



*Personal Computer
Hardware Reference
Library*

Display Station
Emulation Adapter

**Hardware
Maintenance
and Technical
Reference**



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Display Station
Emulation Adapter

**Hardware
Maintenance
and Technical
Reference**

Second Edition (July 1983)

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FEDERAL COMMUNICATIONS COMMISSION (FCC) IBM PERSONAL COMPUTER/DISPLAY STATION EMULATION ADAPTER

The IBM Personal Computer/Display Station Emulation Adapter (hereafter called adapter) is an FCC Class A device designed for installation in the IBM Personal Computer to support attachment of the IBM Personal Computer as a peripheral to other IBM Systems. This information is applicable only in the United States.

Warning: The IBM Personal Computer with the Adapter installed in it generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manuals, may cause interference to radio communications. The IBM Personal Computer with the Adapter installed in it (hereafter called equipment) has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Instructions Pursuant to FCC Part 15 Subpart J

1. This equipment should not be installed less than 30 meters (98.5 feet) from radio or television receivers or their receiving antennas.
2. This equipment should not receive its power from branch circuits that also power radio or television receivers.

If this equipment cannot comply with the above distance limitations:

1. Turn the equipment and the receiver on. If no interference is apparent, no further action need be taken.
2. If interference occurs, reorient or relocate the equipment, the receiver, or both.
3. If interference still occurs, contact your IBM Representative.

Related Publications

- IBM Personal Computer/Display Station Emulation Adapter Installation and Problem Determination Procedures, Part 6109567.
- IBM Personal Computer Guide to Operations, Part 6025000.
- IBM Personal Computer Technical Reference, Part 6025005.
- IBM Personal Computer Hardware Maintenance and Service, Part 6025072.

Preface

The IBM Personal Computer/Display Station Emulation Adapter Hardware Maintenance and Technical Reference manual should be used to isolate and repair any failure of the IBM Personal Computer/Display Station Emulation Adapter which is a Field Replaceable Unit (FRU).

The user should have training on the IBM Personal Computer.

This manual is organized into two parts, each part is then divided into sections. The two parts are as follows:

Part I. *Hardware Maintenance*: Part I contains the problem isolation charts, removal/replacement procedures, locations, and reference information.

Part II. *Technical Reference*: Part II contains the theory, hardware descriptions, glossary, and index.

The “Problem Isolation” section of this manual provides step-by-step instructions that aid the user in identifying the failing Field Replaceable Unit (FRU). When the FRU has been identified, the “Removal/Replacement” section provides all the necessary information to complete the repair activity.

This manual also provides operational instructions, hardware and design information.

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PART I. HARDWARE MAINTENANCE

SECTION 1. INTRODUCTION

Overview

The IBM Personal Computer/Display Station Emulation Adapter allows the IBM Personal Computer to attach to any system currently supporting the same type of twinaxial interface. The IBM Personal Computer/Display Station Emulation Adapter attaches to the system twinaxial line and handles the incoming and outgoing communications between the IBM Personal Computer and the system.

The Display Station Emulation Adapter plugs into a System Expansion slot inside the IBM Personal Computer System Unit.

Special Tools

None required.

How to Use

Always begin with the "Start" Problem Isolation Chart (PIC).

SECTION 2. PROBLEM ISOLATION

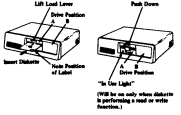
Start

This is the entry point for using all of the IBM Personal Computer/Display Station Emulation Adapter Problem Isolation Charts (PIC).

The failing response may be an audio error response during the Power On Self Test (POST), an error code from the Display Station Emulation Adapter diagnostics, an error code from the IBM Personal Computer/Display Station Emulation Adapter On-line test, or an undiagnosed problem associated with the Display Station Emulation Adapter.

Insert the failing response in the chart on the following page and follow the chart from there to the appropriate PIC as printed in page 14.

Depending on your failure indications, the "Start" PIC directs you to the Display Station Emulation Adapter Diagnostics PIC, the Display Station Emulation Adapter On-line Test PIC, or to the "Removal/Replacement" section of this manual.

<p>Display Station Emulation Adapter Diagnostics</p> <ol style="list-style-type: none">1. Adjust the Contrast and Brightness controls for eye comfort.2. Position the System Unit power switch to OFF.3. Insert the IBM Personal Computer/Display Station Emulation Adapter Diagnostic Aid diskette in drive position 0 and push down the load lever.4. Position the System Unit power switch to ON.  <p><small>PS/2 for use only where diskette is particularly useful in other functions.</small></p> <p>2-12</p>	<p>The following actions will occur after the System Unit power switch is positioned to ON:</p> <ol style="list-style-type: none">1. The Power On Self Test (POST) will run successfully.2. The IBM Personal Computer/Display Station Emulation Adapter diagnostics are loaded from diskette.3. The "IBM Personal Computer/Display Station Emulation Adapter Diagnostics" message displays. <p>Allow sufficient time for the POST to run and the diagnostics to load from diskette before answering the questions below.</p> <p>The IBM Personal Computer/Display Station Emulation Adapter Diagnostic Aid diskette (Model 1.28) (IC40949) IBM Corp. 1982</p> <p>ADAPTER CREDENTIALS</p> <ul style="list-style-type: none">1. NAME TESTER ONE TIME2. NAME TESTER TWO TIME3. NAME TESTER THREE TIME4. NAME TESTER FOUR TIME <p>ENTER THE ACTION DESIRED</p> <p>DID THE ABOVE MESSAGE DISPLAY?</p> <p>CONTINUE →</p> <p>2-13</p>
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The Display Station Emulation Adapter Diagnostics and the Display Station Emulation Adapter On-line Test PICs will guide you through a series of steps and the use of the IBM Personal Computer/Display Station Emulation Adapter Diagnostic Aid diskette to identify the failing FRU.

SECTION 3 REMOVAL REPLACEMENT

The "Removal/Replacement" section will guide you to complete the repair.

When using the PICs, you must always start with the "Start" PIC. Answer the questions carefully, and follow each instruction in sequence.

The example below shows a representative page from the PICs.

ARE ALL SWITCHES SET CORRECTLY?

NO Set all switches on the Display Station Emulation Adapter to the correct position. See Section 4, "Display Station Emulation Adapter Switch Settings" for the correct switch settings.

YES

1. Insert the Display Station Emulation Adapter into any other unused System Expansion Slot (other than the System Expansion Slot it was removed from) or swap System Expansion Slots with another option. Refer to "Replacement" procedure described in Section 3.
2. Insert the Diagnostic Aid diskette in drive position A and push down the Load lever.
3. Plug the System Unit power cord into the wall outlet and position the System Unit power switch to On.

Allow sufficient time for the POST to run and the diagnostics to load from the diskette.

Notes:

SECTION 2. PROBLEM ISOLATION

Start

This is the entry point for using all of the IBM Personal Computer/Display Station Emulation Adapter Problem Isolation Charts (PICs).

The failing symptom may be an audio error response during the Power On Self Test (POST), an error code from the Display Station Emulation Adapter diagnostics, an error code from the Display Station Emulation Adapter On-line test, or an unidentified problem associated with the Display Station Emulation Adapter.

Locate the failing symptom in the chart on the following pages and follow the chart from there to the appropriate PIC, or proceed to page 2-4.

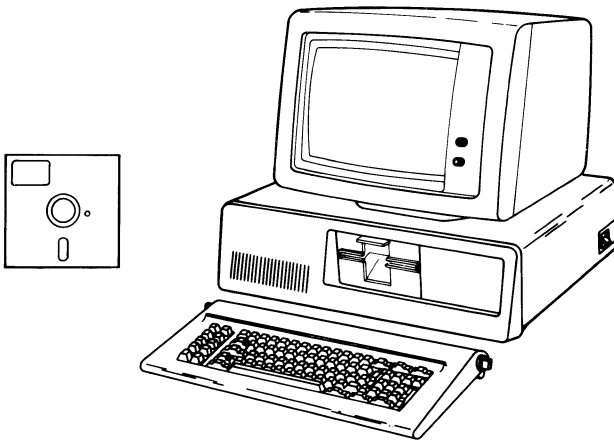
Problem Isolation Chart

Failing Symptom	PIC	Page	Probable Cause
POST Failed	Start	2-4	
Unidentified Problem	Start	2-4	
Error Code			
8000 4000	Display Station Emulation Adapter Diagnostics	2-12	(1) Feature not installed (2) Device Address switches set wrong (3) Display Station Emulation Adapter
2000	Display Station Emulation Adapter Diagnostics	2-12	(1) Station Address switches set wrong (2) Display Station Emulation Adapter

Failing Symptom	PIC	Page	Probable Cause
Error Code			
1000 0400	Display Station Emulation Adapter Diagnostics	2-12	(1) Interrupt Level switches set wrong (2) Display Station Emulation Adapter
0800 0200 0100 0080 0040 0020 0010	Display Station Emulation Adapter Diagnostics	2-12	Display Station Emulation Adapter
0008 0004	Display Station Emulation Adapter On-line Test	2-25	(1) Display Station Emulation Adapter (2) System Twinaxial Network Problem

In order to continue, you must have the following minimum components:

- System Unit with 48K bytes storage
- Keyboard
- 5 ¼ inch Diskette Drive and 5 ¼ inch Diskette Adapter
- IBM Monochrome Display¹
- IBM Monochrome Display and Printer Adapter¹
- Display Station Emulation Adapter
- IBM Personal Computer/Display Station Emulation Adapter Diagnostic Aid Diskette



¹An equivalent Display (80 characters by 25 rows) may be used with the IBM Color/Graphics Monitor Adapter.

DO YOU HAVE THE MINIMUM COMPONENTS?

NO Do not continue.

YES

Perform the following steps to ensure the IBM Personal Computer is operational before proceeding with the IBM Personal Computer/Display Station Emulation Adapter problem isolation:

1. Position the System Unit power switch to Off and remove the AC power cord from the wall outlet.
2. Remove the Display Station Emulation Adapter from the System Unit. Use the "Removal" procedure described in Section 3.
3. Use the "Problem Isolation (PICs)" section in the *IBM Personal Computer Hardware Maintenance and Service* manual to ensure that the IBM Personal Computer is operational.

Note: The IBM Personal Computer/Display Station Emulation Adapter will not be listed on the "Installed Devices" screen.

4. All problems encountered or failures detected while using the IBM Personal Computer PICs should be repaired before returning to this manual.
5. When all tests run successfully and the IBM Personal Computer is operational, return to this manual and continue on the next page.

IS THE IBM PERSONAL COMPUTER OPERATIONAL WITHOUT THE DISPLAY STATION EMULATION ADAPTER INSTALLED?

NO Use the “Problem Isolation (PICs)” section in the *IBM Personal Computer Hardware Maintenance and Service* manual to ensure that the IBM Personal Computer is operational.

YES

1. Position the System Unit power switch to Off and remove the AC power cord from the wall outlet.
2. Ensure that the Display Station Address switches located on the Display Station Emulation Adapter are set to a valid address (0 through 6) and write the address down for reference later in these PIC's. Refer to Section 4, “Display Station Emulation Adapter Switch Settings”.
3. Ensure that the Interrupt Level switches located on the Display Station Emulation Adapter are set for interrupt level 3 or 5 (not both). Write the interrupt level on paper for reference later in this section. Refer to Section 4, “Display Station Emulation Adapter Switch Settings”.
4. Ensure that all other switches located on the Display Station Emulation Adapter are set correctly. Refer to Section 4, “Display Station Emulation Adapter Switch Settings”.

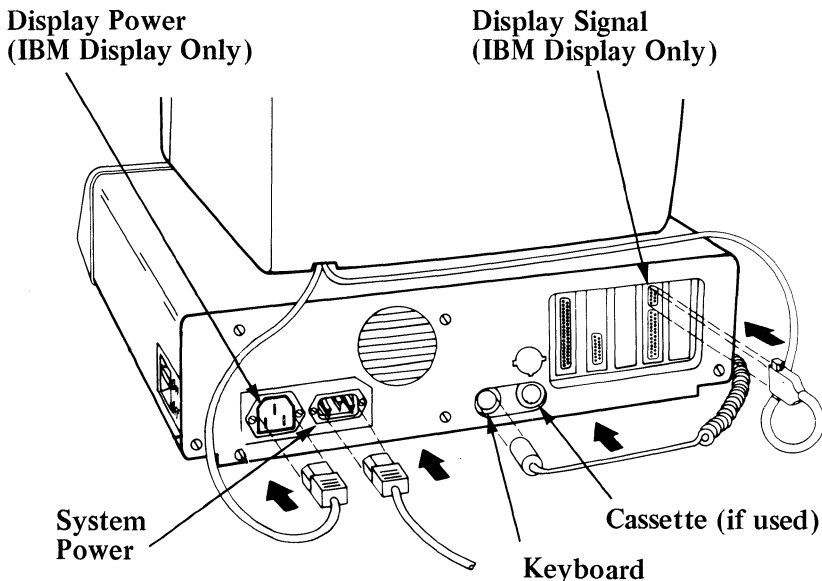
CONTINUE 

ARE THE DISPLAY STATION ADDRESS SWITCHES SET TO A VALID ADDRESS AND ALL OTHER SWITCHES LOCATED ON THE ADAPTER SET CORRECTLY?

NO Set all switches correctly before continuing. Refer to Section 4, ‘‘Display Station Emulation Adapter Switch Settings’’. Failure may have been caused by incorrect switch settings. Go to the next page.

YES Continue on the next page.

1. Reinstall the Display Station Emulation Adapter into the System Unit. (Use the "Replacement" procedure in Section 3, but do not install the system unit cover retaining screws at this time.)
2. See that all connectors are installed securely and in their proper locations.

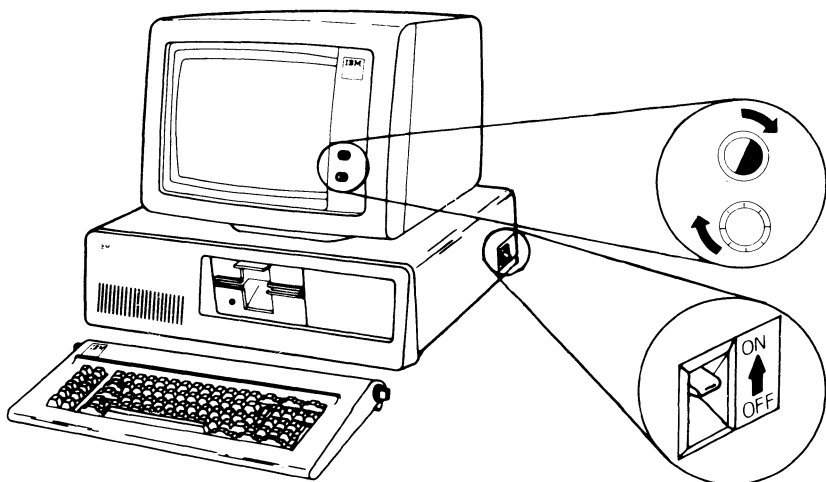


ARE ALL CONNECTORS INSTALLED SECURELY AND IN THE PROPER LOCATIONS?

NO Reconnect or repair the connectors before continuing. Go to the next page.

YES Continue on the next page.

1. Plug the System Unit power cord into a properly functioning, grounded wall outlet.
2. Position the System Unit power switch to On.
3. Turn the Contrast and Brightness controls fully clockwise.



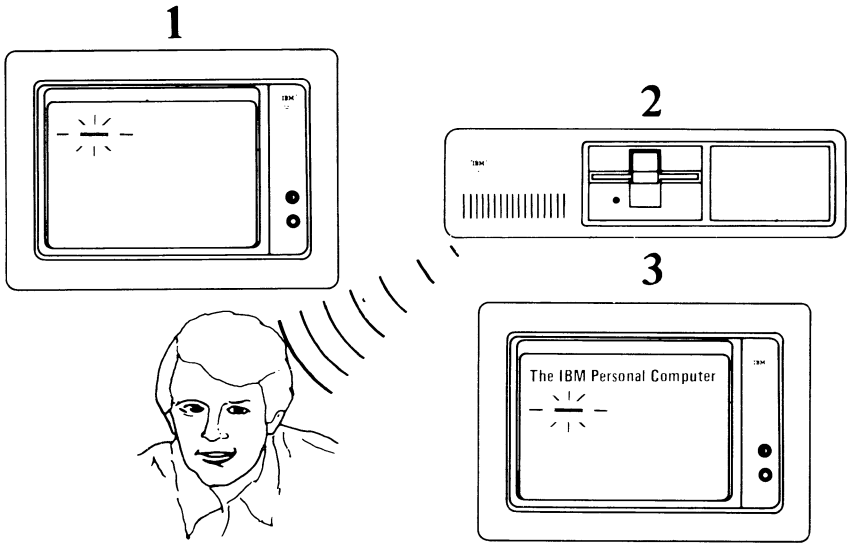
CONTINUE 

When an IBM Personal Computer is powered-on, there are the following three normal responses:

1. A cursor appears on the display in approximately 4 seconds.
2. One short “beep” sounds after the Power On Self Test (POST).
3. “The IBM Personal Computer BASIC” and copyright statement displays. If the IBM Personal Computer/Display Station Emulation Adapter Diagnostic Aid Diskette is loaded, the diagnostic menu should appear on the display (see page 2-13).

If you missed the responses, power off, wait 5 seconds and power on again.

WERE THE THREE RESPONSES CORRECT?

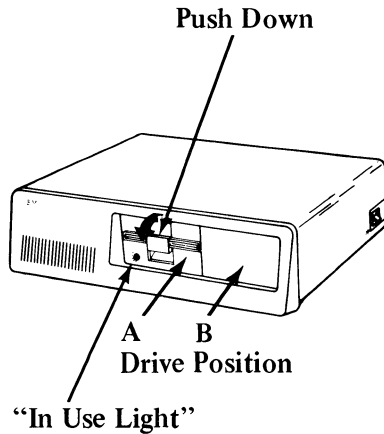
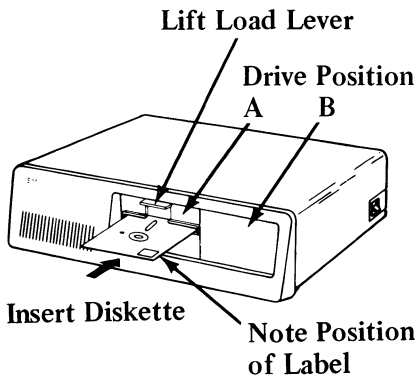


NO Position the System Unit power switch to Off and replace the defective Display Station Emulation Adapter. (See Section 3, "Removal/Replacement".)

YES →

Display Station Emulation Adapter Diagnostics

1. Adjust the Contrast and Brightness controls for eye comfort.
2. Position the System Unit power switch to Off.
3. Insert the IBM Personal Computer/Display Station Emulation Adapter Diagnostic Aid diskette in drive position A and push down the Load lever.
4. Position the System Unit power switch to On.



(Will be on only when diskette is performing a read or write function.)

The following actions will occur after the System Unit power switch is positioned to On:

1. The Power On Self Test (POST) will run automatically.
2. The IBM Personal Computer/Display Station Emulation Adapter diagnostics are loaded from diskette.
3. The "IBM Personal Computer/Display Station Emulation Adapter Diagnostics" message displays.

Allow sufficient time for the POST to run and the diagnostics to load from diskette before answering the question below.

The IBM Personal Computer
Display Station Emulation Adapter Diagnostics
Version 1.20 (C)Copyright IBM Corp. 1982

ADAPTER CHECKOUT

- 0 – RUN TESTS ONE TIME
- 1 – RUN TESTS MULTIPLE TIMES
- 5 – RUN ON-LINE TEST
- 9 – EXIT TO SYSTEM DISKETTE

ENTER THE ACTION DESIRED
?

DID THE ABOVE MESSAGE DISPLAY?

CONTINUE 

NO Position the System Unit power switch to Off and remove the diskette. Make sure the diskette is the "IBM Personal Computer/Display Station Emulation Adapter Diagnostic Aid" diskette and that it was loaded properly. If the diskette was wrong or loaded improperly, go to page 2-12 and load the diagnostics again. Otherwise proceed to the next page.

YES Go to page 2-17

1. Position the System Unit power switch to Off and remove the AC power cord from the wall outlet.
2. Remove the Display Station Emulation Adapter from the System Unit. Use the "Removal" procedure in Section 3.
3. Insert the "IBM Personal Computer/Display Station Emulation Adapter Diagnostic Aid" diskette in drive position A and push down the Load lever.
4. Plug the System Unit power cord into the wall outlet and position the System Unit power switch to On.

Allow sufficient time for the POST to run and the diagnostics to load from the diskette before answering the next question.

CONTINUE 

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Display Station Emulation Adapter Diagnostics
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ADAPTER CHECKOUT

- 0 -- RUN TESTS ONE TIME
- 1 -- RUN TESTS MULTIPLE TIMES
- 5 -- RUN ON-LINE TEST
- 9 -- EXIT TO SYSTEM DISKETTE

ENTER THE ACTION DESIRED
?

DID THE ABOVE MESSAGE DISPLAY?

NO Use the "Problem Isolation (PICs)" section in the *IBM Personal Computer Hardware Maintenance and Service* manual.

YES Position the System Unit power switch to Off and replace the defective Display Station Emulation Adapter. (See Section 3, "Removal/Replacement".)

The following are options available on the diagnostic menu:

0 — RUN TESTS ONE TIME — Run a functional test of the Display Station Emulation Adapter.

1 — RUN TESTS MULTIPLE TIMES — Repeats the functional test of the Display Station Emulation Adapter as many times as you choose. Returns to the diagnostic menu when the ENTER key is pressed.

5 — RUN ON-LINE TEST — Tests if the Display Station Emulation Adapter can communicate with the system through the twinaxial cables.

9 — EXIT TO SYSTEM DISKETTE — Allows the user to exit to the Disk Operating System (DOS) program.

Press (RUN TESTS ONE TIME), then
press (Enter).

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ADAPTER CHECKOUT

0 — RUN TESTS ONE TIME
1 — RUN TESTS MULTIPLE TIMES
5 — RUN ON-LINE TEST
9 — EXIT TO SYSTEM DISKETTE

ENTER THE ACTION DESIRED
?0

CONTINUE 

If a failure is detected during execution of the Display Station Emulation Adapter diagnostics an error message displays.

Note: The Display Station Address message displays only if a valid Display Station Address (0 through 6) is recognized by the diagnostics. The interrupt level message is displayed only if a valid interrupt occurs and is recognized by the diagnostics.

The IBM Personal Computer
Display Station Emulation Adapter Diagnostics
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ADAPTER CHECKOUT

- 0 – RUN TESTS ONE TIME
- 1 – RUN TESTS MULTIPLE TIMES
- 5 – RUN ON-LINE TEST
- 9 – EXIT TO SYSTEM DISKETTE

ENTER THE ACTION DESIRED
?

Display Station Emulation Adapter Diagnostics
- FAILURE DETECTED - XXXX.

Display Station Address Switches Are Set To 3.

Interrupt Level Switches Are Set For Level 3.

DID THE ABOVE ERROR MESSAGE DISPLAY?

Note: 'XXXX' will be a four-digit error code.

YES

1. Position the System Unit power switch to Off and remove the AC power cord from the wall outlet.
2. Remove the Display Station Emulation Adapter from the System Unit. Use the “Removal” procedure described in Section 3.
3. Make sure that the Device Address switches located on the Display Station Emulation Adapter are set correctly (Incorrect Device Address – Error Code 8000 or 4000). See Section 4, “Display Station Emulation Adapter Switch Settings” for the correct switch settings.
4. Make sure that the Display Station Address switches located on the Display Station Emulation Adapter are set to a valid Display Station Address 0 through 6 (Invalid Display Station Address (7) – Error Code 2000). See Section 4, “Display Station Emulation Adapter Switch Settings” for the correct switch settings.
5. Make sure the Interrupt Level switches located on the Display Station Emulation Adapter are set for interrupt level 3 or 5 (Interrupt Level 3 switch On or Interrupt Level 5 switch ON, not both). See Section 4, “Display Station Emulation Adapter Switch Settings”.

CONTINUE 

ARE ALL SWITCHES SET CORRECTLY?

NO Set all switches on the Display Station Emulation Adapter to the correct position. See Section 4, "Display Station Emulation Adapter Switch Settings" for the correct switch settings.

YES

1. Insert the Display Station Emulation Adapter into any other unused System Expansion Slot (other than the System Expansion Slot it was removed from) or swap System Expansion Slots with another option. Refer to "Replacement" procedure described in Section 3.
2. Insert the Diagnostic Aid diskette in drive position A and push down the Load lever.
3. Plug the System Unit power cord into the wall outlet and position the System Unit power switch to On.

Allow sufficient time for the POST to run and the diagnostics to load from the diskette.

4. Press (RUN TESTS ONE TIME),
then press (Enter).

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Display Station Emulation Adapter Diagnostics
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ADAPTER CHECKOUT

- 0 – RUN TESTS ONE TIME
- 1 – RUN TESTS MULTIPLE TIMES
- 5 – RUN ON-LINE TEST
- 9 – EXIT TO SYSTEM DISKETTE

ENTER THE ACTION DESIRED

?

Display Station Emulation Adapter Diagnostics
- FAILURE DETECTED - XXXX.

Display Station Address Switches Are Set To 3.

Interrupt Level Switches Are Set For Level 3.

DID THE SAME FAILURE RECUR?

Note: 'XXXX' will be a four digit error code.

NO Use the "Problem Isolation (PICs)" section in the *IBM Personal Computer Hardware Maintenance and Service* manual.

YES Position the System Unit power switch to Off and replace the defective Display Station Emulation Adapter. (See Section 3, "Removal/Replacement".)

If no failures are detected during execution of the Display Station Emulation Adapter Diagnostics, a "NO TROUBLE FOUND" message is displayed.

The Display Station address and the interrupt level, set in the switches located on the Display Station Emulation Adapter, are also displayed.

The IBM Personal Computer
Display Station Emulation Adapter Diagnostics
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ADAPTER CHECKOUT

0 – RUN TESTS ONE TIME
1 – RUN TESTS MULTIPLE TIMES
5 – RUN ON-LINE TEST
9 – EXIT TO SYSTEM DISKETTE

ENTER THE ACTION DESIRED
?

Display Station Emulation Adapter Diagnostics
Completed Successfully -- NO TROUBLE FOUND.

Display Station Address Switches Are Set To X.

Interrupt Level Switches Are Set For Level X .

Note: Display Station Address 'X' can be any valid Display Station Address 0 through 6. Interrupt level 'X' can be either interrupt level 3 or 5.

**DID THE "NO TROUBLE FOUND" MESSAGE DISPLAY?
(This message should display within 10 seconds.)**

NO Position the System Unit power switch to the Off position and replace the defective Display Station Emulation Adapter. See Section 3, "Removal/Replacement".

YES Continue on the next page.

Verify that the Display Station Address and the Interrupt Level displayed matches the Display Station Address and the Interrupt Level recorded on page 2-6 of this section and set in the Display Station Address and Interrupt Level switches on the Display Station Emulation Adapter.

The IBM Personal Computer
Display Station Emulation Adapter Diagnostics
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ADAPTER CHECKOUT

- 0 – RUN TESTS ONE TIME
- 1 – RUN TESTS MULTIPLE TIMES
- 5 – RUN ON-LINE TEST
- 9 – EXIT TO SYSTEM DISKETTE

ENTER THE ACTION DESIRED
?

Display Station Emulation Adapter Diagnostics
Completed Successfully -- NO TROUBLE FOUND.

Display Station Address Switches Are Set To X .

Interrupt Level Switches Are Set For Level X .

Note: Display Station Address “X” can be any valid Display Station Address 0 through 6. Interrupt Level “X” can be interrupt level 3 or 5.

CONTINUE 

DOES THE DISPLAY STATION ADDRESS AND INTERRUPT LEVEL DISPLAYED MATCH THE ADDRESS AND INTERRUPT LEVEL SET IN THE SWITCHES?

NO Position the System Unit power switch to the Off position and replace the defective Display Station Emulation Adapter. See Section 3, 'Removal/Replacement'.

YES 

Display Station Emulation Adapter On-line Test

1. The On-line test will check if the Display Station Emulation Adapter can communicate with a system through the twinaxial cables.
2. The following *prerequisites* are required to run the Display Station Emulation Adapter On-line test:
 - The IBM Personal Computer must be connected to the twinaxial cable of a system that supports the Display Station Emulation Adapter.
 - The system must be powered on and running a Licensed Program Product that communicates with the IBM Personal Computer/Display Station Emulation Adapter.

Note: For specific system Licensed Program Product requirements refer to the user's guide included with your application software for the Display Station Emulation Adapter.

DO YOU MEET ALL THE PREREQUISITES?

NO Go to Page 2-29

YES

Perform the following:

1. Press to select "RUN ON-LINE TEST."
2. Press (Enter)

After the ENTER key is pressed, the following message displays:

"**RUN ON-LINE TESTS MULTIPLE TIMES? (Y OR N) = =>"

3. Press (No)
4. Press (Enter)

After pressing the ENTER key the On-line test will run. If a failure is detected during the On-line test an error message will be displayed on the Display Screen.

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Display Station Emulation Adapter Diagnostics
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ADAPTER CHECKOUT

0 – RUN TESTS ONE TIME
1 – RUN TESTS MULTIPLE TIMES
5 – RUN ON-LINE TEST
9 – EXIT TO SYSTEM DISKETTE

ENTER THE ACTION DESIRED
?

Display Station Emulation Adapter ON-LINE
Test -- FAILURE DETECTED - XXXX.

Display Station Address Switches Are Set To 3.

DID THE ABOVE ERROR MESSAGE DISPLAY?

Note: 'XXXX' will be a four digit error code.

NO Go to Page 2-30

YES

Perform the following checks:

1. Make sure that the system to which your IBM Personal Computer is connected is operating and is able to recognize the IBM Personal Computer. (This may require activating your IBM Personal Computer on the system or other system operator action.)

CONTINUE



2. Ensure the IBM Personal Computer/Display Station Emulation Adapter has the correct Display Station Address switch setting. The Display Station Address switch setting of the IBM Personal Computer/Display Station Emulation Adapter is displayed.
3. The IBM Personal Computer may be on a twinaxial cable with other display stations. If so, make sure that each display station on the cable has the correct Display Station Address switch setting.
4. Make sure that the twinaxial cable is not terminated at any other display station between your IBM Personal Computer and the system.
5. Make sure that the Terminator accessory (if required) is installed on the T-connector if the IBM Personal Computer is the only or the last display station on the twinaxial cable. Refer to your application software user's guide to determine if your system uses the Terminator accessory.
6. Check that the connectors on the twinaxial cable from the external connector on the System Unit rear panel to the T-connector are properly connected and tightened.
7. Check that the system twinaxial cable connections to the T-connector are properly connected and tightened. Run the On-line test again on page 2-25.

DID THE MESSAGE “FAILURE DETECTED” DISPLAY?

NO Continue on Page 2-30

YES Position the System Unit power switch to the Off position and replace the defective Display Station Emulation Adapter. See Section 3, “Removal/Replacement”.

**IS THE REPORTED FAILING SYMPTOM A
DISPLAY STATION EMULATION ADAPTER ERROR
CODE OF 0008 OR 0004?**

NO No trouble found. The “Run Diagnostics Multiple Times” procedure on page 2-32 should help you if the IBM Personal Computer/Display Station Emulation Adapter has an intermittent problem.

YES Position the System Unit power switch to the Off position and replace the defective Display Station Emulation Adapter. See Section 3, “Removal/Replacement”.

When the Display Station Emulation Adapter On-line test completes without an error, the following message is displayed.

The IBM Personal Computer
Display Station Emulation Adapter Diagnostics
Version 1.20 (C)Copyright IBM Corp. 1982

ADAPTER CHECKOUT

- 0 – RUN TESTS ONE TIME
- 1 – RUN TESTS MULTIPLE TIMES
- 5 – RUN ON-LINE TEST
- 9 – EXIT TO SYSTEM DISKETTE

ENTER THE ACTION DESIRED

?

Display Station Emulation Adapter ON-LINE
Test Completed Successfully - NO TROUBLE
FOUND.

Display Station Address Switches Are Set To X.

Note: “X” can be any valid Display Station Address 0 through 6.

If the System Unit cover screws were previously removed, install and align both cover retaining screws with the threaded tabs on the cover; tighten screws.


You have now completed the IBM Personal Computer/Display Station Emulation Adapter PICs.

The following procedures should help you if the IBM Personal Computer/Display Station Emulation Adapter has an intermittent problem.

CONTINUE 

Run Diagnostics Multiple Times

Perform the following steps to run the Display Station Emulation Adapter diagnostics multiple times.

1. Load the "IBM Personal Computer/Display Station Emulation Adapter Diagnostic Aid" diskette in diskette drive position A and position the System Unit power switch to On.
2. When the diagnostic menu displays, press  (RUN TESTS MULTIPLE TIMES)

and then press  (Enter).

After the ENTER key is pressed, the following message displays:

***STOP LOOPING ON FIRST FAILURE? (Y OR N) = = > "

3. If you press the N key and then press the ENTER key, the Display Station Emulation Adapter diagnostics will run continuously until the ENTER key is pressed again.
4. If you press the Y key and then press the ENTER key, the Display Station Emulation Adapter diagnostics will stop with an error message displayed if an error occurs or continue to run until the ENTER key is pressed again.

Run On-line Test Multiple Times

Perform the following steps to run the Display Station Emulation Adapter On-line test multiple time.

1. Load the "IBM Personal Computer/Display Station Emulation Adapter Diagnostic Aid" diskette in diskette drive position A and position the System Unit power switch to On.
2. When the diagnostic menu displays, press (RUN ON-LINE TEST) and then press (Enter).

After the ENTER key is pressed, the following message displays:

***RUN ON-LINE TEST MULTIPLE TIMES? (Y OR N) = = > "

3. Press the Y key and then press the ENTER key.

After the ENTER key is pressed, the following message displays:

***STOP LOOPING ON FIRST FAILURE? (Y OR N) = = > "



CONTINUE 

4. If you press the N key and then press the ENTER key, the Display Station Emulation Adapter Online test will run continuously until the ENTER key is pressed again.

5. If you press the Y key and then press the ENTER key, the Display Station Emulation Adapter Online test will stop with an error message displayed if an error occurs or continue to run until the ENTER key is pressed again.

If you still have an unresolved problem use the “Problem Isolation (PICs)” section in the *IBM Personal Computer Hardware Maintenance and Service* manual or seek technical assistance.

Perform the following steps to exit to the system diskette:

1. Press  to select "EXIT TO SYSTEM DISKETTE".
2. Press  (Enter).
3. Remove the Diagnostic Aid diskette from drive position A and place it in the protective jacket.
4. Resume your normal operations.

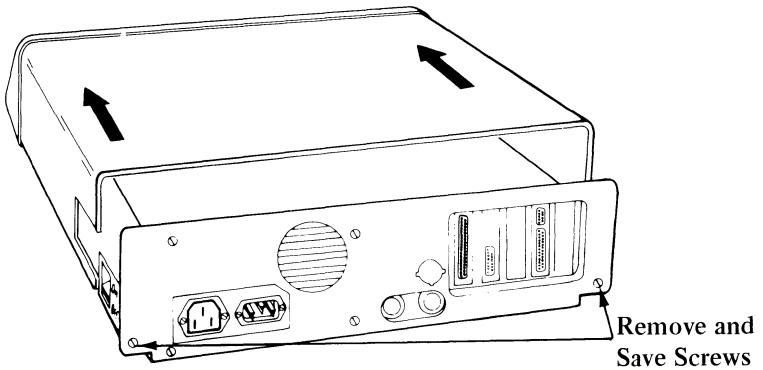
Notes:

SECTION 3.

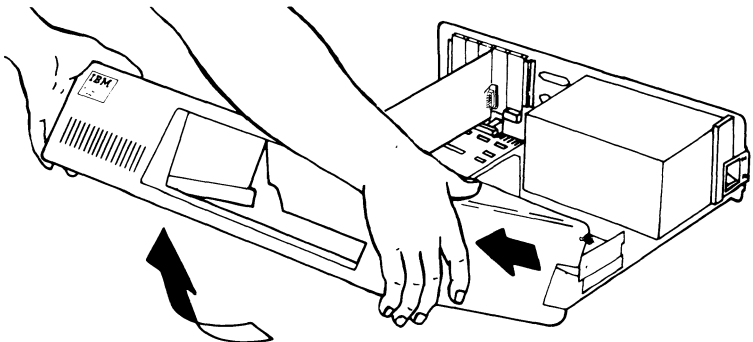
REMOVAL/REPLACEMENT

Display Station Emulation Adapter Removal:

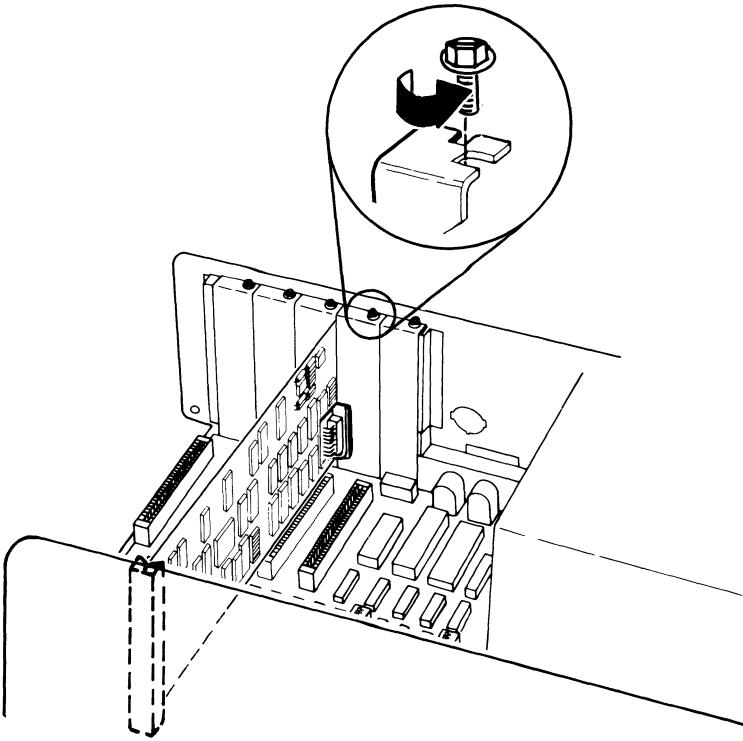
1. Position the System Unit power switch to Off; unplug System Unit power cord from wall outlet and disconnect all cables from the rear of the System Unit.
2. Set the Display, Keyboard, and Printer away from the System Unit work area.
3. Remove and save the two cover retaining screws and slide the System Unit cover toward the front until it will not go any further. Tilt the cover up and remove the cover.



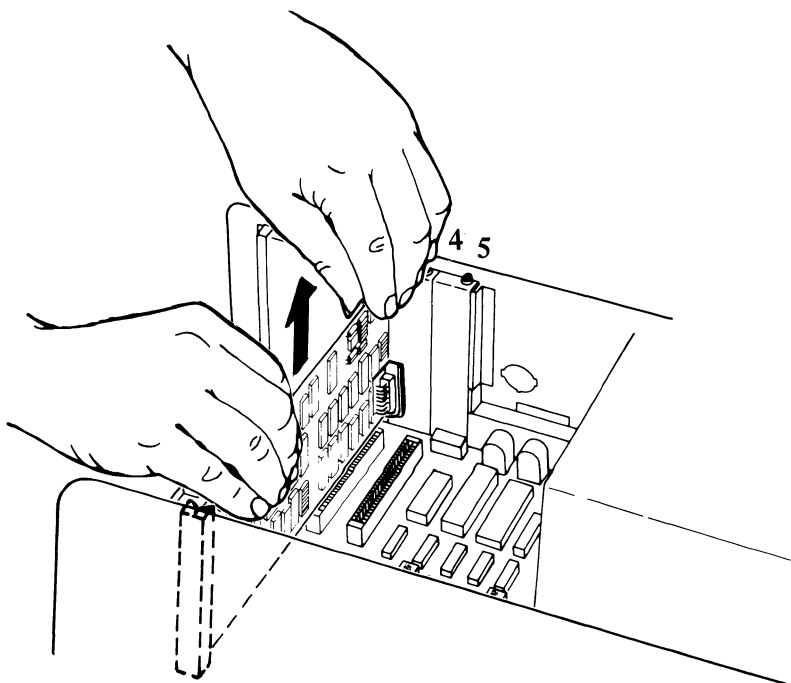
Rear View



4. Remove and save the Adapter Retaining Bracket mounting screw.

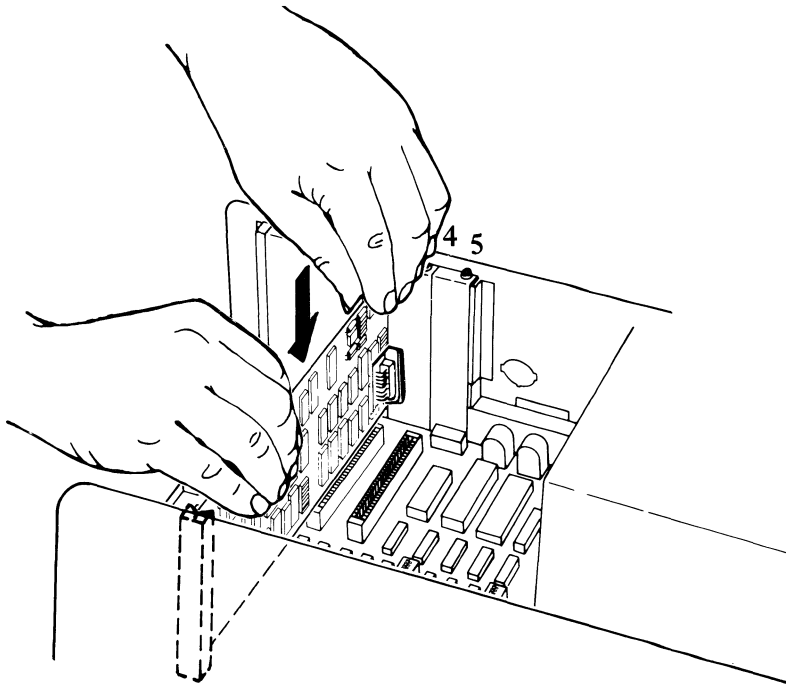


5. Grasp the Display Station Emulation Adapter by the top corners and lift straight up.

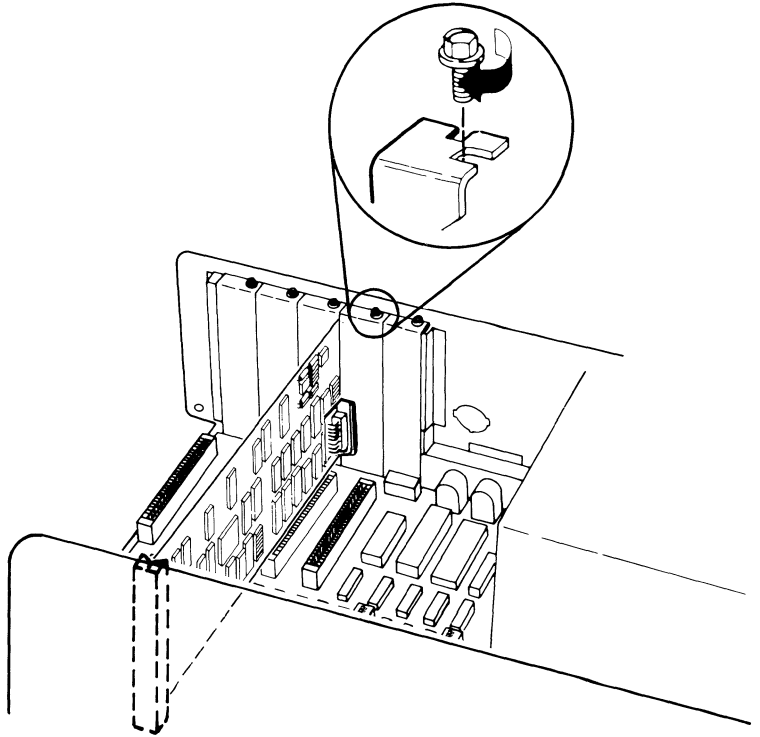


Display Station Emulation Adapter Replacement:

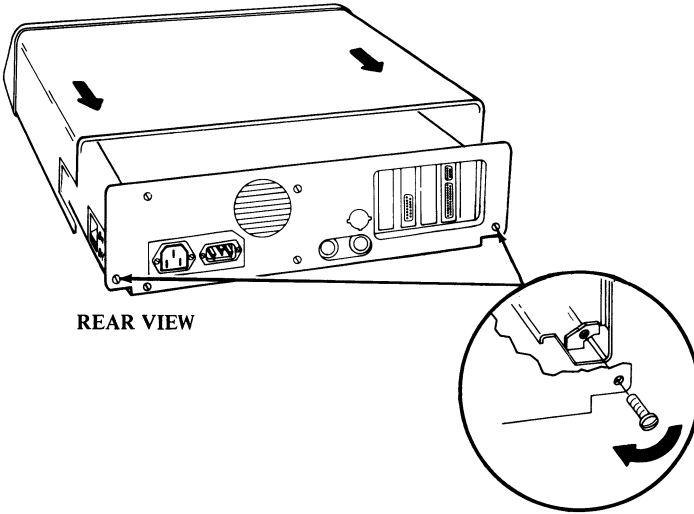
1.
 - a. Make sure that all switches on the Display Station Emulation Adapter are set correctly (See Section 4, "Display Station Emulation Adapter Switch Settings".)
 - b. Insert the Display Station Emulation Adapter into the System Expansion Slot. Press down firmly to seat the Adapter in the System Expansion Slot connector.



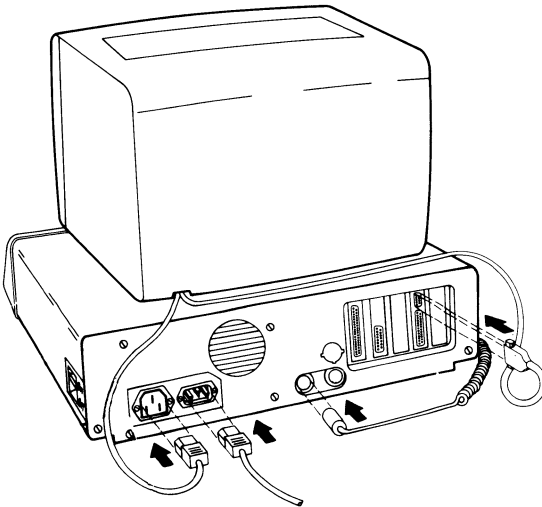
2. Install the Adapter Retaining Bracket mounting screw as shown below.



3. Slide the System Unit cover on and toward the rear of the machine.
4. Align both cover retaining screws with the threaded tabs on the cover; tighten screws.

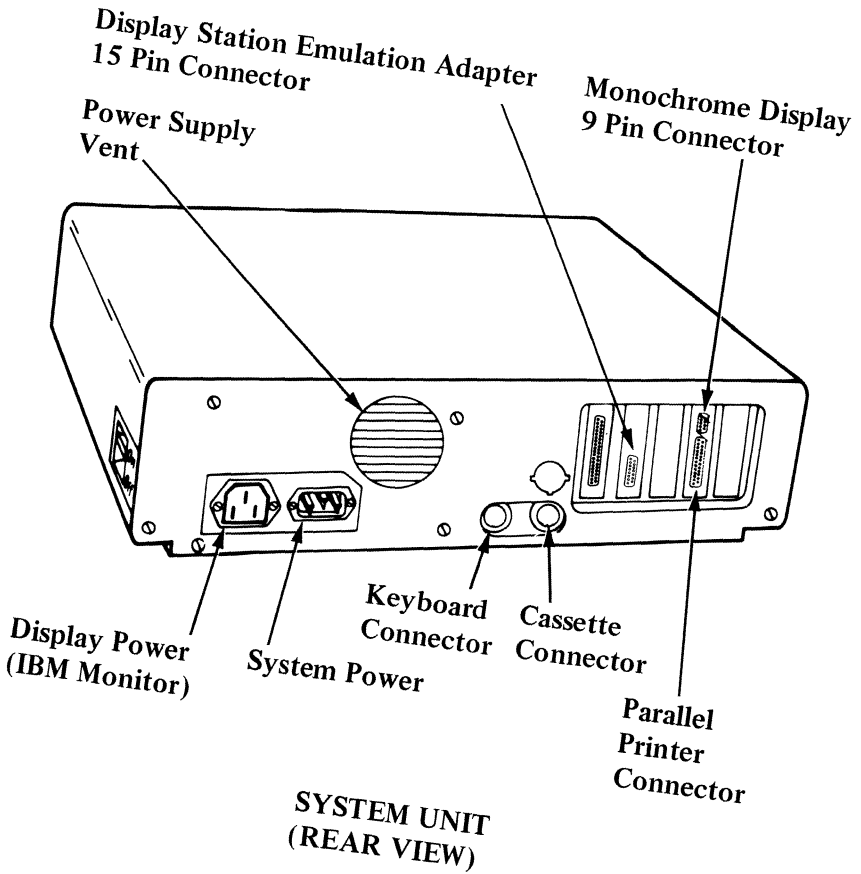


5. Reconnect the cables to System Unit.

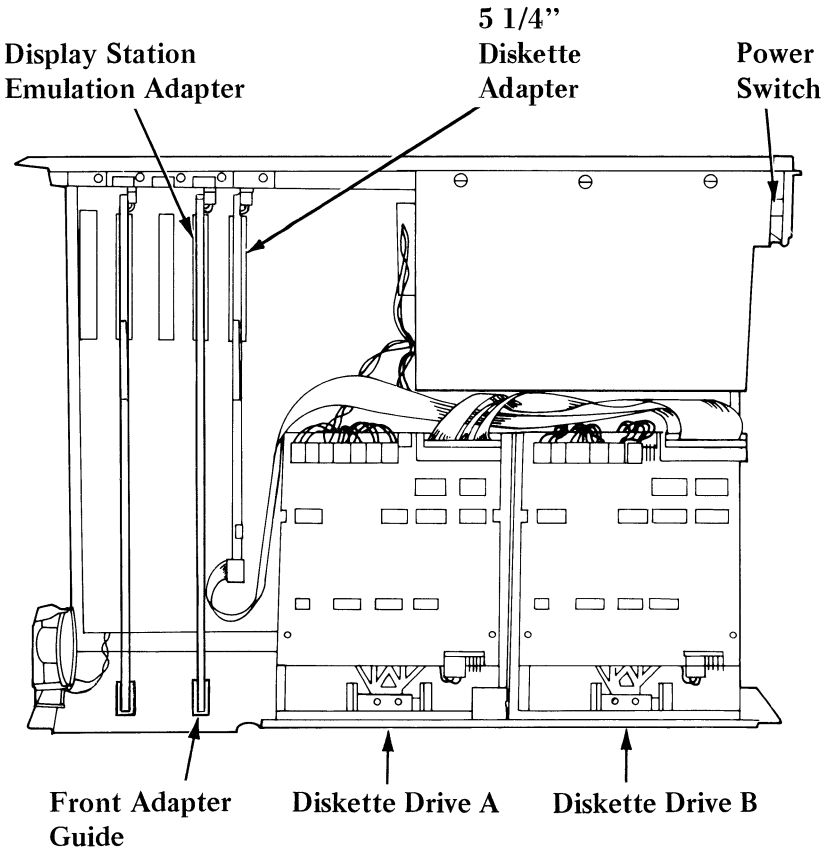


SECTION 4. LOCATIONS

System Unit



System Unit (Continued)



**SYSTEM UNIT
(TOP VIEW)**

Display Station Emulation Adapter Switch Settings

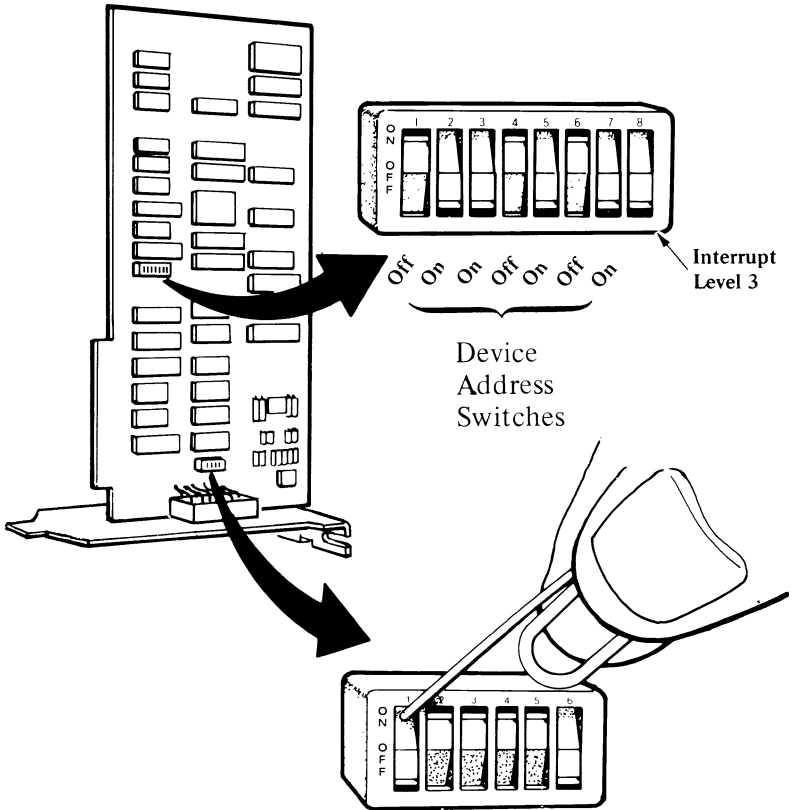


Table 1

Display Station Addresses	Switch Settings		
	1	2	3
0	Off	Off	Off
1	Off	Off	On
2	Off	On	Off
3	Off	On	On
4	On	Off	Off
5	On	Off	On
6	On	On	Off
Invalid (7)	On	On	On

Notes:

PART II. TECHNICAL REFERENCE

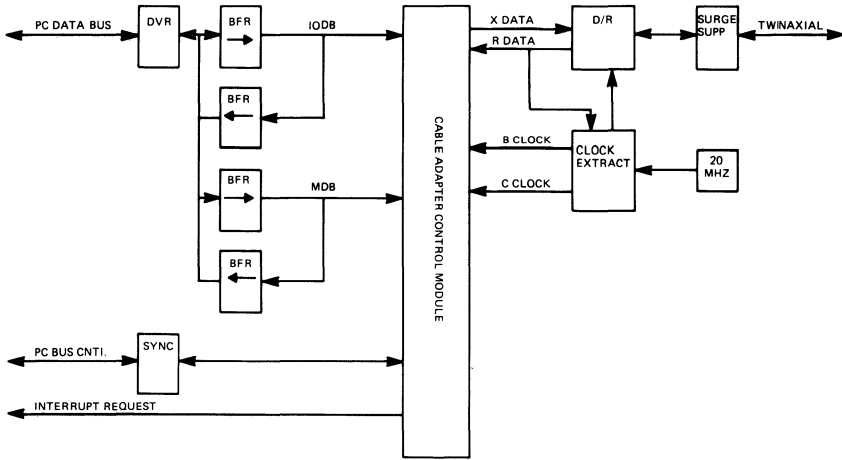
SECTION 5. HARDWARE DESCRIPTION

Introduction

The IBM Personal Computer/Display Station Emulation Adapter provides hardware to connect the IBM Personal Computer to the twinaxial cable of any system that supports the same type of twinaxial interface. The Display Station Emulation Adapter consists of the hardware (drivers, receivers, and logic) to handle incoming and outgoing communications between the IBM Personal Computer and a system.

The Display Station Emulation Adapter interfaces with the IBM Personal Computer through a System Expansion Slot.

Block Diagram



Functional Description

The Display Station Emulation Adapter receives and transmits bi-phase encoded data on the twinaxial cable at a rate of 1 MHz. A twinaxial driver/receiver module is used to drive the twinaxial cable.

The logic on the Display Station Emulation Adapter provides the following functions:

- Serializing/deserializing of data
- Detection of transmission errors
- Parity generation
- Code violation detection
- Display Station address selection
- Bi-phase encode/decode function
- Real time poll status generation
 - Line parity error flag
 - Transmission acknowledge bit
 - Station busy flag
- Response to real time commands
 - Poll command
 - Activate write command
 - Activate read command

The twinaxial driver/receiver module and adapter logic are driven by a clock extraction circuit and a 20 MHz oscillator.

The Display Station Emulation Adapter contains seven interface registers that are used by the IBM Personal Computer to control the adapter functions. These registers are selected by address bits A2 through AC of the I/O address.

Functional Description (continued)

The Display Station Emulation Adapter device address is selected by an 8-position switch assembly located on the adapter. The I/O address range for the adapter is hexadecimal 250 through 257. The adapter address is in bit positions A9 through A0 of the I/O address. The low-order three positions (A2 through A0) select the interface registers on the adapter.

The 8-position switch assembly also selects interrupt level 3 of the IBM Personal Computer by setting switch 8 On.

The IBM Personal Computer display station address is selected by switches 1 through 3 on the 6-position switch assembly located on the adapter.

Optional on-card termination of the twinaxial cable is selected by setting switches 4 and 5 of the 6-position switch assembly to On.

The 6-position switch assembly also selects Interrupt Level 5 of the IBM Personal Computer by setting switch 6 to On.

The Display Station Emulation Adapter requires two direct memory address (DMA) channels of the DMA controller. Activate channel is assigned to DMA Port 1 and Command Queue channel is assigned to DMA Port 3.

The Display Station Emulation Adapter requires one Interrupt Request line to signal the IBM Personal Computer System Unit that the adapter requires attention.

Functional Description (continued)

The DMA request and Interrupt request signals originate in the Display Station Emulation Adapter and are logically disconnected from the I/O Channel Interface following power-on reset or a transition from normal mode to diagnostic mode. They remain logically disconnected from the I/O Channel Interface until an I/O Write command is issued to the Display Station Emulation Adapter. This is done to allow the use of DMA Ports 1 and 3, and Interrupt Levels 3 or 5 by other devices when the Display Station Emulation Adapter is installed but not active.

Phase-Encoding

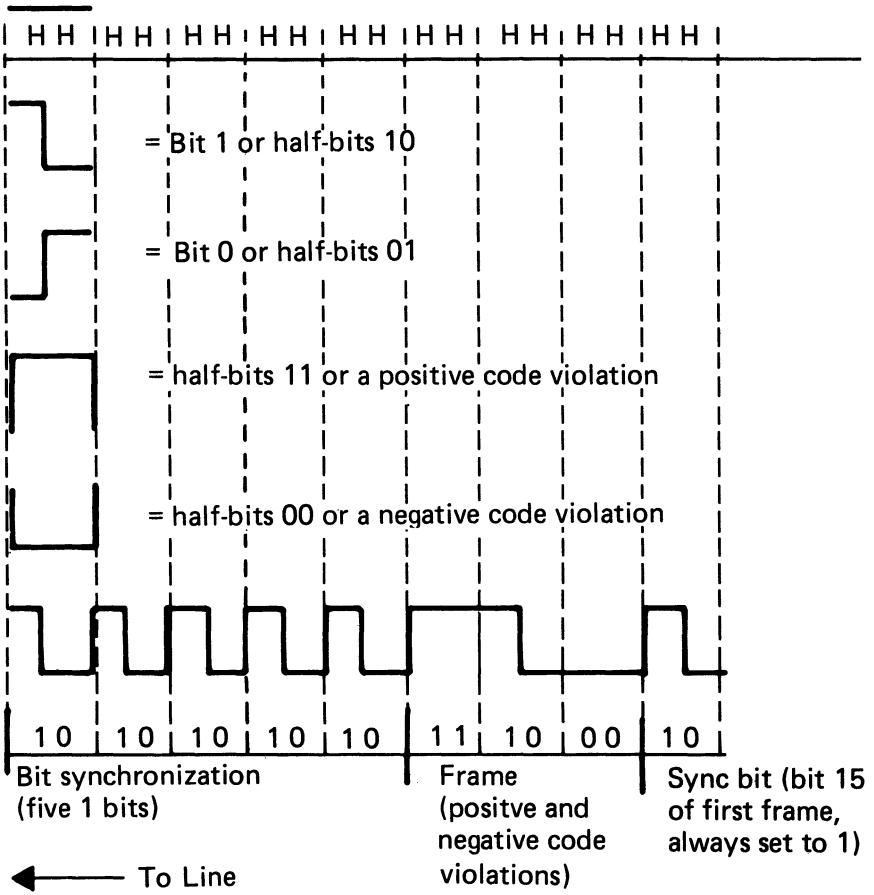
Data sent on the twinaxial cable is phase encoded so that a transition occurs during each bit time. Because the transition divides the bit cell into two parts, the term half-bit will be used in the description that follows. The first half-bit is 0 if the signal is negative (low) during the first half-bit. The first half-bit is 1 if the signal is positive (high) during the first half-bit. Two half-bits make up a bit cell. Each half-bit must be a different polarity to be valid.

When the signal remains positive for the two half-bits in a bit cell, this is a positive code violation. When it remains negative for the two half-bits in a bit cell, this is a negative code violation.

A negative-to-positive transition during the bit cell is a bit 0. A positive-to-negative transition during the bit cell is a bit 1.

When information is to be sent on the twinaxial cable, a group of five 1 bits (1010101010 half bits) is sent to establish bit synchronization. Immediately after the 1 bits are sent, a group of 3 half-bits set to 1 and 3 half-bits set to 0 are sent to establish frame synchronization. This results in a positive code violation followed by a negative code violation.

Phase-Encoding



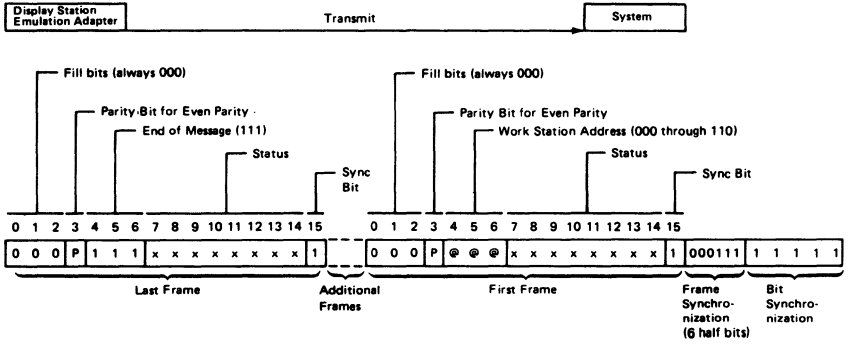
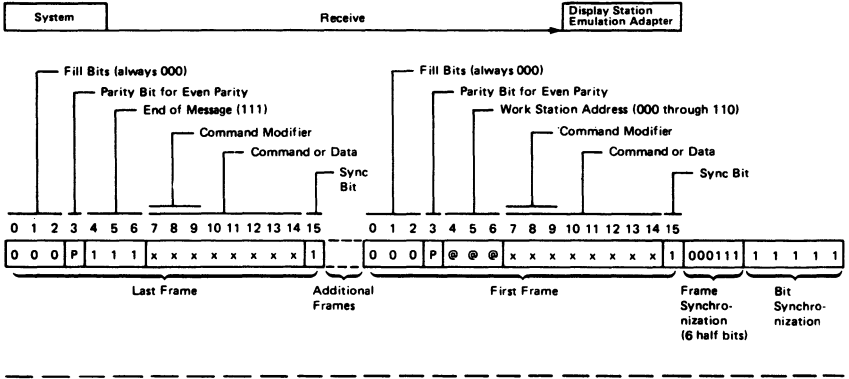
Frame Format

Communications between the IBM Personal Computer/Display Station Emulation Adapter and a system through the twinaxial cable are carried by 16-bit frames. The twinaxial cable usually carries no signal between frames, however, it may carry a number of idle zeros. The maximum transmission rate is 1.0 MHz (16 microseconds per frame).

The 16-bit frame carries 13 bits of information in each direction. The fill bits, which are always 000, serve as a timing delay. The parity bit makes the number of active bits in the frame even. The Display Station Emulation Adapter decodes the address bits and responds to a specific address by sending a response that contains the display station address.

A display station address of 111 indicates an end of message and causes a line turnaround. Bits 7 through 14 contain the data or commands used by the Display Station Emulation Adapter or the IBM Personal Computer. Bit 15, which is always on, is the synchronization bit for the Display Station Emulation Adapter.

Frame Format



Commands

Note: The binary number in parentheses next to the command is bits 10 through 14 of the command frame.

The following commands are twinaxial commands serviced by the Display Station Emulation Adapter and require an emulation program loaded in the IBM Personal Computer in order to be active:

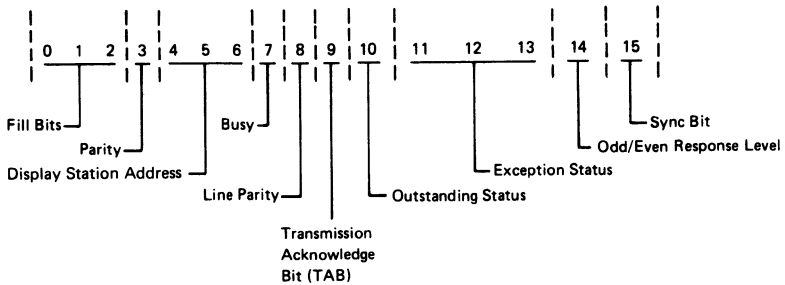
- **Poll (10000):** Is sent to the Display Station Emulation Adapter from a system and initiates the transmission of one or two status words from the adapter per poll command. The poll command acknowledges and resets a line parity error from the Display Station Emulation Adapter. It also acknowledges receiving the last status transmission from the Display Station Emulation Adapter.
- **Write Activate (00001):** If enabled (via the Function Control Register) this command will cause the Display Station Emulation Adapter to store the command/data portion of all subsequent frames of the message into a specified location in data storage.
- **Read Activate (00000):** If enabled (via the Function Control Register) this command will cause the Display Station Emulation Adapter to send data frames to the twinaxial cable from a specified location in data storage.

These commands are serviced by the hardware. Commands not serviced by the hardware are not listed but may be found in the manuals associated with the products they are emulating.

Poll Response Frame

A single response frame is returned to the system after the Display Station Emulation Adapter is polled following power-on. The system receives the first response frame and returns a set mode command to the Display Station Emulation Adapter.

A two-frame response is made to every poll command after the set mode command. The second frame contains a display station address of all 1's (indicating the last message frame) and the scan code in bits 7 through 14. The first frame in the response contains the status information as follows:



- Bit 7**
- 0 = Display station not busy
 - 1 = Display station busy

- Bit 8**
- 0 = No line parity error found
 - 1 = Line parity error found

- Bit 9**
- Initialized to zero at power-on.
 - Toggles when the first command in the queue is executed, and after each transmission.
 - Status is valid only during not busy time.

- Bit 10**
- Indicates there is feature data or status from an I/O device to send to the system

- Bits 11, 12, and 13**
- These three bits are encoded to indicate the exception status as follows:

Bit	11	12	13	Description
	0	0	0	No exception status
	0	0	1	Null or attribute error
	0	1	0	Activate not valid
	1	0	0	Command or device ID not valid
	1	0	1	Input queue or storage overrun
	1	1	0	Register value not valid
	1	1	1	Power-on transition

Bit 14

By analyzing bit 14, the system can determine if the information in the response frame received is the same as the previous response frame, or if the information has changed. Bit 14 is set to zero (0) after power-on. Any change in the response frame changes bit 14 from its previous condition.

Data Transfer

During data transfer, the Display Station Emulation Adapter has three major functions:

- To respond to polling.
- To shift data to the twinaxial cable for transmission to the system.
- To receive data from the system twinaxial cable and decode the data for either or both of the following functions:
 - Commands
 - Transferring data to storage

The Display Station Emulation Adapter finds the display station address on the first frame of a message transmitted. When this address is received and recognized, and a response is returned, the polling is complete.

Data to be transmitted to the system is moved from the IBM Personal Computer data storage, through a serializer/deserializer (SERDES) register, and to the twinaxial cable under control of the Display Station Emulation Adapter.

Received data is moved into the serdes until the sync bit is in the high-order position. The serdes is stopped, permitting time for the data to be transferred to the IBM Personal Computer data storage.

I/O Channel Interface

The following I/O Channel signal and voltage lines are used:

System Board I/O Channel	A2<	-----	+ D7	----->	Display Station Emulation Adapter
	A3<	-----	+ D6	----->	
	A4<	-----	+ D5	----->	
	A5<	-----	+ D4	----->	
	A6<	-----	+ D3	----->	
	A7<	-----	+ D2	----->	
	A8<	-----	+ D1	----->	
	A9<	-----	+ D0	----->	
	A11	-----	+ AEN	----->	
	A22	-----	+ A9	----->	
	A23	-----	+ A8	----->	
	A24	-----	+ A7	----->	
	A25	-----	+ A6	----->	
	A26	-----	+ A5	----->	
	A27	-----	+ A4	----->	
	A28	-----	+ A3	----->	
	A29	-----	+ A2	----->	
	A30	-----	+ A1	----->	
	A31	-----	+ A0	----->	
	B1	-----	Ground	-----	
	B2	-----	+ Reset Drv	----->	
	B3	-----	+ 5 Volts	----->	
	B5	-----	- 5 Volts	----->	
	B10	-----	Ground	-----	
	B13	-----	- IOW	----->	
	B14	-----	- IOR	----->	
	B15	-----	- DACK3	----->	
	B16<	-----	+ DRQ3	-----	
	B17	-----	- DACK1	----->	
	B18<	-----	+ DRQ1	-----	
	B23<	-----	+ IRQ5	-----	
	B25<	-----	+ IRQ3	-----	
	B27	-----	+ T/C	----->	
B29	-----	+ 5 Volts	----->		
B31	-----	Ground	-----		

Display Station Emulation Adapter I/O Channel Interface Line Descriptions

Signal	I/O	Description
D0-D7	I/O	Data bits 0 to 7: These lines provide data bus bits 0 to 7 for the Display Station Emulation Adapter. D0 is the Least Significant Bit (LSB) and D7 is the Most Significant Bit (MSB). These lines are active HIGH.
A0-A9	I	Address bits 0 to 2: These lines are used to select an I/O Register on the Display Station Emulation Adapter. Address bits 3 to 9: These lines are used to address the Display Station Emulation Adapter. A0 is the Least Significant Bit (LSB) and A9 is the Most Significant Bit (MSB). These lines are active HIGH.

AEN	I	Address Enable: When this line is active it tells the Display Station Emulation Adapter that the DMA Controller has control of the address bus, data bus, read command lines, and write command lines. This line is active HIGH.
RESET DRV	I	Reset Driver: This line is used to reset or initialize the Display Station Emulation Adapter logic upon power-on or during a low line voltage outage. This signal is synchronized to the falling edge of the system clock and is active HIGH.
$\overline{\text{IOW}}$	I	-I/O Write Command: This command line instructs the Display Station Emulation Adapter to read the data on the data bus. This signal is active LOW.
$\overline{\text{IOR}}$	I	-I/O Read Command: This command line instructs the Display Station Emulation Adapter to drive its data onto the data bus. This signal is active LOW.

<u>DACK1</u>	I	-DMA Acknowledge 1: This line acknowledges the DMA request for activate service. This signal is active LOW.
<u>DACK3</u>	I	-DMA Acknowledge 3: This line acknowledges the DMA request for queue service. This signal is active LOW.
T/C	I	Terminal Count: This line provides a pulse to the Display Station Emulation Adapter when the terminal count for either DMA channel is reached. This signal is active HIGH.
DRQ1	0	DMA Request 1: The Display Station Emulation Adapter uses this line to request DMA service for activate service. A request is generated by bringing the line to an active level (HIGH). The line must be held high until the DACK1 line goes active.

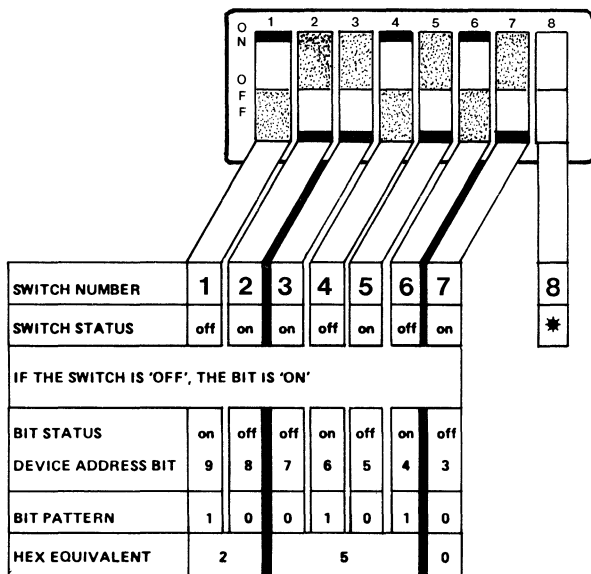
DRQ3	0	DMA Request 3: The Display Station Emulation Adapter uses this line to request DMA service for the queue. A request is generated by bringing the line to an active level (HIGH). The line must be held high until the DACK3 line goes active.
IRQ3 IRQ5	0	Interrupt Request 3 or 5: The Display Station Emulation Adapter uses one of these lines to signal the processor that it requires service. The signal used is selected by the position of the interrupt level 3 or 5 select switches. These signals are active HIGH.

Display Station Emulation Adapter Switch Settings

Device Address Switch Assembly

The device address of the Display Station Emulation Adapter is selected by setting switches 1 through 7 of the 8-position switch assembly located on the adapter. Setting the switch On causes the corresponding I/O address bit to be Off. The settings shown below indicate a device address of hexadecimal 250 – 257. The low order three bits of the I/O address are used to select the interface registers on the adapter.

Switch position 8 is used to select the IBM Personal Computer interrupt level 3. When the switch is On interrupt level 3 is used. When the switch is Off, interrupt level 3 is disabled.



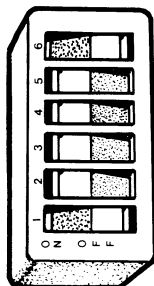
Note: Either interrupt level 3 or interrupt level 5 must be selected, *never* both. The interrupt level selected must be compatible with the emulation software.

Display Station Address Switch Assembly

The display station address of the IBM Personal Computer is selected by setting the 6-position switch assembly located on the Display Station Emulation Adapter. Setting the switch On causes the corresponding station address bit to be set to 1. The switch settings shown below indicate display station address 4 is selected. The switches must be set to a valid display station address (0 through 6) and each display station connected to the same twinaxial cable must have a unique address.

The twinaxial cable must be terminated at the last display station on the line. Switches 4 and 5 are optional Terminate switches. The Terminate switches can be used to terminate the twinaxial cable if the Terminator accessory is not used. The twinaxial cable is terminated with the switches set to On. The twinaxial cable is not terminated with the switches set to Off. The switch settings below indicate the twinaxial cable is *not* terminated.

Switch position 6 is used to select the IBM Personal Computer interrupt level 5. When the switch is On interrupt level 5 is used. When the switch is Off, interrupt level 5 is disabled. The setting shown below indicates interrupt level 5.



- On – Interrupt Level 5
- Off – Terminate Option
- Off – Terminate Option
- Off – Station Address Switch 1
- Off – Station Address Switch 2
- On – Station Address Switch 4

Note: Either interrupt level 3 or interrupt level 5 must be selected, *never* both. The interrupt level selected must be compatible with the emulation software.

Physical and Electrical Characteristics

Dimensions

The Display Station Emulation Adapter is packaged on a single printed circuit card approximately 33.35cm (13.01 inches) long and 10.69cm (4.16 inches) high. The adapter contains one double sided 62-pin connector that fits into an System Expansion slot in the IBM Personal Computer System Unit.

Operating Environment

Environment:	Class B
Particulate:	Class 1
Gas:	Class 1

Power Requirements

- + 5 Volts DC at 750 MA
- 5 Volts DC at 60 MA

Glossary

Terms not found in this glossary may be found in the *IBM Data Processing Glossary* (GC20-1699).

- AC:** Alternating current.
- Address:** A character or group of characters that identifies a register, a particular part of storage, or some other data source or destination.
- Audio:** Sounds that can be heard by the human ear.
- BASIC:** Beginner's all-purpose symbolic instruction code. A programming language with a small collection of commands and a simple syntax, primarily designed for numerical applications.
- Bi-phase Encoding:** See phase-encoding
- Bit:** In binary notation, either of the characters 0 or 1
- Bit cell:** A cell comprised of two half-bits. Carries binary coding for 1 bit of information.
- Byte:** A sequence of eight adjacent binary digits (bits) that are operated upon as a unit.
- Cabled:** Connected by means of some kind of cable.
- Communicate:** The transmission and reception of data.
- Cursor:** A moveable spot of light on the display device, usually indicating where the next character will be entered.
- Data transfer:** The sending of data from the data source and the receiving of the data at a data sink.

Device:	A mechanical or electrical object with a specific purpose.
Device Address:	The unique address of a particular device.
Diskette:	A thin, flexible magnetic disk enclosed in a semi-rigid protective jacket.
Diskette Drive:	The device that rotates the diskette disk.
Display Station Address:	A unique address of an individual Display Station.
DMA:	Direct Memory Address
EAB:	Extended Attribute Buffer.
Emulate:	To imitate one system with another so that the imitating system accepts the same data and achieves the same results as the imitated system.
Enable:	Turned on.
EOQ:	A display station command which designates the end of the command queue.
Execution:	The process of carrying out the instructions of a computer program by a computer.
FRU:	Field Replaceable Unit.
Half-Bit:	A bit cell divided into two parts during a transition cycle.
I/O:	Input/Output.

LSB:	Least Significant Bit.
Microsecond:	One-millionth of a second.
MSB:	Most Significant Bit.
Parity:	Error detection.
Phase-encoded:	The method by which data is transmitted across twinaxial cables.
PIC:	Problem Isolation Chart.
Polarity:	Reference to either a positive or negative charge.
Poll:	The process of inviting data stations to transmit, one at a time.
POST:	Power On Self Test.
SERDES:	Serializer/Deserializer.
System Expansion Slot:	Slots located in the system unit which allow for additional devices to be installed on the IBM Personal Computer.
T-Connector:	A device which allows for three cables to be connected together.
Terminated line:	A transmission line with a resistance attached across its far end equal to the characteristic impedance of the line.
Terminator:	A device used to terminate a transmission line.

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Display Station Emulation Adapter
Hardware Maintenance and Technical Reference

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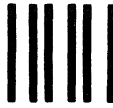
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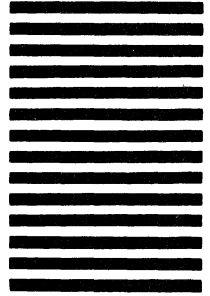


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