. Attach the bottom cover using the eleven screws.
17. Using Figures 2-2 and 2-3, and Table 2-1 as guides, install power and signal cables.

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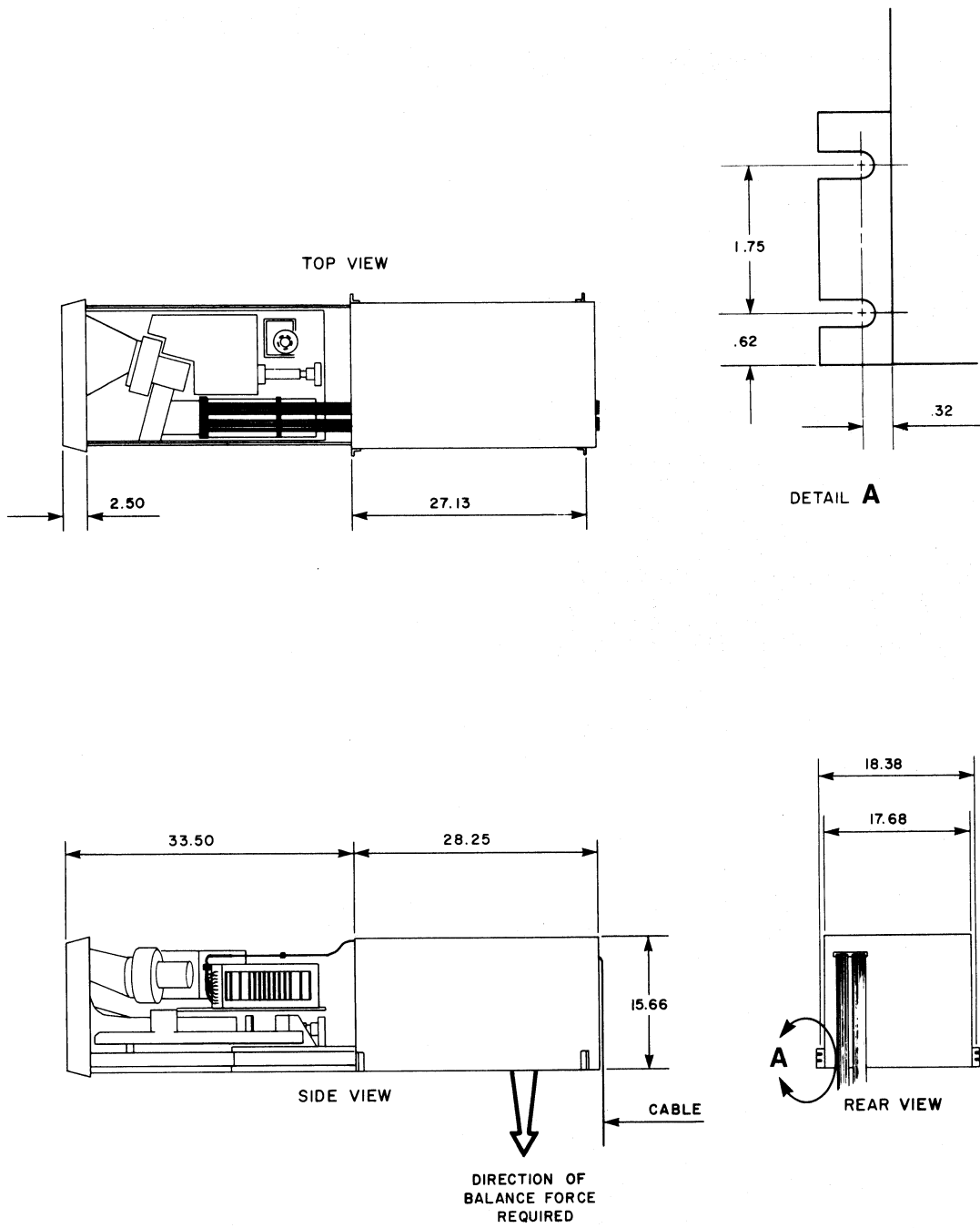
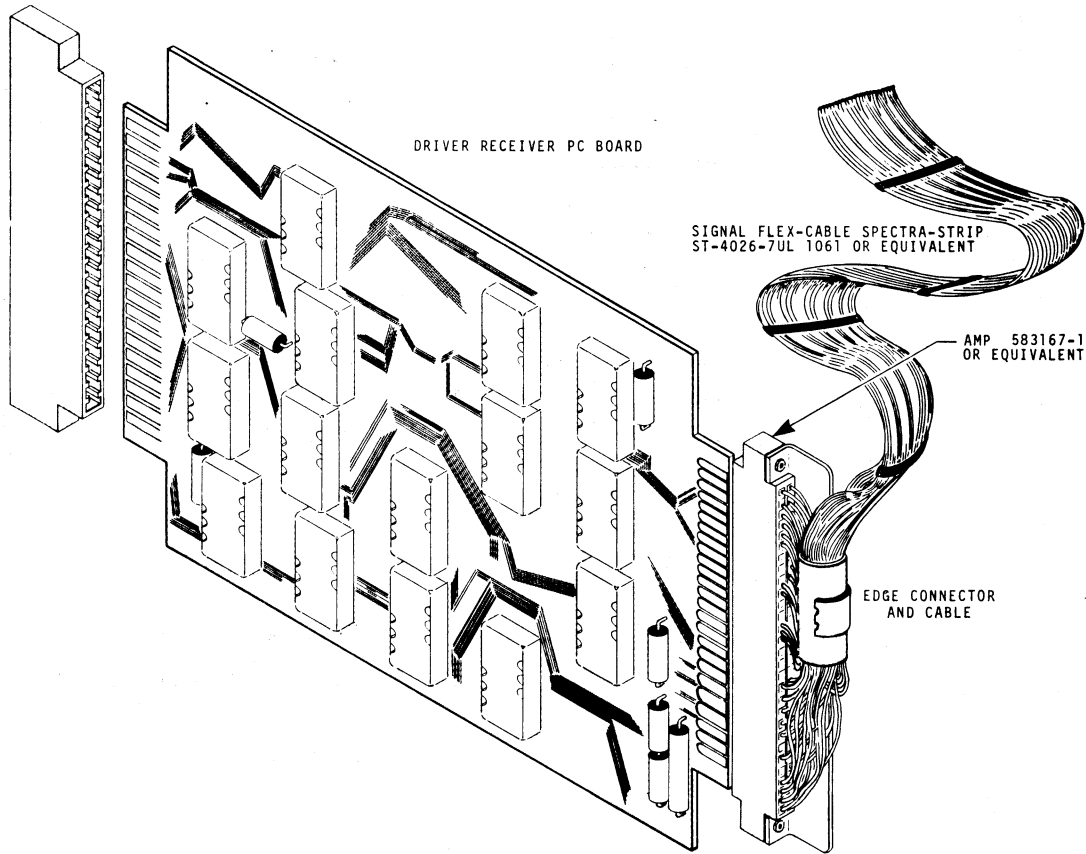


Figure 2-2. Critical Dimensions

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BACK PLATE CONNECTOR



20-6-8/12/71

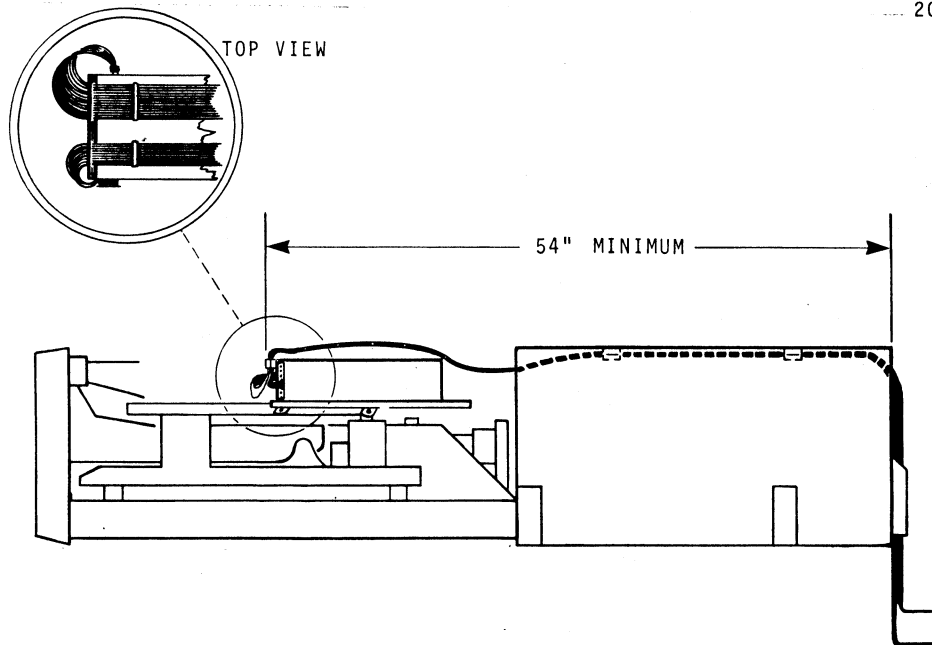
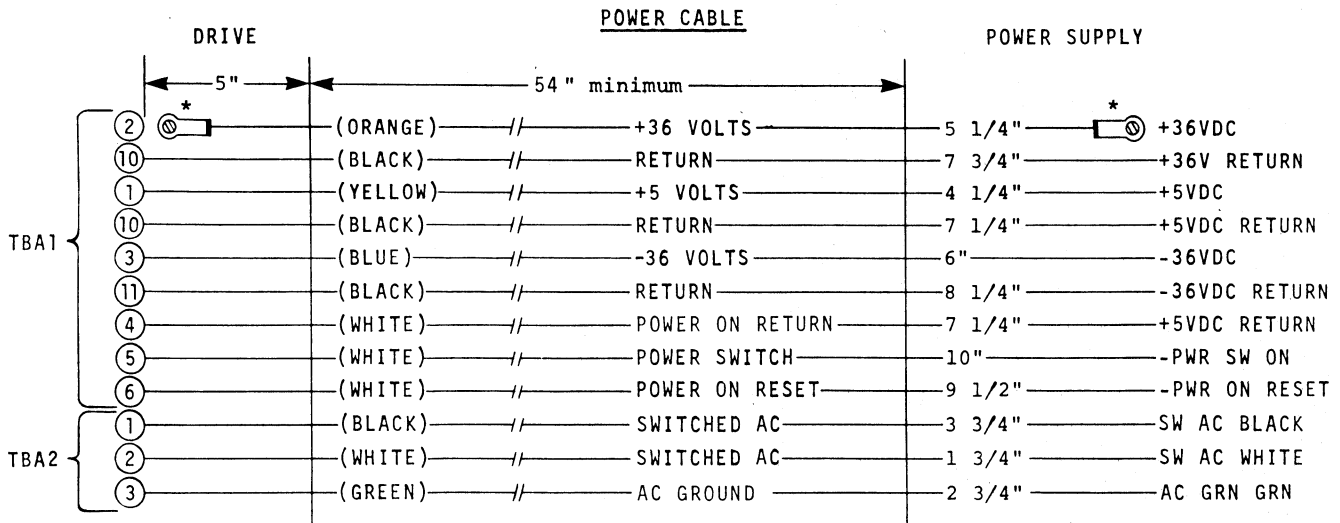


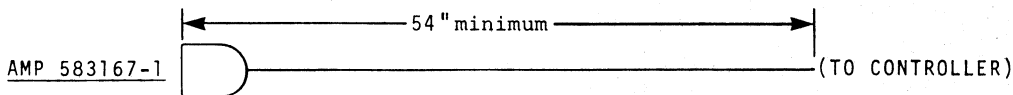
Figure 2-3. Typical Interface Card and Connectors

Table 2-1. Signal and Power Cable Fabrication Data (OEM Configuration)



*#10 LOGS FOR TERMINAL CONNECTIONS

SIGNAL CABLE



SIGNAL	AMP CONNECTOR PIN
-Address Bus 0	J A2 H1
-Address Bus 1	E A2 E1
-Address Bus 2	H A2 J1
-Address Bus 3	D A2 F1
-Address Bus 4	5 A2 C1
-Address Bus 5	C A2 L1
-Address Bus 6	4 A2 D1
-Address Bus 7	B A2 K1
-Set Cylinder	18
-Select Head 1	M
-Select Fixed Disc	K
-DF Write Data	L
-Write Gate	7 B2 L2
-Read Gate	8 B2 R1
-Erase Gate	9
-Drive Reset	15 A2 M1
-Drive Select	19
-Drive Ready	b
-Access Ready	14
-Serial Read Data	U
-Sector Pulse (R)	T
-Index Pulse (R)	W
-Seek Incomplete	21
-Drive Unsafe	22
-Read Data Clock	23 B2 S1
-Read Only Violation (Optional)	R
-Sector Pulse (F)	N
-Index Pulse (F)	Y

Return lines tied to Ground bus inside connector. Tie ground bus to pins 1, A, 25, and Z.

2.2.2 INSTALLATION CHECKOUT. Perform the following steps to test the drive's operational readiness.

Test Equipment and tool requirements:

<u>NAME</u>	<u>IOMEC P/N</u>
Screwdriver, 1/8" Blade	N/A
Wrench, Head Clamping	7-9931
Test Module	7-1483
Disc Cartridge, Alignment	7-0900
Disc Cartridge	N/A
Oscilloscope	Tektronix 547 or equivalent
X1 Probes (3)	Tektronix P6011 or equivalent
Glyptal, 1/2 Oz.	N/A
Voltmeter, Digital	HP-3430A or equivalent

1. Check pigtail leads for excessive stretch after removing head-arm spacers from upper and lower head assemblies.
2. Set Power Supply Breaker and disc POWER switches ON.
3. Check power voltages at A Gate as follows; adjust as necessary.
(See applicable power supply manual for procedures.)

A14-A	-	+5.0±1% VDC
A14-B	-	-36±1% VDC
A14-1	-	+36±1% VDC
A14-Z	-	Ground

4. Set drive POWER switch OFF.
5. Insert test module in A-Gate card slots 16 and 17; set all switches OFF. Unplug the A14 (9171) card.
6. Set drive POWER switch ON.
7. Install disc cartridge (not the alignment cartridge).
8. Set CARTRIDGE switch to LOCK; wait approximately 30 seconds, then set test module MAINT switch ON. This will cause the heads to load.
9. Manually move the head-arm carriage assembly from the rear to the forward crash-stop; verify that there are no obstructions over the entire range. Return the assembly to the rear crash-stop.
10. Set test module MAINT switch OFF.
11. Power drive down the drive by setting the CARTRIDGE switch to UNLOCK, then the POWER switch to OFF.
12. Reinstall the A14 (9171) card removed in step 5.
13. Repeat steps 6, then 8, in that order.
14. Set test module AUTO SEEK switch ON.

15. Set CYLINDER ADDRESS switches 1 through 128 ON one at a time; verify the head-arm carriage assembly moves to the selected cylinder each time. This can be verified by the position pointer on the carriage assembly.
16. Set test module AUTO SEEK switch OFF.
17. Check servo alignment as outlined in paragraph 5.3.1.
18. Check head-arm assembly alignment as described in paragraph 5.3.3.
19. Install user's disc cartridge, initialize discs, and execute diagnostics.

2.3 PREPARATION FOR RESHIPMENT

2.3.1 PACKAGING. To package a drive unit for shipment, proceed as follows:

1. Vacuum drive exterior surfaces and dust off enclosure exterior.
2. Remove filter from intake and vacuum interior of enclosure.
3. Remove air filter, place in plastic bag and seal; then package in carton and hold for packing (see step 13). Apply 3" vinyl tape to air passage on casting. Cover blower and duct openings with plastic film and tape in position.
4. Block heads and tape spacers in position.
5. Tie carriage assembly back with nylon lacing cord or filament tape to actuator magnet.
6. Tape down receiver in 2 places.
7. Tie down A-Gate with nylon lacing cord to hinge and air duct.
8. Position wood support block under A-Gate and tape in position.
9. Pull power cable inside enclosure, coil and tape down; put plug in cushion bag and tape closed.

10. Tape wood block under right side of B-Gate (if installed) and close cover. Cut two (2) pieces of filament tape approximately 18 inches long and secure one end to side of sequence box near the top. Locate the second piece on the side of the sequence box near the bottom. Close the B-Gate, wrap the second end of the tape around the top and front, and side and front of the gate.
11. Cut 2 pieces of filament tape approximately 12 inches long. Secure one end to the right hand cable support and the other across the top and front of B-Gate. Repeat with the second piece of tape.
12. Inspect enclosure exterior for paint scratches; touch up with proper color paint.
13. Wrap Logic Book, miscellaneous papers, etc. in plastic bag; tape closed and tape to inside of enclosure next to power supply.
14. Tape carton containing filter on top of power supply.

15. Secure a strip of Ava-Strap around enclosure at each door handle; tighten with buckle located at left side near rear of enclosure.
16. Repeat 15 for second door on dummy front.
17. Repeat 15 for lower front panel.
18. Position 2 pieces of foam under the Ava Strap. One-half of the block to be on the door handle and one-half on the plastic front trim; position a third piece under buckle. Tape each block to Ava-Strap with filament tape.
19. Repeat 18 for second door on dummy front.
20. Repeat 18 for lower panel.

SECTION 3
OPERATION

3.1 GENERAL

The disc drive operates unattended and requires operator intervention to start up the system, and to change the disc packs.

3.2 CONTROLS AND INDICATORS

The following paragraphs reference Figure 3-1, a diagram of the drive's controls and indicators:

230-2-12/21/70

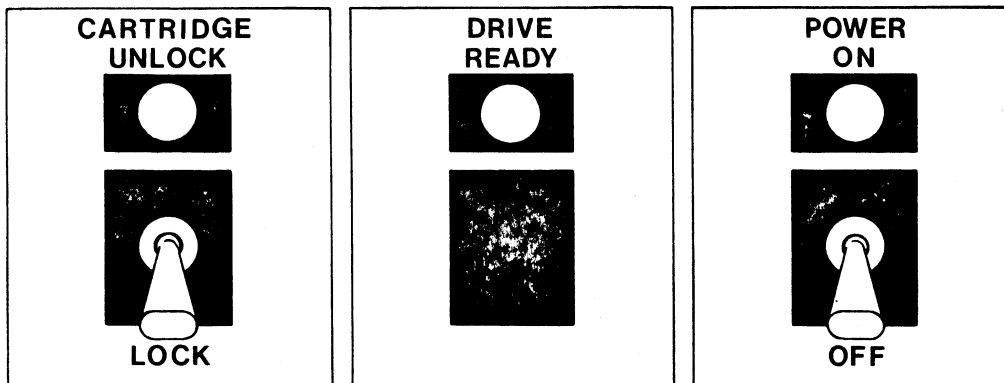


Figure 3-1. Drive Controls and Indicators

3.2.1 POWER ON/OFF Toggle Switch. This switch is normally used to control AC and DC power to the drive. A set of normally open contacts from the switch is wired to the drive power connector. The contacts can switch up to a 5 ampere resistive or inductive load at 125vac.

3.2.2 CARTRIDGE UNLOCK Toggle Switch. This switch starts the disc spin motor if (1) AC and DC power are applied to the disc drive unit, and (2) a disc cartridge is in place and the cartridge lock mechanism is in its locked position.

Setting the switch to its LOCK position will bring the disc(s) up to speed and load the read/write heads. This switch is interlocked with the POWER switch and will not turn on the disc drive motor unless the POWER switch is ON.

Setting the switch to the UNLOCK position will unload the heads and cause the access arm to move the read/write heads to track 000.

3.2.3 CARTRIDGE UNLOCK Indicator. This indicator will be ON at all times that the cartridge lock mechanism is unlocked. The LOCK mechanism must be unlocked to allow removal and insertion of the single disc cartridge.

3.2.4 READY Indicator. This indicator will be ON at all times that the drive is in a READY status to (1) indicate the drive is sequenced up, ready for operation with the disc spinning and heads loaded, and (2) indicate no unsafe conditions are present.

3.2.5 DISC PROTECT Indicator (Optional-not shown). This indicator will be ON whenever the DISC PROTECT switch has been turned on to prevent writing on the fixed disc.

3.2.6 DISC PROTECT Switch (Optional-not shown). Placing this toggle switch into its upper position (ON) prevents writing on the fixed disc. The DISC PROTECT Indicator will be lighted when this switch is active.

3.3 OPERATING PROCEDURES

3.3.1 POWER TURN-ON PROCEDURE

1. Set circuit breaker on the IOMEC Series 720 Power Supply ON.
2. Set drive's POWER switch to the ON position. This applies operating voltages to the drive electronics. If the drive's CARTRIDGE switch is in the UNLOCK position, a disc cartridge may be loaded into the receiver at this time.
3. Load disc cartridge into receiver (paragraph 3.3.3).
4. Set CARTRIDGE switch to LOCK; the spin motor starts, and within 90 seconds, the heads load and the drive is ready for data handling operations.

3.3.2 POWER TURN-OFF PROCEDURE

1. Set CARTRIDGE switch to UNLOCK.
2. When the spin motor stops (CARTRIDGE UNLOCK light lights), remove the disc cartridge.
3. Set POWER switch to OFF.

3.3.3 CARTRIDGE LOADING PROCEDURE

1. If disc is spinning, set CARTRIDGE switch to UNLOCK.
2. When the UNLOCK light lights, open window assembly (hinged at the bottom).
3. Pull down on receiver handle; the cartridge will pop up.
4. Carefully slide the cartridge out from the receiver.

3.3.4 CARTRIDGE UNLOADING PROCEDURE. To unload the cartridge, reverse the Cartridge Loading Procedure (paragraph 3.3.3).



SECTION 4
THEORY OF OPERATION

To be Provided



SECTION 5 MAINTENANCE

5.1 GENERAL

Section 5 provides information and instructions required to keep the drive in proper operating condition. Maintenance information provided includes preventive and corrective maintenance procedures.

Preventive maintenance is defined as the systematic care, inspection, and tests of the drive to keep it in operating condition and to correct minor failures before they develop into major failures. General preventive maintenance categories are adjust, align, check, clean, inspect, lubricate, replace, and tests to determine operational readiness.

Corrective maintenance is defined as the systematic isolation of a fault in a failed drive. This includes tests necessary to isolate the faulty component, the procedures necessary to remove and replace it, and the tests necessary to insure the drive is operating properly.

5.2 SPECIAL TOOLS AND TEST EQUIPMENT

Special tools and test equipment manufactured specifically for drive maintenance are illustrated in Figures 5-1 and 5-2. The following paragraphs describe the function(s) of each item:

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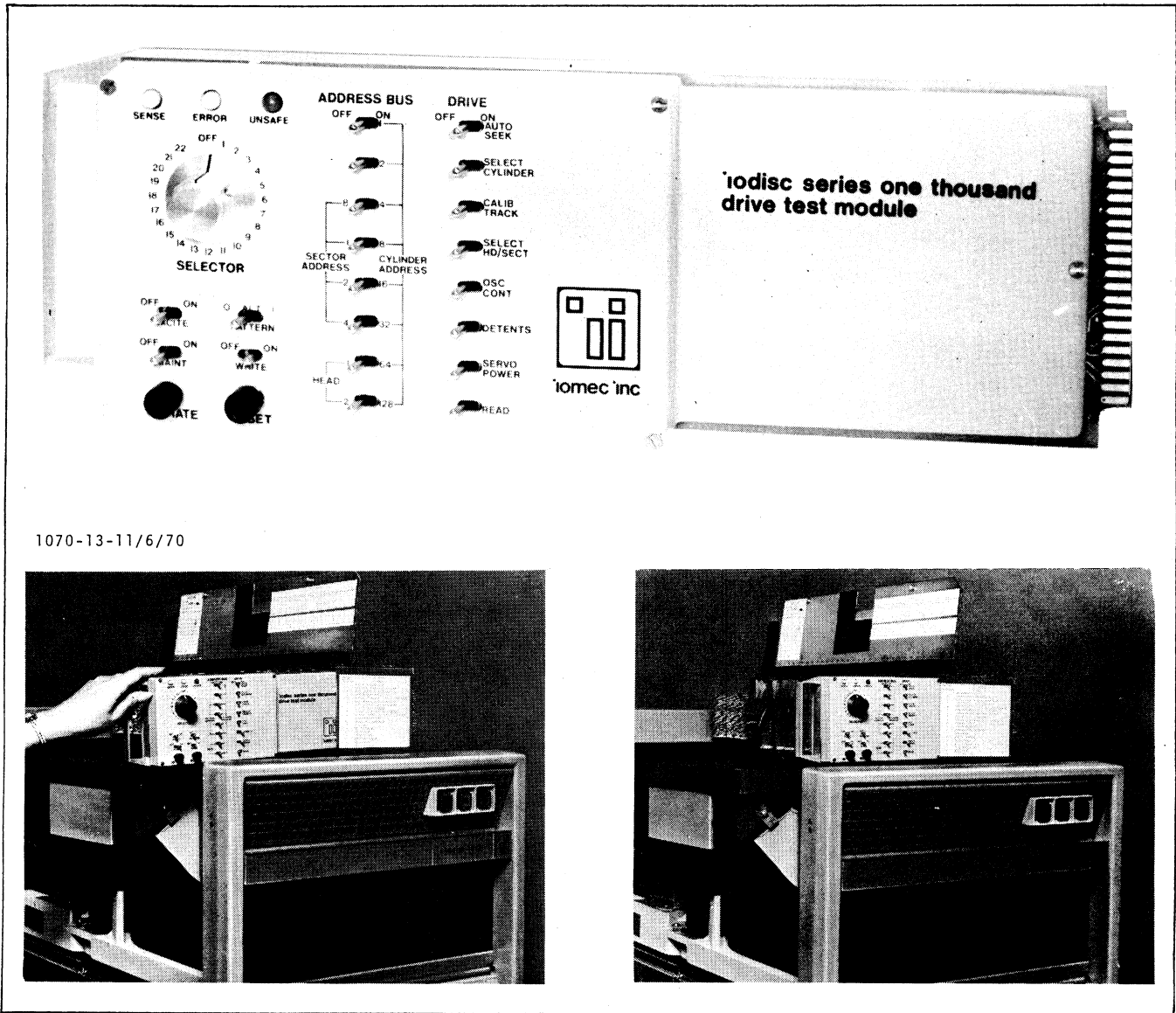


Figure 5-2. IODISC Test Module, IOMEC 7-1483

5.2.1 CARD EXTENDER. The card extender (1), Figure 5-1) is used when making connections to a point on a printed-circuit card. In order to use the extender, the card to be tested is first removed from the gate socket, the extender is inserted, then the card is installed on the extender.

5.2.2 HEAD CLAMPING WRENCH. The head clamping wrench (2, Figure 5-1) is used to loosen and tighten head clamping screws during head positioning adjustments. The tip is an allen type which is made to fit 4 hexhead cap screws.

5.2.3 HEAD ADJUSTING TOOL. The head adjusting tool (3, Figure 5-1) is a non-magnetic screwdriver used in read/write head alignment.

5.2.4 ALIGNMENT CARTRIDGE. The alignment cartridge, identified by a red access door, has special alignment data recorded on tracks 95, 100, and 105; all other tracks are blank. Track 95 provides sector index timing signals, and tracks 100 and 105 provide identical head alignment waveforms.

5.2.5 IODISC TEST MODULE. The IODISC Test Module (Figure 5-2) plugs directly into sockets 16 and 17 of the electronics gate on the drive, and provides a means for checking all drive major functions without the use of a computer or controller. Since it electronically disconnects signals from the computer or controller, it does away with the need of disconnecting interface cables.

In general, the test module provides (1) head selection, (2) cylinder selection, and (3) safety circuit testing. For detailed operating procedures, see the IODISC Test Module Operating Guide (IOMEC 3-12).

5.3 PREVENTIVE MAINTENANCE

The basic objective of the preventive maintenance program is to maximize the drive availability by early detection and correction of potential mechanical or electrical component failures. Often the time spent on routine preventive maintenance can prevent costly failures at some later date.

Successful preventive maintenance requires the implementation of a systematic inspection and maintenance program performed at regularly scheduled intervals. The preventive maintenance schedule (see Table 5-1) lists preventive maintenance required for the drive and provides recommended intervals for performing the maintenance.

This paragraph provides the basis for the preventive maintenance procedures necessary to properly maintain the drive. The paragraph is divided into the following tables:

5-1 Preventive Maintenance Schedule

5-2 Inspection Procedures

5-3 Cleaning Procedures

5-4 Lubrication

Table 5-1. Preventive Maintenance Schedule

Frequency	Operation	Reference
6 months	Clean and lubricate carriage ball bearings	Clean bearings in accordance with table 5-3, step 4. Lubricate bearings in accordance with table 5-4, step 2.
6 months	Clean and lubricate carriage bearing strip	Clean strip in accordance with table 5-3, step 3. Lubricate strip in accordance with table 5-4, step 5.
6 months	Inspect and clean read/write heads	Inspect in accordance with table 5-2, step 14. Clean in accordance with table 5-3, step 1.
6 months	Inspect and clean voice coil actuator	Inspect in accordance with table 5-2, step 6. Clean in accordance with table 5-3, step 6.
6 months	Clean and lubricate carriage rail	Clean in accordance with table 5-3, step 5. Lubricate in accordance with table 5-4, step 3.
6 months	Replace coarse filter	
6 months	Lubricate head load cams	Lubricate cam in accordance with table 5-4, step 4.
12 months	Lubricate head load pivot	Lubricate points in accordance with table 5-4, step 1.
12 months	Inspect head alignment	Inspect in accordance with table 5-2, step 5.
12 months	Check and adjust drive belt tension	If required, adjust tension.
12 months	Clean baseplate and casting	
12 months	Replace absolute filter	

Table 5-2. Inspection Procedures

Step	Procedures
1	Remove front cover and 4 securing screws, and extend drive.
2	Inspect interior for loose wire connections, frayed wiring, dirt, and other physical defects. Clean drive interior in accordance with table 5-3. Tighten or repair loose connections and replace damaged components.
3	Verify that all PC cards are firmly seated.
4	Check exterior cables for frayed wiring, evidence of chafing, or other damage. Repair cable insulation as required.
5	Verify ease of travel of carriage assembly with head bail mechanism released.
6	Inspect voice coil for dirt, deterioration, or evidence of overheating; clean in accordance with table 5-3; replace voice coil if necessary.
7	Inspect air inlets and outlets for obstructions.
8	Inspect air input filter and clean in accordance with table 5-1.
9	Inspect blower motor for evidence of overheating.
10	Inspect drive motor for evidence of overheating.
11	Inspect drive belt for proper tension. Adjust as necessary.
12	Inspect indicators and switches for burned out bulbs and damaged or loose sockets.
13	Inspect linear potentiometer for evidence of excessive wear. Inspect wiper assembly for proper alignment.
14	Inspect heads for contamination. If required, clean heads in accordance with table 5-3.

Table 5-3. Cleaning Procedures

1. Read/Write Heads. Material required:

Quantity	Description	IOMEC P/N
6"	Lint-Free Tissue	7-9925
2	3/4 X 6" Hardwood Tongue Blades	7-9926
3 Oz.	91% Isopropyl Alcohol	7-9927

- a. Remove cartridge; shut down drive.
- b. Remove air filter.
- c. Prepare a cleaning paddle by wrapping several layers of tissue around tongue blade.
- d. Dampen paddle in alcohol, do not soak.

CAUTION

Never touch heads with fingers.

- e. Using a second unwrapped tongue blade to support the back of each head, swab head surfaces with dampened paddle.
- f. Prepare a new paddle; repeat step (e) until cleaning tissue shows no signs of having removed head surface residue.
- g. Using a dental mirror, inspect head surfaces. If still dirty, repeat cleaning steps.

2. Discs. Discs do not require cleaning at any time during their normal life. If, however, a head has contacted the disc surface and causes oxide dusting, the following procedure must be followed:

Material required:

Quantity	Description	IOMEC P/N
3"	Lint-Free Tissue	7-9925
1 Oz.	91% Isopropyl Alcohol	7-9927

- a. Dampen tissue with alcohol.
- b. Depress disc cartridge spindle and rotate cartridge while wiping each surface lightly with tissue.
- c. Install disc in drive and transfer all data to the new disc; discard damaged disc.

3. Carriage Bearing Strip. Material required:

Quantity	Description	IOMEK P/N
3"	Lint-Free Tissue	7-9925
1 Oz.	91% Isopropyl Alcohol	7-9927

- a. Manually move carriage to its limit against drive magnet.
- b. Dampen tissue with alcohol and wipe bearing strip surface clean.
- c. Lubricate bearing strip in accordance with step 1 in Table 5-4.

4. Carriage Ball Bearings. Material required:

Quantity	Description	IOMEK P/N
3"	Lint-Free Tissue	7-9925
1 Oz.	91% Isopropyl Alcohol	7-9927

- a. Saturate the lint-free tissue with alcohol and wipe each bearing clean.
- b. Lubricate bearings in accordance with step 2 of table 5-4.

5. Carriage Rails. Material required:

Quantity	Description	IOMEK P/N
3"	Lint-Free Tissue	7-9925
1 Oz.	91% Isopropyl Alcohol	7-9927

- a. Dampen the lint-free tissue with alcohol and wipe the rail clean.
- b. Lubricate in accordance with step 3 of table 5-4
- c. Spindle Assembly.
- d. Wrap 3" masking tape around one hand with the sticky surface exposed.
- e. Press the tape against all magnetic areas of the spindle until all metallic and dirt particles adhere to the tape.

6. Voice Coil Actuator.

- a. Wrap 3" masking tape around one hand with the sticky surface exposed.
- b. Press the tape against all magnetic areas of the actuator surface until all metallic and dirt particles adhere to the tape.
- c. Pull the carriage out to expose the center pole piece of the actuator and press the tape against all areas of the pole piece.

7. Sector Transducer (Upper and Lower).

- a. Wrap masking tape around one hand with the sticky surface exposed.
- b. Press the tape against all surfaces of the transducer, then remove the tape from your hand and drag it through the transducer slot to pick up metallic particles in the slot.

Table 5-4. Lubrication Procedures

1. HEAD LOAD PIVOT - Apply one drop of #19 oil to each pivot point; remove excess oil with lint-free tissue (see Figure 5-3).
2. CARRIAGE BALL BEARINGS - Apply a drop of #16 oil to outer surface of each ball bearing (6 total); it may be necessary to remove air filter chamber to reach top bearings.
3. CARRIAGE RAIL - Apply a light, even coat of #16 oil; remove excess with a lint-free cloth.
4. HEAD LOAD CAM - Rub in a light coat of Molycoat G to cam(s). (2 for dual disc machines.)
5. BEARING - Manually move carriage to rear crash-stop; apply a light and even coat of Molycoat G to bearing surface.

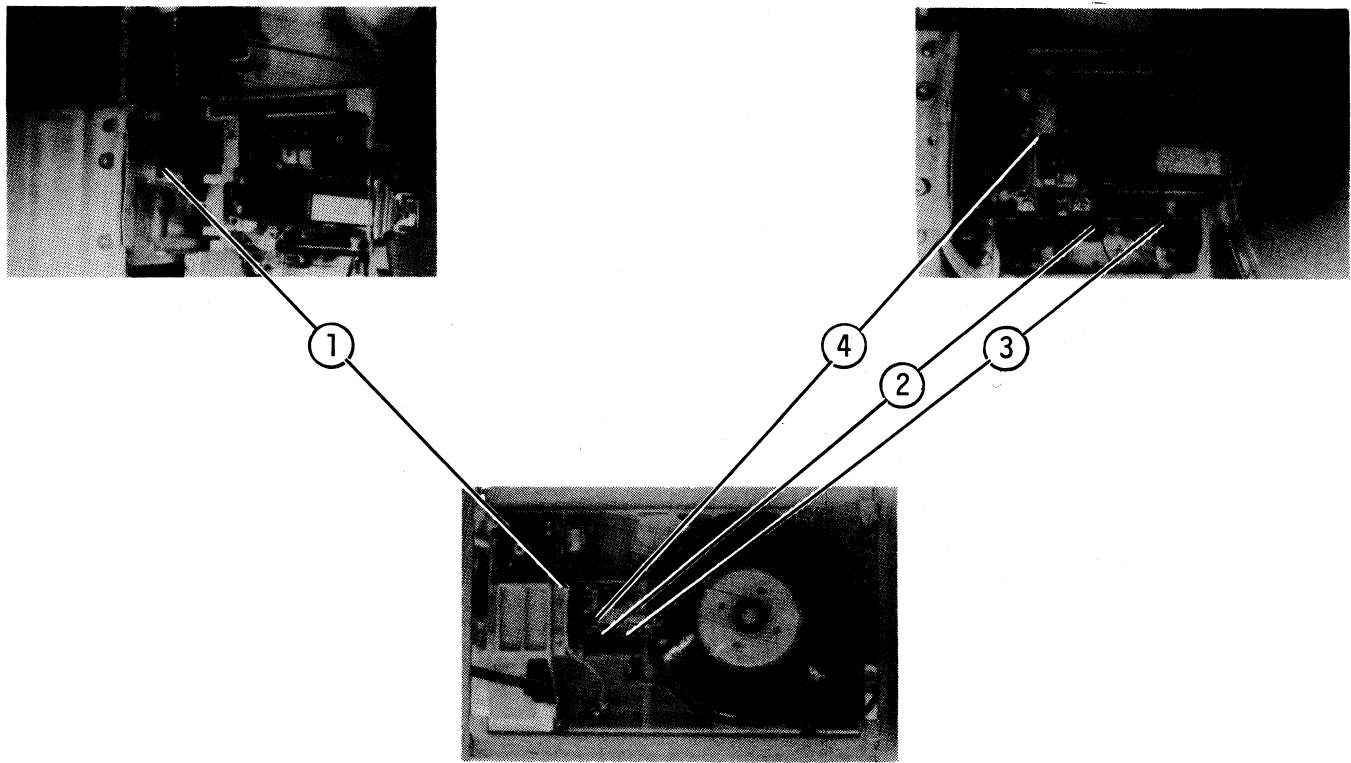


Figure 5-3. Lubrication Locator

5.4.1 SERVO SYSTEM ALIGNMENT. Table 5-5 outlines the alignment required when replacing the Sensor Block or Shutter. It should be performed when positioning errors are detected or servo overshooting is detected.

Test Equipment and tool requirements:

<u>NAME</u>	<u>IOMEK P/N</u>
Oscilloscope (Dual Beam)	Tektronix 547 or equivalent
X1 Probes (2)	Tektronix P6011 or equivalent
Cartridge	N/A
Allen Wrench, 1/8"	N/A
Screwdriver, 1/4" blade	N/A

Table 5-5. Servo System Alignment Procedure

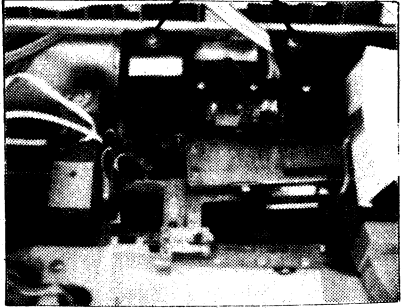
PROCEDURE	REMARKS
1. Remove power and extend drive.	a. Set CARTRIDGE switch to UNLOCK. b. When UNLOCK light comes ON, set POWER switch to OFF.
2. Remove A14 (9671) card from its socket.	This removes the power amplifier from the servo system, allowing no excitation to the voice coil.
3. Install test module in A-Gate slots 16 and 17.	<u>CAUTION</u> Set all switches OFF
4. Slide Voice Coil rearward until the head-arm carriage strikes the rear crash-stop.	
<u>CAUTION</u> In the following steps, when moving the Sensor Block, be sure it is flush against the lip on the drive's baseplate; otherwise, damage will occur to the shutter or block.	
5. Loosen two screws (1) enough to allow the Sensor Block to be moved forward (towards cartridge spindle).	
6. Slide Sensor Block forward (towards spindle) as far as it will go.	
7. Power-up drive.	a. Set POWER switch ON b. CARTRIDGE UNLOCK light should be ON; if not, set CARTRIDGE switch to UNLOCK.
8. Install disc cartridge	

Table 5-5. Servo System Alignment Procedure (continued)

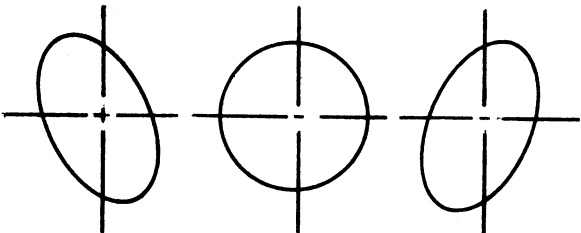
PROCEDURE	REMARKS
9. Connect oscilloscope probe to A13-T (+HOME POS).	a. Connect ground lead to Pins Z or 22 on convenient card jack. b. Adjust oscilloscope for measuring 0 and +5 Volt logic levels
10. Keeping Sensor Block firmly against the baseplate's lip, slowly move the block towards the rear until +HOME POS line goes high.	When +HOME POS goes high (logical "1"), the home position for the carriage has been detected.
11. Continue moving block about 0.010" farther.	This ensures the home position is not critical.
12. Being careful not to shift the Sensor Block's position, tighten screws holding it of the baseplate.	See figure in step 5.
13. <u>NOTE</u> In the following steps, the phase relationships between ϕA and ϕB will be adjusted. When the shutter is adjusted correctly, a 90° phase relationship will be noted between the two phases. This is accomplished by observing lissajous patterns on the oscilloscope display.	 <p>Note: Correct signal is approximately 4 volt peak to peak</p>
14. Move oscilloscope probe to A13-Y.	This is the ϕA test point.
15. Connect another oscilloscope probe to A13-K.	This is the ϕB test point.
16. Connect the connector end of the probe to A13-K to the oscilloscope's External Horizontal input jack.	ϕA will provide vertical deflection and ϕB will provide horizontal deflection.

Table 5-5. Servo System Alignment Procedure (continued)

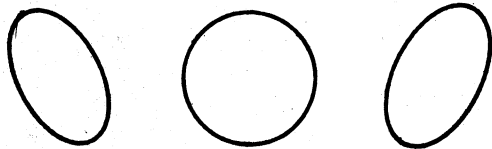
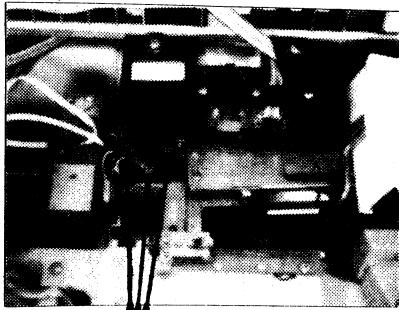
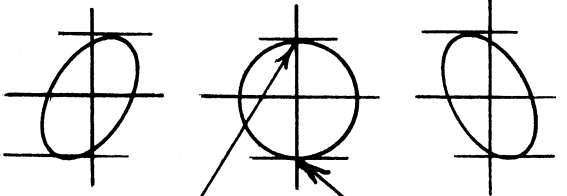
PROCEDURE	REMARKS
17. Set oscilloscope controls so the Horizontal input signal will generate the horizontal sweep.	On most oscilloscopes, this is accomplished by setting the HORIZONTAL DISPLAY control to EXT HORIZ position.
18. Move the carriage assembly back and forth over a small segment of its total travel so that a lissajous pattern is appearing on the oscilloscope display.	a. Adjust the oscilloscope for a convenient display. b. The display will be similar to one of the below displays 
19. Move carriage assembly to the rear crash-stop.	This places the carriage at Home position so the heads will load.
20. Set CARTRIDGE switch to LOCK.	Spin motor starts disc spinning.
21. After approximately 30 seconds, set test module MAINT switch to ON.	Heads will load
<p style="text-align: center;"><u>NOTE</u></p> If the heads fail to load in step 21, go back to step 9 and repeat the steps.	If the heads fail to load, it is probably because you have failed to set up the Home Position sensing correctly.
22. Loosen three screws (2) on the Shutter Assembly using an Allen wrench.	Loosen screws enough so the shutter can be moved perpendicular to the carriage assembly motion 

Table 5-5. Servo System Alignment Procedure (continued)

PROCEDURE	REMARKS
23. Staying at the low end (cylinders 000 to 020), move carriage back and forth to produce a lissajous pattern.	Moving the shutter varies the phase relationships between θA and θB .
24. Adjust so that the pattern lines up with the oscilloscopes bezel patterns as shown.	Note that on the correct waveform display, the tangent lines make with the bezel centerline.
25. Carefully move the shutter perpendicular to the carriage's motion so the tangent lines are as shown in the center waveform.	 <p style="text-align: center;">INCORRECT ← CORRECT → INCORRECT</p>
26. Move carriage to high end (cylinders 150 to 200) and repeat step 25.	This sets the correct phase relationships at the high end of the carriage travel.
27. Repeat step 25 at the low end, then again at the high end.	This ensures adjustments at each end are correct and are not disturbed by the opposite end adjustments
28. Carefully tighten Shutter screws.	2, Figure in step 22.
29. Remove disc cartridge from receiver. (Carriage must be at the rear crash stop for UNLOCK light to come on.)	<ul style="list-style-type: none"> a. Set CARTRIDGE switch to UNLOCK. b. When UNLOCK light comes on, remove cartridge.
30. Set test module MAINT switch OFF.	This prevents premature head loading when the spin motor is started up again in the following step(s).
31. Perform head-arm assembly alignment as described in paragraph 5.4.3.	<p style="text-align: center;"><u>NOTE</u></p> Power drive <u>down</u> and replace A14 (9171) card (see step 2).

5.4.2 SECTOR DETECT ADJUSTMENTS. Table 5-6 outlines procedures for adjusting the sector transducer oscillator amplitude, and the sector timing relative to fixed timing marks on the alignment cartridge.

Test Equipment and Tool Requirements:

<u>Name</u>	<u>IOMEC P/N</u>
Oscilloscope	Tektronix 547 or equivalent
X1 Probes (3)	Tektronix P6061 or equivalent
Screwdriver, 1/4" blade	N/A

Table 5-6. Removable Disc Sector/Index Alignment

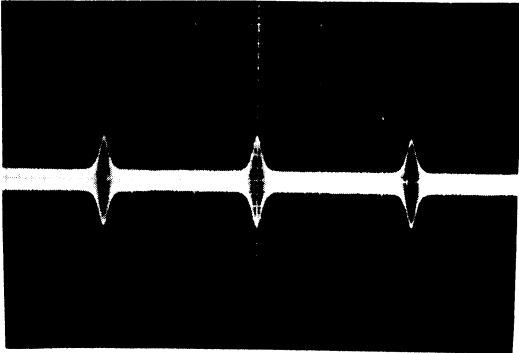
PROCEDURE	REMARKS
1. Remove power and extend drive	a. Set CARTRIDGE switch to UNLOCK. b. When UNLOCK light comes on, set POWER switch OFF.
2. Connect oscilloscope to test points on A-gate. 2a. Install test module; set all switches OFF.	a. Channel 1 - A08-M b. Channel 2 - A08-L c. Sync Probe - A08-17
3. Power up drive	a. Set POWER switch to ON. b. Install alignment cartridge. c. Set CARTRIDGE switch to LOCK. The disc starts spinning and the heads load in approximately 90 seconds.
4. Adjust the oscilloscope for a convenient differential display. (See figure in step 4.)	a. Time Base - 2 mSEC/CM b. Channel 1 & 2 - 0.05V/CM c. Mode - ADD d. Sync - External (+) e. Channel 2 - Inverted
5. Adjust R32 on the A08 card for a peak-to-peak amplitude of 75±1.0 millivolt on the lowest amplitude signal.	
6. Move oscilloscope Channel 1 and 2 probes to read signal test points.	a. Channel 1 - A04-7 b. Channel 2 - A04-H

Table 5-6. Removable Disc Sector/Index Alignment (continued)

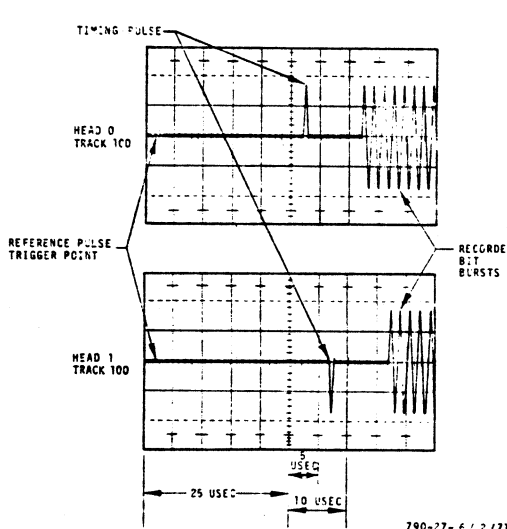
PROCEDURE	REMARKS
7. Set Test Module MAINT switch ON.	This enables the test module to control the drive's functions.
8. Position heads to track 100.	a. Set test module SELECT CYLINDER switch ON. b. Set ADDRESS BUS switches to 100 (64,32, & 4 ON). c. Press RESET, then INITIATE pushbuttons.
9. Select Head 0.	a. Set test module SELECT CYLINDER switch OFF. b. Set all ADDRESS BUS switches OFF. c. Set SELECT HD/SECT switch ON. d. Press RESET, then INITIATE pushbuttons.
10. Adjust the oscilloscope for a convenient display.	a. Channel 1 - 0.5V/CM b. Channel 2 - 0.5V/CM c. Time Base - 5USEC/CM
11. Observe the time delay from the leading edge of the Index Pulse (Sync point) to the synchronizing timing pulse peaks. The delay must be 30 ± 5 microseconds from the start of the sweep. <p style="text-align: center;"><u>NOTE</u></p> If time delays are correct, go to step 14. (IGNORE Polarity of the timing pulse.)	 <p>The diagram shows two oscilloscope-like traces. The top trace is labeled 'HEAD 0 TRACK 100' and the bottom trace is 'HEAD 1 TRACK 100'. A 'TIMING PULSE' is shown at the top, and a 'REFERENCE PULSE TRIGGER POINT' is indicated. 'RECORDED BIT BURSTS' are shown as vertical lines on the right. Time scale markers at the bottom indicate 25 USEC and 10 USEC intervals.</p> <p style="text-align: right;">790-27-6 / 2 / 71</p>

Table 5-6. Removable Disc Sector/Index Alignment (continued)

PROCEDURE	REMARKS
<p>12. Adjust time delay by altering the sector transducer's position through a front panel cutout just below the receiver handle. The correct adjustment is shown in step 11.</p>	<p>a. Loosen two locking screws while keeping tension between the transducer and the mounting plate.</p> <p>b. Turn the center transducer adjusting screw to increase or to decrease the delay as required.</p> <div data-bbox="873 730 1382 1020"> <p>The diagram shows a dark rectangular area representing a front panel cutout. Two screws are indicated by lines pointing to the top edge of the cutout, with the word 'Screws' written to the left. To the right of the cutout, there is a small rectangular area containing three vertical bars, representing the transducer assembly.</p> </div>
<p>13. Tighten two locking screws.</p>	<p style="text-align: center;"><u>CAUTION</u></p> <p>While tightening the screws, observe display to ensure the transducer positioning does not change. If it does, repeat step 12.</p>
<p>14. Power down the drive.</p>	<p>a. Set CARTRIDGE switch to UNLOCK.</p> <p>b. Remove alignment cartridge.</p> <p>c. Set POWER switch to OFF.</p>
<p>15. Remove test module and resume normal operation.</p>	<p>a. Remove test module.</p> <p>b. Close drive cabinet.</p> <p>c. Power up drive, install user cartridge, then resume normal operation.</p>

5.4.3 DISC HEAD-ARM ASSEMBLY ALIGNMENT. Table 5-7 outlines the removable disc head alignment procedures. This alignment should be accomplished whenever the Servo Sensor Block or Shutter assembly is replaced, or when a removable disc head is replaced.

Test equipment and tool requirements:

<u>NAME</u>	<u>IOMEC P/N</u>
Screwdriver, 1/8" Blade	N/A
Wrench, Head-Clamping	7-9931
Test Module	7-1483
Alignment Cartridge	7-0900
Oscilloscope	Tektronix 547 or equivalent
X1 Probes (3)	Tektronix P6011 or equivalent
Lok-Tite 1/2 Oz.	N/A

Table 5-7 . Removable Disc Head Alignment

PROCEDURE	REMARKS
1. Remove power and extend drive.	1. Set CARTRIDGE switch to UNLOCK. 2. When UNLOCK light comes ON, set POWER switch to OFF
2. Using the head-clamping wrench loosen upper disc's head clamping screws.	See Figure 6-2. Do not loosen screws too much, leave them snug tight.
3. Back off both head-adjusting screws until tips are in line with the head-arm stiffeners as shown.	See Figure 6-2.

Table 5-7. Removable Disc Head Alignment (continued)

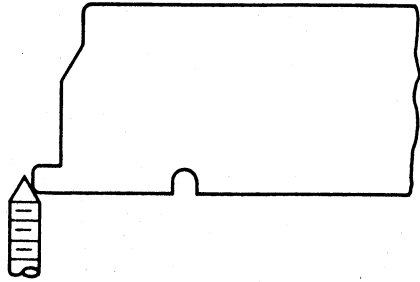
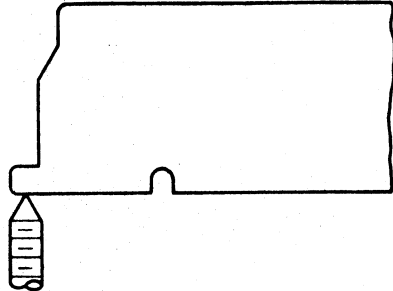
PROCEDURE	REMARKS
<p>4. Gently push head-arm assemblies back toward voice coil until adjusting screw tips make with the corners of the nibs as shown.</p>	
<p><u>CAUTION</u></p> <p>If the head-arm assemblies are pushed back too far, the screw tips may bear against the stiffener edges as shown. In this condition, tightening the screws may unseat or otherwise damage the stiffeners</p>	
<p>5. Tighten head-clamping screws enough to prevent head-arm assemblies from shifting position when the disc is powered up.</p>	<p>Do not over-tighten screws; they must be loose enough to allow the adjusting screws to move the head-arm assemblies.</p>
<p>6. Install test module in A-Gate card slots 16 and 17.</p>	<p>Set all switches OFF</p>
<p>7. Power-up drive and install alignment cartridge.</p>	<ol style="list-style-type: none"> 1. Set POWER switch ON. 2. Install alignment cartridge. 3. Set CARTRIDGE switch to LOCK. 4. Wait approximately 90 seconds for the heads to load.
<p>8. Set test module MAINT switch ON.</p>	<p>This enables the test module to control head positioning to the alignment track.</p>
<p><u>CAUTION</u></p> <p>Do not perform any alignment until the disc has been spinning for at least one hour.</p>	<p>This allows for thermal expansion before aligning heads.</p>

Table 5-7. Removable Disc Head Alignment (continued)

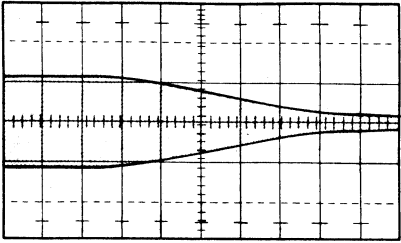
PROCEDURE	REMARKS
<p>9. Connect oscilloscope probes as follows:</p> <p>Channel 1 - A04-7 Channel 2 - A04-H Sync - A08-17</p>	<p>Oscilloscope Settings:</p> <p>Vertical - 0.1V/CM Time Base - 2mS/CM Sync - EXT (-) Mode - ADD (Invert one channel)</p>
<p>10. Adjust oscilloscope for a convenient display</p>	
<p>11. Position heads to Cylinder 105. Select head 0.</p>	<ol style="list-style-type: none"> 1. Set test module SELECT CYLINDER switch ON. 2. Set CYLINDER ADDRESS switches 64, 32, 8, and 1 ON. 3. Press test module RESET pushbutton. 4. Press test module INITIATE pushbutton. <p>The servo system drives the heads to Cylinder 105.</p>
<p>12. Loosen Head 0 clamping screw enough so that the head can be moved with the adjusting screw.</p>	
<p>NOTE</p> <p>In the following steps, if the heads are moved past the alignment position, it will be necessary to move the adjusting screw out, then repeat step 4.</p>	<p>The alignment point is always approached from the outward side of the disc towards the inward side.</p>
<p>13. Adjust the adjusting screw for for an oscilloscope display as shown.</p>	

Table 5-7. Removable Disc Head Alignment (continued)

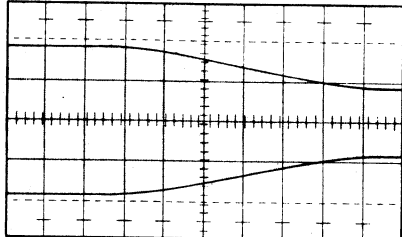
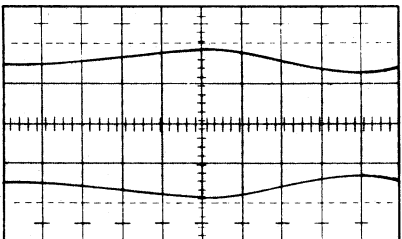
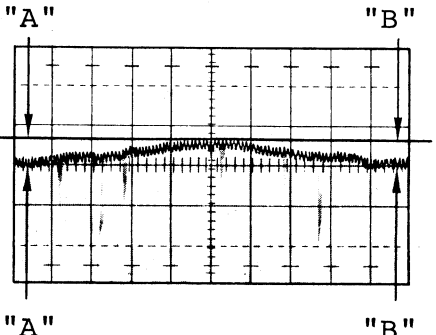
PROCEDURE	REMARKS
<p>14. Continue adjusting the screw CW until the oscilloscope display resembles this figure.</p>	
<p>15. Continue adjusting the screw CW until the oscilloscope presentation resembles this figure.</p>	
<p>16. Increase oscilloscope Vertical sensitivity to 50mV/CM.</p> <p>a. Adjust vertical positioning so the upper edge of the envelope is centered as shown in the figure.</p> <p>b. Make final adjustment on the screw by making "A" value to within 10 millivolts the value of "B".</p>	
<p>17. Using head-clamping wrench, tighten head clamping screw while observing the oscilloscope waveform. If the waveform in step 16 drops off, repeat steps 12 through 16.</p>	<p>Ensure tightening does not affect head positioning (indicated by a drop-off of the waveform shown in step 16).</p>
<p>18. Back off head adjusting screw 1/2 turn.</p>	<p>Head position is held by clamp and clamping screw.</p>
<p>19. Select Head 1.</p>	<ol style="list-style-type: none"> 1. Set test module HEAD ADDRESS switch 1 ON. 2. Press RESET. 3. Press INITIATE.

Table 5-7. Removable Disc Head Alignment (continued)

PROCEDURE	REMARKS
20. Reset oscilloscope to the settings outlined in step 9.	Head 1 is aligned next in this procedure.
21. Using the <u>Head 1</u> clamping and adjusting screws, align Head 1 using the procedures outlined in steps 12 through 18.	Head 1 is the head facing the under surface of the upper disc.
22. To insure correct alignment, return the carriage to Cylinder 0.	<ol style="list-style-type: none"> 1. Select Hd/Sect OFF 2. Select Cylinder ON 3. Set Address Bus to 000. 4. Press Initiate. The carriage should go to Cylinder 0.
23. Repeat steps 11, 16, and 19.	This insures that the carriage was not forced off track during head alignment.
24. Power down the drive and remove alignment cartridge.	

5.4.5 REMOVAL AND REPLACEMENT PROCEDURES

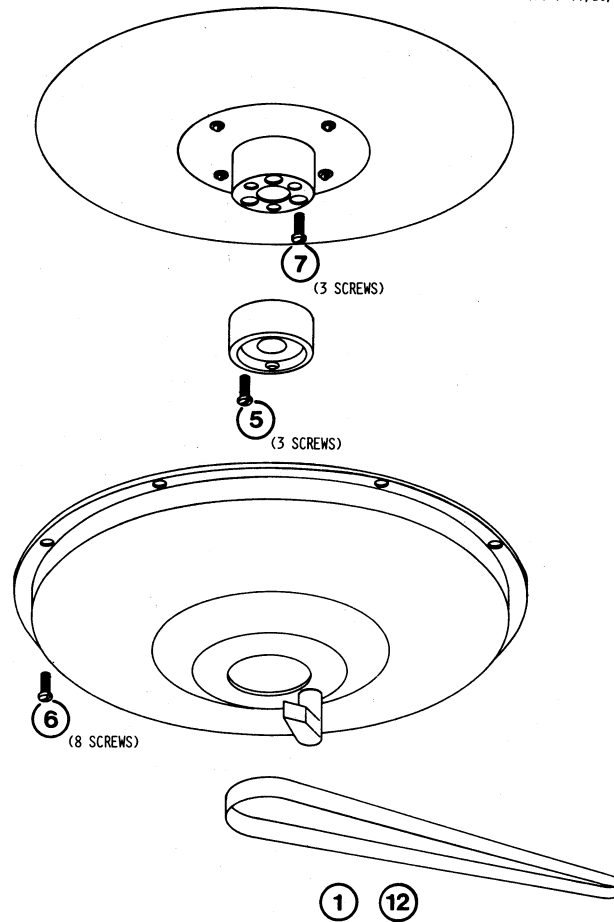
5.4.5.1 Lower Disc Replacement Procedure. Use the following procedure when replacing the non-removable disc.

CAUTION

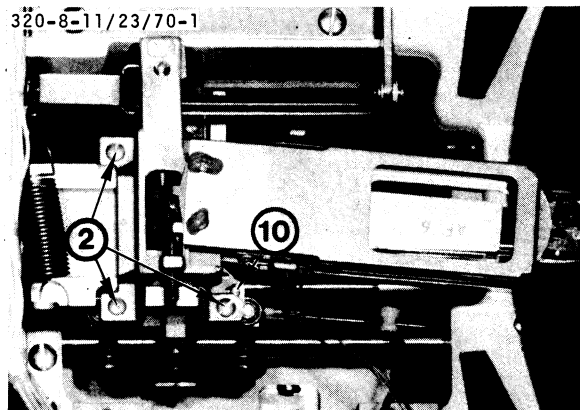
Prior to replacing the disc, correct the malfunction that caused the disc to be replaced. The usual cause is a buildup of contaminants on the head sliders that causes a head crash.

320-7-11/20/70

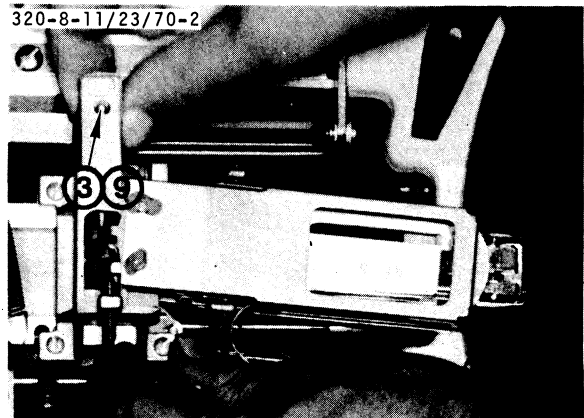
1. Remove drive belt.



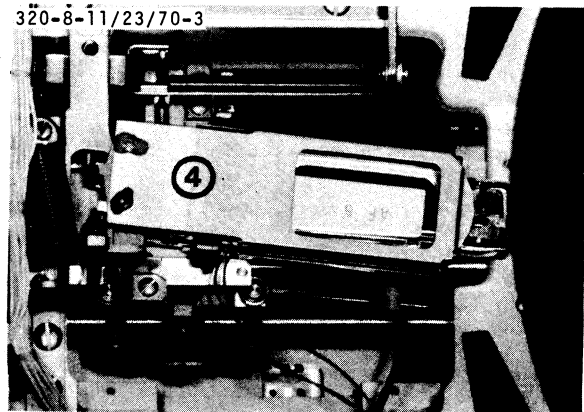
2. Loosen 3 screws holding the lower head assembly to the carriage.



3. Push up on spring-loaded head load pin.



4. Slide lower head assembly back until heads are clear of disc.
5. Remove 3 screws holding pulley to disc flange.
6. Remove disc cover (8 screws).
7. Remove lower disc (3 screws).



CAUTION

When installing new disc, do not touch coated surface with fingers.

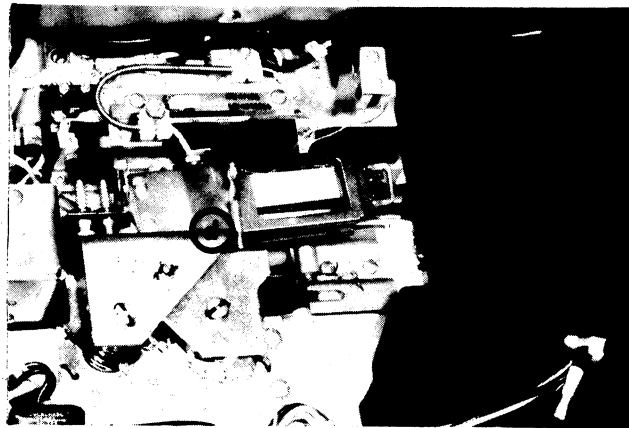
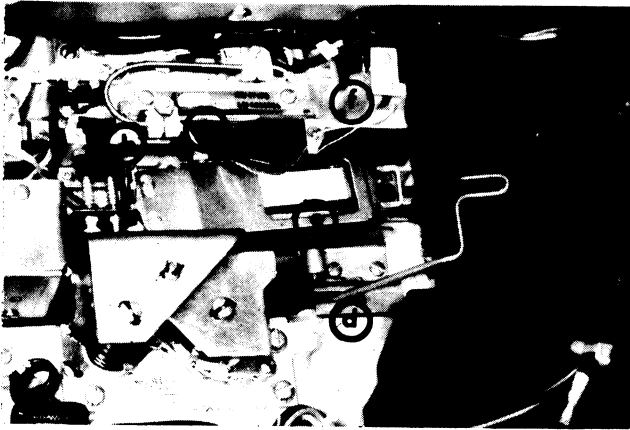
8. Install disc, cover, and pulley in reverse disassembly order (steps 7, 6, and 5).
9. Move lower head assembly forward and reinsert head load pin in head load cam assembly.
10. Ensure alignment pin is in the groove on the lower head assembly.
11. Tighten 3 screws loosened in step 2.
12. Install drive belt.

5.4.5.2 Head-Arm Assembly Removal and Replacement. The head-arm assemblies are removed and replaced using the following procedures.

Test equipment and tool requirements:

<u>NAME</u>	<u>IOMEK P/N</u>
Head Clamping Wrench	7-9931
Head Adjusting Tool	7-9984

1. Removable Disc Head Arm Removal
 - a. Remove disc cartridge.
 - b. Remove power and extend drive.
 - c. Remove air filter chamber (2 screws).
 - d. Slide torsion spring from the door opening wire and position the wire back towards the heads.



- e. If upper head is being replaced, place the shipping spacer between the upper and lower heads. This will prevent the upper head from falling onto the face of the lower when it is loosened in the following steps.
- f. Loosen outer screw on head-connector socket and remove cable socket.
- g. Spread open teflon wire guide and slide head wire out.
- h. Back-off head adjusting screw 2 turns CCW (see figure 6-2).
- i. Loosen the applicable head clamping screw.

CAUTION

When handling the head arm assemblies, grasp the stiffener only (figure), and avoid rough handling of the assemblies. Do not allow the heads to come in contact with other heads or drive assembly components.

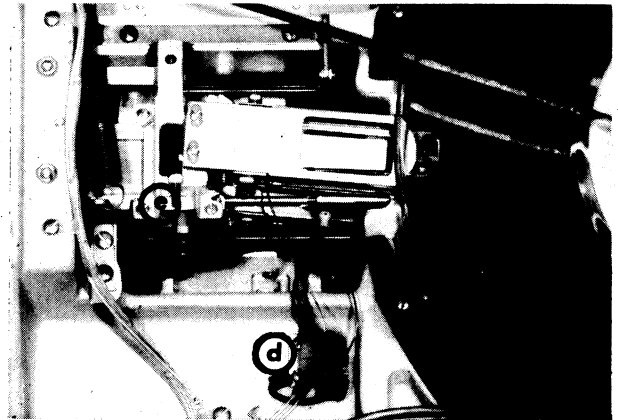
- j. Grasp head arm stiffener and gently slide the assembly forward towards the spindle until it can be lifted out.

2. Removable Disc Head Arm Installation

- a. Install head arm assembly by following the reverse of the Removal procedure.
- b. Load alignment cartridge into receiver and align the head as described in paragraph 5.4.3.

3. Non-Removable Disc Head Arm Removal

- a. Remove power and extend drive.
- b. Remove drive's bottom cover (10 screws).
- c. Perform steps 1 through 6 of paragraph 5.4.5.1.
- d. Loosen outer screw on head-connector socket and remove cable socket.
- e. Back-off head adjusting screw 2 turns CCW.
- f. Loosen the applicable head clamping screw.
- h. Grasp head arm stiffener and gently slide the assembly forward towards the spindle. Do not allow the head to touch the exposed lower disc.



4. Non-Removable Disc Head Arm Installation

Install head arm assembly by following the reverse of the c through h steps in the Removal procedures.

5.4.5.3 Air Filter Removal and Replacement. The air filter system removes contaminants from the air before it is blown over the discs and through the electronics gate. The system contains two filters; a prefilter and an absolute filter. The prefilter removes large particles from the air, such as dust, cigarette ashes, etc; the absolute filter removes particles larger than 0.3 microns from the air after it has passed through the prefilter. Both filters must be replaced at the same time when the absolute filter is replaced; however, the coarse filter is replaced at six-month intervals, whereas the absolute filter is replaced annually.

1. Remove power and extend drive.
2. Remove air filter chamber assembly. Cover air duct with a lint-free cover.
3. Turn filter assembly upside-down.
4. Remove 7 screws holding lower chamber to upper chamber.
5. Remove absolute filter and discard.
6. Insert new absolute filter (IOMEC 7-0408) into the upper filter chamber.

NOTE

When properly installed, the arrow on the filter will point up, and the filter is centered on the upper chamber gasket.

7. Carefully position the lower chamber over the filter and align screw holes.
8. Replace the 7 screws and tighten evenly so the upper and lower chamber gaskets are compressed.
9. Replace prefilter as follows:
 - a. Slide prefilter holder out (from the drive's filter chamber assembly side).
 - b. Remove filter from holder; discard filter.
 - c. Install new prefilter (IOMEC 7-0403) in holder, and slide back into place.
10. Remove lint-free cover from air duct; reinstall air filter chamber assembly.
11. Close drive cabinet and resume normal operation.

SECTION 6

REPAIR PARTS DATA

This section illustrates and lists replaceable drive components and parts. If a repair part cannot be located on the drawings, it may be ordered from IOMEC by providing the following information:

- a. A description of the item
- b. The noun name.
- c. The drive's serial number

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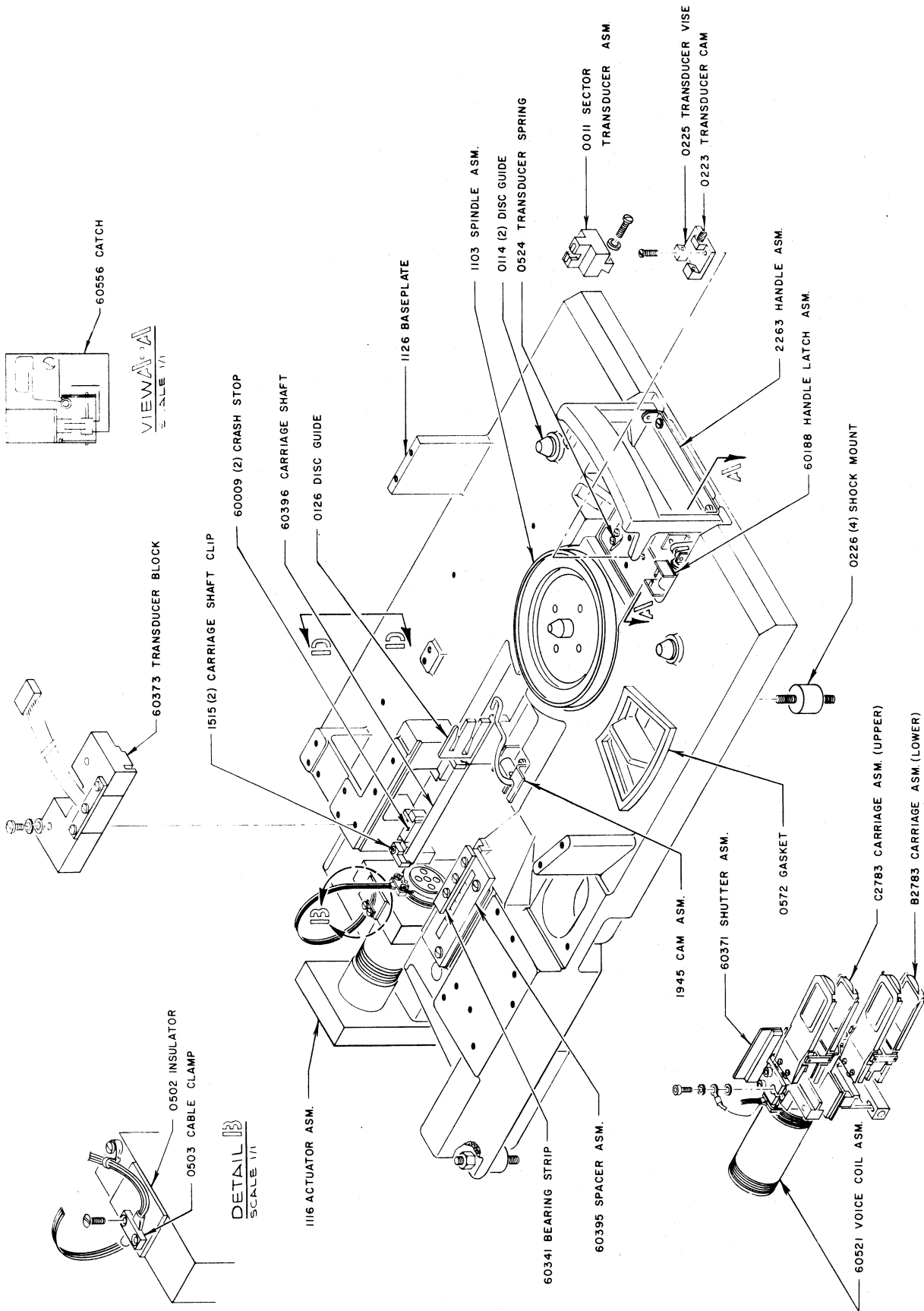


Figure 6-1. Drive Assembly (Sheet 1)

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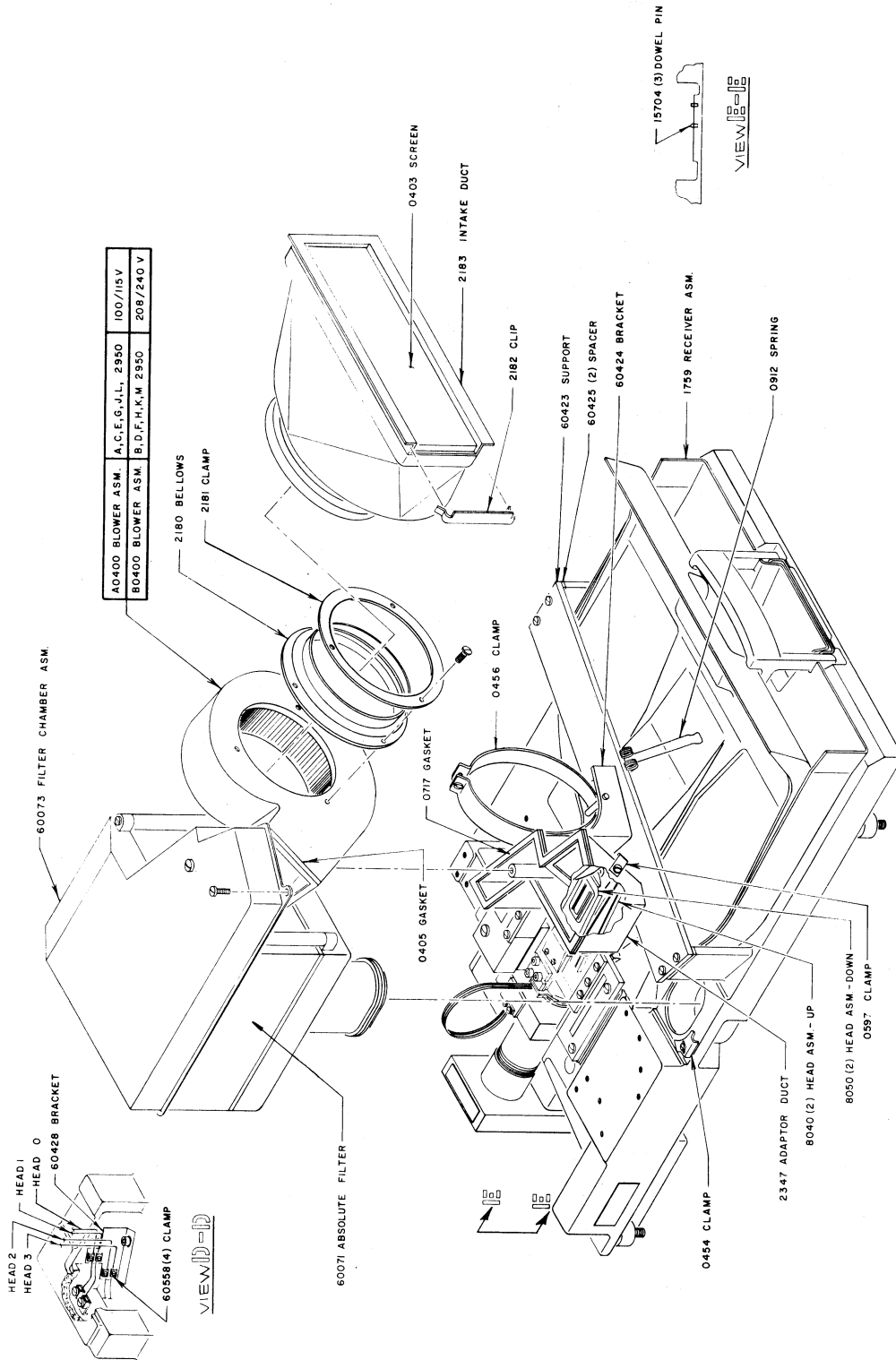


Figure 6-1. Drive Assembly (Sheet 2)

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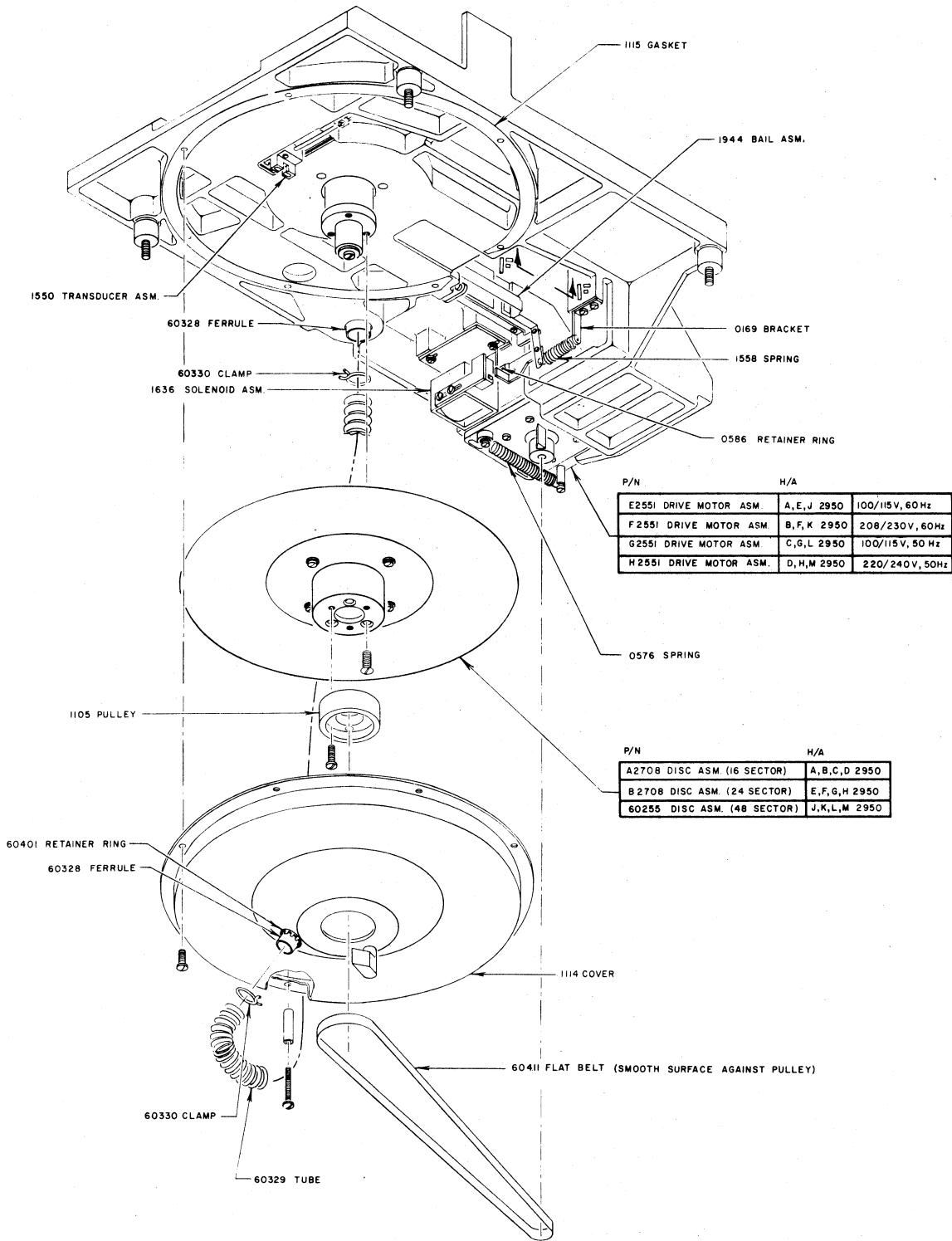


Figure 6-1. Drive Assembly (Sheet 3)

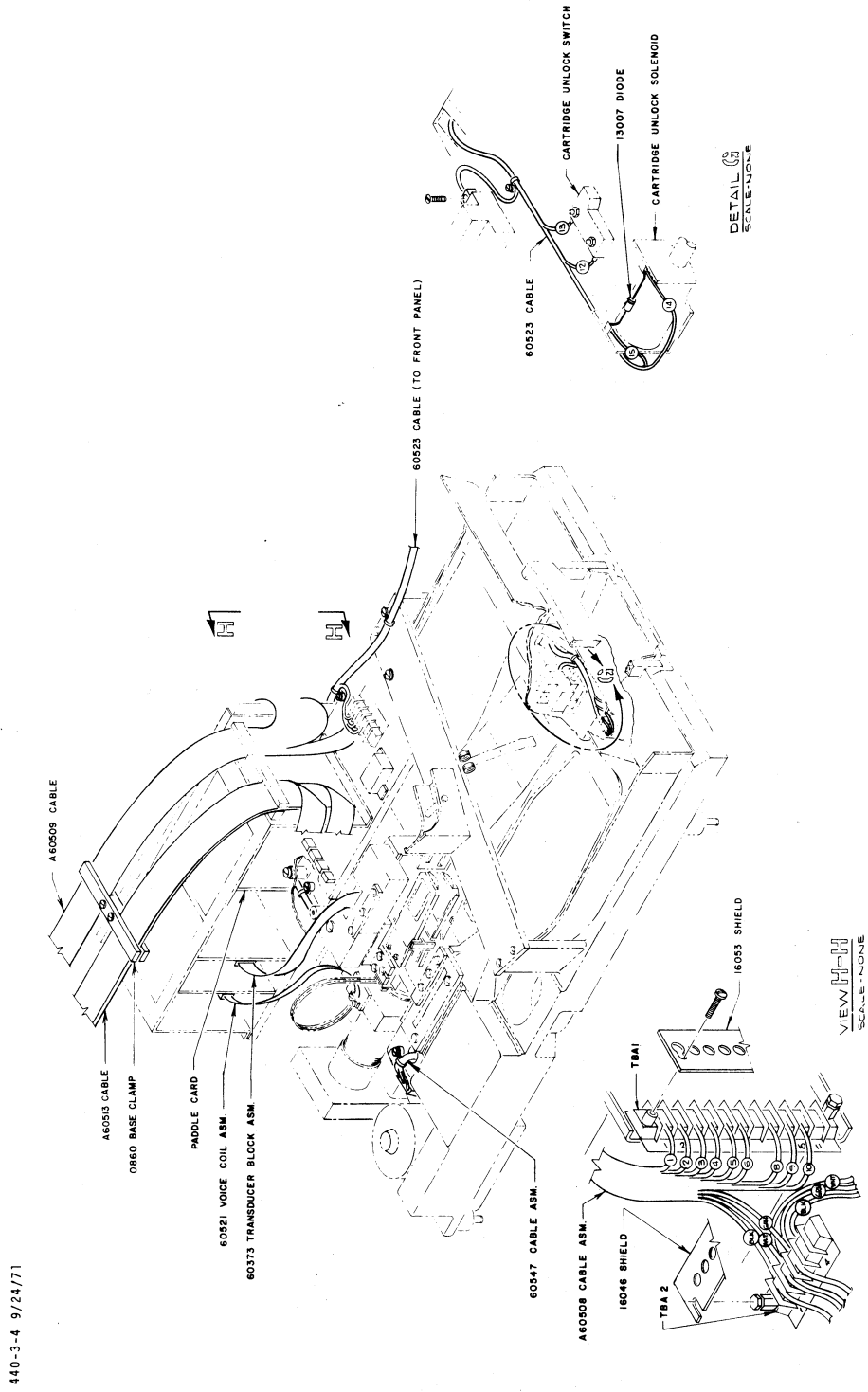


Figure 6-1. Drive Assembly (Sheet 4)

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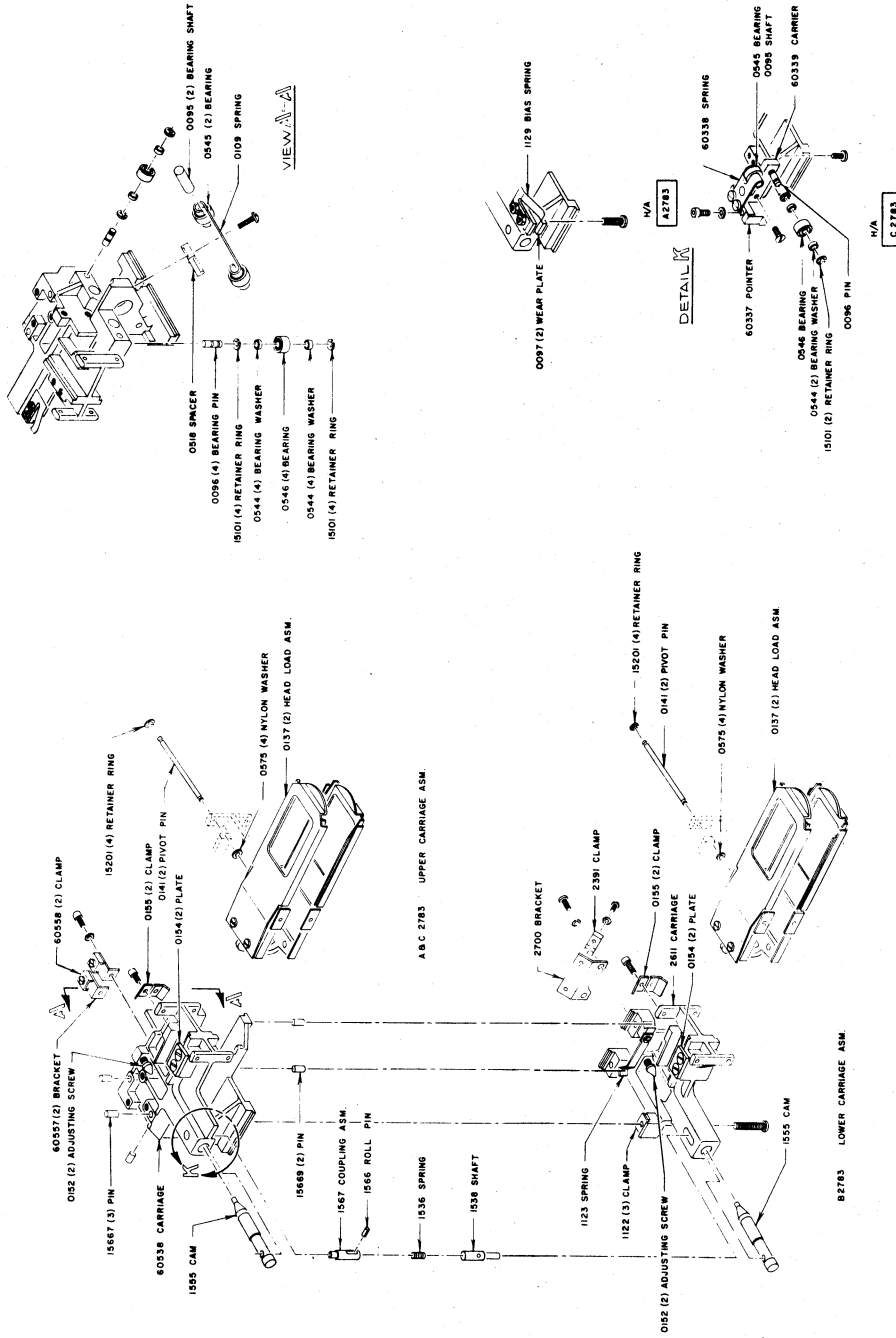
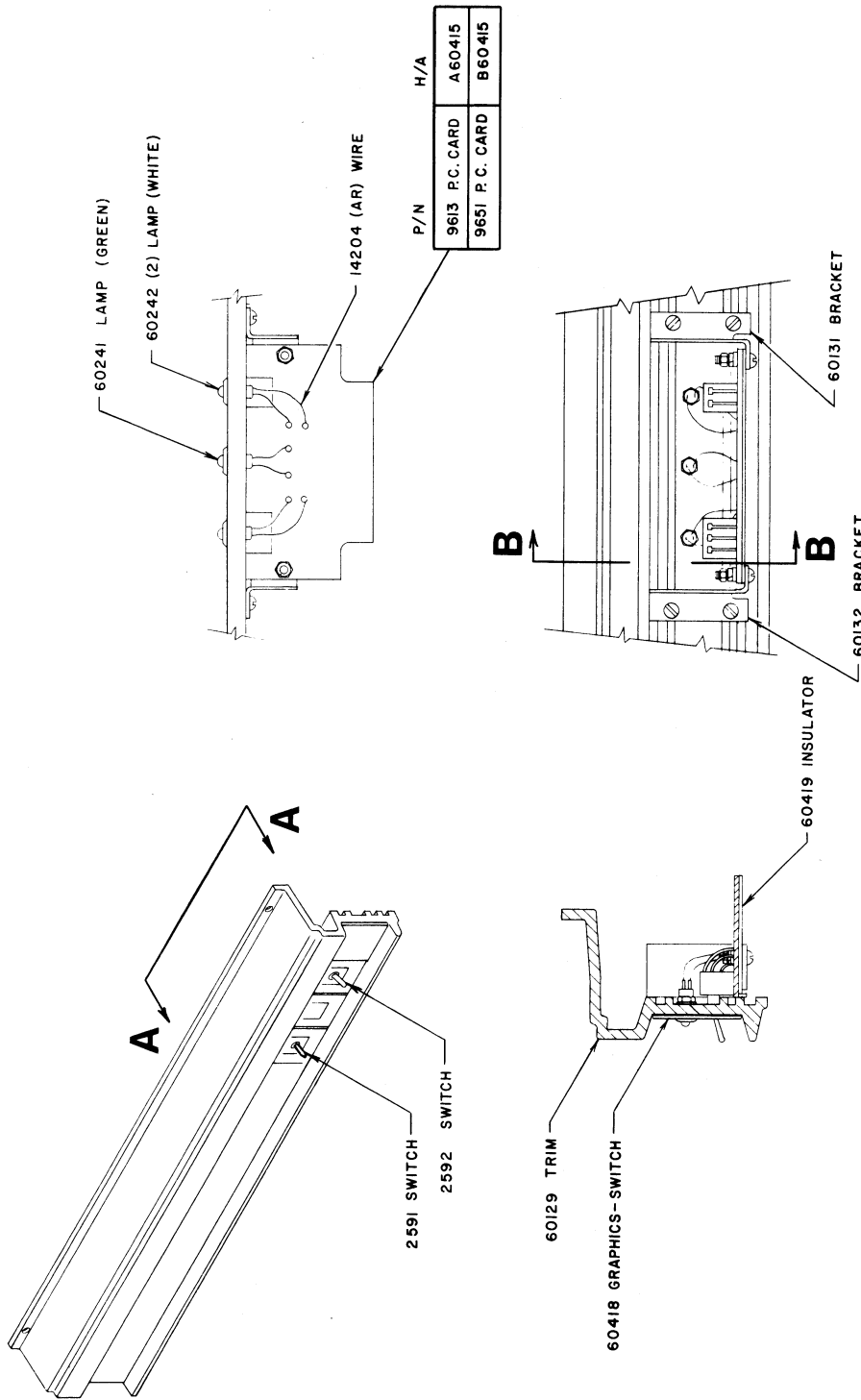


Figure 6-2. Carriage Assembly

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VIEW A-A

SECTION B-B

Figure 6-3. 2002 Drive Switch Assembly



APPENDIX A

DRIVE INTERFACE SIGNAL GLOSSARY

This appendix contains a glossary of interface signals between the OEM Controller and the 2002 Drive. Table A-1 lists those signals that are inputs to the drive; Table A-2 lists those signals that are outputs from the drive to the OEM Controller. Each table is arranged alphabetically by signal mnemonic or name.

NOTE

In Tables A-1 and A-2, a dash (-) in front of the signal mnemonic or name indicates negation; i.e., the signal is low when the action specified is occurring. Conversely, a plus (+) sign indicates a high level when the signal occurs.

Table A-1. Interface Signals To Drive

Mnemonic	Description
-ADDR BUS 0 - 7	Carries cylinder address data during a Set Cylinder operation. These lines are in a stable state 200 nanoseconds before and after the -SET CYLINDER pulse.
-DF WR DATA	Double-frequency encoded data to be written in the next bit cell to come under the read/write head. Each bit cell contains a 160 nanosecond clock pulse and 160 nanosecond data pulse if the data is a logical "1". Bit cell time is 640 nanoseconds.
-DR RESET	Resets status latches and flip-flops in the drive, to insure initialization at start-up time, or to allow restart procedures to be implemented.
-DRIVE SELECT	In single-drive configurations, this line is normally hard-wired to an active state (ground). For multiple drive installations, this line is activated for the selected drive to permit control and data transfers.
-ERASE GATE	Activates the tunnel erase drive. Remains active for at least 25.6 microseconds after the Write Gate drops to allow for physical locations of the write and erase head elements.
-READ GATE	Activates the drive's read amplifier and allows double-frequency data to be read from the disc.
-SEL FIXED DISC	Used in conjunction with the -SELECT HD 1 line when selecting read/write heads; i.e., selects fixed (non-removable) disc.
-SELECT HEAD 1	Used in conjunction with the -SEL FIXED DISC line when selecting read/write heads. Depending upon the state of the above line, when active it selects Heads 1 or 3.
-SET CYLINDER	A pulse on this line strobes data contained on the -ADDRESS BUS lines to be strobed into the Cylinder Address Register, and to start a cylinder access.
-WR GATE	Activates the drive's write amplifier and allows double-frequency data to be written on the disc.

C

C

C

Table A-2. Interface Signals From Drive

Mnemonic	Description
-ACCESS READY	A status line that indicates to the using system the head/arm assembly is not in motion.
-SEL READY	A status line that indicates to the using system that: (1) drive power is on, (2) heads have loaded, (3) the discs are rotating at 70% speed or greater, and 60 seconds have elapsed since the disc's spin motor has been activated.
-DRIVE UNSAFE	A status line that indicates to the using system that a failure has been detected in the write amplifier or head selection matrix. This line is reset by turning off the spin motor, allowing the discs to come to a full stop, then turning it back on.
-INDEX PULSE (F)	When gated by the -DRIVE SELECT line, provides 5 ± 1.0 microsecond pulses to the Controller every 40 milliseconds that indicate the fixed disc's index slot position relative to the read/write heads.
-INDEX PULSE (R)	Same as -INDEX PULSE (F) except the pulse is indicative of the removable disc's index slot position.
-READ DATA CLOCK	When the -READ GATE line is active, a 160 ± 13 nanosecond pulse appears on this line for each data bit read from the disc.
-RD ONLY VIOLATION (Optional)	When active, this line indicates a write operation has been attempted on a "read-only disc." Line resetting is the same as described for the -DRIVE UNSAFE line.
-SECTOR PULSE (F)	Pulses that are indicative of the Fixed Disc's sector slots position relative to the read/write heads. Each pulse is 5 ± 1.0 microseconds in duration; leading edge to leading edge of adjacent sector pulses are as follows: 16 Sector Disc - 2.5 ± 0.1 millisecond 24 Sector Disc - 1.67 ± 0.07 milliseconds 48 Sector Disc - 0.835 ± 0.035 milliseconds

Table A-2. Interface Signals From Drive (continued)

Mnemonic	Description
-SECTOR PULSE (R)	Same as -SECTOR PULSE (F) except the pulse is indicative of the removable disc's sector slot positions.
-SEL SEEK INCOMPLETE	A status line that indicates to the using system that 180 milliseconds have elapsed since a -SET CYLINDER pulse was issued, without the access becoming read (-ACCESS READY line going active).
-SERIAL READ DATA	Binary read data from the selected read/write heads.



APPENDIX B

DRIVE INTERFACE SIGNAL GLOSSARY

This appendix contains a glossary of interface signals between the IOMEC 2800 Series Controller and the 2000 Series Standard Drive. Table B-1 lists those signals that are inputs to the drive; Table B-2 lists those signals that are outputs from the drive to the Controller. Each table is arranged alphabetically by signal mnemonic or name.

NOTE

In Tables B-1 and B-2, a dash (-) in front of the signal mnemonic or name indicates negation; i.e., the signal is low when the action specified is occurring. Conversely, a plus (+) sign indicates a high level when the signal occurs.

Table B-1. Interface Signals To Drive

Mnemonic	Description
-DATA SEL	A unique address line for each drive in a memory system. Selects a drive for a data handling operation.
-DF WR DATA	Serial write data to be recorded on the disc.
-DRIVE ATTN CTRL	Used in conjunction with the Control Select and -Set Attention lines to enable the drive's attention logic.
-DRIVE RESET	A level input as a general reset to the drive.
-ERASE GATE	Used in conjunction with the Write Gate to perform tunnel erase during a write operation.
+CONTROL SEL	Enables File Functional Control data to be strobed into the drive's logic circuits. Used in conjunction with -SET CYLINDER and -SET HD/SCTR.
-MAINT SWITCH ON	Activated when the test module is inserted in the A gate and the MAINT switch is ON.
-OUTBUS 0 - 7	Carries cylinder address data during a Set Cylinder operation; or carries head/sector data during a Set Head/Sector operation.
-READ GATE	Enables the data to be read from the disc during a Read operation. Used in conjunction with the Data Select line.
-SET ATTENTION	Used in conjunction with the Drive Attention Control and Drive Select to set the Attention logic.
-SET CYLINDER	Used in conjunction with the Control Select line to strobe the contents of the Outbus 0 - 7 into the Cylinder Address Register, and to start an access.
-SET HD/SCTR	Used in conjunction with the Control Select line to load the contents of the Outbus into the Head and Sector Registers.
-WRITE GATE	Used in conjunction with the Erase Gate and Data Select lines to perform a write operation.

Table B-2. Interface Signals From Drive

Mnemonic	Description
-ATTN DRIVE 0 - 3	A unique line for each drive in a multi-drive system that, when active, indicates the drive has completed an ordered operation.
-RAW DATA	Double-Frequency read data from the disc that is input to the controller.
-READ ONLY VIOLATION	(Optional). If the option is installed, this line will be active if an attempt is made to write on the disc.
-SEL ATTN	This signal is input to the controller as a status bit when drive has generated an Attention.
-SEL BUSY	This line is active when the drive is performing an operation as ordered by the controller.
-SEL INDEX SELECTED	Index pulse from the disc selected.
-SEL FIRST SEEK	This status line is activated when the heads have been loaded and have been driven from home position to track 000.
-SEL READY	When active, this line indicates the selected drive is in a Ready status.
-SEL SECTOR BITS 1 - 16	Not used in the Standard 2012 Drive.
-SEL SECTOR PULSE	Sector pulses from the selected disc.
-SEL SEEK CHECK	Not used.
-SEL SEEK INCOMPLETE	Line is active when the servo system has not completed an access within 180 milliseconds after the Set Cylinder command has been issued by the controller.
-SEL UNSAFE	This line is activated when an unsafe condition has been detected by the servo or read/write safety circuits.
-SEL SCTR COMPARE	This line is activated one sector prior to the sector on which the data handling operation is to be performed.

