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**TITLE. IBM SYSTEM/36 10SR DISK DRIVE AND
ADAPTER MAINTENANCE INFORMATION MANUAL**

NOTE. ALL ITEMS FOLLOWING THE LAST ROW OF ASTERISKS ARE TO BE SHIPPED.

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842350	SY31-9005-2	RELEASE 4, FIRST CUSTOMER SHIP



**IBM System/36
10SR Disk Drive and Adapter
Maintenance Information Manual**

Order Number
SY31-9005-2

Preface

This manual contains the maintenance information necessary to service the System/36 10SR disk drive and adapter. This manual includes maintenance procedures, FRU descriptions, interface descriptions, and sequence of events sections to aid in diagnosing machine failures not found by the MAPs.

This manual uses a specific range of words so that the text can be understood by customer engineers in countries where English is not the normal language.

It is assumed that the hardware service representative using this manual has been trained on System/36 as described in the System/36-5360 *New Product Planning Technical Service Letter*.

About This Manual

The service procedures in this manual are numbered.

- The MAPs can send you to a specific procedure in this manual.
- Other System/36 MIMs can send you to a specific procedure in this manual.
- Steps in a procedure in this manual can send you to another procedure in this manual or in other System/36 MIMs.
- The index can send you to procedures where key words can be found.

Related Publications

System/36 Hardware Publications

- *General Maintenance Information Manual, SY31-8999*
- *Data Storage Attachment Maintenance Information Manual, SY31-9001*

Third Edition (January 1986)

This major revision makes obsolete SY31-9005-1. Changes or additions were made to support the Model 2 disk drive.

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IBM has prepared this maintenance manual for use by hardware service representatives in the maintenance or repair of the specific machines indicated. IBM makes no representations that it is suitable for any other purpose.

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Safety

Danger and Caution Notices

In the System/36 maintenance manuals, the word *DANGER* informs you of conditions that could cause personal injury or death. (The word *HAZARDOUS* or *WARNING* may appear on labels on machines and field-supply items.) The word *CAUTION* informs you of an action that could cause damage to a program, to a device or system, or to data.

There are blank lines below each notice. You can translate these notices and write your own words on the blank lines.

Danger Notices

A danger notice appears on page V of this Safety section, under *Electrical Accidents—First Aid*.

Danger notices also appear in the following procedures:

97-305 Opening the 10SR Frame

97-310 Drive Belt Removal

97-320 Drive Motor Removal

Caution Notices

Caution notices appear in the following procedures:

97-330 Head/Disk Assembly Removal

97-332 Head/Disk Assembly Replacement

97-346 Carriage Latch Magnet Adjustment

97-370 Filter Assembly Removal

97-372 Filter Assembly Replacement

97-400 Upper Shock Mount Removal

97-404 Lower Shock Mount Removal

Rules for Safety

If you know the safety rules for working with electrical and mechanical equipment and you observe the rules, you can work safely with IBM equipment.

Do not fear electricity, but respect it.

While you are maintaining IBM equipment, observe every safety precaution possible and the following safety rules.

Work Environment

- Do not work alone in hazardous conditions or near equipment that has dangerous voltage. Always inform your manager if the conditions or voltages are a possible problem.
- Always look for possible hazards in your work environment. Examples of hazards are: moist floors, nongrounded extension cables, power surges, and missing grounds.
- Do not perform any action that makes the product unsafe or that causes hazards for customer personnel.
- Before you start the equipment, ensure that other CEs, and customer personnel, are not in a hazardous position.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that the sleeves of your clothing are fastened or are rolled above the elbow.
- Insert your necktie into your clothing or fasten it with a clip (preferably nonconductive) at approximately 8 centimeters (3 inches) from its end.
- Lift the equipment or parts by standing or pushing up with your stronger leg muscles; this action removes the strain from the muscles in your back. Do not lift any equipment or parts that are too heavy for you.
- Put removed machine covers in a safe place while you are servicing the machine. Reinstall the covers before returning the machine to the customer.

- Always keep your CE tool kit away from walk areas so that other persons cannot trip over it. For example, keep the kit under a desk or table.
- Observe good housekeeping practices in the area of the machines while you are performing maintenance and after completing it.
- After maintenance, reinstall all safety devices, such as guards, shields, labels, and grounding devices. Exchange safety devices that are worn or defective. Remember, the safety devices protect you from a hazard. You destroy their purpose if you do not reinstall them when you have completed the service call.

Electrical Safety

- If possible, always disconnect the power-supply cables before you work on a machine. When you switch off power at the wall box, lock the switch in the off position or attach a DO NOT OPERATE tag (Z229-0237) to the switch.

Note: A non-IBM attachment to an IBM machine may be powered from another source and may be controlled by a different switch or circuit breaker.
- Switch off all power before:
 - Removing or assembling the main units of the equipment
 - Working near power supplies
 - Inspecting power supplies
 - Installing changes in machine circuits
- If you really need to work on equipment that has exposed live electrical circuits, observe the following precautions:
 - Ensure that another person who understands the power off controls, is near you. Another person must be there to switch off the power, if necessary.
 - Do not wear jewelry, chains, metal-frame eyeglasses, or other personal metal objects. Remember, if the metal touches the machine, the flow of current increases because the metal is a conductor.

- Use only insulated probe tips or extenders. Remember, worn or cracked insulation is unsafe.
- Use only one hand while you are working on live equipment. Keep the other hand in your pocket or behind your back. Remember, there must be a complete circuit for an electrical shock to occur. This precaution prevents your body from completing the circuit.
- When you use a tester, set its controls correctly and use insulated probes that have the correct electrical specification.
- Do not touch objects that are grounded, such as metal floor strips, machine frames, or other conductors. Use suitable rubber mats obtained locally, if necessary.
- When you are working with machines having voltages more than 30 Vac or 42 Vdc, observe the special safety instructions given in customer engineering memorandums (CEMs).
- Never assume that power has been removed from a circuit. First, ensure that power has been removed.
- Do not touch live circuits with the surface of a plastic dental mirror. Remember, the surface of the dental mirror is conductive and can cause damage or personal injury.
- If an electrical accident occurs:
 - Use caution. Do not be a victim yourself.
 - Switch off the power.
 - Instruct another person to get medical aid.
 - If the victim is not breathing, perform mouth-to-mouth rescue breathing. See *Electrical Accidents—First Aid*.

Mechanical Safety

Do not touch moving mechanical parts when you are lubricating a part, checking for play, or doing other similar work.

Safety Glasses

Wear safety glasses when:

- Using a hammer to drive pins or other similar parts
- Using a power drill
- Using a spring hook to attach or remove a spring
- Soldering parts
- Cutting wire or removing steel bands
- Using solvents, chemicals, or cleaners to clean parts
- Working in any other conditions that could injure your eyes

Tools, Testers, and Field-Use Materials

- Do not use tools or testers that have not been approved by IBM. Ensure that electrical hand tools, such as Wire-Wrap¹ tools and power drills, are inspected regularly.
- Exchange worn or broken tools or testers.
- Do not use solvents, cleaners, or lubricants that have not been approved by IBM.

¹Trademark of the Gardner-Denver Co.

Summary

Prevention is the main aid to electrical safety. Always think about electrical safety and use good practice; for example:

- Ensure that the customer's power receptacle matches the IBM equipment specifications.
- Inspect power cables and plugs; check for loose, damaged, or worn parts.
- Review the procedures in the maintenance documents before you remove a part that can hold an electrical charge from the machine. Carefully discharge the necessary parts exactly as instructed by the procedure.

Never assume that a machine or a circuit is safe. No machine is always completely safe. You may not know the exact condition of a machine because, for example:

- The power receptacles could be wrongly wired.
- Safety devices or features could be missing or defective.
- The maintenance or machine level change history could be wrong or not complete.
- The design could have a problem.
- The machine could have damage, caused when it was shipped.
- The machine could have an unsafe change or attachment.
- An engineering change or a sales change could be wrongly installed.
- The machine could be deteriorated because it is old, or because it operates in an extreme environment.
- A part could be defective, therefore causing a hazard.
- A part could be wrongly assembled.

These are some of the ways that the condition of the machine could affect safety. Before you start a service call or procedure, have good judgment and use caution.

Electrical Accidents—First Aid

When performing rescue procedures for an electrical accident, do as follows:

- **Use Caution:** If the victim is touching the electrical-current source, remove the power. To do this, you may need to operate the room emergency power-off switch or the disconnecting switch. If you cannot find the switch, use a dry wooden rod or other nonconductive object to pull or push the victim away so he or she is not touching the electrical-current source.
- **Work Quickly:** If the victim is unconscious, he or she may need mouth-to-mouth rescue breathing and possibly external cardiac compression if the heart is not beating.
- **Get Medical Aid:** Instruct another person to dial the rescue service (such as the ambulance or the hospital).

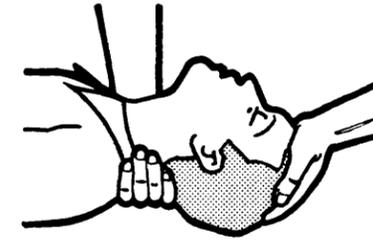
Determine if the victim needs mouth-to-mouth rescue breathing. If he or she does, perform the following steps:

DANGER

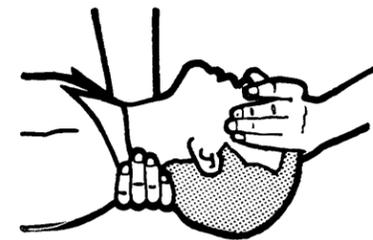
Use extreme care when you perform rescue breathing for a victim who may have breathed in toxic fumes. Do not breathe in air that the victim has breathed out.

1. Prepare for rescue breathing:
 - a. Ensure that the victim's airway is open and that it is not obstructed; check the mouth for objects that may be obstructing the airway, such as chewing gum, food, dentures, or the tongue.

- b. Place the victim on his or her back, put one hand behind the victim's neck, and put the other hand on his or her forehead.
- c. Lift the neck with one hand, and tilt the head backward by pressing on the forehead with the other hand.



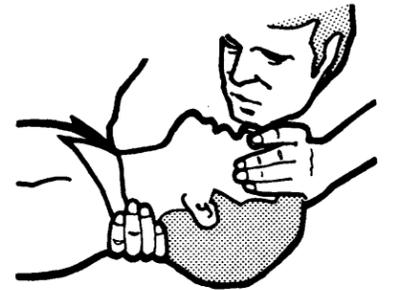
2. Look, listen, and feel to determine if the victim is breathing freely.
 - a. Put your cheek near the victim's mouth and nose.
 - b. Listen and feel for the breathing out of air. At the same time, look at the victim's chest and upper abdomen to see if they move up and down.
3. If the victim is not breathing correctly:
 - a. Keep the victim's head tilted backward. Continue to press on the forehead with your hand; at the same time, position the same hand so that you can pinch together the victim's nostrils with your thumb and finger.



- b. Open your mouth wide and take a deep breath. Make a tight seal with your mouth around the victim's and blow into the victim's mouth.



- c. Remove your mouth to let the victim breathe out, and check that the victim's chest moves down.



- d. Repeat steps b and c once every 5 seconds either until the victim breathes for himself or herself, or until medical aid comes.

Reporting Accidents

Report, to your field manager, all electrical accidents, possible electrical hazards, and accidents that nearly occurred. Remember, an accident that nearly occurs might be caused by a design problem; your immediate reporting ensures that the problem will be solved quickly.

Also report all small electrical shocks. Remember, a condition that causes a small shock need only differ slightly to cause serious injury.

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Contents

OVERVIEW

10SR Disk Drive and Adapter 97-110

LOCATIONS

Adapter Card 97-200
Adapter Top Card Connectors 97-205
Disk Drive 97-210
Disk Drive FRU 97-215
Drive Card Gate 97-220
Drive Card Gate Voltage Connector 97-225
Drive J-Connector 97-230
HDA Board and Data Channel Card 97-235
Identifying 10SR Models 97-240

MAINTENANCE PROCEDURES

REMOVALS, REPLACEMENTS, SERVICE CHECKS, AND ADJUSTMENTS

Preventive Maintenance 97-300
Opening the 10SR Frame 97-305
Drive Belt Removal 97-310
Drive Belt Replacement 97-312
Drive Belt Adjustment 97-314
Drive Motor Removal 97-320
Drive Motor Replacement 97-322
Head/Disk Assembly Removal 97-330
Head/Disk Assembly Replacement 97-332
Carriage Latch Magnet Removal 97-340
Carriage Latch Magnet Replacement 97-342
Carriage Latch Magnet Service Check 97-344
Carriage Latch Magnet Adjustment 97-346
VCM Magnet Removal 97-350
VCM Magnet Replacement 97-352
Antistatic Brush Removal 97-360
Antistatic Brush Replacement 97-362
Filter Assembly Removal 97-370
Filter Assembly Replacement 97-372
Brake Assembly Removal 97-380
Brake Assembly Replacement 97-382
Brake Assembly Service Check 1 97-384
Brake Assembly Service Check 2 97-385
Brake Assembly Adjustment 97-386
VCM Driver Assembly Removal 97-390
VCM Driver Assembly Replacement 97-392

Upper Shock Mount Removal 97-400
Upper Shock Mount Replacement 97-402
Lower Shock Mount Removal 97-404
Lower Shock Mount Replacement 97-406
Power Control Assembly Removal 97-410
Power Control Assembly Replacement 97-412
Drive Motor Pulley Service Check 97-420
Head Carriage Location Service Check 97-422
VCM Coil Connectors 97-430

DIAGNOSTIC INFORMATION

MDI Good Machine Path 97-450
IPL Good Machine Path 97-455
System Test 97-460
Pack Utility Maintenance Program 97-465
Disk Exerciser 97-470

HOW TO INTERPRET ERAP REPORTS

Error History Table 97-500
System Reference Code 97-502
Command Code and Command Modifier 97-504
Sense Byte Summary 97-506
Sense Bytes 97-508
Operation Flag 97-510
Present Sequential Sector Address 97-512
Starting Sequential Sector Address 97-514
Retry Count 97-516
Disk Status 97-518
Error Counter Table 97-520
I/O Counter Table 97-522

FRU DESCRIPTIONS

Data Flow 97-600
10SR Adapter Card 97-605
10SR Logic Assemblies 97-610
10SR Disk Drive Assemblies 97-615

INTERFACE DESCRIPTIONS

Interface Locations 97-700
Data Storage Attachment Interface Lines 97-705
10SR Interface Lines 97-710

SEQUENCE OF EVENTS

Servo Track Follow Operation 97-810
Control/Tag Bus Sequence for Access, Recalibrate, Head Select, and Head Offset Operations 97-820
Access Operation 97-822
Recalibrate Operation 97-824
Head Select Operation 97-826
Head Offset Operation 97-828
Read Operation 97-830
Write Operation 97-832
Control/Tag Bus Sequence for a Sense Operation 97-840
Sense Operation 97-842
Interrupts 97-850
ID Scan Operation 97-860
Power-On Operation 97-870
Power-Off Operation 97-872

REFERENCE

Run Length Limited Code 97-910
Disk Surface Arrangement 97-915
Head Arrangement 97-920
Sector Format 97-925

INDEX X-1

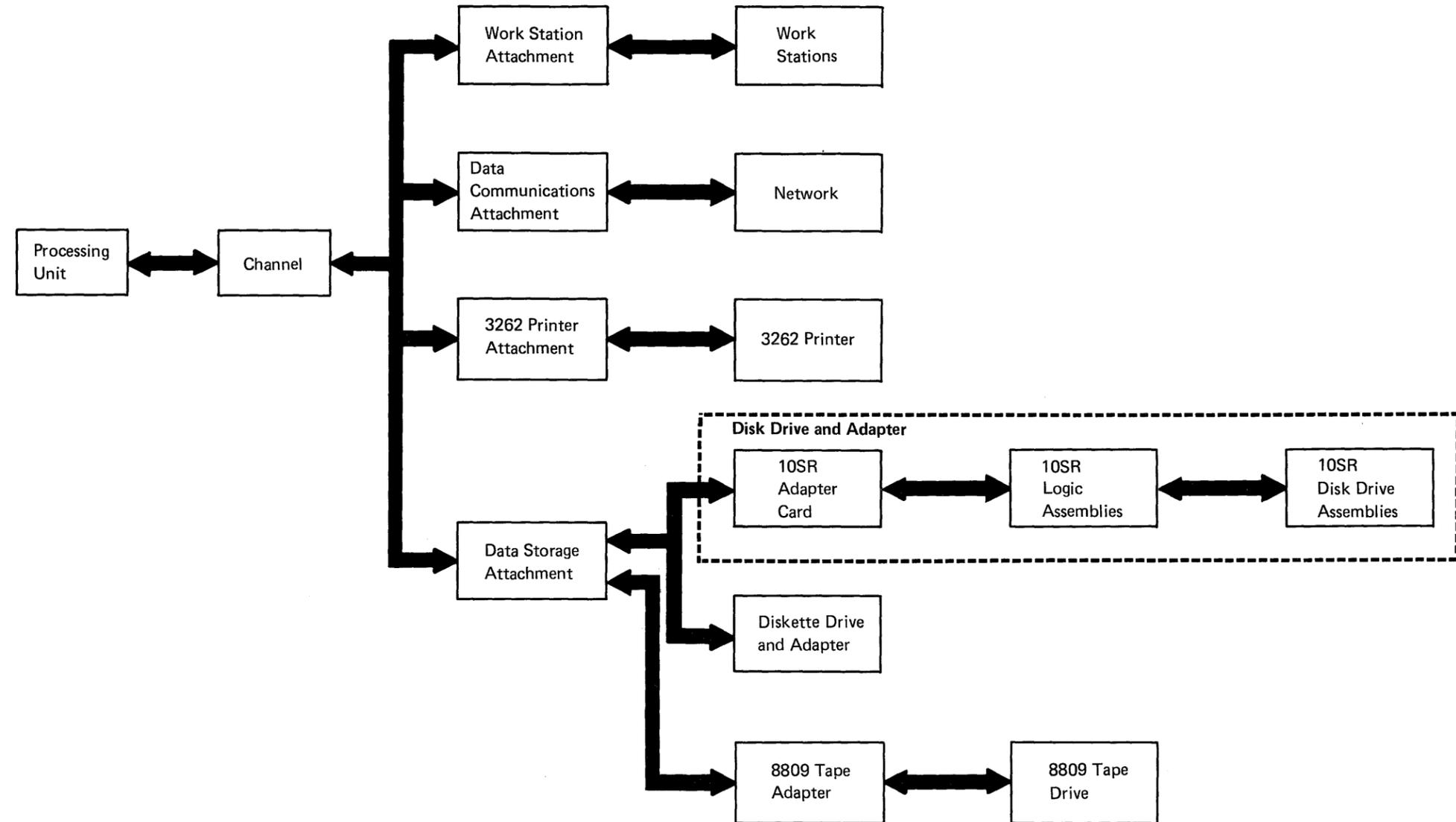
Overview

97-110 10SR Disk Drive and Adapter

The 10SR disk drive has two models: Model 1 and Model 2. Model 1 has 200 megabytes of storage, and Model 2 has 358 megabytes of storage. Up to four drives can be attached to the system. Each disk drive has its own adapter card (A-A2C2 for drive A, A-A2D2 for drive B, A-A2C4 for drive C, and A-A2D4 for drive D) and attaches to the channel through the data storage attachment (DSA). For DSA maintenance information, see Section 90.

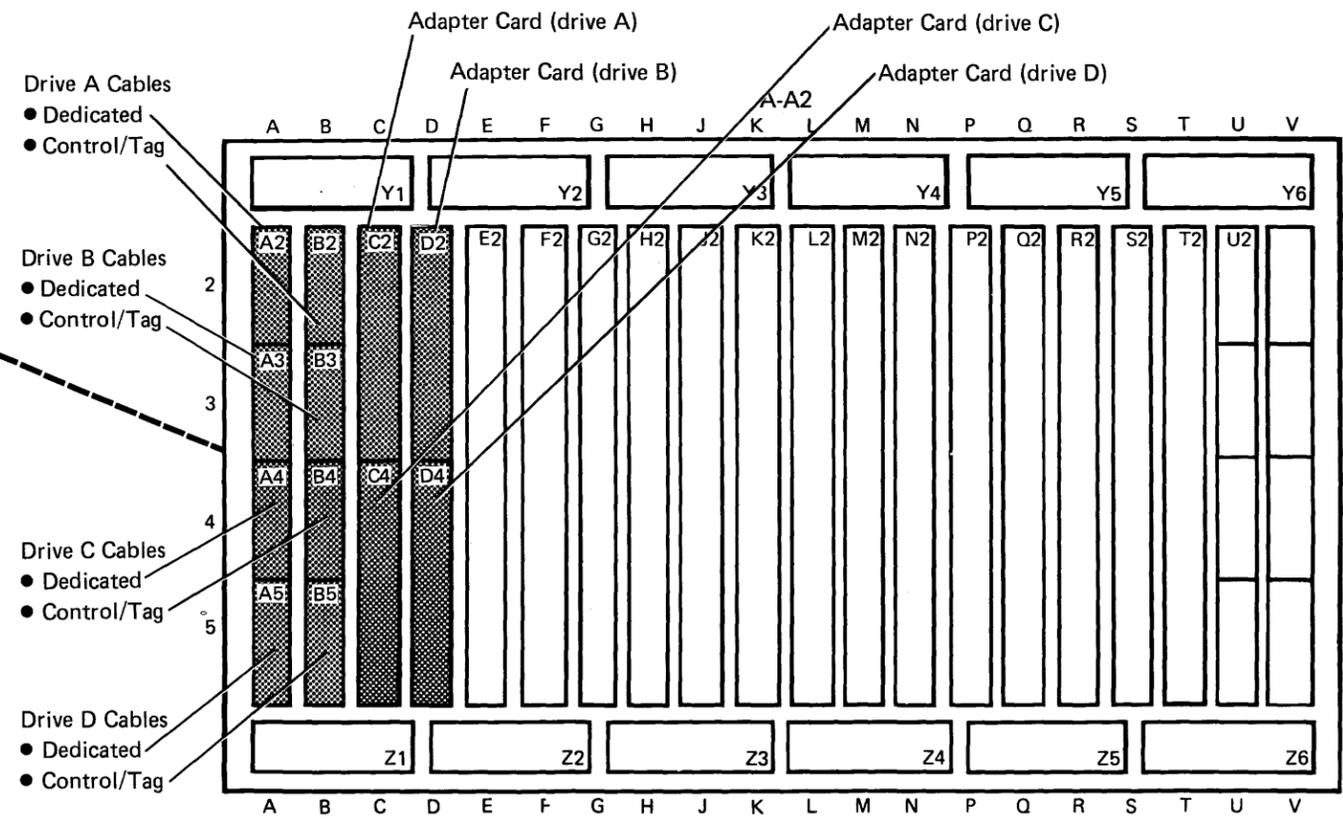
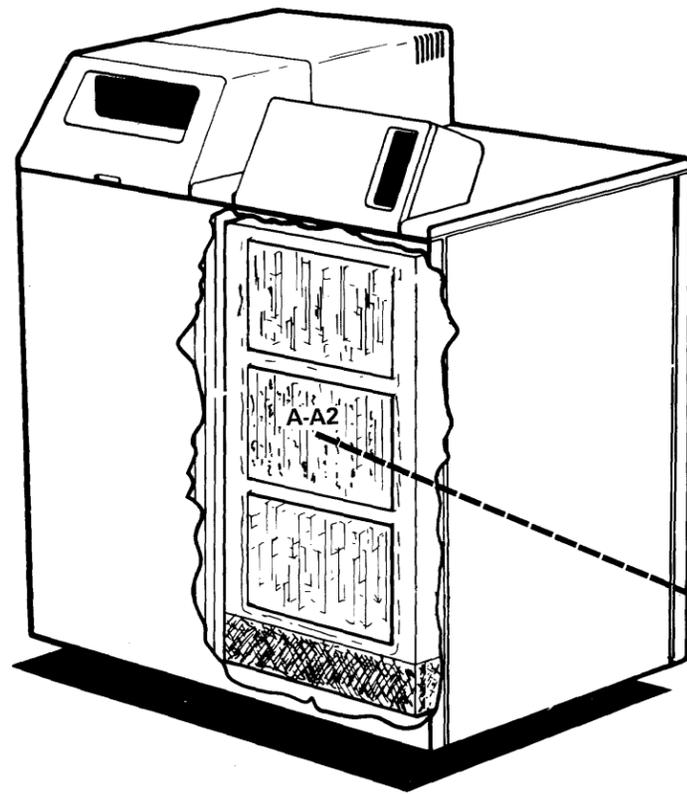
The major field-replaceable units (FRUs) are:

- 10SR adapter card
- 10SR logic assemblies:
 - Access control card
 - Data converter card
 - Servo card
 - Terminator card
 - Data channel card
 - VCM driver
- 10SR disk drive assemblies:
 - Drive motor
 - Carriage latch magnet
 - Brake
 - Power control
 - Head/disk assembly (HDA)



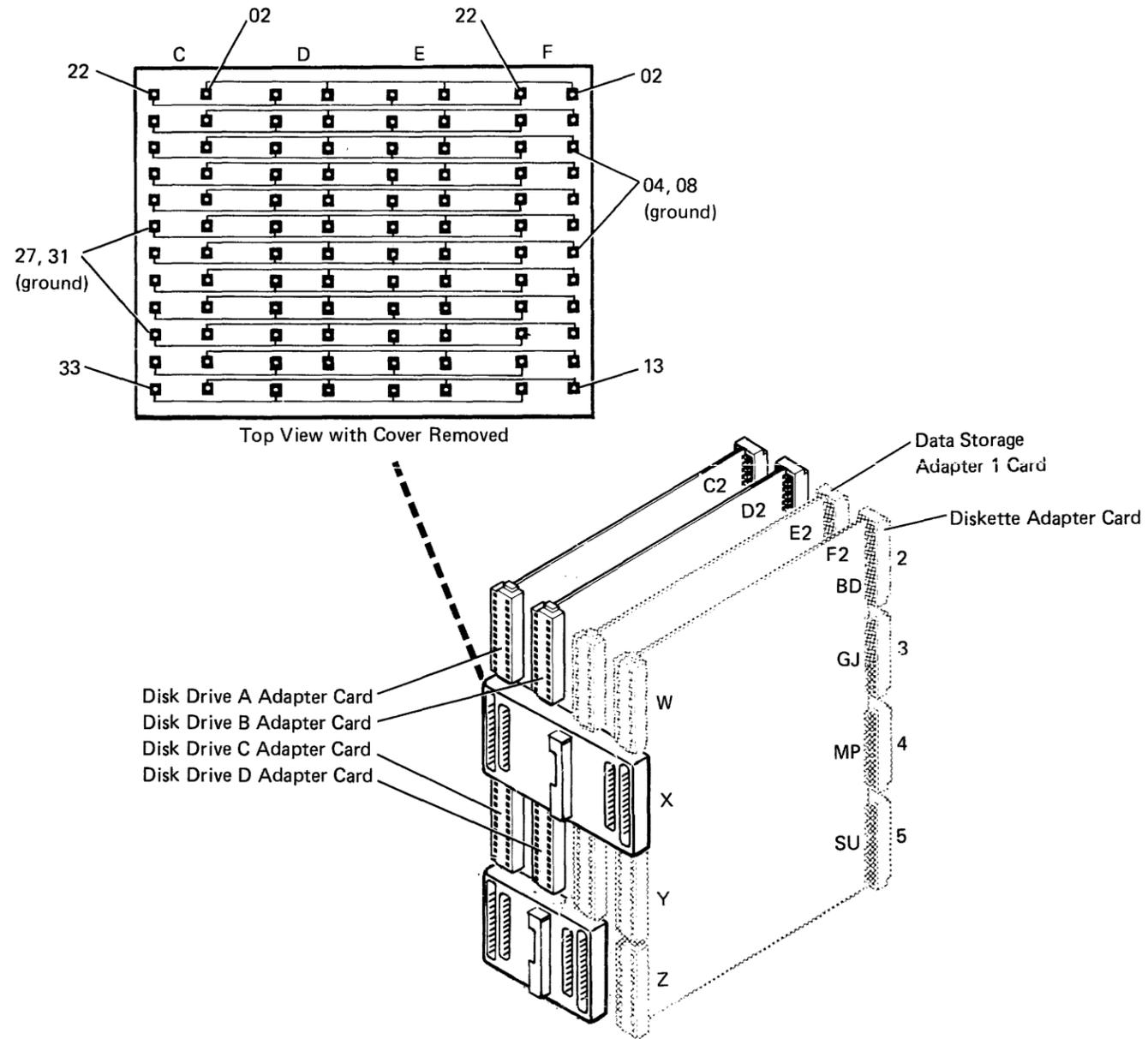
Locations

97-200 Adapter Card



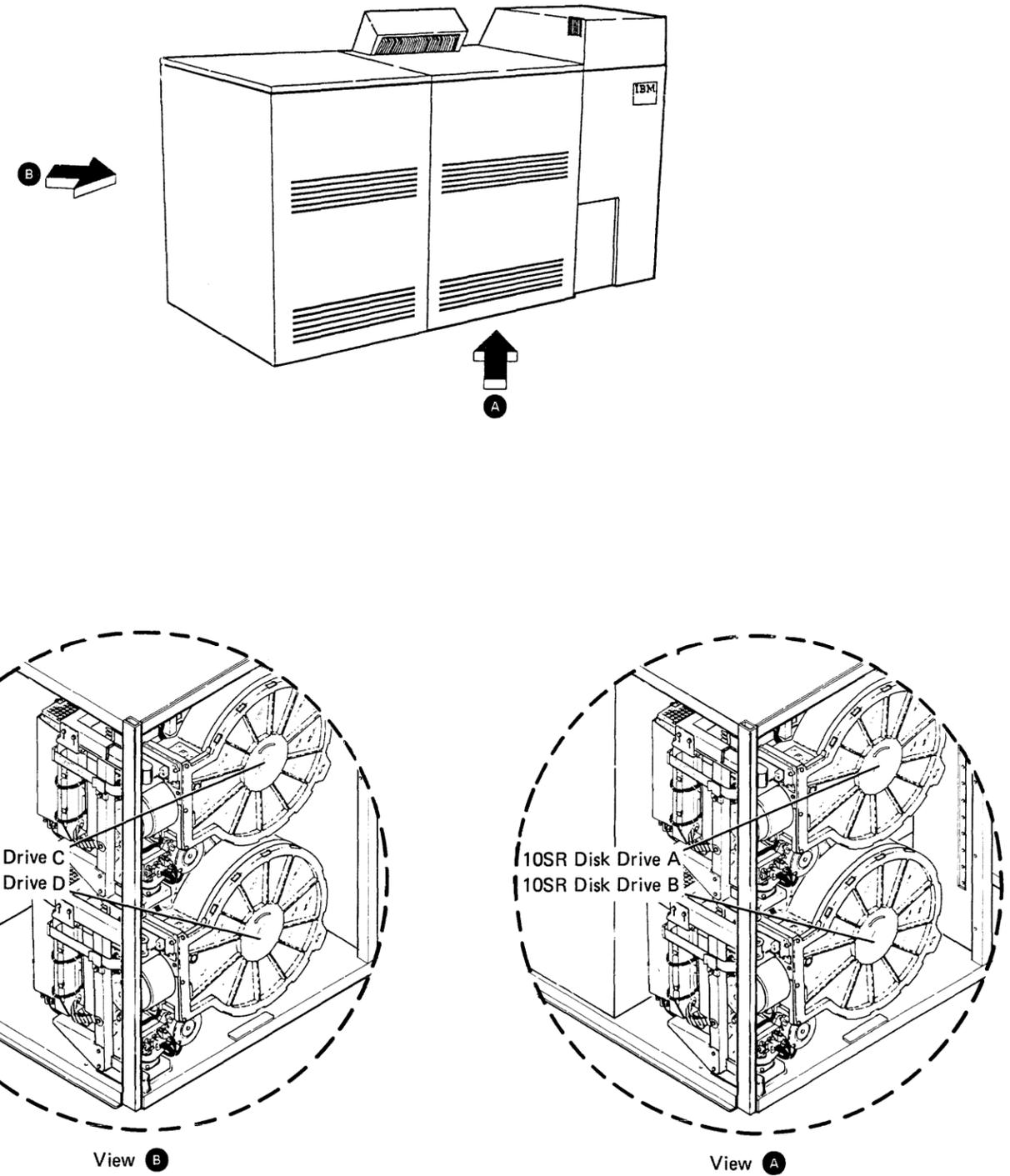
Note: The cards in C2 and D2 may be 4-wide instead of 2-wide as shown for systems with two drives.

**97-205
Adapter Top Card Connectors**

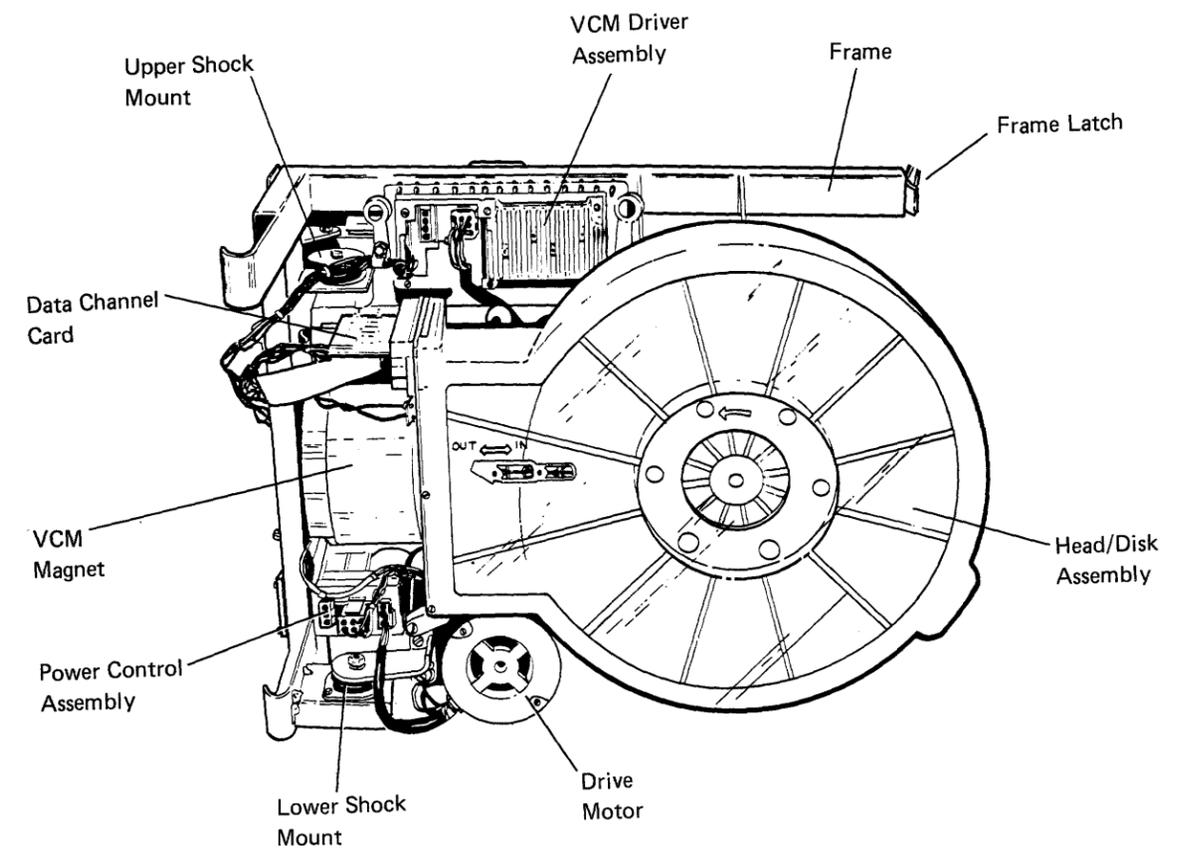
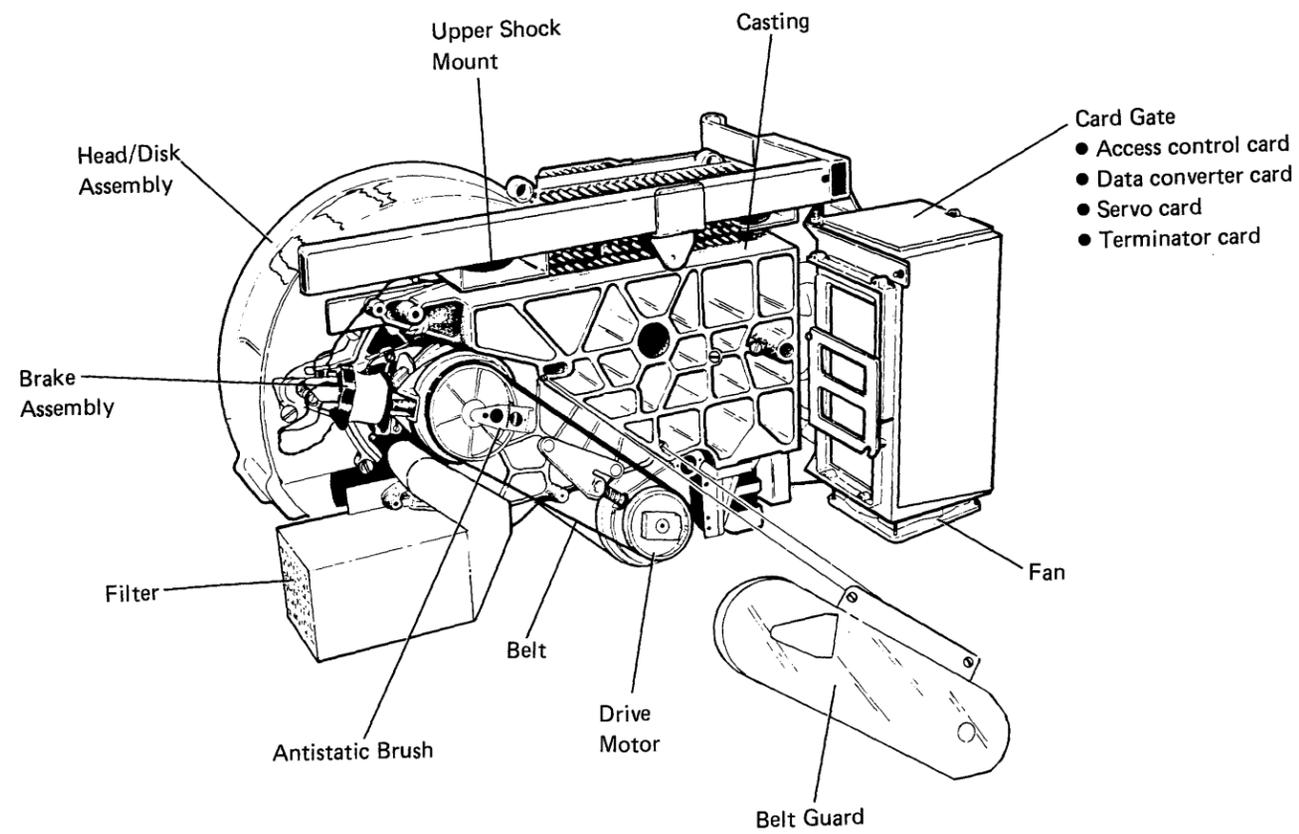


- Notes:**
1. All X04, X08, X27, and X31 pins are ground pins.
 2. The cards in C2 and D2 may be 4-wide instead of 2-wide as shown for systems with two drives.
 3. The 3-wide top card connector is used only when three or four drives are installed.

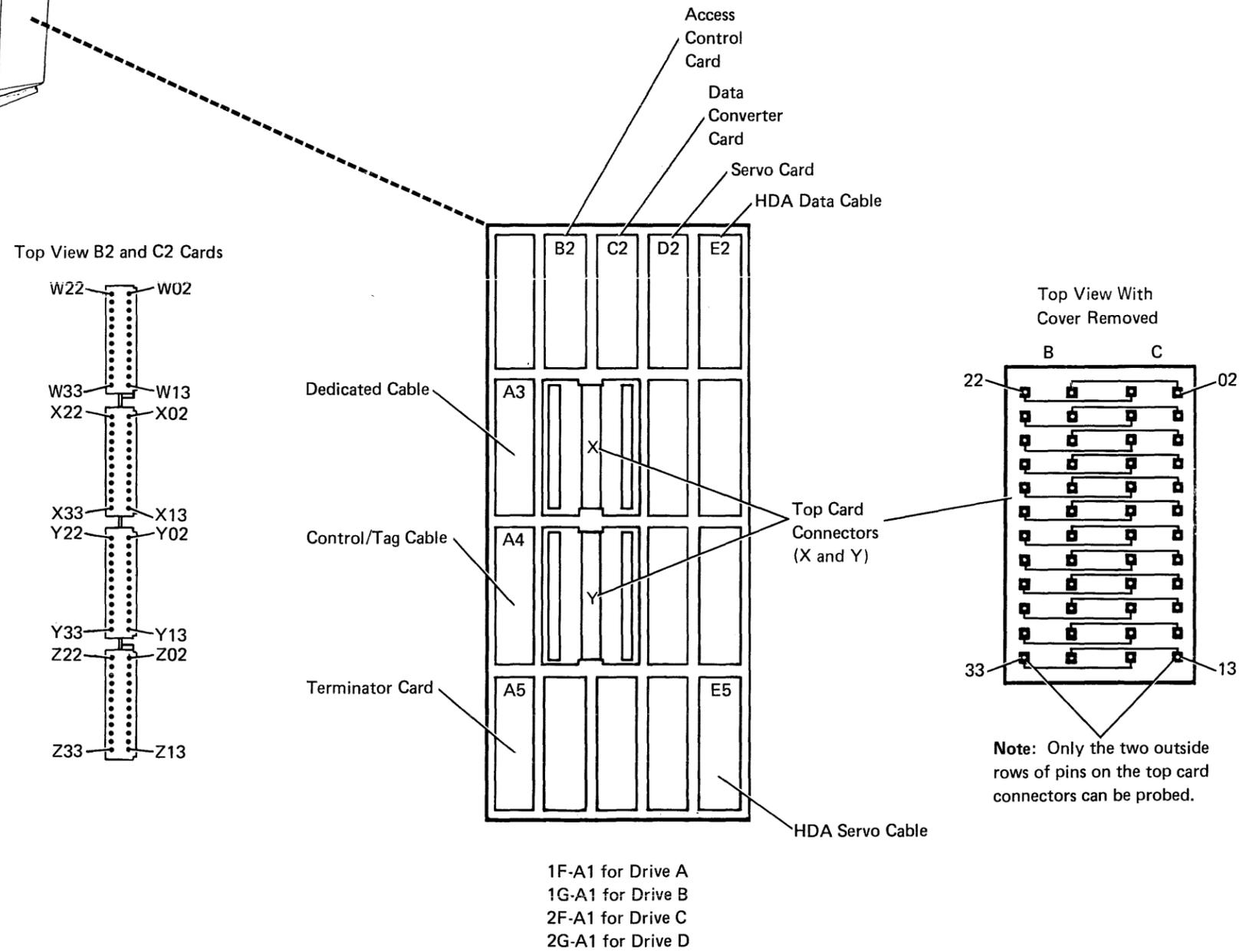
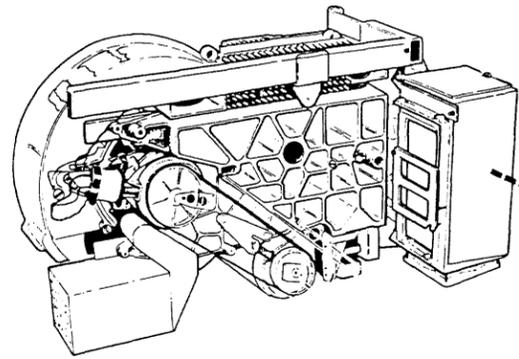
**97-210
Disk Drive**



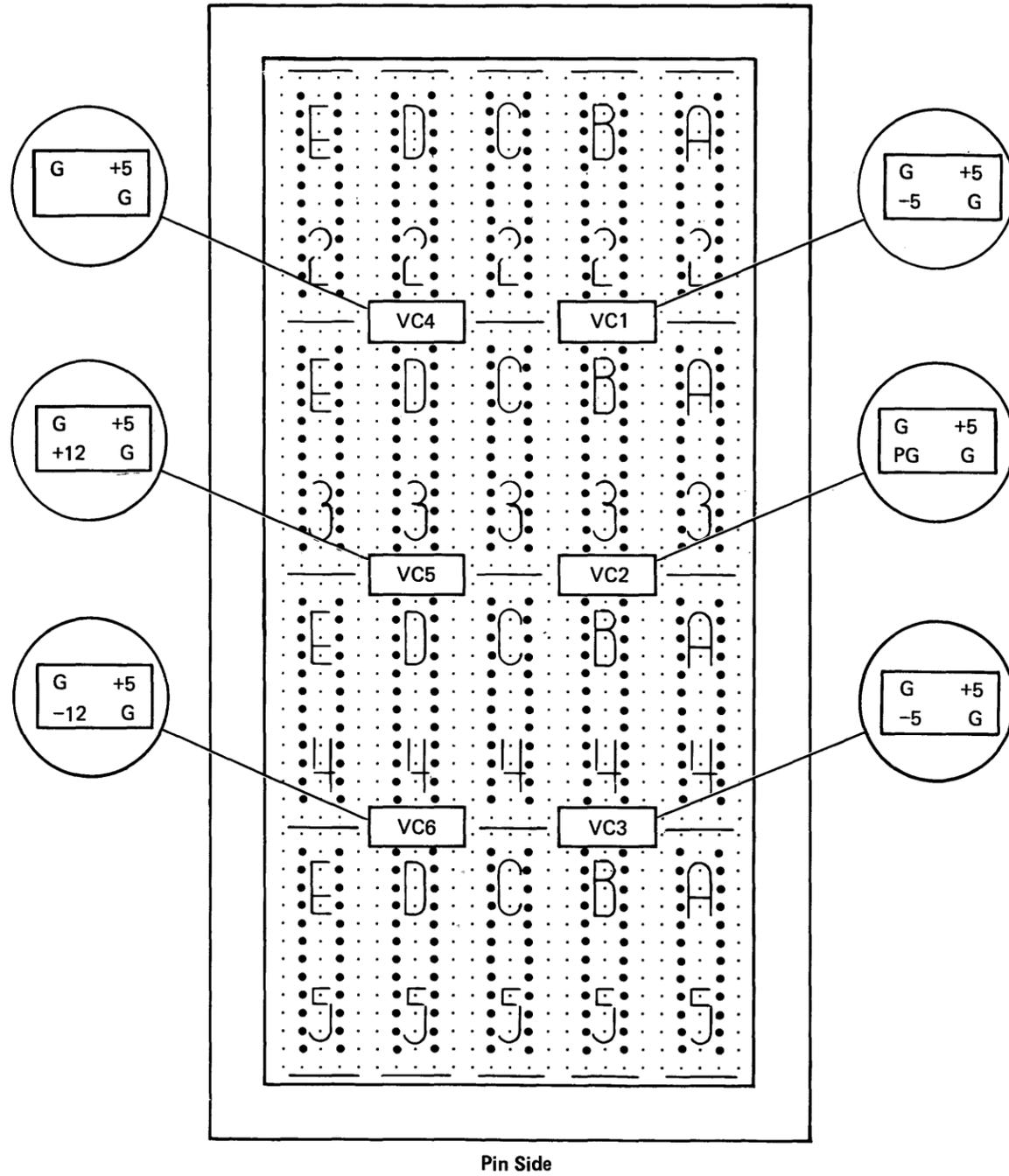
**97-215
Disk Drive FRU**



97-220
Drive Card Gate

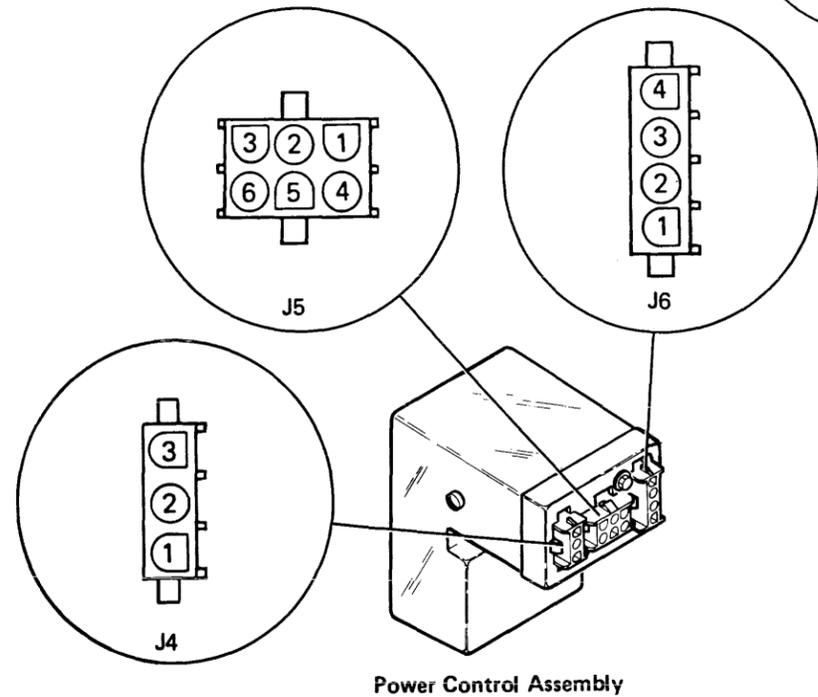
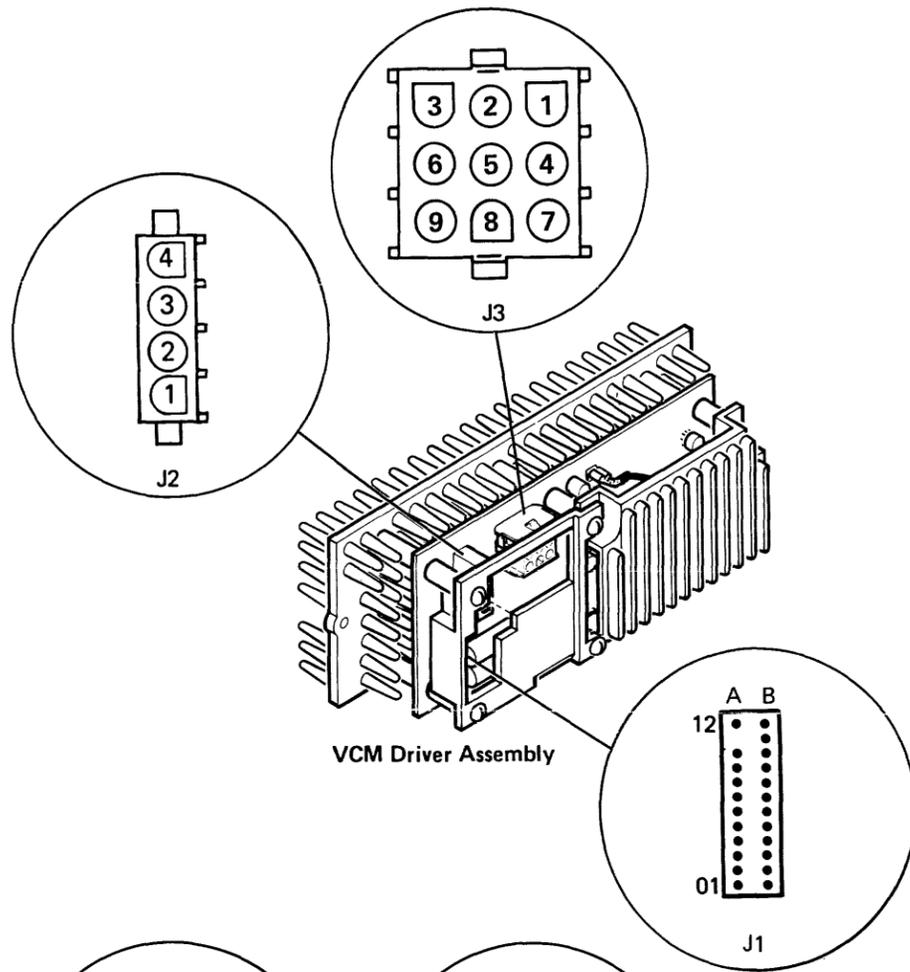


97-225
 Drive Card Gate Voltage Connector



Connector	Pin	Voltage
VC1	A1B2A14	+5 Vdc
	A1B2E14	Ground
	A1B3A01	Ground
	A1B3E01	-5 Vdc
VC2	A1B3A14	+5 Vdc
	A1B3E14	Ground
	A1B4A01	Ground
	A1B4E01	Power good
VC3	A1B4A14	+5 Vdc
	A1B4E14	Ground
	A1B5A01	Ground
	A1B5E01	-5 Vdc
VC4	A1D2A14	+5 Vdc
	A1D2E14	Ground
	A1D3A01	Ground
	A1D3E01	Not used
VC5	A1D3A14	+5 Vdc
	A1D3E14	Ground
	A1D4A01	Ground
	A1D4E01	+12 Vdc
VC6	A1D4A14	+5 Vdc
	A1D4E14	Ground
	A1D5A01	Ground
	A1D5E01	-12 Vdc

97-230
Drive J-Connector



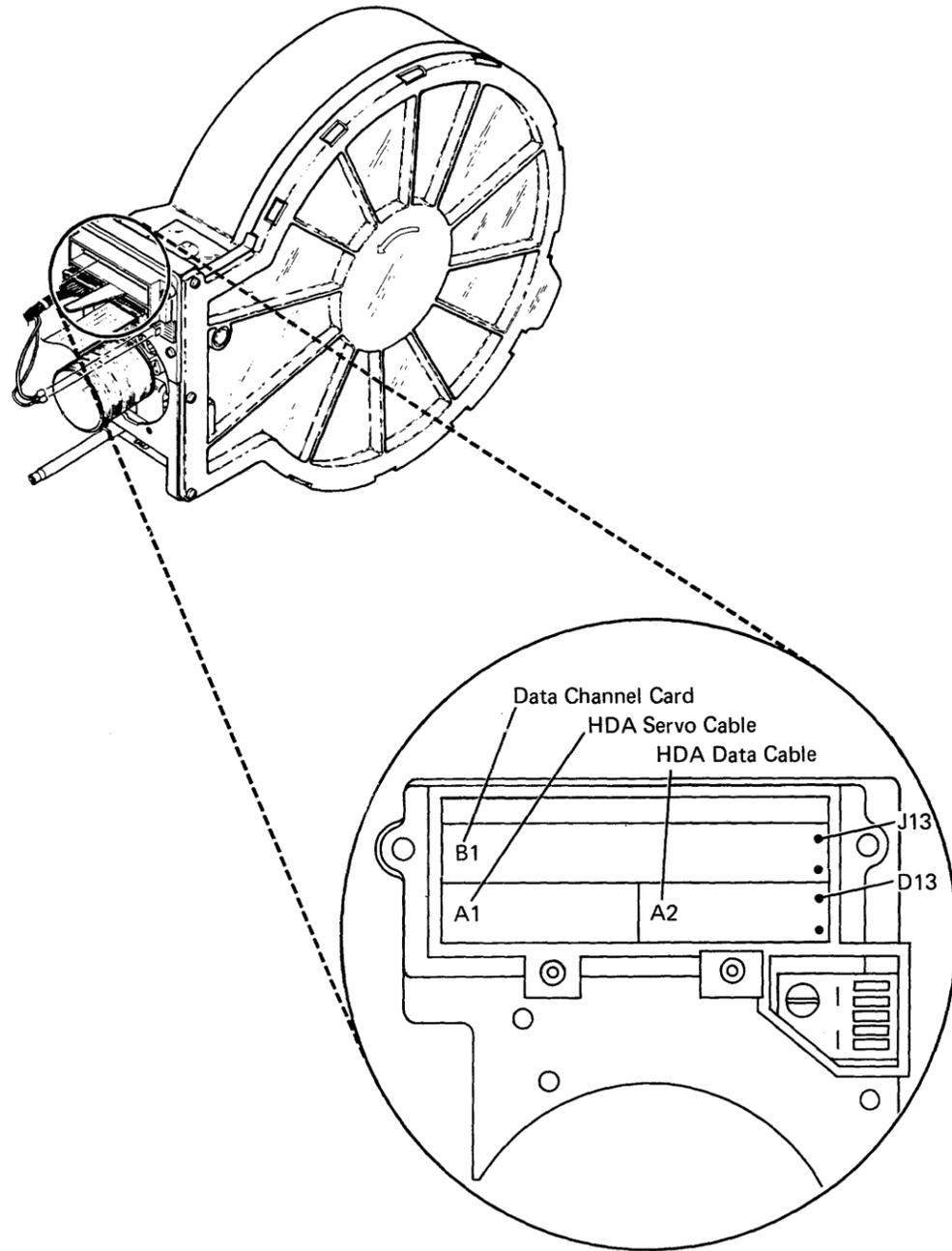
VCM Driver Assembly

Connector	Pin	Description
J1	A02	Not used
	A03	Ground
	A04	TP (factory only)
	A05	Ground
	A06	-12 wrapback
	A07	Ground
	A08	+12 wrapback
	A09	Ground
	A10	Ground
	B02	Ground (36 V return)
	B03	+Power amp drive (in)
	B04	TP (factory only)
J2	1	+36 V
	2	Ground (36 V return)
	3	Ground (36 V return)
	4	-36 V
J3	1	To voice coil
	2	-Motor relay
	3	-36 V
	4	Not used
	5	Not used
	6	Reserved
	7	Voice coil return
	8	+36 V
	9	Ground (36 V return)

Power Control Assembly

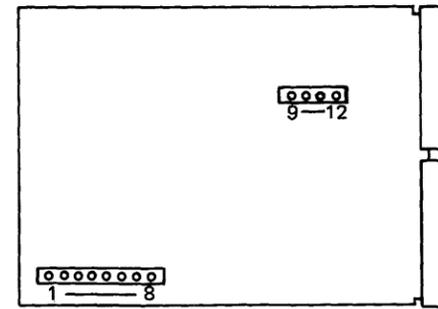
Connector	Pin	Description
J4	1	AC line voltage
	2	Ground
	3	AC line voltage
J5	1	-Motor relay
	2	+36 V
	3	Not used
	4	Reserved
	5	Ground (to brake and carriage latch magnet)
	6	Ground (36 V return)
J6	1	Ground
	2	AC line voltage (to drive motor main winding)
	3	AC line voltage (common)
	4	AC line voltage (to drive motor start winding)

**97-235
HDA Board and Data Channel Card**



1F-W1 for Drive A
1G-W1 for Drive B
2F-W1 for Drive C
2G-W1 for Drive D

Data Channel Card



Data Channel Card

Test Points	Description
1	Ground
2	Ground
3	Ground
4	Read data
5	Read data
6	Ground
7	Write data
8	Write data
9	Factory only
10	Factory only
11	Factory only
12	Factory only

97-240
Identifying 10SR Models

The 10SR Model 1 (200 megabytes) label includes the words IBM HEAD/DISK ASM P/N 1615600.

The 10SR Model 2 (358 megabytes) label includes the words IBM HEAD/DISK ASM P/N 6493600 and 10SR MOD II.

Maintenance Procedures

REMOVALS, REPLACEMENTS, SERVICE CHECKS, AND ADJUSTMENTS

97-300 Preventive Maintenance

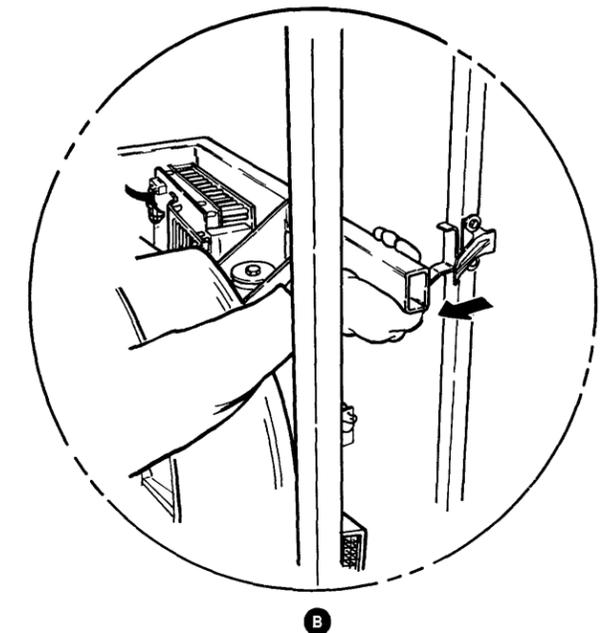
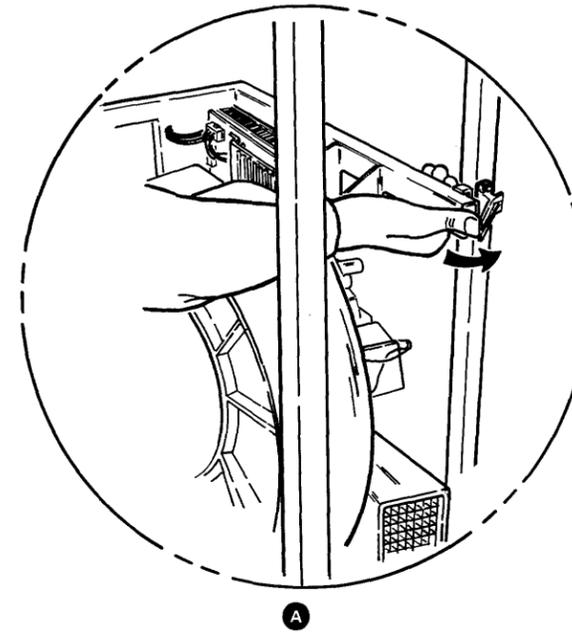
No preventive maintenance is needed for the 10SR disk drive. However, it may be necessary to adjust or exchange field-replaceable units (FRUs). To find a failing unit, use diagnostic programs and maintenance analysis procedures (MAPs). Verify the repairs by running diagnostic programs.

97-305 Opening the 10SR Frame

DANGER

It is possible to pinch your thumb when opening the 10SR frame. To prevent injury, use the following procedure.

1. Place your hand under the 10SR frame as shown **A** and release the latch with your thumb.
2. Place your thumb under the frame as shown **B** and continue to open the frame.



**97-310
Drive Belt Removal**

1. Power off (01-115).
2. Remove the belt guard **F**.

DANGER

The drive motor becomes hot after continuous use. Let the parts cool before touching.

DANGER

After the drive belt is removed, lower the drive motor carefully. It is possible to pinch your hand at **E**.

3. Lift the drive motor **C** against the force of the spring and remove the drive belt **E**.

**97-312
Drive Belt Replacement**

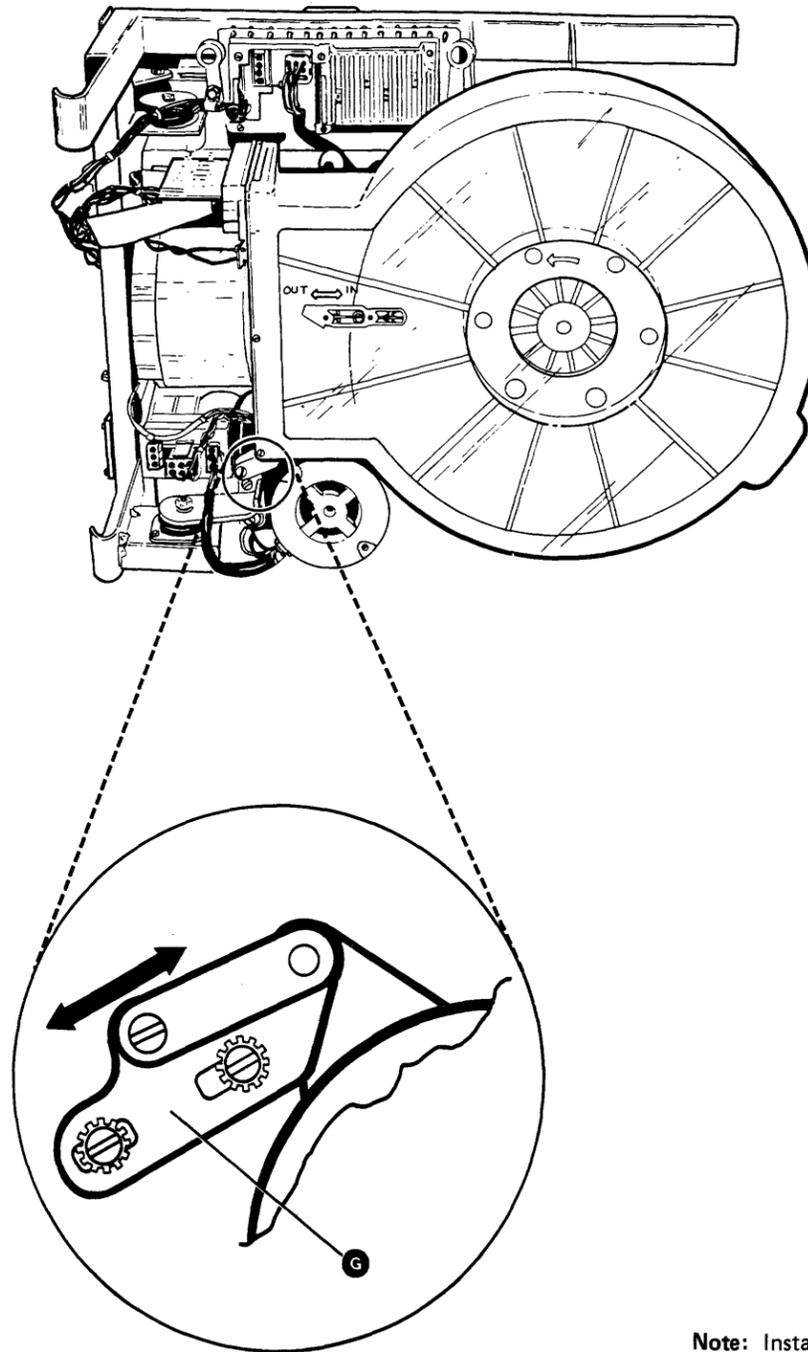
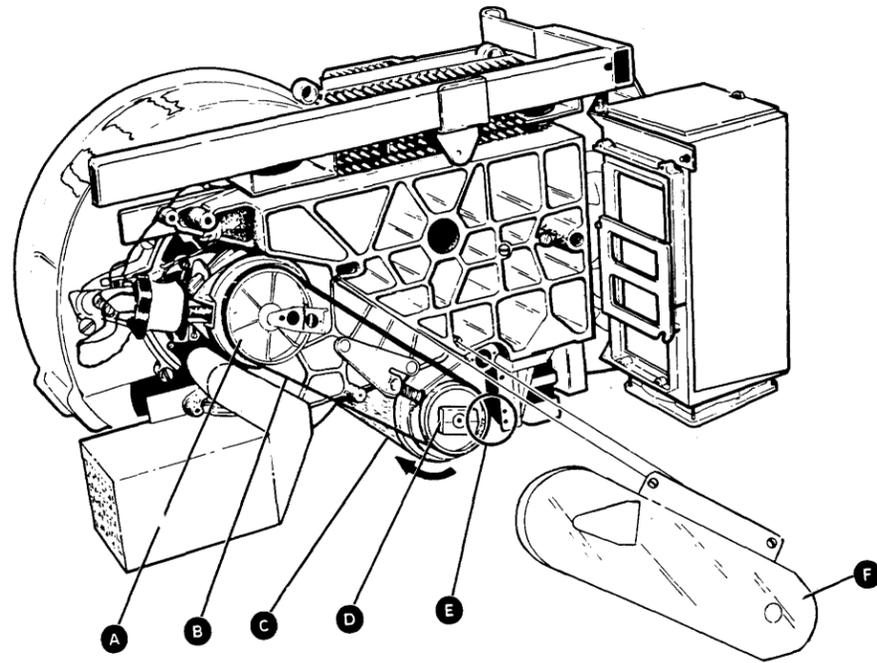
1. Power off (01-115).
2. Lift the drive motor **C** against the force of the spring, place the drive belt **B** around the drive motor pulley **D** and the spindle pulley **A**, and lower the motor until the belt is tight.

Note: Install the drive belt with the printing on the belt facing outward. Locate the belt so that the belt does not overlap the edges of the pulleys.

3. Install the belt guard **F**, using the three screws.
4. Power on (01-110).
5. Verify that the belt does not overlap the edges of the pulleys. If it does, perform the drive belt adjustment (97-314).

**97-314
Drive Belt Adjustment**

1. Power on (01-110).
2. Loosen the two screws on the vibration mount assembly **G**. Move the assembly until the belt does not overlap the edges of the pulleys, then tighten the two screws.



Note: Install the belt with the printing on the belt facing outward. Locate the belt as shown; that is, the belt does not overlap the edges of the pulley.



97-320 Drive Motor Removal

A new start capacitor is included with a new drive motor. Always exchange the start capacitor when exchanging the drive motor.

DANGER

The drive motor becomes hot after continuous use. Let the parts cool before touching.

1. Power off (01-115).
2. Disconnect the drive motor power cable plug (J6) **G**.
3. Remove the screw **H** from the ground wire.
4. Loosen the screw and open the card gate **D**.
5. Remove the screw from the clamp **F** on the capacitor leads.
6. Remove the two screws and the capacitor clamp **E**.
7. Perform the drive belt removal (97-310); then return here.
8. Remove the coil spring **B**.
9. Remove the nut or screw, washer, and lock washer **C** from the pivot shaft.
10. While holding the drive motor **A**, remove the two screws from the vibration mount assembly **K**, and then remove the drive motor.
11. If exchanging the drive motor, remove the spacer **J** and the vibration mount assembly parts (**K**, **L**, and **M**) from the removed drive motor.

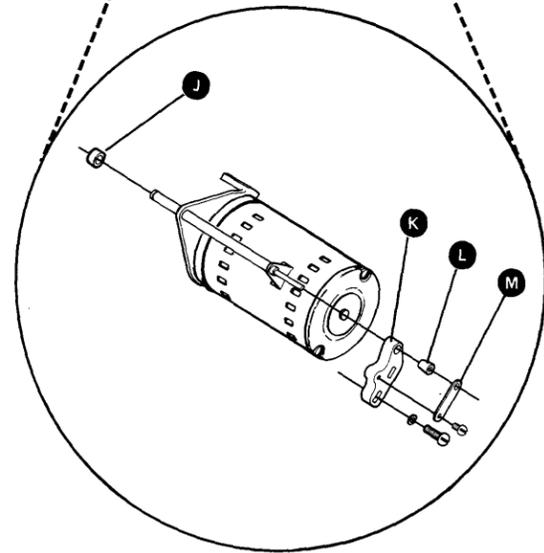
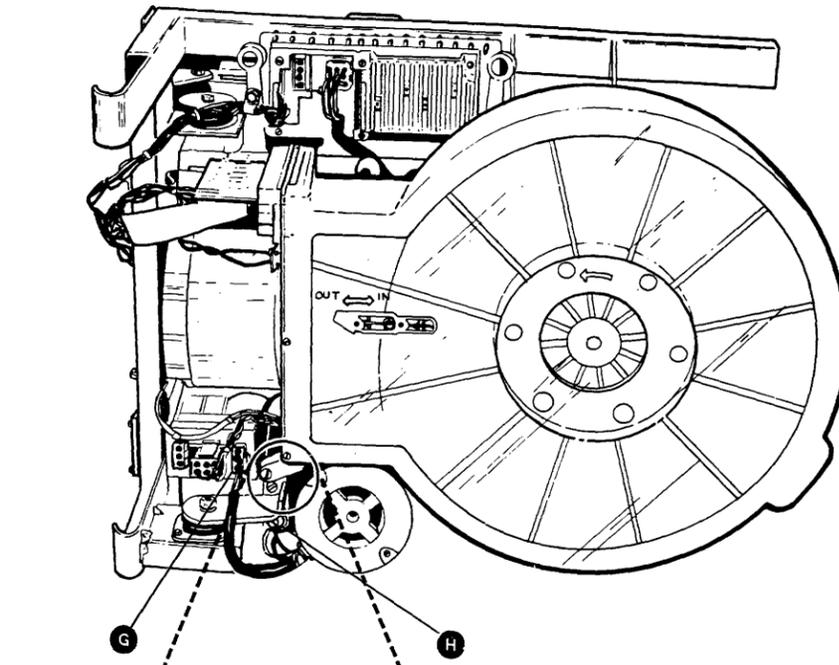
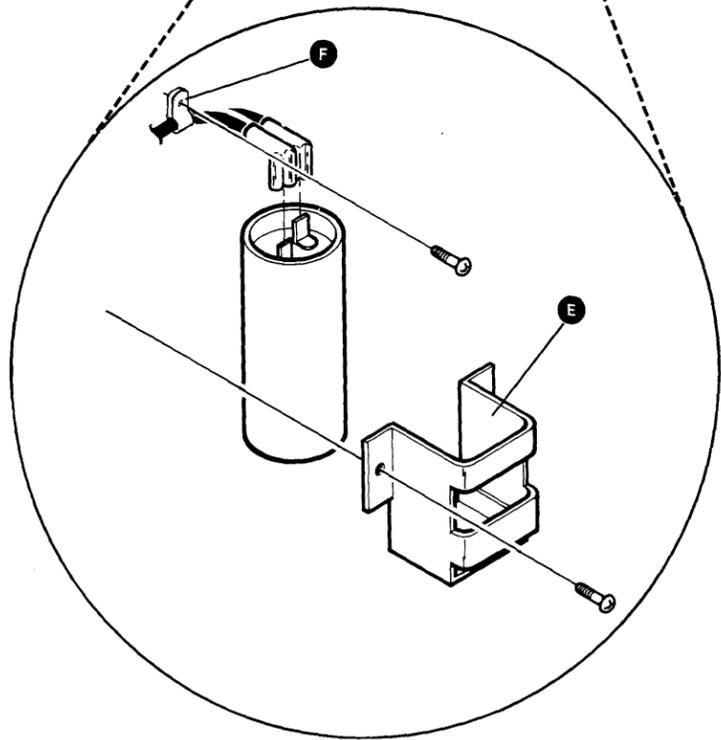
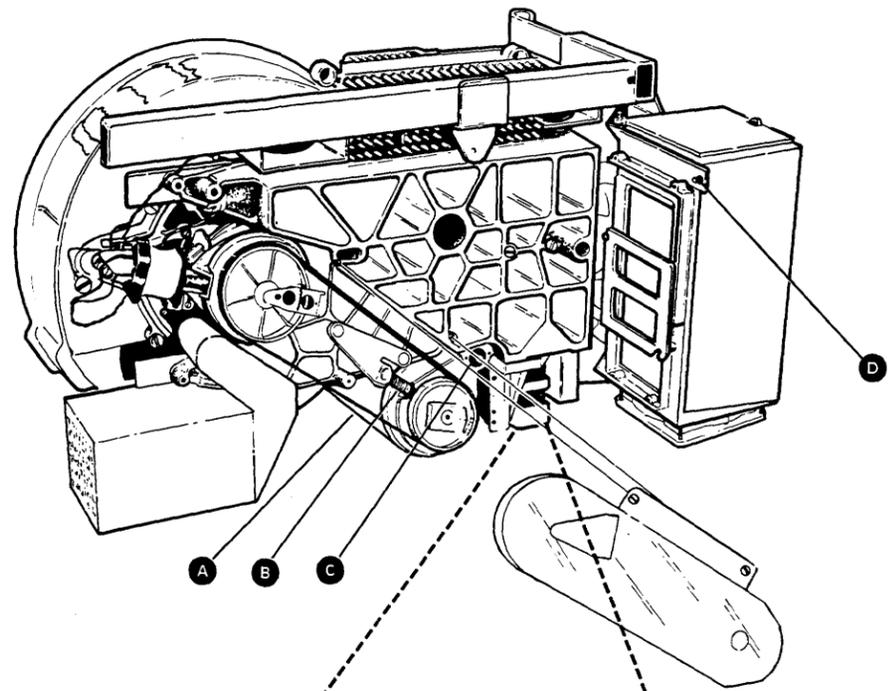
97-322 Drive Motor Replacement

Note: If installing a new drive motor, ensure that:

1. The drive motor voltage rating is correct for your machine (the information is on the motor case).
2. The drive motor pulley is correct for your machine (see 97-420).

A new start capacitor is included with a new drive motor. Always exchange the start capacitor when exchanging the drive motor.

1. Power off (01-115).
2. Place the spacer **J** on the pivot shaft, locate the pivot shaft in the bearing in the casting, and install the drive motor **A** using the two screws through the vibration mount **K**. Install the vibration mount with the screws approximately centered in the slots.
3. Install the nut or screw, washer, and lock washer **C** on the pivot shaft.
4. Lift the drive motor and install the collet **L** on the pivot shaft.
5. Install the retainer **M**.
6. Compress the coil spring **B** and install it.
7. Install the capacitor clamp **E** using the two screws.
8. Install the screw in the clamp **F** on the capacitor leads.
9. Close the card gate **D** and tighten the screw.
10. Install the screw **H** on the ground wire.
11. Connect the drive motor power cable plug (J6) **G**.
12. Perform the drive belt replacement (97-312).



**97-330
Head/Disk Assembly Removal**

The head/disk assembly (HDA) weight is approximately 14 kilograms (30 pounds). Clear a space for the HDA before removing the HDA from the machine.

Notes:

1. If exchanging the HDA, unpack the new HDA from the shipping container before removing the old HDA from the machine. On the new HDA, turn the 6-fluted shipping screw **D** 5-1/4 ± 1/4 turns counterclockwise before installing the HDA.
2. If not exchanging the HDA, you must have bill of material 4248945, which contains the supplies needed to perform this procedure and procedure 97-332.

CAUTION

Do not perform this procedure while personnel are smoking or cleaning in the area. Any amount of dirt can cause one or more data heads to crash or can cause loss of data.

1. Power off (01-115).
2. Perform the drive belt removal (97-310); then return here.
3. Disconnect the two wires to the brake assembly **C**. The cable path for the wires to the brake assembly is through a groove **E** on the casting.
4. Remove the data channel card **F**.
5. Loosen the screws on the two retaining clips and disconnect the two cables (**G** and **H**) from the HDA.
6. Disconnect the two cables (**K** and **L**) from the HDA. The wires in cable **L** have no polarity.

7. Remove the screw that attaches the ground wire **A** to the HDA.
8. Clean the area where the HDA **J** and the VCM magnet **P** meet as thoroughly as possible. First use the brush and then the tack cloth supplied. Gloves are supplied for your use while using the tack cloth.
9. Remove the bolt, the washer, and the spring **Q** from the guide pin. The tension is removed from the spring before the bolt is completely unscrewed.

CAUTION

Be careful not to damage the voice coil **S**.

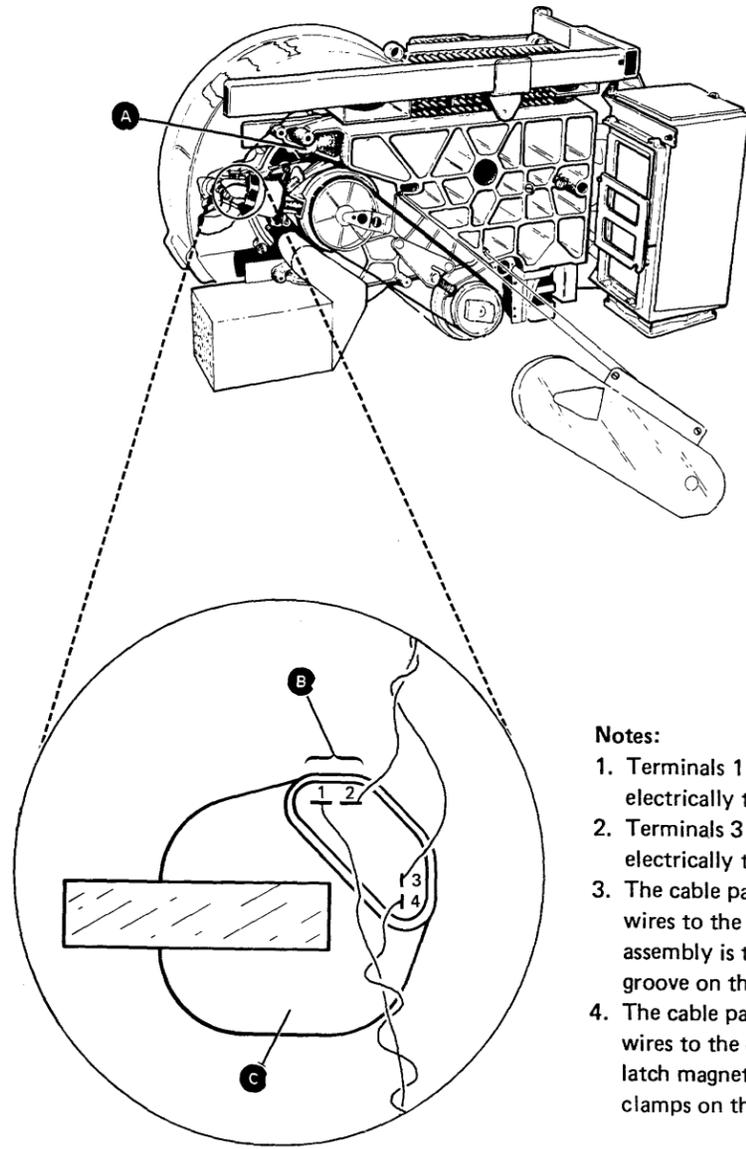
10. Slide the HDA away from the VCM magnet and remove the HDA from the casting. It may be difficult to move the HDA because of friction between the HDA and the casting.

11. Place the HDA on a flat clean surface with the spindle pulley at the top. Install the voice coil shipping protector and O-ring **R** as soon as possible to protect the HDA from dirt and dust. If the gasket **M** remains with the HDA, remove the gasket before installing the voice coil shipping protector.
12. If you are exchanging the HDA, turn the 6-fluted shipping screw **D** clockwise until the end of the screw is 0.02 to 0.1 millimeter (0.001 to 0.004 inch) from the end of the pin; then, follow the steps on the return procedure label (on the HDA).

If the 6-fluted screw is missing, order part number 257960 and install it in the HDA you are returning.

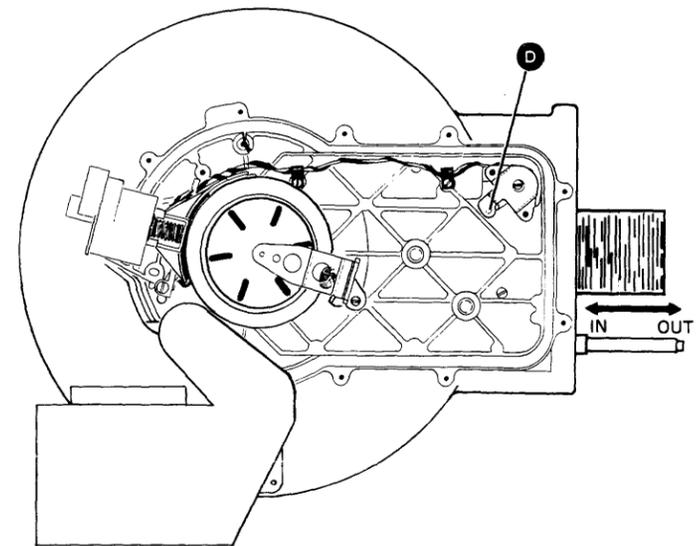
 HEAD/DISK ASM P/N 1615600 DATE OF MFG _____ ATTN : CUSTOMER ENGINEER	
RETURN PROCEDURE	Step 1 – Install voice coil shipping protector. Step 2 – Please mark suitable items <input checked="" type="checkbox"/> and add comments to describe failure to plant.
	<input type="checkbox"/> MES <input type="checkbox"/> Write <input type="checkbox"/> Not ready <input type="checkbox"/> Seek <input type="checkbox"/> Read <input type="checkbox"/> Unsafe <input type="checkbox"/> Intermittent
	CE comments: <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
	Step 3 – Record: System type _____ System serial number _____ Step 4 – Pack in shipping container of new head/disk assembly. Step 5 – Return to branch office for shipment to factory. Rochester

Note: This label is for a Model 1. The P/N (part number) on a Model 2 is 6493600.

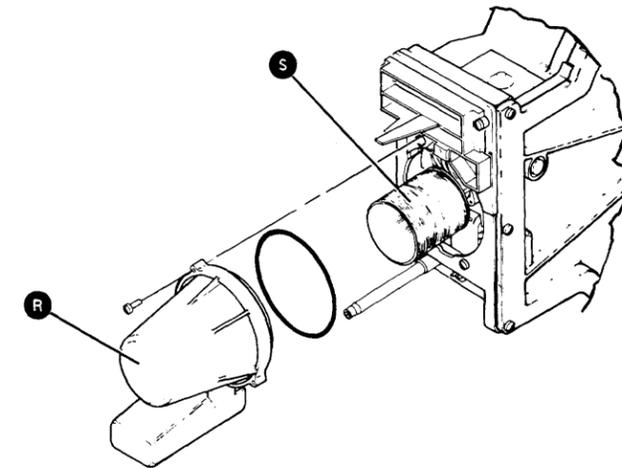
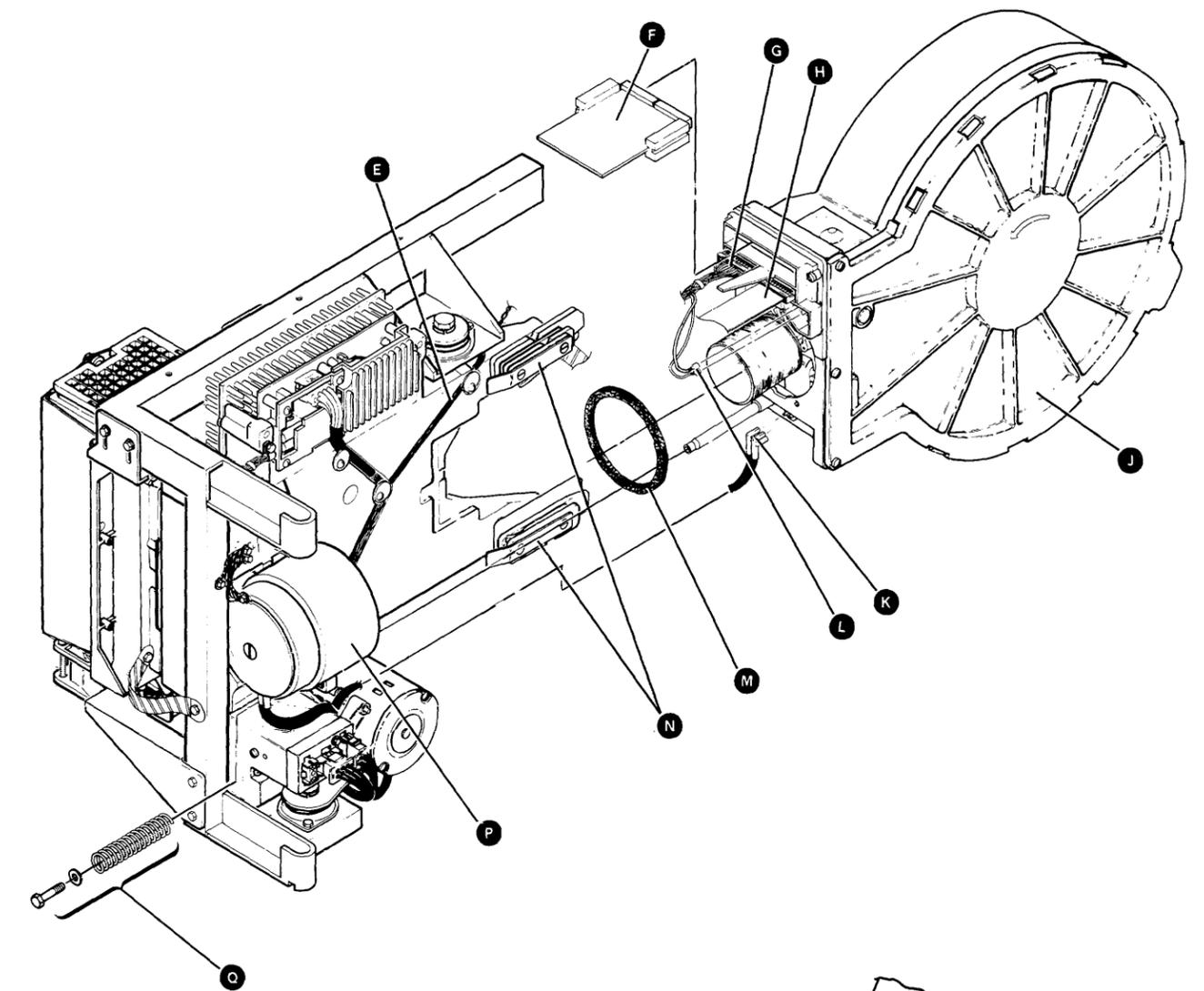


Notes:

1. Terminals 1 and 2 are electrically the same.
2. Terminals 3 and 4 are electrically the same.
3. The cable path for the wires to the brake assembly is through a groove on the casting.
4. The cable path for the wires to the carriage latch magnet is through clamps on the HDA.



Back View with HDA Removed



97-332 Head/Disk Assembly Replacement

1. Power off (01-115).
2. If you are installing a new HDA, on the new HDA, turn the 6-fluted shipping screw **R** $5-1/4 \pm 1/4$ turns counterclockwise.
3. Remove the gasket **M** from the VCM magnet.
4. Clean around the open end of the VCM magnet **P** with the tack cloth. Clean only where the gasket was; do not touch the center of the magnet.
5. Clean the area where the voice coil shipping protector **S** and the HDA meet.
6. Install a new gasket on the VCM magnet **P**.
7. Place a screwdriver through the 10SR frame as shown **A** to keep the frame from closing while you are installing the HDA.
8. Remove the voice coil shipping protector and the O-ring **S** from the HDA.

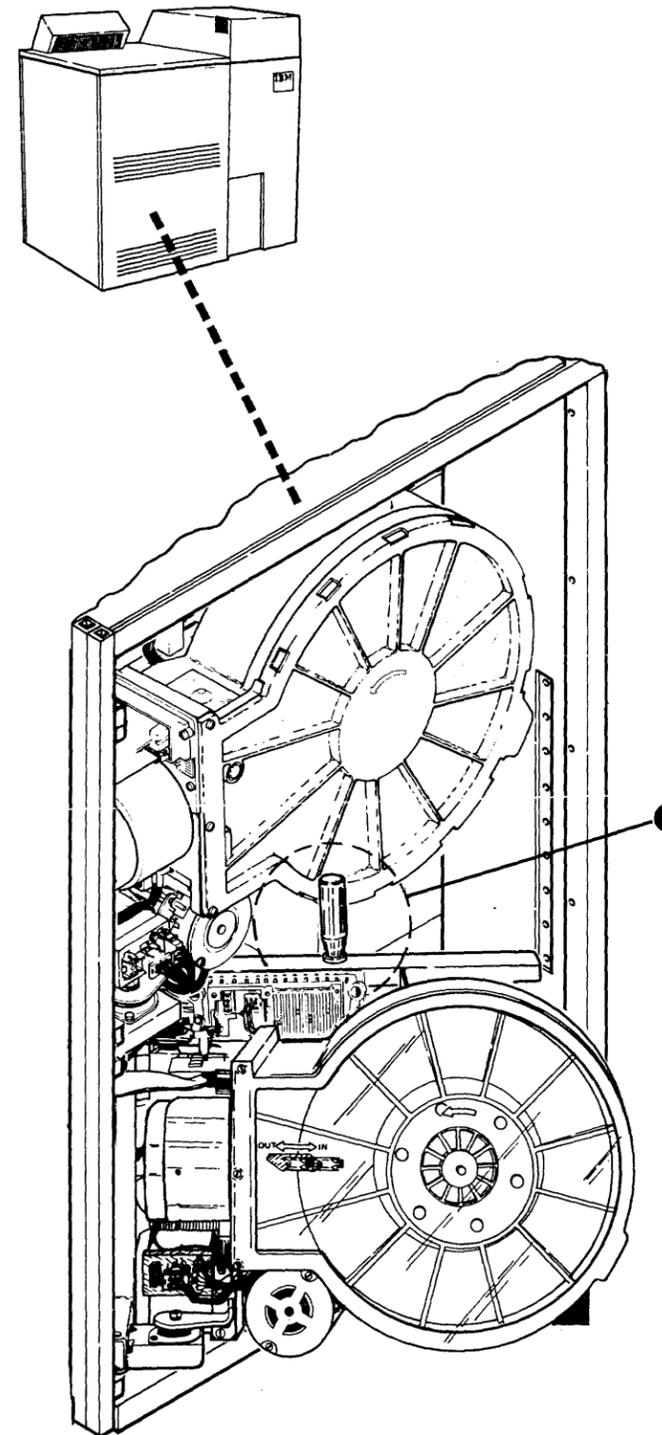
Note: The voice coil shipping protector must not be kept for future use. Always order bill of material 4248945.

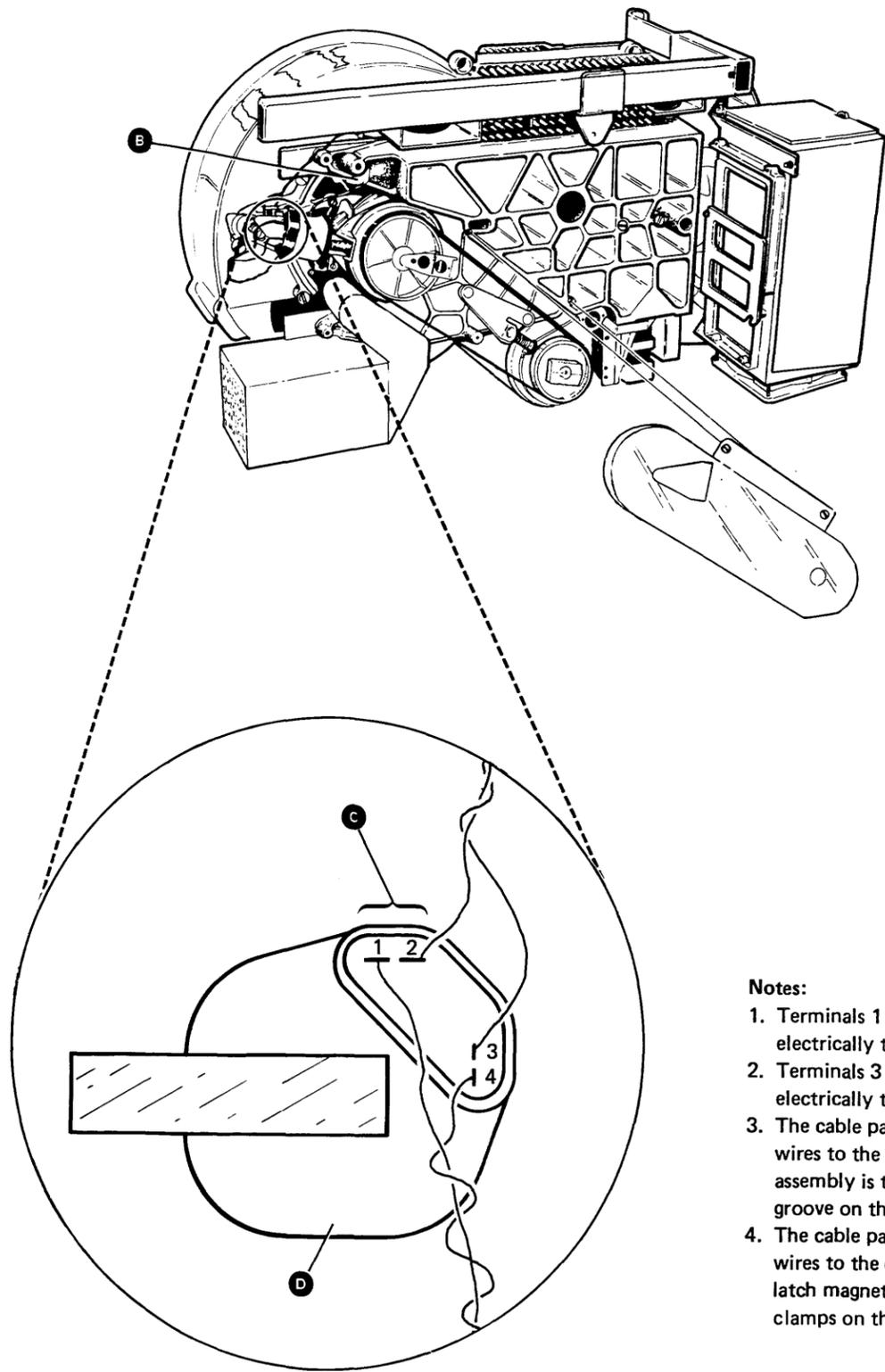
CAUTION

Be careful not to damage the voice coil **T** when you install the HDA.

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-
-
9. Align the guide pin **L** on the HDA **H** with the guide on the casting, align the studs on the rear of the HDA with the guides **N**, and slide the HDA toward the VCM magnet. Ensure that the wires and cables removed in steps 3, 5, and 6 of the HDA removal procedure (97-330) are not pinched.
 10. Install the bolt, washer, and spring **Q**.
 11. Connect the ground wire **B** to the HDA using the screw.
 12. Connect the two wires to the brake assembly **D**.

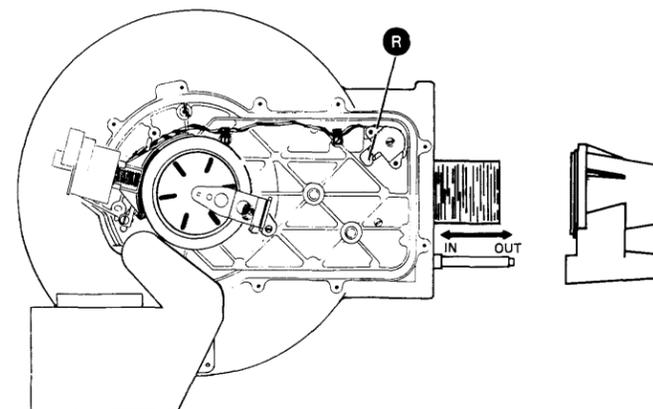
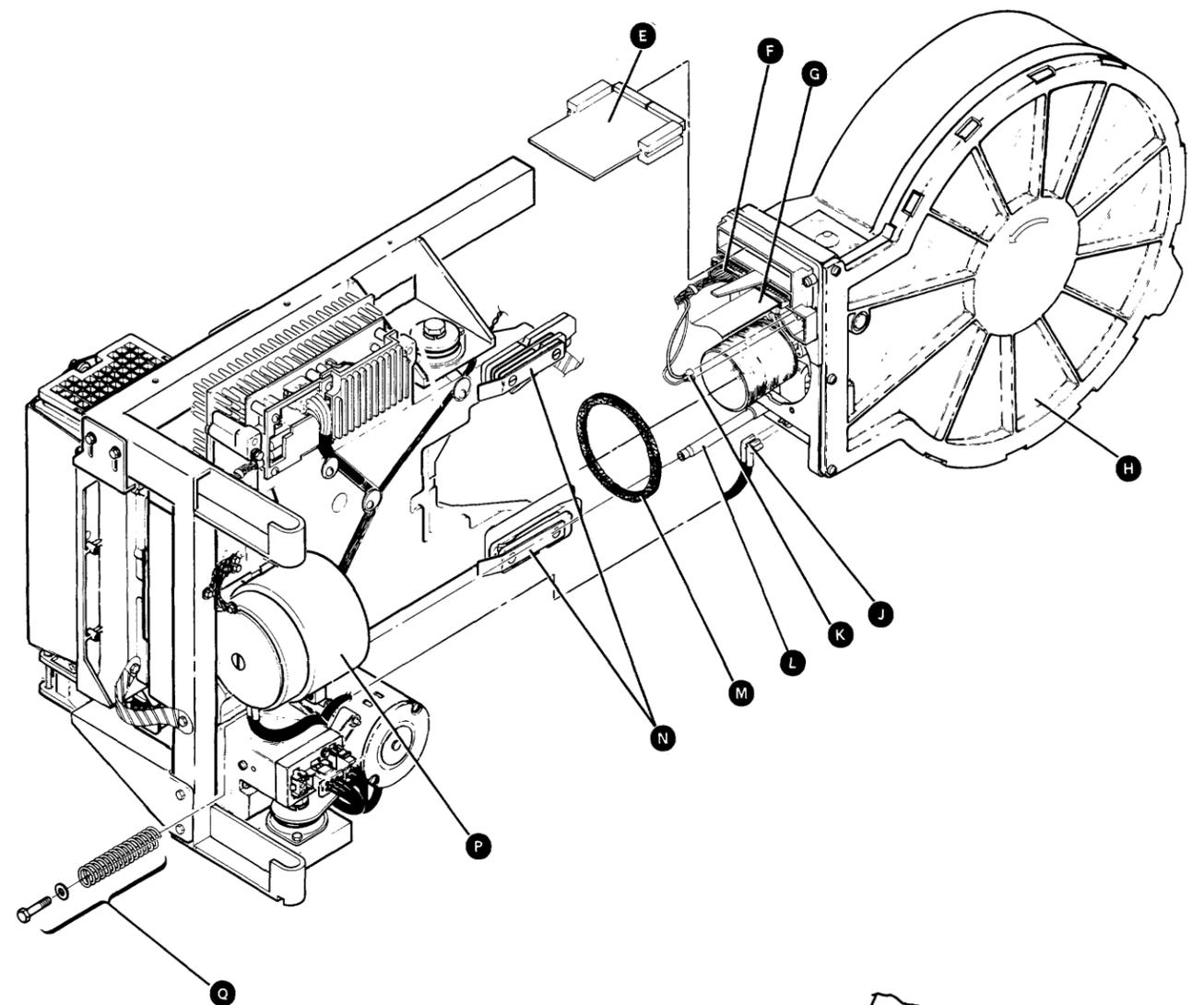
13. Connect the two cables **J** and **K** to the HDA. The wires in cable **K** have no polarity.
14. Connect the two cables **F** and **G** to the HDA and tighten the screws on the cable retainers.
15. Install the data channel card **E**.
16. Disconnect the wire from the wider terminal **C** that goes from the brake assembly to the carriage latch magnet. The cable path for the wires to the carriage latch magnet is through the clamps on the HDA.
17. Perform the drive belt replacement (97-312); then return here.
18. Power on (01-110) for 2 or 3 minutes to ensure that only filtered air is in the HDA before an access occurs.
19. Power off (01-115).
20. Connect the wire to the brake assembly (removed in step 16).
21. If you have installed a new HDA:
 - a. Run the disk MDIs (01-710).
 - b. Run the initialize disk option of the pack utility maintenance procedure (PUMP) (01-730).
 - c. If drive A was exchanged, run the customize utility (01-840).



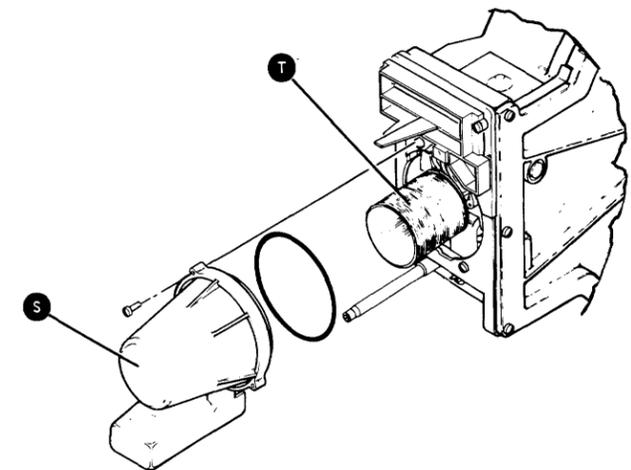


Notes:

1. Terminals 1 and 2 are electrically the same.
2. Terminals 3 and 4 are electrically the same.
3. The cable path for the wires to the brake assembly is through a groove on the casting.
4. The cable path for the wires to the carriage latch magnet is through clamps on the HDA.



Back View with HDA Removed



97-340 Carriage Latch Magnet Removal

If not exchanging the carriage latch magnet, you must have bill of material 4248945, which contains the supplies needed to perform procedures 97-330 and 97-332, before starting this procedure.

If exchanging the carriage latch magnet, you must have the new magnet available before starting this procedure.

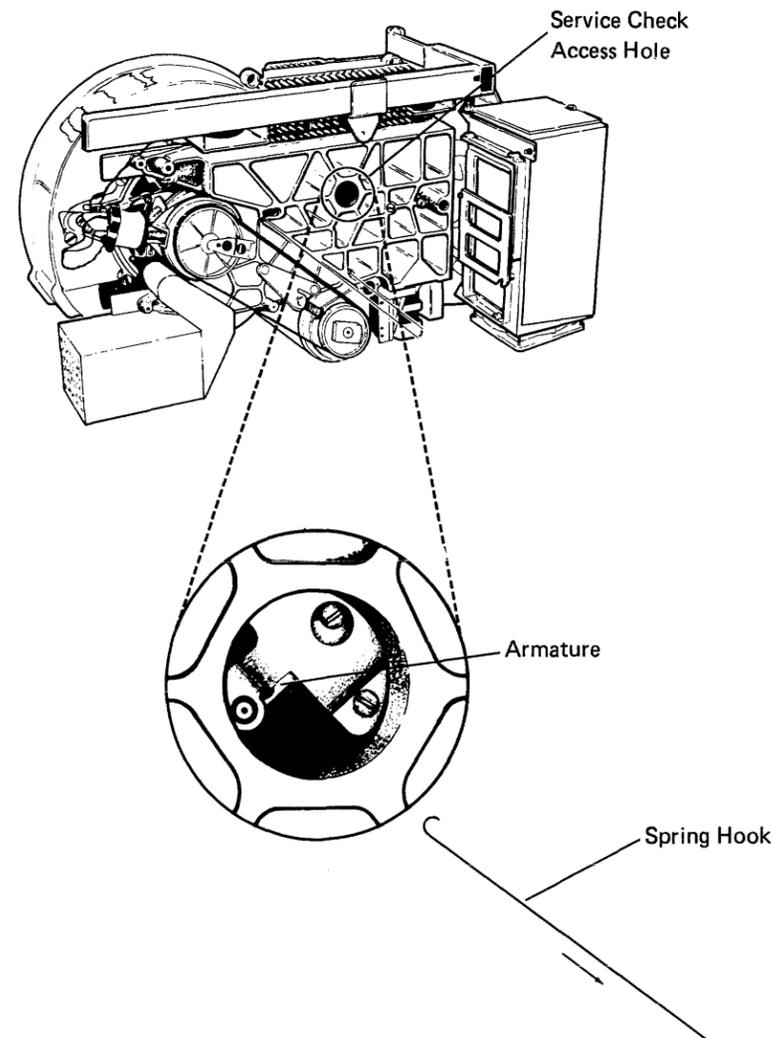
1. Perform the head/disk assembly removal (97-330); then return here.
2. Disconnect the two wires from the brake assembly **A** that go to the carriage latch magnet. (The cable path for the wires to the carriage latch magnet is through clamps on the HDA.)
3. Remove the screws from the clamps **B** on the two wires.
4. Remove the two screws and the cover **C**.
5. Remove the C-clip **F** from the pin.
6. Remove the two studs and the carriage latch magnet **G**.

97-342 Carriage Latch Magnet Replacement

1. Place the carriage latch magnet **G** on the HDA and attach it using the two studs.
- Note:** Ensure that the pin is centered in the hole in the armature.
2. Install the screws in the clamps **B** on the two wires.
 3. Connect the two wires to the brake assembly **A** that go to the carriage latch magnet.
 4. Perform the carriage latch magnet adjustment (97-346).

97-344 Carriage Latch Magnet Service Check

Use this service check only when instructed by the MAPs.



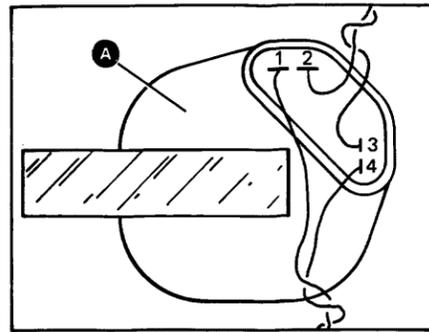
97-346 Carriage Latch Magnet Adjustment

CAUTION

Do not perform this procedure while personnel are smoking or cleaning in the area. Any amount of dirt can cause one or more data heads to crash or can cause a loss of data.

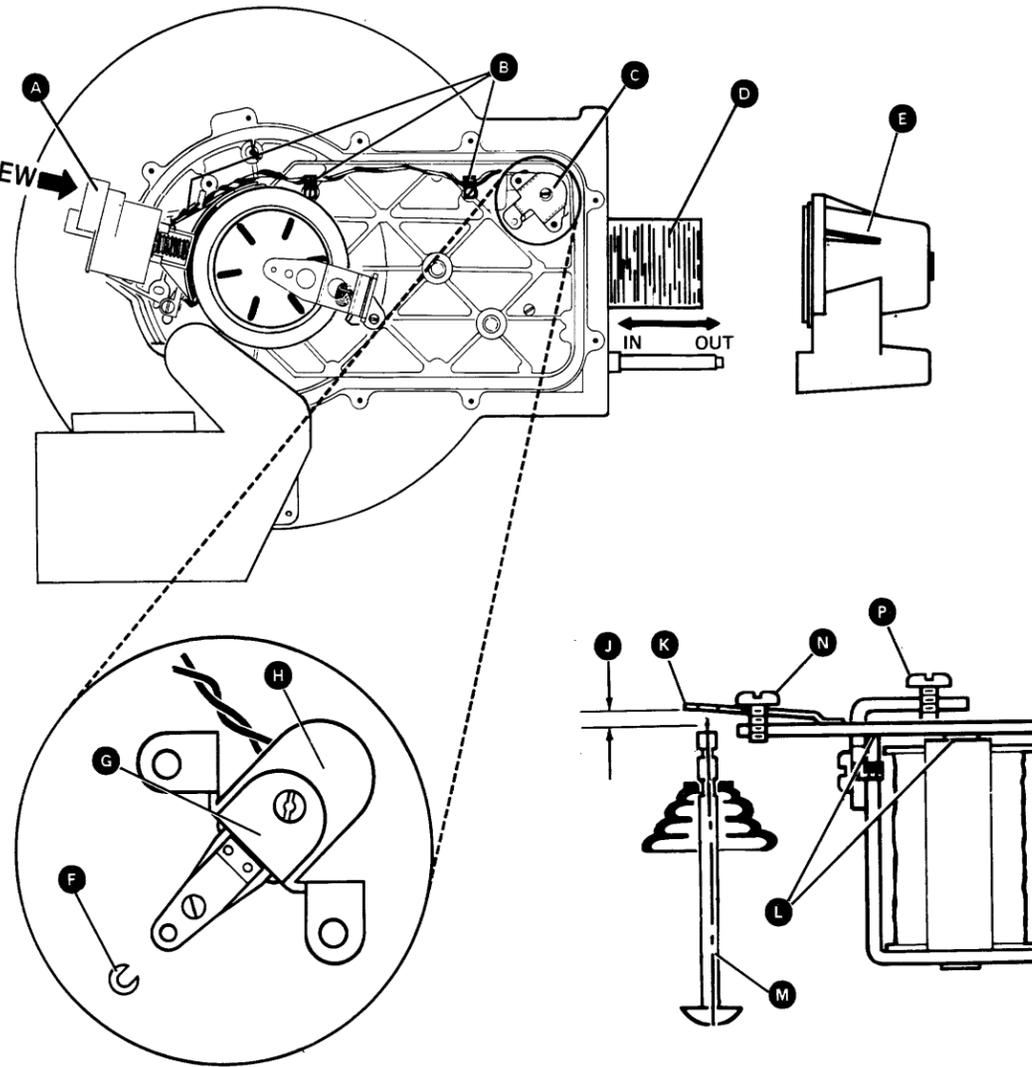
1. Perform the head/disk assembly removal (97-330); then return here.
2. Remove the voice coil shipping protector **E**.
3. Move the voice coil **D** outward until it stops.
4. Remove the two screws and the cover **C**.
5. Remove the C-clip **F** from the pin.
6. Ensure that the carriage is locked. (Use slight pressure on the voice coil, first in the outward direction and then in the inward direction.)
7. Adjust the carriage latch magnet as follows:
 - a. Turn the screw **P** clockwise until the armature touches **L**.
 - b. Adjust the screw **N** for a 0.08-millimeter (0.003-inch) gap **J** between the pin **M** and the armature **K**.
 - c. Turn the screw **P** counterclockwise two turns.
8. Install the C-clip on the pin.
9. Unlock the carriage by hand (press on the armature **H**) and move the voice coil inward approximately 13 millimeters (0.5 inch).
10. Remove the pressure from the armature, put slight pressure on the pin, and move the voice coil outward to lock the carriage.

11. Remove the pressure from the pin and ensure that the carriage is locked by attempting to move the voice coil inward.
12. If the carriage moves inward, return to step 7.
13. Install the cover **E** using the two screws.
14. Perform the head/disk assembly replacement (97-332).



Notes:

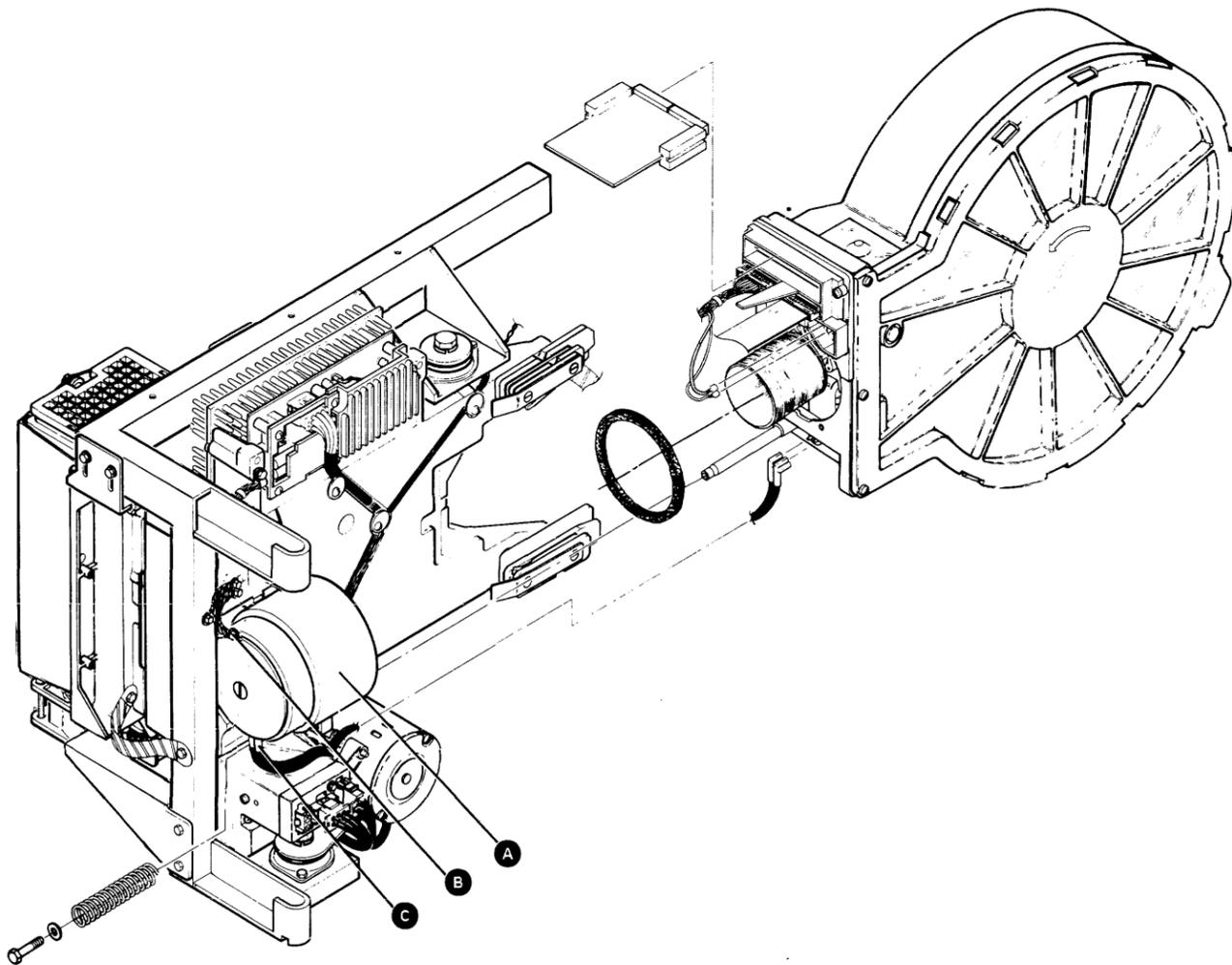
1. Terminals 1 and 2 are electrically the same.
2. Terminals 3 and 4 are electrically the same.
3. The cable path for the wires to the brake assembly is through a groove on the casting.
4. The cable path for the wires to the carriage latch magnet is through clamps on the HDA.



97-350 VCM Magnet Removal

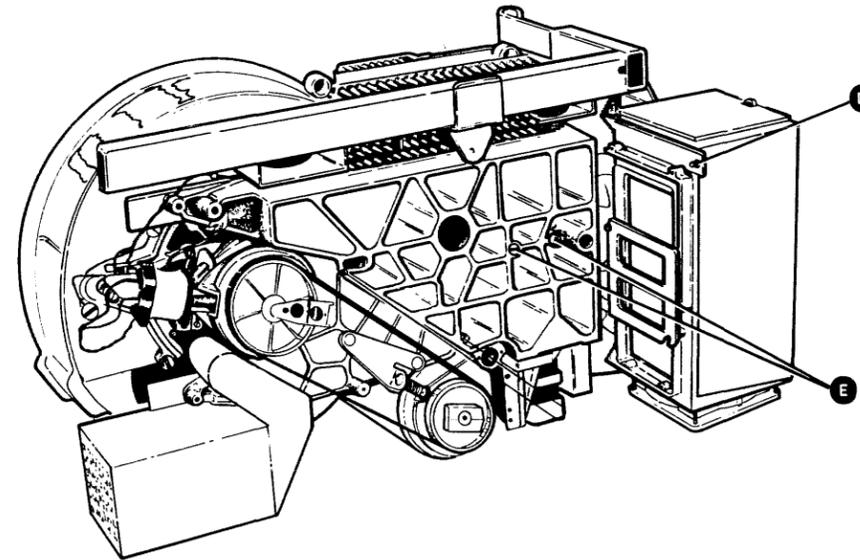
Note: You must have bill of material 4248945, which contains the supplies needed to perform this procedure and procedure 97-352, before starting this procedure.

1. Perform the head/disk assembly removal (97-330); then return here.
2. Remove the two screws and the plastic cover **C**, disconnect the two wires from the VCM magnet **A**, and remove the plastic insulator.
3. Remove the screw from the ground wire **B**.
4. Loosen the screw **D** and open the card gate.
5. Remove the two screws **E** and the VCM magnet **A**.



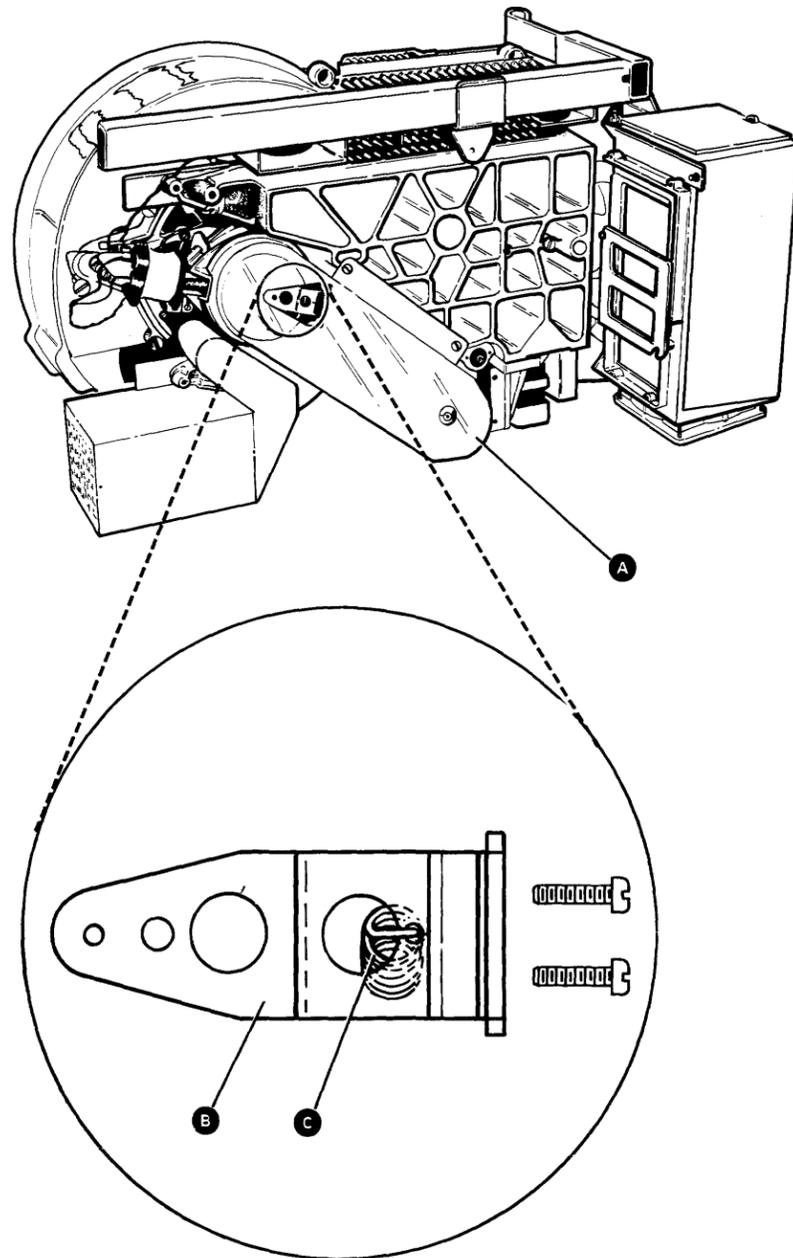
97-352 VCM Magnet Replacement

1. Place the VCM magnet **A** on the pin on the casting and use the two screws **E** to attach the VCM magnet.
2. Close the card gate and tighten the screw **D**.
3. Install the screw on the ground wire **B**.
4. Install the plastic insulator, connect the two wires to the VCM magnet, and install the plastic cover **C**.
5. Perform the head/disk assembly replacement (97-332).



**97-360
Antistatic Brush Removal**

1. Power off (01-115).
2. Remove the three screws and the belt guard **A**.
3. Disconnect the spring **C** from the antistatic brush **B**.
4. Loosen the two screws and remove the antistatic brush.



**97-362
Antistatic Brush Replacement**

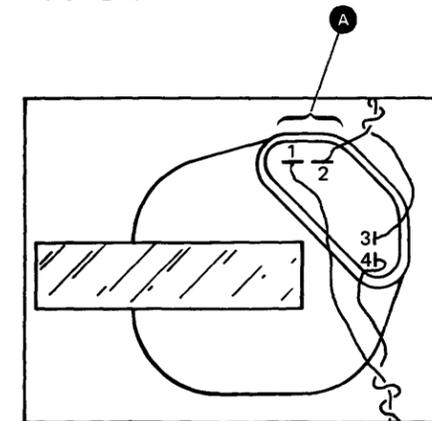
1. Power off (01-115).
 2. Install the antistatic brush **B**, ensure that the antistatic brush is squarely against the bracket, and tighten the two screws.
 3. Connect the spring **C** to the antistatic brush.
- Note:** Do not twist the spring when it is installed.
4. Replace the belt guard **A**.

**97-370
Filter Assembly Removal**

- Notes:**
1. You must have the new filter available before removing the old filter.
 2. You must have bill of material 5811809, which contains the supplies needed to perform this procedure and procedure 97-372, before starting this procedure.

CAUTION
Be careful not to contaminate any part of the HDA while performing this procedure. Any amount of dirt can cause one or more data heads to crash or can cause a loss of data.

1. Power off (01-115).
2. Thoroughly clean the area where the filter and the HDA meet. Use the brush and tack cloth supplied.
3. If the clamp **C** is installed, expand the clamp and slide it away from the HDA.
4. Remove the three screws and the filter **B** from the HDA.



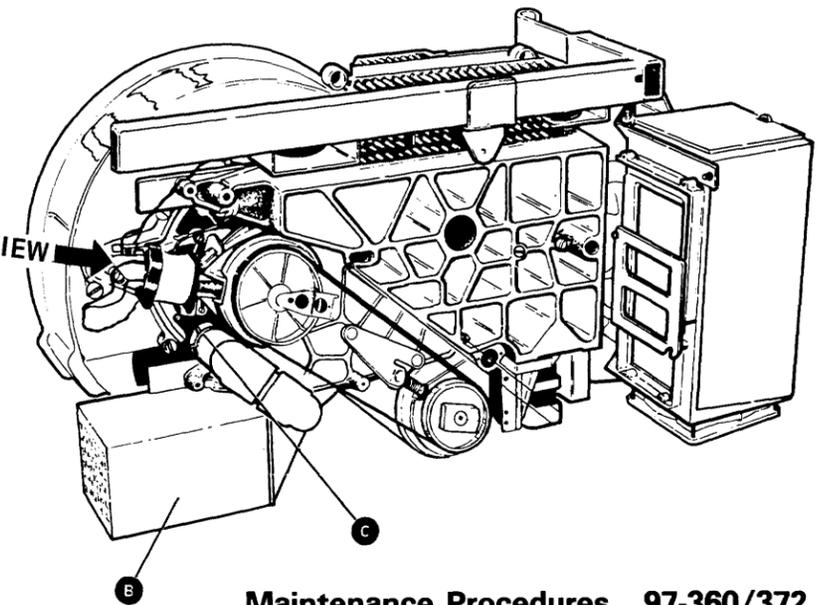
- Notes:**
1. Terminals 1 and 2 are electrically the same.
 2. Terminals 3 and 4 are electrically the same.
 3. The cable path for the wires to the brake assembly is through a groove on the casting.
 4. The cable path for the wires to the carriage latch magnet is through clamps on the HDA.

**97-372
Filter Assembly Replacement**

1. Power off (01-115).
2. Expand the clamp (supplied in bill of material 5811809) and slide it on the elbow on the new filter.

CAUTION
When installing the new filter, ensure that the elbow does not contact the brake drum surface.

3. Slide the filter on the HDA, and install the three screws.
4. Expand the clamp **C** and slide it toward the HDA.
5. Disconnect the wire from the wider terminal **A** that goes from the brake assembly to the carriage latch magnet. The cable path for the wires to the carriage latch magnet is through clamps on the HDA.
6. Power on (01-110) for 2 or 3 minutes to ensure that only filtered air is in the HDA before an access occurs.
7. Power off (01-115).
8. Connect the wire disconnected in step 5.



97-380 Brake Assembly Removal

1. Power off (01-115).
2. Disconnect the four wires from the brake assembly **B**.
3. Remove the two screws **G** and the brake assembly.

97-382 Brake Assembly Replacement

1. Place the brake assembly **B** on the pins **F** on the HDA and use the two screws **G** to attach the assembly. Do not tighten the screws.
2. Connect the four wires to the brake assembly.
3. Perform the brake assembly adjustment (97-386).

97-384 Brake Assembly Service Check 1

1. Power on (01-110).
2. Power off (01-115) and verify that the disk rotation stops in 15 seconds or less.
3. If the disk rotation stops in 15 seconds or less, the brake assembly adjustment is acceptable. If not, perform the brake assembly adjustment (97-386).

Note: If you have already adjusted the brake assembly and the disk rotation still does not stop in 15 seconds or less, exchange the brake assembly.

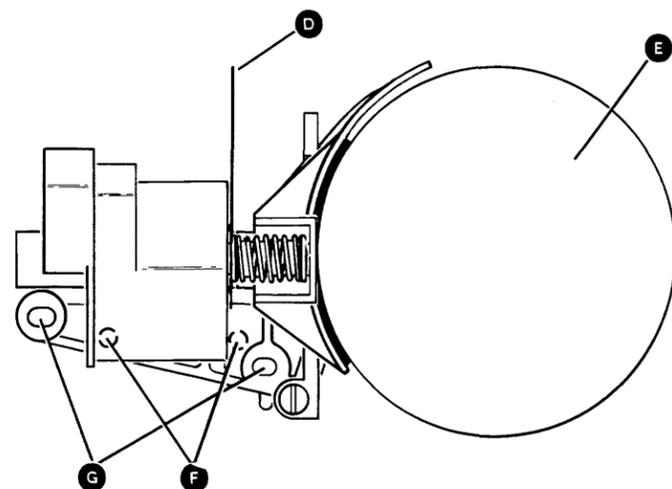
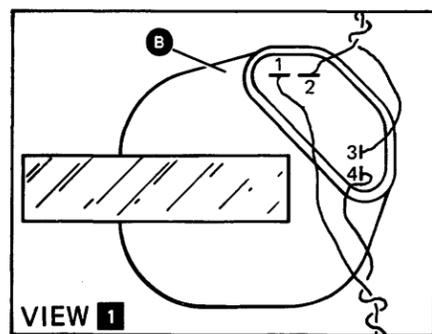
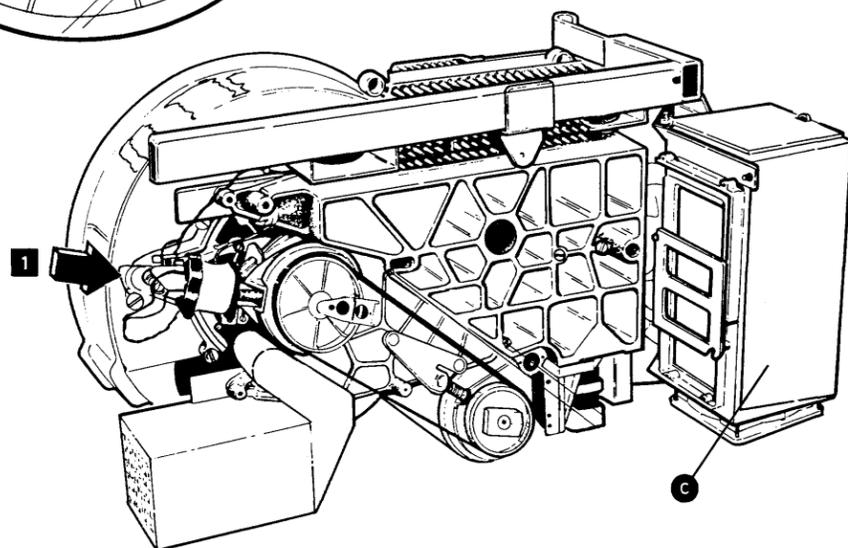
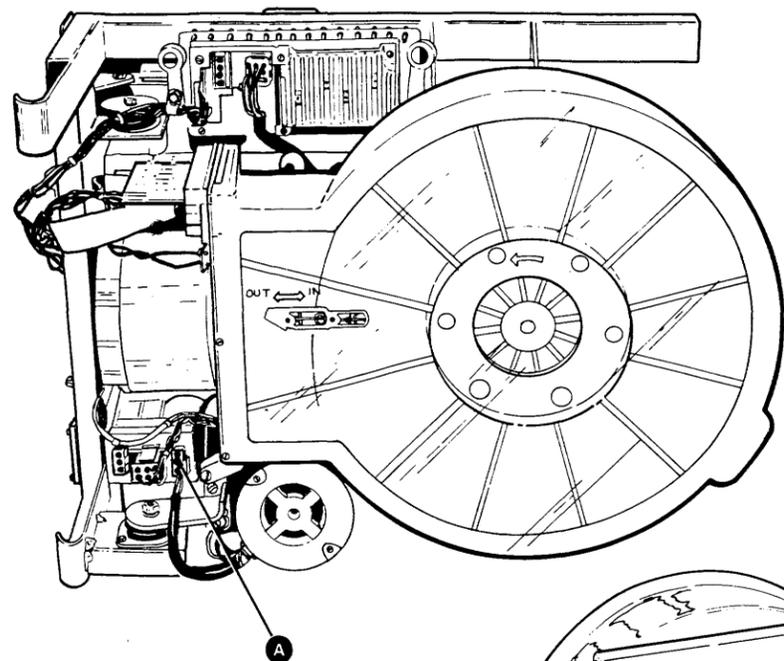
97-385 Brake Assembly Service Check 2

1. Power off (01-115).
2. Disconnect the drive motor power cable plug (J6) **A**.
3. Perform the drive belt removal (97-310); then return here.
4. Install a jumper on the disk drive card gate **C** from A1E5B04 to A1E5D08 (to keep voltage on the brake coil when the power is on).
5. Power on (01-110).
6. Turn the spindle pulley by hand.
7. If the spindle pulley turns freely, the brake assembly adjustment is acceptable. If not, perform the brake assembly adjustment (97-386).

Note: If you have already adjusted the brake assembly and the spindle pulley does not turn freely, exchange the brake assembly.
8. Power off (01-115).
9. Remove the jumper installed in step 4.
10. Connect the drive motor power cable plug (J6) **A**.
11. Perform the drive belt replacement (97-312).

97-386 Brake Assembly Adjustment

1. Power off (01-115).
2. Disconnect the drive motor power cable plug (J6) **A**.
3. Loosen the two screws **G**.
4. Install a jumper on the disk drive card gate **C** from A1E5B04 to A1E5D08 (to keep voltage on the brake coil when the power is on).
5. Place a 0.40-millimeter (0.015-inch) gauge **D** between the armature and the magnet core.
6. Power on (01-110).
7. Slide the brake against the brake drum **E** and tighten the two screws **G**.
8. Power off (01-115).
9. Remove the gauge.
10. Remove the jumper installed in step 4.
11. Connect the drive motor power cable plug (J6) **A**.
12. Perform brake assembly service check 1 (97-384).

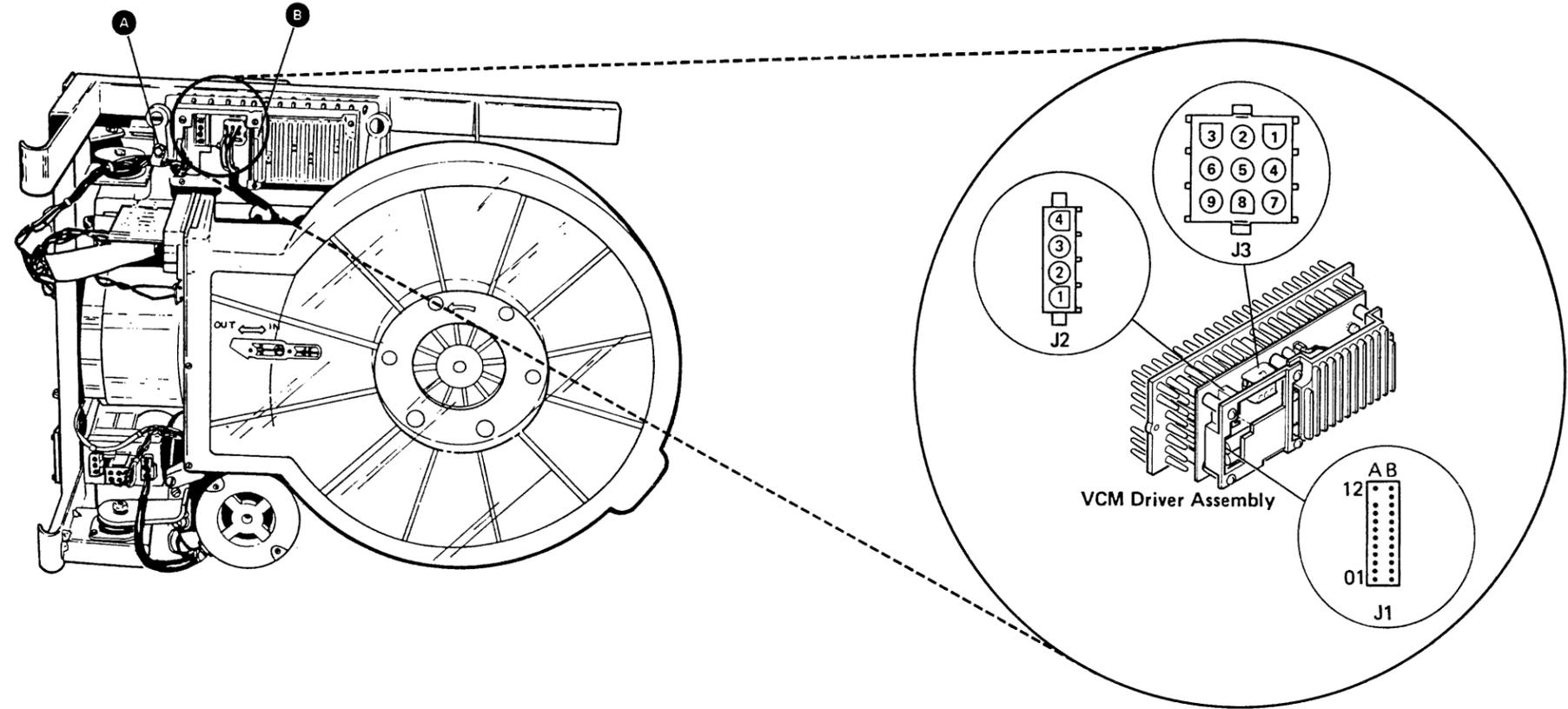


Notes:

1. Terminals 1 and 2 are electrically the same.
2. Terminals 3 and 4 are electrically the same.
3. The cable path for the wires to the brake assembly is through a groove on the casting.
4. The cable path for the wires to the carriage latch magnet is through clamps on the HDA.

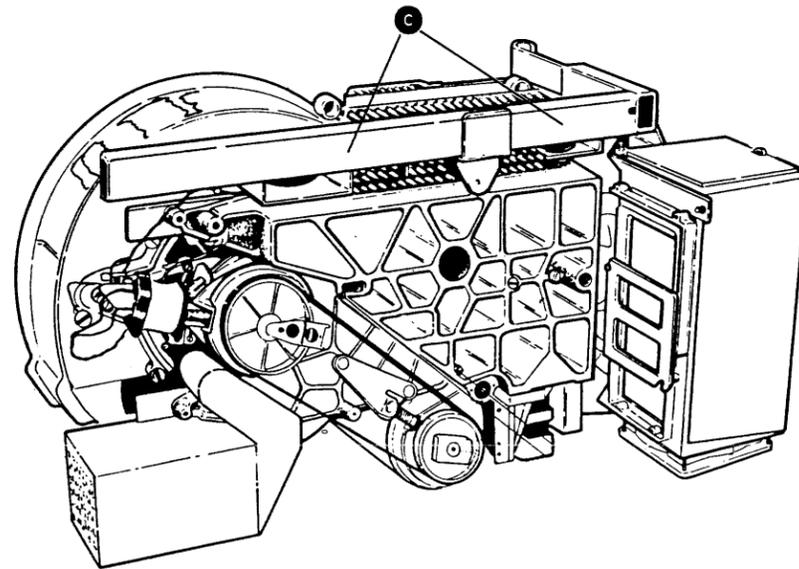
**97-390
VCM Driver Assembly Removal**

1. Power off (01-115).
2. Remove the screw from the cable clamp **A**.
3. Disconnect the three connectors (J1, J2, and J3) from the VCM driver assembly **B**.
4. Remove the two screws **C** and the VCM driver assembly.



**97-392
VCM Driver Assembly Replacement**

1. Install the VCM driver assembly **B**, using the two screws **C**.
2. Connect the three connectors (J1, J2, and J3) to the VCM driver assembly.
3. Install the screw in the cable clamp **A**.



97-400 Upper Shock Mount Removal

CAUTION

Do not remove more than one shock mount at a time unless the HDA has been removed.

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-
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1. Power off (01-115).
 2. Remove the two screws that attach the shock mount **B** to the frame.
 3. Remove the bolt **A** and the shock mount from the casting.

97-402 Upper Shock Mount Replacement

1. Install the shock mount **B** to the casting, using the bolt **A**. Do not tighten the bolt.
2. Install the two screws that attach the shock mount to the frame.
3. Tighten the bolt **A**.

97-404 Lower Shock Mount Removal

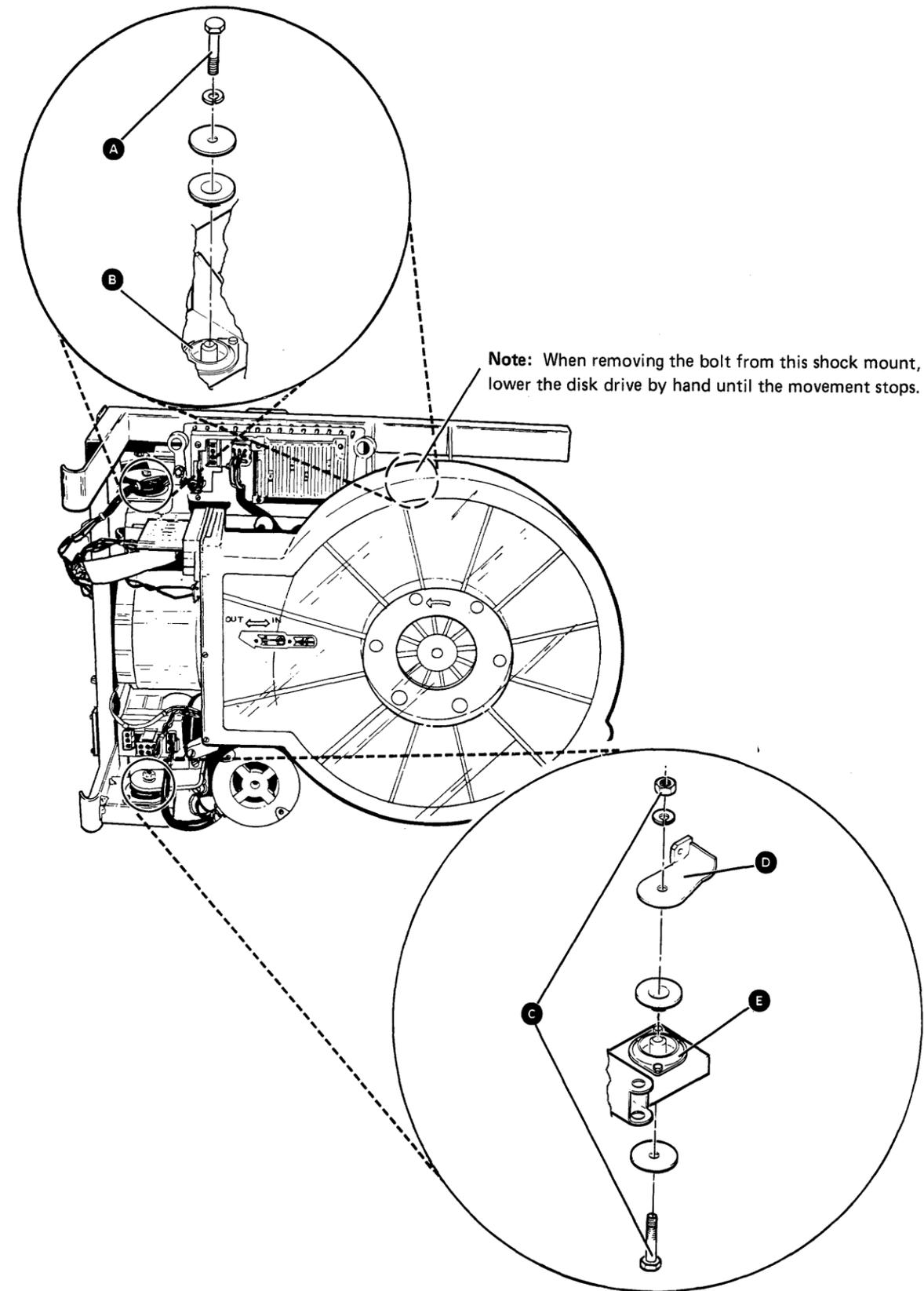
CAUTION

Do not remove more than one shock mount at a time unless the HDA has been removed.

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1. Power off (01-115).
 2. Perform the power control assembly removal (97-410) and return here.
 3. Remove the nut and the bolt **C** that attach the shock mount **E** to the bracket **D**.
 4. Remove the two screws that attach the shock mount to the frame. Pull the bottom of the disk drive forward to remove the rear screw.
 5. Pull the bottom of the disk drive forward and remove the shock mount.

97-406 Lower Shock Mount Replacement

1. Pull the bottom of the disk drive forward and install the shock mount **E** to the frame, using the two screws.
2. Install the bolt and the nut **C** that attach the shock mount to the bracket **D**.
3. Perform the power control assembly replacement (97-412).

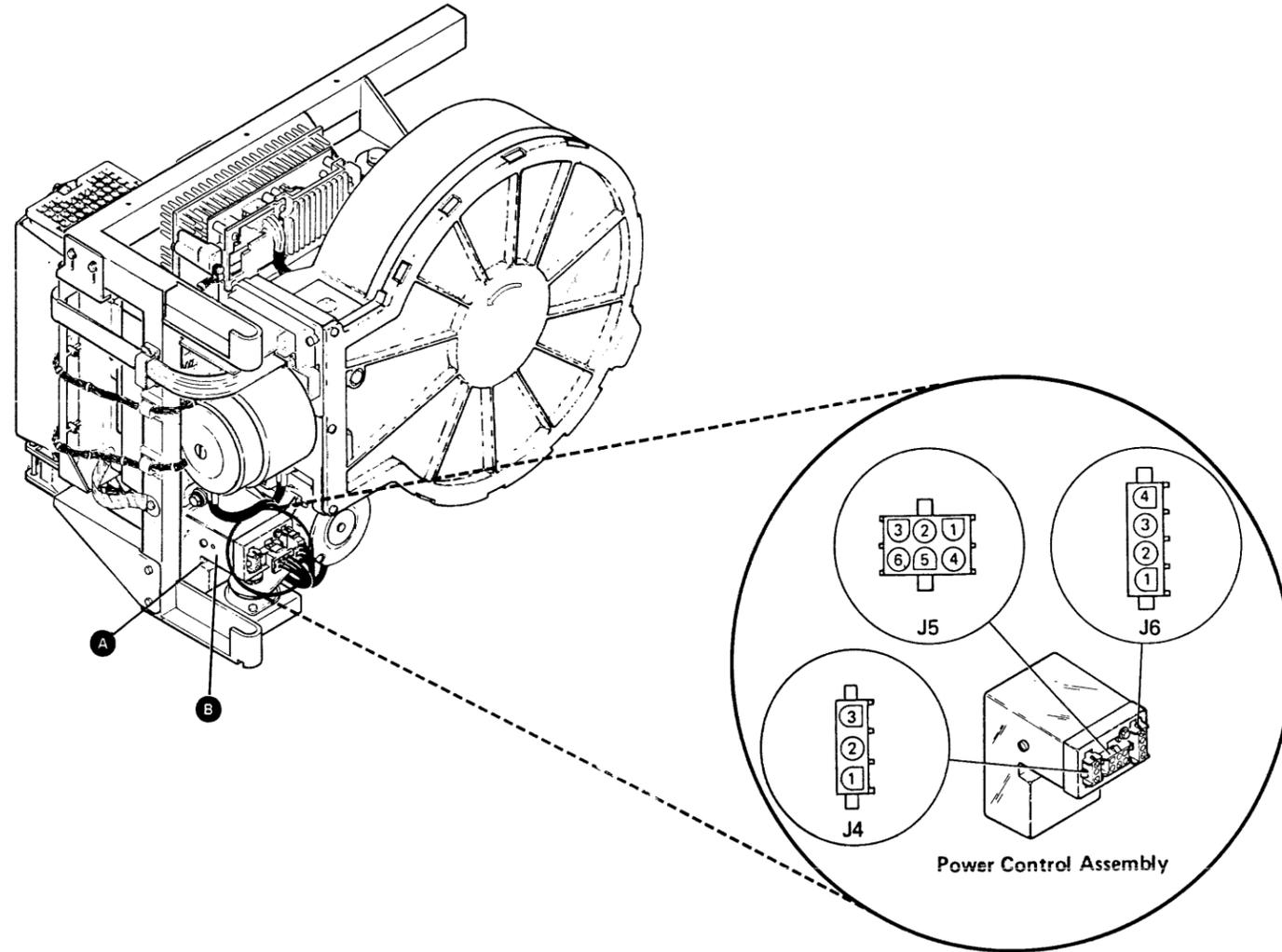


97-410
Power Control Assembly Removal

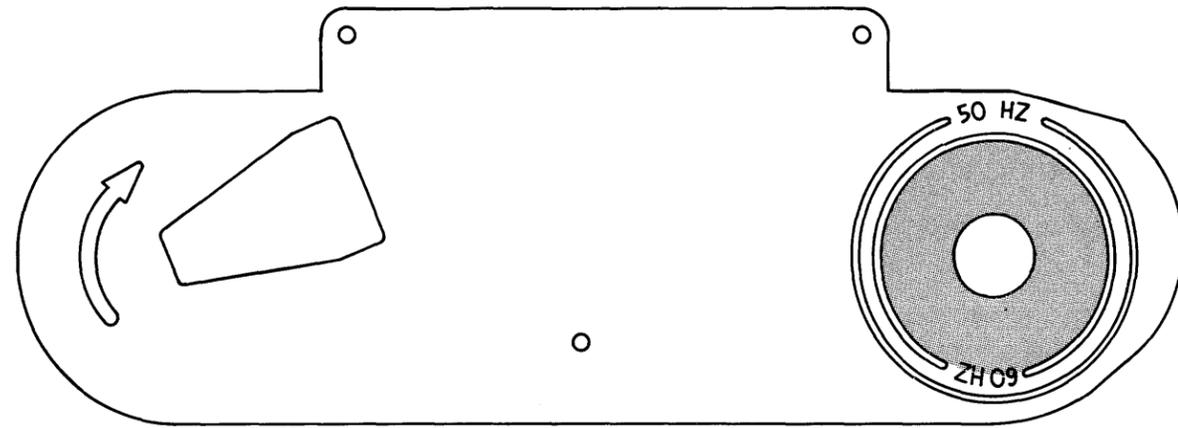
1. Power off (01-115).
2. Remove the three connectors (J4, J5, and J6) from the power control assembly **B**.
3. Remove the two screws **A** that attach the power control assembly to the casting.

97-412
Power Control Assembly Replacement

1. Install the two screws **A** that attach the power control assembly to the casting.
2. Connect the three connectors (J4, J5 and J6) to the power control assembly **B**.

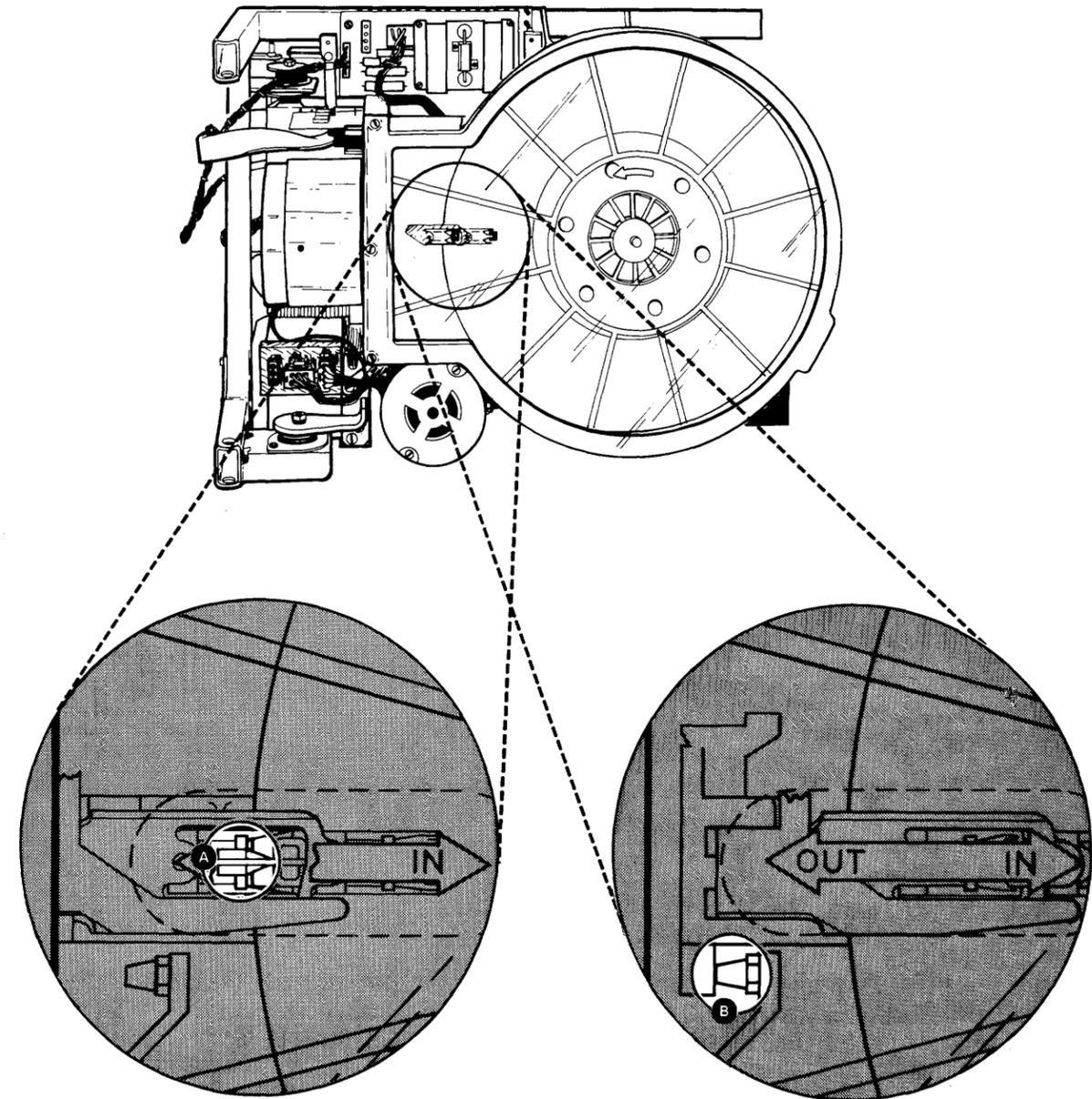


97-420
Drive Motor Pulley Service Check



A pulley for a 60-Hz drive motor is shown.

97-422
Head Carriage Location Service Check

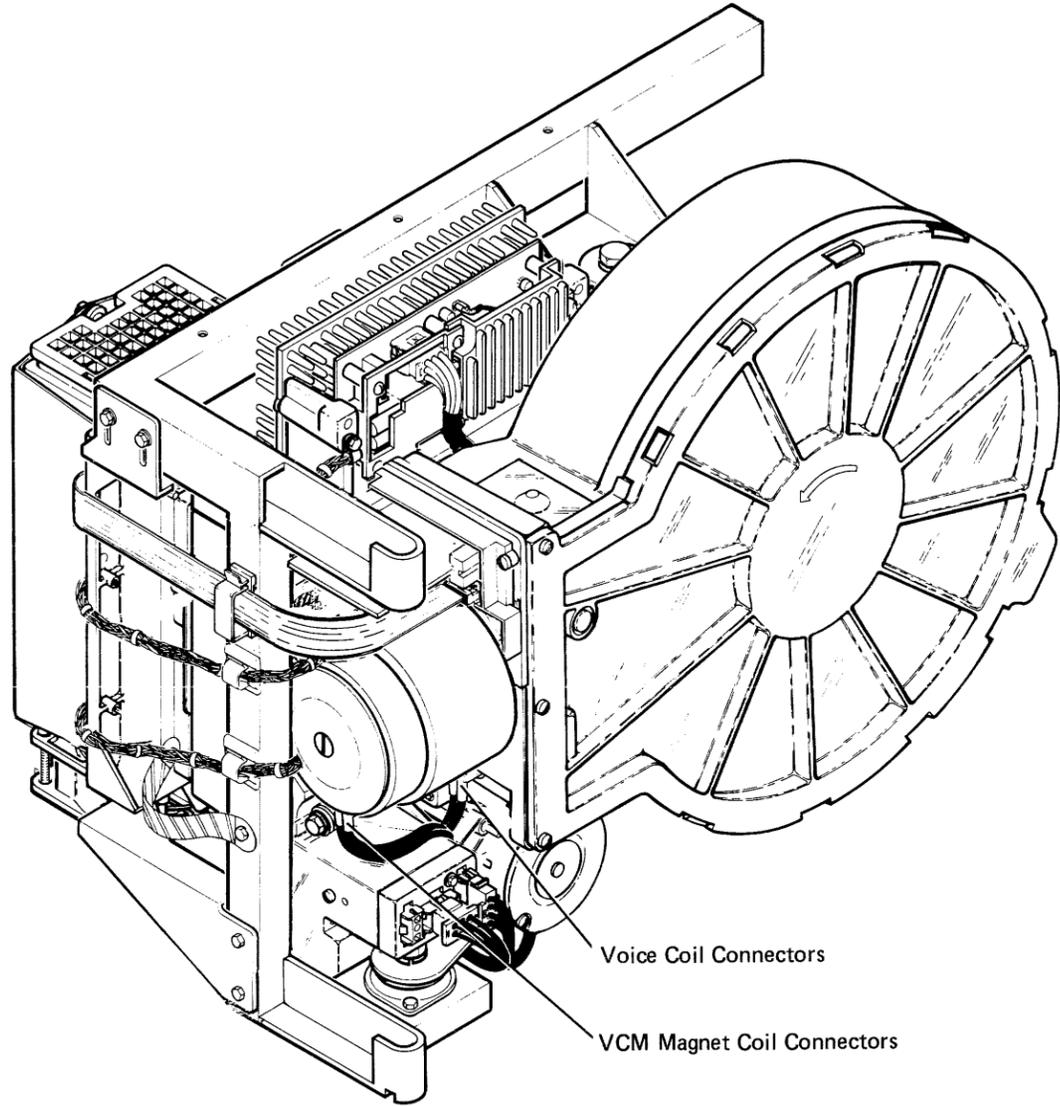


Carriage Location at Outer Stop

When the carriage is at the outer stop, the shiny metal bar is slightly beyond the disk as shown at **A**.

Carriage Location at Inner Stop

When the carriage is at the inner stop, the carriage touches the stop as shown at **B**.



DIAGNOSTIC INFORMATION

97-450 MDI Good Machine Path

The 10SR disk drive and adapter test units (TUs) are divided into three groups. Each group has an MDI (MA301, MA302, or MA330) that loads each TU. The following table shows the sequence of the MDIs and the sequence in which the TUs are run.

If an error occurs in the 10SR disk drive or adapter circuits, a system reference code is displayed on the system console. For information on a specific system reference code, see MAP 0114 or MAP 0116. For information on how to run MDIs, see 01-710.

MDI	Description	TU Sequence
1 MA301	Tests the adapter circuits and registers	TA300 TA301 TA302 TA303 TA304 TA305 TA306 TA307 TA308
2 MA302	Tests the control bus and control circuits	TA312 TA313 TA314 TA311 TA315 TA316

MDI	Description	TU Sequence
3 MA330	Tests the circuits and hardware of the disk drive	TA321 TA320 (run twice) TA322 TA330 TA331 TA332 TA333 TA334 TA335 TA336 TA340 TA343 TA344 TA345 TA346 TA361 TA353 TA323 TA352 TA364 TA376 TA324 TA329 TA321 TA3A0 TA3A1 TA3A2

MDI	Description	TU Sequence
3 MA330 (continued)	Tests the circuits and hardware of the disk drive	TA3A3 TA3A4 TA3A5 TA3A6 TA3A7 TA3A8 TA3A9 TA3AA TA3AB TA3AC TA3AD TA365 TA363 TA348 TA3C0 TA3C1 TA3C2 TA3C3 TA3C4 TA3C5 TA3C6 TA3C7 TA3C8 TA3C9 TA3CA TA3CB TA3CC TA3CD

**97-455
IPL Good Machine Path**

The following table shows the sequence of the test units (TUs) that are run during an IPL. If an error occurs in the 10SR disk drive or adapter circuits, a system reference code is displayed on the system console. For information on a specific system reference code, see MAP 0116.

TU Sequence	Function
TA301 TA306	Tests the adapter circuits and registers
TA321 TA332 TA333 TA323 TA364 TA363 TA352 TA3BD	Tests the circuits and hardware of the disk drive

**97-460
System Test**

System test lets you test the disk drive with all other I/O devices in a mode similar to running customer programs. This method of testing the disk drive can find failures that may not occur when testing a single device.

System test is run under SSP, but must be run on a dedicated system (no customer jobs running). Errors that occur during system test can be displayed or printed. See 01-720 for information on how to run system test and how to display the results.

**97-465
Pack Utility Maintenance Program**

The pack utility maintenance program (PUMP) has the following disk options under dedicated DCP:

- Analyze disk
- Initialize disk
- Sector recover

See 01-730 for information on how to run PUMP.

Analyze Disk

There are two analyze disk options:

- Full disk analyze
- Fast analyze

The full disk analyze option verifies that all sector IDs can be read and that they are in their correct location. This option also verifies that all logical sectors can be read.

The fast analyze option verifies that all logical sectors can be read. This option does not verify that the sector IDs are in their correct location.

Initialize Disk

The initialize disk option writes all sector IDs and all data fields. Zeros are written in the data fields. If errors are sensed during the write operation, an alternative sector is assigned.

Sector Recover

The sector recover option lets you attempt to:

- Recover data from a sector with either ECC errors or no-record-found errors. (An alternative sector can be assigned for any logical sector.)
- Set the defective sector bit in the flag of a sector.

**97-470
Disk Exerciser**

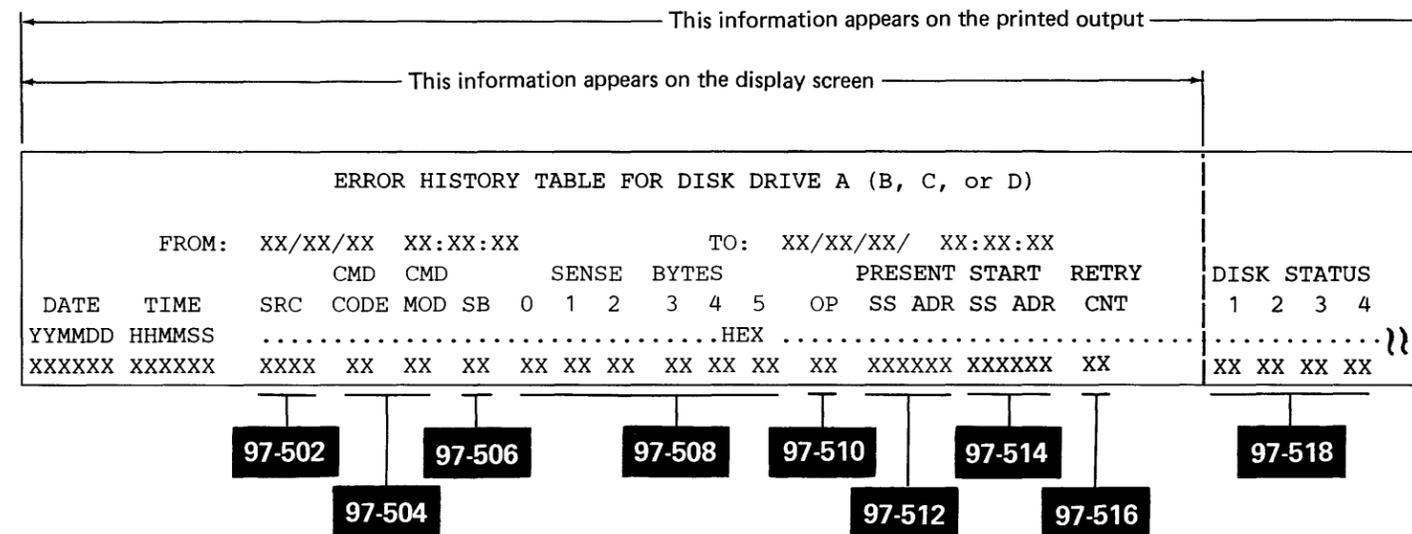
The disk exerciser program lets you select commands from menus for free-lance troubleshooting. Errors that occur during the disk exerciser can be displayed or printed. For a description of the error bytes, use the Help key. See 01-735 for information on how to run the disk exerciser.

HOW TO INTERPRET ERAP REPORTS

See 01-360 for information on how to run ERAP.

97-500 Error History Table

The error history table includes a series of fixed-length entries, with each entry representing an error on the 10SR disk drive, the 10SR adapter, or the data storage attachment. The entries are made in the table so that the latest error is first in the table. The following is an example of a 10SR error history table.



97-502 System Reference Code

The system reference code is a number generated by the 10SR error recovery procedures and passed to the system. For information on a specific system reference code, see MAP 0114 or MAP 0116.

97-504 Command Code and Command Modifier

The command and its modifier identify the disk drive selected and the command executed when the error occurred.

CMD CODE	CMD MOD							Command	
	0	1	2	3	4	5	6		7
XX	X X							Command	
X'0	0	0	0	0	0	0	0	0	Seek
	0	0	0	0	0	0	0	1	Recalibrate
X'1	*	*	0	*	*	*	0	0	Read data
	*	*	0	*	*	0	0	1	Read verify
	0	0	0	0	0	*	1	0	Read diagnostic
	0	0	0	0	0	*	1	1	Read ID
X'2	↓	0	0	*	0	*	0	0	Write data
	0	0	0	*	0	*	1	1	Write format
X'3	0	0	0	0	0	*	0	0	Scan equal
	0	0	0	0	0	*	0	1	Scan low or equal
	0	0	0	0	0	*	1	0	Scan high or equal
	0	0	0	0	0	*	1	1	Scan ID

¹A = Drive A
B = Drive B
C = Drive C
D = Drive D

* See the following chart for bit meanings.
↓ The same 256-byte field is written for the complete write data operation.

Bit	Description
0	Move the data head off track toward home (offset in)
1	Move the data head off track away from home (offset out)
2	Select data storage controller storage
3	Invert the data ECC
4	Use ECC correction
5	Select the control storage address

**97-506
Sense Byte Summary**

The sense byte summary contains the following information, which is used by the 10SR disk drive error recovery procedures when the error code is generated.

Bit	Description
0	A permanent ECC check occurred
1	A permanent no record found occurred
2	Not used
3	A temporary error occurred
4	A hardware error occurred (it could not be recovered from)
5	Not used
6	The ECC field was inverted
7	An error occurred, and ECC corrected it

**97-508
Sense Bytes**

The sense bytes contain status information about the disk drive, disk adapter, and data storage attachment when the error occurred.

Sense Byte 0

Bit	Description
0	Disk Busy The data storage attachment is performing an operation.
1	No Buffer/ATR Available The operation could not be completed because either a DSA buffer or an MSP ATR was not available.
2	DSA Buffer 1 in Use Buffer 1 in the DSA is being used.
3	DSA Buffer 2 in Use Buffer 2 in the DSA is being used.
4	DSA Buffer Loaded The DSA buffer has been loaded for a scan or write data repeat operation.
5	More Data to Transfer Additional data must be moved to complete the present operation.
6	Alternative Sector Processing Active The microcode is searching for an assigned alternative sector.
7	ERP in Progress A procedure to recover from an error is being performed.

Sense Byte 1

Bit	Description
0	Interrupt Time-out The internal data storage attachment timer is on or was set on, or the internal data storage attachment timer has not been reset for 16 to 24 seconds. Temporary interrupt time-out errors can be caused by the system termination utility (01-125).
1	Cycle Steal Address Check The wrong number of data bytes was moved between the system and a storage device during a data operation. Sensed by microcode.
2	Command Parity Check The data storage attachment sensed even parity on the DBO lines from the channel (command operation) or even parity on the data bus from a storage device (sense operation).
3	Cycle Steal Parity Error The data storage attachment sensed even parity on the DBI and DBO lines between the channel and the buffer.
4	DSA Buffer Write Check The DSA sensed an error while the buffer was being loaded for a scan or write data repeat operation.
5	Interface Time-out The storage device adapter card did not complete a sense or command operation in time. Sensed by microcode.
6	Data Unsafe ERP A procedure to recover from a data unsafe error is being performed.
7	Reserved

Sense Byte 2

Bit	Description
0	DSA Data Bus Parity Error Even parity was sensed by the data storage attachment on the DSA data bus.
1	Data Overrun Check The data rate was not maintained during a cycle steal operation.
2	Not used
3	Storage Device End Op The last byte of data on the data bus has been moved to or from the buffer in the data storage attachment.
4	Channel End Op The last byte of data on the DBI and DBO lines has been moved to or from the buffer in the data storage attachment.
5	Scan Equal When scan hit is also on, the scan hit was equal.
6	Scan Hit A scan hit occurred.
7	Scan Low The scan hit was low.

Sense Byte 3

Bit	Description
0	Head Offset The disk drive has received a head offset command from the system.
1	Brake Engaged The disk drive has removed the AC voltage from the disk drive motor and the DC voltage from the brake coil because of one of the following: <ul style="list-style-type: none"> • The disk drive speed is slow because of: <ul style="list-style-type: none"> – A drag on the brake – A loss of AC power – A broken belt • Servo problems are indicated by: <ul style="list-style-type: none"> – A long PLO-out-of-sync condition – A stopped voltage-controlled oscillator
2	Command Reject The disk drive was instructed to do the following: <ul style="list-style-type: none"> • Seek beyond cylinder 571 (Model 1 only) • Select head 14 or 15 • Use head offset (in) at the same time as head offset (out) • Seek while in a head offset condition • Seek when read or write is active
3	Command Error The disk drive has sensed a control bus or tag bus parity error or an illegal tag code.

Sense Byte 3

Bit	Description
4	Data Unsafe The disk drive has inhibited the write gate and deactivated all AE module select lines because a condition that could lead to lost data was sensed. The following conditions set this bit: <ul style="list-style-type: none"> • Write and read active at the same time • Write and head offset active at the same time • Write and servo off track active at the same time • Write and not ready active at the same time • Write active on cylinder 571 (Model 1) or cylinder 1023 (Model 2) • Write active during a sector pulse • An arm electronics module select error • Wrong encoding of write data • Failure to write a correct sync field pattern in the first gap following an index or sector pulse
5	Device Busy The disk drive has an access, recalibrate, head offset, head select, or DC reset operation in process.
6	Home The disk drive has completed a correct power-on sequence, DC reset, or recalibrate operation. The data heads are located at cylinder 0 with head 0 selected.
7	Disk Not Ready The disk drive has sensed one or more of the following: <ul style="list-style-type: none"> • The 'power good' line is not active • A servo error such as: <ul style="list-style-type: none"> – A disk speed or VCO check – A PLO-out-of-sync condition – A seek time-out – A servo off-track check – An unexpected guard-band check • A loose card or cable in the disk drive • A pulse on the 'device DC reset' line to the disk drive with the 'control sample' line active

Sense Byte 4

Bit	Description
0	Field Parity Error The adapter card sensed odd parity on the data record and ECC fields.
1	Data Cycle Parity Error The adapter card sensed bad parity on the data received from the system.
2	Sector Check Either an extra sector pulse was sensed or a sector pulse was missing (not used during ID scan operations).
3	Sync Not Found Check A sync byte was not sensed when one was expected.
4	CRC/ECC Check Indicates: <ul style="list-style-type: none"> • A CRC check in the ID field on a read ID or scan read ID command • An ECC check in a data record • A data record with an inverted ECC was read when expecting a normal ECC • A data record with a normal ECC was read when expecting an inverted ECC
5	Disk Format Check A sector pulse occurred while a sector was being read or written.
6	Data Cycle Underrun Check The data storage attachment did not respond to all requests on the 'xxx req data xfr' line ¹ from the adapter card.
7	Data Cycle Overrun Check The 'xxx xfr ready' line ¹ from the data storage attachment was not active for the complete period while the adapter card was transferring data.

¹The real line name includes disk A, disk B, disk C, or disk D. The active line determines the drive transferring the data.

Sense Byte 5

Bit	Description
0	Command Cycle Parity Check The adapter card sensed bad parity in the control block bytes received from the data storage attachment.
1	Cable Continuity Error One or more of the 10SR disk cables are loose.
2	No Record Found Check The needed sector was not found in two disk revolutions.
3	Disk Access Time-out A command did not complete in the expected time.
4	Disk Write Data Check Write current was not sensed when the 'write gate' line was active.
5	No Control Sample Received The access control card did not activate the 'control sample returned' line after the adapter card activated the 'control sample' line.
6	Disk Sense Parity Check The adapter card sensed bad parity on the control/tag bus cable.
7	Disk Interrupt Error The 'xxx interrupt' line ¹ from the disk drive was not reset by the sense command.

¹The real line name includes disk A, disk B, disk C, or disk D. The active line determines the drive requesting the interrupt.

97-510 Operation Flag

The operation flag is used by the disk IOCH (input/output control handler).

97-512 Present Sequential Sector Address

The present sequential sector address contains the relative sequential sector address (from the start of the drive) of the sector being used when the error occurred.

The present sequential sector address contains 000000 when the following commands are executed:

- Seek
- Recalibrate
- Read ID
- Write format
- Scan ID

97-514 Starting Sequential Sector Address

The starting sequential sector address contains the relative sequential sector address (from the start of the drive) of the sector that was used before the present sector.

97-516 Retry Count

The retry count contains the number of times the operation in error was attempted.

97-518 Disk Status

The disk status bytes contain additional status information about the disk drive when the error occurred. This information is used by the MDIs.

Disk Status Byte 1

Bit(s)	Description
0-2	These bits indicate the following servo interrupt conditions: 0 1 2 0 0 0 System service request (not an error) 0 0 1 Guard band 2 0 1 0 Servo off track 0 1 1 Unexpected guard band 1 0 0 Seek time-out 1 0 1 Disk speed/VCO check 1 1 0 PLO out of sync 1 1 1 (not) power good
3	On track
4	Guard band
5, 6	In drive and out drive: These bits control the seek operation as follows: 5 6 0 0 On track or at outer stop 0 1 Move outward 1 0 Move inward 1 1 Not used
7	Disk interrupt

Disk Status Byte 2

Bit(s)	Description
0	Odd track
1	Access reset
2	Depress profile
3	Accelerate
4-6	Not used
7	Retract

Disk Status Byte 3

Bit(s)	Description
0-2	These bits indicate the following data unsafe errors: 0 1 2 0 0 0 Write and not ready both active 0 0 1 Write and servo off track 0 1 0 Write active and not in data field 0 1 1 Write and read active at the same time, write and head offset active at the same time, or write active either on cylinder 571 (Model 1) or on cylinder 1023 (Model 2)
	1 0 0 AE unsafe without an AE selected 1 0 1 Write active and AE select error 1 1 0 Write not active and AE unsafe with an AE selected 1 1 1 Write active and AE unsafe
3	Data converter wrap error
4	Write data interface check
5	Not used
6	Sector counter error
7	Card/cable not seated

Disk Status Byte 4

Bit(s)	Description
0-7	Reserved

**97-520
Error Counter Table**

The error counter table includes a series of counters, with each counter assigned to collect a specific type of error on the 10SR disk drive and adapter. Both temporary and permanent errors are collected.

The following chart lists the errors as they appear in the error counter table. The chart also shows the sense bit that is set for each error.

Error Counter Table for Disk Drive A (B, C, or D)

Error	Sense	
	Byte	Bit
Interrupt time-out checks	1	0
Cycle steal address checks	1	1
Command parity checks	1	2
Cycle steal parity checks	1	3
DSA buffer write checks	1	4
Interface time-out check	1	5
DSA data bus parity checks	2	0
Data overrun checks	2	1
Data cycle parity checks	4	1
Sector checks	4	2
Sync not found checks	4	3
CRC/ECC checks	4	4
Disk format checks	4	5
Data cycle underrun checks	4	6
Data cycle overrun checks	4	7
Brake engaged checks	3	1
Command reject checks	3	2
Command error checks	3	3
Data unsafe checks	3	4
Disk not ready checks	3	7
Disk write data checks	5	4
Cable continuity checks	5	1
No records found checks	5	2
Command cycle parity checks	5	0
Disk access time-out checks	5	3
No control sample received checks	5	5
Disk sense parity checks	5	6
Disk interrupt checks	5	7

**97-522
I/O Counter Table**

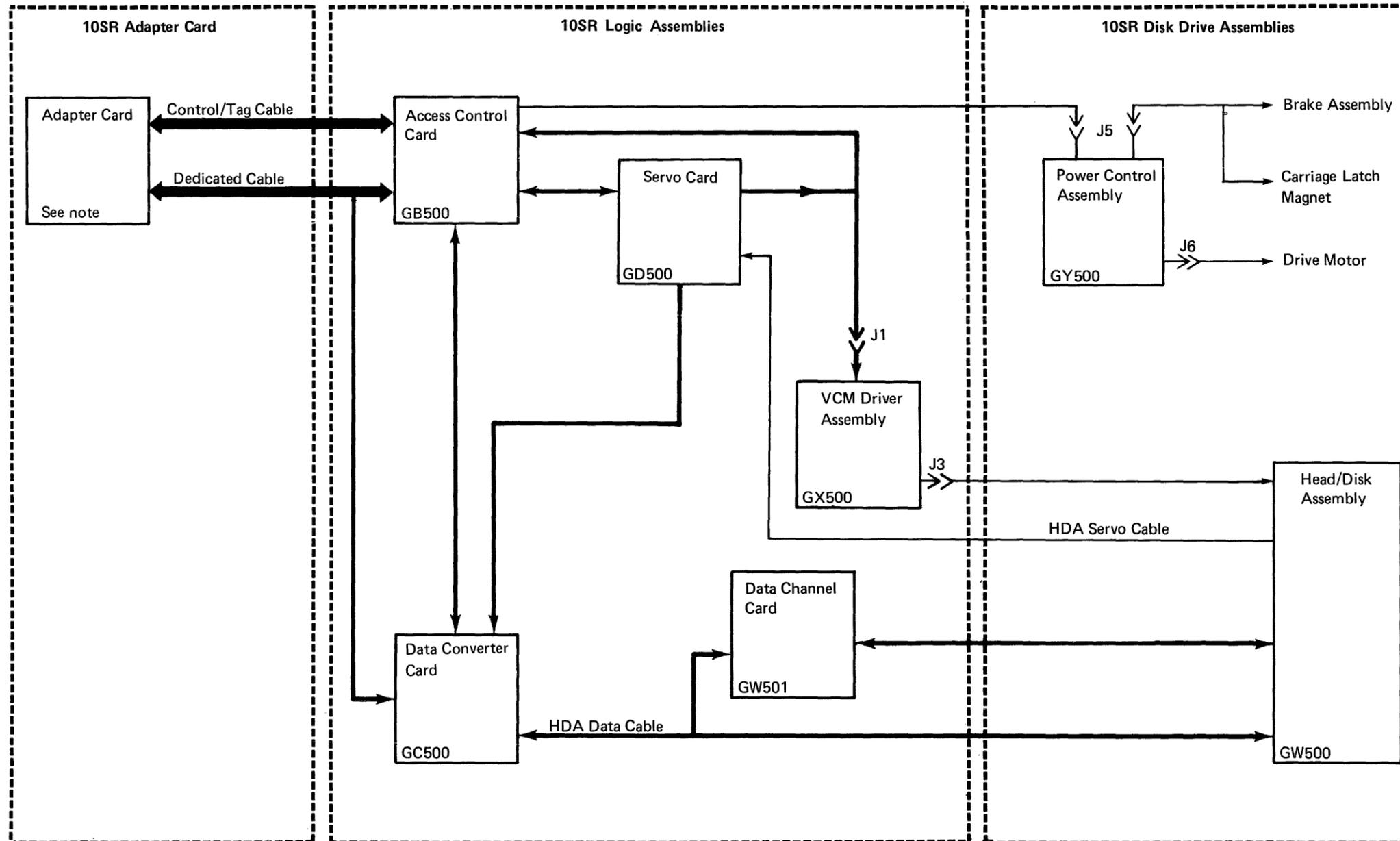
The I/O counter table includes a series of counters, with each counter assigned to collect the following statistics about each 10SR disk drive:

- The number of read operations
- The number of write operations
- The number of scan read operations
- The number of long access operations (seeking across more than 1/3 of the cylinders)
- The number of short access operations (seeking across less than 1/3 of the cylinders)

FRU Descriptions

97-600 Data Flow

Use the following figure for reference when using the FRU description paragraphs.



Note:

FC200 for drive A
FD200 for drive B
FC220 for drive C
FD220 for drive D

97-605 10SR Adapter Card

The adapter card:

- Decodes commands from the data storage attachment
- Controls the lines in the dedicated and control/tag cables
- Controls access operations
- Serializes and deserializes data
- Generates and tests CRC and ECC characters
- Supplies error correction, using the ECC characters

97-610 10SR Logic Assemblies

Access Control Card

The access control card:

- Executes the commands received from the adapter card
- Determines the number of tracks and the direction of an access operation
- Supplies diagnostic and sense information

Data Converter Card

The data converter card:

- Encodes the serial data to RLL code (97-910)
- Decodes the RLL code to serial data (97-910)
- Generates the read clock

Servo Card

The servo card:

- Controls the voice coil motor (VCM) during the access operations and track follow operations

Data Channel Card

The data channel card:

- Supplies the write current to the data heads on write operations
- Increases the amplitude and converts (from analog to digital) the signals from the data head on read operations

VCM Driver Assembly

The VCM driver assembly controls the current through the VCM as instructed by the servo card.

97-615 10SR Disk Drive Assemblies

Power Control Assembly

The power control assembly controls the AC voltage to the drive motor and the DC voltage to the brake and carriage latch assemblies.

Drive Motor

The drive motor quickly drives the disk to operating speed.

Carriage Latch Magnet

The carriage latch magnet keeps the head carriage locked until DC voltage is supplied by the power control assembly.

Brake Assembly

The brake assembly stops the disk in 15 seconds or less when power is removed.

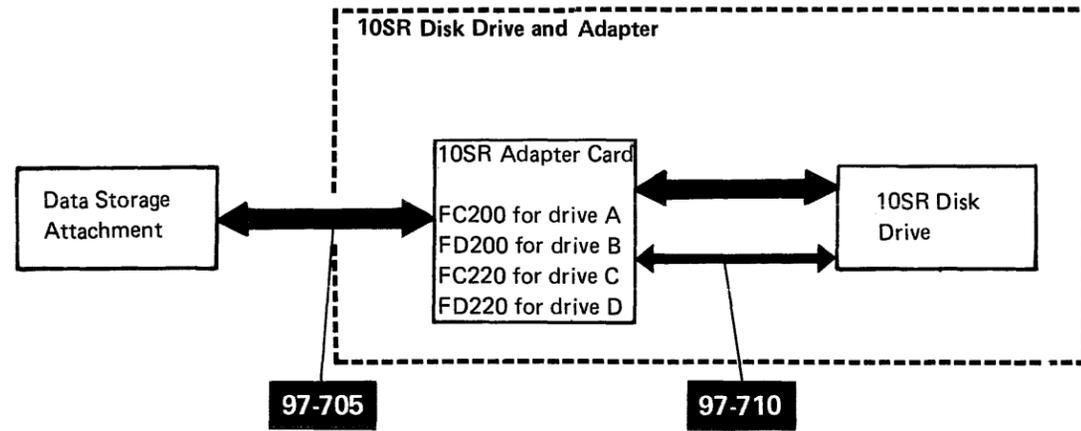
Head/Disk Assembly

The head/disk assembly includes the disks, the data heads, the servo head, and the voice coil. The data heads read and write information from and to the surface of the disks.

Interface Descriptions

97-700 Interface Locations

The following figure shows the interfaces used by the 10SR disk drive and adapter and where you can find a description of each interface.



97-705 Data Storage Attachment Interface Lines

For a description of these lines, see 90-720.

**97-710
10SR Interface Lines**

The lines between the 10SR adapter card and the 10SR disk drive are in two cables: the dedicated cable and the control/tag cable. The TU column in the following tables indicates a test unit to loop when probing the interface line.

Dedicated Cable

Signal Name	Definition	TU
Cable link	These two lines indicate when the dedicated cable is seated correctly.	
-Control sample	This line is used with the tag bus lines to start a control bus load or sense cycle. This line also is used with the 'device DC reset' line.	TA315
-Drive select	This line selects the disk drive. This line also disables the 'R/W data bit 0', 'R/W data bit 1', 'sector', 'index', 'write gate return', 'L1 clock', and 'L2 clock' lines from the disk drive not selected.	TA315
-ID scan	This line is used with the 'drive select' line to permit the disk drive to switch the data heads during an ID scan operation (97-860).	TA316

Signal Name	Definition	TU
-Index	This line is used with the 'drive select' line to indicate the start of a data track. Index pulses are generated when the servo head is over the guard band or on any data cylinder. After the PLO circuits have synchronized, one index pulse per revolution is generated.	TA315
-Interrupt	This line is activated by the disk drive when it needs system service (97-850).	TA315
-L1 clock and -L2 clock	These lines are used with the 'drive select' line to synchronize the data to and from the adapter card. During a read operation, these lines come from the VFO circuits on the data converter card, which are synchronized to the read data from the disk. During a write operation, these lines come from the PLO circuits on the data converter card, which are synchronized to signals from the servo head.	TA315
-Read	This line is used with the 'drive select' line to permit data read from the disk to be decoded by the data converter card and to be sent on the 'R/W data bit 0' and 'R/W data bit 1' lines together with the 'L1 clock' and 'L2 clock' pulses to the DSA.	TA315

Signal Name	Definition	TU
-R/W data bit 0 and -R/W data bit 1	These two lines move data between the disk drive and the adapter card. On both lines, a VTL up level is a 0 and a VTL down level is a 1.	TA315
-Sector	This line is used with the 'drive select' line to indicate the start of each sector. Sector pulses are generated when the servo head is over the guard band or on any data cylinder. There are 700 sector pulses per disk revolution in ID scan mode or 50 sector pulses when not in ID scan mode. Sector pulses are not generated if a data unsafe condition is sensed.	TA315
-Write	This line is used with the 'drive select' line to turn on the write current source to permit write data from the 'R/W data bit 0' and 'R/W data bit 1' lines to be encoded by the data converter card and written by the selected head. If a data unsafe error (sense bit 4) occurs, the 'write' line is ignored and the write current is turned off.	TA315
-Write gate return	This line is used with the 'drive select' line to verify that the write gate in the disk drive was set on.	TA315

Control/Tag Cable

Signal Name	Definition	TU
Cable link	These two lines indicate when the control/tag cable is seated correctly.	
-Control sample returned	This line indicates to the adapter card that the 'control sample' line was received and that the tag bus was read by the disk drive.	TA315
-Device DC reset	This line is used with the 'control sample' line to set all latches, counters, registers, and the microprocessor on the access control card to a power-on-reset condition.	TA315
-Tag bus and -Control bus	The tag bus contains three tag lines and a parity line (odd parity). The three tag bus lines describe the information on the control bus. The control bus contains eight control lines and a parity line (odd parity). The eight control bus lines move information between the adapter card and the disk drive.	TA315

Sequence of Events

97-810 Servo Track Follow Operation

The servo track follow operation, performed completely in the disk drive, keeps the data heads correctly aligned over the data track.

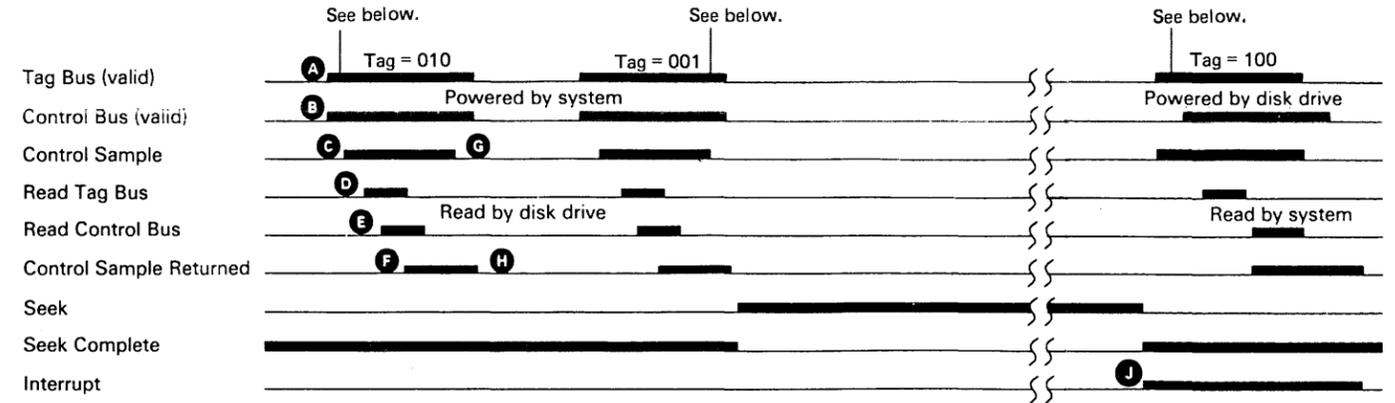
10SR Disk Drive	
1	The head/disk assembly (HDA) reads and increases the amplitude of the information on the servo surface.
2	The servo card generates a position error signal from the information read by the servo head and uses that position error signal to control the current placed on the voice coil.
3	The data converter card supplies control information to the servo card.
4	The VCM driver assembly controls the voice coil current as instructed by the servo card.
5	The HDA moves the attached head carriage when current passes through the voice coil.

**97-820
Control/Tag Bus Sequence for Access,
Recalibrate, Head Select, and Head
Offset Operations**

After the adapter card decodes the command from the system (90-820), the following sequence occurs between the adapter card and the disk drive. When the interrupt is received, a sense operation is performed (97-842).

A recalibrate operation can be started either by two control/tag bus cycles or by a single control/tag bus cycle (tag code 001 with bits 0 and 1 both on).

A head offset operation is started by a single control/tag bus cycle (tag code 001 with either bit 2 or bit 3 on).



10SR Adapter Card	10SR Disk Drive
<p>1 Sets a tag code of 010 on the tag bus A, sets the cylinder address bits on the control bus B, and then sets the 'control sample' line C to a down level</p>	
	<p>2 Decodes the tag bus D, reads the control bus E, and then sets the 'control sample returned' line F to a down level</p>
<p>3 Resets the 'control sample' line G</p>	
	<p>4 Resets the 'control sample returned' line H</p>
<p>5 Sets a tag code of 001 on the tag bus, sets the cylinder address bits and head select bits on the control bus, and then sets the 'control sample' line to a down level</p>	
	<p>6 Decodes the tag bus, reads the control bus, sets the 'control sample returned' line to a down level, and then seeks to the track</p>
<p>7 Resets the 'control sample' line</p>	
	<p>8 Resets the 'control sample returned' line</p>
	<p>9 Sets the 'xxx interrupt' line' J to a VTL down level when the access operation is complete. The disk drive ignores more access operations if the disk busy bit is set to 1</p>

¹The real line name includes disk A, disk B, disk C, or disk D. The active line determines the disk requesting the interrupt.

Tag Bus Bits 0 1 2	Control Bus Bits							
	0	1	2	3	4	5	6	7
0 0 1 Seek control	Off		Head select 8	Head select 4	Head select 2	Head select 1	Cylinder address 512	Cylinder address 256
Bits 1-7 have another meaning if bit 0 is on.	On	Recalibrate	Head offset (in)	Head offset (out)			Diagnostic command	Reset error
0 1 0 Cylinder address	Cylinder address 128	Cylinder address 64	Cylinder address 32	Cylinder address 16	Cylinder address 8	Cylinder address 4	Cylinder address 2	Cylinder address 1
1 0 0 Sense byte	Head offset	Brake engaged	Command reject	Command error	Data unsafe	Device busy	Home	Not ready

97-822 Access Operation

Model 1, the access operation can seek to any of 572 cylinders.

Model 2, the access operation can seek to any of 1024 cylinders.

The operation is started when the system sends a command to the disk drive (90-820 and 97-820).

10SR Disk Drive	
1	The access control card: <ul style="list-style-type: none"> Determines the difference between the present location of the head carriage and the cylinder address received on the control/tag bus and dedicated cables; also determines the direction of the movement. Activates the 'in drive' or 'out drive' line. Sets the disk busy bit. Generates a desired carriage velocity signal to control the speed of the access. Resets the 'in drive' or 'out drive' line when the expected cylinder is reached. Resets the disk busy bit. Sets an interrupt.
2	The head/disk assembly (HDA) reads and increases the amplitude of the information on the servo surface.
3	The servo card: <ul style="list-style-type: none"> Generates a position error signal from the information read by the servo head. Converts the desired carriage velocity signal from digital to analog. Uses the position error signal and the desired carriage velocity signal to control the current placed on the voice coil.
4	The VCM driver assembly controls the voice coil current as instructed by the servo card.
5	The HDA moves the attached head carriage when current passes through the voice coil.
<p>Note: The longest access operation (570 tracks for a Model 1, 1022 tracks for a Model 2) will complete in less than 45 milliseconds. If the access operation is longer than 100 milliseconds, either the 'in drive' or the 'out drive' line is reset and the head carriage is moved to the landing zone. The not-ready sense bit and an interrupt are set.</p>	

97-824 Recalibrate Operation

The recalibrate operation moves the head carriage to cylinder 0 and selects head 0. This operation returns the disk drive to a known condition. The operation is started when the system sends a command to the disk drive (90-820 and 97-820).

10SR Disk Drive	
1	The access control card: <ul style="list-style-type: none"> Activates the 'out drive' line. Sets the disk busy bit. Generates a desired carriage velocity signal to control the speed of the access.
2	The head/disk assembly (HDA) reads and increases the amplitude of the information on the servo surface.
3	The servo card: <ul style="list-style-type: none"> Generates a position error signal from the information read by the servo head. Converts the desired carriage velocity signals from digital to analog. Uses the position error signal and the desired carriage velocity signals to control the current placed on the voice coil.
4	The VCM driver assembly controls the voice coil current as instructed by the servo card.

10SR Disk Drive	
5	The HDA moves the attached head carriage when current passes through the coil.
6	The data converter card determines when the head carriage is in the guard band.
7	The access control card: <ul style="list-style-type: none"> Resets the 'out drive' line when the guard band is reached. Activates the 'in drive' line. Sends head 0 to the head address register. Generates a desired carriage velocity signal to control the speed of the access.
8	Steps 2 , 3 , 4 , 5 , and 6 are repeated.
9	The access control card: <ul style="list-style-type: none"> Resets the 'in drive' line when cylinder 0 is reached. Resets the disk busy bit. Sets the home sense bit. Sets an interrupt.
<p>Note: If the time from when the 'in drive' line is activated until the carriage leaves the guard band is longer than 100 milliseconds, the 'in drive' line is reset and the head carriage is moved to the landing zone. The not-ready sense bit and an interrupt are set.</p>	

97-826 Head Select Operation

The head select operation selects any of 14 data heads for a read or write operation. The operation is started when the system sends a command to the disk drive (90-820 and 97-820).

10SR Disk Drive	
1	The access control card determines the head number from the control/tag and dedicated cables and sends that number to the head address register.
2	The data converter card determines the correct head, using the head address number.
3	The head/disk assembly (HDA) selects the data head from the lines in the HDA data cable.

97-828 Head Offset Operation

The head offset operation moves the head carriage slightly off the center of the track when the system is attempting to recover data during a read operation. The operation is started when the system sends a command to the disk drive (90-820 and 97-820).

10SR Disk Drive	
1	The access control card: <ul style="list-style-type: none"> Determines the direction of the head offset operation from the control/tag and dedicated cables. Activates the 'head offset in' or the 'head offset out' line. Resets the disk busy bit. Sets an interrupt.
2	The servo card changes the servo circuits to offset the heads.
3	The VCM driver assembly controls the voice coil current as instructed by the servo card.
4	The head/disk assembly (HDA) moves the attached head carriage when current passes through the voice coil.

**97-830
Read Operation**

The read operation is preceded by an access, recalibrate, head select, or head offset operation, which locates the head carriage over the correct cylinder and selects the correct head.

Any time a data head is selected and the 'write' line is not active, the data head is reading the data from the disk.

10SR Adapter Card	10SR Disk Drive
	1 The head/disk assembly (HDA) reads and increases the amplitude of the information read from the data surface.
	2 The data channel card: <ul style="list-style-type: none"> Increases the amplitude of the data signal from the HDA. Converts the data signal from analog to digital.
	3 The data converter card: <ul style="list-style-type: none"> Decodes the index pulse. Generates a sector pulse every 609 bytes (50 sector pulses per disk revolution). Generates a read clock in synchronization (frequency and phase) with the data signal-variable frequency oscillator (VFO) circuits. Generates the L1 and L2 clock pulses. Decodes the data signal from the RLL code to serial data (97-910). Sends the serial data to the adapter card in synchronization with the L1 and L2 clock pulses.
4 The adapter card: <ul style="list-style-type: none"> Decodes the serial data from the L1 and L2 clock pulses. Converts the serial data from serial to parallel-SERDES circuits. Generates the CRC/ECC characters and compares the generated character with the character read from the disk. 	

**97-832
Write Operation**

The write operation is preceded by an access, recalibrate, or head select operation, which locates the head carriage over the correct cylinder and selects the correct head.

Any time a data head is selected and the 'write' line is active, the data head is writing data on the disk.

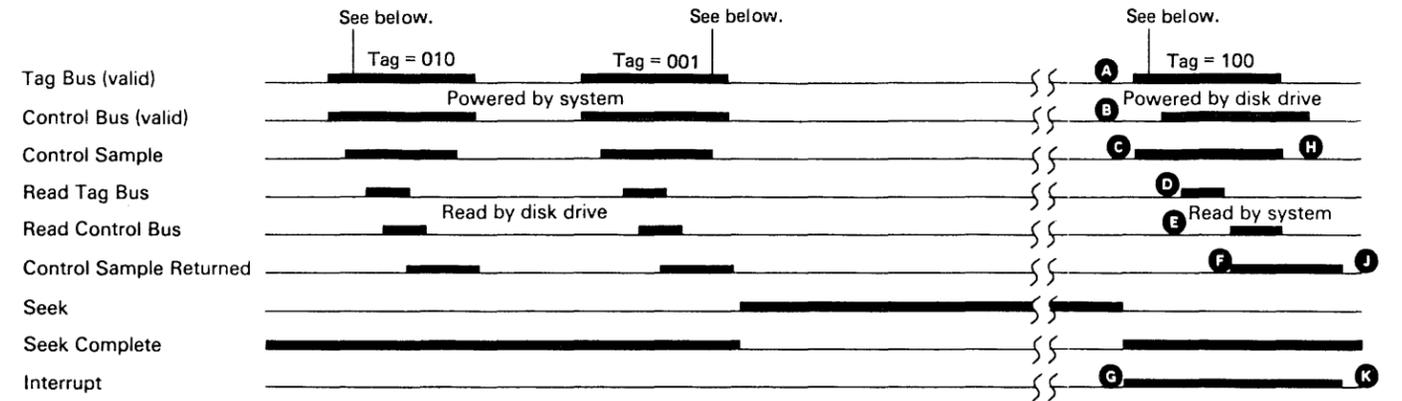
10SR Adapter Card	10SR Disk Drive
1 The adapter card: <ul style="list-style-type: none"> Receives bytes of data (parallel data) from the system (90-835). Converts the data from parallel (bytes) to serial-SERDES circuits. Sends the serial data to the data converter card. Generates the CRC/ECC characters and sends them to the data converter card. 	
	2 The head/disk assembly (HDA) reads and increases the amplitude of the information on the servo surface.
	3 The servo card generates the servo clock for the data converter card.
	4 The data converter card: <ul style="list-style-type: none"> Decodes the index pulse. Generates a sector pulse every 609 bytes (50 sector pulses per disk revolution). Codes the serial data from the system to RLL code. Generates the 2F write clock in synchronization with signals from the servo surface-phase locked oscillator (PLO) circuits.
	5 The data channel card sends the data to the data head in synchronization with the 2F write clock.
	6 The HDA writes the data on the data surface.

**97-840
Control/Tag Bus Sequence for a Sense
Operation**

After the adapter card decodes the sense operation from the system (90-825), the following sequence occurs between the adapter card and the disk drive.

10SR Adapter Card	10SR Disk Drive
	1 Sets the 'xxx interrupt' line ¹ G to a VTL down level
2 Sets a sense tag code (100) on the tag bus A and then sets the 'control sample' line C to a down level	
	3 Decodes the tag bus D , sets the requested sense information on the control bus B , and then sets the 'control sample returned' line F to a down level
4 Decodes the control bus E and resets the 'control sample' line H	
	5 Resets the 'xxx interrupt' line ¹ K , the 'control sample returned' line J , and the control bus

¹The real line name includes disk A, disk B, disk C, or disk D. The active line determines the disk requesting the interrupt.



Tag Bus Bits 0 1 2	Control Bus Bits							
	0	1	2	3	4	5	6	7
0 0 1 Seek control	Off		Head select 8	Head select 4	Head select 2	Head select 1	Cylinder address 512	Cylinder address 256
Bits 1-7 have another meaning if bit 0 is on.	On	Recalibrate	Head offset (in)	Head offset (out)			Diagnostic command	Reset error
0 1 0 Cylinder address	Cylinder address 128	Cylinder address 64	Cylinder address 32	Cylinder address 16	Cylinder address 8	Cylinder address 4	Cylinder address 2	Cylinder address 1
1 0 0 Sense byte	Head offset	Brake engaged	Command reject	Command error	Data unsafe	Device busy	Home	Not ready
1 0 1 Diagnostic sense byte 1	A0 (see Note 1)	A1 (see Note 1)	A2 (see Note 1)	On track	Guard band	In drive	Out drive	Interrupt
1 1 0 Diagnostic sense byte 2	Odd track	Access reset	Depress profile	Accelerate				Retract
1 1 1 Diagnostic sense byte 3	U0 (see Note 2)	U1 (see Note 2)	U2 (see Note 2)	Data converter wrap error	Write data interface check		Sector counter error	Card/cable not seated

Notes:

1. Servo Interrupts

A0	A1	A2	
0	0	0	System service request*
0	0	1	Guard band 2
0	1	0	Servo off track error
0	1	1	Unexpected guard band
1	0	0	Seek time-out error
1	0	1	Disk speed/VCO check
1	1	0	PLO out of sync
1	1	1	(not) power good

2. Data Unsafe Errors

U0	U1	U2	
0	0	0	Write (not ready)
0	0	1	Write (off track)
0	1	0	Write (not in data field)
0	1	1	Write (read, offset, or on cyl 571—Model 1) Write (read, offset, or on cyl 1023—Model 2)
1	0	0	Not write (AE unsafe with AE not selected)
1	0	1	Write (chip select unsafe)
1	1	0	Not write (AE unsafe with AE selected)
1	1	1	Write (AE unsafe)

*Not an error condition

**97-842
Sense Operation**

The sense operation moves disk drive status from the disk drive to the system. The operation is started when the system sends a command to the disk drive (90-825 and 97-840).

10SR Disk Drive	
1	The access control card: <ul style="list-style-type: none"> • Generates an interrupt (97-850). • Supplies the sense information.

**97-850
Interrupts**

Interrupts are generated by the microprocessor (on the access control card) for the following conditions:

- Normal conditions:
 - After a correct power-on sequence
 - After a correct seek or recalibrate operation
 - After a head offset operation
 - After a head select operation
 - After the heads are moved to cylinder 0 in response to the 'device DC reset' line
- Not-normal conditions:
 - When the command reject sense bit (sense bit 2) is on
 - When the command error sense bit (sense bit 3) is on
 - When the data unsafe sense bit (sense bit 4) is on
 - When the not-ready sense bit (sense bit 7) is on because of a servo error
 - When the head offset sense bit (sense bit 0) is on because the microprocessor is in diagnostic mode

The disk drive logic must be reset by the adapter card before any more commands, except sense commands, can be executed.

**97-860
ID Scan Operation**

The ID scan operation selects the data heads in a pattern that permits all 700 sector IDs in a cylinder to be read in one revolution of the disk.

10SR Adapter Card	10SR Disk Drive
1 The adapter card: <ul style="list-style-type: none"> • Sets the 'ID scan' and 'drive select' lines to a down level. • Resets the 'ID scan' line when the specified ID is found or the specified ID is not found in one complete disk revolution (the no-record-found bit is set). 	
	2 The head/disk assembly (HDA) reads and increases the amplitude of the information read from the data surface.
	3 The data channel card: <ul style="list-style-type: none"> • Increases the amplitude of the data signal from the HDA. • Converts the data signal from analog to digital.
	4 The data converter card: <ul style="list-style-type: none"> • Generates a sector pulse every 43.5 bytes (700 sector pulses per disk revolution). • Generates a read clock in synchronization (frequency and phase) with the data signal-variable frequency oscillator (VFO) circuits. • Synchronizes the data head selection with the sector pulses. • Generates the L1 and L2 clock pulses. • Decodes the data signal from RLL code to serial data. • Sends the serial data to the adapter card in synchronization with the L1 and L2 clock pulses.

Note: When the adapter card resets the 'ID scan' line, the same data head remains selected and the sector data field(s) can be read or written.

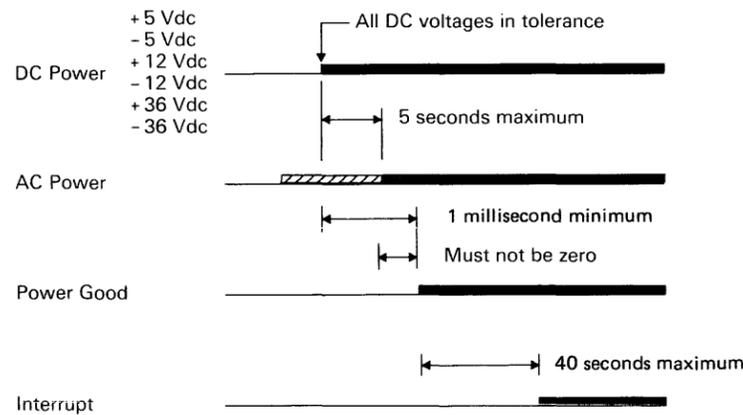
**97-870
Power-On Operation**

The power-on operation prevents the disk drive from turning until the system DC voltages are in tolerance.

Disk Drive Description by FRU

Processing Unit	10SR Disk Drive
1 The system supplies AC and DC voltage to the disk drive and activates the 'power good' line when all the DC voltages are in tolerance.	
	2 The access control card: <ul style="list-style-type: none"> • Activates the 'motor relay' line. • Starts a 16-second delay to permit the disk to reach the correct speed.
	3 The power control assembly: <ul style="list-style-type: none"> • Picks the control relay, which activates the brake coil, the carriage latch magnet, and the drive motor. • Picks the motor start relay, which removes the motor start winding from the circuit.
	4 The drive motor turns the disk.
	After the delay:
	5 The access control card: <ul style="list-style-type: none"> • Moves the head carriage to cylinder 0 (97-822). • Sets the home bit. • Generates an interrupt (97-850).

Power-On Sequence

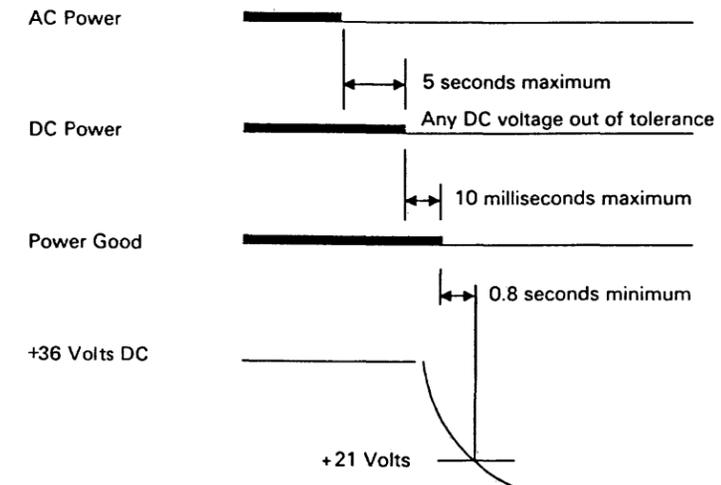


**97-872
Power-Off Operation**

The power-off operation moves the head carriage to the landing zone and stops the disk rotation.

Processing Unit	10SR Disk Drive
1 The system deactivates the 'power good' line and removes AC and DC voltage from the disk drive when any of the DC voltages are out of tolerance.	
	2 The access control card: <ul style="list-style-type: none"> • Deactivates the 'motor relay' line. • Activates the 'retract carriage' line, which moves the head carriage to the landing zone.
	3 The power control assembly: <ul style="list-style-type: none"> • Deactivates the control relay, which deactivates the brake coil, the carriage latch magnet, and the drive motor. • Deactivates the motor start relay.

Power-Off Sequence



Reference

97-910 Run Length Limited Code

The run length limited (RLL) code is used to record the data on the disk.

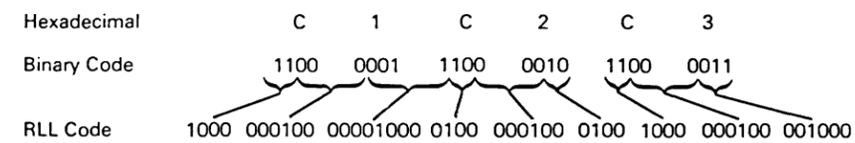
The data moves in binary code between the adapter card and the disk drive. For write operations, the serial data is analyzed in the disk drive by the data converter card and encoded to RLL. For read operations, the RLL code is decoded to serial data by the data converter card.

Data Patterns

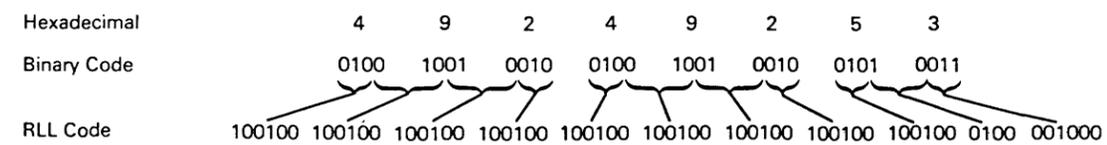
Binary Code	RLL Code
10	0100
11	1000
000	000100
011	001000
010	100100
0010	00100100
0011	00001000

The following examples show the conversion of hexadecimal data from binary code to RLL code.

Example 1

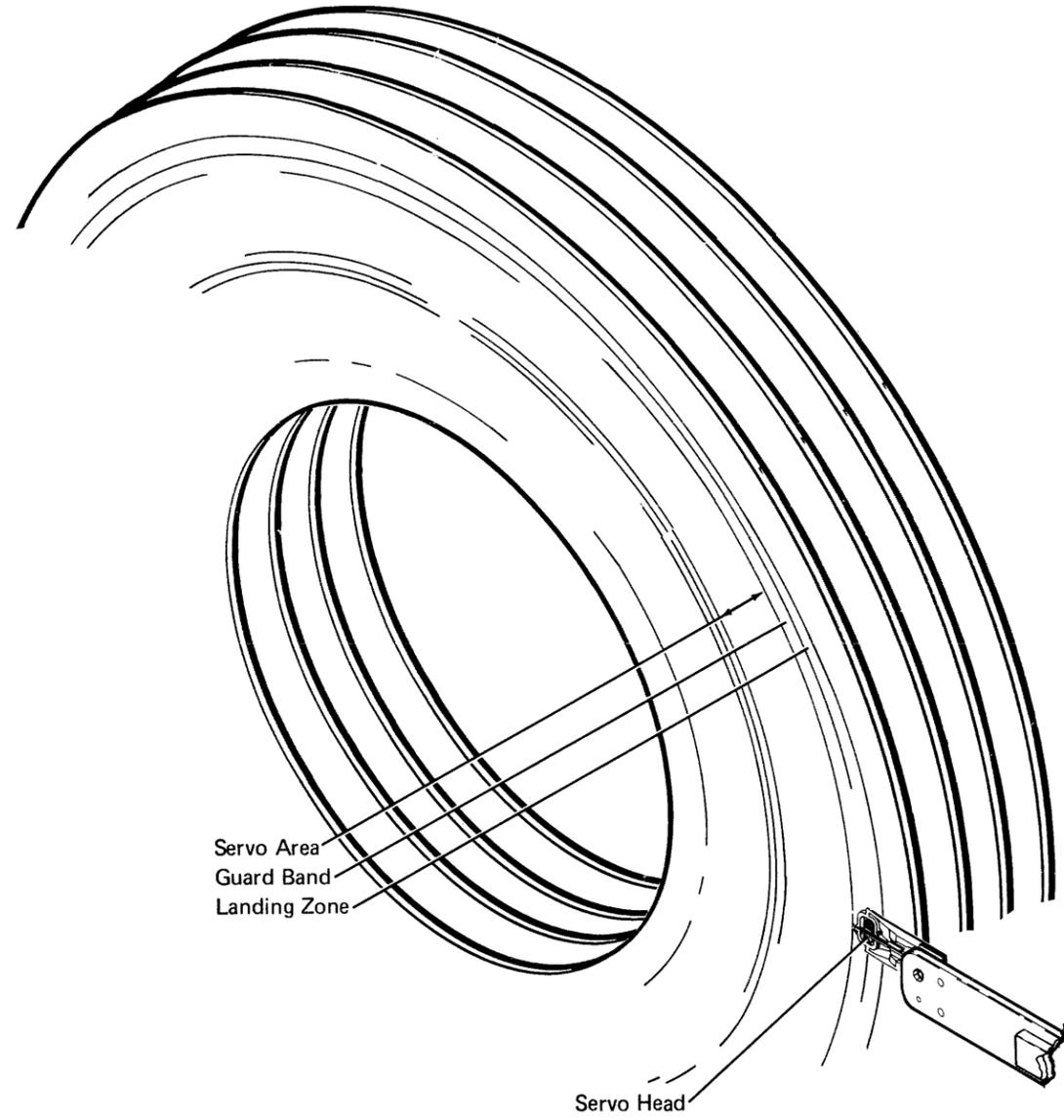


Example 2

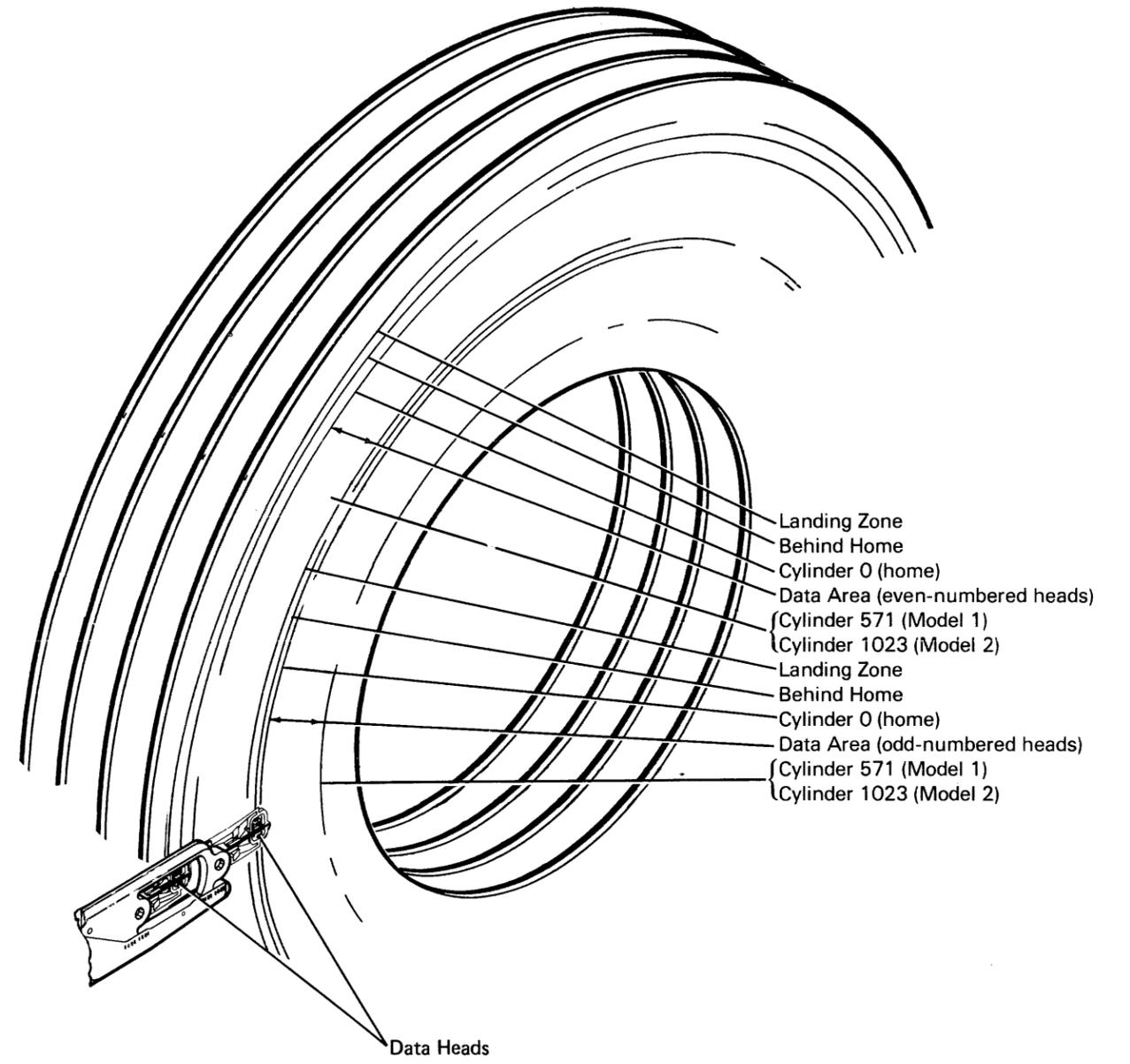


97-915
Disk Surface Arrangement

Servo Surface

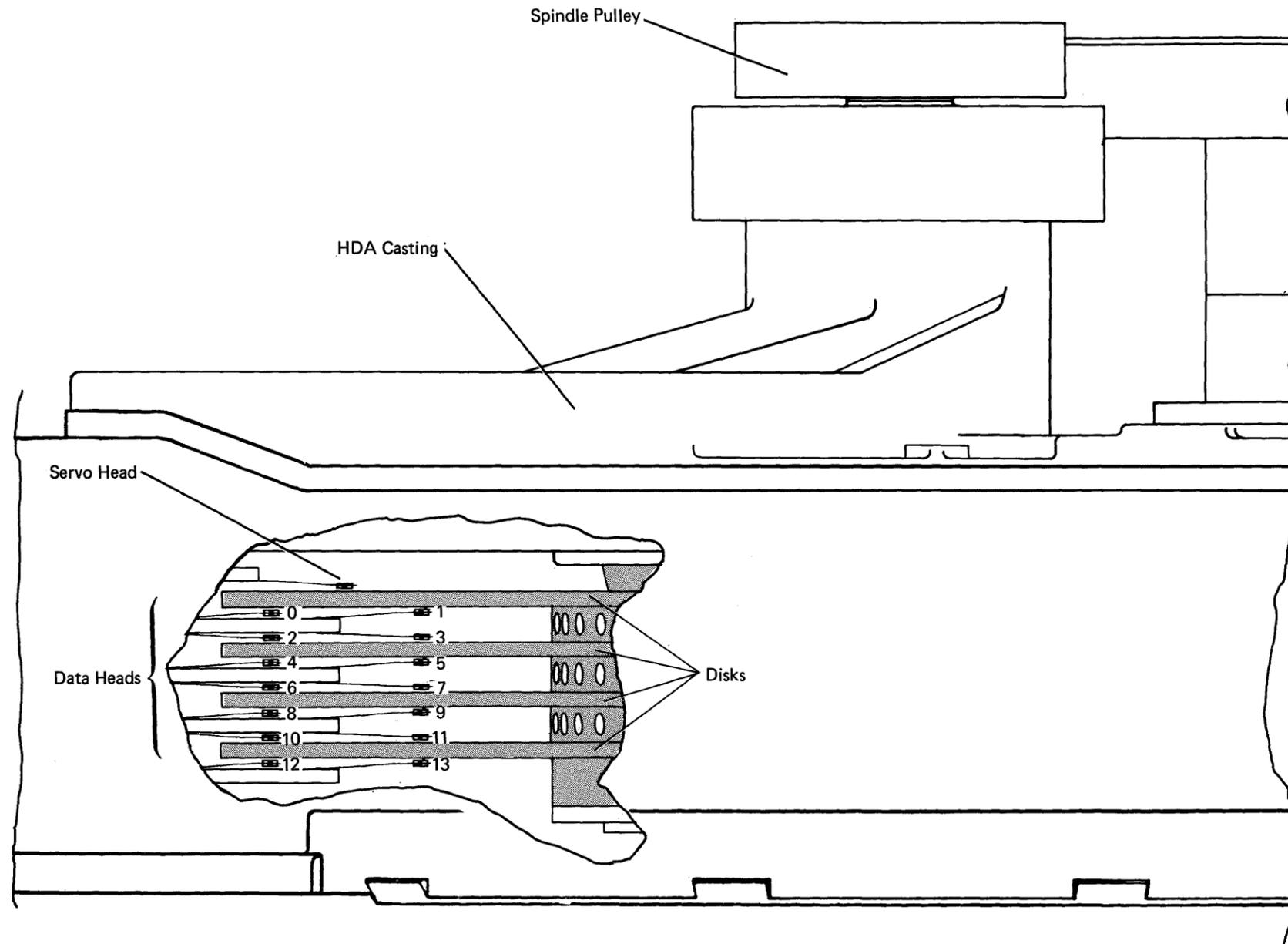


Data Surface



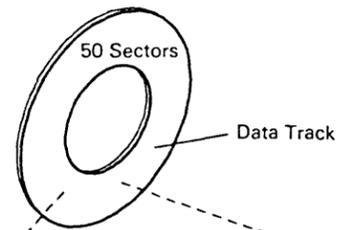
Note: The CE cylinder is cylinder 570 (Model 1) or cylinder 1022 (Model 2).

97-920
Head Arrangement



**97-925
Sector Format**

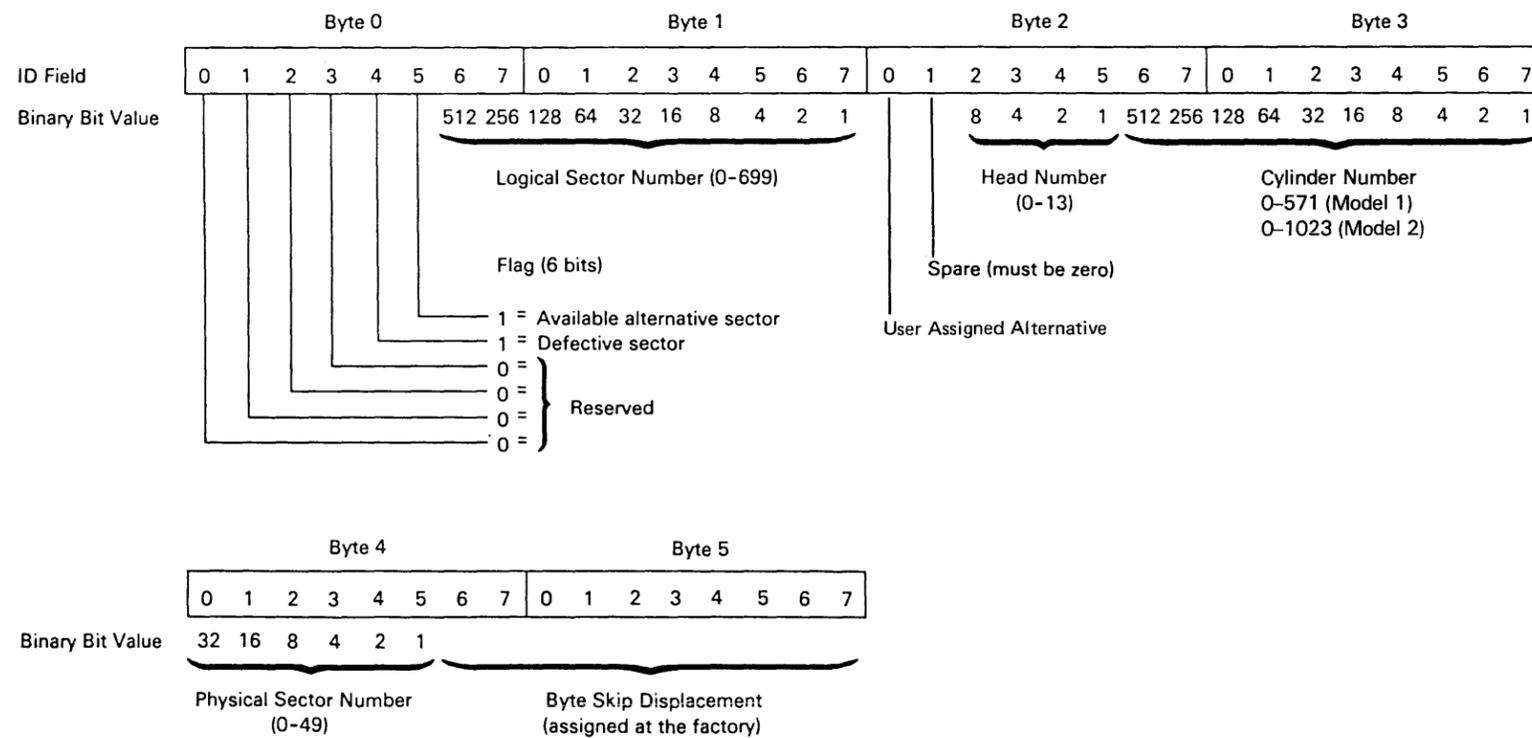
Each disk sector contains 609 bytes. The following figure shows the sector format.



Field	Gap	ID ¹	CRC	Gap	Data	ECC	Gap	Data	ECC	Gap
Length in Bytes	20	6	2	22	256	6	20	256	6	15 ²

¹The bits of the 6-byte ID field are shown below.

²This field is decreased by 7 bytes when byte skip displacement is used.



Index

A

access control card
FRU description 97-610
location 97-215
access operation 97-822
adapter card
FRU description 97-605
location 97-200
antistatic brush
removal 97-360
replacement 97-362

B

belt, see drive belt
brake
adjustment 97-386
removal 97-380
replacement 97-382
service check 1 97-384
service check 2 97-385
brake assembly
FRU description 97-615

C

cable locations
adapter, A-A2 board 97-200
drive
1F/1G/2F/2G-A1 board 97-220
1F/1G/2F/2G-W1 board 97-235
card locations
adapter 97-200
drive card gate 97-220
carriage latch magnet
adjustment 97-346
FRU description 97-615
removal 97-340
replacement 97-342
service check 97-344

D

data channel card
FRU description 97-610
location 97-240
test pin locations 97-235
data converter card
FRU description 97-610
location 97-215
data flow 97-600
diagnostic information
disk exerciser 97-470
IPL good machine path 97-455
MDI good machine path 97-450
pack utility maintenance program 97-465
system test 97-460
disk drive
capacity 97-110
FRU locations 97-215
identifying 10SR models 97-240
location 97-210
number available 97-110
disk drive cards
FRU descriptions 97-610
locations 97-215
disk exerciser 97-470
disk surface arrangement 97-915
drive belt
adjustment 97-314
removal 97-310
replacement 97-312
drive motor
FRU description 97-615
pulley service check 97-420
removal 97-320
replacement 97-322

E

ERAP, how to interpret reports 97-500
error counter table 97-520
error history table 97-500
exerciser, disk 97-470

F

filter
removal 97-370
replacement 97-372
FRU descriptions 97-605, 97-610, 97-615

G

good machine path
IPL 97-455
MDI 97-450

H

HDA, see head/disk assembly
head arrangement 97-920
head carriage location service check 97-422
head/disk assembly (HDA)
FRU description 97-615
removal 97-330
replacement 97-332
head offset operation 97-828
head select operation 97-826

I

I/O counter table 97-522
ID scan operation 97-860
identifying 10SR models 97-240
interface lines 97-700
interrupts 97-850
introduction 97-110

J

J-connector location chart 97-230

L

locations
access control card 97-215
adapter card 97-200
cable
adapter 97-200
drive 97-220
data channel card 97-235
data channel card test pins 97-235
data converter card 97-610
disk drive 97-210
disk drive cards 97-220
disk drive FRU 97-215
J-connectors 97-230
servo card 97-215

M

motor, see drive motor

O

operations 97-800
access 97-822
head offset 97-828
head select 97-826
ID scan 97-860
interrupts 97-850
power-off 97-872
power-on 97-870
read 97-830
recalibrate 97-824
sense 97-842
servo track follow 97-810
write 97-832
overview 97-110

P

pack utility maintenance program 97-465
power control assembly
FRU description 97-615
removal 97-410
replacement 97-412
power-off operation 97-872
power-off sequence 97-872
power-on operation 97-870

power-on sequence 97-870
preventive maintenance 97-300

R

read operation 97-830
recalibrate operation 97-824
RLL code conversion 97-910

S

sector format 97-925
sense bytes 97-508
sense operation 97-842
service checks
 brake 97-384,97-385
 carriage latch magnet 97-344
 drive motor pulley 97-420
 head carriage location 97-422
servo card
 FRU description 97-610
 location 97-215
servo track follow operation 97-810
shock mounts
 lower
 removal 97-404
 replacement 97-406
 upper
 removal 97-400
 replacement 97-402
status, see sense bytes

T

test units (TUs)
 IPL good machine path 97-455
 MDI good machine path 97-450
top card connectors
 location
 adapter card 97-205
 drive card 97-220

U

utilities 97-465

V

VCM coil connectors 97-430
VCM driver assembly
 FRU description 97-610
 removal 97-390
 replacement 97-392
VCM magnet
 removal 97-350
 replacement 97-352

W

write operation 97-832

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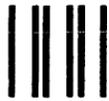


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