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***** 838739	***** SY31-9001-B	***** CHECKPOINT 9 DRAFT
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IBM System/36
Data Storage Attachment
Maintenance Information Manual

Order Number
SY31-9001-2

Third Edition (October 1986)

This major revision makes obsolete SY31-9001-1. Changes or additions were made to support the 6157 Tape Drive.

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PREFACE

This manual contains the maintenance information necessary to service the System/36 data storage attachment. This manual includes diagnostic information, 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*
- *Processing Unit and Channel Maintenance Information Manual, SY31-9000*
- *21ED Disk Drive and Adapter Maintenance Information Manual, SY31-9002*
- *51TD Diskette Drive and Adapter Maintenance Information Manual, SY31-9003*
- *10SR Disk Drive and Adapter Maintenance Information Manual, SY31-9005*
- *72MD Diskette Magazine Drive and Adapter Maintenance Information Manual, SY31-9006*
- *8809 Tape Adapter Maintenance Information Manual, SY31-9010*
- *Processing Unit and Channel Maintenance Information Manual (Stage 2), SY31-9015*
- *Processing Unit and Channel Maintenance Information Manual (Stage 3), SY31-9035*
- *6157 Tape Adapter Maintenance Information Manual, SY31-9037*

Other Hardware Publications

- *8809 Magnetic Tape Unit Maintenance Information Manual, SY32-5051*

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 vii of this Safety section, under “Electrical Accidents—First Aid.”

Caution Notices

There are no caution notices in this MIM.

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 hardware service representatives 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 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.

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 been damaged 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).

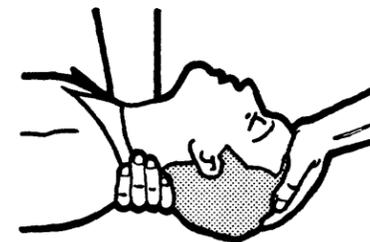
Determine if the victim needs mouth-to-mouth rescue breathing. If he or she does, perform the following steps:

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.

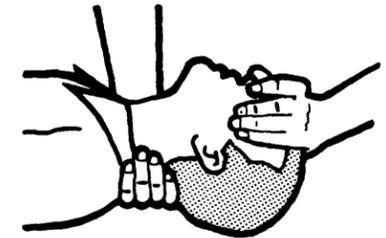
.....

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.

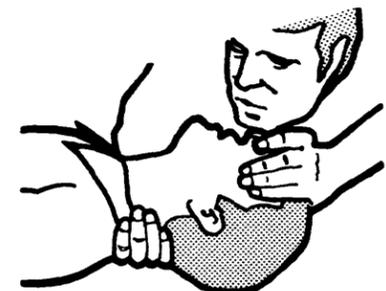
3. If the victim is not breathing correctly:
 - a. Keep the victim's head tilted backward. Continue to press on the forehead with your hand; at the same time, position the same hand so that you can pinch together the victim's nostrils with your thumb and finger.



- 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.

¹ Trademark of the Gardner-Denver Co.

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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OVERVIEW

90-110 (Part 1)

Data Storage Attachment

The data storage attachment (DSA) is used to attach all storage devices (diskette, disk, and tape) to the channel.

The following storage devices can be connected to the data storage attachment:

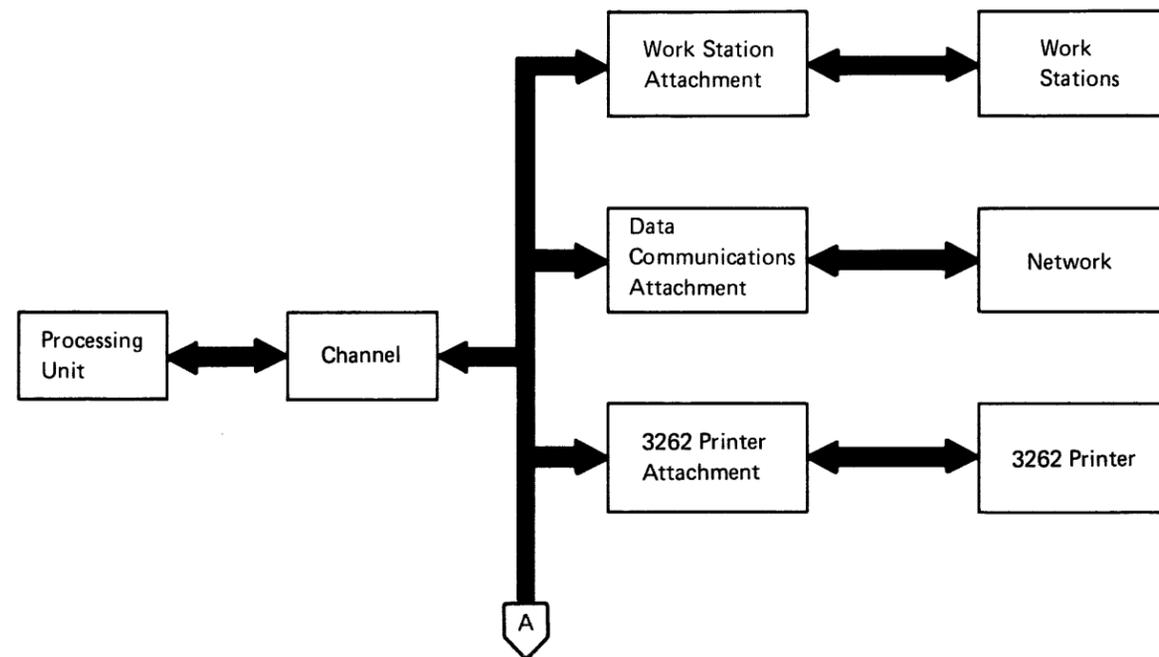
- One diskette drive
- One or two 8809 tape drives
- One 6157 tape drive
- Either one or two 21ED disk drives or one to four 10SR disk drives

When the data storage attachment includes a data storage controller, the DSA can perform device-to-device data transfers below the system channel. That is, after the system commands start the data transfer, the system channel is not needed until the transfer is complete or an error occurs. The following device-to-device data transfers can occur:

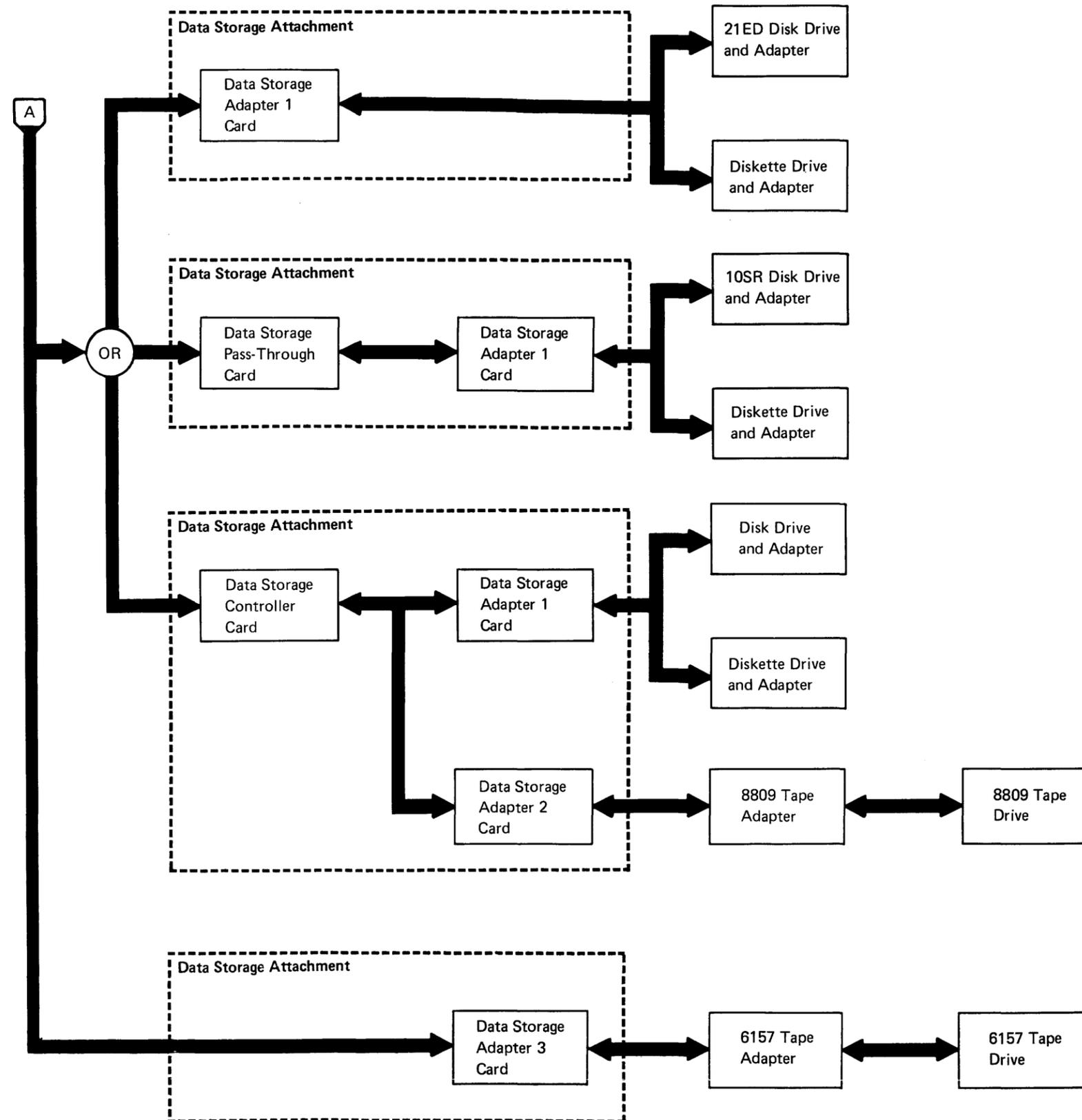
- Disk to disk
- Disk to diskette
- Diskette to disk
- Disk to 8809 tape
- 8809 tape to disk

The major FRUs are:

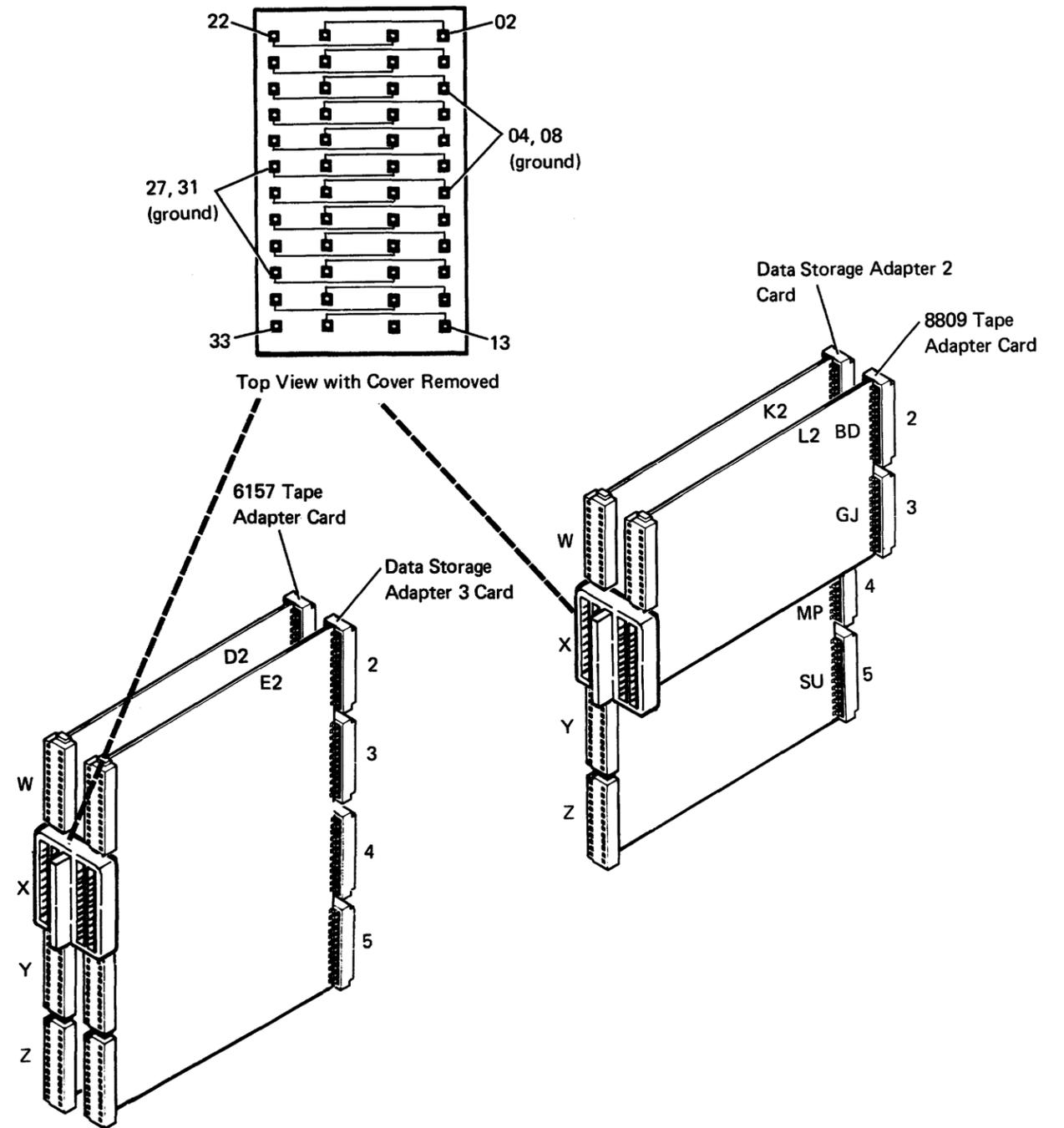
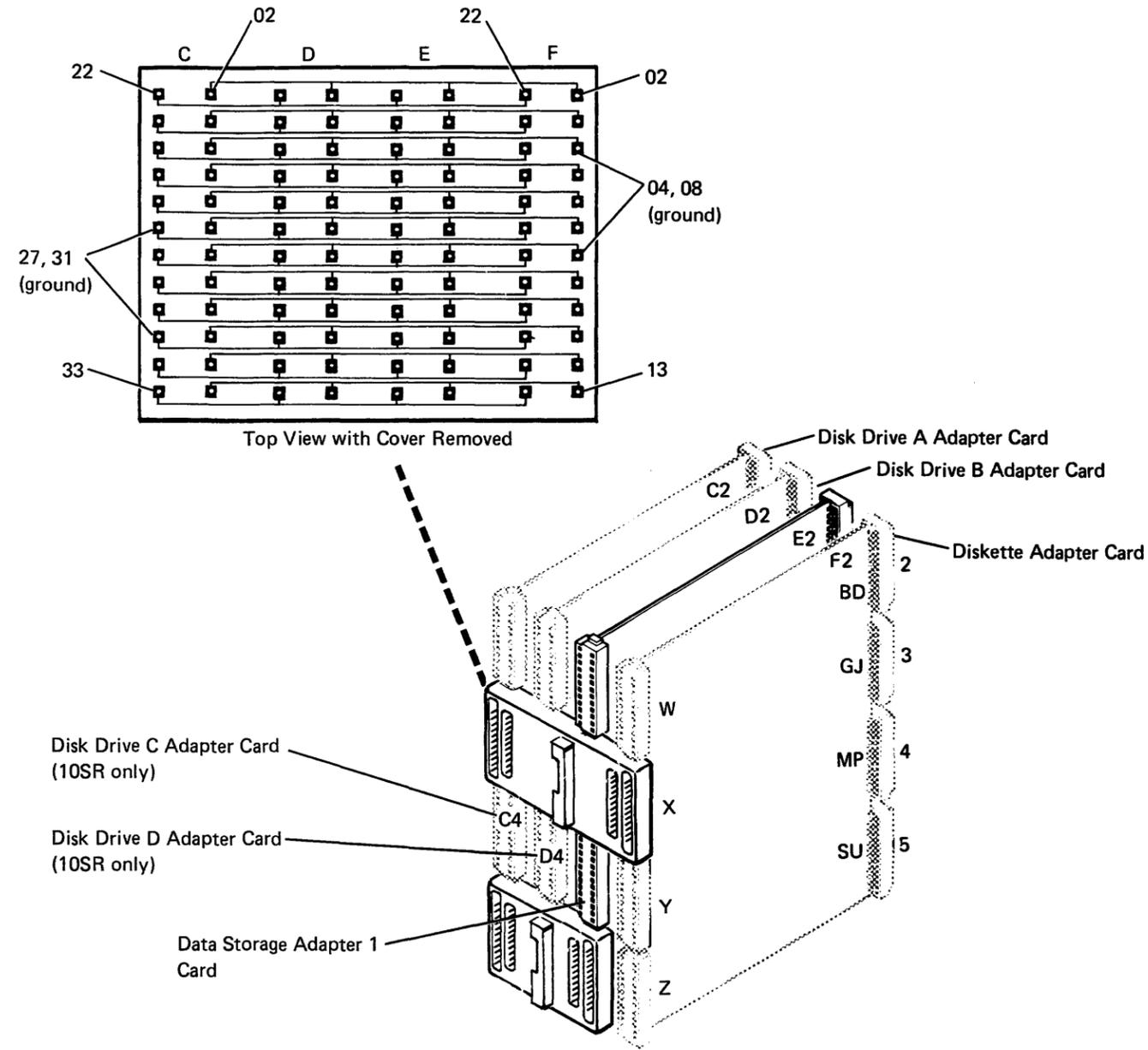
- A data storage pass-through card
- A data storage adapter 1 card
- A data storage adapter 2 card
- A data storage adapter 3 card
- A data storage controller card



Data Storage Attachment



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 10SR disk drives.
3. The 3-wide top card connector (Z) is used only when three or four 10SR disk drives are installed.

Maintenance Procedures

DIAGNOSTIC INFORMATION

90-400

MDI Good Machine Path

The data storage attachment test units (TUs) are divided into groups. Each group has an MDI 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 data storage attachment circuits, a reference code is displayed on the system console. For information on a specific reference code, see MAP 0114 or MAP 0115.

For information on how to run MDIs, see 01-710.

MDI	Description	TU Sequence
1 Mxx01	Connects the selected storage device MDIs to the data storage attachment MDIs <i>xx Storage Device</i> A2 21ED A3 10SR B1 8809 tape D2 Diskette	Txx01
2 M65FF	Determines if a data storage controller is installed on the system	T65FF
3 M6103	Tests the bus coupler-to-system channel interface (runs only if 8809 tape is installed on the system)	T6101 T6102 T6103 T6104
4 M6102	Tests the data storage controller card (runs only if 8809 tape is installed on the system)	T610F T6106 T6110 T6111 T6112 T6113 T6114 T6115 T6116 T6108 T6109 T610A T610B T610C

MDI	Description	TU Sequence
5 M6501	Tests the buffer control circuits on the data storage adapter cards	T6501 T6502 T6503 T6504 T6505 T6506 T6507 T6508 T6509 T6510 T6511 T6512
6 M6502	Tests the buffer data paths on the data storage adapter cards	T6520 T6521 T6524 T6525 T6530 T6531 T6532 T6533 T6534 T6535 T6536 T6538 T6539 T6540

90-410

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 data storage attachment circuits, a reference code is displayed on the system console. For information on a specific reference code, see MAP 0116.

TU Sequence	Description
T6101 T6102 T6103 T6104 T6110 T6111 T6112 T6113 T6114 T6115 T6116 T6117 T6118	Tests the data storage controller card (runs only if 8809 tape is installed on the system)
T6501 T6507 T6509 T6510 T6511 T6512	Tests the buffer control circuits on the data storage adapter cards
T6524 T6525 T6531 T6534 T6538 T6539 T6540	Tests the buffer data paths on the data storage adapter cards

90-630

Data Storage Adapter 2 Card

The data storage adapter 2 card contains the following logic:

- Channel interface and data storage attachment interface 2 control circuits
- Data buffers and control circuits
- Interrupt control circuits
- Cycle steal control circuits

Channel Interface and Data Storage Attachment Interface 2 Control Circuits A and E

The interface control circuits receive the I/O instructions from the system and pass the information to the tape control unit.

Data Buffers and Control Circuits D

The two data buffers (1024 bytes each) operate separately and, therefore, permit overlapping data operations to two storage devices.

The data is moved between the tape control unit and a buffer, 1 byte at a time. The data is moved between the system and a buffer, in blocks of either 128 or 256 bytes, 2 bytes at a time.

Interrupt Control Circuits C

The interrupt control circuits control the 'interrupt level 4' line in the channel interface. This line is activated when the data storage adapter 2 card or the tape control unit needs system service.

Cycle Steal Control Circuits B

The cycle steal control circuits control the 'base cs req new' and 'chan burst cs req' lines in the channel interface. These lines are activated when the data storage adapter 2 card needs to receive data from or send data to the system.

90-640

Data Storage Controller Card

The data storage controller card contains the following logic:

- A bus coupler
- A processor
- Storage

Bus Coupler

The bus coupler operates in two modes: normal mode and transparent mode.

In normal mode, the bus coupler:

- Decodes I/O instructions from the control processor or from the processor on this card
- Controls both the data transfers between the two processors and between the system channel and the data storage adapter 1 and 2 cards
- Directs interrupts to the system channel and to the processor on this card

In transparent mode, the bus coupler:

- Sends I/O commands from the system channel directly to the data storage adapter 1 or 2 card
- Directs the interrupts from the data storage adapter 1 and 2 cards to the system channel
- Controls the data transfers between the system channel and the data storage adapter 1 and 2 cards

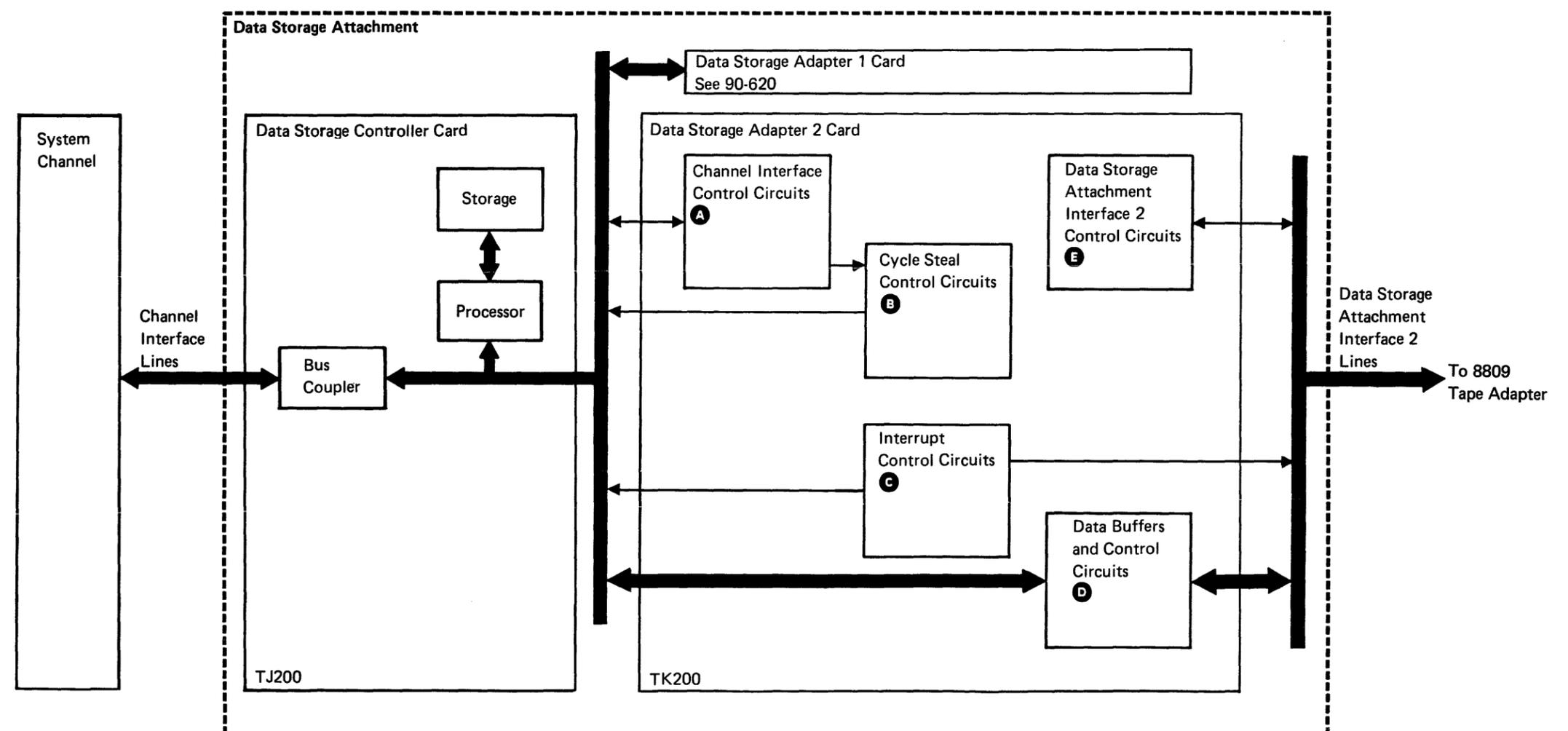
Processor

The processor on this card executes the data storage attachment microcode to control the attachment operations during device-to-device transfers.

Storage

Storage contains:

- The data storage attachment microcode that is loaded by the control processor
- The working storage needed by the processor on this card



Data Storage Adapter 3 Card

The data storage adapter 3 card contains the following logic:

- Channel interface and data storage attachment interface 3 control circuits
- Data buffers and control circuits
- Interrupt control circuits
- Cycle steal control circuits

Channel Interface and Data Storage Attachment Interface 3 Control Circuits A and E

The interface control circuits receive the I/O instructions from the system and pass the information to the tape control unit.

Data Buffers and Control Circuits D

The two data buffers (1024 bytes each) operate separately and, therefore, permit overlapping data operations to two storage devices.

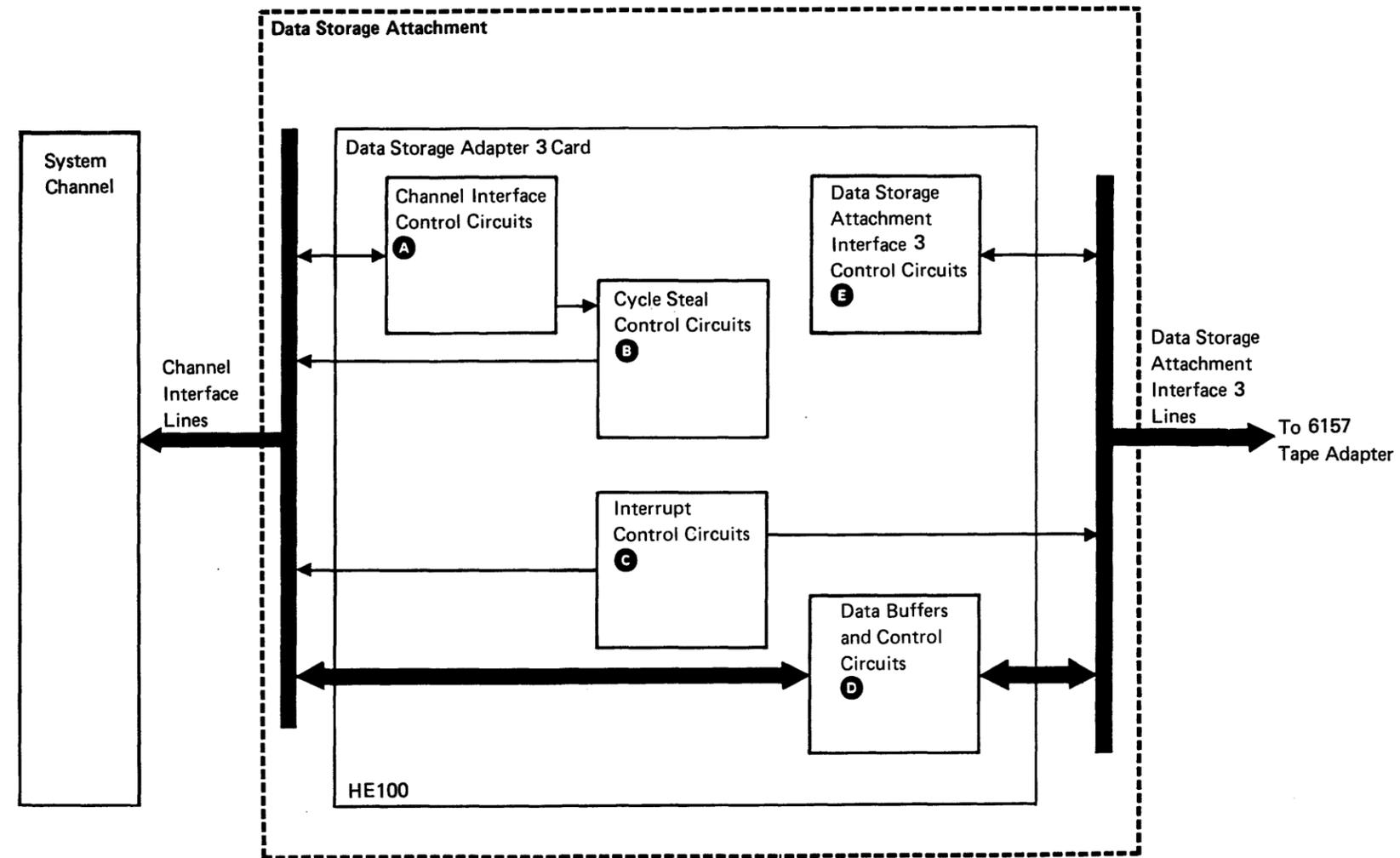
The data is moved between the tape control unit and a buffer, 1 byte at a time. The data is moved between the system and a buffer, in blocks of either 128 or 256 bytes, 2 bytes at a time.

Interrupt Control Circuits C

The interrupt control circuits control the 'interrupt level 4' line in the channel interface. This line is activated when the data storage adapter 3 card or the tape control unit needs system service.

Cycle Steal Control Circuits B

The cycle steal control circuits control the 'base cs req new' and 'chan burst cs req' lines in the channel interface. These lines are activated when the data storage adapter 3 card needs to receive data from or send data to the system.

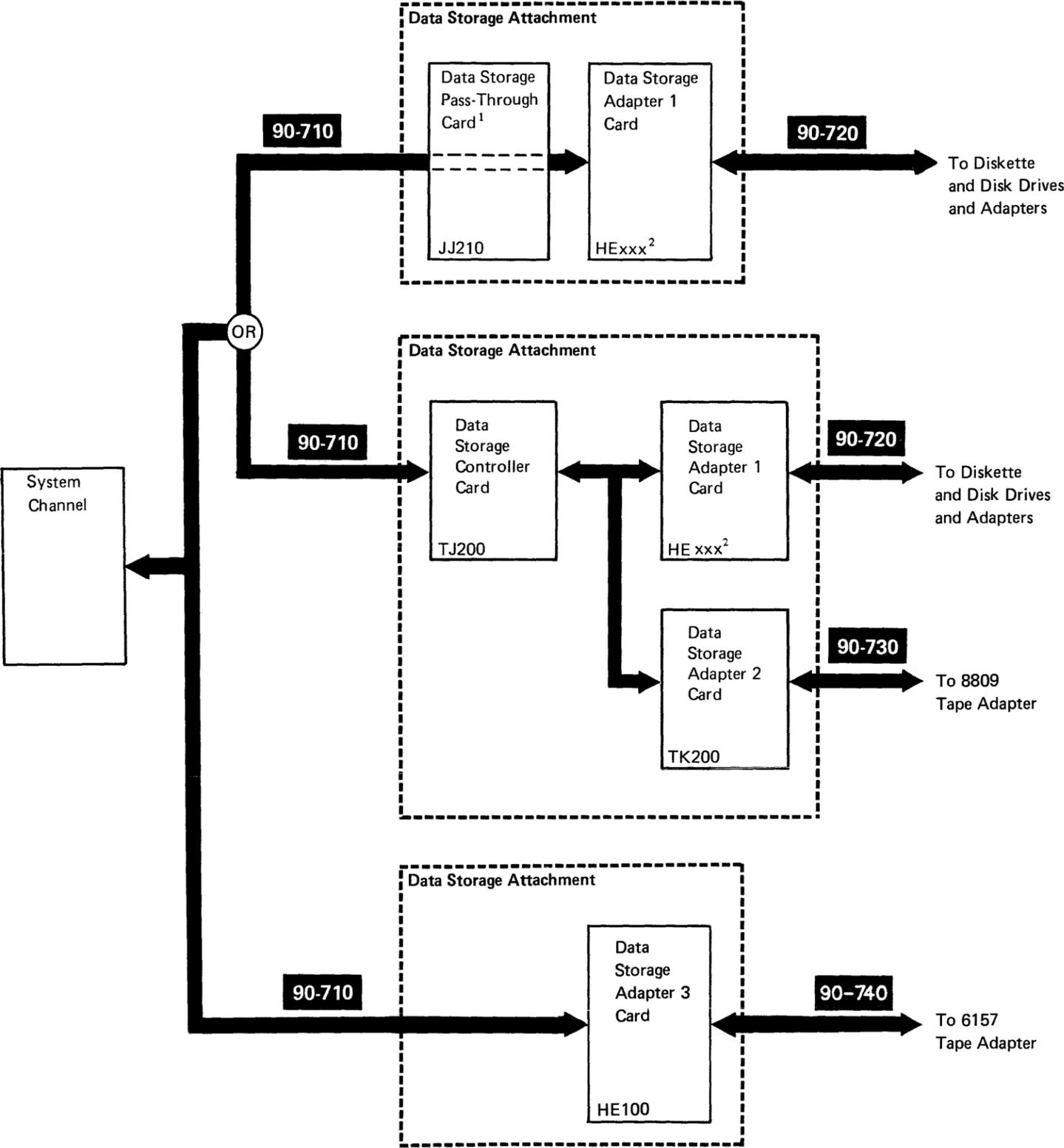


INTERFACE DESCRIPTIONS

90-700

Interface Locations

The following figure shows the interface to and from the data storage attachment and where you can find a description of the interface.



¹The data storage pass-through card is only in systems with 10SR disk drives and without 8809 tape drives. It does not change the signals on the channel interface lines.
²xxx = 100 for systems with 21ED disk drives.
xxx = 200 for systems with 10SR disk drives.

90-710

Channel Interface Lines

For a description of the channel interface lines, see 10-710.

90-720 (Part 1)

Data Storage Attachment Interface 1 Lines

The TU column in the following charts indicates a test unit to loop when probing the interface line.

Bidirectional Lines between the Data Storage Attachment and the Storage Device

Signal Name	Description	TU
-DSA data bus bit P, 0-7	These nine lines (eight data lines and one parity line) move control and sense information and data between the data storage attachment and the storage device.	See note.
<p>Note: <i>The TU to select is determined by the storage device used.</i></p> <p><i>TA20C 21ED disk drive</i> <i>TA315 10SR disk drive</i> <i>TD219 51TD diskette drive</i> <i>TD220 72MD diskette magazine drive</i></p>		

Storage Device-to-Data Storage Attachment Lines

Signal Name	Description	TU
-Disk A interrupt -Disk B interrupt -Disk C interrupt -Disk D interrupt -Dskt interrupt	These lines indicate the storage device either has an error condition or is at the end of an operation.	See note.
-Disk A req data xfr -Disk B req data xfr -Disk C req data xfr -Disk D req data xfr -Dskt req data xfr	These lines indicate which storage device needs a cycle to move data to the data storage attachment.	See note.
<p>Note: <i>The TU to select is determined by the storage device used.</i></p> <p><i>TA20C 21ED disk drive</i> <i>TA315 10SR disk drive</i> <i>TD219 51TD diskette drive</i> <i>TD220 72MD diskette magazine drive</i></p>		

90-720 (Part 2)

Data Storage Attachment Interface 1 Lines

Data Storage Attachment-to-Storage Device Lines

Signal Name	Description	TU
–Disk A ack data xfr –Disk B ack data xfr –Disk C ack data xfr –Disk D ack data xfr –Dskt ack data xfr	These lines indicate which storage device is assigned the next cycle on the DSA data bus for a read data or write data operation.	See Note 1.
–Disk/dskt reset	This line resets the storage devices.	See Note 2.
–Disk/dskt select	This line is used as a strobe pulse to gate commands, addresses, or data to the storage device.	See Note 1.
–Disk/dskt write/not read	This line indicates the direction of the control or sense information on the DSA data bus lines. An active level (–) indicates the movement is from the data storage attachment to a storage device. A not-active level (+) indicates the movement is from a storage device to the data storage attachment.	See Note 1.
–DSA adr bus bit 0-4	These five lines specify the control or sense information on the DSA data bus.	See Note 1.
–IPL disk A	This line causes an initial program load from disk drive A to the system.	See Note 3.
–IPL dskt	This line causes an initial program load from the diskette drive to the system.	See Note 4.
–LSSD B clock –LSSD C clock	These lines synchronize the data storage attachment and the storage device adapter cards.	See Note 1.
–Disk A select –Disk B select –Disk C select –Disk D select –Dskt select	These lines indicate which storage device is assigned the current cycle on the DSA data bus for a command or sense operation.	See Note 1.
–Disk A xfr ready –Disk B xfr ready –Disk C xfr ready –Disk D xfr ready –Dskt xfr ready	These lines permit the data storage attachment to delay or end the data movement from the storage device.	See Note 1.
<p>Notes:</p> <ol style="list-style-type: none"> The TU to select is determined by the storage device used. <ul style="list-style-type: none"> TA20C 21ED disk drive TA315 10SR disk drive TD219 51TD diskette drive TD220 72MD diskette magazine drive Press and release the System Reset key. Select either mode 0 or mode F, then press and release the Load key. Select mode E, then press and release the Load key. 		

90-730**Data Storage Attachment Interface 2 Lines**

The TU column in the following charts indicates a test unit to loop or an action to perform when probing the interface line.

Bidirectional Lines between the Data Storage Attachment and the 8809 Tape Adapter

Signal Name	Description	TU
-DSA data bus bit P, 0-7	These nine lines (eight data lines and one parity line) move control and sense information and data between the data storage attachment and the 8809 tape adapter.	TB126

Data Storage Attachment-to-Tape Adapter Lines

Signal Name	Description	TU
-Tape ack data xfr	This line indicates the tape adapter is assigned the next cycle on the data bus for a read data or write data operation.	TB120
-Tape reset	This line resets the 8809 tape adapter.	TB120
-Tape write/not read	This line indicates the direction of the control or sense information on the data bus lines. An active level (-) indicates the movement is from the data storage attachment to the 8809 tape adapter. A not-active level (+) indicates the movement is from the 8809 tape adapter to the data storage attachment.	TB121
-DSA adr bus bit 0-4	These five lines specify the control or sense information on the data bus.	TB121
-LSSD B clock -LSSD C clock	These lines synchronize the data storage attachment and the 8809 tape adapter card.	TB120
-Tape select	This line indicates the 8809 tape adapter is assigned the current cycle on the DSA data bus for a command or sense operation.	TB120
-Tape xfr ready	This line permits the data storage attachment to delay or end the data movement from the 8809 tape adapter.	TB129

Tape Adapter-to-Data Storage Attachment Lines

Signal Name	Description	TU
-Tape interrupt	This line indicates the 8809 tape adapter either has an error condition or is at the end of an operation.	TB131
-Tape req data xfr	This line indicates the 8809 tape adapter needs a cycle to move data to the data storage attachment.	TB129

90-740**Data Storage Attachment Interface 3 Lines**

The data storage attachment interface 3 lines cannot be probed.

SEQUENCE OF EVENTS

90-810

CSIPL (Disk)

For a description of the IPL sequence for the disk drive, see 10-810.

90-815

CSIPL (Diskette)

For a description of the IPL sequence for the diskette drive, see 10-810.

90-820

Command Operation

Note: During a command operation, the byte of command information is not stored in the data storage adapter 1, 2, or 3 card buffer. It is passed directly to the storage device.

The command operation sends commands to a storage device or to the data storage controller card.

Processing Unit	Data Storage Attachment	Storage Device
1 The main storage program needs a storage device. For a description of an I/O operation, see 10-820.		
2 The control storage program issues the necessary I/O commands. For a description of an I/O instruction transfer, see 10-821. Note: For system-to-device operations, go to 4 . For device-to-device data transfer operations, go to 3 .		
	3 The data storage controller, if present, issues the necessary commands for a device-to-device data transfer.	
	4 The data storage adapter card ¹ activates the 'xxx select' line ² , the 'xxx write/not read' line ³ , and the 'xxx select' line ³ .	
	5 One byte of command information moves on data storage attachment data bus 1, 2, or 3 to the storage device.	
		6 The storage device sets its busy status bit to stop additional command cycles until the byte of command information is stored.
Note: Steps 2 through 6 are repeated until all of the necessary command information is moved to the storage device.		
¹ The data storage adapter 1 card is used for disk and diskette operations. The data storage adapter 2 and 3 cards are used for tape operations. ² The real line name includes disk A, disk B, disk C, disk D, tape, or dskt. The active line determines the storage device that receives the command information. ³ The real line name includes disk/dskt or tape. The line name is determined by the data storage adapter used.		

90-825

Sense Operation

Note: During a sense operation, the byte of status information is not stored in the data storage adapter 1, 2, or 3 card buffer. It is passed directly to the system.

The sense operation gets status information from a storage device.

The status information is included in the device error history table. See the following for a description:

- 10SR disk drive and attachment (97-500)
- 21ED disk drive and attachment (95-500)
- 51TD diskette drive and attachment (91-500)
- 72MD diskette magazine drive and attachment (93-500)
- 8809 tape attachment (99-500)
- 6157 tape attachment (98-500)

Processing Unit	Data Storage Attachment	Storage Device
1 The control storage program issues the necessary I/O commands. For a description of an I/O instruction transfer, see 10-821.		
	2 Activates the 'xxx select' line ¹ and the 'xxx select' line ² .	
		3 One byte of status information moves on data storage attachment data bus 1, 2, or 3 to the system.
		4 The storage device sets its busy status bit to stop additional sense cycles until the byte of sense information is sent.
<p>Note: Steps 1 through 3 are repeated until all of the status information is moved to the system.</p>		
<p>¹ The real line name includes disk A, disk B, disk C, disk D, tape, or dskt. The active line determines the storage device that supplies the status information.</p> <p>² The real line name includes disk/dskt or tape. The line name is determined by the data storage adapter card used.</p>		

90-830

Write Data Operation

The write data operation moves data from the system to a storage device or from one storage device to another storage device.

Processing Unit	Data Storage Attachment	Storage Device
1 The main storage program needs to write data to a storage device or requests a device-to-device data transfer. For a description of an I/O operation, see 10-820.		
2 The control storage program issues the necessary I/O commands. For a description of an I/O instruction transfer, see 10-821.		
	3 A command operation occurs (90-820).	
	4 The data storage adapter card ¹ activates the 'cycle steal request' line to the system or to the data storage controller.	
5 The data moves in blocks of either 128 or 256 bytes (2 bytes at a time) from the system to the data storage adapter card ¹ buffer 1 or 2 by cycle steal. For a description of cycle steal, see 10-825.		
	6 The data storage adapter card ¹ activates the 'xxx xfr ready' line ² when the buffer is ready.	
		7 Activates the 'xxx req data xfr' line ² .
	8 The data storage adapter card ¹ activates the 'xxx ack data xfr' line ² for the storage device.	

Processing Unit	Data Storage Attachment	Storage Device
	9 The data storage adapter card ¹ activates the 'xxx select' line ³ , which gates the byte of data on data storage attachment data bus 1, 2, or 3 to the storage device.	
		10 Activates the 'xxx interrupt' line ² when the write operation is complete.
	11 The data storage adapter card ¹ activates the 'interrupt level 4' line.	
12 The control storage and main storage programs end the operation. For a description of an I/O operation, see 10-820.		
<p>Note: Steps 7 through 9 are repeated until the number of bytes instructed by the control storage program or the data storage controller are written.</p>		
<p>¹ The data storage adapter 1 card is used for disk and diskette operations. The data storage adapter 2 and 3 cards are used for tape operations.</p> <p>² The real line name includes disk A, disk B, disk C, disk D, tape, or dskt. The active line determines the storage device that receives the data.</p> <p>³ The real line name includes disk/dskt or tape. The line name is determined by the data storage adapter card used.</p>		

Read Data Operation

The read data operation moves data from a storage device to the system or from one storage device to another storage device.

Processing Unit	Data Storage Attachment	Storage Device
1 The main storage program needs to read data from a storage device or requests a device-to-device data transfer. For a description of an I/O operation, see 10-820.		
2 The control storage program issues the necessary I/O commands. For a description of an I/O instruction transfer, see 10-821.		
	3 A command operation occurs (90-820).	
	4 The data storage adapter card ¹ activates the 'xxx xfr ready' line ² for the storage device when buffer 1 or 2 (either buffer can be used) is ready.	
		5 Activates the 'xxx req data xfr' line ² .
	6 The data storage adapter card ¹ activates the 'xxx ack data xfr' line ² for the storage device.	
	7 The data storage adapter card ¹ activates the 'xxx select' line ³ , which gates the byte of data on the data storage attachment data bus 1, 2, or 3 to its buffer.	
	8 The data storage adapter card ¹ activates the 'cycle steal request' line when the buffer is ready.	
9 The data is received in blocks of either 128 or 256 bytes (2 bytes at a time) from the buffer (by cycle steal). For a description of cycle steal, see 10-825.		

Processing Unit	Data Storage Attachment	Storage Device
		10 Activates the 'xxx interrupt' line ² when the storage device read operation is complete.
	11 The data storage adapter card ¹ activates the 'interrupt level 4' line.	
12 The control storage and main storage programs end the operation. For a description of an I/O operation, see 10-820.		
<p>Note: Steps 5 through 9 are repeated until the number of bytes instructed by the control storage program are read.</p>		
<p>¹ The data storage adapter 1 card is used for disk and diskette operations. The data storage adapter 2 and 3 cards are used for tape operations.</p> <p>² The real line name includes disk A, disk B, disk C, disk D, tape, or dskt. The active line determines the storage device that supplies the data.</p> <p>³ The real line name includes disk/dskt or tape. The name is determined by the data storage adapter card used.</p>		

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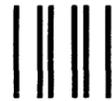
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**IBM System/36
Data Storage Attachment
Maintenance Information Manual**

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