IBM

IBM

IBM 3270
Personal Computer
Attachment

1.1

User's Guide

IBM

IBM 3270
Personal Computer
Attachment

User's Guide

IBM

IBM 3270
Personal Computer
Attachment

User's Guide

Federal Communications Commission Radio Frequency Interference Statements

An IBM Personal Computer System Unit, when attached to an IBM 3278 Display Station or an IBM 3279 Color Display Station, complies with the requirements in Part 15 of FCC Rules for a Class A computing device. Operation of this equipment in a residential area may cause unacceptable interference to radio and television reception, requiring the operator to take whatever steps are necessary to correct the interference.

Preface

This manual tells you:

- How to attach the IBM Personal Computer System Unit to the IBM 3278 Display Station or to the 3279 Color Display Station

- How to operate the display station as a personal computer

- How to use the display station as a programmable terminal

- How to do screen capture and file transfer

- How to do problem determination and isolate the defective device (the system unit or the display).

This manual does not tell you how to operate a personal computer; refer to the IBM Personal Computer manuals listed under "Other Manuals to Read."

Who Should Use This Manual

This manual is for any 3278 or 3279 user who has the IBM Personal Computer System Unit attached to the 3278 or 3279 display. This manual assumes that you are familiar with:

- General concepts, such as how to log on to the host application

- The 3278/3279 keyboard

- The IBM Personal Computer manuals, including the *IBM Personal Computer Disk Operating System* (DOS 1.1 or 2.0). Refer to the respective *DOS* manual for an explanation of the DOS 1.1 or 2.0 commands and concepts used in this manual.

What Is in This Manual

This manual has six chapters and 10 appendixes:

Chapter 1, Introduction, gives an overview of the IBM 3270 Personal Computer Attachment.

Chapter 2, Setup and Option Installation, contains instructions for preparing, placing, cabling, powering-up, and checking out the IBM 3270 Personal Computer Attachment. Use this chapter when setting up your IBM 3270 Personal Computer Attachment.

Chapter 3, Customization, tells you how to prepare your IBM 3270 Personal Computer Attachment DOS diskette and how to select your keyboard reference card. Read this chapter before trying to operate your display station as an IBM Personal Computer.

Chapter 4, How to Operate and Use the Keyboard, explains the operating sequence and how to use the 3278/3279 keyboard in personal computer mode. It tells how to switch modes and gives some commonly used personal computer key sequences. This chapter also shows you how to use the XLATKBD program to change the personal computer key function mapping on your 3278/3279 keyboard.

Chapter 5, Data Transfer, explains how to capture screens and to transfer files between the personal computer and the host with the sample application programs supplied.

Chapter 6, Problem Determination, tells you how to isolate and correct problems that occur during setup and during operation of the IBM 3270 Personal Computer Attachment. Read this chapter when your system does not work properly.

Appendix A, Assembler Application Program Interface, defines the functions that a personal computer application program can use to pass data between the personal computer application program and the IBM Personal Computer 3270 Attachment Option.

Appendix B, BASIC Application Program Interface, describes concepts similar to Appendix A for beginner's all-purpose symbolic instruction code (BASIC).

Appendix C, PASCAL Application Program Interface, describes concepts similar to Appendix A for PASCAL.

Appendix D, IBM Personal Computer 3270 Attachment Option, gives technical reference information about the IBM Personal Computer 3270 Adapter.

Appendix E, Setup for Data Transfer, guides supervisors or system programmers in setting up the personal computer, host, and control unit for screen capture and file transfer.

Appendix F, Data Transfer Formats and Translation Tables, provides data formats and translations for the supplied data transfer sample application programs.

Appendix G, File Transfer Data Streams and Error Messages, gives the structures for transferring data between the host and the personal computer. This appendix contains descriptions for "impossible" file transfer error messages.

Appendix H, Advanced Diagnostics, should be used as an addendum to the *IBM Personal Computer Hardware and Service* and *IBM Personal Computer XT Hardware and Service* manuals. It is assumed that users of this appendix have hardware service experience.

Appendix I, Parts List, gives the part numbers for the cables, distribution box, and adapters used by the IBM Personal Computer 3270 Attachment Option.

Appendix J, Repack Instructions, contains instructions on how to repack your system unit when relocating it or returning it for repair.

Keyboard Reference Cards, at the back of the manual, fold out for quick key reference when you are working in personal computer mode.

Other Manuals to Read

IBM Personal Computer Library

These personal computer manuals will be useful for reference:

- *Guide to Operations,* Part Number 6025003

- *BASIC,* Part Number 6025010

- *Disk Operating System,* Part Number 6024001

- *Technical Reference,* Part Number 6025008.

CMS and TSO Manuals

Conversational monitor system (CMS) and time sharing option (TSO) manuals are listed in:

- *IBM System/370 and 4300 Processors Bibliography,* GC20-0111.

IBM 3270 Information Display System Library

Some IBM 3270 Information Display System manuals you might also use are:

- *IBM 3274 Control Unit Description and Programmer's Guide,* GA23-0061

- *IBM 3274 Control Unit Planning, Setup, and Customizing Guide,* GA27-2827

- *IBM 3274 Control Unit Customizing Guide,* GA23-0065

- *IBM 3270 Information Display System Data Stream Programmer's Reference,* GA23-0059.

Contents

Chapter 5. Data Transfer   5-1

Chapter 6. Problem Determination   6-1

Appendix A. Assembler Application Program Interface   A-1

Appendix B. BASIC Application Program Interface   B-1

Appendix C. PASCAL Application Program Interface   C-1

Appendix D. IBM Personal Computer 3270 Attachment Option   D-1

Appendix E. Setup for Data Transfer   E-1

Appendix F. Data Transfer Formats and Translation Tables   F-1

Appendix G. File Transfer Data Streams and Error Messages   G-1

Appendix H. Advanced Diagnostics   H-1

Appendix I. Parts List   I-1

Appendix J. Repack Instructions   J-1

Figures

Tables

Summary of Changes

If you have used this manual before, you will want to know the changes to the IBM 3270 Personal Computer Attachment as well as the changes to this *User's Guide*.

Changes to the IBM 3270 Personal Computer Attachment

The IBM 3270 Personal Computer Attachment now supports:

• The IBM 3279 Color Display

• The IBM Personal Computer Disk Operating System, Release 2.0.

The HOST command now supports:

• The structured field TRACE

• PATH.

The PCXFER command now supports:

• User-specified ASCII-to-EBCDIC translation

• TCAM.

The Interrupt Handler (3270ATT) now supports the attachment of personal computer monitors and generates a break for each keystroke.

The customization program on the Customization diskette is simpler to use.

A new diskette, the Attachment Option Enhancements diskette, is now part of the IBM 3270 Personal Computer Attachment. This diskette includes:

• The XLATKBD program for changing keyboard mappings

• The BASIC version of the Application Program Interface

• The PASCAL version of the Application Program Interface.

Changes to the User's Guide

Chapter 5, Data Transfer, is reorganized for improved usability. Some of the information from Chapter 5 is now in two new appendixes:

- Appendix E, Setup for Data Transfer

  Guides supervisors or system programmers in setting up the personal computer, host, and control unit for screen capture and file transfer.

- Appendix F, Data Transfer Formats and Translation Tables

  Provides data formats and translations for the supplied data transfer sample application programs.

Appendix A, Assembler Application Program Interface, is reorganized for improved usability.

Appendix B, BASIC Application Program Interface, and Appendix C, PASCAL Application Program Interface, have been added.

As a result, the other appendixes have changed places:

- Appendix B, IBM Personal Computer 3278 Attachment Option, is now Appendix D.

- Appendix C, File Transfer Data Streams, is now Appendix G.

- Appendix E, Advanced Diagnostics, is now Appendix H.

- Appendix D, Parts List, is now Appendix I.

- Appendix F, Repack Instructions, is now Appendix J.

File transfer error messages have been added in Appendix G, File Transfer Data Streams and Error Messages.

Chapter 1. Introduction

What Is the IBM 3270 Personal Computer Attachment?

The IBM 3270 Personal Computer Attachment is a feature that allows an IBM Personal Computer System Unit (referred to as **system unit** in this manual) to be connected to an IBM 3278 Display Station (Figure 1-1) or to an IBM 3279 Color Display Station.
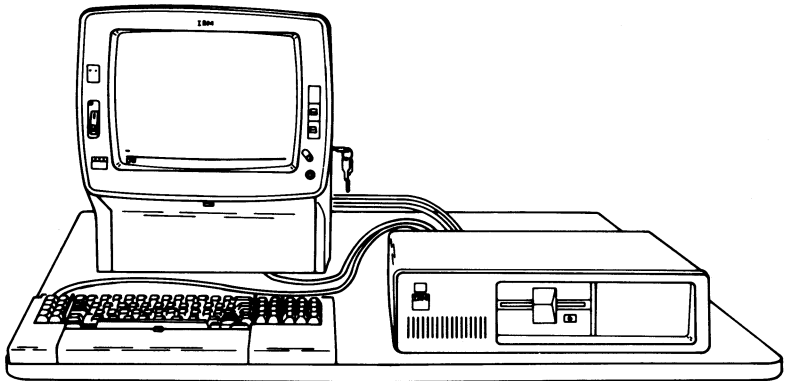
Figure 1-1. 3278 Display Station with IBM 3270 Personal Computer Attachment and IBM Personal Computer System Unit

With the IBM 3270 Personal Computer Attachment you can:

- Use the 3278 or 3279 display and keyboard in place of the IBM Personal Computer Monitor and Keyboard

- Use the IBM Personal Computer Disk Operating System (DOS) 1.1 or 2.0 (referred to as **DOS** through the rest of this manual)

- Use application programs that run with the IBM Personal Computer DOS

- Run host and personal computer programs simultaneously

- Transfer data between the host system and the IBM Personal Computer printer, diskette, or fixed disk (the term disk refers both to the diskette and to the fixed disk for the rest of this manual)

- Transfer files between the host system and the IBM Personal Computer printer or disk

- Transfer selected host-generated screens to the IBM Personal Computer printer or disk

- Use either the IBM Monochrome Display and Printer Adapter (for 3278 Models 1−4) or the IBM Color/Graphics Monitor Adapter (for all 3278 and 3279 models)

- Use the IBM Personal Computer System Unit

- Use the IBM Personal Computer with the Expansion Unit 5161 (Models 1 and 2)

- Use the IBM Personal Computer XT System Unit 5160.

Modes of Operation

The IBM 3270 Personal Computer Attachment allows you to operate with the host computer or with the system unit. These two modes of operation are called **host computer mode** and **personal computer mode.** You can operate in these modes with any IBM 3274 or 3276 control unit or IBM Integrated Display Adapter (IDA). (For the rest of the manual, the term **control unit** refers to all three types: 3274, 3276, and IDA.)

Host computer and personal computer modes operate independently.

The data transfer functions depend on the 3274 control unit micro-code. This microcode provides a communication path for host and personal computer sample data transfer applications.

Host Computer Mode

When the system is in host computer mode, the control unit processes your input and sends it to the host. The system unit does not interfere with the processing. All your 3278 or 3279 functions operate as before. It does not matter whether the system unit On/Off switch is set to On or Off.

Personal Computer Mode

When the system operates as an IBM Personal Computer (personal computer mode), the personal computer program running in the system unit processes your input. The results display on the 3278 or 3279 display (referred to as **display** for the rest of this manual).

In personal computer mode, the display station can use software available for the IBM Personal Computer that executes under control of the IBM Personal Computer DOS. You can run existing personal computer programs or develop new ones. In this mode, the 3278/ 3279 keyboard (referred to as **keyboard** for the rest of this manual) is your input device, and the display is your monitor. The system unit is now processing all your input and requests. It does not matter whether the control unit or the host is on or off.

A set of IBM Personal Computer manuals comes with your system unit. Take the time necessary to understand these manuals and the many functions and applications you can perform. For other IBM Personal Computer options available for your display station, refer to the IBM Personal Computer documentation.

Considerations for the 3279 Color Display

A 3279 Model 2A, 2B, 3A, or 3B requires a 3274 or 3276 control unit to carry out its color convergence. If your 3279 is not connected to an operating control unit, it will remain unconverged and no personal computer mode picture will be displayed (the divider line will be green). In this case, a green personal computer mode picture may be seen by setting the front panel Normal/Test switch to Test.

Once the 3279 has been converged, it will remain converged even if the control unit is disconnected or powered off.

If you were previously using a color monitor with your personal computer, you will notice some differences between the color monitor display and the 3279 display:

- **Color**

    The 3279 does not intensify colors. Light blue is displayed as blue, light green as green, and so on. Also, there may be some differences in shading between the 3279 and another color monitor.

- **Borders**

    The 3279 does not show a top/bottom border color, and the left and right borders are likely to be smaller than on other monitors.

- **Characters**

    The ratio of character height to character width is different on the 3279 (the ratio of character width to height is 3 to 4, while a typical personal computer monitor is 5 to 6). In addition, characters have a more noticeable striped effect (particularly on a 3279 Model 2).

Note that the 3279 has a Color Convergence Procedure to ensure that secondary colors are pure. See the *Problem Determination Guide* in your keyboard for the color convergence procedure. Do not leave the host computer mode display showing the convergence procedure when you switch to personal computer mode. Otherwise, you would prevent other users from using the convergence routine.

Data Transfer

The IBM 3270 Personal Computer Attachment also provides expanded programming capability by transferring data between the host applications and the personal computer applications. Two types of data transfer support are provided as sample applications: file transfer and screen capture.

The file transfer function initiated in host computer mode allows you to send files that were processed in personal computer mode to the host for further processing or storage. Files can also be sent from the host to the system unit for processing or storage. The sample application programs provided transfer files in both of these directions. You can work in personal computer mode and then transfer these files to the host, or vice versa, at your convenience.

You can use the screen capture sample application program to copy the contents of the host screen image to the IBM Personal Computer printer or disk.

See Chapter 5 for information about how to capture screens and how to transfer files.

What Are the Prerequisites for the IBM 3270 Personal Computer Attachment?

The following are required for the IBM 3270 Personal Computer Attachment:

1. An IBM Personal Computer

   Choose **one** from the list below:

   ☐ An IBM Personal Computer 5150 Model X14, X64, or X74 with a Color/Graphics Monitor Adapter (any 3278 or 3279 model)

   ☐ An IBM Personal Computer 5150 Model X14, X64, or X74 with a Monochrome Display and Parallel Printer Adapter (3278 Model 1, 2, 3, or 4)

   ☐ An IBM Personal Computer XT 5160 Model X87 with a Color/Graphics Monitor Adapter (any 3278 or 3279 model)

   ☐ An IBM Personal Computer XT 5160 Model X87 with a Monochrome Display and Parallel Printer Adapter (3278 Model 1, 2, 3, or 4)

   ☐ An IBM Personal Computer System Unit with
   - A Color/Graphics Monitor Adapter (any 3278 or 3279 model) or a Monochrome Display and Parallel Printer Adapter (3278 Model 1, 2, 3, or 4)
   - A 5-1/4-inch Diskette Drive Adapter and one diskette drive
   - A 64K-byte memory (K equals 1024) for DOS 1.1 or a 128K-byte memory for DOS 2.0

   ☐ An IBM Personal Computer XT System Unit with
   - A Color/Graphics Monitor Adapter (any 3278 or 3279 model) or a Monochrome Display and Parallel Printer Adapter (3278 Model 1, 2, 3, or 4)

2. IBM Personal Computer DOS

3. An IBM Display Station (that includes one of the IBM 3278/3279 keyboards defined by the layout diagrams in Chapter 3)

   Choose **one** from the list below:

   ☐ IBM 3278 Display Station (with no Magnetic Slot Reader, FC 4999) Model 1, 2, 3, or 4

   ☐ IBM 3278 Display Station (with no Magnetic Slot Reader, FC 4999) Model 5 (Color/Graphics Monitor Adapter Required)

   ☐ IBM 3279 Color Display Station (with no Magnetic Slot Reader FC 4999, no Selector Pen FC 6350/51/60, and no Video Output FC 8750) Model 2A, 2B, S2A, 3A, 3B, S2B, S3G, 02X, or 03X (all the models require the Color/Graphics Monitor Adapter)

Requirements for Screen Capture

The following are required if you use screen capture:

1. An IBM 3274 Control Unit with Configuration Support C, Release 46 or higher; or with Configuration Support D, Release 60 or higher

2. A 128K-byte memory (minimum) in the IBM Personal Computer System Unit for sample application programs.

Requirements for File Transfer

The following are required if you use file transfer:

1. An IBM 3274 Control Unit with Configuration Support C, Release 46 or higher; or with Configuration Support D, Release 60 or higher

2. A 128K-byte memory (minimum) in the IBM Personal Computer System Unit for sample application programs.

3. Virtual Machine/System Product (VM/SP)

   If the IBM 3278 does not have an Extended Character Set Adapter (FC 3610 or FC 3620), or if the 3279 does not have the Extended Function (FC 3850), then Service Level 206 (PUT 8305) must be installed on VM/SP.

4. Time Sharing Option (TSO) with Advanced Communication Function/Virtual Telecommunications Access Method (ACF/VTAM), Release 1.3

   or

   TSO with Advanced Communication Function/Telecommunication Access Method (ACF/TCAM), Release 2.4

   • Program Temporary Fix (PTF) UZ90256, UZ90257, UZ90258 Authorized Program Analysis Report (APAR OZ69872)

   • PTF UZ67877 (APAR OZ73530)

Chapter 2. Setup and Option Installation

Introduction

This chapter contains all the information needed to complete setup of your IBM 3270 Personal Computer Attachment. It tells you:

- What you need for setup

- How to prepare your system unit for cabling it to the display

- How to cable up your system unit to the display

- How to do the Power-On Self-Test.

Follow the instructions in each procedure in sequence. A check box □ is provided at each step and at each action you must do. Put a check (✓) in the box as you finish each action and each step. This helps you to keep track of which steps have been completed in the event you are interrupted during setup.

Getting Ready

In the shipment containing your IBM 3270 Personal Computer Attachment are two boxes, labeled as follows:

- IBM 3270 PC ATTACHMENT FEATURE
  STEP 1
  CE INSTALLED
  SEE USER GUIDE

  This box contains parts for your display. These must be installed by the service representative before you can cable the IBM Personal Computer 3270 Attachment Option to the display station.

- IBM 3270 PC ATTACHMENT FEATURE
  STEP 2
  USER INSTALLED
  SEE USER GUIDE

  This box contains parts that must be installed on the system unit.

  ☐ If the parts are still in the boxes, open box 2; unpack and lay out the parts.

  ☐ If your display station is a new installation, set it up per the customer setup instructions shipped with the display; then return here.

Responsibilities of Your Service Representative

1. Have your service representative install the IBM 3278 or the 3279 Personal Computer Adapter. If your 3278 display has the IBM 3278 Personal Computer Adapter installed, the back of the display looks like Figure 2-1. If your 3279 Color Display has the IBM 3279 Personal Computer Adapter installed, the back of your display looks like Figure 2-2. If the back of your display does not look like Figure 2-1 or Figure 2-2, stop setup until the IBM 3278 or 3279 Personal Computer Adapter is installed.

2. Make sure you have all the items on the Checklist.
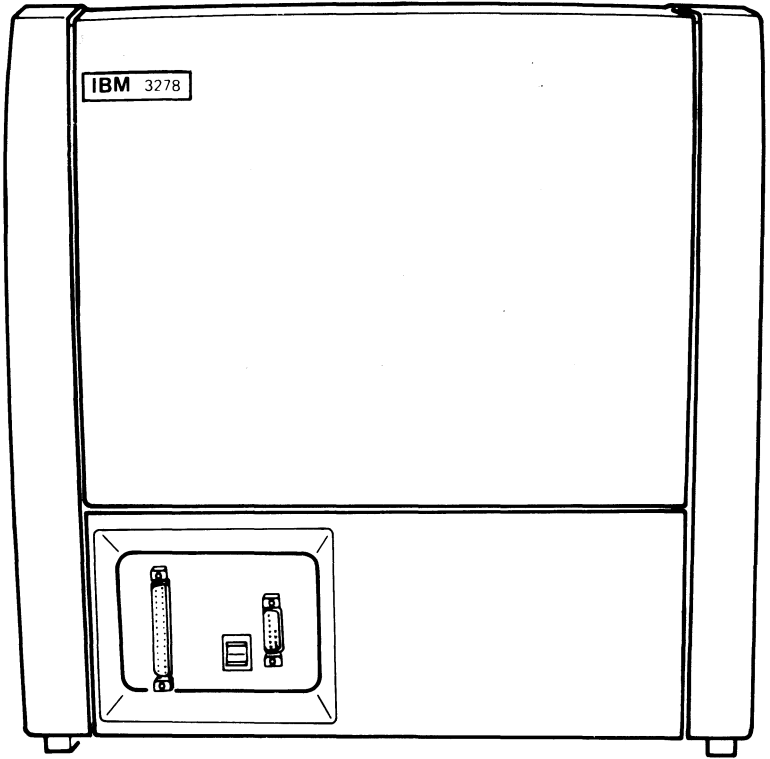
Figure 2-1. Rear View of a 3278 Display with IBM 3278 Personal
Computer Adapter Installed
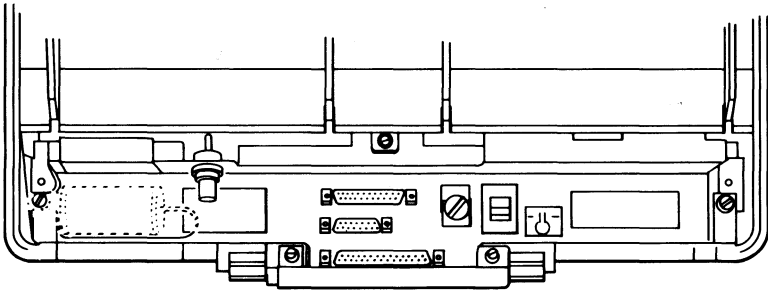
Figure 2-2. Rear View of a 3279 Color Display with IBM 3279
Personal Computer Adapter Installed

Checklist

Before attempting to cable the system unit to the display, you must have all of the items listed below. If any item is missing, contact your IBM sales representative or your site coordinator.

Do not continue with the setup until you have all the parts listed.

Separately Obtained Prerequisite Items

☐ 3278 Display with the IBM 3278 Personal Computer Adapter Installed (see Figure 2-1) or 3279 Color Display with the IBM 3279 Personal Computer Adapter Installed (see Figure 2-2)
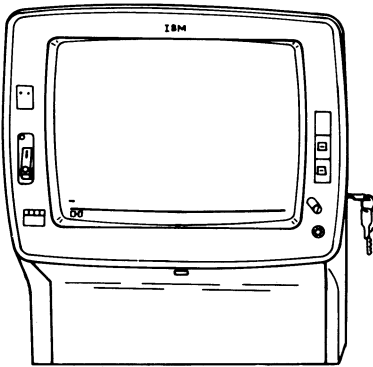
3278 Display   **3279 Color Display**
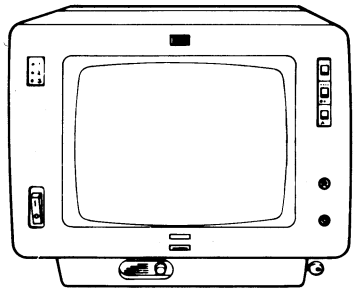
☐ 3278/3279 Keyboard
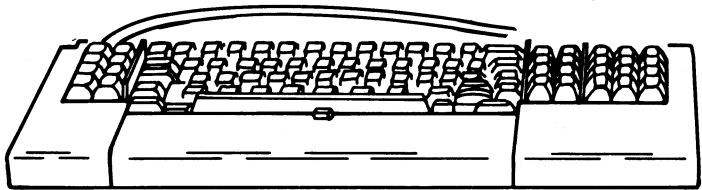
□ System Unit

Note: The system unit can be a 5150 (for the IBM Personal Computer) or a 5160 (for the IBM Personal Computer XT). The diagrams in this chapter show a 5150, but apply for a 5160 as well.
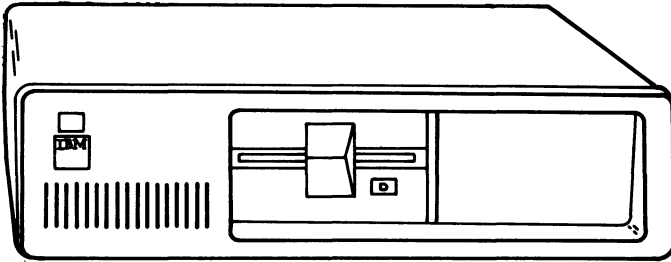
□ Monochrome Display and Parallel Printer Adapter
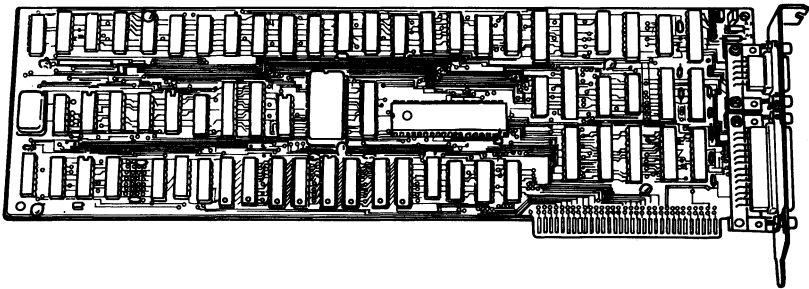
or

□ Color/Graphics Monitor Adapter
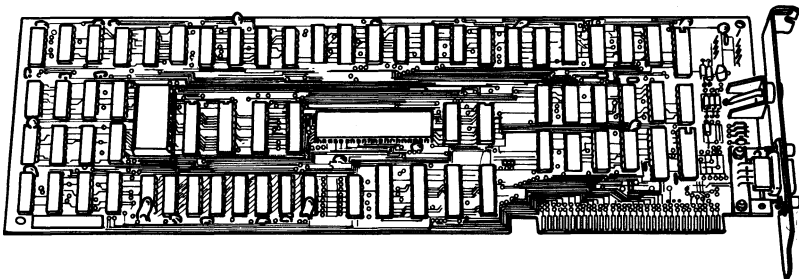
Parts Supplied with the IBM Personal Computer 3270 Attachment Option

☐ Distribution Box
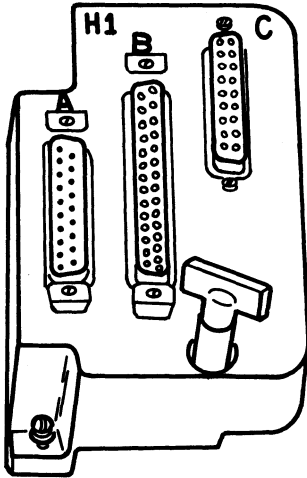
☐ Plastic Card Guide

☐ IBM Personal Computer 3270 Adapter
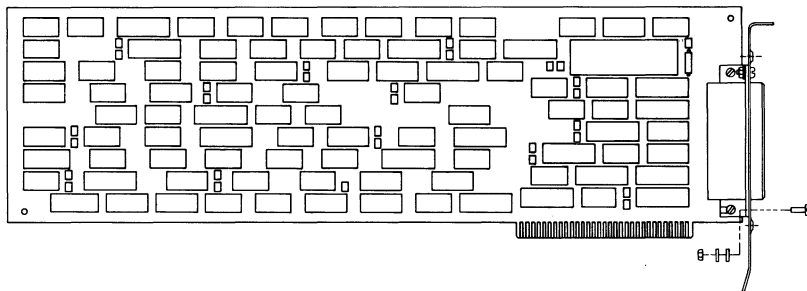
☐ Video Cable, Part Number 4752128 (on label)
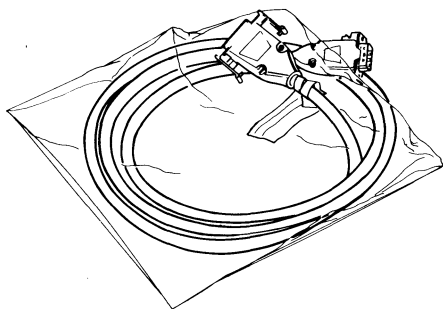
☐ Keyboard Adapter Cable, Part Number 4752129 (on label)
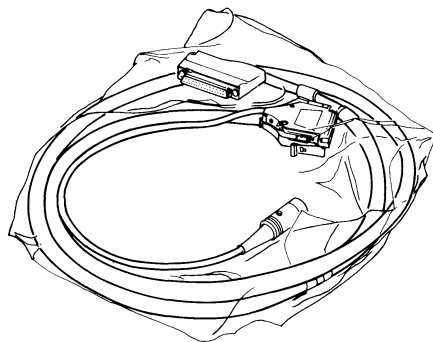
☐ Feature Bus Cable, Part Number 4752127 (on label)
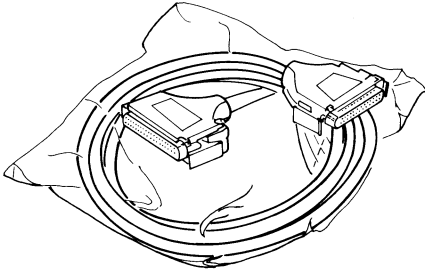
Helpful Hints for Setup

You will install the options in the system unit in the following order (as outlined in the rest of this chapter):

1. Additional Memory Modules (Step 5)

2. The IBM Personal Computer 3270 Adapter (Step 7)

3. Additional Diskette Drive

4. Display Adapter (either Monochrome or Color/Graphics) (Step 9)

5. All other options.

Readying a System Unit That Is Part of an IBM Personal Computer

If your system unit is part of a currently operating IBM Personal Computer, do the following:

☐ Set the system unit On/Off switch to Off.

☐ Remove the power cord from the power outlet.

☐ Disconnect the power cord from the system unit.

☐ Disconnect the keyboard attached to the system unit. Remove this keyboard: you do not need it.

☐ Disconnect the monitor attached to the system unit. Remove this monitor: you do not need it.

☐ Disconnect all other cables from the system unit.

Go to Step 3 of the procedure "Installing the IBM Personal Computer 3270 Attachment Option."
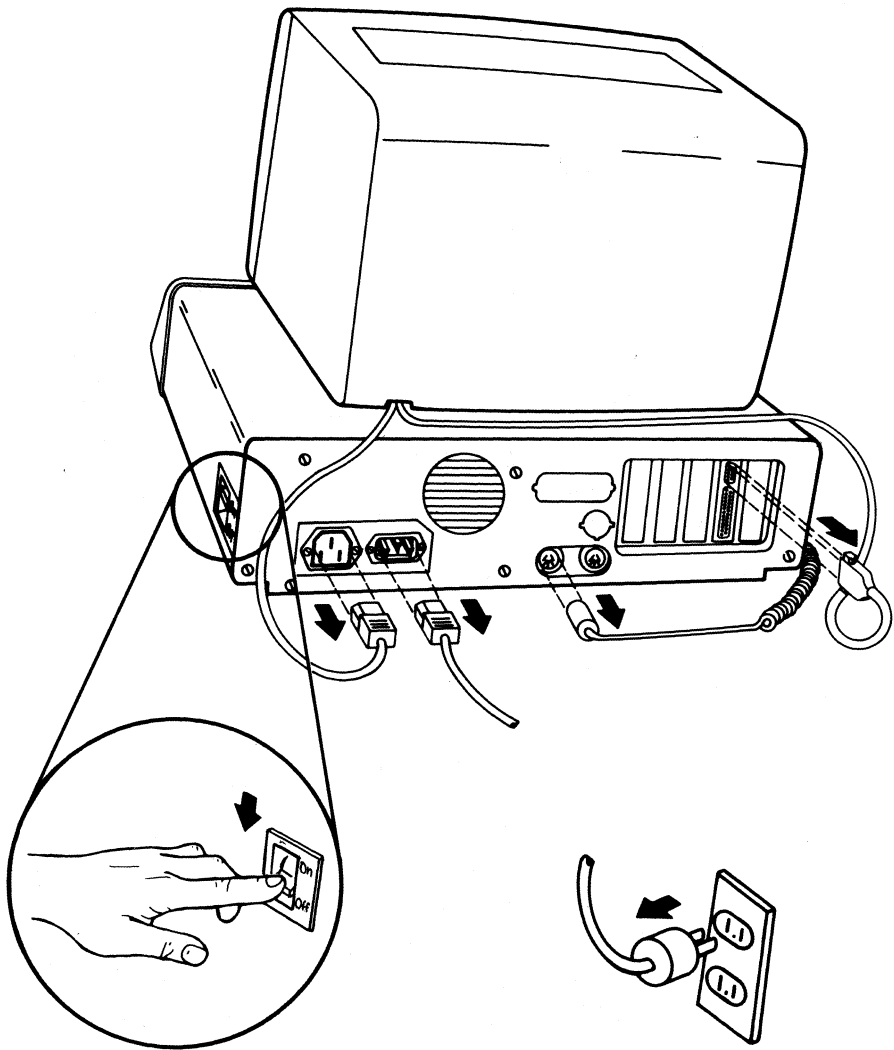
Readying a New System Unit

☐ **Step 1**

For a new system unit, do the following:

☐ Remove the tape from the diskette drive.
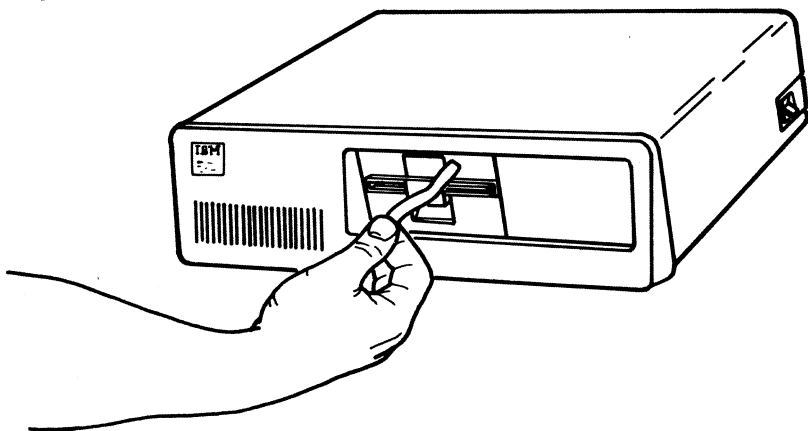
☐ Lift the lever.

Lever
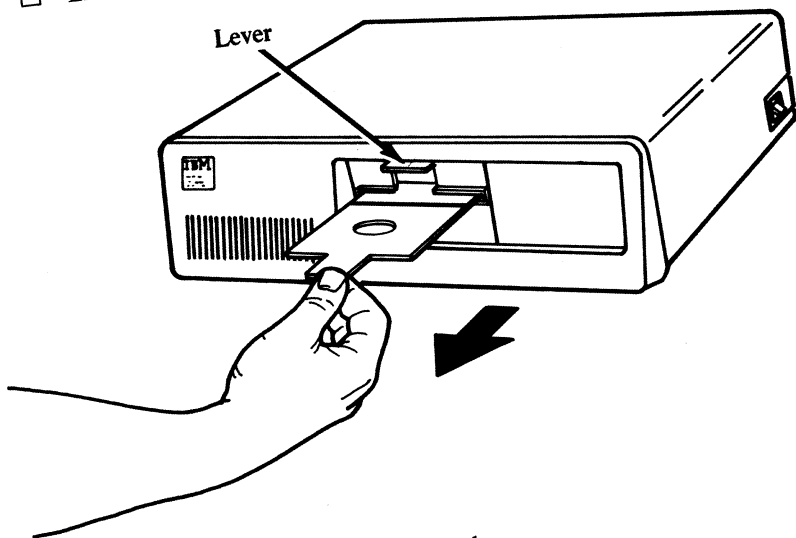
☐ Remove the shipping cardboard.

Step 2

☐ Set the system unit On/Off switch to Off.
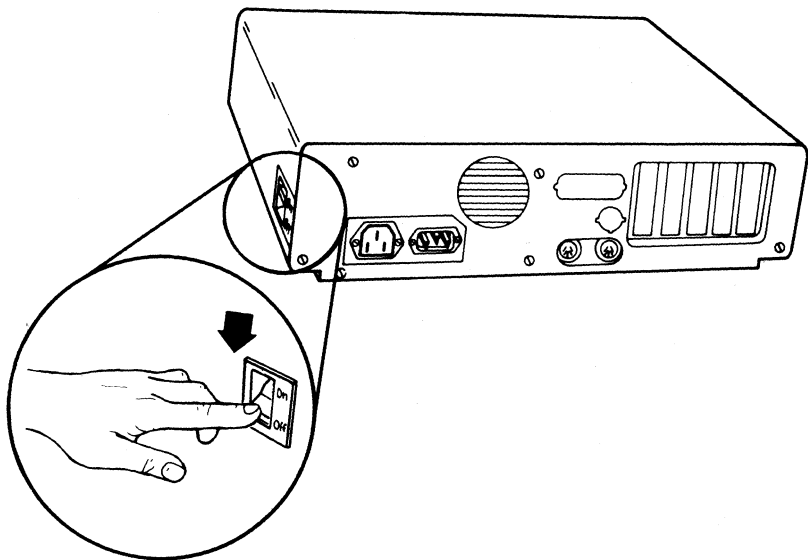
Installing the IBM Personal Computer 3270 Attachment Option

☐ **Step 3**

Move the system unit to an area where you have adequate room to remove the cover and to work. Arrange the system unit so that you have easy access to both the front and the rear. It is not necessary to have the system unit next to the display for this part of the option installation.

You need a flat-blade screwdriver for installing the options and the cables. (A 3/16-inch nutdriver may be used.)

☐ Remove the cover mounting screws from the system unit. Save these screws for reinstalling the cover.

CCW

Cover Mounting Screws
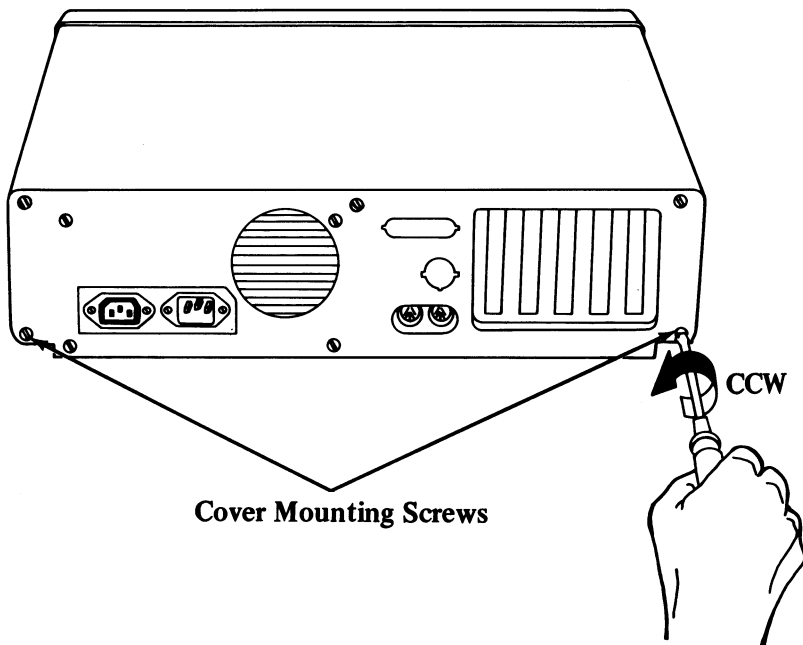
Most system units have five cover mounting screws as illustrated.
Some earlier models have only two cover mounting screws (the two
lower ones). Remove them. Discard the screw from the upper right;
save the other four (if using the earlier model, save both screws).

☐ **Step 4**

☐ Carefully slide the system unit cover away from the rear and
toward the front of the system unit as indicated below. When
the cover goes no further, tilt the cover up and remove it from
the base. Set the cover aside.
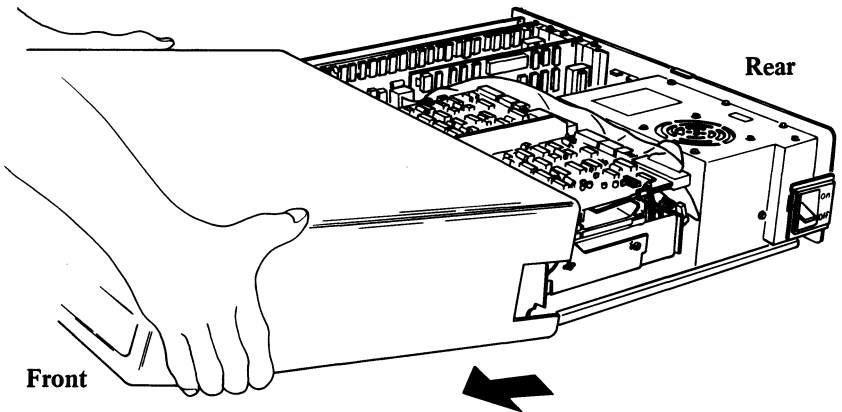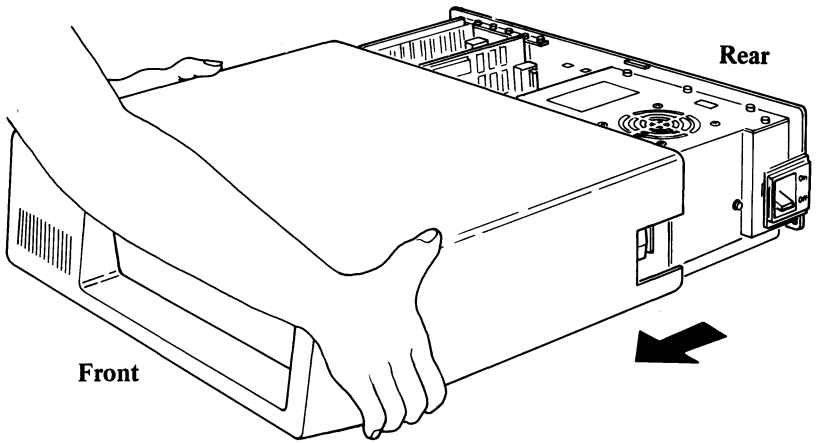
☐ **Step 5**

If you have any additional memory modules, install them now.

☐ **Step 6**

☐ Look at the inside left rear of your system unit.
There are five expansion slots (eight slots for the Personal
Computer XT). If all the expansion slots are filled, see your
sales representative. You must install the IBM Personal Com-
puter 3270 Adapter in expansion slot 1. If this system unit was
part of an IBM Personal Computer system and there is a card
in expansion slot 1, remove this card and install it later in an
empty expansion slot. Save the screw that was removed from
expansion slot 1.
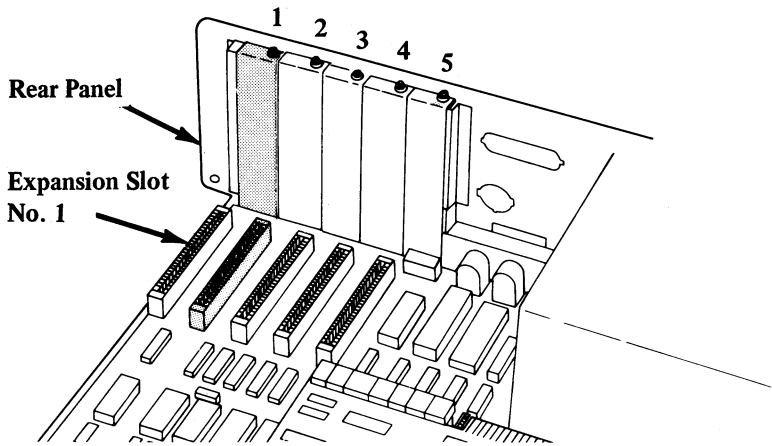
☐ Using a flat-blade screwdriver or a 3/16-inch nutdriver, remove
the screw that holds the system expansion slot cover in place
by turning the screw counterclockwise (↻).
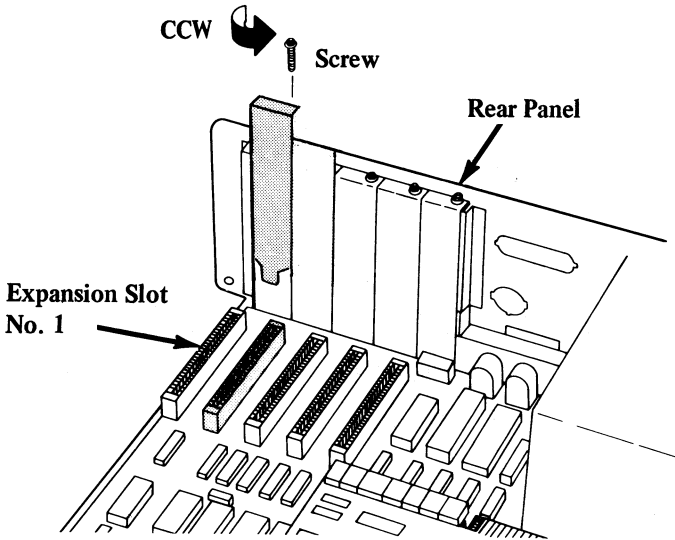
☐ Save the screw for installation of the IBM Personal Computer
3270 Adapter. The system expansion slot cover is no longer
needed.

☐ **Step 7**

☐ Align the plastic card guide, pointer down, and snap it in place (in expansion slot 1) as shown.

Front

Rear

Front

Plastic Card Guide in Place

Rear
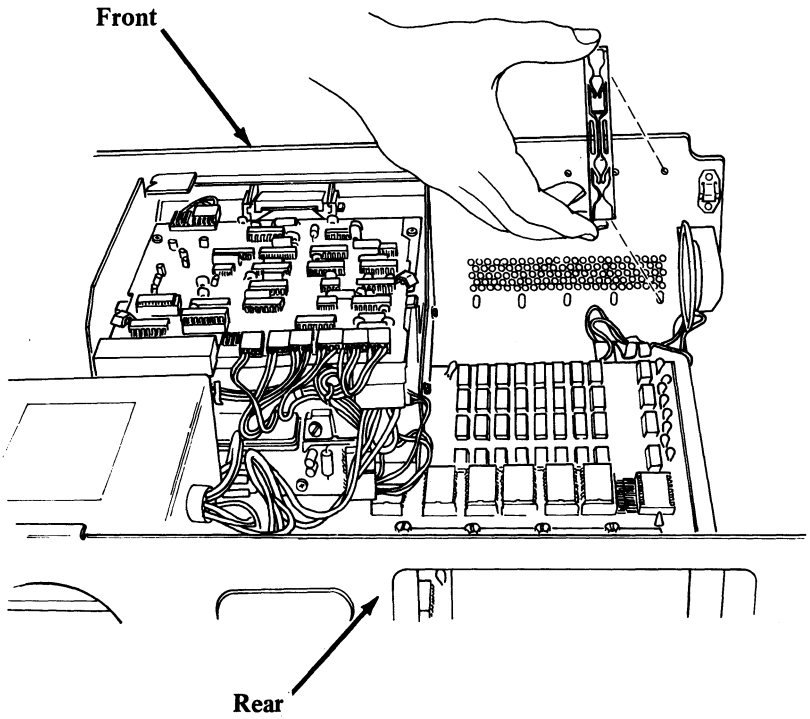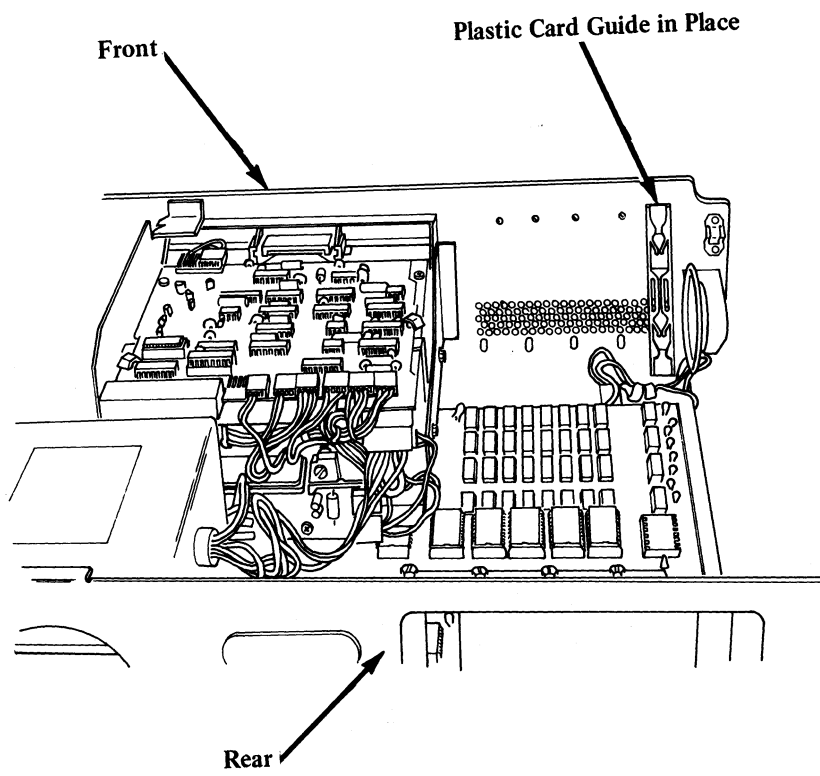
☐ **Step 8**

☐ Install the IBM Personal Computer 3270 Adapter in expansion
slot 1. Make sure the connector on the card is firmly seated in
the socket. Do not be afraid to apply pressure.

Front→

Rear

Retaining Bracket   Notch

Rear

Front

CAUTION
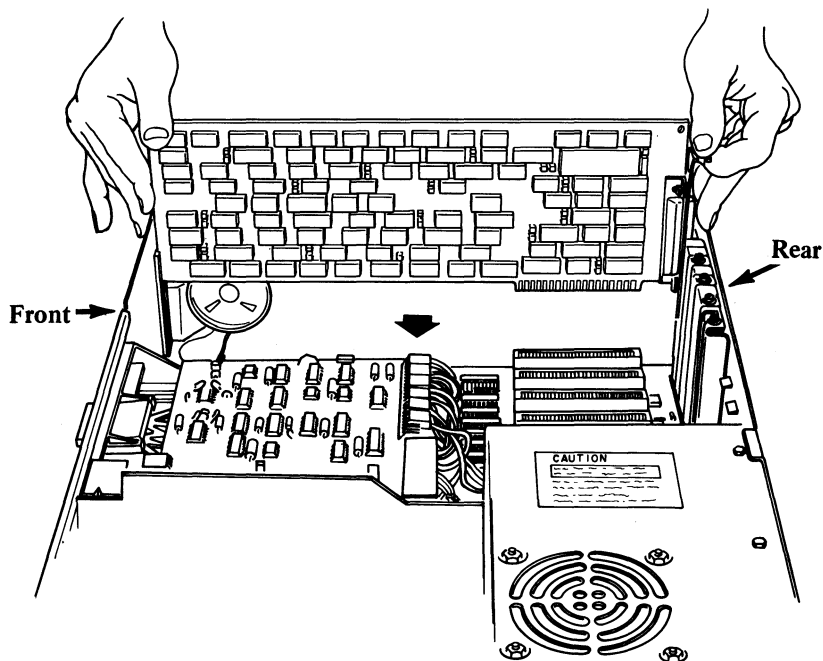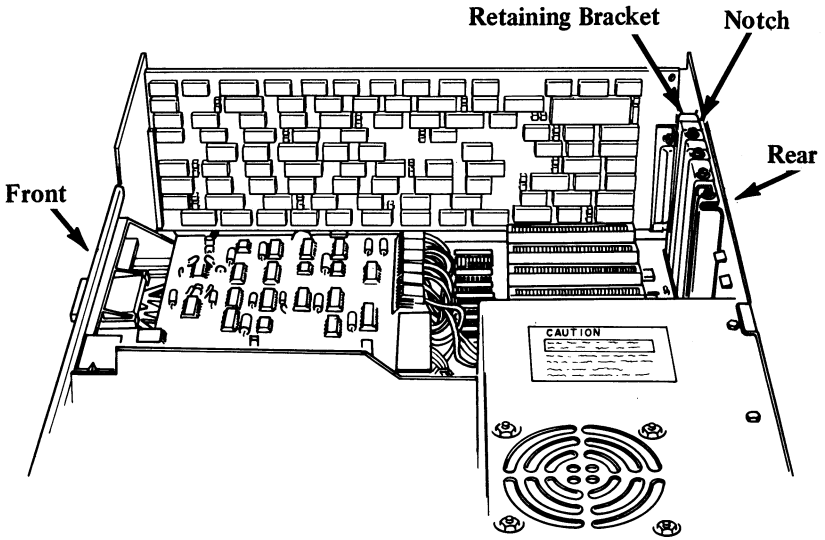
☐ Align the notch in the option retaining bracket with the hole
in the rear panel of the system unit. Start the screw clockwise
(⟳) and screw in snugly. Turn the screw counterclockwise
(⟲) one-half turn. You must leave this screw loose until the
distribution box is connected.

☐ **Step 9**

☐ If you have any other options to install, install them by following the installation instructions that were shipped with the option.

CAUTION
Do not connect the power cord or try any diagnostic testing of the options at this time. Do any required test *after* you have completed setup of the IBM Personal Computer 3270 Attachment Option.

You may save time if you install these options in the following sequence:

1. Additional Diskette Drive

2. Display Adapter (either Monochrome or Color/Graphics)

   For Display Adapter switch setting installation, consider the following:

When the adapter card is for:	Set the switch for monitor type:
Monochrome Display and Printer	IBM Monochrome Display
Color/Graphics	80 X 25 Color

3. All other options.

After all options have been installed, *return here to continue with the setup.*

☐ **Step 10**

☐ Align the distribution box connector with the IBM Personal
Computer 3270 Attachment Option card connector. Connect
the distribution box to the card by pushing the distribution
box connector against the card connector as far as it goes.
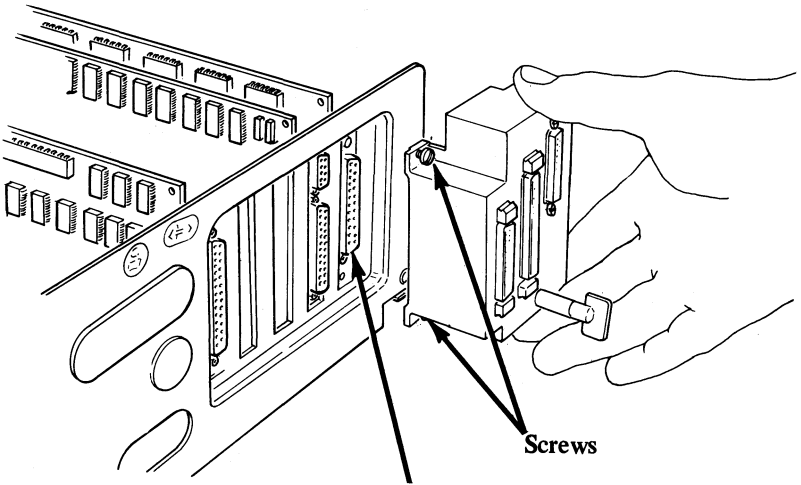
Screws

**IBM Personal Computer
3270 Attachment Option Card Connector**

☐ With a flat-blade screwdriver, tighten the screws on the
distribution box.

☐ Tighten the screw in the retaining bracket for the IBM
Personal Computer 3270 Attachment Option card (Step 7).

☐ **Step 11**

☐ Replace the system unit cover by positioning the cover as shown and carefully sliding it toward the rear of the system unit.

Rear

Front

Rear

Front
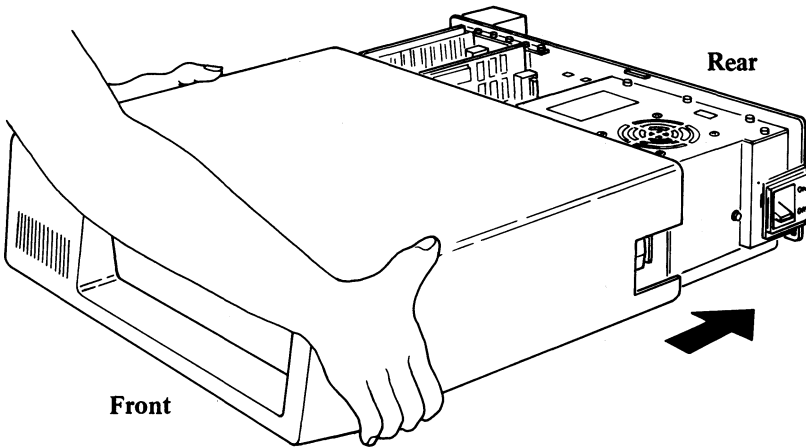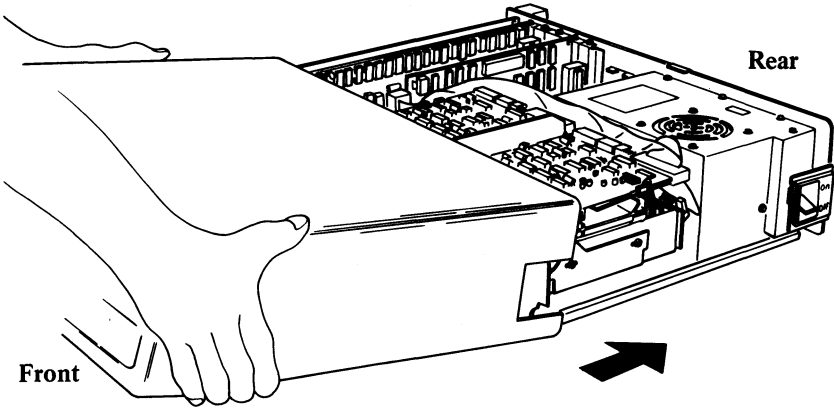
☐ Step 12

☐ When the cover is all the way to the rear, align the cover mount-
ing screws with the threaded tabs. Using a flat-blade screwdriver,
replace the two lower screws removed in Step 3 and tighten
by turning them clockwise (⌒↴). (If you are using an older
model, these are the only screws replaced.) Then, replace the
additional two screws removed from Step 3 by inserting them in
the top left and center mountings and tightening them. The top
right mounting screw is not used.

Cover

Threaded
Tab

Cover
Screw

CW
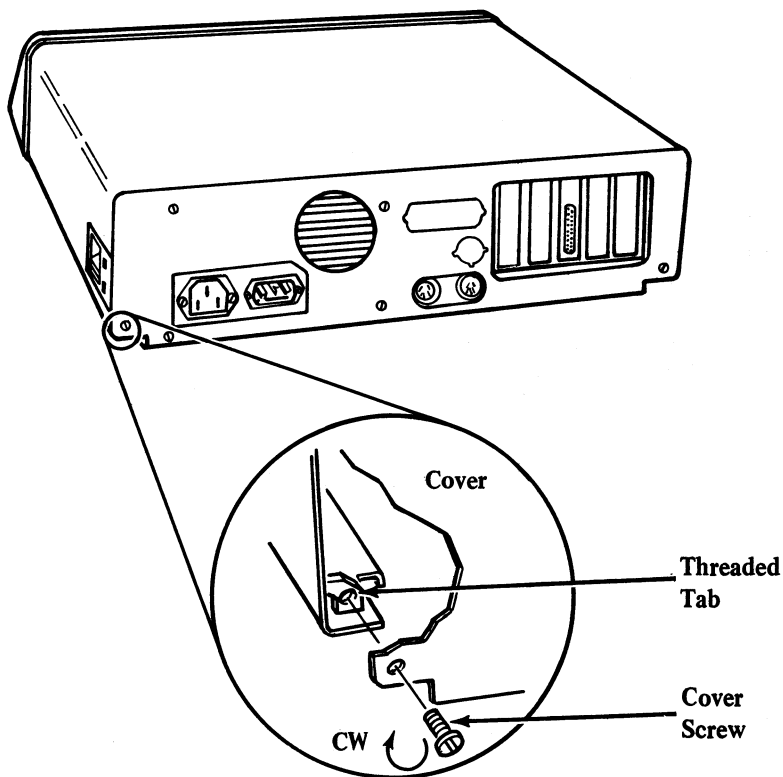
Your system unit is now ready to be cabled to the display.

Cabling the System Unit to the Display

Refer to the Checklist for the part numbers of the cables.

☐ **Step 13**

☐ Set the display On/Off switch to the off position (O).

On

Off
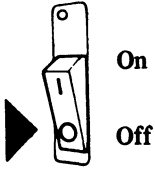
☐ Remove the display power cord from the power outlet.
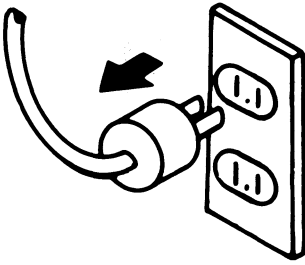
☐ **Step 14**

☐ Move the system unit to the display station area.

☐ Place the system unit so that it is to the right of the display, as shown.
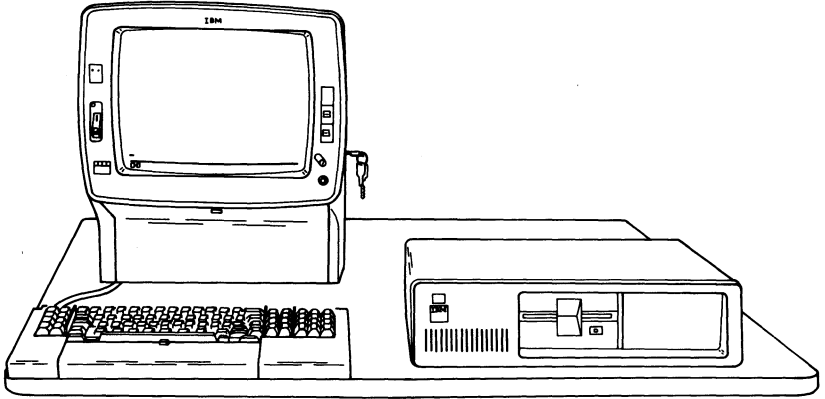
☐ Arrange the display and the system unit for easy access to the front and rear.

☐ **Step 15**

☐ Align the video cable connector (the end with the screws) with the monochrome or color/graphics card connector. Connect the cable to the card by pushing the cable connector against the card connector as far as it goes.

☐ Tighten the screws with a flat-blade screwdriver.

Video Cable
Monochrome Card Connector
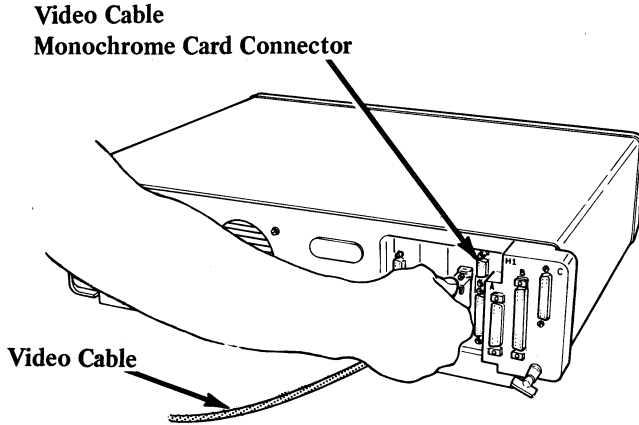
Video Cable

With Monochrome Display and Parallel Printer Adapter (Top Connector)

Video
Cable

Video Cable
Color/Graphics Card
Connector
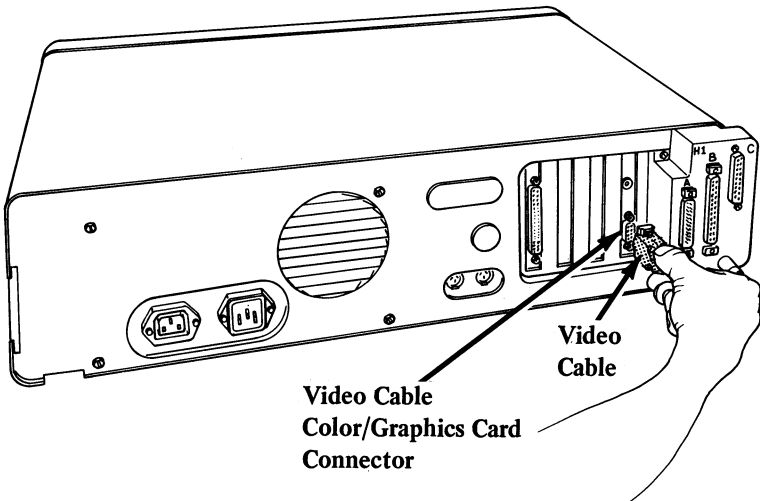
With Color/Graphics Monitor Adapter (Bottom Connector)

☐ **Step 16**

☐ On the back of the display, align the video cable connector (the end with the latches) with the smaller display connector. Connect the cable to the display by pushing the cable connector against the display connector until it latches. Remove the screw from the 3279 by turning it counterclockwise (↻).

3278 Display

Display
Connector

Video Cable Connector

Video Cable

Video Cable Connector

Video Cable   Screw
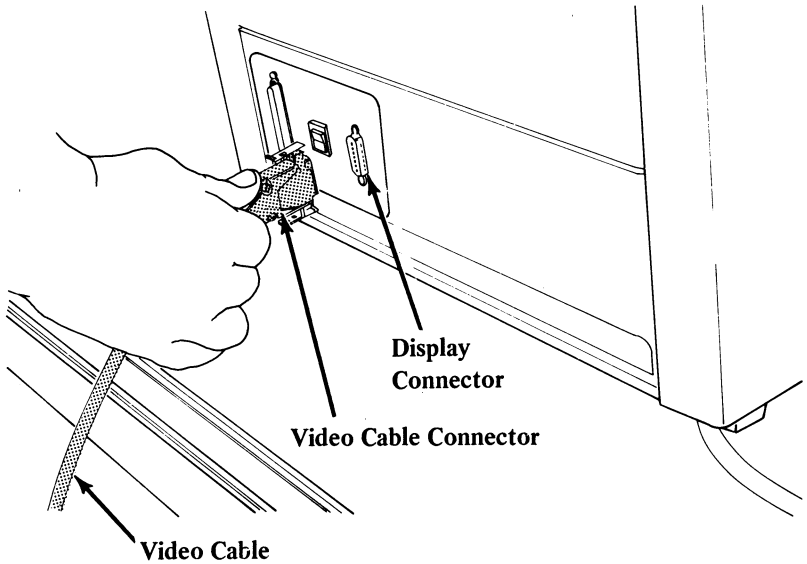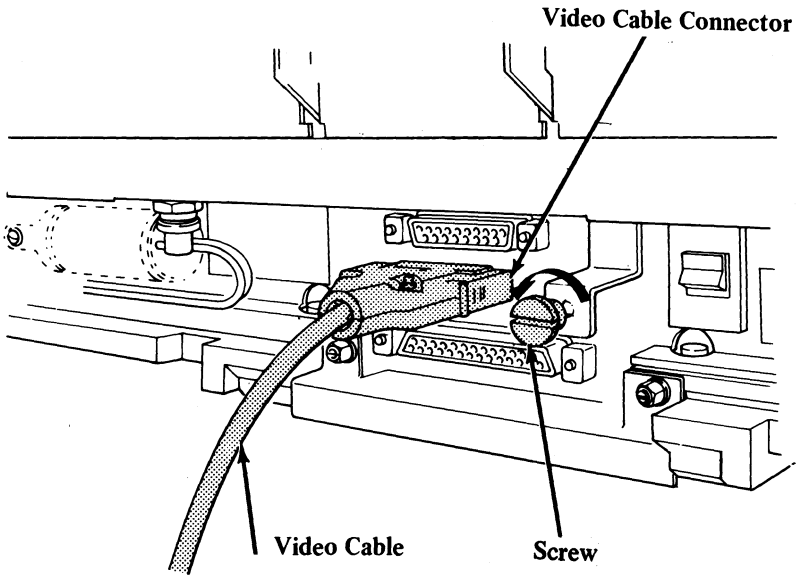
☐ **Step 17**

☐ Align the keyboard adapter cable connector (the end with the pigtail attached) with connector A on the left side of the distribution box. Connect the cable to the distribution box by pushing the cable connector against connector A until the latches catch.

**Keyboard
Adapter Cable
Pigtail Lead Socket**

Connector *A*

Keyboard Adapter Cable
Connector

**Keyboard
Adapter Cable
Pigtail Lead**

Keyboard
Adapter Cable
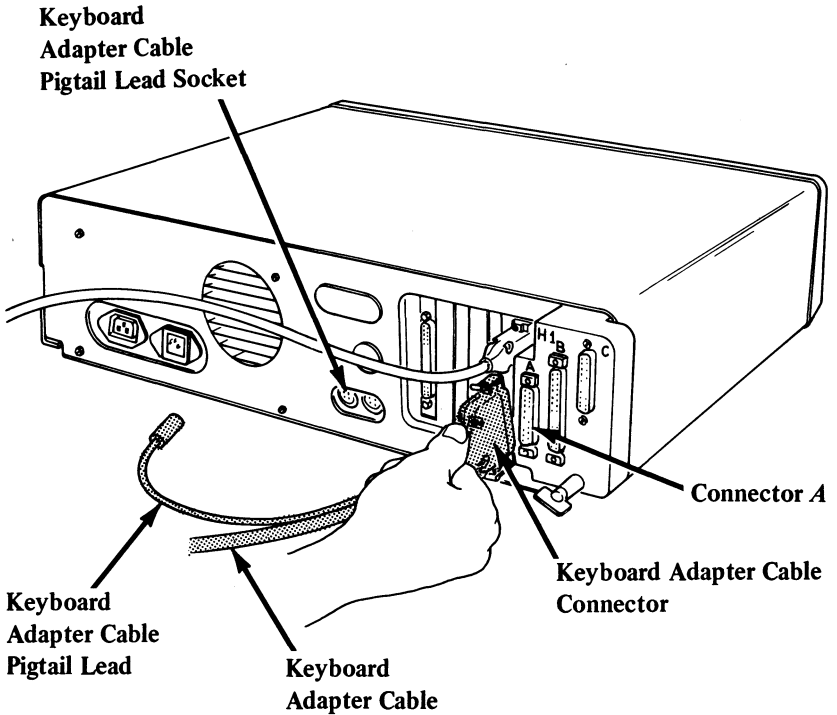
☐ Plug the pigtail lead connector into the socket labeled **Keyboard** on the rear of the system unit (the socket on the left).

Keyboard Adapter Cable
Pigtail Lead Socket
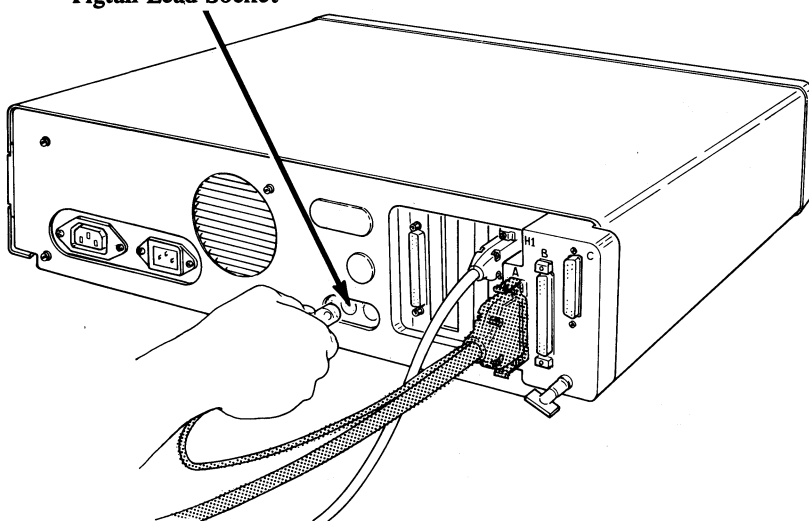
□ **Step 18**

□ Align a feature bus cable connector (the end without the part
number label) with connector B (the center one) on the distribu-
tion box. Connect the cable to the distribution box by pushing
the cable connector against connector B until the latches catch.

Connector *B*

Feature Bus Cable
Connector (distribution box end,
the end without the label)

Feature Bus Cable

Label

Display End
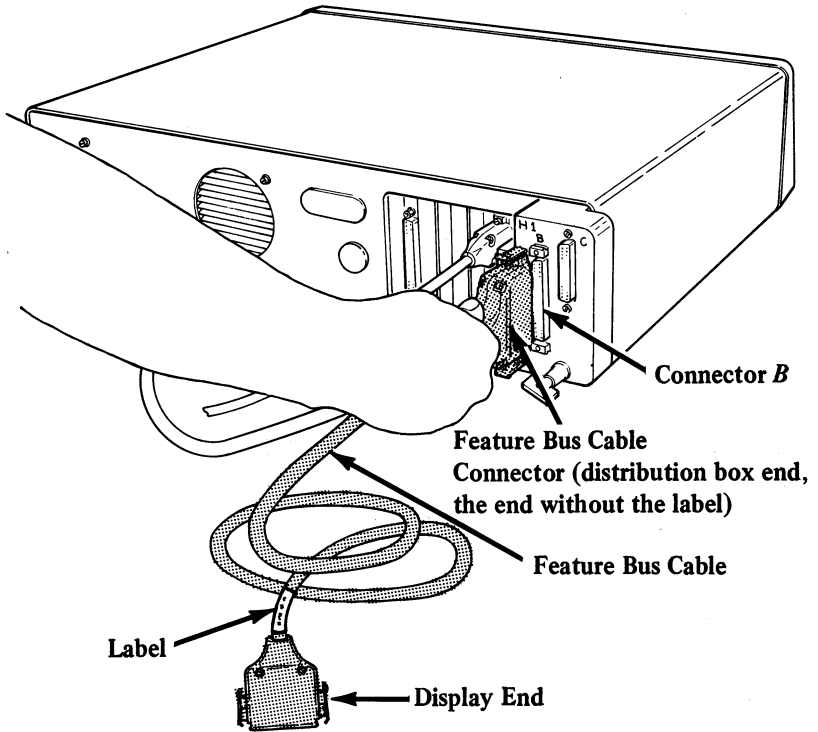
☐ **Step 19**

☐ On the back of the display, align the other feature bus cable
connector with the display connector. Connect the cable to the
display by pushing the cable connector against the display con-
nector until the latches catch.

3278 Display

Display Connector

Feature Bus Cable Connector

Feature Bus
Cable

3279 Color Display

Feature Bus Cable
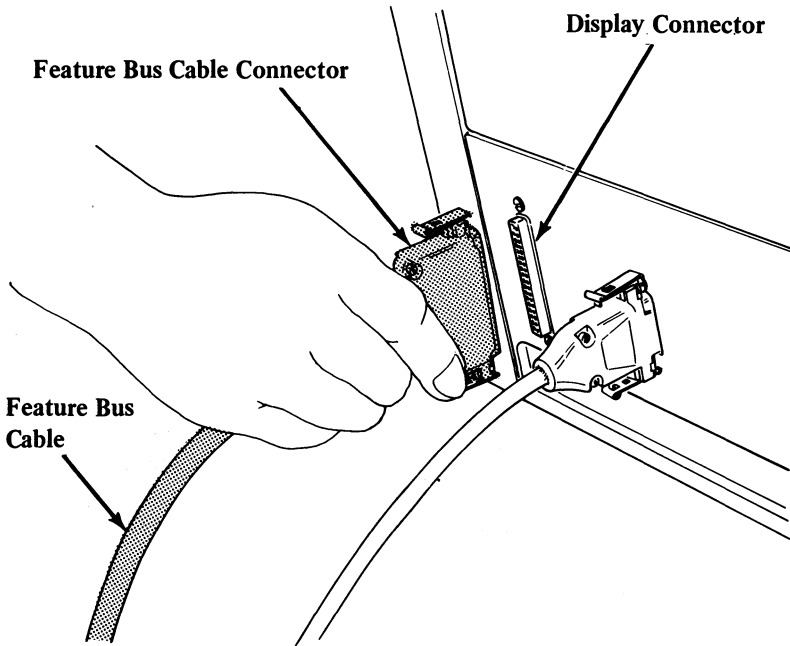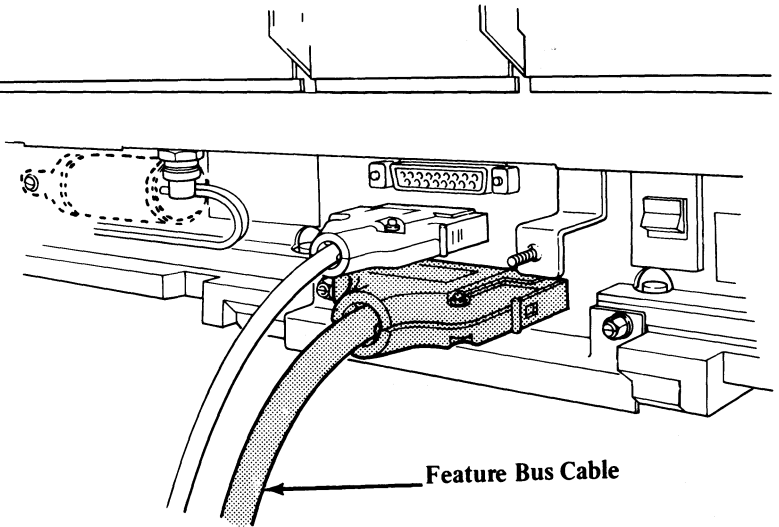
☐ **Step 20**

If you have a 3279 display, go to Step 25; otherwise, continue here.

☐ Open the display front cover by pushing the latch (located under the front center edge of the display) away from you toward the machine.
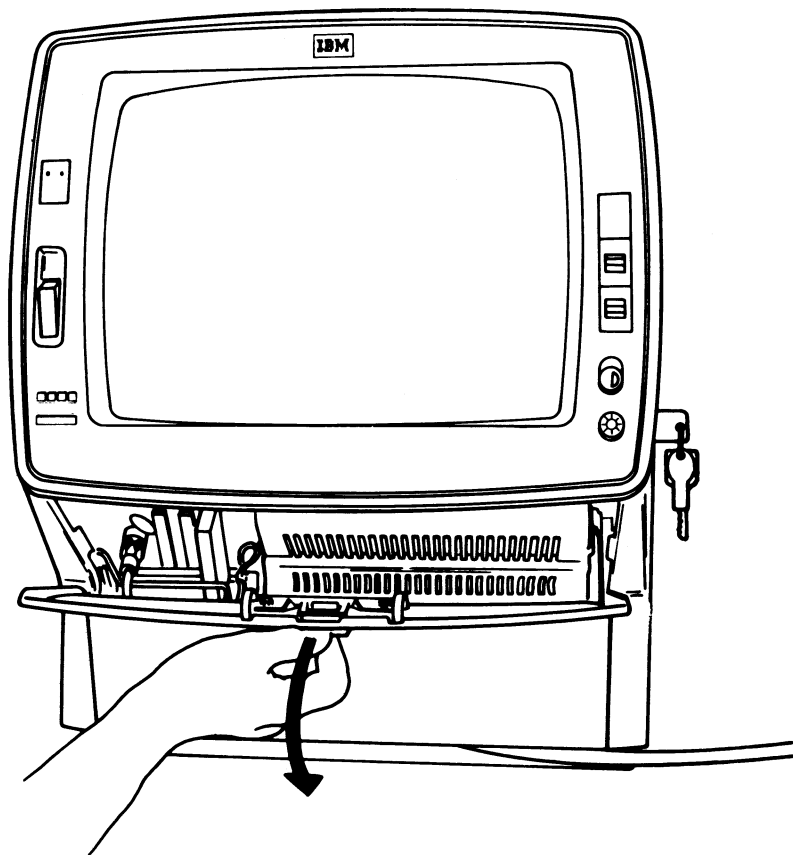
☐ Remove the front cover by lifting it off the pivot pins (one on each side, at the bottom where the front cover meets the display).
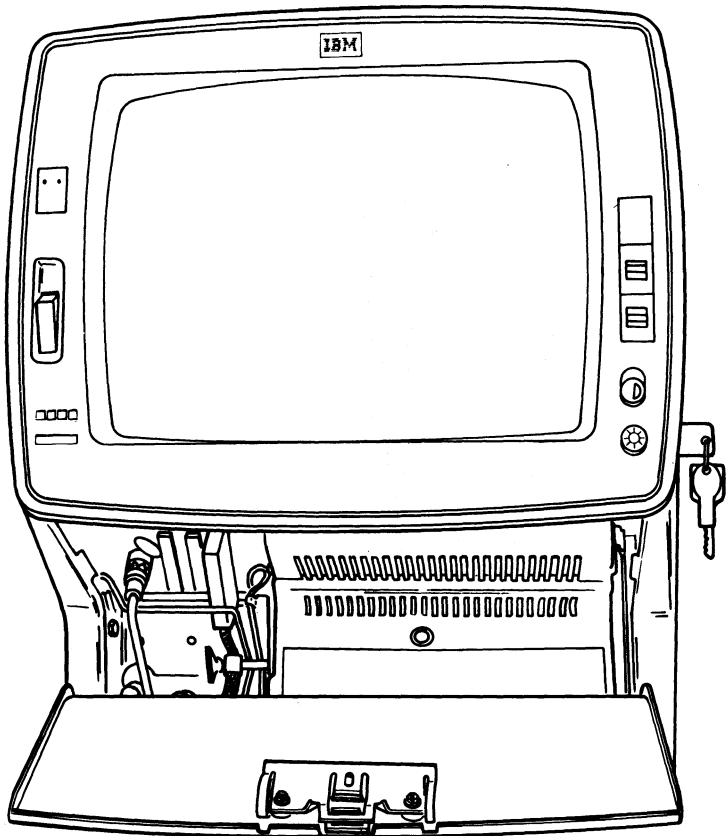
☐ **Step 21**

☐ Under the cover, find the keyboard cable connector. To remove the keyboard cable connector, unlatch the retainer wire by pressing in and to the left to clear the latch. Then lift the retainer wire, and swing it to the left.

Keyboard Cable Connector

Retainer Wire

Wing Nut

Keyboard Cable Clamp
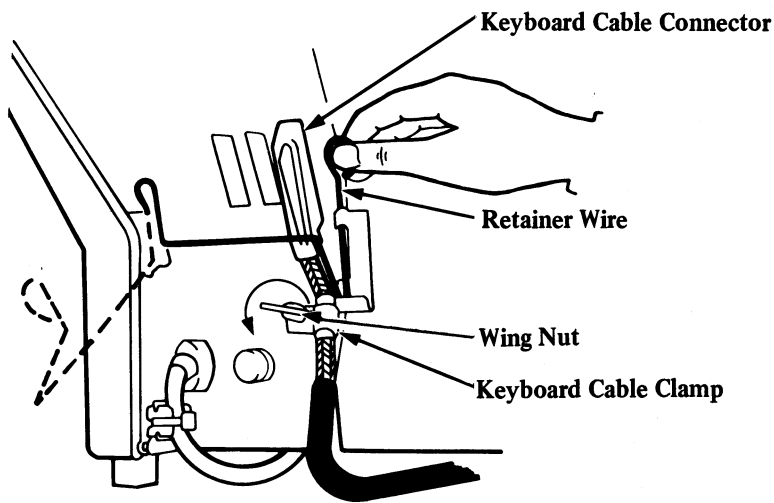
☐ Remove the wing nut by turning it counterclockwise (↻).

☐ **Step 22**

☐ Pull the keyboard cable connector out, and remove the keyboard cable clamp from the stud.

Keyboard Display Connector

Keyboard Cable Connector

Stud

Keyboard Cable Clamp
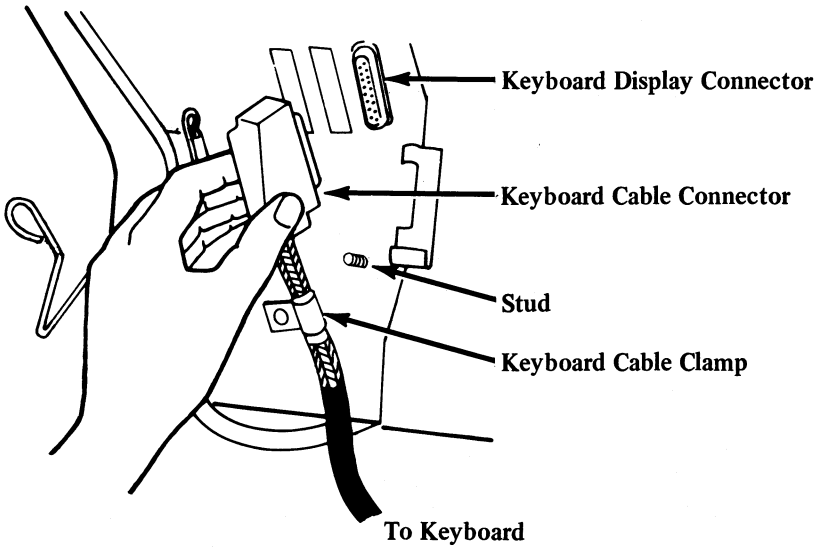
To Keyboard

☐ Move the keyboard out of your way. The keyboard cable will be connected to the distribution box later.

☐ **Step 23**

☐ Place the keyboard adapter cable clamp on the stud.

☐ Connect the keyboard adapter cable to the display by pushing the cable connector against the right-hand display connector, above the letters **KEYBD**, as far as it goes.

☐ Replace the wing nut on the stud and tighten by turning it clockwise (↰).

Keyboard Display Connector

Keyboard Adapter Cable Connector

Stud

Keyboard Adapter Cable Clamp

To System Unit
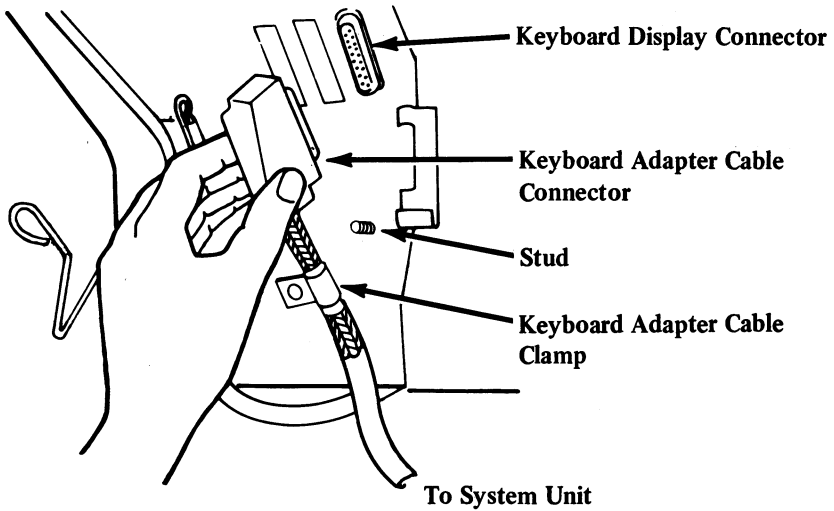
☐ **Step 24**

☐ Check that any cables to be held by the retainer wire are properly plugged into their sockets.

☐ Swing the retainer wire across the cable connector. Insert the bottom of the retainer wire in the slot, and latch it into place. The retainer wire keeps the connector tightly in place; it therefore takes some extra force to latch it into place. Do not be afraid to apply the necessary force.

Remember, if the device cable is not attached, follow the Customer Setup Instructions for your display to attach it at this time.

☐ Position the power cord, the device cable, the keyboard adapter cable, and the other cables so that they do not interfere with closing the front cover.

☐ Install the front cover on the pivot pins. Close the cover, and slide the cover latch toward you.
Go to Step 26.

Device Cable

Keyboard Adapter Cable Connector

Replace retainer wire bottom first

To System Unit
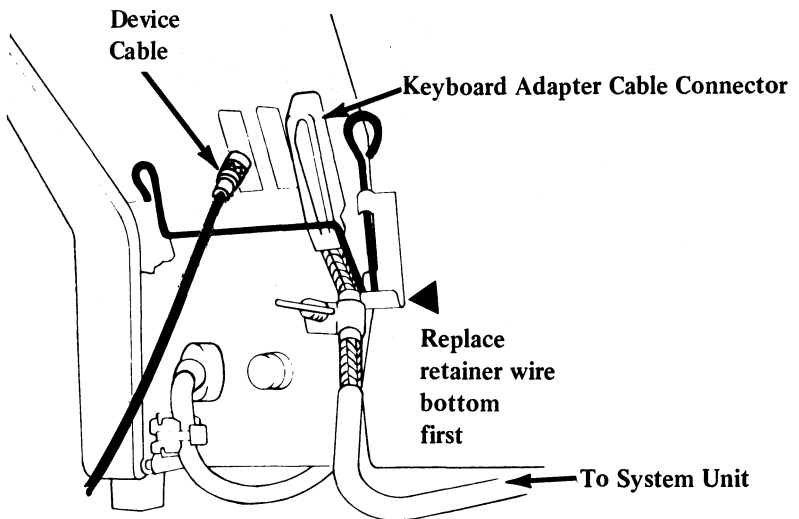
☐ **Step 25**

For a 3279 Color Display:

☐ Unplug the keyboard cable and remove it from the display.

☐ Place the keyboard adapter cable clamp on the stud.

☐ Connect the keyboard adapter cable to the display by pushing the cable connector against the display connector as far as it goes.

☐ Replace the screw and tighten it by turning it clockwise (↻).

☐ Remember, if the device cable is not attached, follow the Customer Setup Instructions for your display to attach it at this time.

Screw Keyboard
Adapter
Cable
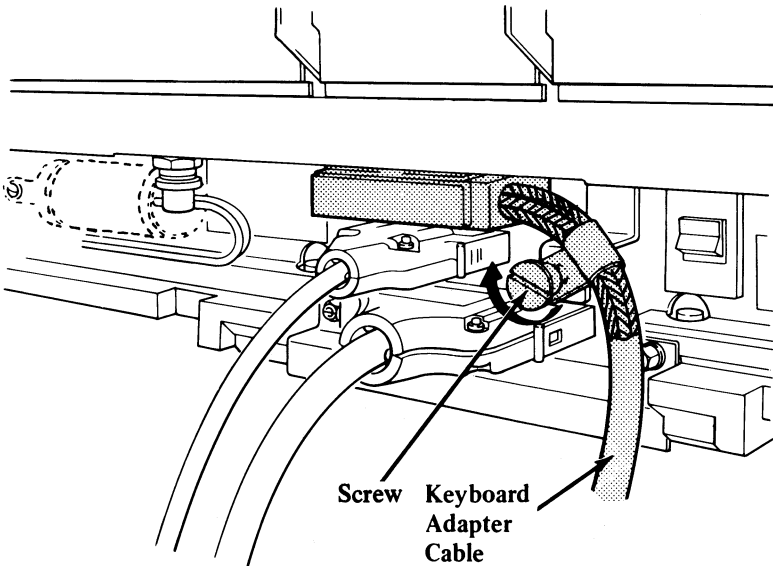
☐ **Step 26**

☐ Position the keyboard so that the keyboard cable reaches the distribution box.

☐ Remove the wing screw from the distribution box by turning the wing screw counterclockwise (↶).

Wing Screw Stud

Wing Screw
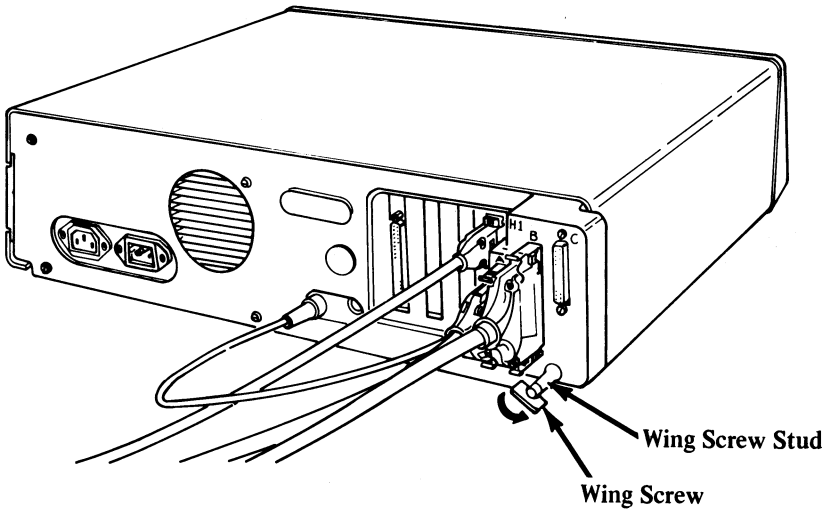
☐ **Step 27**

☐ Align the keyboard cable connector with connector C on the right side of the distribution box. Connect the cable to the distribution box by pushing the cable connector against connector C as far as it goes.

Keyboard Cable Connector

Connector *C*

Keyboard Cable

Wing Screw
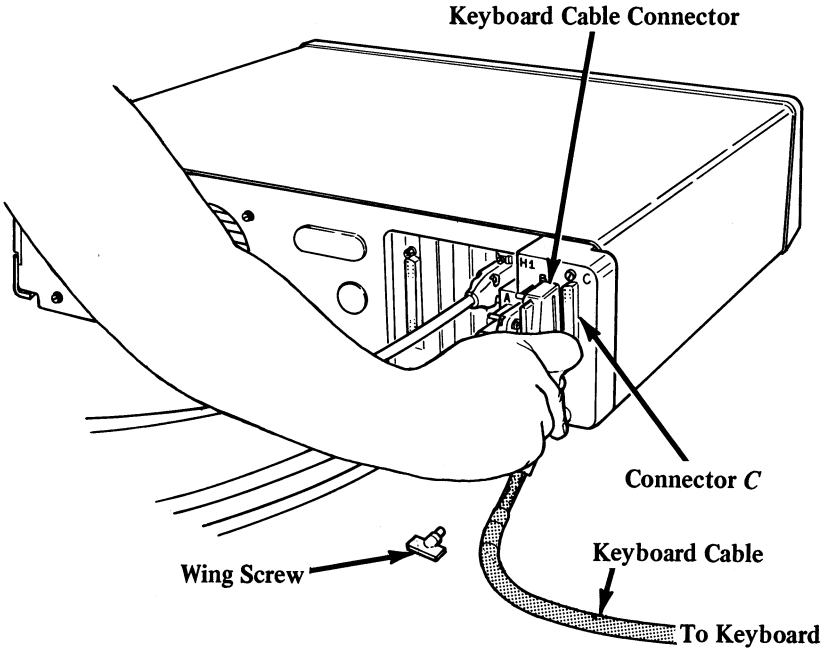
To Keyboard

☐ If necessary, move the keyboard cable clamp so that it lines up with the wing screw stud. Insert the wing screw into the stud, and tighten the wing screw by turning it clockwise ($\curvearrowright$).

Keyboard Cable Connector

Wing Screw Stud

Keyboard Cable Clamp

To Keyboard

Keyboard Cable

Wing Screw
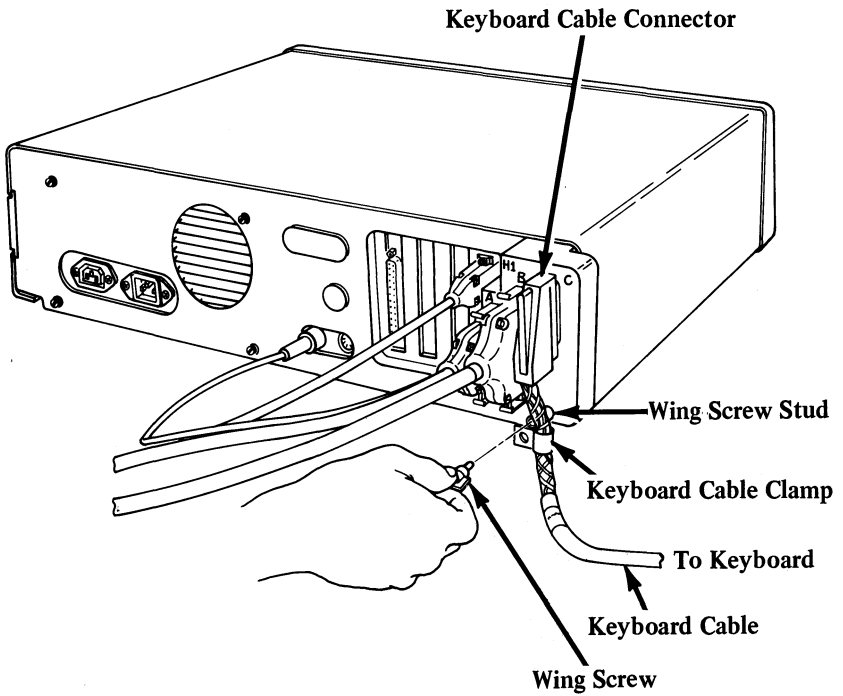
□ **Step 28**

Your cabling of the IBM 3270 Personal Computer Attachment is
completed. The rear of your system unit should look like Figure
2-3, and the rear of your display should look like Figure 2-4 or 2-5.

The keyboard adapter cable, the video cable, and the feature bus
cable should be cabled to the display. The keyboard cable should
be cabled to the keyboard.
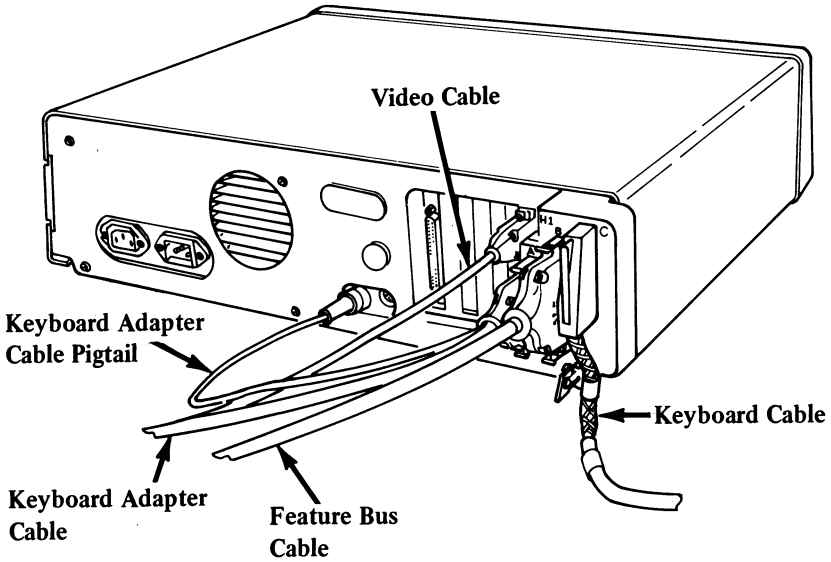
**Figure 2-3. Rear View of a System Unit Cabled for IBM 3270
Personel Computer Attachment**

Feature   Video   Video
Bus   Test   Cable
Cable   Switch
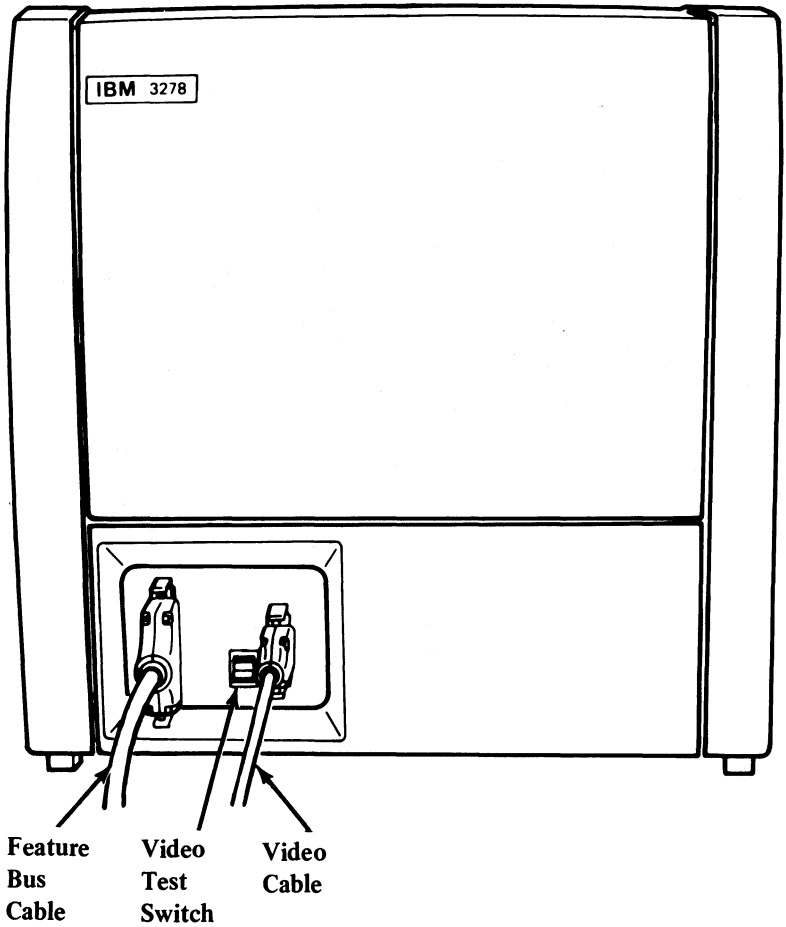
Figure 2-4. Rear View of a 3278 Display Cabled for IBM 3270
Personal Computer Attachment
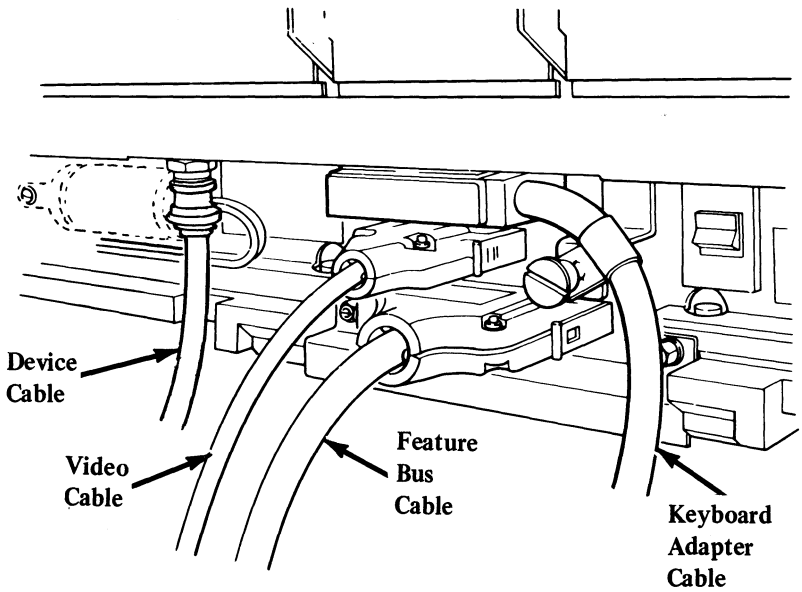
Figure 2-5. Rear View of a 3279 Color Display Cabled for
IBM 3270 Personal Computer Attachment

☐ **Step 29**

☐ Make sure that the system unit On/Off switch is set to Off.

CAUTION
Be sure to connect the power cords of the system unit and of the display to the same branch supply (wall outlet).

☐ Plug the system unit power cord into the system unit power cord socket.

☐ Now plug the system unit power cord into the power outlet.
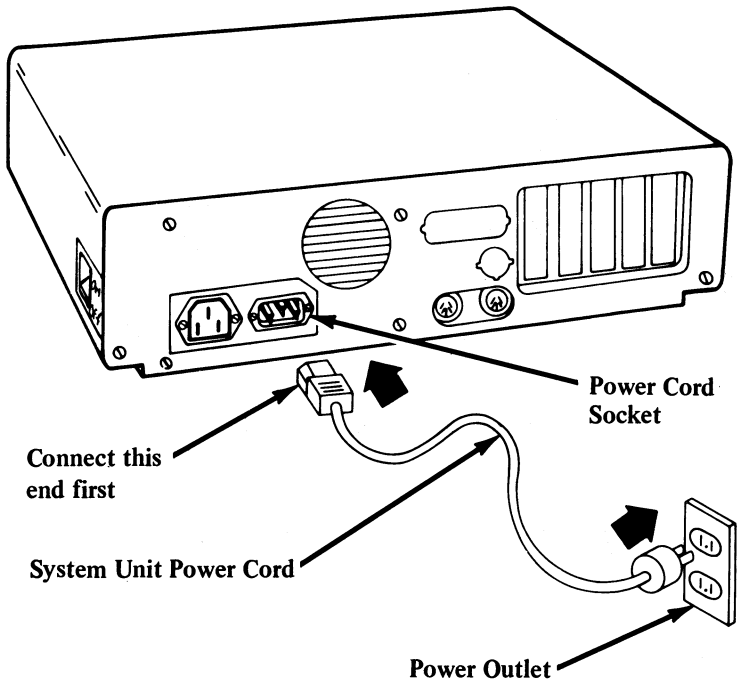
☐ Plug the display power cord into its power outlet.

The option installation is completed. Now continue with the Power-On Self-Test.

Power-On Self-Test (POST)

☐ **Step 1**

☐ Set the display On/Off switch to the On position (I).

On

Off
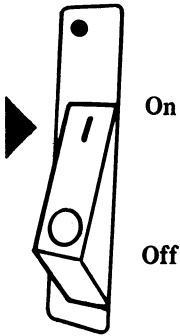
For a 3278 display, turn the contrast and

brightness controls clockwise (⌐ᗷ) as far as they go.

☐ For a 3279 display, turn the brightness

control clockwise (⌐ᗷ) as far as it goes.

☐ **Step 2**

Note: When performing tests or diagnostics, disconnect any external devices that may be connected to your asynchronous communication adapter.

When you first switch on the system unit, the Power-On Self-Test (POST) is run. This test usually takes from 3 to 45 seconds, and several responses occur during the test. Please note the responses.

☐ Set the system unit On/Off switch to On.

Notes:

1. On some models of the 3279 Color Display Station, the screen may have an unstable image and multiple images. This condition is normal for this step.

2. On some models of the Personal Computer system unit, a momentary 301 message appears on the screen. This condition is normal for this step.

You receive these responses:

1. A cursor appears on the screen.

2. You hear one short beep.

3. The IBM Personal Computer Basic message appears on the screen.
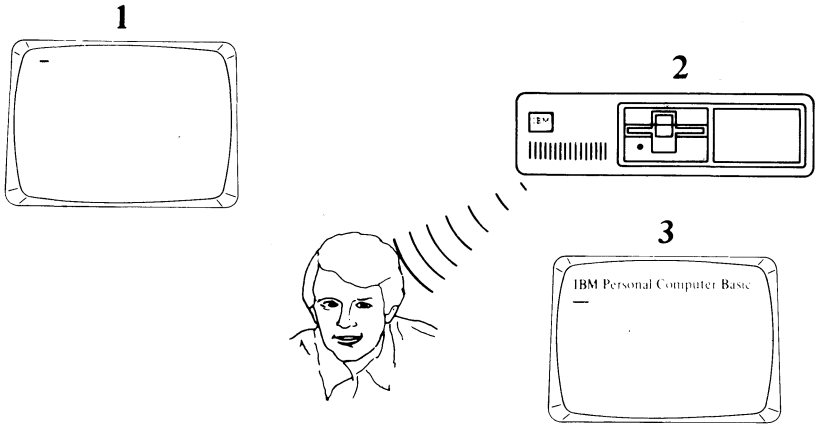
Note: These responses tell you that the self-test has been completed successfully. Other information appears on the screen but is not important at this time.

☐   Adjust the display contrast and brightness for viewing comfort.

The setup is completed.

If the responses were correct, your system is ready for customization. See Chapter 3.

If the responses were *incorrect*, go to Entry Point 205 of Problem Determination Procedure 2 in Chapter 6.

Notes:

1.   Keep the packaging materials and containers; store them in a safe place. Use these materials and containers if the system unit has to be returned for service.

2.   The 3278/3279 keyboard can only be used with the system unit On/Off switch in the Off position until the DOS customization is completed in Chapter 3.

Chapter 3. Customization

Introduction

This chapter shows you how to build a system diskette for use
on the 3278 or 3279 display station with the IBM 3270 Per-
sonal Computer Attachment. You must complete Chapter 2
of this manual before customizing.

The customization procedure is performed in personal computer
mode. The machine does not require keyboard input until you
are prompted by a menu. At that time, follow the directions on
the screen. The customization procedure combines the infor-
mation on your IBM Personal Computer DOS diskette(s), sup-
plied in your IBM Personal Computer DOS book, with the
information on the IBM Personal Computer 3270 Attachment
Option Customization diskette and puts it all on a third diskette.

IBM Personal
Computer DOS

IBM Personal Computer
3270 Attachment Option
Customization

IBM Personal Computer
3270 Option DOS
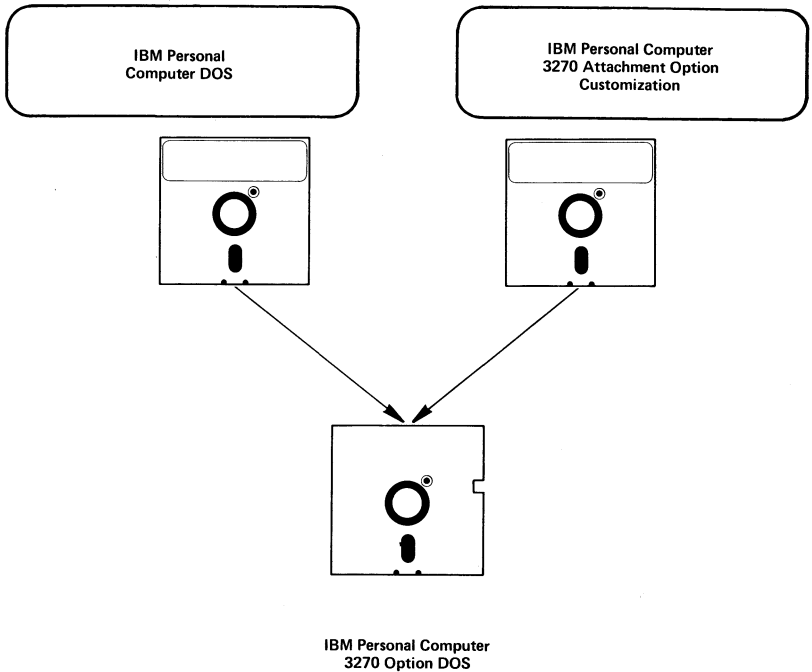
At the end of the procedure, the IBM Personal Computer 3270 Attachment Option DOS diskette takes the place of the IBM Personal Computer DOS diskette. *Any time you need to use your DOS diskette in the future, make sure you use the IBM Personal Computer 3270 Attachment Option DOS diskette.* Save the IBM Personal Computer DOS diskette and the IBM Personal Computer 3270 Attachment Option Customization diskette for backup.

Getting Started

Before you begin, you will need:

- Your IBM Personal Computer DOS diskette(s) (distributed with the *IBM Personal Computer Disk Operating System* manual)

- Your IBM Personal Computer 3270 Attachment Option Customization diskette (distributed with the *IBM 3270 Personal Computer Attachment User's Guide*)

- A blank diskette (supplied by you).

Identifying Your Keyboard and Choosing a Keyboard Reference Card

During the customization procedure, the menu asks you to identify the keyboard language and the possible request for price quotation (RPQ) that apply to your 3278/3279 keyboard. Figures 3-1 through 3-16 show layouts of the keyboards supported. If you do not know which keyboard you have, compare each layout with your keyboard.

Note that several keys on each keyboard layout are highlighted (white). When the corresponding keys on your keyboard match the highlighted keys on the layout, check all the other keys to make sure that this is your keyboard. If not, keep going until you find a match. Make sure your keyboard matches *all* the keys on the layout. If you cannot find your keyboard among the layouts provided, contact your IBM sales representative and stop customization.

At the end of this manual are 16 Personal Computer Mode Keyboard Reference Cards (referred to as **keyboard reference cards** throughout this manual), which fold out for use in personal computer mode. The areas highlighted on the keyboard reference card show the IBM Personal Computer key functions that do not have an equivalent label on the keyboard. The areas not highlighted show the key functions that are the same (or similar) in both personal computer and host computer modes. The keyboard reference card you should use is specified in the Note in Figures 3-1 through 3-16. This keyboard reference card can be folded up against the edge of the manual (when the manual is not in use) for reference during personal computer mode.
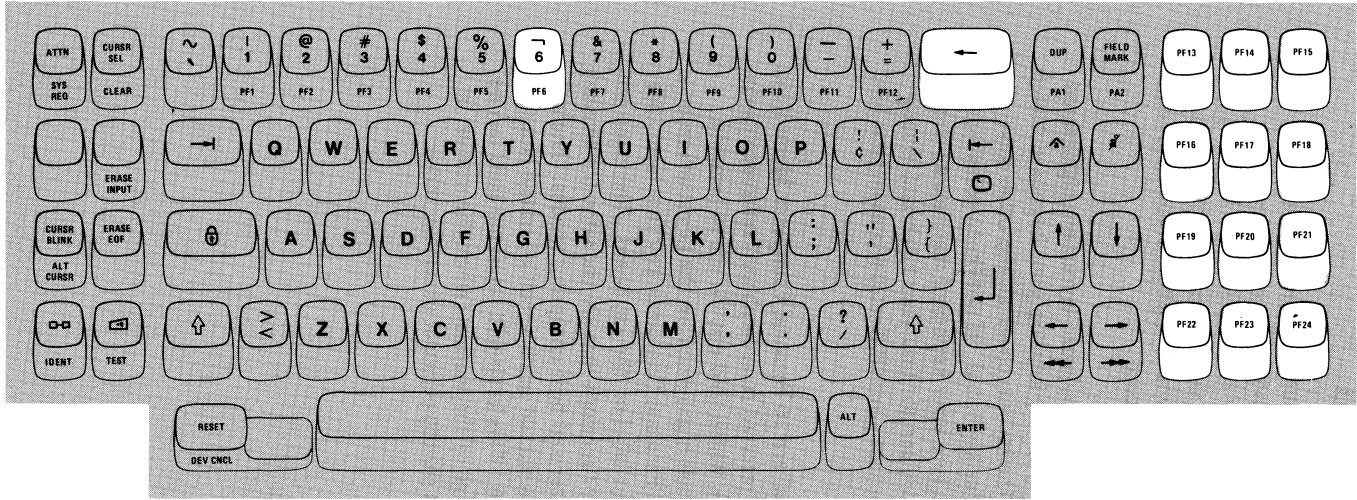
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 1.

Figure 3-1. 87-Key EBCDIC Typewriter Keyboard
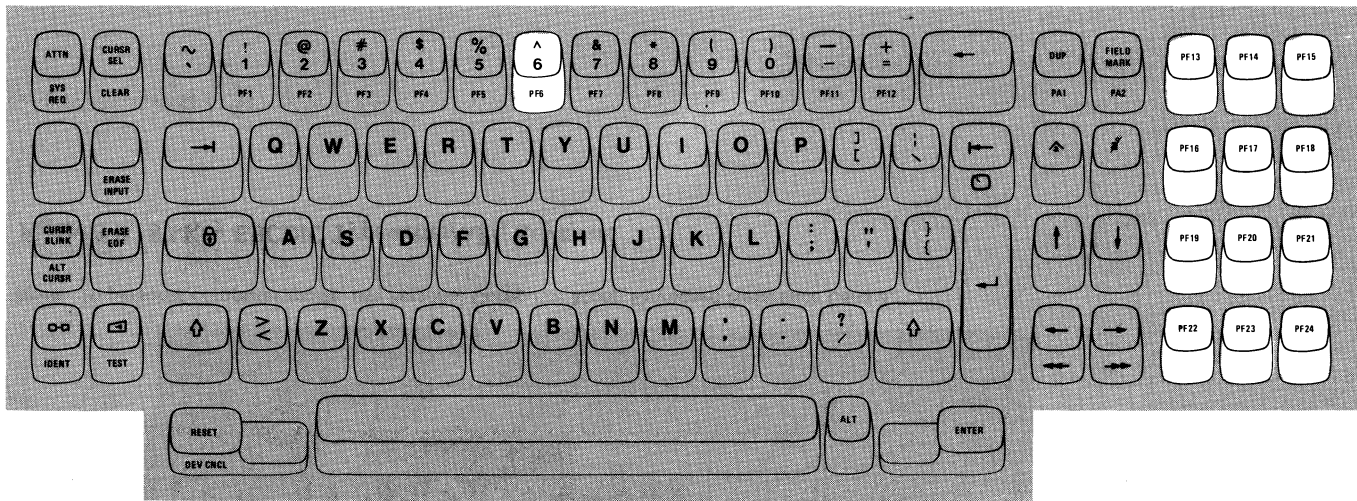
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 2.

Figure 3-2. 87-Key ASCII Typewriter Keyboard
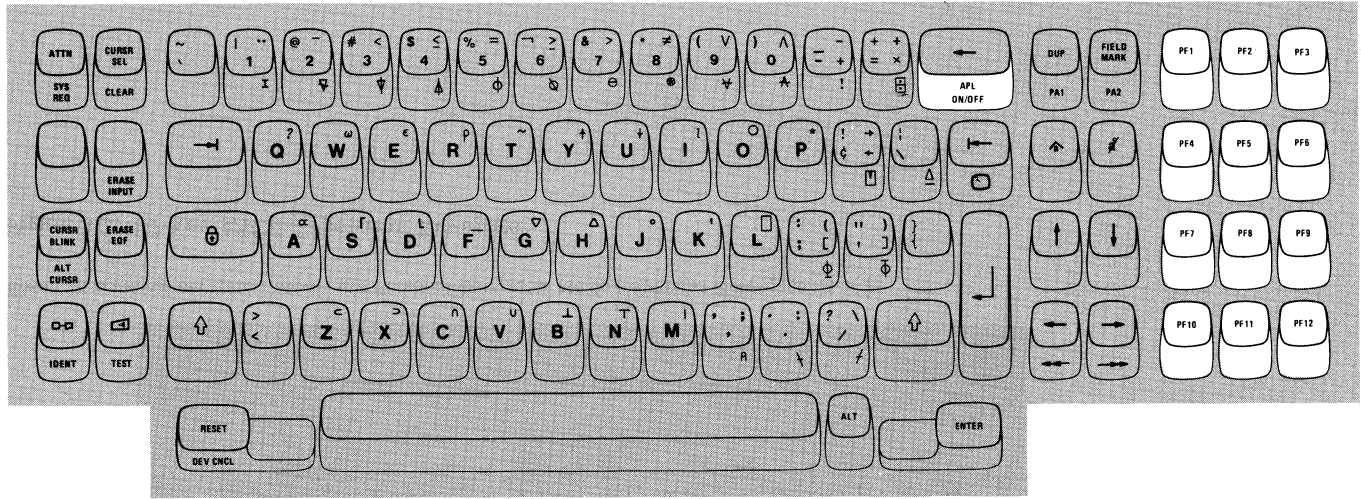
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 3.

Figure 3-3. 87-Key EBCDIC Typewriter/APL Keyboard
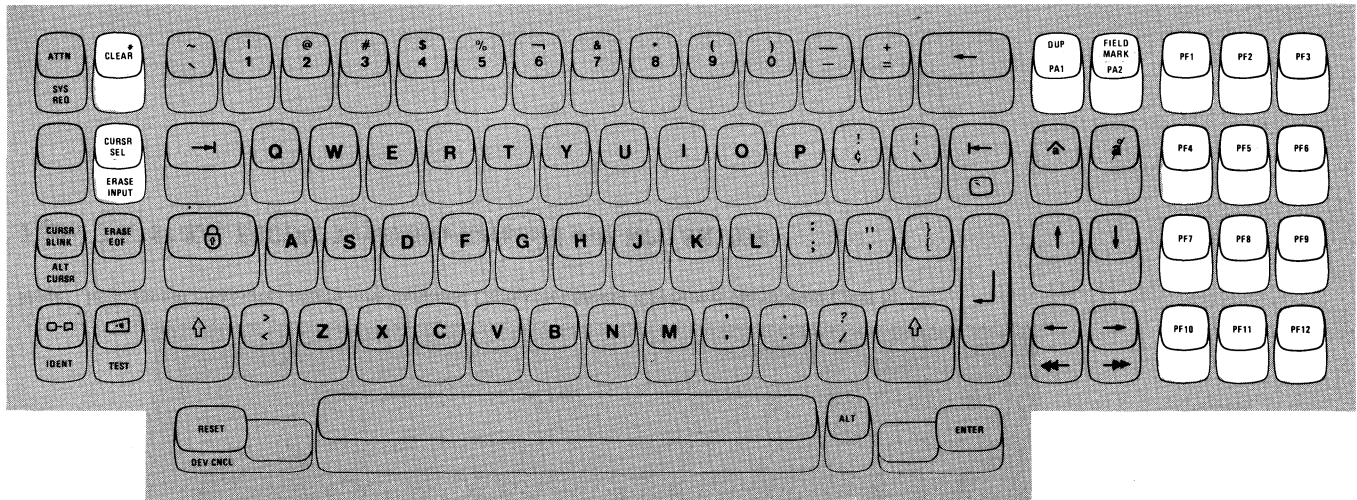
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 4.

Figure 3-4. 87-Key EBCDIC Typewriter Keyboard with RPQ 8K0808
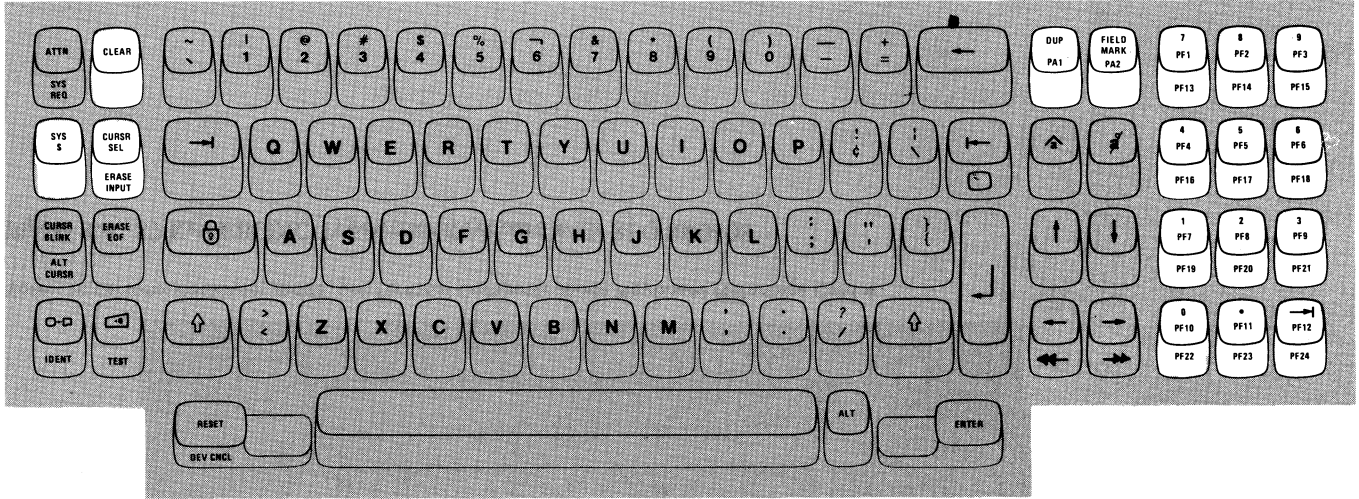
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 5.

Figure 3-5. 87-Key EBCDIC Typewriter Keyboard with RPQ 8K1038
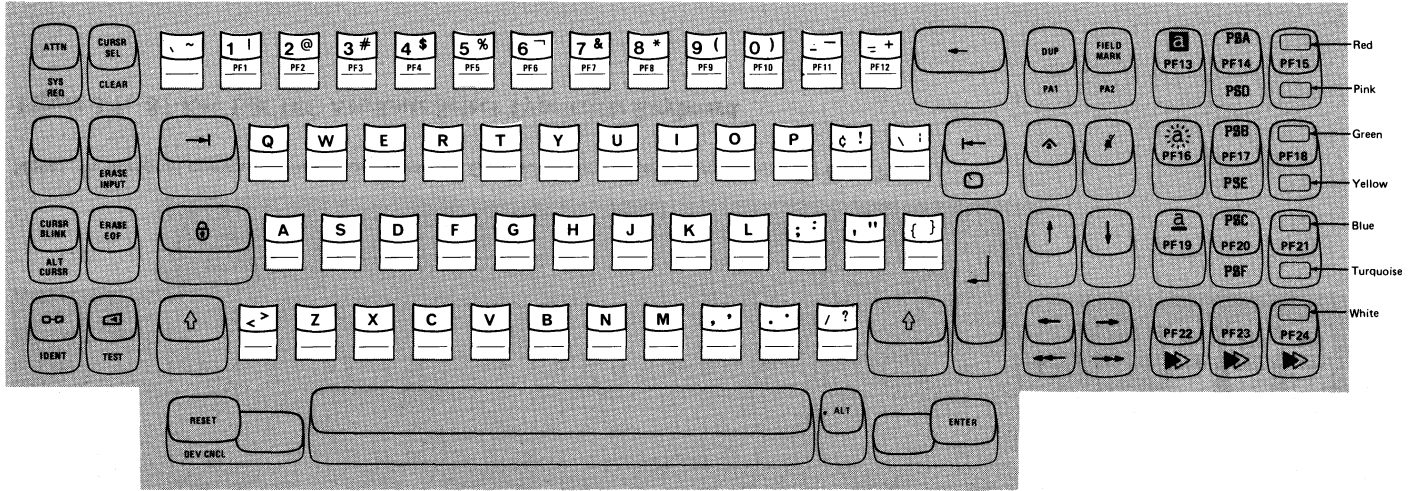
Note that the shape of the highlighted keys is different from that of the other keys.

Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 6.

Figure 3-6. 87-Key EBCDIC Typewriter Overlay Keyboard
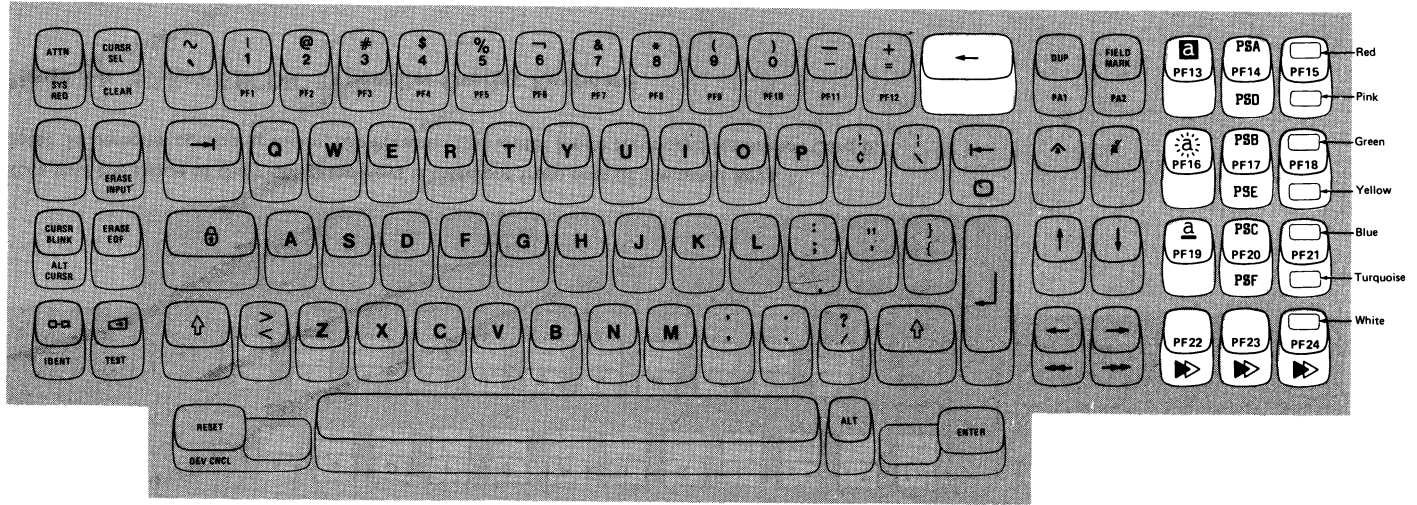
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 7.

Figure 3-7. 87-Key EBCDIC Attribute Select Typewriter Keyboard
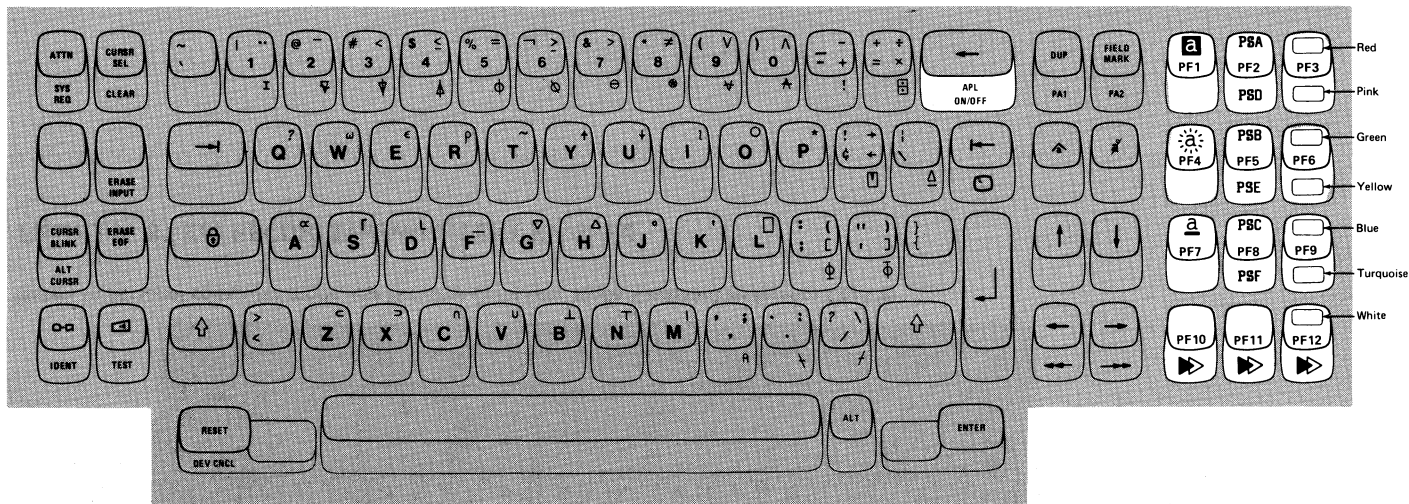
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 8.

Figure 3-8. 87-Key EBCDIC Attribute Select Typewriter/APL Keyboard
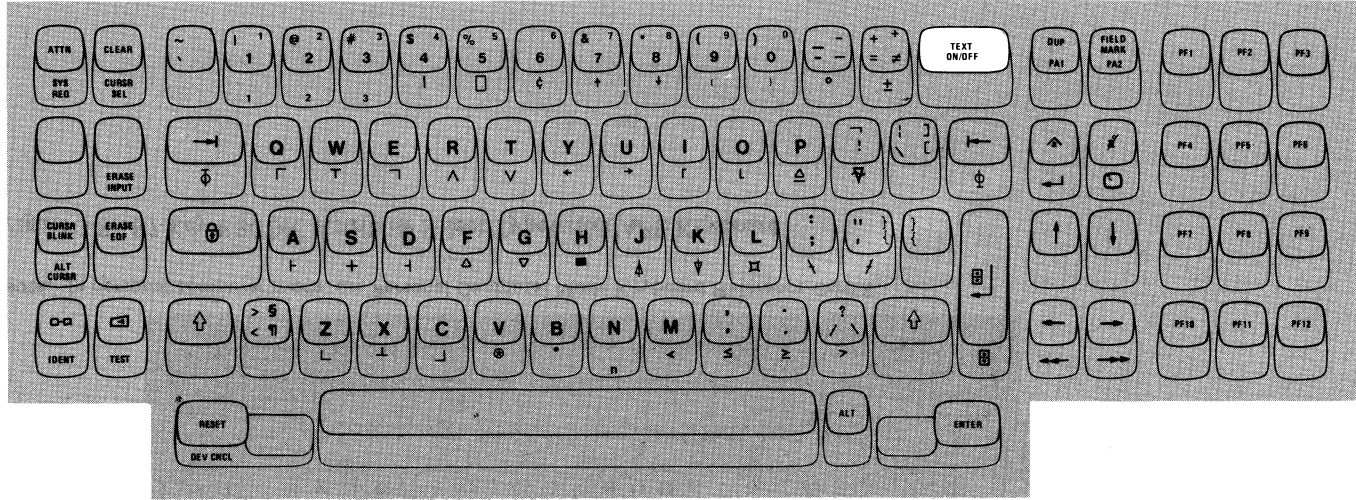
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 9.

Figure 3-9. 87-Key EBCDIC Typewriter/TEXT Keyboard
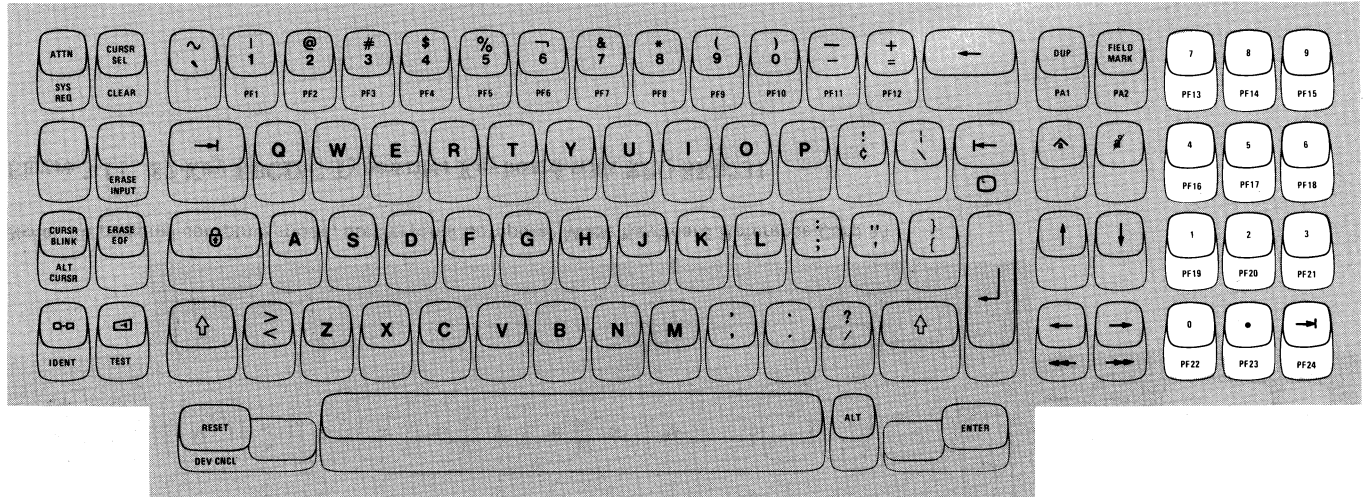
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 10.

Figure 3-10. 87-Key EBCDIC Typewriter Keyboard with RPQ 8K0932
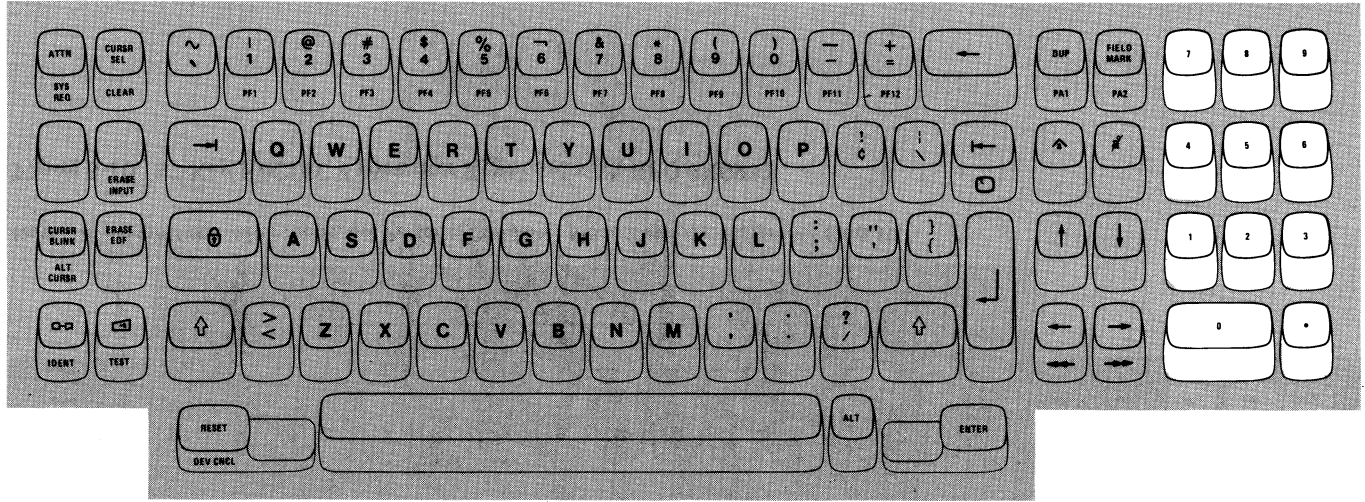
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 11.

Figure 3-11. 87-Key EBCDIC Typewriter Keyboard with RPQ 8K0731
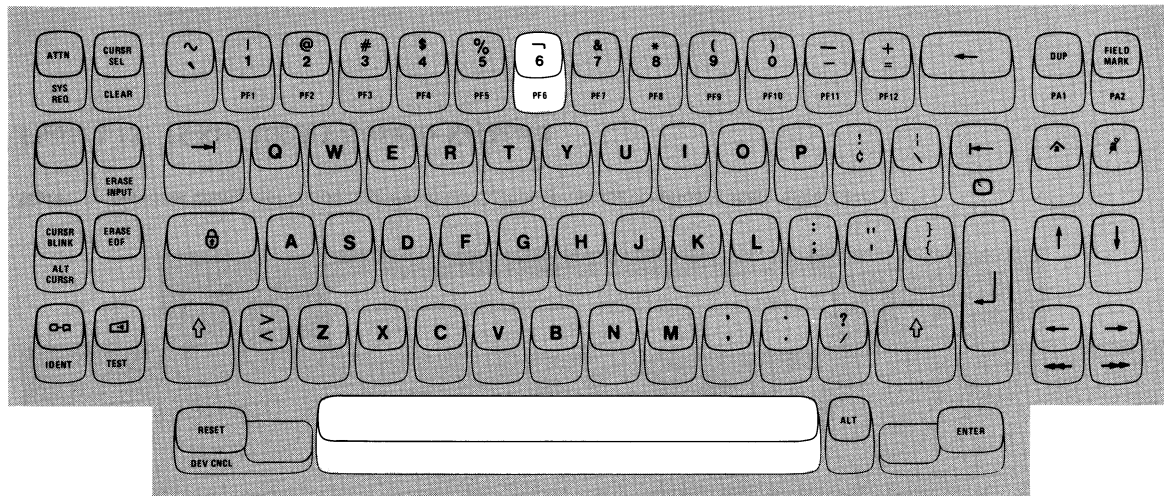
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 12.

Figure 3-12. 75-Key EBCDIC Typewriter Keyboard
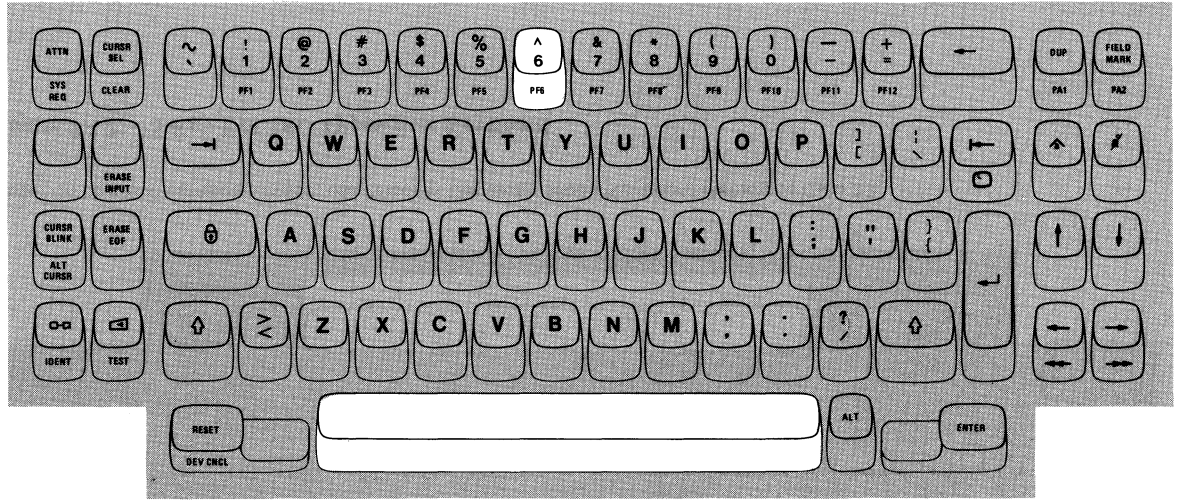
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 13.

Figure 3-13. 75-Key ASCII Typewriter Keyboard
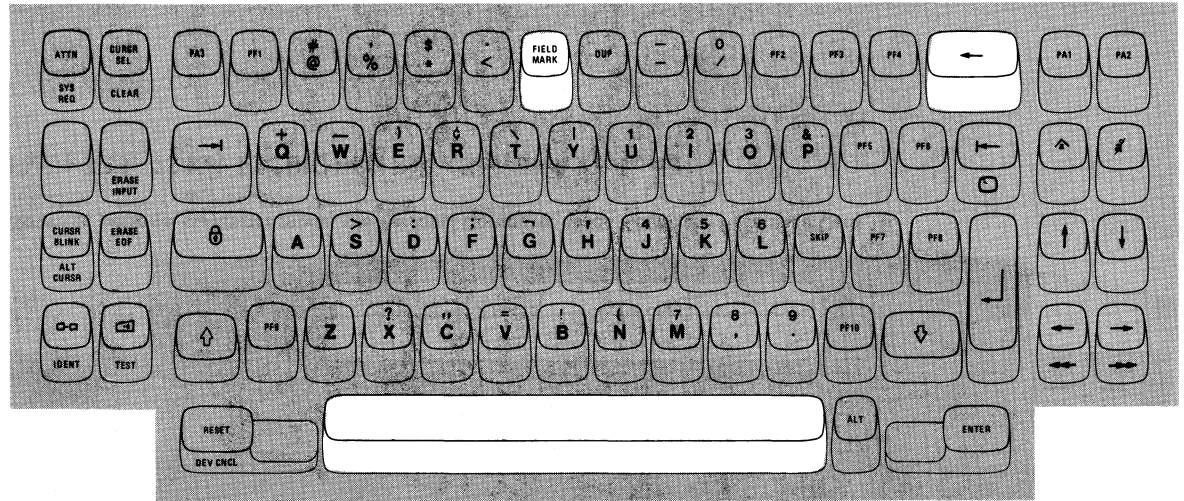
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 14.

Figure 3-14. 75-Key EBCDIC Data Entry Keyboard
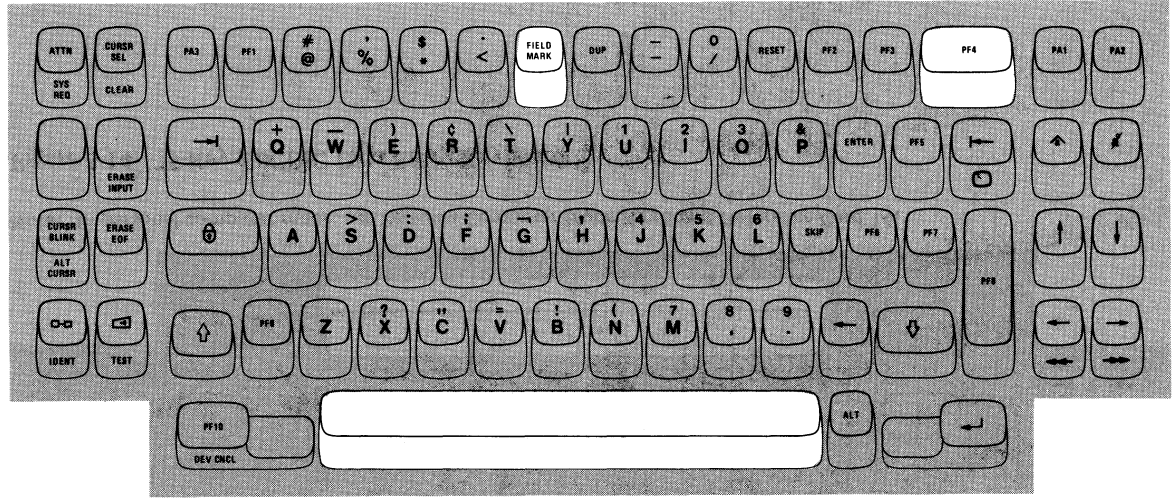
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 15.

Figure 3-15. 75-Key EBCDIC Data Entry Keypunch Keyboard
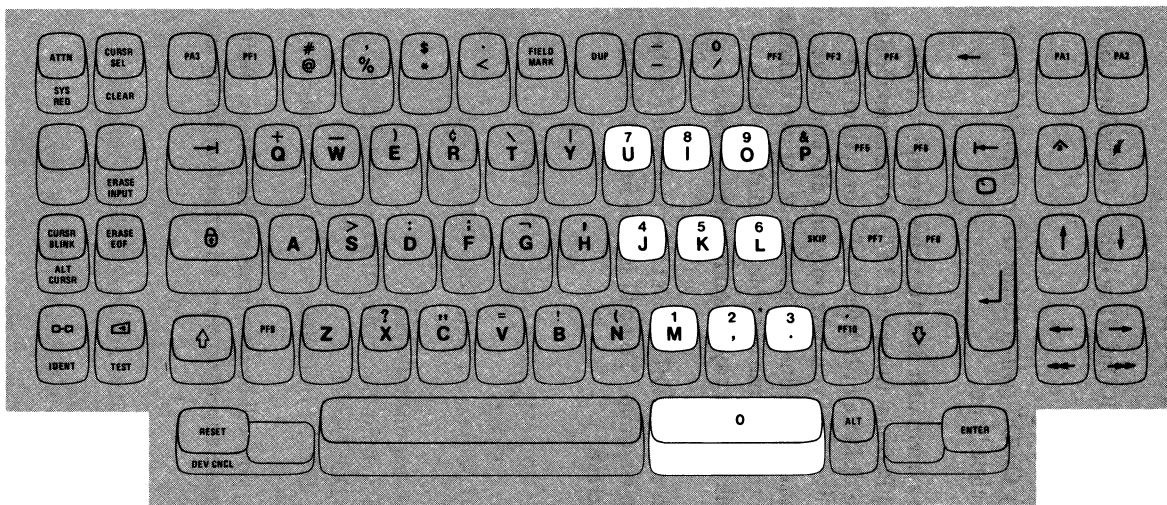
Note: In personal computer mode, use Personal Computer Mode Keyboard Reference Card 16.

Figure 3-16. 75-Key EBCDIC Data Entry Keyboard with RPQ 8K0732

The Customization Procedure

1. Set up your system unit On/Off switch to Off before you begin.

2. Set the display On/Off switch to the On position (|) if the display is not already on.

3. Make sure the system unit diskette drive is empty. Then insert the IBM Personal Computer 3270 Attachment Option Customization diskette into drive A of your system unit and close the door. (If you have only one diskette drive, the customization procedure is the same as for two diskette drives, except that you use only the "A" diskette drive. The system will prompt any action required of you.)

4. Set the system unit On/Off switch to On and wait for the system unit to warm up. You will see the following messages on the screen:

    IBM Personal Computer 3270 Attachment Option
    Customization Program
    Version 1.10 (C)Copyright IBM Corp. 1982, 1983

    Keep the following diskettes ready:
    The IBM DOS System diskette(s) (the diskette(s) distributed with the DOS book)
    and a BLANK diskette (this diskette need not be formatted)

    From here on, you will be prompted by the system. Wait for the message to appear on your screen before taking any action.

    Please REMOVE (name of diskette) diskette from drive (name)
    Please INSERT (name of diskette) diskette from drive (name)

    These two messages are displayed until you place the required diskette in the specified drive, and a beep periodically sounds. Do not be concerned if the red light on the diskette drive is already on before you insert your diskette.

The system checks whether the diskette has already been inserted. Wait for these messages before you insert a diskette.

Check that you have the correct diskette in the correct diskette drive, and close the diskette drive door. If the diskette drive door is left open, the message

Close the diskette drive door

appears on your screen and a beep periodically sounds until the door is closed. Close the door, and the machine begins reading the diskette.

If a diskette with a write-protect tab is in the diskette drive that required a blank diskette, the messages

Diskette is write protected
Please REMOVE this diskette and
INSERT the BLANK diskette without the tab

appear on your screen. Remove this diskette, and insert the blank diskette without a write-protect tab on it. A beep periodically sounds until you insert the blank diskette. These two messages may also occur if a write-protected diskette inserted in the diskette drive in the preceding step is still in the diskette drive and a blank diskette is now required for this step.

The system begins to write on the blank diskette. A few minutes after inserting the blank diskette, you might see linker (LINK) information on your screen. You can ignore this information. The customization process is taking place. Do not open the diskette doors or remove the diskette until you see further information; otherwise, you will prevent completion of the cusomization process.

5. When the machine stops processing, you see a menu and are asked to indicate the keyboard language supported by your system. (This is where the keyboard and RPQ information you found before is given to the system.) Using the Cursor Up (↑) and Cursor Down (↓) keys, move the cursor under the asterisk next to your keyboard language and press any alphanumeric key.

6. Next, do the same as in step 5 with the keyboard RPQ that applies to your system. For example, if no RPQ applies, move the cursor under the asterisk next to NO RPQ and press any key. You see more linker information on your screen. For example, if you identified your keyboard as an RPQ keyboard, you must inform the system. Move the cursor to the correct RPQ and press ENTER.

7. When the system stops processing (you see concluding messages and an A >), the DOS customization is completed. The original blank diskette contains your new DOS system. (This diskette is single-sided.)

   If, when you type, you see symbols on your screen that do not match your keyboard, you specified the wrong keyboard in steps 5 and 6. You must restart the customization process from the beginning. If the procedure does not work, try the procedure again before calling your IBM sales representative.

   Label your new diskette *IBM Personal Computer 3270 Attachment Option DOS.*

Customizing for Your Needs

Now that you have customized a diskette for the IBM 3270 Personal Computer Attachment, you will want to customize the same diskette for typical system and application needs. The diskette you just customized contains:

AUTOEXEC.BAT file

COMMAND.COM file

3270ATT.EXE file

ERASE___ME.BAT file

Two other hidden DOS files

The IBM Personal Computer DOS diskette (supplied with your *IBM Personal Computer DOS Guide to Operations*) contains many more files which did not transfer to your newly customized IBM 3270 Personal Computer Attachment Option DOS diskette. You will need some of these DOS files for your normal operations as well as other files to support your applications. The next two sections, "Customizing Your System Disk" and "Customizing Your Application Disk(s)," will help you customize for your own needs.

Note: The following operations require knowledge of IBM Personal Computer DOS commands. Refer to your *IBM Personal Computer DOS* manual for information. Remember that the term **disk** refers to a diskette or fixed disk.

Customizing Your System Disk

Follow the steps below to build your system diskette:

1. Erase ERASE___ME.BAT (left over from your earlier cus-
    tomization steps) from the IBM 3270 Personal Computer
    Attachment Option DOS diskette you just built.

2. Copy other IBM Personal Computer DOS files you will
    need onto your IBM 3270 Personal Computer Attachment
    Option DOS diskette. (For example, you will need the
    FORMAT file to format additional diskettes for use on the
    IBM Personal Computer. Be careful: You can destroy all
    the information on your fixed disk if you use the FORMAT
    command incorrectly.) (Refer to the *IBM Personal Com-
    puter Disk Operating System* manual for this information.

3. Add any additional commands you require to the
    AUTOEXEC.BAT file on your IBM 3270 Personal Com-
    puter Attachment Option DOS diskette. This completes
    your system diskette. Now, this diskette is **self-loading**,
    which means it can be inserted to power up the system unit
    or used with a keyboard system reset.

    Notes:

    a. The 3270ATT command must *always* be the first entry
        in the AUTOEXEC.BAT file for the IBM 3270 Personal
        Computer Attachment. The AUTOEXEC.BAT file is
        always needed on the diskette that you use to start the
        system (a self-loading diskette). For more information
        about the AUTOEXEC.BAT file, refer to "Batch
        Processing" in Chapter 2 of the *IBM Personal Computer
        Disk Operating System* manual. Chapter 2 also con-
        tains information about creating a double-sided system
        diskette.

The personal computer 3270 interrupt handler (3270ATT.EXE) automatically modifies the display parameters for both the IBM Monochrome Display Adapter and the IBM Color/Graphics Display Adapter for use with the 3278 or 3279 display station.

If both display adapters are installed in your personal computer, you can request 3270ATT to modify only one set of display parameters. If you add the MONO option to the 3270ATT command in your AUTOEXEC.BAT file, the interrupt handler modifies only the parameters for the monochrome display adapter. If you add the COLOR option, the interrupt handler modifies only the parameters for the color/ graphics display adapter.

b. You cannot successfully complete an IBM Personal Computer system reset unless you have a self-loading application diskette or the IBM Personal Computer 3270 Attachment Option DOS diskette in drive A of your system unit. If you try an IBM Personal Computer system reset with a diskette that is not customized for the IBM 3270 Personal Computer Attachment in drive A, the keyboard will be inoperative. To correct this:

(1) **Using a system diskette:**

   (a) Ignore any messages on the display.

   (b) Insert the correct diskette in drive A.

   (c) Set the system unit On/Off switch to Off.

   (d) Wait 5 seconds.

   (e) Set the system unit On/Off switch to On.

(2) **Using a system fixed disk:**

   (a) Ignore any messages on the display.

   (b) Remove any diskette from drive A.

(c) Set the system unit On/Off switch to Off.

(d) Wait 5 seconds.

(e) Set the system unit On/Off switch to On using the system fixed disk.

4. If you wish, you can transfer all the information from your system diskette to a fixed disk. (The term **system disk** refers to a system diskette or to a system disk for the rest of this manual.) Simply follow disk formatting instructions in the *IBM Personal Computer DOS* manual. Be sure the AUTOEXEC.BAT file for the fixed disk includes the 3270ATT entry as its first entry. Also be sure that you copy 3270ATT.EXE to the fixed disk.

Customizing Your Application Disk(s)

Now that you have your system disk completed, you can begin
building your application disk(s).

Application program disks usually come with a set of instruc-
tions for copying selected IBM Personal Computer DOS files
onto the application disk. In addition to these instructions, you
must use your system disk and do the following:

1. Copy the 3270ATT.EXE file onto the application disk.

2. Change the application disk AUTOEXEC file so the first
   command is **3270ATT**. If your application disk does not
   have an AUTOEXEC file, copy the one from your system
   disk.

Examples

The above instructions are helpful in general cases, but here are
some tips for specific applications:

- If you use the IBM Personal Computer DOS FORMAT
  command with /S, or the SYS command, you must also copy
  the 3270ATT.EXE file and the AUTOEXEC.BAT file (con-
  taining the 3270ATT command) onto the target disk. This
  allows you to use the target disk as a self-loading disk.

- The IBM Personal Computer 3270 Attachment Option
  interrupt handler takes up some memory after installation.
  For this reason, personal computer application programs
  that just fit into 64K will require additional memory to run
  on the IBM 3270 Personal Computer Attachment.

- The IBM Personal Computer 3270 Attachment Option
  interrupt handler also takes up diskette space. As a result,
  some of your personal computer application programs that
  were stored on self-loading diskettes might not fit on a
  diskette with the IBM 3270 Personal Computer Attach-
  ment. You can move these application programs to your
  fixed disk or continue to run them from diskette.

To execute them:

1. Load the system diskette. When it has been loaded, you will see A > on the screen.

2. Remove the system diskette, and insert your application diskette.

3. Enter the command

   AUTOEXEC

   This will start your application diskette.

- If you wish to run Science Research Associates (SRA[1]) application programs on the IBM 3270 Personal Computer Attachment, customize the application program diskette, following the procedure at the beginning of this section. After an SRA program diskette is customized, the AUTOEXEC file must be modified. Before loading the SRA program diskette, add the 3270ATT command at the beginning of the AUTOEXEC file and change the command COLOR to LOGO.

Building a Diagnostics Diskette

As an example of an application disk, you need to build a Diagnostics diskette. You build it by copying all the files on your system diskette to a blank formatted diskette, which will become your Diagnostics diskette. Copy the 3270DIAG.EXE file from your customization diskette to your Diagnostics diskette. Store the Diagnostics diskette where it will be easily accessible if you need it for the problem determination procedures in Chapter 6.

Preparing for Data Transfer

You may prepare your new system disk for data transfer at this time. The process is described under "Preparing for Data Transfer" in Chapter 5. If you prefer, you can wait until you need to use the data transfer function.

---

[1] Registered trademark of Science Research Associates

Chapter 4. How to Operate and Use the Keyboard

Operating Sequence

Now that you have set up and installed all your options (Chapter 2) and built your system disk (Chapter 3), your IBM Personal Computer is ready for operation. Your daily operating sequence will be similar to the following:

1. Ready your system disk. (This means you insert your system diskette in drive A, or you remove any diskette from drive A to allow the system fixed disk in drive C to be used.)

2. Set the display On/Off switch to the On position (I).

3. Set the system unit On/Off switch to On.

   The Power-On Self-Test (POST) will run every time the system unit is powered on.

4. When POST is completed:

   a. In personal computer mode, follow your IBM Personal Computer operating procedures.

   b. In host computer mode, follow your host operating procedures.

5. Terminate operations with the appropriate procedure.

6. Set the system unit On/Off switch to Off.

7. Set the display On/Off switch to the Off position (0).

How to Switch Modes from the Keyboard

You switch modes by pressing the following keys:

- On TEXT keyboards, press and hold ALT, and then press PA1.

- On all other keyboards, press and hold ALT, and then press the Insert (✦) key.

If the display station is in host computer mode, it switches to personal computer mode. If in personal computer mode, it switches to host computer mode. You use the mode switch key combination in both host computer and personal computer modes.

In host computer mode, your system unit, keyboard, and display operate as a 3278 or 3279 display station. In host computer mode, the display screen has an operator information area (OIA) and user display space. See Figure 4-1.
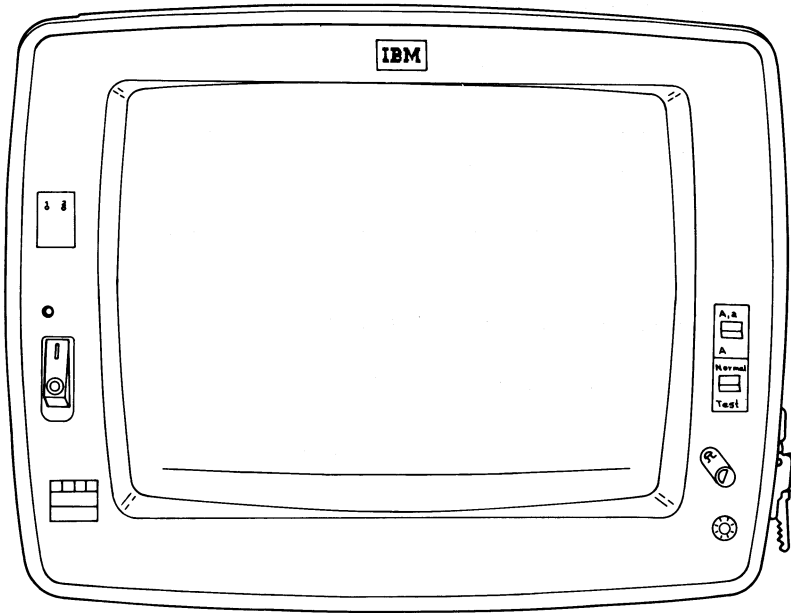
Figure 4-1. Host Computer Mode Display

In personal computer mode, the display screen has no operator
information area. See Figure 4-2.
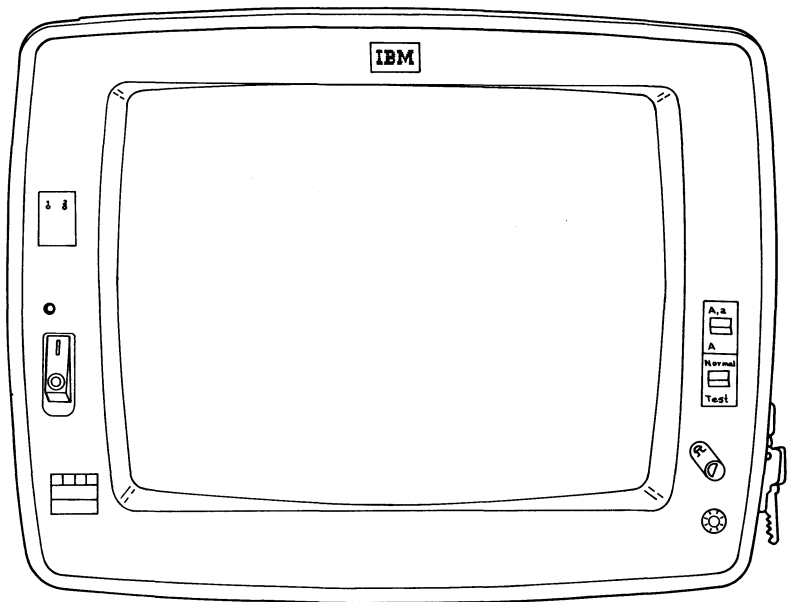
Figure 4-2. Personal Computer Mode Display

The shapes of the characters displayed in personal computer
mode differ from those of the same characters displayed in host
computer mode. In host computer mode, the characters are
generated by the 3278 or 3279 display station. In personal
computer mode, the characters are generated by the personal
computer.

Using the Keyboard in Host Computer Mode

The keyboard is the input device for your display station with the IBM 3270 Personal Computer Attachment. The keyboard performs 3278/3279 functions when in host computer mode. All the functions engraved on the keytops are performed when each key is pressed, except for the mode switch, explained previously.

Using the Keyboard in Personal Computer Mode

In personal computer mode, the keyboard performs the functions of an IBM Personal Computer Keyboard. Some of these functions are not engraved on the 3278/3279 keyboard keytops. To help you locate the keys that perform the IBM Personal Computer functions, the keyboard reference cards at the back of this manual show the IBM Personal Computer Keyboard functions mapped to a layout of the keyboard. In addition, Table 4-1 shows commonly used key sequences referred to in the IBM Personal Computer documentation you received with your system unit.

Changing the Keyboard Mapping

You might use the XLATKBD program on the Attachment Option Enhancements diskette to change the standard mappings between the personal computer keyboard and the 3278/3279 keyboard (as shown on the keyboard reference cards). Run the XLATKBD program for instructions.

Using the Keyboard Reference Cards

The keyboard reference cards duplicate some of the functions on the keyboard layouts (Figures 3-1 through 3-16). Use the functions defined on the keyboard reference card you selected for your keyboard. The highlighted keys on the keyboard reference card show the functions that your keyboard performs when the display station is in personal computer mode. This keyboard reference card, not the key engravings, must be used when the display station operates in personal computer mode. For example, if the display station is in personal computer mode and your application supports *page up,* press the ALT and Cursor Up (↑) keys together. This performs the page-up function. Refer to the IBM Personal Computer manuals for instructions on how to use the personal computer.

Commonly Used Key Sequences

Table 4-1 lists the key sequences found in IBM Personal Computer manuals and the keyboard keys you press to perform that personal computer function.

You should remember that most IBM Personal Computer key functions are application-dependent. The same key sequence might not perform the same function in two different applications. Refer to the IBM Personal Computer manuals for the differences.

Table 4-1. Commonly Used Key Sequences

Personal Computer Key Sequence	3278/3279 Key Sequence	Comments
ALT CTRL Del	PA1 ⚡	IBM Personal Computer system reset.
ESC	ALT PA3 ALT (See keyboard reference card)	Data Entry keyboards. All others.
NUM LOCK	Not on 3278	There is no numeric keypad.
Scroll Lock	CURSR SEL	
CTRL Scroll Lock (Break)	ATTN	
Home	◣	
Pg Up (page up) Pg Dn (page down)	ALT ↑ ALT ↓	
End	ALT →|	
Ins Del	⬀ ⬓	
Caps Lock	🔒	3278/3279 has a Shift or Numeric Lock (all keys shift), not a Caps Lock.
F1—F10 ⬆ F1—F10 CTRL F1—F10 ALT F1—F10	PF1—PF10 (See keyboard reference card) F11—F20 (See keyboard reference card) F21—F30 (See keyboard reference card) F31—F40	
Prt Sc	▭▭	Print screen.
CTRL Prt Sc	PA1 ▭▭	Start/stop echo screen to print.

Table 4-1. Commonly Used Key Sequences (continued)

Personal Computer Key Sequence	3278/3279 Key Sequence	Comments
CTRL ← CTRL →	ALT ← ALT →	Reverse word. Advance word.
CTRL End	ERASE EOF	Delete to end of line.
CTRL Pg Dn	ERASE INPUT	Delete to end of screen.
CTRL Home CTRL Pg Up	CLEAR PA1 ↑	
CTRL A–Z	PA1 A–Z	PA1 makes the next keystroke operate as if the CTRL key were held.
ALT A–Z ALT 1–0, –, =	PA2 A–Z PA2 1–0, –, =	PA2 makes the next keystroke operate as if the Personal Computer ALT key were held.
ALT 0–9 (on numeric keypad)	FIELD MARK nnn (nnn = 0–9)	The first three digits (0–9) entered after pressing of FIELD MARK operate as if ALT were held and they came from the numeric keypad.
CTRL NUMLOCK (pause)	DUP	Pause. Any key except Shift (↑ , ↓), Shift Lock (⊕), or ALT will resume operation of the personal computer.

Table 4-1. Commonly Used Key Sequences (continued)

Personal Computer Key Sequence	3278/3279 Key Sequence	Comments
◄┘	◄┘ or ENTER	Enters the data.
CTRL ◄┘	ALT ◄┘ or ALT ENTER	Move to next line.
Not available	⌨ Clicker	Toggles keyboard clicker on/off.
Not available	RESET	Cancels ALT, CTRL, Scroll Lock, and ALT 0–9 (on numeric keypad) functions.

Chapter 5. Data Transfer

Introduction

Data transfer functions move information from the host to the IBM Personal Computer or from the IBM Personal Computer to the host. The IBM 3270 Personal Computer Attachment permits two types of data transfer:

- Screen capture

- File transfer.

Before you can transfer data, you need application programs. You can choose from two options:

- You can write your own application programs.

- You can use the sample application programs supplied on the diskettes with this book.

How to Use This Chapter

This chapter explains the use of the supplied sample application programs for screen capture and file transfer. This chapter is used with Appendixes A, B, C, E, F, and G because they concern data transfer also.

Appendix A defines the functions that a personal computer application program can use to pass data between the personal computer application program and the IBM Personal Computer 3270 Attachment Option for Assembler.

Appendix B parallels Appendix A for BASIC.

Appendix C parallels Appendix A for PASCAL.

Appendix E guides supervisors or system programmers in setting up the host and the control unit for screen capture and file transfer.

Appendix F provides data formats and translations for the data transfer sample application programs supplied.

Appendix G gives the structures for transferring data between the host and the personal computer. This appendix contains descriptions for "impossible" file transfer error messages.

What Is Screen Capture?

Screen capture copies the screen image from the host display to the personal computer. You can copy this host screen image to these output devices:

- A personal computer diskette

- A personal computer fixed disk

- A personal computer printer.

You prepare for screen capture in personal computer mode, but you capture screens from host computer mode.

Screen capture requires:

- A personal computer screen capture application program

- An IBM 3274 Control unit customized for the IBM 3270 Personal Computer Attachment.

Screen capture *does not* require a screen capture application program at the host. Any host screen image can be captured. For more information about your system's preparation for screen capture, ask your system program or go to Appendix E.

What Is File Transfer?

File transfer copies a file from the host to the personal computer (or vice versa). *The original file stays intact.*

For example, you can create a BASIC file on your host system and transfer it to your IBM Personal Computer for processing.

You prepare for file transfer in personal computer mode, but you transfer files in host computer mode. You can transfer files in two ways:

- Using a' menu panel

- Using a straight command.

Until you understand file transfer well, you should use the menu method.

File transfer requires:

- A personal computer file transfer application program

- An IBM 3274 Control Unit customized for the IBM 3270 Personal Computer Attachment

- A host file transfer application program.

For more information abour your system's preparation and setup for file transfer, ask your system programmer or go to Appendix E.

A Guide to Special Notation

Throughout this chapter, the formats of the commands use the syntax notation described below:

- *Uppercase Characters*

  Command name or operands consisting of uppercase characters must be spelled as shown, but can be entered in uppercase or lowercase.

- *Lowercase Characters*

  Lowercase characters are variables that show the *kind* of information, rather than the exact information, that must be supplied. The actual entry replaces the lowercase description.

- *Square Brackets* [ ]

  When square brackets enclose an operand, they indicate a completely optional specification. This includes any accompanying commas or equal signs. Square brackets are not included when the specification is entered.

- *Or-Sign* |

  The or-sign is used to separate options for a single optional or required specification. If a group of options is shown and the individual options are separated by or-signs, one of the options in the group can be chosen. If none of these operands is coded, the default value is used.

- *Commas and Parentheses*

  Commas and parentheses must be entered as shown. When they appear within brackets, they are optional and are to be used only if the accompanying operand is used.

A Guide to Data Transfer Sample Application Programs

Several data transfer sample application programs are included on the diskettes that come with this book. Since you should understand the names and functions of the sample application programs, a guide to them is given in Table 5-1.

Table 5-1. A Guide to Data Transfer Sample Application Programs

Program Name	Function
HOST.EXE	Supports screen capture *and* file transfer for the IBM Personal Computer. (You find HOST.EXE on the Customization diskette.)
	These three files must be present in a CMS host for file transfer:
PCXFER MODULE	Transfers files between a CMS host and an IBM Personal Computer.
PCXFER EXEC	Runs PCXFER MODULE or uses the Interactive System Productivity Facility (ISPF) to run PCXFER MODULE with a menu.
PROFILE PCXFER	Contains the default values for PCXFER MODULE.
	These two files are optional for file transfer in a CMS host:
PCXFER MACLIB	Supports ISPF panels.
PCXFER HELPCMS	Provides online information about file transfer when you use CMS HELP command. (You find all five files for CMS on the *data transfer: VM/CMS* diskette.)

Table 5-1. A Guide to Data Transfer Sample Application Programs (continued)

Program Name	Function
	These two data sets must be present in a TSO host for file transfer:
PCXFER.LOAD	Transfers data sets between a TSO host and an IBM Personal Computer.
PCXFER.PROFILE	Contains default values for PCXFER.LOAD.
PCXFER.CLIST	Runs PCXFER.LOAD or uses ISPF to run PXCFER.LOAD with a menu.
	These two data sets are optional for file transfer in a TSO host:
PCXFER.PANEL	Supports ISPF panels.
PCXFER.HELP	Provides online information about file transfer when you use the TSO HELP command.

By the End of This Chapter

You learn how to use the sample application programs to:

- Copy a host screen image to your IBM Personal Computer (screen capture)

- Copy a host CMS file or TSO data set to your IBM Personal Computer (file transfer)

- Copy a personal computer DOS file to CMS or TSO (file transfer).
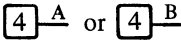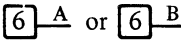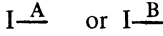
Preparing for Data Transfer

You must prepare for data transfer before you can use the supplied sample programs to do screen capture and file transfer. The following steps outline what to do:

1. **Customize the control unit.**

   Both screen capture and file transfer require customization of the IBM 3274 Control Unit for the IBM 3270 Personal Computer Attachment. Your system programmer takes responsibility for this step.

   Look in the left side of the operator information area (OIA) to see what type of control unit your display station is attached to. Try to match one of the symbols below:

Symbol	Meaning
$\boxed{4}\!-\!^A$ or $\boxed{4}\!-\!^B$	IBM 3274 Control Unit
$\boxed{6}\!-\!^A$ or $\boxed{6}\!-\!^B$	IBM 3276 Control Unit Display Station
$I\!-\!^A$ or $I\!-\!^B$	IBM Integrated Display Adapter

   If your display station is not attached to an IBM 3274 Control Unit, you cannot do screen capture or file transfer.

   To check whether the 3274 is customized, type HOST while in personal computer mode. (Make sure the diskette in the default drive contains HOST.EXE, which is supplied on the Customization diskette, so that HOST can run.) Two copyrights appear on the screen, and then the screen switches to host computer mode. If this does not happen, see Appendix E and the *IBM 3274 Control Unit Planning, Setup, and Customizing Guide,* GA27-2824, for customization information.

2. **Copy HOST.EXE to your personal computer application disk.**

   HOST.EXE, the IBM Personal Computer sample application program for both screen capture and file transfer, is supplied on the IBM Personal Computer Attachment Option Customization diskette with this book. For convenience, you might copy HOST.EXE onto your daily application disk. *(See the procedure in Chapter 3 for preparing an application disk if you do not have one.)*

3. **Upload the CMS or TSO host sample application programs.**

   The host sample file transfer application programs included on the diskette must be sent to the host to run. (Remember, the host does not need a screen capture application program.) Since this step is time-consuming, you should send these application programs to the host once. Then users share the programs by:

   ● Distribution over the host network to another system

   ● A common shared host storage unit

   ● A private host storage unit.

   To check whether the application programs are already uploaded, type in a host list command to see whether the CMS or TSO files listed in Table 5-1 are in your host. Refer to Appendix E for uploading directions.

   Note for TSO Users: Before you can transfer files, you must allocate DD (PCXFPROF) to point to the PCXFER.PROFILE data set.

Screen Capture: Transferring a Screen to IBM Personal Computer with Sample Application Program

Screen capture copies your host screen image to your personal computer printer, diskette, or fixed disk. With screen capture, you keep a permanent record of any host screen image.

By using screen capture, you avoid waiting for output from busy 3270 printers or from busy host printers. If an IBM Personal Computer printer is attached to your system unit, you can copy your screen image immediately.

Output Formats and Output Devices

For screen capture, you can choose an output format and an output device, as follows:

Output Format	Available Output Devices
Edit Format (default)	Personal computer printer (default)
	Personal computer diskette
	Personal computer fixed disk
Unformatted	Personal computer diskette
	Personal computer fixed disk

Edit Format, the default output format, is what you see on the screen.

Edit Format defaults to output with headers and trailers. A header is an additional line at the beginning of the screen image, and a trailer is an additional line at the end of the screen image. The header and the trailer separate screen captures and provide a time stamp.

The default output device is the printer.

Unformatted output is simply a copy of the display station's buffers, which store information in machine code. The diskette and the fixed disk are the available output devices.

Two types of buffer can be captured:

● The 3278/3279 Regeneration Screen Buffer with 3278/ 3279 character codes and basic field attributes

● The Extended Attribute Buffer (EAB) with 3278/3279 extended character attribute codes (requires the /E option).

The Programmed Symbol Set (PSS) buffers cannot be captured.

Refer to Appendix F for translation tables and screen capture output formats.

The HOST Sample Application Command Options

Now that you know what screen capture output formats are available, you learn how to code your choices in the HOST command. Then you can capture a screen. Figure 5-1 shows the HOST command syntax:

```
Type: HOST [target-filespec [/U [/E]] | [/N]] [/T]
```

Figure 5-1. HOST Command Syntax

Table 5-2. HOST Command Options

Option	Use
target-filespec	You substitute a standard DOS filespec (the file you wish to write to). The filespec might take this form: [drive:] [path\] filename [.exit]. If you omit the filespec, /U and /E are ignored, and Edit Format results.
/U	Sends the screen capture an unformatted output to the target-filespec.
/E	Captures the extended attribute buffer as well as the regeneration (screen) buffer. If you omit /U, the output defaults to Edit Format, and /E is ignored.
/N	Omits headers and trailers in Edit Format output.
/T	Provides a TRACE of the structured fields sent and is received by the personal computer HOST.EXE program. /T is valid for any format and output device. The TRACE output always appears on the personal computer mode display.

How to Capture a Screen

Follow the procedure in Table 5-3 to complete a screen capture.

Table 5-3.   Procedure for Screen Capture

User Action	Computer Response
Type HOST [options] Press ENTER. (Skip this step if HOST.EXE already is running.)	The display station switches to host computer mode.
	☐ ⟶ ☐ 99 is displayed on the right of the operator information area.
Log on to your CMS or TSO host. (Skip this step if you have already logged on.)	
Display the screen you want to capture.	
Press the Print Screen key: ☐ ⟶ ☐	The screen image is sent to the personal computer printer, diskette, or fixed disk.
	☐ ⟶ ■ 99 is displayed on the right of the operator information area while the screen is captured.

Table 5-3. Procedure for Screen Capture (continued)
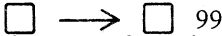
User Action	Computer Response
If you press the print screen key again while a screen is captured, the new screen remains pending.	☐ ⟶ ☐ is displayed on the left of the operator information area until the current screen is captured. Then, ☐ ⟶ ■ is again displayed on the right of the operator information area.
If you want to terminate a pending screen capture, press DEV CNCL (ALT + RESET on most keyboards). A screen capture already printing cannot be terminated.	☐ ⟶ ☐ disappears from the left of the operator information area.
If you do not need any more screen captures, want to terminate HOST.EXE, and are in host computer mode: Hold ALT and press the Insert (⇧) key or Hold ALT and press PA1 (for a text keyboard).	The display switches to personal computer mode.

Table 5-3.   Procedure for Screen Capture
(continued)

User Action	Computer Response
Then, press ATTN	HOST.EXE completes processing.
	☐ ⟶ ☐ 99 disappears from the right of the operator information area in host computer mode.

Screen Capture Error Messages

- If you see error messages during screen capture, follow the Problem Determination Procedures in Chapter 6.

- If you see 2%% in the operator information area, your 3274 Control Unit may not be customized or your data transfer path may have problems. See your supervisor or system programmer.

- If you see ☒ 69 in the operator information area, your display may be attached to a 3276 Control Unit, which does not support data transfer. See your supervisor or system programmer.

- If nothing happens, and I^A or I^B is displayed in the left of the operator information area, your display is attached to an integrated display adapter (IDA). The IDA does not support data transfer functions for the IBM 3270 Personal Computer Attachment. See your supervisor or system programmer.

File Transfer: Transferring Files between Host and Personal Computer with Sample Application Programs

You can transfer a copy of a file from your personal computer to your host or from your host to your personal computer.

Reasons for Using File Transfer

Both the host computer and the personal computer have advantages and disadvantages in completing certain tasks. As a user of the IBM 3270 personal computer attachment, you can choose the machine (personal computer or host) that best performs your task.

- **Flexibility**

  You can continue working on the personal computer when the host is not available. When the host is available again, you can transfer the file you have been working on in personal computer mode to the host.

- **Printing**

  You may have both personal computer printers and high-speed host printers available to you. The host printers print at a much higher speed than the personal computer printers, but the personal computer printers may have a quicker turnaround of jobs. The host printers may also have a higher quality printout than the personal computer printers. By weighing these tradeoffs, you can choose the best printer to match your task and transfer your file to the appropriate computer.

- **Backup**

  You can keep backup copies of personal computer files on your host system. Likewise, personal computer diskettes can store backup copies of sensitive host files or data sets for security.

- **Long Distance**

  You can transfer files from one personal computer to another personal computer over your host network to save time when exchanging diskettes is inconvenient (because of long distance, for example).

- **Merging Files**

  You can merge data from host files and from personal computer files.

Guidelines for File Transfer

Follow the guidelines below before you transfer a file.

- **Personal Computer**

  Only files that are organized under DOS can be transferred with the sample application programs. The *IBM Personal Computer EasyWriter Version 1.0* files CANNOT be transferred.

- **Host Computer**

  Only CMS files or TSO data sets can be transferred with the sample application programs.

- **File Sizes**

  The target computer's available storage capacity can limit file size for file transfer. For example, if you transfer a file from the host to a personal computer diskette, make sure the file will fit on the diskette. File transfer does not allow you to span volumes. Likewise, do not transfer from the personal computer to the host a file that is too large for the available host storage device.

- **Methods**

  From host computer mode you can do file transfer:

  — From a menu

  — As a command.

  You should use the menu until you understand the file transfer process well. With the command format, you may use some options not available from the menu.

- **Changing Command Options**

  Once you transfer files using the command method, many options are available. If you find that you need to change the same options for most of the files you transfer, you might wish to change the PROFILE PCXFER file or data set.

  In addition, PROFILE PXCFER might not contain unique host filetypes and descriptive qualifiers, or filetypes and descriptive qualifiers that are spelled differently by your host. You will need to change PROFILE PCXFER to reflect your host's filetype or descriptive qualifier conventions, or your files might be transferred in a different format from that you intended.

  You can change PROFILE PCXFER easily, but you must first master the "File Transfer" and "Syntax for PROFILE PCXFER" sections of this chapter.

Transferring a File with a Menu

Your system needs the Interactive System Productivity Facility (ISPF) for support of the menu panels. Usually, your system programmer sets up ISPF. Refer to Appendix E for more information.

Follow Table 5-4 to complete a menu-driven file transfer.

Table 5-4. Procedure for File Transfer with a Menu

User Action	Computer Response
Type HOST and press ENTER (Skip this step if HOST.EXE already is running.	The display station switches to host computer mode.
	☐ ⟶ ☐ 99 is displayed in the operator information area.
Log on to your CMS or TSO host. (Skip this step if you have already logged on.)	
Type PCXFER and press ENTER	A menu panel is displayed on your screen. (An error message is displayed if you do not have access to ISPF.)
Complete the menu: 1. Enter values into blank fields (= = >). 2. Type over any default values you wish to change. 3. Press ENTER.	Status messages are displayed on your screen as the file transfer occurs.

Table 5-4. Procedure for File Transfer with a Menu (continued)

User Action	Computer Response
If you want to cancel the file transfer, press PF3 or PF15 If you see x-f, press RESET and try again.	PCXFER is terminated. The display returns to the menu.
If you do not need any more files transferred, exit the menu by pressing PF3 or PF15	The PCXFER menu is completed.
If you want to terminate HOST.EXE and are in host computer mode: Hold ALT and press the Insert key (⇑) or Hold ALT and press PA1 (for a text keyboard).	The display switches to personal computer mode.
Then, press ATTN	HOST.EXE completes processing.
	☐ ⟶ ☐ 99 disappears from the right of the operator information area in host computer mode.

Transferring a File with Commands

Follow Table 5-5 to complete a file transfer without a menu. You can find more information about coding the PCXFER command options in CMS and TSO in the sections that follow.

Table 5-5. Procedure for File Transfer with Commands

User Action	Computer Response
Type HOST and press ENTER (Skip this step if HOST.EXE already is running.)	The display station switches to host computer mode
	☐ ⟶ ☐ 99 is displayed in the operator information area.
Log on to your CMS or TSO host. (Skip this step if you have already logged on.)	
If you are a TSO user, you must allocate DD (PCXFPROF) to point to the PCXFER.PROFILE data set before running PCXFER. (Skip this step if you have already allocated DD.)	

Table 5-5. Procedure for File Transfer with Commands (continued)

User Action	Computer Response
For CMS, enter PCXFER cms-file-id TO | FROM personal-computer-filespec [(options] **For TSO**, enter PCXFER DSNAME (TSO-data-set-name) TO | FROM FILESPEC (personal-computer-filespec) [options]	For both CMS and TSO: 1. Status messages appear as the file transfer progresses. 2. PCXFER completes processing.
To terminate PCXFER during a file transfer, press PF3 or PF15. If you see x-f, press RESET and try again.	PCXFER is terminated.

Table 5-5. Procedure for File Transfer with Commands (continued)

User Action	Computer Response
If you want to terminate HOST.EXE and are in host computer mode: Hold ALT and press the Insert (ⓐ) key or Hold ALT and press PA1 (for a text keyboard).	The display switches to personal computer mode.
Then, press ATTN	HOST.EXE completes processing.
	☐ ⟶ ☐ 99 disappears from the right of the operator information area in host computer mode.

PCXFER Command Options for CMS

The CMS PCXFER command transfers files from CMS to your personal computer or from your personal computer to CMS. Each time you enter the CMS PCXFER command, you must supply the required fields:

- cms-file-id

- TO | FROM

- personal-computer-filespec

However, several optional fields help you tailor the file transfer to your special needs. Figure 5-2 outlines the complete PCXFER command, including options.

```
PCXFER cms-file-id
   TO | FROM
   personal computer-filespec [(
   [NEWfile | REPlace]
   [EDIT | BAS | VAR | LIST | UNFM]
   [TRAN[(fn[ft[fm]])] | NOTRAN]
   [LRecl nnnnn]
   [RECFM F | V]
   [UNNum] [)]]
```

Figure 5-2. CMS PCXFER Command Syntax

Required Fields

cms-file-id

You type in the CMS filename and filetype. The filemode is optional and defaults to A1 if you omit it.

TO | FROM

TO copies your CMS file to your personal computer target file. FROM copies a CMS target file from your personal computer file.

personal computer filespec

You supply a valid IBM Personal Computer DOS file specification (for example, A:[path\] TEST.FIL or LPT1). You can use the PATH parameter as a valid part of the filespec. (Refer to the *IBM Personal Computer DOS* manual.)

Optional Fields

(

A left parenthesis is required if you are specifying any of the following optional fields.

NEW | REP

You use REPlace to replace an existing copy of the file with the copy of the file being transferred. Since NEWfile is the default value for creating the first copy, file transfer halts if the target file already exists.

UNNum

UNNum removes sequence numbers from a CMS file when it is transferred to a personal computer file. Otherwise, sequence numbers are not removed. UNNum applies only for files transferred from CMS to the personal computer.

The sequence numbers are removed from the last 8 characters of each record if the CMS file has a fixed (F) RECFM. The sequence numbers are removed from the first 8 characters of each record if the CMS file has a variable (V) RECFM.

Note: The remainder of the optional fields default to values determined by the CMS filetype. These default values are found in the PROFILE PCXFER file. You choose one of the options below only to override the values determined by PROFILE PCXFER. The PROFILE PCXFER syntax is described under "Syntax for PROFILE PCXFER and PCXFER.PROFILE". Use that section to change any defaults in PROFILE PCXFER.

EDIT | BAS | VAR | LIST | UNFM

EDIT, BAS, VAR, LIST, and UNFM are personal computer file formats. See the heading "A Guide to Choosing the Personal Computer File Formats," at the end of this chapter, and Appendix F to choose one of these options.

TRAN | NOTRAN

TRAN translates each character from the source file to the target file (from personal computer ASCII to host EBCDIC, or vice versa). See Appendix F for these translation tables. NOTRAN opts for no translation.

You can use the (fn ft fm) option of TRAN to change the way PCXFER translates a file. (fn ft fm) identifies a file that uses modifications to the translation table. Refer to the translation tables in Appendix F for a description of what should be in this file identified by (fn ft fm). If fn, ft, and fm are not specified, the default translation tables found in Appendix F are used. If ft is not specified, the default is TRAN.

LRecl nnnnn

LRecl specifies the logical record length of the CMS file. LRecl applies only for file transfer from the personal computer to CMS.

RECFM F | V

RECFM specifies the record format of the CMS file. The format contains fixed (F) or variable (V) length records. RECFM applies only for file transfer from the personal computer to CMS.

An Example

Figure 5-3 shows an example of how the PCXFER command works. You can try out a similar example on your system.

EXAMPLE

Suppose you type in:
pcxfer memo1 script to memo1.scr (rep

The result:

1. PCXFER transfers the CMS file "memo1 script" to the IBM Personal Computer.

2. If "memo1.scr" already exists on the diskette or fixed disk, PCXFER will replace "memo1.scr" with "memo1 script" from CMS.

3. If "memo1.scr" does not exist on the diskette or fixed disk, PCXFER creates a new file "memo1.scr" from the CMS file "memo1 script".

Figure 5-3. An Example of File Transfer for CMS

PCXFER Command Options for TSO

The TSO PCXFER command transfers data sets from the personal computer to TSO or from TSO to the personal computer. Each time you enter the TSO PCXFER command, you must supply the required fields:

- DSName(tso-data-set-name)

- TO | FROM

- FILEspec(personal-computer-filespec)

Several optional fields, however, help you tailor the file transfer to your special needs. Figure 5-4 outlines the complete PCXFER command, including options.

```
PCXFER DSName(tso-data-set-name)
   TO | FROM
   FILEspec(personal-computer-filespec)
   [NEW | MOD]
   [EDIT | BAS | VAR | LIST | UNFM]
   [TRAN | NOTRAN | TRANS(dsname)]
   [RECFM(F | FB | FA | FM | FBA | FBM | V | VB | VA
       | VBA | VBM | U)]
   [VOLume(tso-volume-identifier)]
   [PASSword(tso-data-set-password)]
   [LRECL(nnnnn)]
   [BLKSIZE(nnnnn)]
   [SPACE(nn)]
   [SPACE2(nn)]
   [TRACKS | CYLinder]
   [DIR(nn)]
   [UNNum]
```

Figure 5-4. TSO PCXFER Command Syntax

Required Fields

DSName(tso-data-set-name)

You must supply a valid TSO data set name. Refer to the *IBM System/370 and 4300 Processors Bibliography*, GC20-0111, for more information.

TO | FROM

TO copies your TSO data set to your personal computer data set. FROM copies a TSO data set from your personal computer data set.

FILEspec(personal-computer-filespec)

You supply a valid IBM Personal Computer DOS file specification (for example, A:[path\] TEST.FIL or LPT1). You can use the PATH parameter as a valid part of the filespec. (Refer to the *IBM Personal Computer DOS* manual.)

Optional Fields

NEW | MOD

You use MOD to replace an existing copy of the data set with the copy of the data set being transferred. Since NEW is the default value for creating the first copy, file transfer halts if the target data set already exists.

UNNum

UNNum removes sequence numbers from a TSO data set when it is transferred to a personal computer data set. Otherwise, sequence numbers are not removed. UNNum applies only for data sets transferred from TSO to the personal computer.

The sequence numbers are removed from the last 8 characters of each record if the TSO data set has a fixed (F) RECFM. The sequence numbers are removed from the first 8 characters of each record if the TSO data set has a variable (V) RECFM.

VOLUME, SPACE, SPACE2, TRACKS, CYLINDERS, DIR

You use these options to create a new data set on TSO. These options are the same as the options on the TSO ALLOCATE and ATTRIB commands. However, SPACE specifies the primary allocation amount, and SPACE2 specifies the secondary allocation amount.

Note: The remainder of the optional fields default to values determined by the TSO descriptive qualifier. These default values are found in the PCXFER.PROFILE data set. You choose one of the options below only to override the values determined by PCXFER.PROFILE. The PCXFER.PROFILE syntax is described under "Syntax for PROFILE PCXFER and PCXFER.PROFILE". Use that section to change any defaults in PCXFER.PROFILE.

EDIT | BAS | VAR | LIST | UNFM

EDIT, BAS, VAR, LIST, and UNFM are personal computer file formats. See the heading "A Guide to Choosing the Personal Computer File Formats," at the end of this chapter, and Appendix F to choose one of these options.

TRAN | NOTRAN | TRAN(dsname)

TRAN translates each character from the source data set to the target data set (from personal computer ASCII to host EBCDIC, or vice versa). See Appendix F for these translation tables. NOTRAN opts for no translation.

You can use the (dsname) option of TRAN to change the way PCXFER translates a data set. (dsname) identifies a data set that contains modifications to the translation table. Refer to the translation tables in Appendix F for a description of what should be in this data set identified by (dsname). If (dsname) is not specified, the default translation tables found in Appendix F are used.

PASSword(tso-data-set-password)

PASSWORD is used to specify TSO read or write passwords. If not specified, TSO prompts you for these passwords. File transfer will not protect the replaced data set with a password if the password was not specified.

RECFM, LRECL, BLKSIZE

You use these options to create a new data set on TSO.

Syntax for PROFILE PCXFER and PCXFER.PROFILE

Your host uses the PROFILE entry to find out what default options apply to the files or data sets you transfer if you do not specify the options in CMS or TSO. PROFILE PCXFER lists the filetype or descriptive qualifier and the corresponding logical record length (LRecl), record format (RECFM), translation option (TRAN or NOTRAN), and personal computer file format (EDIT, BAS, VAR, LIST, UNFM). PCXFER will choose default options unless you override it by putting the options you desire in the PCXFER command.

You will want to make sure that the default options specified in PROFILE PCXFER are the ones you need and want for file transfer. (This discussion also applies to PCXFER.PROFILE for TSO.) You can do this in three ways:

1. You should make sure that the filetypes or descriptive qualifiers listed in PROFILE PCXFER match the ones you conventionally use on your host.

    For example, in CMS, PROFILE PCXFER might contain the filetype ASSEMBLE to indicate an assembly language file. Your system might use the filetype ASM or SYSIN to indicate an assembly language file. Unless you change (using your host editor) the ASSEMBLE to ASM or SYSIN, PCXFER will transfer an ASM or SYSIN file under the options corresponding to '*'. '*' is used for any filetypes not listed in PROFILE PCXFER.

2. Besides changing filetypes to your host conventional file-types, you can add new filetypes or ones unique to your host to PROFILE PCXFER. Again, you simply change PROFILE PCXFER with your host editor.

3. You can also change the options corresponding to the file-types in PROFILE PCXFER.

For instance, if you always want the TRAN option with a SCRIPT file, you should make sure PROFILE PCXFER lists TRAN as the default option. Otherwise, you will need to type in the TRAN option every time you enter the PCXFER command.

Suppose your host printer will not be available for some time, because of repair, and you have many short memos in SCRIPT to print. You might choose to change the personal computer file format default for SCRIPT filetypes from EDIT to LIST. If you process the file with script in your host, you can transfer the file to the IBM Personal Computer. Then, the personal computer printer will print out the actual memo (LIST format) and not the memo without the printer carriage control characters (EDIT format).

To look at or change PROFILE PCXFER in CMS, locate PROFILE PCXFER A1 in your host editor.

CMS PROFILE PCXFER Syntax

Figure 5-5 outlines the fomat for entries in PROFILE PCXFER.

```
cms-filetype | *
RECFM F | RECFM V
LRECL N fn[ft[fm]]
TRAN | NOTRAN
EDIT ¡ UNFM | VAR | BAS | LIST
```

Figure 5-5. CMS PROFILE PCXFER Syntax

Field Definitions

- **cms-filetype**

  You supply a user-specified filetype.

- *****

  Use * for filetypes that do not match a statement in your profile. The * specifies that this profile statement *applies to any file being copied to or from CMS with a filetype for which there is no profile statement.* Suppose, for example, you transferred a personal computer file to CMS that has a filetype of TREE. If your profile did not have a statement with a filetype of TREE, the following statement in the IBM-supplied profile would apply to the CMS file: * recfm v lrecl 65535 notran unfm.

- **RECFM**

  The record format, or RECFM, can use fixed-length records (F) or variable-length records (V).

- **LRECL n**

  LRECL specifies the logical record length. The number of characters in each record, n, can be a maximum value of 65535.

- **TRAN**

  TRAN translates characters between ASCII and EBCDIC as the file is copied. (The Personal Computer uses ASCII code to represent characters; the host uses EBCDIC to represent characters.) You use TRAN when you copy a file that you will need to read, edit, or list on the screen or to print on the printer.

  Tables F-8 and F-9 (in Appendix F) respectively show the translation values from ASCII to EBCDIC and from EBCDIC to ASCII.

You can use the (fn ft fm) option of TRAN to change the way PCXFER translates a file. (fn ft fm) identifies a file that uses modifications to the translation table. Refer to the translation tables in Appendix F for a description of what should be in this file identified by (fn ft fm). If fn, ft, and fm are not specified, the default translation tables found in Appendix F are used. If ft is not specified, the default is TRAN.

- **NOTRAN**

  NOTRAN does not translate characters between ASCII and EBCDIC as the file is copied. Use NOTRAN for files you do not need to display, such as files containing executable code or binary data.

Personal Computer File Format Descriptions

- **EDIT**

  The Personal Computer file transferred is in EDIT format. If you transfer a file from the Personal Computer, make sure that the Personal Computer file you transfer is in EDIT format. If you transfer a file to the Personal Computer, the file created at the Personal Computer will be in EDIT format. Refer to "A Guide to Choosing Personal Computer File Formats," at the end of this chapter, for more information.

- **UNFM**

  Files are sent as is. The Personal Computer file being transferred is in UNFM format. Refer to "A Guide to Choosing Personal Computer File Formats," at the end of this chapter, for more information.

- **VAR**

  The Personal Computer file being transferred is in VAR format. If you transfer a file from the Personal Computer, make sure that the Personal Computer file you transfer is in VAR format. If you transfer a file to the Personal Computer, the file created at the Personal Computer is in VAR format. Refer to "A Guide to Choosing Personal Computer File Formats," at the end of this chapter, for more information.

- **BAS**

  The format of a BAS file is determined by the first byte of the file.

  If the first byte of the file is X'FF' or X'FE', the Personal Computer file is in UNFM format. These are the values that BASIC uses to identify internal format and protected format BAS files on the Personal Computer.

  If the first byte of the file is not X'FF' or X'FE', the Personal Computer file is in EDIT format. You can generate EDIT file formats from BASIC by saving your BASIC program with the ASCII option.

- **LIST**

  The file is a listing file with printer control information in it. If you transfer a file from the Personal Computer, PCXFER reformats the file for the host printer. If you transfer a file to the Personal Computer, PCXFER reformats the file for the IBM Personal Computer Printer. Refer to "A Guide to Choosing Personal Computer File Formats," at the end of this chapter, for more information.

TSO PCXFER.PROFILE Syntax

Figure 5-6 outlines the format for entries in PCXFER. PROFILE.

```
tso-descriptive-qualifier | *
DSORG PS | PO
RECFM (F | FB | FA | FM | FBA | FBM | V | VB | VA | VM
    | VBA | VBM | U)
LRECL n
BLKSIZE n
TRAN | NOTRAN | TRANS(dsname)
EDIT | UNFM | VAR | BAS | LIST
```

Figure 5-6. TSO PCXFER.PROFILE Syntax

Field Definitions

- **tso-descriptive-qualifier**

  The tso descriptive qualifier is the last qualifier of a user-specified TSO data set name. For example, in the TSO data-set name ONE.TWO.THREE, THREE is the descriptive qualifier. You supply your own descriptive qualifier.

- *****

  Use * for data set types that do not match a statement in your profile. * specifies that this profile statement *applies to any data set being copied to or from TSO with a data set name for which there is no profile statement.*

- **DSORG**

  The data set organization, DSORG, can be partitioned organization (PO) or physical sequential organization (PS).

- **RECFM**

  RECFM represents the record format and the characteristics of the data set.

  − **A**

    The data set records contain American National Standards Institute (ANSI) control characters.

  − **B**

    The data set contains blocked records.

  − **F**

    The data set contains fixed-length records.

  − **M**

    The records in the data set contain machine code control characters.

- **U**

  The data set contains undefined-length records.

- **V**

  The data set contains variable-length records.

- **LRECL n**

  LRECL n specifies logical record length. The number of characters in each record, n, can be a maximum value of 32756.

- **BLKSIZE n**

  BLKSIZE n specifies block size, where n is the length in bytes of a data block. The maximum block size is 32760.

- **TRAN**

  TRAN translates characters between ASCII and EBCDIC as the data set is copied. (The personal computer uses ASCII code to represent characters; the host uses EBCDIC to represent characters.) You use TRAN when you copy a data set that you will need to read, edit, or list on the screen or to print on the printer.

  Tables F-8 and F-9 (in Appendix F) respectively show the translation values from ASCII to EBCDIC and from EBCDIC to ASCII.

- **TRANS(dsname)**

  You can use the (dsname) option of TRANS to change the way PCXFER translates a data set. (dsname) identifies a data set that contains modifications to the translation table. Refer to the translation tables in Appendix F for a description of what should be in this data set identified by (dsname). If (dsname) is not specified, the default translation tables found in Appendix F are used.

- **NOTRAN**

  NOTRAN does not translate characters between ASCII and
  EBCDIC as the data set is copied. Use NOTRAN for data sets
  you do not need to read, such as data sets containing executable
  code or real numbers.

Personal Computer File Format Descriptions

- **EDIT**

  The Personal Computer file transferred is in EDIT format. If you
  transfer a file from the Personal Computer, make sure that the
  Personal Computer file you transfer is in EDIT format. If you
  transfer a file to the Personal Computer, the file created at the
  Personal Computer will be in EDIT format. Refer to "A Guide
  to Choosing Personal Computer File Formats," at the end of this
  chapter, for more information.

- **UNFM**

  Files are sent as is. The Personal Computer file being transferred
  is in UNFM format. Refer to "A Guide to Choosing Personal
  Computer File Formats," at the end of this chapter, for more
  information.

- **VAR**

  The Personal Computer file being transferred is in VAR format.
  If you transfer a file from the Personal Computer, make sure that
  the Personal Computer file you transfer is in VAR format. If you
  transfer a file to the Personal Computer, the file created at the
  Personal Computer is in VAR format. Refer to "A Guide to
  Choosing Personal Computer File Formats," at the end of this
  chapter, for more information.

- **BAS**

  The format of a BAS file is determined by the first byte of the
  file.

If the first byte of the file is X'FF' or X'FE', the Personal Computer file is in UNFM format. These are the values that BASIC uses to identify internal format and protected format BAS files on the Personal Computer.

If the first byte of the file is not X'FF' or X'FE', the Personal Computer file is in EDIT format. You can generate EDIT file formats from BASIC by saving your BASIC program with the ASCII option.

- **LIST**

  The file is a listing file with printer control information in it. If you transfer a file from the Personal Computer, PCXFER reformats the file for the host printer. If you transfer a file to the Personal Computer, PCXFER reformats the file for the IBM Personal Computer Printer. Refer to "A Guide to Choosing Personal Computer File Formats," at the end of this chapter, for more information.

A Guide to Choosing Personal Computer File Formats

You can choose from five Personal Computer file formats when you enter your PCXFER command in CMS or TSO. (See Table 5-6.) If you don't choose a format, the file transfer program defaults to a value provided by the PROFILE PCXFER file or PROFILE.PCXFER data set.

Your choice of a Personal Computer file format depends on your task.

Table 5-6. A Guide to Personal Computer File Formats

Format	Applications	Use and Examples
EDIT	Edlin or Visicalc	Use EDIT format if you want to edit, display, or list in both the personal computer and host computer modes. Examples: 1. Program Source Files (ASSEMBLER, PASCAL, PL/1) 2. Editable Data Files (Visicalc DIF format files)
BAS	BASIC Editor or BASICA Editor	If you save the file with the ASCII option, the file transfers in EDIT format. You can edit the file on CMS or TSO. If you save the file without an option or with the Protected option, the file transfers in UNFM format. The file is not usable on CMS or TSO.
VAR	CMS file or TSO file transferred as VAR format file	Use VAR format for any noneditable CMS or TSO file with variable-length or undefined records. VAR keeps the record format, so the transferred file is an exact copy of the original. Examples: CMS or TSO load modules.

Table 5-6. A Guide to Personal Computer File Formats (continued)

Format	Applications	Use and Examples
LIST	Output listing of: Assembler PASCAL Compiler BASIC Compiler COBOL Compiler FORTRAN Compiler	Use LIST format for files with printer control characters. The file transfer program converts ASCII printer control characters to System/370 printer machine control characters, and vice versa. A personal computer listing file sent to TSO should have RECFM M to indicate machine-readable control characters.
UNFM	Visicalc, BASIC program, PASCAL program	Use UNFM format for files that do not fit in any of the above categories. Examples: Visicalc output (such as TEST.VC)

Chapter 6. Problem Determination

IBM Service Information for the IBM 3270 Personal Computer Attachment Option

To obtain IBM service during the warranty period and after the expiration of warranty, use the Problem Determination Procedures provided in this chapter to determine which machine type is defective.

- If the problem is in the 3278 or 3279 display, or in the 3278/3279 keyboard, call your normal service number.

- If the problem is in the IBM Personal Computer, the IBM Personal Computer 3270 Attachment Option, or any other IBM Personal Computer option (for example, 5152 Printer), call the National Support Center as follows:

  If you are within the continental United States or Puerto Rico, call toll-free **1 (800) 428-2569**. In Hawaii, Alaska, and Guam, call collect **(312) 986-7451**.

Introduction to Problem Determination

This chapter contains problem determination procedures to help you isolate and resolve operational and system failures. These problem determination procedures direct you to:

- Perform certain checks

- Make a series of observations

- Respond as indicated by the No-Yes results of those observations.

By following the directions in the problem determination procedures, you can determine whether service is needed or what action to take to make your system operational again.

The general procedure is as follows:

1. Use the Symptom Index (Table 6-1) to locate the problem type or symptom that most accurately describes your problem.

2. Follow the action recommended for your symptom. Always start a procedure with all cables connected and the rear Test switch set to Normal.

3. If you complete the recommended action without isolating the problem, use the Symptom Index to locate another problem type or symptom that also describes your problem.

4. If you cannot find an appropriate entry in the Symptom Index, start at Problem Determination Procedure 1, Undetermined Failures.

5. Whichever path you are directed to take in a problem determination procedure, follow it until the procedure indicates the defective unit or tells you to return to user operation.

6. Users with hardware service experience should refer to Appendix H for advanced diagnostic information.

When directed by a problem determination procedure to return the system unit for repair, include:

•   The distribution box

•   All cables that connect the system unit to the display

•   The system unit power cord

•   All IBM cards within that unit. *DO NOT* include non-IBM cards and cables.

Remember, whenever you return the system unit for repair, you can hook up the keyboard cable to the display and operate in host computer mode until the repaired system unit is returned.

Note: Refer to Appendix J for information on how to repack components for shipping or relocation.

Diagnostic Aids

In order to run the IBM Personal Computer 3270 Adapter Diagnostics "3270DIAG", 3270DIAG.EXE must be co-resident with 3270ATT.EXE (See step 3 under "Customizing Your System Disk" in Chapter 3.)

When you are directed to run the IBM Personal Computer Diagnostics (from the *IBM Personal Computer Guide to Operations*) or the Advanced Diagnostics (from the *IBM Personal Computer Hardware Maintenance and Service* manual), the diagnostics must be at Version 1.02 or later. The version number is on the IBM Personal Computer Diagnostics diskette label.

Running the IBM Personal Computer Diagnostics and Advanced Diagnostics

When directed to perform the IBM Personal Computer Diagnositcs, do the following:

1. Set the system unit On/Off switch to Off.

2. Ready your system disk. (This phrase means you insert your system diskette in drive A.)

3. Set the system unit On/Off switch to On. Wait for initialization to be completed.

4. Remove the system diskette from drive A of the system unit.

5. Insert the IBM Personal Computer Diagnostics diskette into drive A of the system unit.

6. If drive A is not the default drive, they type A:.

7. Type COMMAND then press ENTER.

8. The IBM Personal Computer Diagnostics will load and execute. Follow the IBM Personal Computer operating Procedures given in Section 4, "Problem Determination," of the *IBM Personal Computer Guide to Operations*.

Notes:

- Since the IBM Personal Computer keyboard is not attached to the system unit, the keyboard section of the IBM Personal Computer Diagnostics *WILL NOT* run successfully. On some personal computer models, the diagnostics will enter the keyboard test. The keyboard test pattern appears on the display. If you enter the keyboard test, exit it by holding down the "n" key and pressing the Enter key several times. **Do not attempt to perform the keyboard tests.**

- The IBM Personal Computer 3270 Adapter does not appear in the list of installed devices displayed by the IBM Personal Computer diagnostic programs. If the list is otherwise correct, respond Y (Yes) to the question "IS THE LIST CORRECT (Y/N)?"

System Unit Problems

When the system unit is called out in the problem determination procedures as the failing element, it may be helpful to do the problem determination again with all the nonessential adapter and memory cards removed.

Intermittent IBM Personal Computer 3270 Attachment Option Problems

Run the IBM Personal Computer 3270 Attachment Option Diagnostics (3270DIAG.EXE) in single-pass mode for normal problem determination. Multipass mode should be used only to determine intermittent IBM Personal Computer 3270 Adapter problems. Problem Determination Procedure 6 includes instructions for loading and running 3270DIAG.EXE.

Screen Capture and Data Transfer Checkout

Run the Data Transfer Wrap Test, Option 2, of the IBM Personal Computer 3270 Attachment Option Diagnostics (3270DIAG.EXE) for a quick verification of the 3274-to-personal-computer connection. Problem Determination Procedure 6 includes instructions for loading and running 3270DIAG.EXE.

Symptom Index

Use the Symptom Index (Table 6-1) to locate the problem or symptom that most accurately describes your situation. Next, follow directly across the chart to the problem determination procedure number to be used to resolve the problem. Locate the procedure in the following pages and perform the actions specified. If you cannot find an applicable problem type or symptom for your situation, start at Problem Determination Procedure 1 (Undetermined Failures).

Table 6-1.   Symptom Index Chart

Symptom	Action
After power-on of system unit: 1. Incorrect or no audio response (anything other than a single short beep from the system unit) or 2. Any error message on the screen other than a temporary 301 code or a 19xx code (see below for 19xx errors) or 3. Wrong or random characters, or no cursor on screen.	Start at Procedure 2, ENTRY POINT 200.

Table 6-1. Symptom Index Chart (continued)

Symptom	Action
3278 display problems: 1. Display station inoperable or 2. Screen blank, distorted, or unreadable in host computer or personal computer mode	Start at Procedure 3, ENTRY POINT 300.

3279 display problems:
 	
1. Screen blank, distorted, unstable, or unreadable in host computer or personal computer mode
 	
    or
 	
2. Wrong or random characters (without using the keyboard)
 	
    or
 	
3. Wrong colors
	Start at Procedure 9, ENTRY POINT 900.

Keyboard problems: Keyboard dead, characters on screen not as expected, or other key functions fail in either host computer or personal computer mode.	Start at Procedure 4, ENTRY POINT 400.

Table 6-1. Symptom Index Chart (continued)

Symptom	Action
19xx errors A 19xx error code displayed during the IBM 3270 Personal Computer Attachment initialization (xx = number listed in Table 6-2).	Start at Procedure 5, ENTRY POINT 500.
Data transfer failures: Errors observed during screen capture or file transfer operations.	Start at Procedure 6, ENTRY POINT 600.
Mode switch failure: 1. Display does not change from host computer to personal computer mode when the system unit is switched on. or 2. Display does not go to host computer mode when the system unit is switched off. or 3. Display fails to switch between modes when ALT and PA1 (on text keyboards) or ALT and Insert (on all other keyboards) are pressed. or 4. Display switches from one mode to the other when it should not.	Start at Procedure 7, ENTRY POINT 700.

Table 6-1. Symptom Index Chart (continued)

Symptom	Action
Error codes in the operator information area: Error information in the operator information area in host computer mode.	Start at Procedure 8, ENTRY POINT 800.
Printer problems: Printer failure (printer attached to the system unit).	See the *IBM Personal Computer Guide to Operations* manual.
Undetermined failures: Symptoms not listed above.	Start at Procedure 1, ENTRY POINT 100.

Problem Determination Procedure 1: Undetermined Failures

Problem determination is based on the assumption that some units of the system are known to be operational, or have proved to be operational from previous problem resolution, in order to test the suspected defective unit. For example, to perform Problem Determination Procedure 4: Keyboard Problems, the display device must be working properly if the keyboard test pattern is to be displayed and checked with a known good pattern.

If you have a failure, but cannot determine the exact nature of the failure, sequentially perform Problem Determination Procedures 2 through 7 for a 3278, or sequentially perform procedures 2, 9, and 4 through 7 for a 3279, until the failing element has been identified.

If you complete procedures 2 through 7 without finding any problems, run the IBM Personal Computer Diagnostics. See the instructions under the heading "Running the IBM Personal Computer Diagnostics and Advanced Diagnostics."

Doing problem determination in this manner will ensure that you will not receive false error indications.

If your control unit supports the data transfer function, it may be helpful to run the Data Transfer Wrap Test, Option 2, of the IBM Personal Computer 3270 Attachment Option Diagnostics (3270DIAG) for a quick verification of the 3274-Control-Unit-to-personal-computer connection. (See "Screen Capture and Data Transfer Checkout," in this chapter.)

Problem Determination Procedure 2: Power-On Self-Test (POST)

ENTRY POINT 200

1. Set the system unit On/Off switch to Off.

2. Wait 5 seconds.

3. Remove any diskette in drive A.

4. When you switch on the system unit, the Power-On Self-Test is run. This usually takes from 5 to 90 seconds, depending on the amount of memory installed in your system. Several responses occur during this test.

   Notes:

   a. On some models of the 3279 color display, the screen may have an unstable image and multiple images. This condition is normal for this step.

   b. On some models of the IBM Personal Computer System Unit, a momentary 301 message appears on the screen. This condition is normal for this step.

   Note the responses:

   • A cursor appears on the screen.

   • The memory test progress messages also appear.

   • You hear one short beep.

- The IBM Personal Computer Basic message appears on the screen.

- No other error messages are displayed.

5. Set the system unit On/Off switch to On.

Have the above responses occurred?

No   Yes – Go to ENTRY POINT 210.

Go to ENTRY POINT 220.

ENTRY POINT 210

1. Set the system unit On/Off switch to Off.

2. Wait 5 seconds.

3. Ready the system disk.

4. When you switch on the system unit, the Power-On Self-Test is run and the IBM Personal Computer 3270 Attachment Option initialization takes place. This usually takes from 5 to 90 seconds, depending on the amount of memory installed in your system. Several responses occur during the test.

   Notes:

   a. On some models of the 3279 color display, the screen image may be temporarily unstable and the screen may have multiple images. This condition is normal for this step.

   b. On some models of the IBM Personal Computer System Unit, a momentary 301 message appears on the screen. This condition is normal for this step.

   Note the responses:

   - A cursor appears on the screen.

   - The memory test progress messages also appear.

- You hear one short beep.

- IBM Personal Computer 3270 Attachment Option appears on the screen. *There should be only one stable image at this time.*

- No other error messages are displayed.

5. Set the system unit On/Off switch to On.

Have the above responses occurred?

No   Yes — Power-On Self-Test (POST) did not fail. Return to the
               user operation or to the procedure that sent you here.

220

Was the POST failure indicated by the display of a *301* error message that *remained* on the screen?

No   Yes

      EXIT POINT 225
      Check that the keyboard pigtail lead and the keyboard
      adapter cable are properly connected. See Figure 6-4. If no
      trouble is found, have the system unit serviced.

230

Was the POST failure indicated as an incorrect audio response by the system unit?

No   Yes

      EXIT POINT 235
      Any response other than a single short beep indicates a system
      unit problem. Have the system unit serviced.

240

Was an error code of 19xx received? (xx = the numbers listed in Problem Determination Procedure 5.)

No   Yes — Go to Problem Determination Procedure 5,
│   ENTRY POINT 500.
▼
250

**Was the POST failure indicated by the display of any error message
other than a temporary 301 code?** (A temporary 301 error message
is one that remains on the screen for less than 90 seconds.)

No   Yes
│   │
│   ▼
│   EXIT POINT 255
│   Display of any error message other than a temporary 301 code
│   indicates the system unit is the failed element. Have the system
│   unit serviced.
▼
260

**Was the POST failure indicated by wrong or random characters on the
display screen or by the absence of a cursor?**

No   Yes — The appearance of wrong or random characters, the
│   absence of a cursor, or an unstable display indicates the
│   system unit or the display station is the failed element.
│   For a 3278, go to procedure 3, ENTRY POINT 300.
│   For a 3279, go to procedure 9, ENTRY POINT 900.
▼
EXIT POINT 265
Have the system unit serviced.

Problem Determination Procedure 3: 3278 Display Failure Problems

ENTRY POINT 300

1. Set the system unit On/Off switch to the Off position.

2. Set the display On/Off switch to the Off position (O).

3. Verify that the *Video* cable is properly connected between the *display station* and the *display/monitor adapter* (see Figure 6-1).

4. If both the *monochrome display adapter* and the *color display adapter* are installed and the IBM Monochrome Display and a 3278 or 3279 are connected, you should know that only one display will be active during POST and 3270ATT initialization.

5. Verify that the system board display switch setting is correct. Refer to the *IBM Personal Computer Guide to Operations* for the correct switch setting.

6. Set the display On/Off switch to the On position (|).

   Is the display screen a correct host computer mode display image (a data area and an operator information area separated by a line) and is the display station operable? See Figure 4-1, in Chapter 4.

No   Yes — Go to ENTRY POINT 330.

↓

310

1. Set the display On/Off switch to the Off position (O).

2. Disconnect the feature bus cable from the *distribution box* (at the system unit).

3. Set the display On/Off switch to the On position (|).

Is the display screen a correct host computer mode display image (a data area and an operator information area separated by a line) and is the display station operable? See Figure 4-1.

No   Yes

EXIT POINT 315
Have the system unit serviced.

1. Set the display On/Off switch to the Off position (O).

2. Remove the feature bus cable from the display station end.

3. Set the display On/Off switch to the On position (|).

Is the display problem still the same?

No   Yes — Verify that the host is operational, and that your display
          is properly connected to the device cable. If so, have
          your display serviced.

EXIT POINT 325
Have the system unit serviced.

ENTRY POINT 330

1. Ready the system disk.

2. Reconnect the feature bus cable if necessary. (When you power on the system unit, the display should immediately switch from host computer mode to personal computer mode.)

3. Set the system unit On/Off switch to On.

Does the *host computer mode* image remain on the screen after the system unit is powered on?

No   Yes — Go to procedure 7, ENTRY POINT 700 (mode switch
          failures).

340
Wait for the system to complete initialization.

Note: If your AUTOEXEC.BAT file switches your system to host computer mode, you must switch modes to return to personal computer mode before answering the next question.

Is the display in personal computer mode and the screen image OK?

No   Yes

345

1.   Run the IBM Personal Computer Diagnostics if you have not already done so. (See "Diagnostics Aids," early in this chapter, for the IBM Personal Computer Diagnostic operating instructions.)

RETURN HERE WHEN FINISHED.

Note: Certain color combinations from the color/graphics monitor adapter are difficult to read on the 3278 display.

Did the display tests in the IBM Personal Computer Diagnostics run OK?

No   Yes — The display is OK. Return to user operation or to the procedure that sent you here.

350

1.   Set the system unit On/Off switch to Off.

2.   Set the display On/Off switch to the Off position (O).

3.   Disconnect the video and feature bus cables at the display station end. (See Figure 6-1.)

4.   Set the display On/Off switch to the On position (|).

5.   Set the brightness and contrast controls fully clockwise (↷).
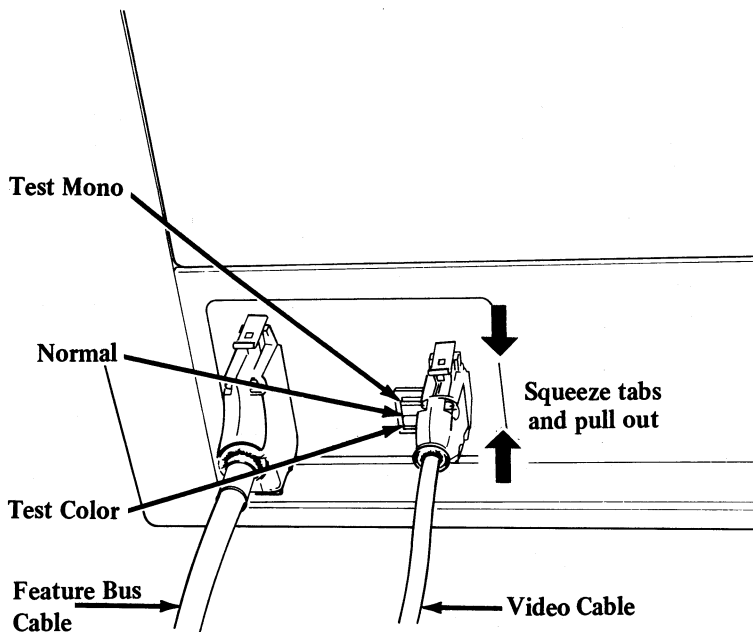
Figure 6-1. Video and Feature Bus Cables at 3278 Display

Is your display connected to a color/graphics monitor adapter in the system unit?

No   Yes — Go to ENTRY POINT 370.

360

1. At the rear of the display, set the Video Test switch to the Test Mono position. (See Figure 6-1.) The video test pattern should be like the pattern in Figure 6-2.

Procedure 3
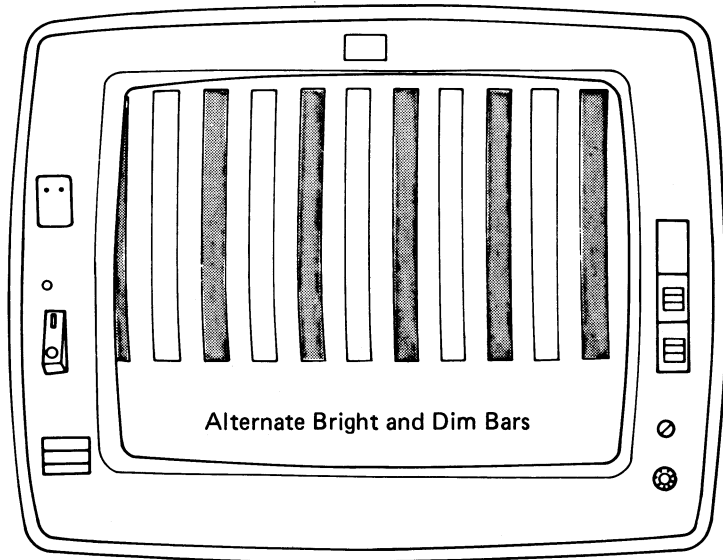
Figure 6-2. Test Mono Video Test Pattern

Is the video test pattern displayed like the pattern in Figure 6-2?

No   Yes

      EXIT POINT 365
      Have the system unit serviced.

Have the display serviced.

ENTRY POINT 370

At the rear of the display, set the Video Test switch to the Test Color
position. (See Figure 6-1.) Observe the test pattern in Figure 6-3.

6-18   Problem Determination
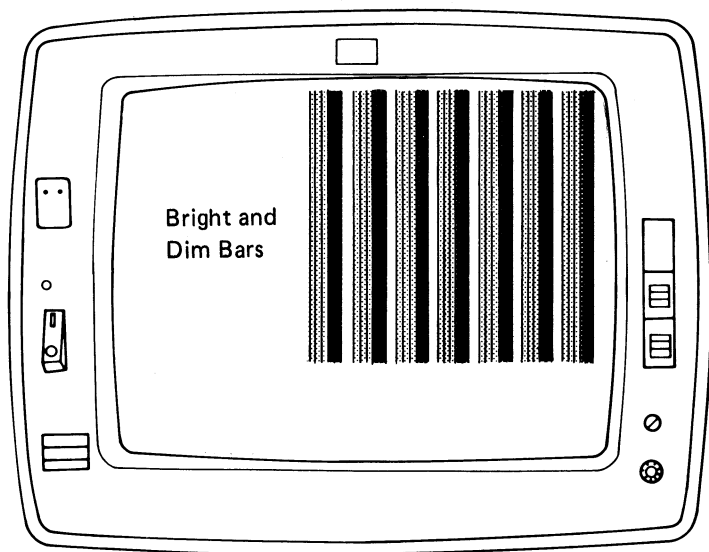
Figure 6-3. Test Color Test Pattern

Is the video test pattern displayed like the pattern in Figure 6-3?

No   Yes

        EXIT POINT 375
        Have the system unit serviced.

Have the display serviced.
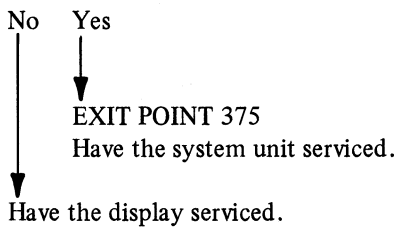
Problem Determination Procedure 4: Keyboard Problems

ENTRY POINT 400

1. Set the system unit On/Off switch to Off.

2. Set the display On/Off switch to the Off position (O).

3. Verify that the KEYBOARD ADAPTER CABLE PIGTAIL HAS NOT MISTAKENLY BEEN CONNECTED TO THE ADJACENT CASSETTE CONNECTOR at the rear of the system unit. (See Figure 6-4.)
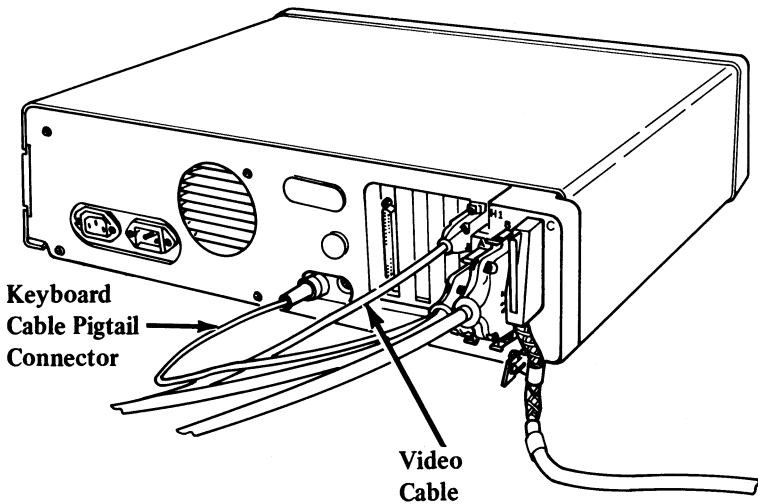
Figure 6-4. Keyboard Adapter Cable Pigtail Connection

4. Make certain that all cables connecting the system unit, the distribution box, and the display are securely connected.

5. Set the display On/Off switch to the On position (|). You are now in host computer mode.

6. Do the keyboard tests detailed in the display station *Problem Determination Guide* located in the keyboard. For a 3278, do only the keyboard tests. For a 3279, do the control unit tests also as far as selecting Test mode using ALT and TEST. *Return here when finished.*

7. If you have not already done so, return the display Normal/Test switch to Normal.

8. If your keyboard problem was in host computer mode, test the keyboard by performing the keyboard function that failed (for example, clicker, shift, alt, keystroke).

Did all the tests run successfully?

No   Yes — Go to ENTRY POINT 430.

410

1. Set the display On/Off switch to the Off position (|).

   CAUTION
   Make sure that you do *not* connect the personal computer printer cable to distribution box connector C or to the keyboard adapter cable connector. Such a connection would result in damage to your printer and to the system unit.

2. Disconnect the keyboard cable and the keyboard adapter cable from the distribution box, and connect the two cable ends together. (See Figure 6-5.)

To Keyboard

Keyboard Cable ⟶

To Display

Line up connectors
properly and push
together.

Keyboard
Adapter
Cable
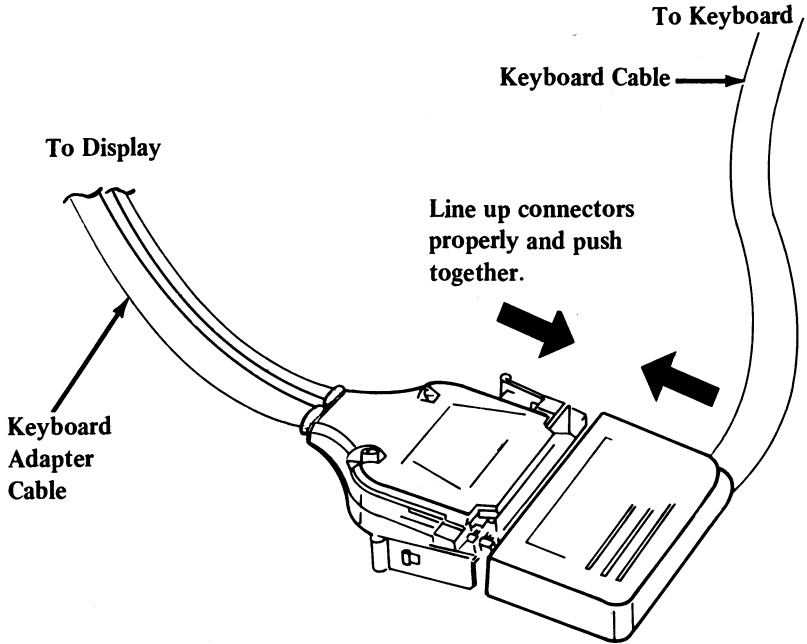
Figure 6-5. Keyboard Cable and Keyboard Adapter Cable Connection

3. Set the display On/Off switch to the On position (|).

4   Repeat the keyboard tests from the display station *Problem
    Determination Guide* located in the keyboard. For a 3278, do
    only the keyboard tests. For a 3279, do the control unit tests
    also as far as selecting Test mode using ALT and TEST. *Return
    here when finished.*

5. If you have not already done so, return the display Test/Normal
    switch to Normal.

6. If your keyboard problem was in host computer mode, test the
    keyboard by performing the keyboard function that failed
    (for example, clicker, shift, alt, keystroke).

Did the tests run successfully this time?

No   Yes

EXIT POINT 415
Have the system unit serviced.

420
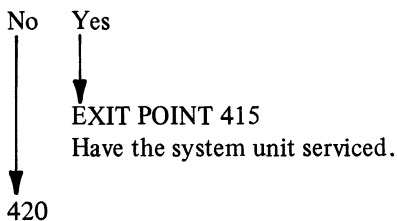
1. Set the display On/Off switch to the Off position (O).

2. Disconnect the keyboard cable from the keyboard adapter
    cable.

3. Disconnect the keyboard adapter cable from the display. (See
    Figure 6-7.)

4. Connect the *keyboard* cable to the display station. For a 3278,
    see Figure 6-6. For a 3279, see Figure 6-7.

5. Set the display On/Off switch to the On position (|).

6. Repeat the keyboard tests from the display station *Problem
    Determination Guide,* located in the keyboard. For a 3278, do
    only the keyboard tests. For a 3279, do the control unit tests
    also as far as selecting Test mode using ALT and TEST. *Return
    here when finished.*

7. If you haven't already done so, return the display Test/Normal
    switch to Normal.

8. If your keyboard problem was in host computer mode, test the
    keyboard by performing the keyboard function that failed (for
    example, clicker, shift, alt, keystroke).

Keyboard Cable Connector

Keyboard Cable Socket

Stud

Cable Clamp
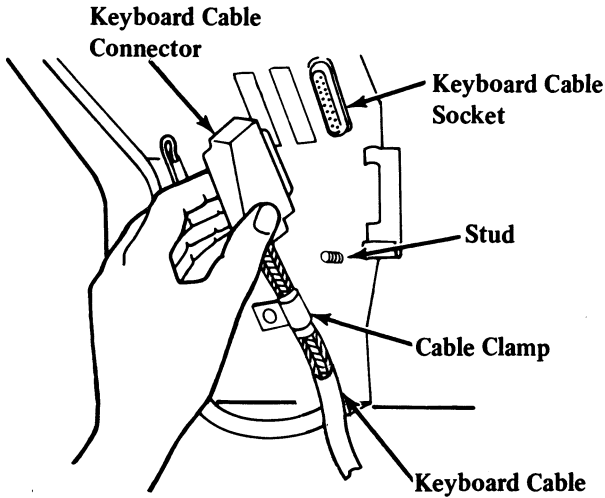
Keyboard Cable

Place the keyboard cable clamp over the stud.

Plug the keyboard cable connector into the right-hand cable socket above the letters KEYBD.

Wing Nut

Replace retainer wire bottom first
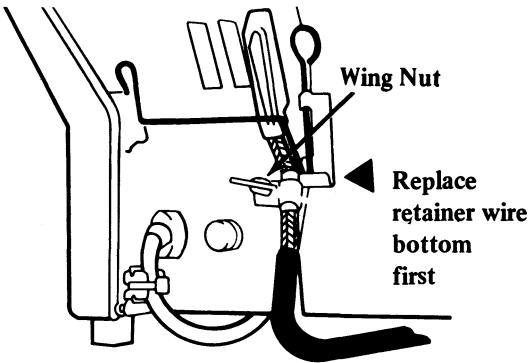
CAUTION
Make sure that the keyboard cable is fully seated.

Swing the retainer wire across the cable connector. Insert the bottom of the retainer wire in the slot, and latch it into place. The retainer wire keeps the connector tightly in place; it therefore takes some extra force to latch it into place. (Do not be afraid to apply the necessary force.)

Install and tighten the wing nut.

Figure 6-6. Connection of Keyboard Cable to 3278 Display
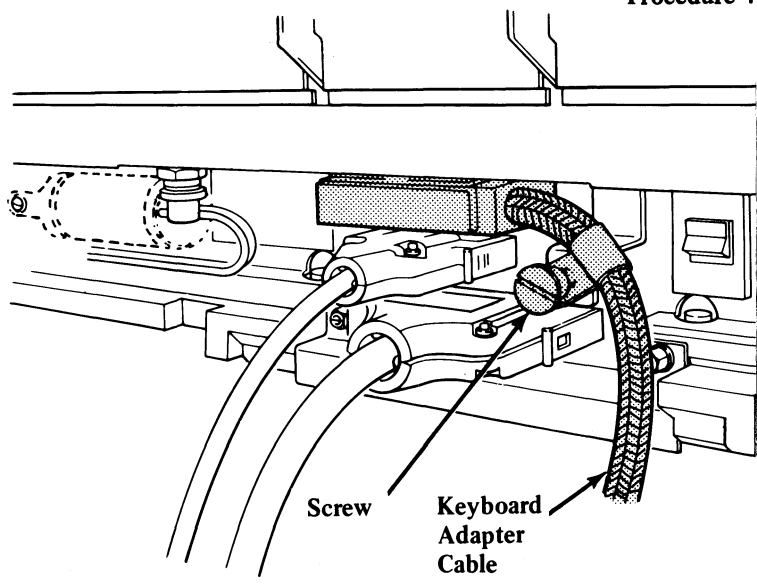
Figure 6-7. Connection of Keyboard Cable to 3279 Color Display

Procedure 4

Did the tests run successfully this time?

No   Yes

EXIT POINT 425
Have the system unit serviced.

Have the keyboard serviced.
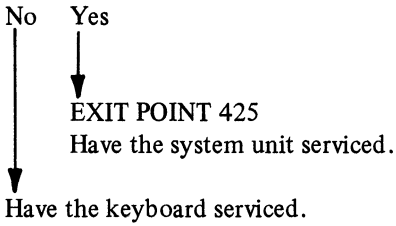
ENTRY POINT 430

1. Ready a system disk.

2. Set the system unit On/Off switch to On.

3. Wait for the system unit to complete the initialization procedure.

4. If necessary, press the mode switch keys to enter personal computer mode.

5. Type q space p (q p) (press three keys) from the keyboard.

Do the characters q and p appear on the screen separated by a space (q p) ?

No   Yes

   431

   1. Press the mode switch keys to enter host computer mode.

   2. Do the keyboard tests specified in the display station
      Problem Determination Guide, located in the keyboard.
      For a 3278, do only the keyboard tests. For a 3279, do the
      control unit tests as far as selecting Test mode using ALT
      and TEST. RETURN HERE WHEN FINISHED.

   3. If you haven't already done so, return the display
      Test/Normal switch to Normal.

   Did the keyboard tests run successfully?

   No   Yes

         You have completed all the keyboard tests and have
         found no problem. Return to user operation or to the
         procedure that sent you here.

   EXIT POINT 437
   Have the system unit serviced.

EXIT POINT 439
Have the system unit serviced.

Problem Determination Procedure 5: Error Codes and Messages

IBM 3270 Personal Computer Attachment Error Codes and Messages

ENTRY POINT 500

The error codes and messages described in this procedure can appear only during 3270ATT initialization; that is, during the *power on* sequence, or during an IBM Personal Computer system reset with a system disk in the default drive.

Table 6-2 gives the error code message you will see on the personal computer mode display screen. Do the action recommended for each error code message. If you do not get one of these messages during the *power on* sequence or during an IBM Personal Computer system reset, exit this procedure and return to user operation or to the procedure that sent you here.

Note: On some 3279 displays, the error code image might appear unstable or more than once on the screen.

Table 6-2. 19xx Error Codes

Error Code	Message	Recommended Action
1901	IBM Personal Computer 3270 Adapter Not Operational	1. Check that the IBM Personal Computer 3270 Attachment Option is properly installed. (See Chapter 2.) Go to EXIT POINT 505. 2. If the message still appears during initialization, have the system unit serviced.

Table 6-2. 19xx Error Codes (continued)

Error Code	Message	Recommended Action

1902
 	
or
 	
1903
	3278/3279 Keyboard Not Supported — Typewriter Assumed
	
	3278/3279 Keyboard Not Supported in the Specified Language — Typewriter Assumed
		1. Check that all the keyboard cables and the distribution box are properly connected.
		
		2. If you have just:
		
		  a. Installed the IBM 3270 Personal Computer Attachment
		
		  b. Customized or recustomized
		
		  c. Replaced the keyboard
		
		  review Chapter 3, especially the keyboard customization procedure. Repeat the customization procedure if necessary.
		
		3. If none of the conditions in step 2 (above) is true, go to procedure 4, ENTRY POINT 400, and do steps 400 to, but not including, 430. *Return here when finished.*
		
		Go to EXIT POINT 515. If no problems are found and 1903 still appears, have the system unit serviced.

Table 6-2. 19xx Error Codes (continued)

Error Codes	Message	Recommended Action
1904	IBM Personal Computer 3270 Adapter Failure	Go to EXIT POINT 525. Have the system unit serviced.

Problem Determination Procedure 6: Data Transfer Problems

ENTRY POINT 600

1. Verify that the 3274 Control Unit has been customized for the IBM 3270 Personal Computer Attachment.

2. Set the display On/Off switch to the Off position (O).

3. Set the system unit On/Off switch to Off.

4. Insert a system diskette containing the diagnostic program 3270DIAG into drive A of the system unit.

5. Set the display On/Off switch to the On position (|).

6. Set the system unit On/Off switch to On, and wait for the system to complete initialization.

7. From the keyboard, type 3270DIAG. Press ENTER and wait for the main menu to appear (Figure 6-8).

```
The IBM Personal Computer 3270 Attachment Option Diagnostic Program.
Version 1.10 (C) Copyright IBM Corp. 1982, 1983.

SELECT AN OPTION

   0 - RUN 3270 Attachment Diagnostics
   1 - RUN Feature Bus Cable Diagnostics
   2 - RUN Data Transfer Wrap Test
   9 - Exit diagnostics




ENTER THE DESIRED ACTION →__
```

Figure 6-8. Main Menu

8. Press the O key to select the IBM Personal Computer 3270 Attachment Option Diagnostic. Wait for the second menu to appear (Figure 6-9).

```
The IBM Personal Computer 3270 Attachment Option Diagnostic Program.
Version 1.10 (C) Copyright IBM Corp. 1982, 1983.




SELECT AN OPTION

0 - RUN Test One Time
1 - RUN Test Multiple Times
8 - Return to Main Menu



ENTER THE DESIRED ACTION →__
```
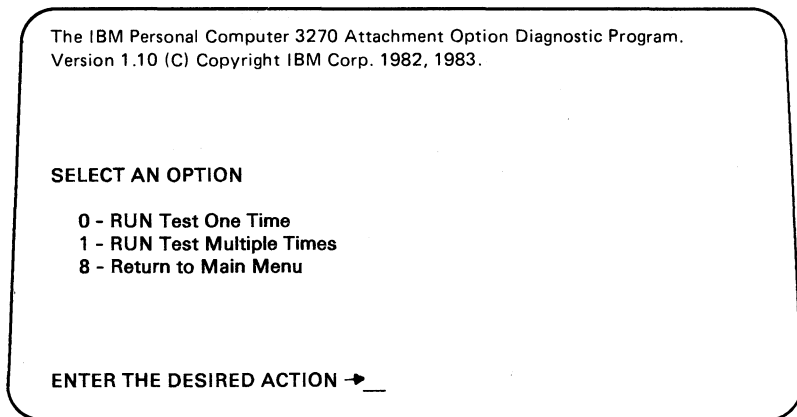
Figure 6-9. Second Menu

9. In the menu, select "RUN Test One Time" by pressing the 0 key.

10. Wait for operating instructions (Figure 6-10) to appear on the screen. Press the spacebar to get to the next screen.

Procedure 6

The IBM Personal Computer 3270 Attachment Option Diagnostic Program.
Version 1.10 (C) Copyright IBM Corp. 1982, 1983.

You Will Be Instructed Shortly to Disconnect The Feature Bus Cable
From The Distribution box, At Which Time Your Display Will Return
to Host-Computer Mode.

To Terminate the 3270 Attachment Diagnostics After They Have Started:

A. Press (9) Key.
B. Wait for Short Beep(s).
C. Reconnect Feature Bus Cable To Distribution Box.

Press SPACE BAR to Continue
Or
Press the (8) Key to Return to Main Menu.

Figure 6-10. Operating Instructions

11. Wait for feature bus cable disconnect instructions (Figure 6-11) to appear on the screen.

```
The IBM Personal Computer 3270 Attachment Option Diagnostic Program.
Version 1.10 (C) Copyright IBM Corp. 1982, 1983.



Disconnect the Feature Bus Cable From the Distribution Box.

  ┌──────────────────────────────────────────────────────────┐
  │ Note Screen Will Revert To HOST-COMPUTER MODE             │
  └──────────────────────────────────────────────────────────┘

Then Press The Space Bar to Continue Test.



      Press the (8) Key to Return to Main Menu.
```

Figure 6-11. Feature Bus Cable Disconnect Instructions

12. Disconnect the feature bus cable from the *distribution box* (at the system unit). (After the cable is disconnected, the screen will revert to the *host computer mode* image.)

13. Press the spacebar to start the IBM Personal Computer 3278 Attachment Option Diagnostic. Wait approximately 3 to 5 seconds for an audio response.

Did you hear one short beep?

No   Yes – Go to ENTRY POINT 610.

EXIT POINT 605
Have the system unit serviced.

ENTRY POINT 610
Reconnect the feature bus cable to the distribution box.

Does your display screen look like Figure 6-12?

No   Yes – Go to ENTRY POINT 620.

EXIT POINT 615
Have the system unit serviced.

Procedure 6

```
The IBM Personal Computer 3270 Attachment Option Diagnostic Program.
Version 1.10 (C) Copyright IBM Corp. 1982, 1983.

           Error Log Summary.
                              Count.
  Loop Through Diagnostics.    [    1 ]

     1950 Error.---------------▶ [    0 ]

     1951 Error.---------------▶ [    0 ]

     1952 Error ---------------▶ [    0 ]

           Diagnostics Completed.

     Press The [8] Key To Return to Main Menu. __
```

Figure 6-12. Error Log Summary

ENTRY POINT 620

1. Set the system unit On/Off switch to Off.

2. Set the display On/Off switch to the Off position (O).

3. Wait 5 seconds.

4. Set the display On/Off switch to the On position (|).

5. Set the system unit On/Off switch to On.

6. From the keyboard, type 3270DIAG and then press ENTER. Wait for the main menu to appear on the screen (Figure 6-8).

7. Do the following steps, and record your results on the error-recording chart (Table 6-3) or on a separate sheet of paper. Use the "1st Pass" column for the first time through the steps and the "2nd Pass" column for the second time through.

Table 6-3. Error-Recording Chart

1st Pass				2nd Pass		
ENTRY POINT 620	**Yes**	**No**	**Error Code Indicator**	**Yes**	**No**	**Error Code Indicator**
Step 10						
Step 11						
Step 12						
Step 13						
Step 15						
Step 17						

8. Switch the Normal/Test switch from Normal to Test and back.

9. Press the 1 key to run the Feature Bus Cable Diagnostics.

   Did you get the message

   FEATURE BUS CABLE DIAGNOSTICS COMPLETED

   within 5 seconds?

10. Record answer Yes or No.

11. Press the mode switch keys to go into host computer mode.

Did the display switch to host computer mode?
Record your answer.

No   Yes

12. Record any error indicators that appear in the operator information area.

13. Press the mode switch keys to go into personal computer mode.

Did the display switch to personal computer mode?
Record your answer.

No   Yes

14. Press the mode switch keys.

15. Enter any characters from the keyboard.

Did the characters appear on the screen?
Record your answer.

No   Yes — Go to ENTRY POINT 630.

16. Switch the Normal/Test switch from Normal to Test and back (once only).

17. Enter any characters from the keyboard.

Did the characters appear on the screen?
Record your answer.

No   Yes

ENTRY POINT 630

1. Set the system unit On/Off switch to Off.

2. Set the display On/Off switch to the Off position (O).

3. Disconnect the feature bus cable from the display and from the system unit.

4. Take the end that was connected to the display and connect it to the distribution box. Connect the other end to the display.

5. Set the display On/Off switch to the On position (|).

6. Set the system unit On/Off switch to On and wait for the system to complete initialization.

Is the display in host computer mode?

No   Yes

EXIT POINT 635
Have the system unit serviced.

640
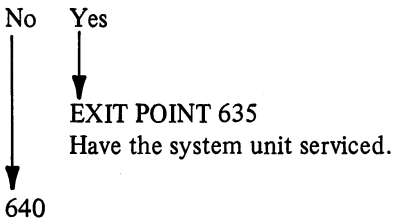
1. From the keyboard, type 3270DIAG and then press ENTER. Wait for the main menu to appear on the screen (Figure 6-8).

2. Do all steps from step 8 ENTRY POINT 620 to, but not including, ENTRY POINT 630. Once again, record your answers; this time, use the "2nd PASS" column.

3. Compare the answers recorded in the two columns.

Are there any differences?
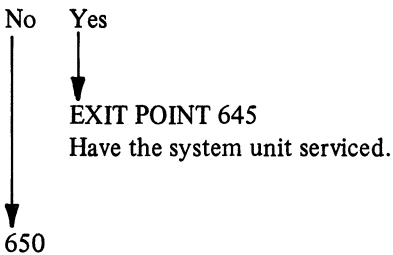
No   Yes

EXIT POINT 645
Have the system unit serviced.

650

1. Set the system unit On/Off switch to Off.

2. Wait 5 seconds.

3. Set the system unit On/Off switch to On.

4. From the keyboard, type 3270DIAG and then press ENTER. Wait for the main menu to appear on the screen (Figure 6-8).

5. Press the 2 key to run the Data Transfer Wrap Test.

Did you receive a WRAPTEST COMPLETE message?
(Do not wait longer than 5 seconds.)

No   Yes

          Were there any WRAPTEST error messages?

          No   Yes — Have the display serviced.

          The file transfer and screen capture hardware is OK.
          Return to the user operation or to the procedure that sent
          you here.

Have the display serviced.

Problem Determination Procedure 7: Mode Switch Problems

ENTRY POINT 700

If you were sent here from another procedure in which you removed cables, reconnect those cables now.

1. Set the display On/Off switch to the On position (|).

2. Set the system unit On/Off switch to Off.

Is the display in host computer mode and the screen image OK?
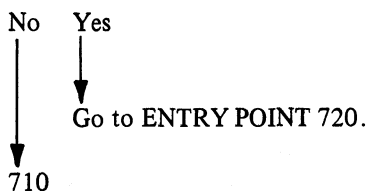
No   Yes

Go to ENTRY POINT 720.

710

1. Set the display On/Off switch to the Off position (O).

2. Disconnect the feature bus cable from the display.

3. Set the display On/Off switch to the On position (|).

Is the display in host computer mode and the screen image OK?

No   Yes

EXIT POINT 715
Have the system unit serviced.
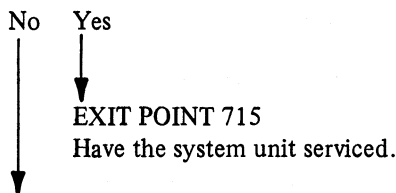
Verify that the host is operational and that your display is properly connected to the device cable. If no trouble is found, have your display serviced.

Procedure 7

ENTRY POINT 720

1. Ready a system disk. (When you power on the system unit, the display should immediately switch to personal computer mode.)

2. Set the system unit On/Off switch to On.

Does the display switch to personal computer mode immediately after the system is powered on?

No   Yes

      ↓

      722

    1. Wait for the system to complete initialization.

    2. Press the mode switch keys several times.
       Does the display change modes each time these keys are pressed?

    No   Yes — The mode switch hardware is functioning properly. Return to user operation or to the procedure that sent you here.

    Go to procedure 4, ENTRY POINT 400, and do steps 400 to, but not including, 430 to test the keyboard. While testing the keyboard, make sure that you test the mode switch keys. RETURN HERE WHEN FINISHED.

    3. If you haven't already done so, set the display Test/Normal switch to Normal.

    Was a problem found during the keyboard test?

    No   Yes — Follow the recommended action for the problem found in Problem Determination Procedure 4.

    EXIT POINT 725
    Have the system unit serviced.

730

1. Set the system unit On/Off switch to Off.

2. Set the display On/Off switch to the Off position (O).

3. Disconnect the feature bus cable from the display.

4. Disconnect the video cable from the display.

5. Set the display On/Off switch to the On position (|).

6. Put the Video Test switch to the Test Mono (3278) or Test (3279) position. See Figure 6-1 (3278) or 6-13 (3279).

Did you get the test pattern shown in Figure 6-2 (3278) or 6-15 (3279)?

No   Yes

EXIT POINT 735
Have the system unit serviced.

Have the display serviced.

Problem Determination Procedure 8: Messages in the Operator Information Area

ENTRY POINT 800

If you see ⬚ 69 in the operator information area, you might be attached to a 3276 Control Unit Display Station, which does not support data transfer.

A 2% % error code could be caused by the following:

• The 3274 Control Unit does not have Configuration Support C, Release 46 or higher, or Configuration Support D, Release 60 or higher, installed.

• The 3274 Control Unit has not been customized for the IBM Personal Computer 3270 Attachment Data Transfer control function.

• The keyboard customization procedure has not been performed correctly. (See Chapter 3.)

• The 3278 Personal Computer Attachment Option Card in the system unit has a problem.

Refer to your display station documentation for other causes of the 2% % error.

Machine checks in the range 235 – 238 are posted as a result of data transfer problems, that is, a failure during a file transfer or screen capture. The likely causes are:

• Any user action that interferes with the execution of the data transfer application program in the personal computer; for example, doing a keyboard system reset.

• Error in the data transfer application program in the personal computer.

• Hardware problems, which Problem Determination Procedure 6 should detect.

810

Is the indicator a machine check in the range 235 — 238?

No   Yes
     |
     ▼
     812

   1. Switch the Test/Normal switch from Normal to Test and back.

   2. Set the system unit On/Off switch to Off.

   3. Ready a system disk.

   4. Set the system unit On/Off switch to On.

   5. Retry the data transfer operation that was under way when the machine check occurred.

   Does a machine check of 235 — 238 recur?

   No   Yes
        |
        ▼
        Go to Problem Determination Procedure 6,
        ENTRY POINT 600, and return here if no problem is found.
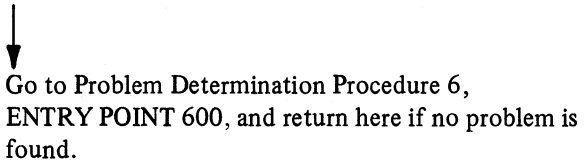
        Is the data transfer application program running in the personal computer operating correctly?

        No   Yes — Return to user operation or to the procedure
         | that sent you here.
         ▼
        Correct the application program and retry.
        EXIT POINT 820
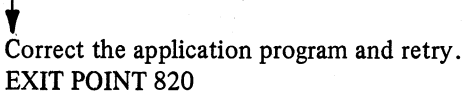
   Return to user operation or to the procedure that sent you here.

Follow the instructions in the display *Problem Determination Guide* (found in the keyboard).

Problem Determination Procedure 9: 3279 Display Failure Problems

Note: The 3279 Models 2 and 3 have slight differences. For example: the Model 2 displays may be slightly brighter than the Model 3 displays; and, in personal computer mode, the Model 2 displays have horizontal striped characters.

ENTRY POINT 900

1. Verify that the video cable is properly connected between the display station and the display/monitor adapter (see Figure 6-13).

2. Set the system unit On/Off switch to Off.

3. Set the 3279 On/Off switch to the Off position (O).

4. At the back of the 3279, in the access area, make sure that the Normal/Test switch is set to Normal. See Figure 6-13.

5. At the system unit, disconnect the feature bus and video cables. See Figure 6-14.

6. Set the 3279 On/Off switch to the On position (|).
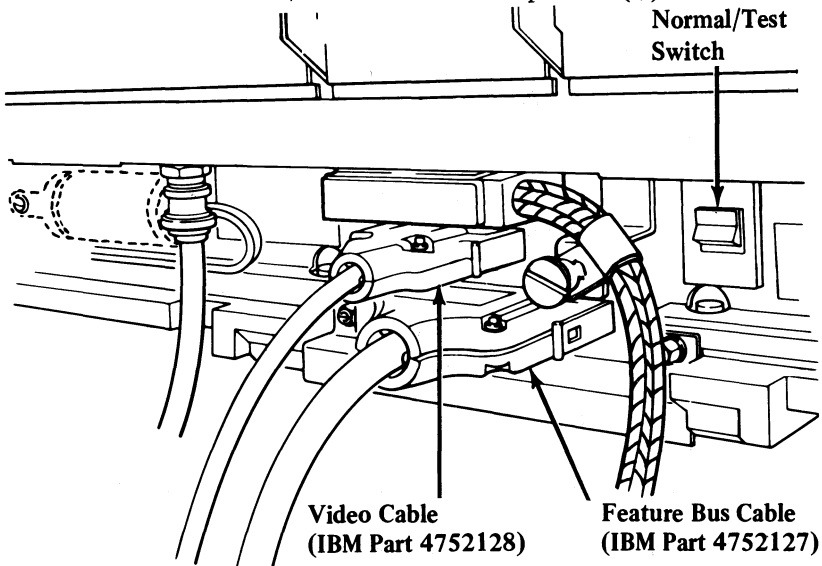
Figure 6-13. Feature Bus and Video Cables on the 3279

Video Cable
(IBM Part 4752128)
to Color/Graphics
Monitor Adapter

Feature Bus Cable
(IBM Part 4752127)
to Socket B on the
Distribution Box
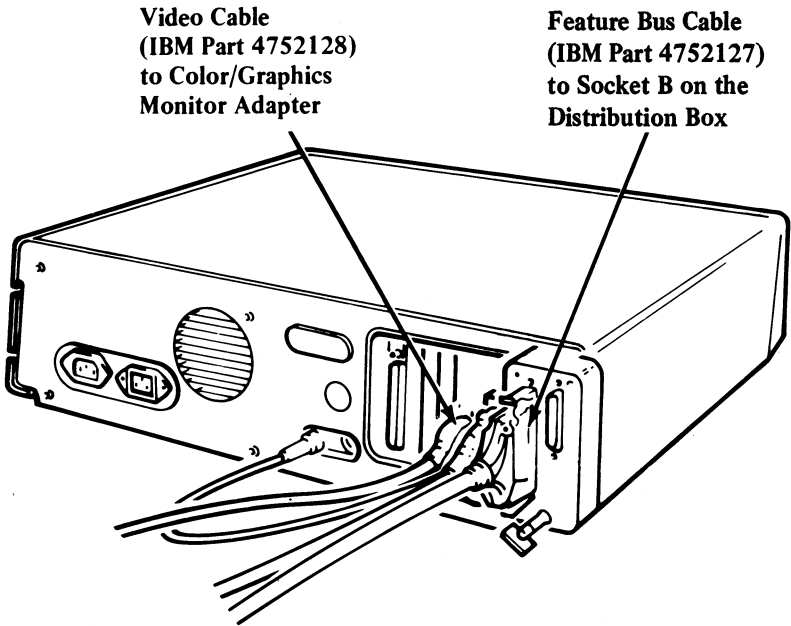
Figure 6-14. Distribution Box on the System Unit

Does the 3279 show a correct host computer mode image, and is the
display station operable? (You should have a data area above the line
and an operator information area below the line.)

Yes   No

Disconnect the feature bus and video cables from the 3279.
See Figure 6-13.

Is the problem still the same?

No   Yes — Verify that the host is operational and that your
display is properly connected to the device cable.
If no trouble is found, refer to the symptom index
in the *Problem Determination Guide* for your
3279 Color Display Station.

EXIT POINT 915
Service your system unit.

ENTRY POINT 920

Procedure 9

1. Set the 3279 On/Off switch to the Off position (O).

2. Reconnect the feature bus and video cables to the system unit.

3. Set the 3279 On/Off switch to the On position (|).

Does the 3279 show a correct host computer mode image?

Yes   No — Go to EXIT POINT 925. (Have your system unit
  | serviced.)
  ▼
ENTRY POINT 930

At the system unit:

1. · Ready a system disk.

2. Set the On/Off switch to On.

> **Note:** On some models of the 3279 color display, the screen may
> have an unstable image and multiple images. This condition is
> normal for this step.

Does the 3279 show a correct host computer mode image?

No   Yes — Go to Procedure 7, ENTRY POINT 700.
  |
  ▼
ENTRY POINT 940

Wait for the system unit to complete initialization (this may take up
to 90 seconds).

Does the 3279 show a correct personal computer mode image? (If the
displayed characters are the wrong color, answer No.)

No   Yes
 | |
 | ▼
 | ENTRY POINT 945.
 |
 | Run the IBM Personal Computer Diagnostics if you have not
 | already done so. (See "Diagnostic Aids," early in this chapter,
 | for instructions.)
 |
 | **Did the display tests in the diagnostics run OK?**
 |
 | No   Yes — The 3279 is OK. Return to the procedure that
 | | sent you to this procedure.
 ▼   ▼
ENTRY POINT 950

1. Set the system unit On/Off switch to Off.

2. Set the 3279 On/Off switch to the Off position (O).

3. Disconnect the feature bus and video cables from the 3279. See
    Figure 6-14.

4. Set the 3279 On/Off switch to the On position (|).

5. Set the brightness control fully clockwise.

6. Set the Video Test switch to Test at the back of the 3279. See
    Figure 6-13.

Check the displayed video test pattern against the pattern shown in
Figure 6-14. **Is the displayed pattern the same as shown in the figure?**

No   Yes
 | |
 | ▼
 | EXIT POINT 975
 | Service your system unit.
 ▼
Service your 3279.

The number of color bars at the left (and right) sides of the pattern may vary.

130–140 mm
(Model 2)
170–180 mm
(Model 3)

BLACK WHITE MAGENTA CYAN BLUE YELLOW RED GREEN BLACK
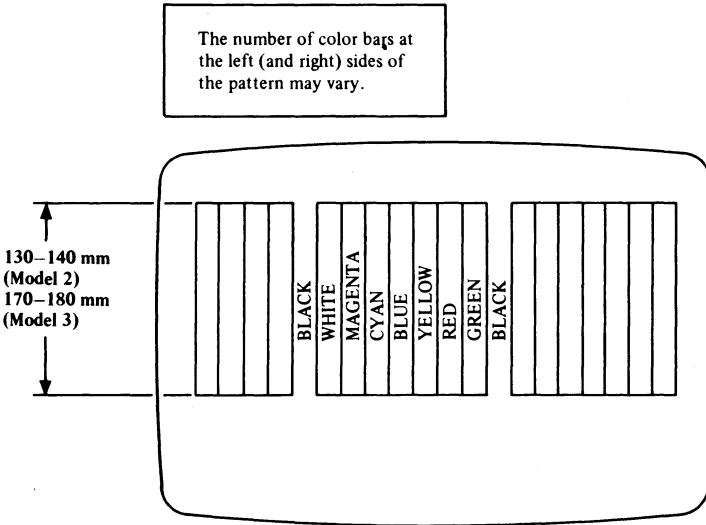
Notes:

1. The color bars should have straight edges.

2. Adjacent bars should have no overlap or blank spaces between them (except the black bars).

3. Black bars should not show any trace of color.

4. The height of the displayed bars should be:

   • IBM 3279 Model 2: between 130 and 140 mm

   • IBM 3279 Model 3: between 170 and 180 mm

5. If the edges of the bars are not sharp, do the color convergence procedure and then recheck the color test pattern. (The convergence procedure is described in the *Problem Determination Guide* stored in your keyboard.)

Figure 6-15. Color Test Pattern for the 3279 Color Display Station

Appendix A. Assembler Application Program Interface

Introduction

This appendix describes the interface between a personal computer application program and the IBM 3270 Personal Computer Attachment BIOS extension. (See Figure A-1.)

Personal Computer Application	INT '50' → ← IRET	3270 Attachment BIOS Extension	
Interrupt Handler Extensions	← CALL (Far)	3270 Attachment Interrupt Handler	← IRQ 2
Data Transfer Screen Capture Wrap Test	RET →		IRET →
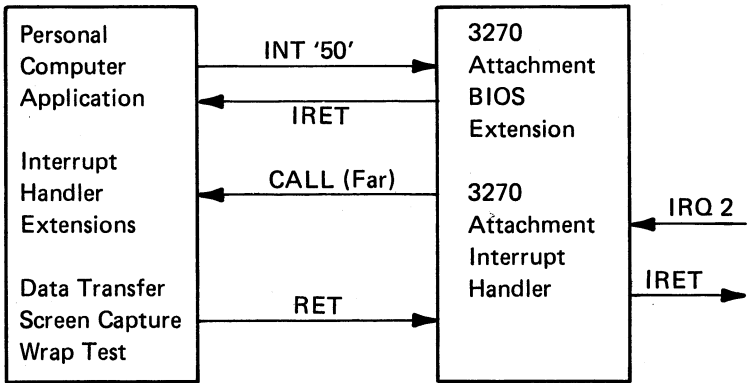
Figure A-1. Diagram of Assembler Application Program Interface

The customization process creates the BIOS extension (3270ATT.EXE) on your IBM 3270 Personal Computer Attachment DOS diskette. The AUTOEXEC.BAT file starts up 3270ATT.EXE. Then 3270ATT.EXE handles both:

● Hardware interrupts from the Personal Computer 3270 Attachment Adapter

● Software interrupts from a personal computer application program.

3270ATT.EXE occupies approximately 5K of memory above the old end of DOS.

The BIOS extension provides a sofware interrupt interface for personal computer application programs to control the operation of the IBM 3270 Personal Computer Attachment. This interface is similar to the function calls used to communicate with DOS.

In order to request a function, an application program puts the desired function code into the AH register, puts any other required parameters into the appropriate registers, and executes an INT 50H instruction.

All registers are preserved by the BIOS extension, except for:

● The carry flag (CF), which indicates whether the function was accepted

● The AX register, which contains a return code (in the AL portion of the register)

● The BX register, which contains returned information for certain function calls.

The BIOS extension uses the application program's stack to save registers and other information. The application program's stack area should be at least 128 bytes larger than the requirements of the application program.

The terms used to define the function codes for interrupt 50H in this appendix are listed here:

● Reg   = Contents of a register or a pointer

● ValueH   = Hexadecimal value

● Seg:reg   = Contents of a register based on a segment register

● AH, AL, etc = Register name

● CF   = Carry flag

● Bits   = Bit 7 is most significant, 0 least significant

● Control unit = IBM 3274 Control Unit, IBM 3276 Control Unit Display Station, or IBM Integrated Display Adapter (IDA)

Function Code 0: Set Mode

The **set mode** function associates the 3278/3279 keyboard and display either with the program running in the personal computer or with the program running in the host.

You can use this function with a display connected to any control unit.

The 3278/3279 keyboard and display can associate independently with the personal computer or with the host. When the 3278/3279 keyboard and display both associate with the personal computer (for example, the program running on the personal computer receives all keystrokes and the display is showing the image from the personal computer display adapter), the terminal is in personal computer mode. If you enter the mode switch key sequence at the 3278/3279 keyboard (ALT and INSERT on most keyboards), the terminal is switched to host computer mode.

When the 3278/3279 keyboard and display associate with the host (for example, the control unit receives all keystrokes and the display is showing the image from the control unit), the terminal is in host computer mode. If you enter the mode switch key sequence at the 3278/3279 keyboard, the terminal is switched to personal computer mode.

The 3278/3279 keyboard can associate with the personal computer, and the display can associate with the host. In this mode of operation, a program running on the personal computer can monitor all keystrokes from the 3278/3279 keyboard and selectively pass them on to the control unit for processing.

For example, a personal computer application program could be written that monitors for special key sequences (such as F11 through F40) and substitutes character strings for the special key sequences (such as a programmed "soft key" facility for TSO or VM/370). If you enter the mode switch key sequence in this mode, the terminal is switched to host computer mode. Since the image shown will not change, you will not be able to see any difference in the display. However, the personal computer application program will lose control of the keyboard.

The 3278/3279 keyboard can associate with the host, and the display can associate with the personal computer. If you enter the mode switch key sequence in this mode, the terminal is switched to personal computer mode. Since the image shown will not change, you will not see any difference in the display. However, the control unit will no longer be receiving the keystrokes.

Invocation

AH	0
AL	0—Change to host computer mode
AL	1—Change to personal computer mode
AL	2—Display host computer image; do not change keyboard association
AL	3—Display personal computer image; do not change keyboard association

Accepted

CF	0
AL	0

Rejected

CF	1
AL	2—Invalid mode set code

Return code 2 indicated that the AL register did not contain a valid value (0, 1, 2, or 3).

Example

```
;-------CHANGE TO HOST COMPUTER MODE
   MOV     AH,0     ;FUNCTION = SET MODE
   MOV     AL,0     ;SELECT HOST COMPUTER MODE
   INT     50H
```

Function Code 1: Send Keystrokes to the 3278/3279 Keyboard Interface

The **send keystroke** function sends keystrokes to the control unit as if you were pressing the keys on the actual 3278/3279 keyboard. The keystrokes are sent at a maximum rate of 10 keystrokes per second.

You can use the send keystroke function in two different ways.

First Method

The first way of using the send keystroke function can be used with a display connected to any control unit.

Invocation (without an Active Interrupt Handler Extension)

AH	1
CX	Length of buffer
DS:DX	Address of buffer containing keystroke encodings (see Table A-1)

Accepted

CF	0
AL	0

Rejected

CF	1
AL	4—Invalid keystroke encoding in the message

Return code 4, invalid keystroke encoding, indicates that **CX=0** or a keystroke encoding found in the message is not valid for the type of 3278/3279 keyboard that is attached to the personal computer. Table A-1 lists all the possible keystroke encodings. However, you can only use the encodings that correspond to the actual keys on the 3278/3279 keyboard you are

using. For example, the typewriter/APL keyboards do not have
PF13−PF24 keys. Therefore, you cannot use keystroke encod-
ings corresponding to PF13−PF24 on a typewriter/APL
keyboard.

With this method of sending keystrokes, part of the message
might not reach the control unit if the 3278/3279 keyboard
became locked during the keystroke transfer. For example,
when a message is received from the host during keystroking,
and the keyboard is locked because of a previous ENTER key-
stroke, the keystrokes run into an attribute byte. Use this
method only when you are not sure the display is connected to
a 3274 Control Unit customized for the 3270 Personal Com-
puter Attachment.

Example

```
;--------DEFINE OUTPUT BUFFER

BUFFER_LENGTH DW   BUFFER_END-BUFFER
BUFFER        DB   'THIS IS AN EXAMPLE FOR SEND KEYSTROKES',8AH
BUFFER_END    EQU  $
        .
        .
        .
;-------SEND KEYSTROKES TO THE 3278/3279 KEYBOARD INTERFACE

SEND_KEYSTROKES:
    MOV     AH,1                ;FUNCTION = SEND KEYSTROKES
    LEA     DX,BUFFER           ; ADDRESS OF KEYSTROKE BUFFER
    MOV     CX,BUFFER_LENGTH    ; LENGTH OF BUFFER
    INT     50H
    JNC     DONE                ;FUNCTION SUCCESSFUL - CONTINUE

;-------OPERATION REJECTED - TAKE CORRECTIVE ACTION
        .
        .
        .
```

Second Method

The second way of using the send keystroke function requires
a display that is connected to a 3274 Control Unit customized
for the IBM 3270 Personal Computer Attachment. To use this
form of the send keystroke function, your application program
must issue the set 3270 attachment interrupt vector function
(for any of the allowable types of data transfer) before issuing

the send keystroke function. If there is an active 3270 Attachment Interrupt Vector when the send keystroke function is issued, the BIOS extension determines whether the keystrokes actually reached the 3274 Control Unit.

Invocation (with an Active Interrupt Handler Extension)

AH	1
CX	Length of buffer
DS:DX	Address of buffer containing keystroke encodings (see Table A-1)

Accepted

CF	0
AL	0

Rejected

CF	1
AL	4—Invalid keystroke encoding the message
AL	6—Power on reset received from the 3274 Control Unit
AL	10—Keyboard is inhibited because of a previous keyboard attention being processed
AL	11—Keyboard is inhibited
AL	12—Keyboard became inhibited because of an attention-generating keystroke in the message. The entire message was received by the 3274 Control Unit.
AL	13—Keyboard became inhibited while sending keystrokes. The message may have been partially received by the 3274 Control Unit.

Return code 4, invalid keystroke encoding, indicates that CX=0 or a keystroke encoding found in the message is not valid for the type of 3278/3279 keyboard that is attached to the personal computer. Table A-1 lists all the possible keystroke encodings. However, you can only use the encodings that correspond to the actual keys on the 3278/3279 keyboard you are using. For example, the typewriter/APL keyboards do not have PF13—PF24 keys. Therefore, you cannot use keystroke encoding corresponding to PF13—PF24 on a typewriter/APL keyboard.

Return code 6, power on reset, can result for the first message sent after the set 3270 attachment interrupt vector function is issued. This code indicates the 3274 Control Unit acknowledges the IBM 3270 Personal Computer Attachment is active. In this case, your application program should resend the keystroke sequence. If **return code 6** results after the first message is successfully sent, it means that (1) the display was turned off and on, (2) the Test/Normal switch was switched to Test and back to Normal, or (3) the 3274 Control Unit went through the initial machine load (IML) procedure. In this case, the connection to the host was probably lost. Your application program should switch to host computer mode to allow the user to re-establish the host session.

Return code 10, previous attention pending, results if the previous message has not been processed by the host. Your application program should reissue the send keystroke function until the return code changes.

Return code 11, keyboard inhibited, results if the keyboard is locked before sending your message. This code indicates that:

• The host computer program did not unlock the keyboard.

• You tried to send a keystroke when the cursor was pointing to an attribute byte or a protected field.

• You tried to send a keystroke when the host was sending a message to the terminal.

Your application program can retry sending the message by sending a RESET keystroke first (either separately or at the beginning of the original message). If the problem is that the cursor is positioned incorrectly, your application program may have to send a TAB, BACK TAB, HOME, or CLEAR keystoke after the RESET, before sending the message again.

Return code 12, keyboard now inhibited, results if your message was completely accepted by the 3274 Control Unit and your message ended with a keystroke that caused an attention interrupt (for example, ENTER, PA1, PA2, CLEAR). Since this is a normal condition, no error recovery is required.

Return code 13, keyboard became inhibited, results if the keyboard was unlocked before you sent your message and became locked during transmission of the keystrokes. The exception is an attention-generating keystroke at the end of the message. Your application program can resend the message by sending a RESET keystroke and a BACK TAB or CLEAR keystroke, and resending the original message. However, this can return the same error if the keyboard became locked because of an error in formatting the message. Examples are two attention-generating keystrokes in the same message and a message that extends past the end of the current input field.

Example

```
;--------DEFINE OUTPUT BUFFER

BUFFER_LENGTH DW  BUFFER_END-BUFFER
BUFFER        DB  'THIS IS AN EXAMPLE FOR SEND KEYSTROKES',8AH
BUFFER_END    EQU $
              .
              .
              .
;--------3270 ATTACHMENT INTERRUPT HANDLER EXTENSION

INT_HANDLER   PROC FAR
              .
              .
              .
              RET
INT_HANDLER   ENDP
              .
              .
              .
;--------      DEFINE A 3270 ATTACHMENT INTERRUPT HANDLER EXTENSION

              MOV  AH,2                  ;FUNCTION = SET INTERRUP VECTOR
              MOV  AL,1                  ; FOR SCREEN CAPTURE MESSAGES
              MOV  DX,OFFSET INT_HANDLER ;ADDRESS OF INTERRUPT HANDLER
              INT  50H

;--------      SEND KEYSTROKES TO THE 3278/3279 KEYBOARD INTERFACE

        SEND_KEYSTROKES:
              MOV  AH,1                  ;FUNCTION = SEND KEYSTROKES
              LEA  DX,BUFFER             ; ADDRESS OF KEYSTROKE BUFFER
              MOV  CX,BUFFER_LENGTH      ; LENGTH OF BUFFER
              INT  50H
              JNC  DONE                  ;FUNCTION SUCCESSFUL - CONTINUE

;--------      OPERATION REJECTED - TAKE CORRECTIVE ACTION
              .
              .
              .
```

Table A-1. ASCII-to-Keystroke Translation

	0	1	2	3	4	5	6	7
0			space	0	@	P	`	p
1			!	1	A	Q	a	q
2			"	2	B	R	b	r
3			#	3	C	S	c	s
4			$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			'	7	G	W	g	w
8	←		(	8	H	X	h	x
9	→|		)	9	I	Y	i	y
A			*	:	J	Z	j	z
B		ESCAPE	+	;	K	[	k	{
C			,	<	L	\	l	|
D	↵		-	=	M	]	m	}
E			.	>	N		n	~
F			/	?	O	—	o	

Table A-1. ASCII-to-Keystroke Translation (continued)

	8	9	A	B	C	D	E	F
0	|	Attn	DUP	PF1	PF17	🅰	PSA	Red
1	¬	SysReq	PA1	PF2	PF18	ä	PSB	Green
2	¢	Cursor Select	FIELD MARK	PF3	PF19	a̲	PSC	Blue
3	←	Clear	PA2	PF4	PF20		PSD	White
4	→|		⌂	PF5	PF21		PSE	Pink
5	|←			PF6	PF22		PSF	Yellow
6	↵		⬧	PF7	PF23			Turquoise
7	⊙	ERASE INPUT		PF8	PF24	▶	▶	▶
8	RESET	Cursor blink	↑	PF9	Ä	ä	i	
9	DEV CNCL	ALT Cursor		PF10	Ö	ö	Pts	
A	ENTER	ERASE EOF	↓	PF11	Ü	ü	'	
B	Start ALT	Escape		PF12	Ñ	ã	∧	
C	End ALT	▭-▭	←	PF13	ñ	è	··	
D	PA3	IDENT	←	PF14	§	é	ﬤ	
E	Skip	◁	→	PF15	ß	ò	°	
F	APL ON/OFF TEXT ON/OFF	TEST	→→	PF16	£	ù		

Notes:

1. If a particular keyboard does not have a specified key (for example, SKIP does not exist on the typewriter keyboard), the equivalent keystroke encoding is invalid.

2. To send a series of one or more keystrokes for which you normally must hold the ALT key (for example, the special APL or TEXT key), send the START ALT encoding, the normal encoding for the keys, then the END ALT encoding.

Function Code 2: Set 3270 Attachment Interrupt Vector

The **set 3270 attachment interrupt vector** function associates an interrupt handler extension with a particular type of data flow between the IBM Personal Computer and the 3274 Control Unit.

This function can be used only with a display attached to a 3274 Control Unit customized for the IBM 3270 Personal Computer Attachment.

The interrupt handler extension is called by the BIOS extension when data is received from the 3274 Control Unit about the type of data flow. See "3270 Attachment Interrupt Handler Extension Interface," later in this appendix, for details about coding the interrupt handler extension.

Invocation

AH	2
AL	0—Set data transfer interrupt vector
AL	1—Set screen capture interrupt vector
AL	2—Set wrap test interrupt vector
DS:DX	Address of interrupt handler extension entry point

Accepted

CF	0
AL	0

Rejected

CF	1
AL	3—IBM Personal Computer 3270 Adapter not operational
AL	5—Invalid interrupt vector code

Return code 3, IBM Personal Computer 3270 Adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or is not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 5, invalid vector code, indicates that the AL register did not contain a valid value (0, 1, or 2).

Example

```
;--------3270 ATTACHMENT INTERRUPT HANDLER EXTENSION

INT_HANDLER PROC   FAR
          .
          .
          .
          RET
INT_HANDLER ENDP
          .
          .
;--------        DEFINE A 3270 ATTACHMENT INTERRUPT HANDLER EXTENSION

          MOV   AH,2                  ;FUNCTION = SET INTERRUPT VECTOR
          MOV   AL,1                  ; FOR SCREEN CAPTURE MESSAGES
          MOV   DX,OFFSET INT_HANDLER ; ADDRESS OF INTERRUPT HANDLER
          INT   50H
```

Function Code 3: Reset 3270 Attachment Interrupt Vector

The **reset 3270 attachment interrupt vector** function disassociates an interrupt handler extension from a particular type of data flow between the IBM Personal Computer and the 3274 Control Unit.

This function can be used only with a display attached to a 3274 Control Unit customized for the IBM 3270 Personal Computer Attachment.

The interrupt handler extension is not called by the BIOS extension when data is received from the 3274 Control Unit. If data is received from the 3274 Control Unit and no interrupt handler extension is present for that data type, the data is discarded. When all three 3270 attachment interrupt vectors are reset, the BIOS extension disables the feature bus interface between the personal computer and the display.

Invocation

AH	3
AL	0—Reset data transfer interrupt vector
AL	1—Reset screen capture interrupt vector
AL	2—Reset wrap test interrupt vector

Accepted

CF	0
AL	0

Rejected

CF	1
AL	3—IBM Personal Computer 3270 Adapter not operational
AL	5—Invalid interrupt vector code

Return code 3, IBM Personal Computer 3270 Adapter not oper-
ational, indicates that the IBM Personal Computer 3270 Adapter
is not installed or is not operational, or that the POST for the
Feature Bus Interface portion of the adapter failed.

Return code 5, invalid vector code, indicates that the AL regis-
ter did not contain a valid value (0, 1, or 2).

Example

```
;--------CANCEL A 3270 ATTACHMENT INTERRUPT HANDLER EXTENSION

        MOV     AH,3                    ;FUNCTION = RESET INTERRUPT VECTOR
        MOV     AL,1                    ; FOR SCREEN CAPTURE MESSAGES
        INT     50H
```

Function Code 4: Set 3270 Attachment Input Buffer Address

The set 3270 attachment input buffer address function specifies
an input buffer to be used for any data received from the 3274
Control Unit for a particular type of data flow.

This function can be used only with a display attached to a 3274
Control Unit customized for the IBM 3270 Personal Computer
Attachment.

An input buffer can be specified for a data flow only if an inter-
rupt handler extension is active for that type of data. Whenever
a message is received from the 3274 Control Unit for that data
type, the BIOS extension saves the data in the specified input
buffer and calls the interrupt handler extension when the mes-
sage is complete. Then, the input buffer is not available for
receiving data until the interrupt handler extension returns to
the BIOS extension or until the interrupt handler extension
specifies a new input buffer address.

Invocation

AH	4
AL	0—Set data transfer input buffer. The minimum length of the buffer is 2K bytes.
AL	1—Set screen capture input buffer. The minimum length of each buffer is 4 plus the number of characters on the display screen that you want to capture. (See Function Code 5 for further explanation.) Note that the screen capture will always start at the upper left corner of the screen. For example, if you want to capture the first two lines from the screen of Model 2, then the number of characters is 160.
AL	2—Set wrap test input buffer. The minimum length of the buffer is 256 bytes.
CX	Length of input buffer. If CX equals 0, then DS:DX is ignored and assumed to be 0 (no input buffer available).
DS:DX	Address of input buffer

Accepted

CF	0
AL	0

Rejected

CF	1
AL	3—IBM Personal Computer 3270 Adapter not operational
AL	5—Invalid interrupt vector code

Return code 3, IBM Personal Computer 3270 Adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or is not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 5, invalid vector code, indicates that the AL register did not contain a valid value (0, 1, or 2), or that the application program did not previously issue the set 3270 attachment interrupt vector function for that data type.

Example

```
;--------DEFINE INPUT BUFFER

BUFFER_LENGTH  DW   BUFFER_END-BUFFER
BUFFER         DB   1924DUP(?)
BUFFER.END     EQU  $
         .
         .
         .
;--------       SET SCREEN CAPTURE INPUT BUFFER ADDRESS

               MOV  AH,4              ;FUNCTION = SET INPUT BUFFER ADDRESS
               MOV  AL,1              ; FOR SCREEN CAPTURE MESSAGES
               MOV  DX,OFFSET_BUFFER  ; ADDRESS OF INPUT BUFFER
               MOV  CX,BUFFER_LENGTH  ; LENGTH OF INPUT BUFFER
               INT  50H
```

Function Code 5: Send Message to 3274 via Feature Bus Interface

The **send message** function sends a message to the 3274 Control Unit using the feature bus interface.

This function can be used only with a display attached to a 3274 Control Unit customized for the IBM 3270 Personal Computer Attachment.

A message can be sent to the 3274 for a data flow only if an interrupt handler extension is active for that type of data.

Invocation

AH	5
AL	0—Send data transfer message
AL	1—Send screen capture options message
AL	2—Send wrap test message
CX	Length of message
DS:DX	Address of message

Accepted

CF	0
AL	0

Rejected

CF	1
AL	3—IBM Personal Computer 3270 Adapter not operational
AL	5—Invalid vector code or interrupt vector not set
AL	6—Message canceled by a power-on reset
AL	7—Message canceled because of a protocol violation
AL	8—Message canceled by a user request

Return code 3, IBM Personal Computer 3270 Adapter not oper-
ational, indicates that the IBM Personal Computer 3270 Adapter
is not installed or is not operational, or that the POST for the
feature bus interface portion of the adapter failed.

Return code 5, invalid vector code, indicates that the AL register
did not contain a valid value (0, 1, or 2), or that the application
program did not previously issue the set 3270 attachment inter-
rupt vector function for that data type.

Return code 6, power on reset, can result for the first message
sent after issuing the set 3270 attachment interrupt vector func-
tion. This code indicates that the 3274 Control Unit acknowl-
edges that the personal computer attachment is active. In this
case, your application program should resend the message. If
return code 6 results after the first message is successfully sent,
the display was turned off and on, the Test/Normal switch was
switched to Test and back to Normal, or the 3274 Control Unit
went through the IML procedure. In this case, the connection
to the host was probably lost. Your application program should
switch to host computer mode to allow the user to reestablish
the host session.

Return code 7, protocol violation, indicates that the 3274 Control Unit has rejected the message. This can occur when a Wrap Test message longer than 252 bytes or a Screen Capture Options message longer than 1 byte is sent.

Return code 8, canceled by user request, indicates that the application program issued a cancel message function for that data flow before the message was sent to the 3274 Control Unit.

The buffer for a data transfer message must contain no more than 2048 bytes of data. This data normally consists of one or more structured fields. (See Appendix G for the format of the structured fields used by the sample file transfer application program.)

The buffer for a set screen capture options message must contain 1 byte of data. This byte tells the 3274 Control Unit what type of data will be sent to the personal computer when the user presses the PRINT key on the 3278/3279 keyboard. The data must be one of the following:

- 80H   Send only character buffer

- 40H   Send only extended attribute buffer

- COH   Send character buffer and extended attribute buffer

- 00H   Do not send any data to the personal computer

If your application program uses the screen capture facility, it must invoke the following functions:

- Set 3270 Attachment Interrupt Vector — Screen Capture

- Set 3270 Attachment Input Buffer Address — Screen Capture

- Send Message — Screen Capture Options (80H, 40H, or COH)

    .
    . (process data)
    .

- Send message — Screen Capture Options (00H)

- Reset 3270 Attachment Interrupt Vector — Screen Capture

The application program can either process local copy requests from the user or read the screen buffers at any time by sending PRINT keystrokes to the 3274 Control Unit (using the send keystroke function).

Example

```
;--------DEFINE SCREEN CAPTURE OPTIONS MESSAGE

BUFFER_LENGTH   DW      BUFFER_END-BUFFER
BUFFER          DB      80H             ;SEND ONLY CHARACTER BUFFER
BUFFER_END      EQU     $
                .
                ..
                .

;--------        SEND SCREEN CAPTURE OPTIONS MESSAGE TO 3274 CONTROL UNIT

                MOV     AH,5            ;FUNCTION = SEND MESSAGE
                MOV     AL,1            ;SCREEN CAPTURE OPTIONS MESSAGE
                MOV     DX,OFFSET_BUFFER  ; ADDRESS OF OUTPUT BUFFER
                MOV     CX,BUFFER_LENGTH  ; LENGTH OF OUTPUT BUFFER
                INT     50H
```

Function Code 6:   Cancel Message Sent to 3274

The **cancel message** function cancels a message previously scheduled using the send message function. The message is canceled only if the BIOS extension has not already started sending the message to the 3274 Control Unit. Since programs running under IBM Personal Computer DOS cannot have multiple tasks running at the same time, the only use for this function is within an interrupt handler. For example, a BREAK interrupt handler is called directly from the keyboard BIOS.

This function can be used only with a display attached to a 3274 Control Unit customized for the IBM 3270 Personal Computer Attachment.

Invocation

AH	6
AL	0–Cancel data transfer message
AL	1–Cancel screen capture options message
AL	2–Cancel wrap test message

Accepted

CF	0
AL	0

Rejected

CF	1
AL	3–IBM Personal Computer 3270 Adapter not operational
AL	5–Invalid interrupt vector code

Return code 3, IBM Personal Computer 3270 Adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 5, invalid vector code, indicates that the AL register did not contain a valid value (0, 1, or 2).

Example

```
;--------CANCEL SCREEN CAPTURE OPTIONS MESSAGE

        MOV     AH,6                    ;FUNCTION = CANCEL MESSAGE
        MOV     AL,1                    ; SCREEN CAPTURE OPTIONS MESSAGE
        INT     50H
```

Function Code 7: Modify Keyboard Input Translation Table

The **modify keyboard input translation table** function changes the translation table used by the BIOS extension. The table converts keystrokes from the 3278/3279 keyboard for use by an application program running on the personal computer.

This function can be used with a display attached to any control unit.

When you press a key on the 3278/3279 keyboard, the BIOS extension does the following:

- Reads the 3278/3279 keyboard scan code

- Translates the scan code to a relative key number (see Figure A-2)

- Uses the relative key number and current keyboard state as an index into the Keyboard Input Translation Table to find the required personal computer keyboard state and scan code

- Sends the appropriate series of keystrokes to the personal computer

By modifying the Keyboard Input Translation Table, your application program can change the assignment of personal computer functions on the 3278/3279 keyboard. For example, you can change the SYS REQ key to be the personal computer ESC function by setting the table entry for relative key 58 when in ALT case to return scan code 1.

Invocation

AH	7
CH	3278/3279 relative key number 1 to 89 (see Figure A-2)
CL	1–Lowercase (alphacase on data entry keyboards)
CL	2–Uppercase (numeric case on data entry keyboards)
CL	3–Personal computer Ctrl case
CL	4–Personal computer Alt case
CL	5–Alt case
DH	Personal computer scan code (1 to 83), special function value (-1 to -14), or ignore keystroke (0)
DL	Required Personal Computer Keyboard State
	0xxxxxxx Lowercase
	1xxxxxxx Uppercase
	x1xxxxxx Ctrl case
	xx1xxxxx Alt case
	xxxxxx10 Send break/Alt after keystroke

Special Function Values

Some of the keys on the 3278/3279 keyboard identify functions that do not exist on the personal computer keyboard. Because of the 3270 ATT interrupt handler, these functions are available in personal computer mode. Examples are the clicker key and 3278/3279 ALT key. Also, some of the functions available as a key on the personal computer keyboard are not defined as keys on the 3278/3279 keyboard. To specify these special functions, you use the following values as personal computer scancode:

– 1	Shift Lock key
– 2	Left Hand Shift key
– 3	Right Hand Shift key
– 4	Numeric Lock key
– 5	Numeric Shift key
– 6	Alphanumeric Shift key
– 7	ALT key
– 8	Reset key
– 9	Clicker On/Off key
–10	Start Decimal Input key
–11	Toggle Mode key
–12	Enter personal computer CTRL case
–13	Enter personal computer ALT case
–14	Pause until another key is hit

Look at Table 4-1 for further information. Note that the
3278/3279 Shift, Shift Lock, and ALT keys generate a make,
and not a break, key bit. Reassigning these keys to other keys
will lock your keyboard when you use these keys.

Accepted

CF   0
AL   0
BX   Previous contents of the input translation table
            entry

Rejected

CF   1
AL.   9—Invalid parameters

Return code 9 indicates that register CH did not contain a valid
value (1—89), register CL did not contain a valid value (1—5), or
register DH did not contain a valid value (-14 through 83).

Example

```
;--------MODIFY KEYBOARD INPUT TRANSLATE TABLE

MOV       AH,7                    ;FUNCTION = MODIFY KBD INPUT TABLE
MOV       CH,58                   ; 3278/3279 ATTN KEY
MOV       CL,4                    ;   WHILE IN ALT CASE
MOV       DH,1                    ; BECOME ESC KEY
MOV       DL,00H                  ; (LOWER CASE)
INT       50H
MOV       OLD,BX                  ;SAVE THE OLD TABLE ENTRY

;--------THE SYS REQ KEY (ALT AND ATTN ON THE 3278/3279 KEYBOARD)IS
;--------NOW SEEN BY A PERSONAL COMPUTER PROGRAM AS THE ESC KEY
   .
   .
   .
;--------RESTORE KEYBOARD INPUT TRANSLATE TABLE

MOV       AH,7                    ;FUNCTION = MODIFY KBD INPUT TABLE
MOV       CH,58                   ; 3278/3279 ATTN KEY
MOV       CL,4                    ;   WHILE IN ALT CASE
MOV       DX,OLD                  ; BECOME ORIGINAL VALUE
INT       50H

;--------THE SYS REQ KEY (ALT AND ATTN ON THE 3278/3279 KEYBOARD) IS
;--------NOW RESTORED TO ITS ORIGINAL ENCODING (WHICH IS IGNORE
;--------KEYSTROKE)
```

Function Code 8: Modify Keystroke Output Translation Table

The **modify keystroke output translation table** function changes the translation table used by the BIOS extension when keystrokes are sent from an application program to the control unit.

This function can be used with a display connected to any control unit.

When an application program invokes the send keystroke function, the BIOS extension does the following:

- Uses the keystroke encoding as an index to the Keystroke Output Translation Table and finds the required 3278/3279 Keyboard state and relative key number

- Translates the relative key number to a 3278/3279 keyboard scan code

- Sends the appropriate series of keystrokes to the control unit.

By modifying the Keyboard Output Translation Table, your application program can change the assignment of keystroke encodings.

Invocation

AH	8
CH	Keystroke encoding (0 to 255)
DH	3278/3279 Relative key number 1 to 89 (see Figure A-2) or ignore keystroke (0)
DL	Required 3278/3279 keyboard state
	0xxxxxxx Lowercase
	1xxxxxxx Uppercase
	xx1xxxxx Alt case or start of sequence of Alt keystroke
	xxxxxx1x End of sequence of Alt keystrokes
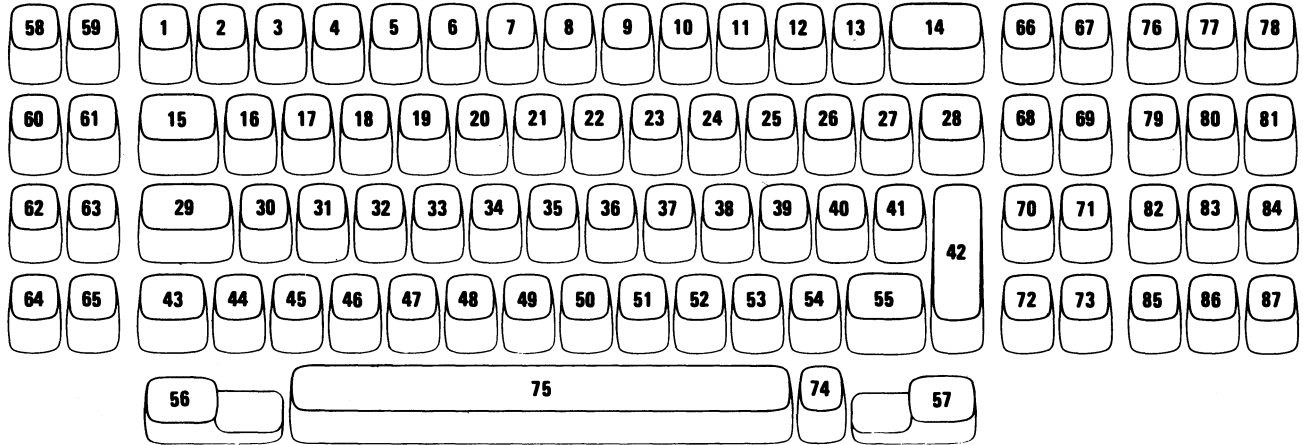
Notes:

1. There is no key 88.
2. Spacebar 75 may be split into two keys (75, 89) on a keyboard.

Figure A-2. 3278/3279 Relative Key Numbering

Accepted

CF	0
AL	0
BX	Previous contents of the input translation table entry

Rejected

CF	1
AL	9—Invalid parameters

Return code 9 indicates that register DH did not contain a valid value (0—89).

Example

```
;--------MODIFY KEYSTROKE OUTPUT TRANSLATION TABLE

    MOV     AH,8                    ;FUNCTION = MODIFY KEYSTROKE OUTPUT TABLE
    MOV     CH,'%'                  ; THE PERCENT SIGN ENCODING
    MOV     DH,67                   ; BECOMES FIELD MARK
    MOV     DL,0                    ; (LOWER CASE)
    INT     50H
    MOV     OLDPCT,BX               ;SAVE OLD TABLE ENTRY
;--------FROM NOW ON WHEN A "%" KEYSTROKE IS SENT, THE HOST
;--------PROGRAM WILL SEE A FIELD MARK
```

Function Code 9: Query Keyboard ID

The **query keyboard ID** function determines the type of 3278/3279 keyboard attached to the personal computer.

This function can be used with a display connected to any control unit

Invocation

| AH | 9 |

Accepted

CF   0
AL   1
BX   Keyboard ID
          0110 U.S. EBCDIC Typewriter
          0111H U.S. EBCDIC Typewriter – RPQ 8K0731
          0112H U.S. EBCDIC Typewriter – RPQ 8K0808
          0113H U.S. EBCDIC Typewriter – RPQ 8K0932
          0114H U.S. EBCDIC Typewriter – RPQ 8K 1038
          0120H U.S. Data Entry
          0121H U.S. Data Entry – RPQ 8K0732
          0130H U.S. Data Entry Keypunch
          0140H U.S. EBCDIC Typewriter/APL
          0150H U.S. EBCDIC Typewriter/Text
          0160H U.S. EBCDIC Typewriter – Attribute Select
          0170H U.S. EBCDIC Typewriter/APL – Attribute Select
          0210H U.S. ASCII Typewriter

This function is always accepted.

Return Codes

Table A-2 gives the return codes for each function.

Table A-2. Function and Return Code Cross-Reference

AH Value	Function	Return Code												
		1	2	3	4	5	6	7	8	9	10	11	12	13
0	Set mode		X											
1	Send keystrokes to the keyboard interface				X						X	X	X	X
2	Set the interrupt vector			X		X								
3	Reset the interrupt vector			X		X								
4	Set input buffer address			X		X								
5	Send a message to the 3274			X		X	X	X	X					
6	Cancel message to the 3274			X		X								
7	Modify the keyboard input translation table									X				
8	Modify the keyboard output translation table									X				
9	Query keyboard ID													
All others		X												

Note: Function AH = 9 will always be accepted with a return code = 0.

3270 Attachment Interrupt Handler Extension Interface

An application program can specify an interrupt handler extension to be called when data is received from the 3274 Control Unit. This interrupt handler extension can process data for any of the three data flows recognized by the BIOS extension (data transfer, screen capture, or wrap test). The same interrupt handler extension can process data for any combination of data flows.

The interrupt handler extension must be defined as a FAR PROCEDURE. It is directly called by the BIOS extension and must return to the BIOS extension by issuing a Return (RET) instruction. The BIOS extension passes a function code to the interrupt handler extension in the AL register. The contents of other registers are described below.

The interrupt handler extension modifies 8088 registers except the stack segment (SS) and the stack pointer (SP). On entry to the interrupt handler, the contents of all registers (except those listed below) are unpredictable. Be careful if the interrupt handler has any variable with an implied segment attribute. The DS register is not guaranteed to point to your variables' data segment.

When the BIOS extension calls the interrupt handler extension, all interrupt levels are enabled. Note that the interrupt handler extension receives control as part of interrupt processing. Therefore, since IBM Personal Computer DOS does not allow for concurrent active requests, the interrupt handler extension cannot request any DOS functions while it is in control.

Function Code 1: Message Received from 3274

This function code indicates a message is received from the 3274 Control Unit for one of the types of data assigned to this interrupt handler extension. If a message is received from the 3274 Control Unit and no interrupt handler extension is assigned to that data type, the message is discarded.

Invocation

AH	1
AL	Flags
	1xxxxxxx Message truncated (Input buffer too small)
	0xxxxxxx Message not truncated
CX	Length of Input Message
ES:DX	Address of input buffer. (This address was previously set by the application program using the set 3270 attachment input buffer address function.)

If the message truncated flag is set, the input buffer specified by the application program is too small to contain the entire message received from the 3274 Control Unit. The remainder of the message is automatically discarded and cannot be retrieved by the interrupt handler extension.

The input buffer for data transfer message contains one or more structured fields sent by a host system application program. See Appendix G for the format of the structured fields used by the sample file transfer application program.

The input buffer for a screen capture message contains the contents of either the display station character buffer, the display station extended attribute buffer, or both. The following header precedes the contents of each buffer:

Buffer Length	Buffer Type	Row Length
Byte 0 Byte 1	Byte 2	Byte 3

- Buffer Length = The number of bytes in the display buffer plus 2 (for example, for a 3278 Model 2, this will be 1922).

- Buffer Type = The type of display buffer whose contents follow. This byte will be 00H for the display character buffer or 01H for the display extended attribute buffer.

- Row Length = The number of characters currently being displayed on each line of the display. This value will be 40, 80, or 132.

The buffer data that follows the header contains the specified display buffer.

The display's character buffer contains the internal representation of the displayed characters and field attributes. See Tables F-5 and F-8 for the internal codes. Note that all characters in a nondisplay field are replaced with blanks.

The display extended attribute buffer contains the internal representation of the character attributes. See Table F-9 for the internal codes.

Function Code 2: Power On Reset

This function code indicates that power-on reset was received from the 3274 Control Unit. A power-on reset is generated by the 3274 Control Unit when the display is turned off and on, when the Test/Normal switch is switched to Test and back to Normal, or when the 3274 Control Unit goes through the IML procedure. If any of these events occurred before your application program started, your interrupt handler extension may be entered immediately with the Power On Reset function code. If one of these events occurs while your program is running, your interrupt handler extension is also entered. Note that when a power-on reset is received from the 3274 Control Unit, the BIOS extension invokes all active interrupt handler extensions, even if the same interrupt handler is active for more than one data flow, and cancels all outstanding send message and send keystroke requests.

Invocation

AH   2

Function Code 3: Message Lost

This function code indicates that a message was received from the 3274 Control Unit when no input buffer was available to save the data. An input buffer is not available if the application program did not issue the set input buffer address function, if the application program issued the set input buffer address function specifying the length or address of the input buffer as zero, or if the interrupt handler extension is processing a received message, unless a set input buffer address function is issued to specify a new input buffer. The message affected is automatically discarded by the BIOS extension and cannot be retrieved by the interrupt handler extension.

Invocation

AH   3

Example of Sending Keystrokes

```
;--------DEFINE DATA AREAS

BUFFER_LENGTH    DW   BUFFER_END-BUFFER
BUFFER           DB   'THIS IS AN EXAMPLE FOR SEND KEYSTROKES'
                 DB   8AH ;ENCODING FOR ENTER KEY
BUFFER_END       EQU  $
RESET_KEY        DB   88H ;ENCODING FOR 3278/3279 RESET KEY
CLEAR_KEY        DB   93H ;ENCODING FOR 3278/3279 CLEAR KEY
  .
  .
  .


;--------DEFINE INTERRUPT HANDLER EXTENSION

  MOV     AH,2                    ;FUNCTION = SET INTERRUPT VECTOR
  MOV     AL,1                    ; FOR SCREEN CAPTURE DATA
  MOV     DX,OFFSET INT_HANDLER   ; ADDRESS OF INTERRUPT HANDLER
  INT     50H
  .
  .
  .
;--------SEND KEYSTROKES TO THE 3278/3279 KEYBOARD INTERFACE
SEND:
  MOV     AH,1                    ;FUNCTION = SEND KEYSTROKES
  LEA     DX,BUFFER               ; ADDRESS OF KEYSTROKE BUFFER
  MOV     CX,BUFFER_LENGTH        ; LENGTH OF BUFFER
  INT     50H
  JNC     DONE                    ;KEYSTROKES SENT SUCCESSFULLY

;--------OPERATION REJECTED - TAKE CORRECTIVE ACTION

ILLEGAL_KEYSTROKE:
  CMP     AL,4                    ;BUFFER CONTAINS INVALID KEYSTROKE-
  JE      ERROR1                  ; PROGRAMMING ERROR

POWER_ON_RESET:
  CMP     AL,6                    ;POWER ON RESET
  JE      SEND                    ; RESEND THE KEYSTROKES

AID_PENDING:
  CMP     AL,10                   ;PREVIOUS ATTENTION STILL PENDING-
  JE      SEND                    ; KEEP TRYING
```

```
KB_INHIBITED:
 CMP      AL,11                  ;KEYBOARD IS LOCKED-
 JNE      KB_LOCKED
 CALL     RESET                  ; SEND RESET KEYSTROKE
 JMP      SEND                   ; TRY AGAIN

KB_LOCKED:
 CMP      AL,12                  ;ATTENTION KEY AT END OF MESSAGE-
 JE       DONE                   ; WAS ACCEPTED

MESSAGE LOST:                    ;KEYBOARD BECAME LOCKED-
 CALL     RESET                  ; SEND RESET KEYSTROKE
 CALL     CLEAR                  ; SEND CLEAR KEYSTROKE
 JMP      SEND                   ; TRY AGAIN

;--------OPERATION SUCCESSFUL - CONTINUE PROCESSING

DONE:
 .
 .
 .
;--------SEND A RESET KEYSTROKE

RESET PROC NEAR
 MOV      AH,1
 LEA      DX,RESET_KEY
 MOV      CX,1
 INT      50H
 RET
RESET ENDP

CLEAR PROC NEAR
 MOV      AH,1                   ;FUNCTION = SEND KEYSTROKE
 LEA      DX,CLEAR_KEY           ; ADDRESS OF CLEAR KEYSTROKE
 MOV      CX,1
 INT      50H
 JNC      CLEAR_DONE             ;FUNCTION ACCEPTED
 CMP      AL,12                  ;CLEAR LOCKED THE KEYBOARD
 JE       CLEAR_DONE             ; THIS IS NORMAL

 CALL     RESET                  ;OTHER ERROR - RESET THE KEYBOARD
 JMP      CLEAR                  ; AND TRY AGAIN

CLEAR_DONE:
 RET
CLEAR ENDP

;--------INTERRUPT HANDLER EXTENSION

INT_HANDLER PROC  FAR
 .
 .
 .
 RET
INT_HANDLER ENDP
```

Assembler Application Program Interface   A-35

Example of Screen Capture

```
;--------EXAMPLE OF SCREEN CAPTURE
;NOTE: THIS EXAMPLE DOES NOT CHECK FOR ALL POSSIBLE RETURN CODES!
BUFFER_LENGTH       DW         BUFFER_END-BUFFER
BUFFER              LABEL      BYTE
SECTION_LENGTH      DW ?                         ;NUMBER OF BYTES FOLLOWING THIS FIELD
TYPE                DB ?                         ;BUFFER TYPE (00 = CHARACTER BUFFER)
ROW_LENGTH          DB ?                         ;ROW LENGTH (40,80, OR 132)
SCREEN_CONTENTS     DB         264 DUP (?)       ;BUFFER CONTENTS
BUFFER_END          EQU        $
SCREEN_CAPTURE_PARM DB         80H               ;SEND ONLY CHARACTER BUFFER
SCREEN_CAPTURE_OFF  DB         00H               ;RESUME LOCAL COPY FUNCTION
SCREEN_CAPTURE_KEY  DB         9CH               ;KEYSTROKE FOR PRINT SCREEN KEY

INT_HANDLER PROC    FAR                          ;INTERRUPT HANDLER EXTENSION
 .
 .(PROCESS CAPTURED SCREEN IMAGE)
 .
 RET
INT_HANDLER ENDP

;--------SET INTERRUPT VECTOR FOR SCREEN CAPTURE
 MOV     .AH,2                   ;FUNCTION = SET INTERRUPT VECTOR
 MOV     AL,1                    ; FOR SCREEN CAPTURE MESSAGES
 LEA     DX,INT_HANDLER          ; ADDRESS OF INTERRUPT HANDLER
 INT     50H

;--------SET SCREEN CAPTURE INPUT BUFFER ADDRESS

 MOV     AH,4                    ;FUNCTION = SET INPUT BUFFER ADDRESS
 MOV     AL,1                    ; FOR SCREEN CAPTURE MESSAGES
 LEA     DX,BUFFER               ; ADDRESS OF INPUT BUFFER
 MOV     CX,BUFFER_LENGTH        ; LENGTH OF INPUT BUFFER
 INT     50H

;--------REQUEST ONLY THE CHARACTER BUFFER

SCREEN_PARMS:
 MOV     AH,5                    ;FUNCTION = SEND MESSAGE
 MOV     AL,1                    ; SCREEN CAPTURE OPTIONS
 LEA     DX,SCREEN_CAPTURE_PARM ;OPTION BYTE
 MOV     CX,1                    ;1 DATA BYTE
 INT     50H

 CMP     AL,6                    ;POWER ON RESET-
 JE      SCREEN_PARMS            ; RESEND THE OPTIONS
```

```
;--------CAPTURE THE FIRST TWO LINES OF THE CURRENT SCREEN

      MOV       AH,1                     ;FUNCTION = SEND KEYSTROKES
      LEA       DX,SCREEN_CAPTURE_KEY    ; SEND PRINT SCREEN KEY
      MOV       CX,1                     ; 1 KEYSTROKE
      INT       50H
      JC        ERROR_HANDLING           ;PROCESS ERROR IF REJECTED
      .
      .
      .

;--------TERMINATE SCREEN CAPTURE - THE 3274 WILL RESUME NORMAL
;--------LOCAL COPY PROCESSING IF YOU PRESS THE PRINT SCREEN KEY

TERMINATE:
      MOV       AH,5                     ;FUNCTION = SEND MESSAGE
      MOV       AL,1                     ; SCREEN CAPTURE OPTIONS
      LEA       DX,SCREEN_CAPT_OFF       ; NO BUFFERS WANTED
      MOV       CX,1                     ; 1 BYTE MESSAGE
      INT       50H
      CMP       AL,6                     ;POWER ON RESET-
      JE        TERMINATE                ; RESEND THE OPTION BYTE

;--------RESET INTERRUPT VECTOR

CANCEL:
      MOV       AH,3                     ;FUNCTION = RESET INTERRUPT VECTOR
      MOV       AL,1                     ; FOR SCREEN CAPTURE MESSAGES
      INT       50H
```

Appendix B. BASIC Application Program Interface

This appendix describes a program that provides an interface between a personal computer application program written in beginner's all-purpose symbolic instruction code (BASIC) and the data transfer facilities of the IBM 3270 Personal Computer Attachment. (See Figure B-1.)

The data transfer interface provides facilities for selecting the mode of the display, sending keystrokes to the display, retrieving the contents of the screen, and exchanging structured fields with a program running in the host.
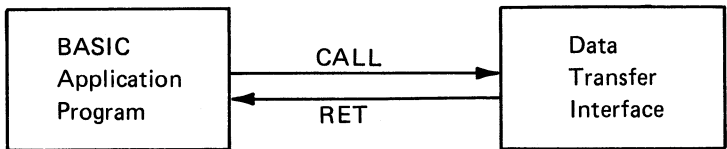
Figure B-1. Diagram of the BASIC Application Program Interface

Using the Interface with the BASIC Interpreter

The data transfer interface is contained in a separately compiled module named DT3270B.BIN. This module, which occupies about 8K bytes of storage, must be loaded by the BASIC application program. The following BASIC statements can be used to load the data transfer interface module at the end of available memory:

```
' LOAD THE DATA TRANSFER INTERFACE AT THE END
' OF AVAILABLE MEMORY
DEF SEG=&H40
END.MEMORY.SEG=64*(256*PEEK(&H14)+PEEK(&H13))
DT.SEG=END.MEMORY.SEG-&H200
DEF SEG=DT.SEG
BLOAD "DT3270B.BIN",0
```

The data transfer interface module can actually be loaded anywhere in memory that does not conflict with DOS or BASIC.

The BASIC application program must define numeric variables to contain the offsets to the appropriate entry points:

```
' DEFINE THE ENTRY POINTS INTO THE BASIC DATA
' TRANSFER INTERFACE
OPEN3720=0
CLOSE3270=5
MODE3270=10
WRITE3270=15
GET3270=20
INPUT3270=25
FLUSH3270=30
WRITEHOST=35
INPUTHOST=40
FLUSHHOST=45
```

To invoke a function in the data transfer interface, a BASIC application program must ensure that the current segment pointer points to the data transfer interface module before it calls the appropriate entry point:

```
' SWITCH THE DISPLAY STATION TO HOST COMPUTER MODE
DEF SEG=DT.SEG
MODE%=0
CALL MODE3270(MODE%,RC%)
```

Using the Interface with the BASIC Compiler

The data transfer interface is contained in a separately compiled object file named DT3270B.OBJ. This object file must be linked with the compiled BASIC program. The following command can be used to combine a BASIC application program named SAMPLE with the data transfer interface module:

```
LINK SAMPLE+DT3270B;
```

To invoke a function in the data transfer interface, the BASIC application program issues the CALL statement to invoke the appropriate function:

```
' SWITCH THE DISPLAY TO HOST COMPUTER MODE
MODE%=0
CALL MODE3270(MODE%,RC%)
```

Function: Open I/O Interface

The **open I/O interface** function allows I/O to be directed to the display or to an application program running in the host. The open I/O interface function is automatically invoked by all other functions within the data transfer interface except **set terminal model**. A BASIC application program may invoke this function explicitly if desired.

Invocation

CALL OPEN3270(return.code)

return.code must be an integer variable

Accepted

return.code   0

Rejected

return.code   1—Personal Computer 3270 Adapter not operational

Return Code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Example

```
' INITIALIZE THE DATA TRANSFER FACILITY
CALL OPEN3270(RC%)
```

Function: Close I/O Interface

The **close I/O interface** function concludes I/O to the display or to the host. When you exit from the BASIC interpreter by using the SYSTEM command or exit from a compiled BASIC program, the close I/O interface function is automatically executed. A BASIC application program may explicitly invoke this function at any time to terminate all I/O to the display.

Invocation

CALL CLOSE3270(return.code)

return.code must be an integer variable

Accepted.

return.code   0

This function is always accepted.

Example

```
' TERMINATE THE DATA TRANSFER FACILITY
CALL CLOSE3270(RC%)
```

Function: Set Terminal Mode

The **set terminal mode** function associates the keyboard and the display either with the program running in the personal computer or with the program running in the host.

In personal computer mode, the keyboard and the display are associated with a program running on the personal computer. The program receives all keystrokes, and the display shows the image from the personal computer display adapter. If you enter the mode switch key sequence at the keyboard (ALT and INSERT on most keyboards), the display station is switched to host computer mode.

In host computer mode, the keyboard and the display are associated with the host. The 3274 or 3276 control unit receives all keystrokes, and the display shows the image from the 3274 or 3276 control unit. If you enter the mode switch key sequence at the keyboard, the display is switched to personal computer mode.

Invocation

CALL MODE3270(mode,return.code)

mode and return.code must be integer variables

mode   0—Switch to host computer mode
mode   1—Switch to personal computer mode

Accepted

return.code   0

Rejected

return.code   3—Invalid mode value

return code 3 indicates that the mode value was not valid (0 or 1).

Example

```
' SWITCH TO HOST COMPUTER MODE
MODE%=0
CALL MODE3270(MODE%,RC%)
```

Function: Output Keystrokes to Display Station

The **output keystrokes** function sends keystrokes to the display as if the user were pressing the keys on the actual keyboard. The keystrokes are sent at a rate not exceeding 10 keystrokes per second.

This function automatically invokes the open I/O interface function.

Invocation

CALL WRITE3270(keystrokes,return.code)

keystrokes must be a string variable
return.code must be an integer variable

keystrokes   String variable containing keystroke encodings.
                       See Table A-1. When invoked from a program run-
                       ning under the BASIC interpreter, this variable can
                       contain from 1 to 255 keystroke encodings. When
                       invoked from a compiled BASIC program, this vari-
                       able can contain from 1 to 32767 keystroke
                       encodings.

Accepted

return.code   0

Rejected

return.code   1—IBM Personal Computer 3270 Adapter not
                           operational
return.code   4—Invalid keystroke encoding in the message
return.code   5—Keyboard is locked. The message may have been
                           partially received by the display station before
                           the keyboard became locked.
return.code   6—Power-on Reset received from display station

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or is not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 4, invalid keystroke encoding, indicates that the string variable is null or contains a keystroke encoding that is not valid for the type of keyboard attached to the personal computer. Table A-1 lists all the possible keystroke encodings. However, you may only output the encodings that correspond to actual keys on the keyboard that you are using. For example, the Typewriter/APL keyboards do not have PF13–PF24 keys. Therefore, you cannot output keystroke encodings corresponding to PF13–PF24 on a Typewriter/APL keyboard.

Return code 5, keyboard locked, is generated if the message cannot be sent to the display.

- If the keyboard locks because of a previously sent message, the message is automatically re-sent until it is accepted.

- If the keyboard locks because of any other condition, a RESET keystroke is sent, followed by the message. If the message is not accepted this time, a return code 5 results.

- If the keyboard locks during transmission of the message, a RESET keystroke is sent, followed by a BACK TAB keystroke, followed by the message. If this sequence fails 10 times, return code 5 results.

Return code 6, power on reset, indicates that the display was turned off and on, the Test/Normal switch was switched to Test and back to Normal, or the 3274 Control Unit went through the IML procedure. In this case, the connection to the host was probably lost. The application program should switch to host computer mode to allow the user to reestablish the host computer session.

Example

```
' OUTPUT KEYSTROKES TO THE DISPLAY
BUFFER$="THIS IS AN EXAMPLE FOR OUTPUT KEYSTROKES"+CHR$(&H8A)
CALL SEND3270(BUFFER$,RC%)
```

Function: Read Screen Image

The **read screen image** function reads the current host screen image from the display into a buffer. After invoking the read screen image function, the application program may retrieve the data from this buffer by invoking the receive screen image data function. When the application program has retrieved all the data it is interested in, the program must free the buffer by invoking the flush screen image buffer function.

This function automatically invokes the open I/O interface and flush screen image buffer functions.

Invocation

CALL GET3270(return.code)

return.code must be an integer variable

Accepted

return.code   0

Rejected

return.code	1—IBM Personal Computer 3270 Adapter not operational
return.code	5—Keyboard locked
return.code	6—Power on reset received from display station
return.code	7—User pressed the ATTN key

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed, or is not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 5, keyboard locked, indicates that the display did not accept the print screen keystroke from the personal computer.

Return code 7, attention received, indicates that you pressed the ATTN key on the keyboard before the screen image was received from the 3274 Control Unit.

Return code 6, power on reset, indicates that the display was turned off and on, the Test/Normal switch was switched to Test and back to Normal, or the 3274 Control Unit went through the IML procedure. In this case, the connection to the host was probably lost. The application program should switch to host computer mode to allow you to reestablish the host session.

Example

```
' READ THE CURRENT HOST COMPUTER SCREEN IMAGE

CALL GET3270(RC%)
```

Function: Receive Screen Image Data

The **receive screen image data** function retrieves one line of data from the host screen image buffer. This buffer may be empty or may contain a host screen image that results either when you press the Print Screen key on the keyboard or the application program invokes the read screen image function.

This function automatically invokes the open I/O interface function.

After the application program retrieves all the screen image data it is interested in, the program must invoke the flush screen image buffer function to make the screen image buffer available to receive more data.

Invocation

```
buffer=SPACE$(132)
CALL INPUT3270(line,length,return.code)
buffer=LEFT$(buffer,length)
```

line, length, and return.code must be integer variables
buffer must be a string variable

line	Integer variable containing the number of the line on the screen for which the data is to be retrieved. The top line of the screen is line 1.
buffer	String variable containing at least enough characters to contain one line of the data from the display station. For a 3278 Model 5 display station, the variable is 132 characters. For any other 3278 or 3279 display, the variable is 80 characters. The contents of this variable will be changed by this function. However, because of restrictions imposed by BASIC, the number of characters in this variable cannot be changed. The application program should truncate this variable to the number of characters returned in "length" after invoking this function.

Accepted

return.code	0—Entire line retrieved
return.code	9—Partial line retrieved
buffer	String variable containing the specified line of data from the host screen image.
length	Integer variable containing the length of the data returned. This value will vary from 0 to the current display station line width (40, 80, or 132 characters).

Return code 9, partial line retrieved, indicates that the entire display line does not fit in the specified string variable. The application program must initialize the string variable with enough characters to contain the display line and reinvoke the receive screen image data function to retrieve the entire display line.

Rejected

return.code	1—IBM Personal Computer 3270 Adapter not operational
return.code	6—Power on reset received from display station
return.code	8—Screen image buffer is empty
return.code	12—Invalid line number

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or is not operational, or that the POST for the Feature Bus interface portion of the adapter failed.

Return code 6, power on reset, indicates that the display was turned off and on, the Test/Normal switch was switched to Test and back to Normal, or the 3274 Control Unit went through the IML procedure. In this case, the connection to the host was probably lost. The application program should switch to host computer mode to allow you to reestablish the host computer session.

Return code 8, screen image buffer empty, indicates that the screen image does not contain any data. The application program may invoke the read screen image function to obtain a copy of the current host screen image, or reinvoke the receive screen image data function repeatedly until you press the Print Screen key (when a screen image will be received automatically).

Return code 12, invalid line number, indicates that the line number specified was not between 1 and the number of lines being displayed on the screen.

The data received by the application program will be character encodings compatible with the personal computer displays. Trailing blanks and nulls are removed from the data before it is moved into the specified string variable. See Tables F-7 and F-8 for the encodings used by this function.

Example

```
' OBTAIN THE CURRENT HOST COMPUTER SCREEN IMAGE
CALL GET3270 (RC%)
FOR LINE.NO%=1 TO 24
   BUFFER$=SPACE$(132)
   CALL INPUT3270(LINE.NO%,BUFFER$,LENGTH%,RC%)
   IF RC=0 THEN BUFFER$(LINE.NO%)=LEFT$(BUFFER$,LENGTH%)
NEXT
CALL FLUSH3270(RC%)
```

Function: Flush Screen Image Buffer

The **flush screen image buffer** function clears the screen image input buffer and makes it available to receive another screen image.

This function automatically invokes the open I/O interface function.

Invocation

CALL FLUSH3270(return.code)

return.code must be an integer variable

Accepted

return.code   0

Rejected

return.code   1—IBM Personal Computer 3270 Attachment
                          Adapter not operational

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Example

```
' CLEAR THE HOST COMPUTER SCREEN IMAGE BUFFER

CALL FLUSH3270 (RC%)
```

Function: Output Data to Host

The **output data** function sends a message containing one or more structured fields to a program running in the host.

This function automatically invokes the open I/O interface function.

This function requires a program running in the host that receives structured fields. For example, the PCXFER program sends and receives the structured fields specified in Appendix G.

Invocation

CALL WRITEHOST(message,return.code)

message must be a string variable
return.code must be an integer variable

message   String variable containing the structured field(s)
                 to be sent to the host. When invoked from a pro-
                 gram running under the BASIC interpreter, this
                 string may contain from 1 to 255 characters of data.
                 When invoked from a compiled BASIC program,
                 this string may contain from 1 to 2048 bytes of
                 data.

Accepted

return.code   0

Rejected

return.code   1–IBM Personal Computer 3270 Adapter not
                    operational
return.code   6–Power on reset received from display
return.code   7–User pressed the ATTN key
return.code   11–Message length is invalid

Return code 1, adapter not operational, indicates that the IBM
Personal Computer 3270 Adapter is not installed or not
operational, or that the POST for the feature bus interface por-
tion of the adapter failed.

Return code 6, power on reset, indicates that the display was turned off and on, the Test/Normal switch was switched to Test and back to Normal, or the 3274 Control Unit went through the IML procedure. In this case, the connection to the host was probably lost. The application program should switch to host computer mode to allow you to reestablish the host session.

Return code 7, attention received, indicates that you pressed the ATTN key on the keyboard before the message was sent to the host.

Return code 11, message length invalid, indicates that the string variable is null or contains more then 2048 bytes of data.

Example

```
' SEND A LISTFILE STRUCTURED FIELD
' TO THE HOST PROGRAM

FILENAME$="TEST"
BUFFER$=CHR$(&H00)+CHR$(11+LEN(FILENAME$))+
        CHR$(&HD0)+CHR$(&H11)+CHR$(&H11)+CHR$(&H01)+
        CHR$(&H04)+CHR$(&H40)+CHR$(&H11)+CHR$(&H03)+
        CHR$(1+LEN(FILENAME$))+FILENAME$
CALL SENDHOST(BUFFER$,RC%)
```

Function: Receive Data from Host

The **receive data** function retrieves structured field data that was received from a program running in the host.

This function automatically invokes the open I/O interface function.

If the application program wants to discard the remainder of the data (without receiving the data), it invokes the flush data buffer function to allow another structured field to be received from the host.

This function requires a program running in the host that sends structured fields. For example, the PCXFER program sends the structured fields specified in Appendix G.

Invocation

```
buffer=SPACE$(255)
CALL INPUTHOST (buffer,length,return.code)
buffer=LEFT$(buffer,length)
```

buffer must be a string variable
length and return.code must be integer variables

buffer   String variable containing the number of characters
                   you expect to receive. The contents of this variable
                   will be changed by this function. However, because
                   of restrictions imposed by BASIC, the number of
                   characters contained in this variable cannot be
                   changed. The application program should truncate
                   this variable to the number of characters returned in
                   "length" after invoking this function.

Accepted

return.code   0—Entire message received
return.code   9—Partial message received
buffer   String variable containing the structured field(s)
                   received from the host.

Return code 0, entire message received, indicates that the entire message has been received by the application program.

Return code 9, partial message received, indicates that the entire message does not fit in the specified string variable. The application program must repeatedly issue the receive data function until the return code is set to 0 to receive the entire message.

Rejected

return.code	1—IBM Personal Computer 3270 Adapter not operational
return.code	6—Power on reset received from display
return.code	8—No data waiting
return.code	10—Message lost
return.code	11—Message too long

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 6, power on reset, indicates that the display was turned off and on, the Test/Normal switch was switched to Test and back to Normal, or the 3274 Control Unit went through the IML procedure. In this case, the connection to the host was probably lost. The application program should switch to host computer mode to allow the user to reestablish the host computer session.

Return code 8, no data waiting, indicates that no data was received from the host.

Return code 10, message lost, indicates that data was received from the host while the application program was processing previous data. The second message is discarded.

Return code 11, message too long, indicates that the data received
from the host exceeds 2048 bytes. The entire message is discarded.

Example

```
' RECEIVE A STRUCTURED FIELD FROM A HOST PROGRAM

RC%=8
WHILE RC%=8
  RC%=9:INDEX%=0
  WHILE RC%=9
    INDEX%=INDEX%+1
    BUFFER$(INDEX%)=SPACE$(255)
    CALL INPUTHOST(BUFFER$(INDEX%),LENGTH%,RC%)
    IF RC<>8 THEN BUFFER$(INDEX%)=LEFT$(BUFFER$(INDEX%),LENGTH%)
  WEND
WEND
```

Appendix C. PASCAL
Application Program Interface

This appendix describes a program that provides an interface between
a personal computer application program written in PASCAL and the
data transfer facilities of the IBM 3270 Personal Computer Attach-
ment. (See Figure C-1.)

The data transfer interface provides facilities for selecting the mode of
the display, sending keystrokes to the display, retrieving the contents
of the display screen, and exchanging structured fields with a program
running in the host.
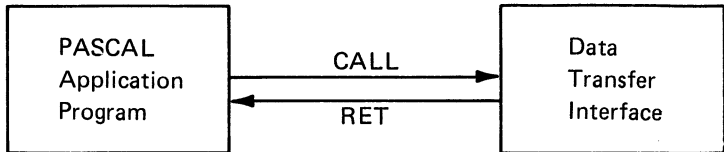
Figure C-1. Diagram of the PASCAL Application Program Interface

Using the Interface

The data transfer interface is contained in a separately compiled
object file called DT3270P.OBJ. This object file must be linked with
the compiled PASCAL program. The following command can be used
to combine a PASCAL application program called SAMPLE with the
data transfer interface module:

```
LINK SAMPLE+DT3270P;
```

To invoke any function in the data transfer interface, the PASCAL application program must declare all the entry points it wants to use as external functions:

```
FUNCTION OPEN3270:INTEGER;
  EXTERNAL;
FUNCTION CLOSE3270:INTEGER;
  EXTERNAL;
FUNCTION MODE3270(MODE:INTEGER):INTEGER;
  EXTERNAL;
FUNCTION WRITE3270(VAR KEYSTROKES:LSTRING):INTEGER;
  EXTERNAL;
FUNCTION GET3270:INTEGER;
  EXTERNAL;
FUNCTION INPUT3270(LINE:INTEGER;VAR BUFFER:LSTRING):INTEGER;
  EXTERNAL;
FUNCTION FLUSH3270:INTEGER;
  EXTERNAL;
FUNCTION WRITEHOST(VAR BUFFER:LSTRING):INTEGER;
  EXTERNAL;
FUNCTION INPUTHOST(VAR BUFFER:LSTRING):INTEGER;
  EXTERNAL;
FUNCTION FLUSHHOST:INTEGER;
  EXTERNAL;
```

To invoke a function in the data transfer interface, the PASCAL application program invokes the appropriate function:

```
' SWITCH THE DISPLAY TO HOST COMPUTER MODE

RC:=MODE3270(0);
```

Function: Open I/O Interface

The **open I/O interface** function allows I/O to be directed to the display or to an application program running in the host. The open I/O interface function is automatically invoked by all other functions in the data transfer interface except for set terminal mode. A PASCAL application program invokes this function explicitly if desired.

Declaration

```
FUNCTION OPEN3270:INTEGER;
   EXTERNAL;
```

Accepted

    value   0

Rejected

    value   1–IBM Personal Computer 3270 Adapter
                              not operational

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Example

```
'  INITIALIZE THE DATA TRANSFER FACILITY

RC:=OPEN3270;
```

Function: Close I/O Interface

The **close I/O interface** function concludes I/O to the display or to the host. When you exit from the application program, the close I/O interface function is automatically executed. A PASCAL application program explicitly invokes this function at any time to terminate all I/O to the display.

Declaration

```
FUNCTION CLOSE3270:INTEGER;
  EXTERNAL;
```

Accepted

value   0

This function is always accepted.

Example

```
' TERMINATE THE DATA TRANSFER FACILITY

RC:=CLOSE3270;
```

Function: Set Terminal Mode

The **set terminal mode** function associates the keyboard and the display either with the program running in the personal computer or with the program running in the host.

In personal computer mode, the keyboard and the display are associated with a program running in the personal computer. The program receives all keystrokes, and the display shows the image from the personal computer display adapter. If you enter the mode switch key sequence at the keyboard (ALT and INSERT on most keyboards), the display is switched to host computer mode.

In host computer mode, the keyboard and the display are associated with the host. The 3274 or 3276 control unit receives all keystrokes, and the display shows the image from the 3274 or 3276 control unit. If you enter the mode switch key sequence at the keyboard, the display is switched to personal computer mode.

Declaration

```
FUNCTION MODE 3270(mode:INTEGER):INTEGER;
   EXTERNAL;
```

mode may be any integer expression

| mode | 0—Switch to host computer mode |
| mode | 1—Switch to personal computer mode |

Accepted

value   0

Rejected

value   3—Invalid mode value

Return code 3 indicates that the mode value was not valid (0 or 1).

Example

```
' SWITCH TO HOST COMPUTER MODE

RC:=MODE3270(0);
```

Function: Output Keystrokes to Display

The **output keystrokes** function sends keystrokes to the display as if the user were pressing the keys on the actual keyboard. The keystrokes are sent at a rate not exceeding 10 keystrokes per second.

This function automatically invokes the open I/O interface function.

Declaration

```
FUNCTION WRITE3270(VAR keystrokes:LSTRING):INTEGER;
  EXTERNAL;
```

keystrokes   Lstring variable containing keystroke encodings. See Table A-1. This variable may contain from 1 to 255 keystroke encodings.

Accepted

value   0

Rejected

value   1—IBM Personal Computer 3270 Adapter not operational

value   4—Invalid keystroke encoding in the message

value   5—Keyboard is locked. The message might have been partially received by the display before the keyboard became locked.

value   6—Power on reset received from display

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 4, invalid keystroke encoding, indicates that the string variable is null or contains a keystroke encoding that is not valid for the type of keyboard attached to the personal computer. Table A-1 lists all the possible keystroke encodings. However, you can only output the encodings that correspond to actual keys on the keyboard you use. For example, the Typewriter/APL keyboards do not have PF13–PF24 keys. Therefore, you cannot output keystroke encodings corresponding to PF13–PF24 on a Typewriter/APL keyboard.

Return code 5, keyboard locked, is generated if the message cannot be sent to the display station:

- If the keyboard locks because of a previously sent message, the message is automatically re-sent until it is accepted.

- If the keyboard locks because of any other condition, a RESET keystroke is entered, followed by the message. If the message is not accepted this time, a return code 5 results.

- If the keyboard locks during transmission of the message, a RESET keystroke is entered, followed by a BACK TAB keystroke, followed by the message. If this sequence fails 10 times, return code 5 results.

Return code 6, power on reset, indicates that the display was turned off and on, the Test/Normal switch was switched to Test and back to Normal, or the 3274 Control Unit went through the IML procedure. In this case, the connection to the host was probably lost. The application program should switch to host computer mode to allow you to reestablish the host session.

Example

```
' OUTPUT KEYSTROKES TO THE DISPLAY

BUFFER:='THIS IS AN EXAMPLE FOR OUTPUT KEYSTROKES'*CHAR(#8A);
RC:=SEND3270(BUFFER)
```

Function: Read Screen Image

The **read screen image** function reads the current host screen image from the display into a buffer. After invoking the read screen image function, the application program retrieves the data from this buffer by invoking the receive screen image data function. When the application program retrieves all the data it is interested in, it must free the buffer by invoking the flush screen image buffer function.

This function automatically invokes the open I/O interface and flush screen image buffer functions.

Declaration

```
FUNCTION FLUSH3270:INTEGER:
  EXTERNAL;
```

Accepted

value   0

Rejected

value	1—IBM Personal Computer 3270 Adapter not operational.
value	5—Keyboard locked
value	6—Power on reset received from display
value	7—User pressed the ATTN key

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 5, keyboard locked, indicates that the display did not accept the Print Screen keystroke from the personal computer.

Return code 7, attention received, indicates that you pressed the ATTN key on the keyboard before the screen image was received from the 3274 Control Unit.

Return code 6, power on reset, indicates that the display was turned off and on, the Test/Normal switch was switched to Test and back to Normal, or the 3274 Control Unit went through the IML procedure. In this case, the connection to the host was probably lost. The application program should switch to host computer mode to allow you to reestablish the host session.

Example

```
' READ THE CURRENT HOST SCREEN IMAGE

RC:=GET3270;
```

Function: Receive Screen Image Data

The **receive screen image data** function retrieves one line of data from the host screen image buffer. This buffer may be empty or may contain a host screen image that results when either the user presses the Print Screen key on the keyboard or the application program invokes the read screen image function.

This function automatically invokes the open I/O interface function.

After the application program retrieves all the screen image data it is interested in, the program must invoke the flush screen image buffer function to make the screen image buffer available to receive more data.

Declaration

```
FUNCTION INPUT3270(line:INTEGER;VAR buffer:LSTRING):INTEGER;
   EXTERNAL;
```

line   Integer expression specifying the number of the line on the screen for which the data is to be retrieved. The top line of the screen is line 1.

Accepted

value	0–Entire line retrieved
value	9–Partial line retrieved
buffer	Lstring variable set to the specified line of data from the host screen image. The length of this variable will be set to the length of the data returned. This value will vary from 0 to the current display line width (40, 80, or 132 characters).

Return code 9, partial line retrieved, indicates that the entire display line does not fit in the specified lstring variable. The application program must reinvoke the receive screen image data function with a large lstring variable to retrieve the entire display line.

Rejected

value	1–IBM Personal Computer 3270 Adapter not operational
value	6–Power on reset received from display
value	8–Screen image buffer is empty
value	12–Invalid line number

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 6, power on reset, indicates that the display was turned off and on, the Test/Normal switch was switched to Test and back to Normal, or the 3274 Control Unit went through the IML procedure. In this case, the connection to the host was probably lost. The application program should switch to host computer mode to allow you to reestablish the host session.

Return code 8, screen image buffer empty, indicates that the screen image buffer does not contain any data. The application program may invoke the read screen image function to obtain a copy of the current host screen image, or reinvoke the receive screen image data function repeatedly until you press the Print Screen key. Then, a screen image will be received automatically.

Return code 12, invalid line number, indicates that the line number specified was not between 1 and the number of lines being displayed on the screen.

The data received by the application program will be character encodings compatible with the personal computer displays. Trailing blanks and nulls are removed from the data before it is moved into the specified string variable. See Tables F-3 and F-4 for the encodings used by this function.

Example

```
' OBTAIN THE CURRENT HOST SCREEN IMAGE

RC:=GET3270;
FOR LINE_NO:=1 24 DO
   RC:=INPUT3270(LINE_NO,BUFFER[LINE_NO1]);
RC:=FLUSH3270
```

Function: Flush Screen Image Buffer

The **flush screen image buffer** function clears the screen image input buffer and makes it available to receive another screen image.

This function automatically invokes the open I/O interface function.

Declaration

```
FUNCTION FLUSH3270:INTEGER;
  EXTERNAL;
```

Accepted

value   0

Rejected

value   1—IBM Personal Computer 3270 Adapter not
                         operational

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Example

```
' CLEAR THE HOST SCREEN IMAGE BUFFER

RC:=FLUSH3270;
```

Function: Output Data to Host

The **output data** function sends a message containing one or more structured fields to a program running in the host.

This function automatically invokes the open I/O interface function.

This function requires a program running on the host that receives structured fields. For example, the PCXFER program sends and receives the structured fields specified in Appendix G.

Declaration

```
FUNCTION WRITEHOST(VAR message:LSTRING):INTEGER;
  EXTERNAL;
```

message   Lstring variable containing the structured field(s) to be sent to the host. This string may contain from 1 to 255 characters of data.

Accepted

value   0

Rejected

value   1—IBM Personal Computer 3270 Adapter not operational

value   6—Power on reset received from display

value   7—User pressed the ATTN key

value   Message length is invalid

Return code 1, adapter not operational, indicates that the IBM Personal computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 6, power on reset, indicates that the display was turned off and on, the Test/Normal switch was switched to Test and back to Normal, or the 3274 Control Unit went through the IML procedure. In this case, the connection to the host was probably lost. The application program should switch to host computer mode to allow you to reestablish the host session.

Return code 7, attention received, indicates that you pressed the ATTN key on the keyboard before the message was sent to the host.

Return code 11, message length invalid, indicates that the string variable is null.

Example

```
' SEND A LISTFILE STRUCTURED FIELD TO THE HOST PROGRAM

FILENAME:='TEST';
BUFFER  := CHAR(#00)*CHAR(11+FILENAME.LEN)*
           CHAR(#D0)*CHAR(#11)*CHAR(#11)*CHAR(#01)*
           CHAR(#04)*CHAR(#40)*CHAR(#11)*CHAR(#03)*
           CHAR(1+FILENAME.LEN)*FILENAME;
RC:=SENDHOST(BUFFER)
```

Function: Receive Data from Host

The **receive data** function retrieves structured field data that was received from a program running in the host.

This function automatically invokes the open I/O interface function.

If the application program wants to discard the remainder of the data (without receiving it), it can invoke the flush data buffer function to allow another structured field to be received from the host.

This function requires a program running in the host that sends structured fields. For example, the PCXFER program sends the structured fields specified in Appendix G.

Declaration

```
FUNCTION INPUTHOST(VAR buffer:LSTRING):INTEGER;
  EXTERNAL;
```

Accepted

value	0—Entire message received
value	9—Partial message received
buffer	Lstring variable set to the structured field(s) received from the host. The length of this variable will be set to the number of characters received.

Return code 0, entire message received, indicates that the entire message does not fit in the specified lstring variable. The application program must repeatedly issue the receive data function until the return code is set to 0 to receive the entire message.

Rejected

value	1—IBM Personal Computer 3270 Adapter not operational
value	6—Power on reset received from display
value	8—No data waiting
value	10—Message lost
value	11—Message too long

Return code 1, adapter not operational, indicates that the IBM Personal Computer 3270 Adapter is not installed or not operational, or that the POST for the feature bus interface portion of the adapter failed.

Return code 6, power on reset, indicates that the display was turned off and on, the Test/Normal switch was switched to Test and back to Normal, or the 3274 Control Unit went through the IML procedure. In this case, the connection to the host was probably lost. The application program should switch to host computer mode to allow you to reestablish the host session.

Return code 8, no data waiting, indicates that no data was received from the host.

Return code 10, message lost, indicates that data was received from the host while the application program was processing previous data. The second message is discarded.

Return code 11, message too long, indicates that the data received from the host exceeds 2048 bytes. The entire message is discarded.

Example

```
' RECEIVE A STRUCTURED FIELD FROM A HOST PROGRAM

REPEAT
  INDEX:=0;
  REPEAT
    INDEX:=INDEX+1;
    RC:=INPUTHOST(BUFFER[INDEX])
  UNTIL RC<>9
UNTIL RC<>8;
```

Function: Flush Data Buffer

The **flush data buffer** function clears the host data buffer and makes it available to receive another structured field from the host program.

This function automatically invokes the open I/O interface function.

Declaration

```
FUNCTION FLUSHHOST:INTEGER;
  EXTERNAL;
```

Accepted

value   0

Rejected

value   1–IBM Personal Computer 3270 Adapter not
                             operational

Return code 1, adapter not operational, indicates that the IBM
Personal Computer 3270 Adapter is not installed or not operational,
or that the POST for the feature bus interface portion of the adapter
failed.

Example

```
' CLEAR THE HOST DATA BUFFER
RC:=FLUSHHOST;
```

Appendix D. IBM Personal Computer 3270 Attachment Option

The IBM Personal Computer 3270 Attachment Option provides a variety of interfaces between the system unit and the host-system-connected display station. These interfaces enable the display station to communicate either with the system unit or with the host processing system, and permit data transfers between personal computer and host system applications.

The IBM Personal Computer 3270 Attachment Option contains various control and status registers that are accessible to the personal computer (via the Personal Computer I/O channel interface) or to the host system (via the 3278/3279 feature bus interface). In addition, a 256x8-bit buffer on the IBM Personal Computer 3270 Attachment Option is accessible to both personal computer and host programs (although not simultaneously) for data transfer operations. Another portion of the IBM Personal Computer 3270 Attachment Option provides a 3278/3279 keyboard interface with either the system unit or the display.

The IBM Personal Computer 3270 Attachment Option also contains diagnostic circuitry which allows the testing of the IBM Personal Computer 3270 Attachment Option internal buses and control/status registers. (These read-write tests can be performed only when the IBM Personal Computer 3270 Attachment Option is in diagnostic mode, with the feature bus in/out cable removed from the distribution box at the rear of the system unit.)

Figure D-1 is a block diagram of the IBM Personal Computer 3270 Attachment Option. The IBM Personal Computer interface with the IBM Personal Computer 3270 Attachment Option is described under the headings "Register Descriptions" and "Operations."

Interfaces

Information about the Personal Computer I/O channel interface is provided in the *IBM Personal Computer Technical Reference* manual (6025005).

All Personal Computer I/O channel interface lines are located at the 62-pin bottom connector on the IBM Personal Computer 3270 Attachment Option. All other interface lines are located at the 79-pin D-shell connector at the rear of the IBM Personal Computer 3270 Attachment Option.

Figures D-2 through D-5 illustrate the cable pin connections for the IBM Personal Computer 3270 Attachment Option card and the distribution box.

Figure D-1. Block Diagram of IBM Personal Computer 3270 Attachment Option

3278/3279 I/O 25-Pin D — **Dist Box A Conn 25-Pin D** — **Personal Computer Card Conn**

25-Pin D (I/O)	Signal	Dist Box A 25-Pin D	Card Conn
1		1	
2	+ Scan Bit 6 Out	2	7
3	+ Scan Bit 2 Out	3	9
4	− KB Ack	4	3
5	+ Clicker	5	1
6	Make Break Out	6	30
7	+ Ident Bit 3	7	
8	+ Scan Bit 1 Out	8	36
9	− Data Avail Out	9	56
10	+ Scan Bit 3 Out	10	60
11	DC Return	11	
12	+ Scan Bit 5 Out	12	66
13		13	65
14	+ Scan Bit 4 Out	14	6
15		15	
16	+ 5 Vdc	16	
17	+ Ident Bit 0	17	
18	+ Ident Bit 1	18	
19	− 5 Vdc	19	
20	+ 8.5 Vdc	20	
21	− Pwr On Reset	21	55
22	+ Ident Bit 2	22	
23	+ Scan Bit 0 Out	23	59
24		24	
25		25	63

(To 3278 or 3279) Keyboard Out

External Cable

Keyboard DIN Conn
| 2 | + Kybd Data |
| 1 | − Req/Clk |

3278/3279 Keyboard Conn — **Dist Box C Conn 25-Pin D**

Signal	Dist Box C 25-Pin D	Keyboard In
	1	
+ Scan Bit 6	2	12
+ Scan Bit 2	3	11
− KB Ack Out	4	5
+ Clicker Out	5	2
+ Make Break	6	31
+ Ident Bit 3	7	28
+ Scan Bit 1	8	29
− Data Avail	9	54
+ Scan Bit 3	10	58
DC Return	11	62
+ Scan Bit 5	12	64
	13	
+ Scan Bit 4	14	8
	15	
+ 5 Vdc	16	4
+ Ident Bit 0	17	35
+ Ident Bit 1	18	34
− 5 Vdc	19	
+ 8.5 Vdc	20	
− Pwr On Reset	21	32
+ Ident Bit 2	22	57
+ Scan Bit 0	23	61
	24	
	25	

(From 3278/3279 Keyboard) Keyboard In

External Cable — Keyboard Cables

Figure D-2. 3278/3279 Keyboard Cable Pin Connections

3278/3279 Rear I/O 37-Pin D	Dist Box B Conn 37-Pin D		Personal Computer Card Conn	
6	1		68	+ FBO 3
13	2		70	+ FBO 4
9	3		72	+ FBO 6
17	4		74	+ FBO 8
19	5		76	+ FBO 11
1	6		78	− Feature Clock
14	7		51	− FBI 3
21	8		52	− FBI 5
3	9		53	− FBI 8
23	10		50	− FBI 10
18	11		49	+ FBO 2
28	12		27	+ FBO 5
2	13		25	+ FBO 7
7	14		23	+ FBO 9
25	15		21	+ FBO 10
24	16		19	− FBI 2
4	17		17	− FBI 4
11	18		15	− FBI 6
5	19		13	− FBI 7
30	20		67	− FBI 9
8	21		69	− Feature Response
29	22		71	− Acknowledge
10	23		73	+ PC Clock Out
16	24		75	− Analog Sw Cntl
15	25		77	(+3278)/(−3279)
32	26		79	− Present Poll
31	27	Diagn Intrlk	45	− Gate Test Select
12	28		46	− Poll Request
22	29		48	− Strobe Feat Bus Out
20	30		47	− Reset Feat
27	31		26	Signal Ground
26	32		24	− FBO Poll Request
	33	Spare	22	
	34	Spare	20	
	35	TP Ser 2	18	
	36	TP Ser 1	16	
	37	TP L0, L1, L2	14	

Feature Bus Cable

Feature Bus Signal Cable

Figure D-3. 3278/3279 Feature Bus Cable Pin Connections

3278/3279 Rear I/O 15-Pin D   **Personal Computer Card Conn 9-Pin D**

15-Pin D	Signal	9-Pin D
1	+ Green	4
2	+ Blue	5
3	+ Hi Int	6
4	+ Vert Ret	9
5	+ Red	3
6	+ Horiz Ret	8
7	Sig Ground	2
8	+ Gate Test	1
9	+ Video	7
10		
11		
12		
13		
14		
15		
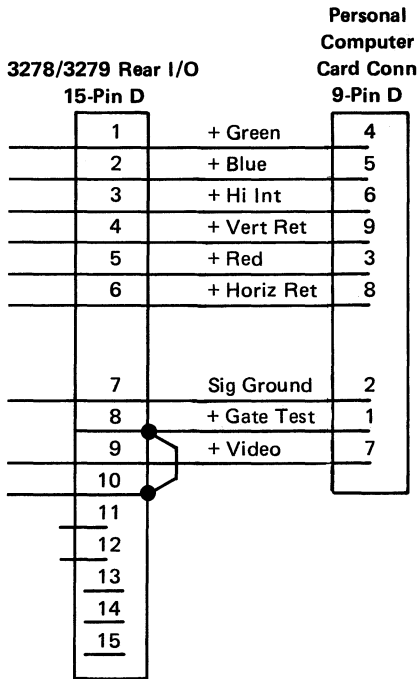
Figure D-4. Video Cable Pin Connections

Pin 1
Pin 28
Pin 79
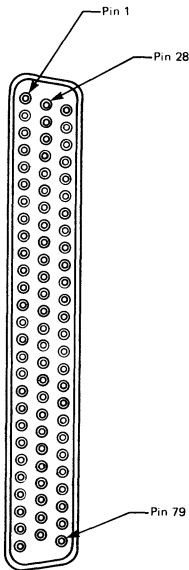
Figure D-5. IBM Personal Computer 3270 Attachment 79–Pin
Connector

3270 Attachment Option   D-7

Register Descriptions

The IBM Personal Computer 3270 Attachment Option registers des-
cribed here include personal computer and feature-bus-accessible con-
trol and status registers, the 256x8-bit random access storage (RAM)
buffer, registers within the keyboard interface module (for example,
Intel[1] 8255), and the diagnostic buffer and register. (See Figure D-1.)

Personal Computer Addressing of Registers

These accessible IBM Personal Computer 3270 Attachment Option
registers and buffers (except the 256x8-bit buffer) reside in personal
computer processor I/O address space. The 256x8-bit RAM buffer,
in turn, resides in personal computer memory space.

---

[1]Trademark of Intel Corporation

Following is the personal computer addressing scheme for the personal-computer-accessible IBM Personal Computer 3270 Attachment Option registers and buffers.

Address (Space) (in hexadecimal)	Register/Buffer	Personal Computer Function
3E0 (I/O)	Keyboard input register (port A of Intel 8255 module)	Read
3E1 (I/O)	Keyboard output register (port B of Intel 8255 module)	Write
3E2 (I/O)	Keyboard control register (port C of Intel 8255 module)	Read/write
3E3 (I/O)	Keyboard command register (command port of Intel 8255 module)	Write
3E4 (I/O)	IBM Personal Computer 3270 Attachment Option command register	Write
3E4 (I/O)	IBM Personal Computer 3270 Attachment Option status register	Read
3E5 (I/O)	Keyboard serializer register	Write
3E5 (I/O)	Start op modifier register	Read
3E6 (I/O)	Diagnostic register — Feature bus out	Write
3E6 (I/O)	Diagnostic buffer — Feature bus in	Read
3E7 (I/O)	Diagnostic register — Feature bus out	Write
3E7 (I/O)	Diagnostic buffer — Feature bus in	Read
E4000-E40FF (MEM)	256x8-bit RAM buffer	Read/write

Personal-Computer-Accessible Registers/Buffers

The following registers/buffers are read from, or written to, only the personal computer I/O channel data bus.

Keyboard Interface Registers

The IBM Personal Computer 3270 Attachment Option uses the Intel 8255 programmable peripheral interface module to interface with the keyboard, with the display keyboard input socket, and with the analog switch control. The internal registers within the programmable peripheral interface module are referred to herein as *I/O ports*. Following is a summary of the keyboard interface assignments for the programmable peripheral interface module.

8255 Port	Personal Computer Function	Hexadecimal I/O Address
A	3278/3279 Keyboard In	3E0
B	3278/3279 Keyboard Out	3E1
C	Status and Control	3E2
D	Command	3E3

Descriptions of the functions of the Intel 8255 internal registers follow:

3278/3279 Keyboard In (Port A, Mode 1 Input Only): Each keyboard scan code is placed in this register as the key is pressed by the operator. An interrupt is generated when the register is loaded.

3278/3279 Keyboard Out (Port B, Mode 1 Output Only): Scan code written to this register is passed through the keyboard out register to the display, as though the keyboard were directly attached to the display.

3278/3279 Status and Control (Port C, Read-Write): This register is used to report keyboard status and to provide keyboard and display control.

Bit assignments for read-only operations (for example, status) are as follows:

Bit	Value	Meaning
7	X (Don't care)	(Most significant bit) Reserved
6	X (Don't care)	Reserved
5	0/1	Keyboard data status: 0 = No data available 1 = Data available
4	0/1	Port A interrupt: 0 = Interrupt disabled 1 = Interrupt enabled
3	0/1	Port A interrupt status: 0 = No IRQ 1 = IRQ — keyboard data available
2	0/1	Port B interrupt: 0 = Disabled 1 = Enabled
1	0/1	Port B output buffer status: 0 = Full 1 = Empty
0	0/1	(Least significant bit) Port B interrupt status: 0 = No IRQ 1 = IRQ — Display keyboard output register available

Bit assignments for write-only operations (for example, control) are as follows:

Bit	Value	Meaning
7	0/1	(Most significant bit) Select buffer image: 0 = Display personal computer image buffer 1 = Display host computer image buffer
6	0/1	Select keyboard input: 0 = Select keyboard data when reading port A 1 = Select keyboard ID when reading port A
5	X (Don't care)	Reserved
4	0/1	Port A interrupt control: 0 = Disable 1 = Enable
3	X (Don't care)	Reserved
2	0/1	Port B interrupt control: 0 = Disable 1 = Enable
1	0/1	Port B output buffer status: 0 = Full 1 = Empty
0	X (Don't care)	(Least significant bit) Reserved

3278/3279 Command (Command Port): The Intel 8255 command register controls the Host Processor switch and enables/disables interrupts from the display.

Listed below are the possible values for the command register:

Hex Value	Command
03	No Output Character Available (turns on bit 1, port C)
04	Disable Interrupt from Display (turns off bit 2, port C)
05	Enable Interrupt from Display (turns on bit 2, port C)
08	Disable Interrupt from Keyboard (turns off bit 4, port C)
09	Enable Interrupt from Keyboard (turns on bit 4, port C)
0E	Switch Display to Personal Computer Mode (turns off bit 7, port C)
0F	Switch Display to Host Computer Mode (turns on bit 7, port C)

Adapter Command Register

This 1-byte (that is, 8-bit), write-only register resides at personal computer I/O address hexadecimal (hex) 3E4. Listed below are the register bit values and their associated command assignments:

Bits 7654 3210	Hex Value	IBM Personal Computer 3270 Attachment Option Command
0000 0000	00	Turn off Personal Computer Keyboard Output Interrupt Flag
0000 0001	01	Operation Complete
0000 0010	02	Operation Complete for Read Sequence (3274 can read data from adapter buffer)
0000 0011	03	Request Read from 3274
0000 0100	04	Screen Capture Complete
0000 0101	05	Screen Capture in Process
0000 0110	06	Turn Off the IBM Personal Computer Attachment 3270 Option Diagnostic Mode
0000 0111	07	Turn On IBM Personal Computer Attachment 3270 Option Diagnostic Mode

Bits 7654 3210	Hex Value	IBM Personal Computer 3270 Attachment Option Command
0000 1000	08	Turn Off Keyboard Clicker
0000 1001	09	Turn on Keyboard Clicker
0000 1010	0A	Disable IBM Personal Computer 3270 Attachment Option Keyboard Out Interface to Display
0000 1011	0B	Enable IBM Personal Computer 3270 Attachment Option Keyboard Out Interface to Display
0000 1100	0C	IBM Personal Computer 3270 Attachment Option Feature Bus Interface Disabled
0000 1101	0D	IBM Personal Computer 3270 Attachment Option Feature Bus Interface Enabled
0000 1110	0E	Reset Command (same as system reset from system unit except does not reset 8255 or 'serial port busy' latches)
0000 1111	0F	Reserved

IBM Personal Computer 3270 Attachment Option Status Register

This 1-byte, read-only register resides at personal computer I/O address hex 3E4. Listed below are the bit assignments for this register:

Bit   **Description**

7   (Most significant bit) Reserved (always 0).

6   Poll request active. This bit is a 1 when a poll request is active. It is reset when the acknowledge for the poll is received.

5   Display type. This bit is a 1 for a 3278 display and a 0 for a 3279 display.

4   Personal Computer keyboard output busy. This bit is a 1 when the keyboard serializer is busy. It is reset when the register becomes available or with personal computer reset.

3   Personal Computer keyboard output interrupt. This bit is a 1 when the keyboard serializer has completed sending a character. It is reset by the IBM Personal Computer 3270 Attachment Option command 00 to 0E, or with personal computer reset.

2   Start op interrupt. This bit is a 1 when the start op modifier register has been loaded from 'feature bus out'. The bit is reset when the start op modifier register is read by the personal computer or with personal computer reset, or IBM Personal Computer 3270 Attachment Option command 0E.

1   IBM Personal Computer 3270 Attachment Option keyboard-out interrupt. This bit is a 1 when the IBM Personal Computer 3270 Attachment Option keyboard-out register (8255 port B) is available to accept another character from the personal computer data bus. This bit is reset when data is sent to the register (via a personal computer command) or by personal computer reset.

Bit	Description

0   (Least significant bit) Keyboard data avail interrupt. This bit is a 1 when the IBM Personal Computer 3270 Attachment Option has received a character from the 3278/3279 keyboard via the keyboard-in register (8255 port A). This bit is reset when the data is read from the IBM Personal Computer 3270 Attachment Option or with personal computer reset.

Keyboard Serializer Register

This 1-byte, write-only register resides at personal computer I/O address hex 3E5. The data written into this register is serialized and sent to the keyboard socket of the Personal Computer system unit.

Note: Writing into the keyboard serializer sets (to logic 1) the personal computer keyboard output busy (bit 4) of the IBM Personal Computer 3270 Attachment Option status register. When serialization is completed, bit 4 is reset (to logic 0) and bit 3 (Personal Computer keyboard output interrupt) of that register is set.

Data is sent from the keyboard serializer as follows: first, a parity bit (always 1) is sent; next, data is sent starting with the least significant bit, followed by the next least significant bit, etc..... up to the most significant bit data bit.

The keyboard serializer also responds to a reset command from the IBM Personal Computer keyboard port. The command is X'FF'; the response is X'AA'. Then, Interrupt IRQ 2 turns on with status register bit 3 on.

Start Op Modifier Register

This 1-byte, read-only register resides at personal computer I/O address hex 3E5. This register is used to pass control information between the 3274 Control Unit and the personal computer during data transfers. This register is loaded from 'feature bus out' with a Start On command.

Note: Loading this register sets bit 2 (Start Op Interrupt) of the IBM Personal Computer 3270 Attachment Option status register. That bit is reset when the personal computer reads the start op modifier register.

Listed below are the register bit values for the start op modifier register.

Bits 7654 3210	Hex Value	IBM Personal Computer 3270 Attachment Option Command
0000 0000	00	Reserved
0000 0001	01	Display Power On Reset
0000 0010	02	Read Operation
0000 0011	03	Write Operation
0000 0100	04	Execute
0000 0101	05	Abort Transfer
0000 0110	06	Abort to Last Verify
0000 0111	07	Error
0000 1000	08	Verify Data
0000 1001	09	Reserved
0000 1010	0A	Reserved
0000 1011	0B	Reserved
0000 1100	0C	Reserved
0000 1101	0D	Reserved
0000 1110	0E	Reserved
0000 1111	0F	Reserved

IBM Personal Computer 3270 Attachment Option Diagnostic Register

This 15-bit-wide register can be written to by the personal computer only when the IBM Personal Computer 3270 Attachment Option is in diagnostic mode.

Note: The diagnostic register can be accessed only in IBM Personal Computer 3270 Attachment Option diagnostic mode, with the feature bus in/out cable removed from the distribution box attached to the rear of the system unit.

The lines driven by the diagnostic register at personal computer I/O address hex 3E6 are:

Bit	Function
7	Feature Bus Out bit 10
6	Feature Bus Out bit 11
5	Strobe Feature Bus Out
4	Acknowledge
3	Reset
2	Present Poll
1	FBO Poll Request
0	Reserved

The lines driven by the diagnostic register at personal computer I/O address hex 3E7 are:

Bit	Function
7	Feature Bus Out bit 2
6	Feature Bus Out bit 3
5	Feature Bus Out bit 4
4	Feature Bus Out bit 5
3	Feature Bus Out bit 6
2	Feature Bus Out bit 7
1	Feature Bus Out bit 8
0	Feature Bus Out bit 9

IBM Personal Computer 3270 Attachment Option Diagnostic Buffer

The diagnostic buffer receives nine lines from the IBM Personal Computer 3270 Attachment Option 'feature bus in', and three feature control lines.

Note: The diagnostic buffer can be accessed only in the IBM Personal Computer 3270 Attachment Option diagnostic mode, with the feature bus in/out cable removed from the distribution box.

These are the lines that are read from personal computer I/O address
hex 3E6:

Bit	Function
7	Feature Bus In bit 10
6	Feature Response
5	Poll Request
4	Analog Switch Control
3	Reserved
2	Reserved
1	Reserved
0	Reserved

These are the lines that are read from personal computer I/O address
hex 3E7:

Bit	Function
7	Feature Bus In bit 2
6	Feature Bus In bit 3
5	Feature Bus In bit 4
4	Feature Bus In bit 5
3	Feature Bus In bit 6
2	Feature Bus In bit 7
1	Feature Bus In bit 8
0	Feature Bus In bit 9

IBM Personal Computer 3270 Attachment Option RAM Buffer

Resident on the IBM Personal Computer 3270 Attachment Option is
a 256x8-bit RAM buffer. It resides in the personal computer memory
address space, starting at the base address of hex E4000. The buffer
can be written to or read from either by the personal computer or by
a Feature Bus command, but not simultaneously. The personal com-
puter may access the buffer only from the time the IBM Personal
Computer 3270 Attachment Option receives a Start Op command
until the personal computer responds with an Operation Complete
hex 01 and Operation Complete for Read hex 02 command. If the
personal computer violates this restriction, the contents of the buffer
will not be modified, and the personal computer will NOT be informed
of the violation. The data that was read will be invalid, and the data

written ignored, if the personal computer was doing a write-memory operation. The only other time that the personal computer has access to the RAM buffer is when the 'feature bus interface enabled' latch has been reset. At all other times, the buffer is dedicated to the feature bus.

Operations

Keyboard In

This function interfaces the keyboard with the personal computer. The interface is asynchronous in that when the keyboard has a character to send it activates the 'data avail' line. The keyboard expects an acknowledgment from the personal computer. If another key is pressed on the keyboard before the first one is read in, the keyboard will buffer the second character. The keyboard contains a 2-character buffer. If the buffer overflows, the keyboard forces the overrun scan code (hex 00) into the keyboard buffer. The scan code for the key pressed is valid from the keyboard under the 'data avail' window.

The Intel 8255 module is the main device used to interface with the keyboard. In the initialization program it has been first set to read the keyboard ID. This ID is a 4-bit code that tells the software which type of keyboard is attached.

For normal operation after initialization, the 8255 port A is set up for strobed input. When the 'data avail' line from the keyboard becomes active, the eight scan bits are loaded into the 8255. The 8255 responds by activating the 'Kb ack' line. A pulse synchronizer is used to ensure that the maximum length of the 'Kb ack' line is only 420 nanoseconds (ns). When the software reads port A of the 8255, the 'data avail' line from the 8255 is deactivated. If a second key is pressed before the 8255 has been read, the strobe line to the 8255 is blocked and 'Kb ack' withheld. In this way, the keyboard buffers the keystrokes. The 8255 also generates an interrupt to the personal computer when a character has been read into the 8255.

The clicker line from the display is either passed through to the keyboard in host computer mode or controlled by a command in the personal computer software in personal computer mode.

Keyboard Out

This interface sends keystrokes from the personal computer to the display and is fully asynchronous. Port B of the 8255 is used in strobed output mode to send data to the display. After a character is loaded into the 8255, the 8255 activates the 'data avail out' line. The display responds by activating 'Kb ack out' and deactivating 'data avail out', causing the 8255 to activate the interrupt request. This interrupt signals that the 8255 is available to receive more data.

To avoid sending erroneous data to the display during IPL and reconfiguration of the 8255, the 'data avail out' line is gated with the display gate latch. When the latch is set, data is enabled to be sent to the display.

Keyboard Serializer

The keyboard serializer formats the keyboard data to be sent to the personal computer. After a keystroke has been read in from the 3278/3279 keyboard, the personal computer software determines where to send the data. If the display station is in personal computer mode, the keystroke is mapped by the software to a corresponding personal computer keyboard scan code. Next, the new scan code is sent to the keyboard serializer. When a character is sent to the serializer, the personal computer Kbd Output Busy bit becomes active in the IBM Personal Computer 3270 Attachment Option status register. The data is serialized as follows. First, a 1 bit is sent. Next, the eight data bits are sent with the least significant bit first. Finally, after all the bits have been sent, the personal computer Kbd Output Busy bit is reset and the personal computer Kbd Output Interrupt bit in that register becomes set.

Feature Command, Decode and Execution

The IBM Personal Computer 3270 Attachment Option interfaces with 3278/3279 feature bus to enable the transfer of data between the personal computer and the display. The interface contains two unidirectional buses and various control lines. Commands and data are sent to the IBM Personal Computer 3270 Attachment Option over 3278/3279 Feature Bus Out, and data is sent to the display over 3278/3279 Feature Bus In.

Commands are sent to the IBM Personal Computer 3270 Attachment Option in the following manner:

1. The IBM Personal Computer 3270 Attachment Option address and command are placed on 'feature bus out'.

2. The display activates the '-strobe FBO'.

3. The IBM Personal Computer 3270 Attachment Option checks for address hex 5, and checks whether the command is valid and the parity good.

4. The IBM Personal Computer 3270 Attachment Option responds with '-feature response' if the above conditions are met. If the conditions are not met, the display will time out because the IBM Personal Computer 3270 Attachment Option did not respond.

5. The command is executed by the IBM Personal Computer 3270 Attachment Option.

   a. If the command is a read type, the IBM Personal Computer 3270 Attachment Option places the appropriate data on 'feature bus in'. For a multibyte read, up to four bytes of data are sent, depending on the two low-order bits in the BAR.

   b. If the command is a write type, the IBM Personal Computer 3270 Attachment Option stores the data from 'feature bus out' in the appropriate RAM buffer location. The display responds with additional 'strobe FBO' lines for each byte to be transferred. Data parity is always checked.

Logic Diagrams

Figures D-6 through D-22 show the logic for the IBM Personal Computer 3270 Adapter.

EXIT

PG A007 {
+ DATA BIT 0 ——————— A09
+ DATA BIT 1 ——————— A08
+ DATA BIT 2 ——————— A07
+ DATA BIT 3 ——————— A06
+ DATA BIT 4 ——————— A05
+ DATA BIT 5 ——————— A04
+ DATA BIT 6 ——————— A03
+ DATA BIT 7 ——————— A02
}
PG A013 + IRQ2 ——————— B04

ENTER

A31 ——————— ADDRESS BIT 0 ⎫
A30 ——————— ADDRESS BIT 1 ⎪
A29 ——————— ADDRESS BIT 2 ⎪
A28 ——————— ADDRESS BIT 3 ⎬ PG A003
A27 ——————— ADDRESS BIT 4 ⎪
A26 ——————— ADDRESS BIT 5 ⎪
A25 ——————— ADDRESS BIT 6 ⎪
A24 ——————— ADDRESS BIT 7 ⎭

A23 ——————— ADDRESS BIT 8 PG A003
A22 ——————— ADDRESS BIT 9 PG A003
A21 ——————— ADDRESS BIT 10 ⎫
A20 ——————— ADDRESS BIT 11 ⎪
A19 ——————— ADDRESS BIT 12 ⎪
A18 ——————— ADDRESS BIT 13 ⎬ PG A005
A17 ——————— ADDRESS BIT 14 ⎪
A16 ——————— ADDRESS BIT 15 ⎭

A15 ——————— ADDRESS BIT 16 ⎫
A14 ——————— ADDRESS BIT 17 ⎪
A13 ——————— ADDRESS BIT 18 ⎬ PG A005
A12 ——————— ADDRESS BIT 19 ⎭

B20 ——————— PC CLOCK PG A003
B02 ——————— + RESET DRV PG A003
B14 ——————— - IOR PG A003, 005
B12 ——————— - MEMR PG A005
B11 ——————— - MEMW PG A010
A11 ——————— - AEN PG A005
B13 ——————— - IOW PG A003

B03,29 ——————— + 5 VOLTS
B01,10,31 ——————— GROUND

Figure D-6. Personal Computer Adapter (Personal Computer I/O PG A001)
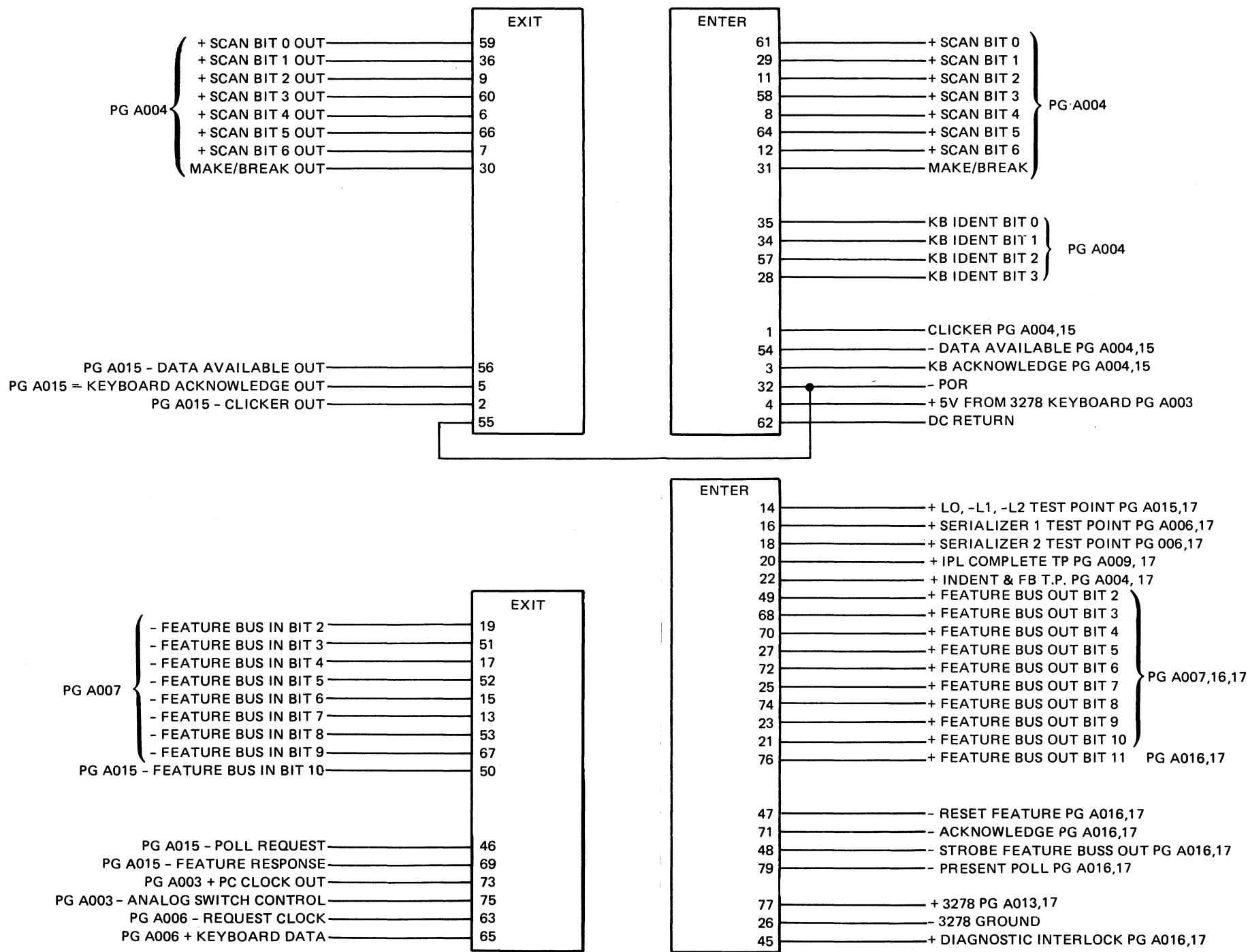
Figure D-7. Personal Computer Adapter (Keyboard and Feature Bus PG A002)
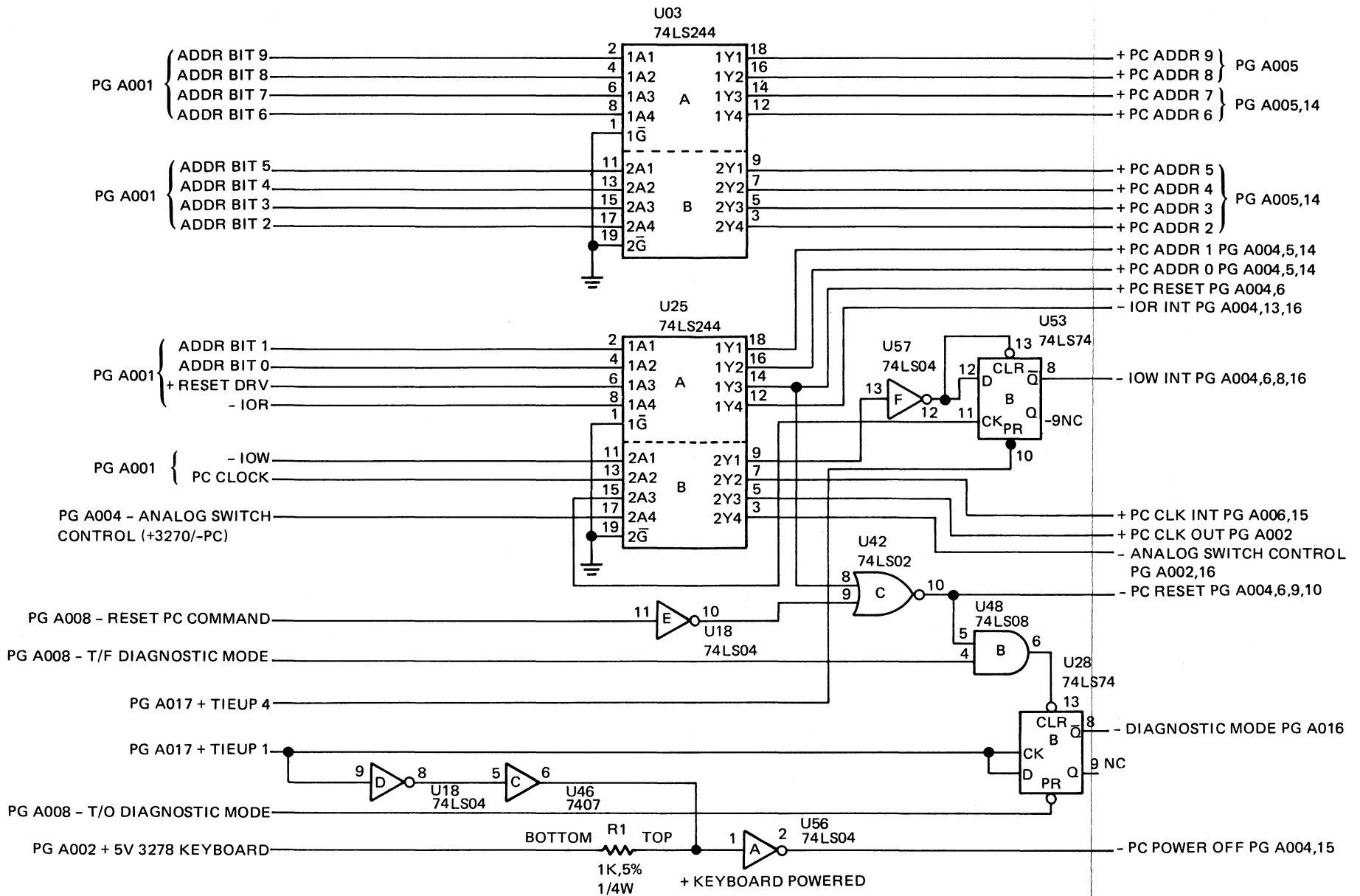
Figure D-8. Personal Computer Adapter (Redrive and Diagnostic PG A003)
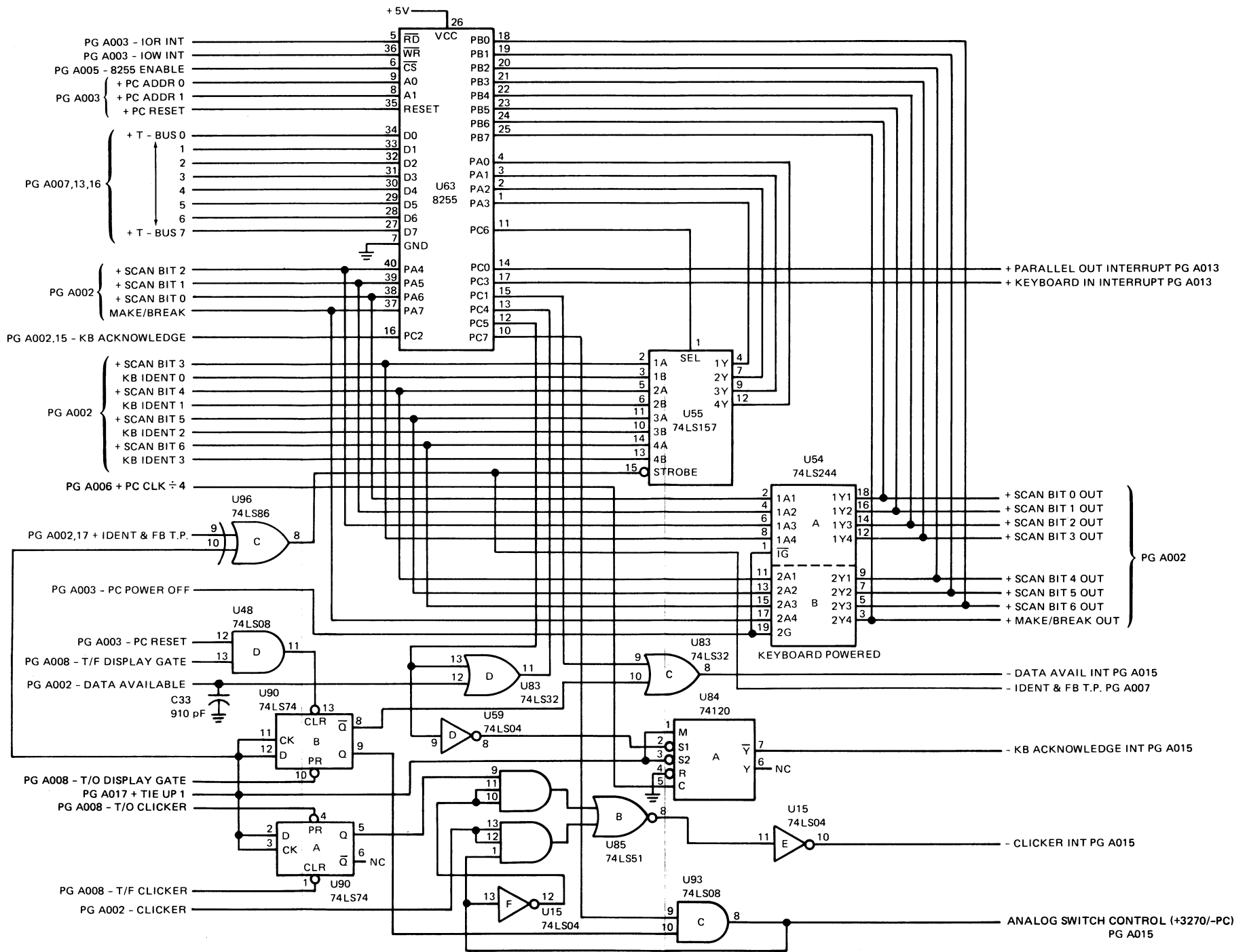
Figure D-9. Personal Computer Adapter (Keystroke I/O Ports PG A004)
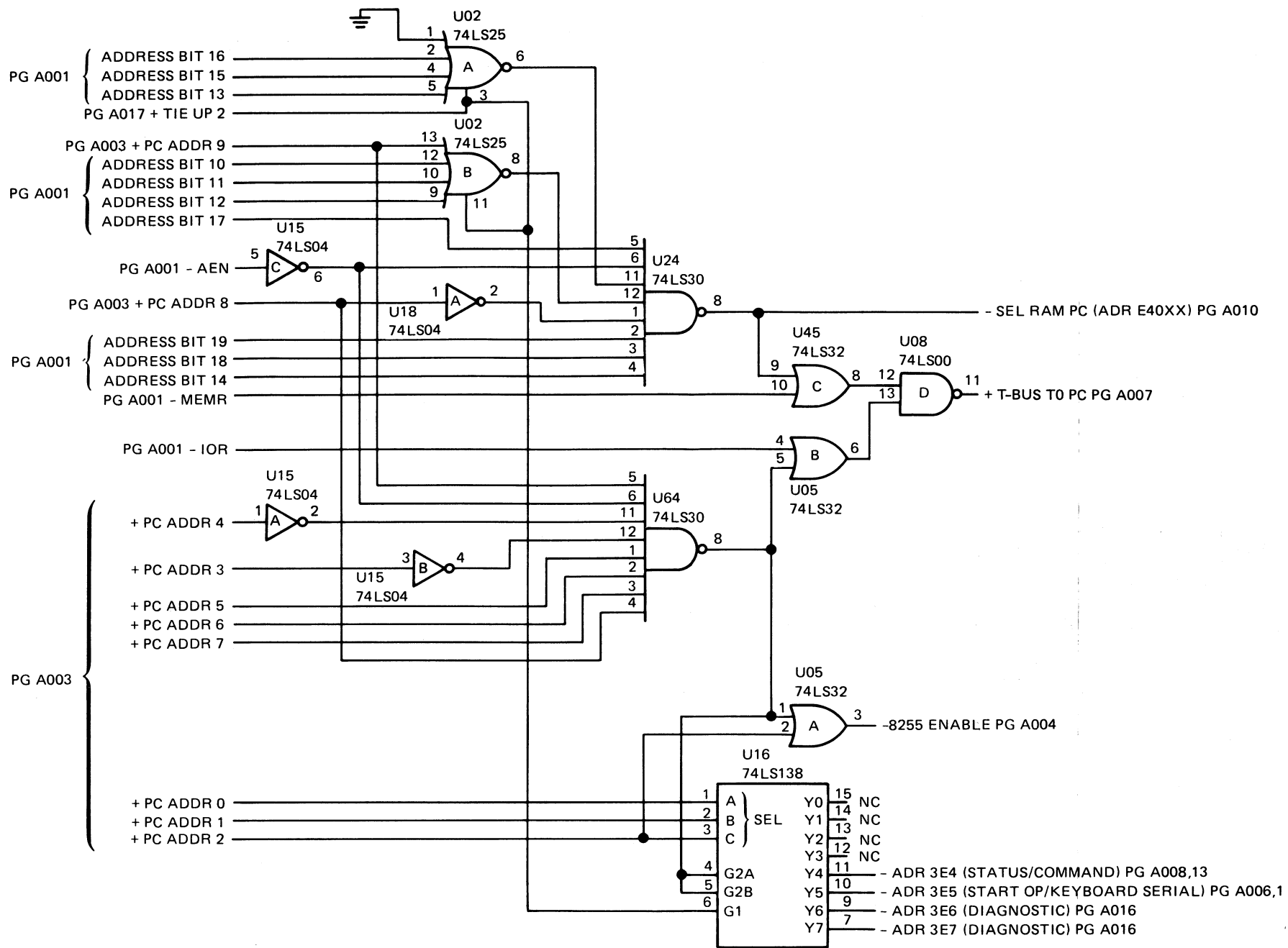
Figure D-10. Personal Computer Adapter (Memory and I/O Address PG A005)
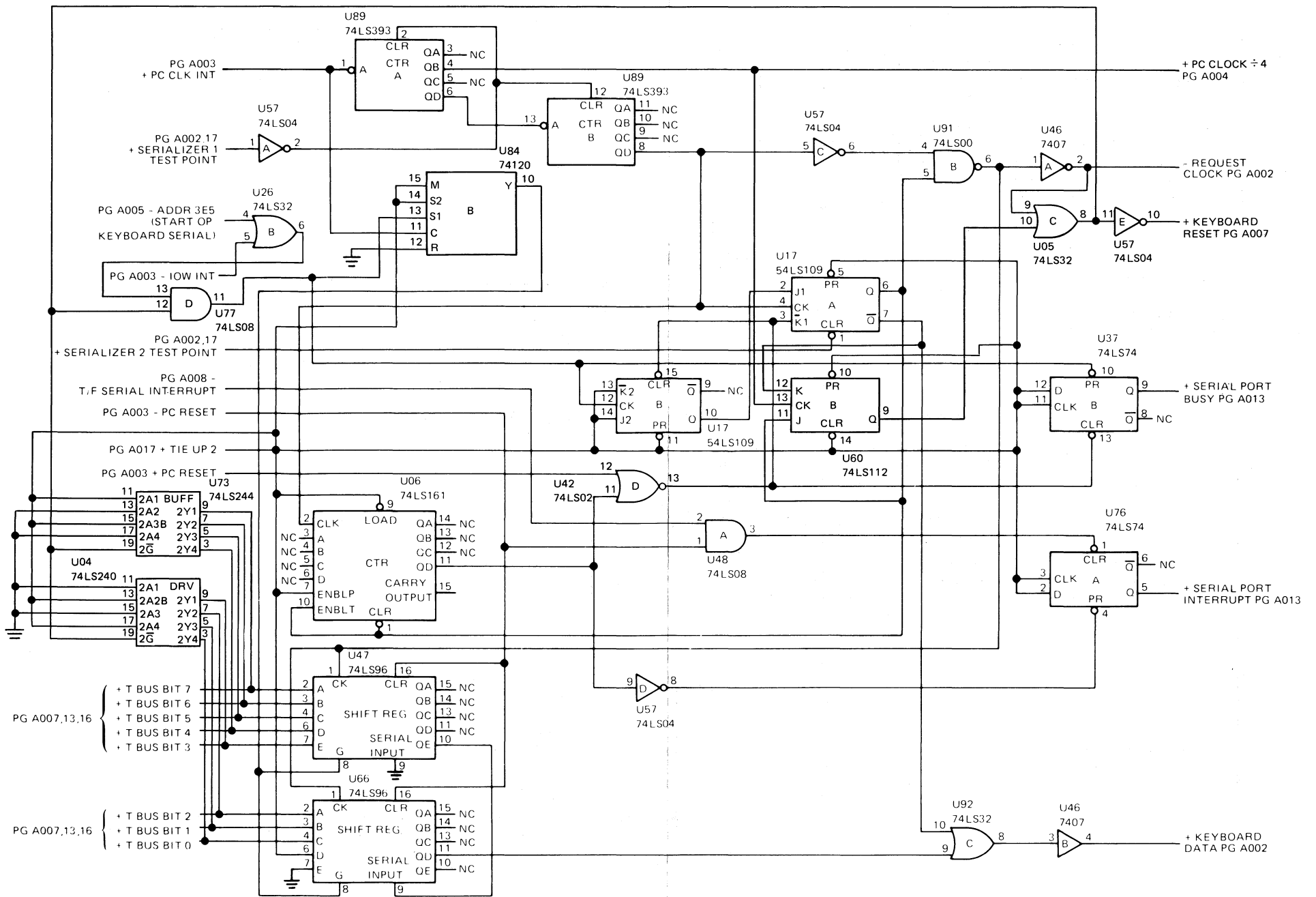
Figure D-11. Personal Computer Adapter (Keyboard Serializer PG A006)
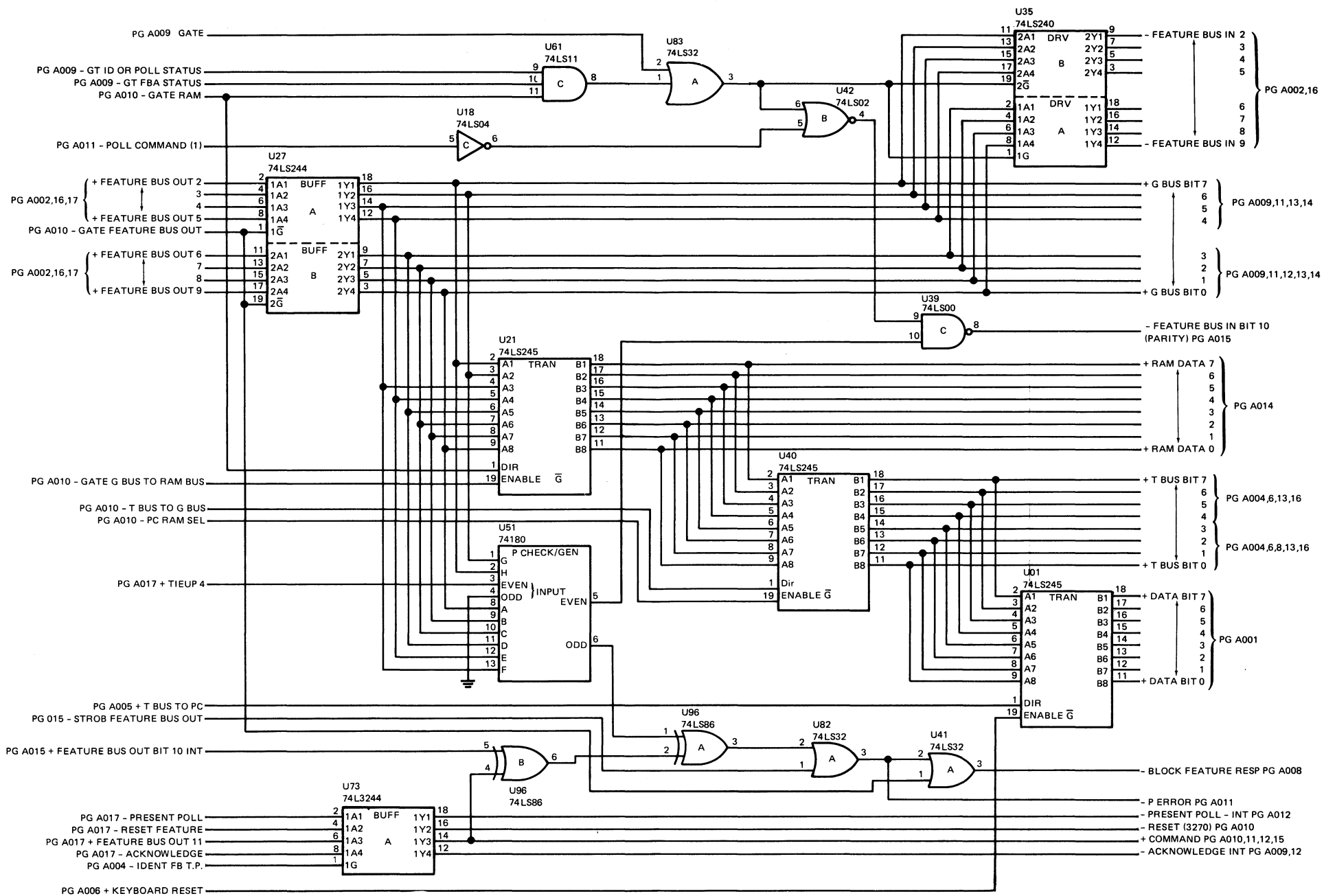
Figure D-12. Personal Computer Adapter (Feature Bus Receivers and Drivers PG A007)
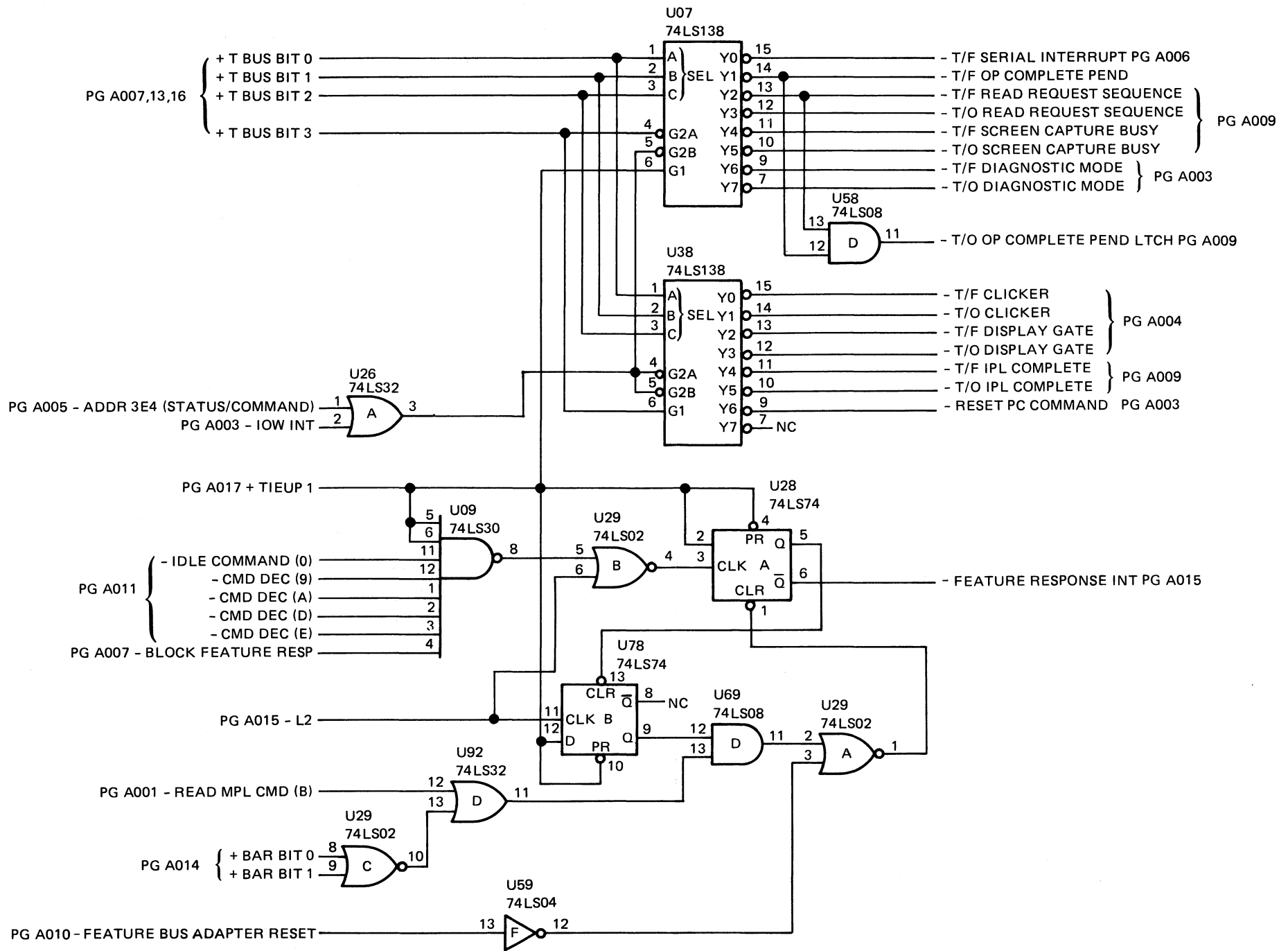
Figure D-13. Personal Computer Adapter (Command Decode Feature Response PG A008)
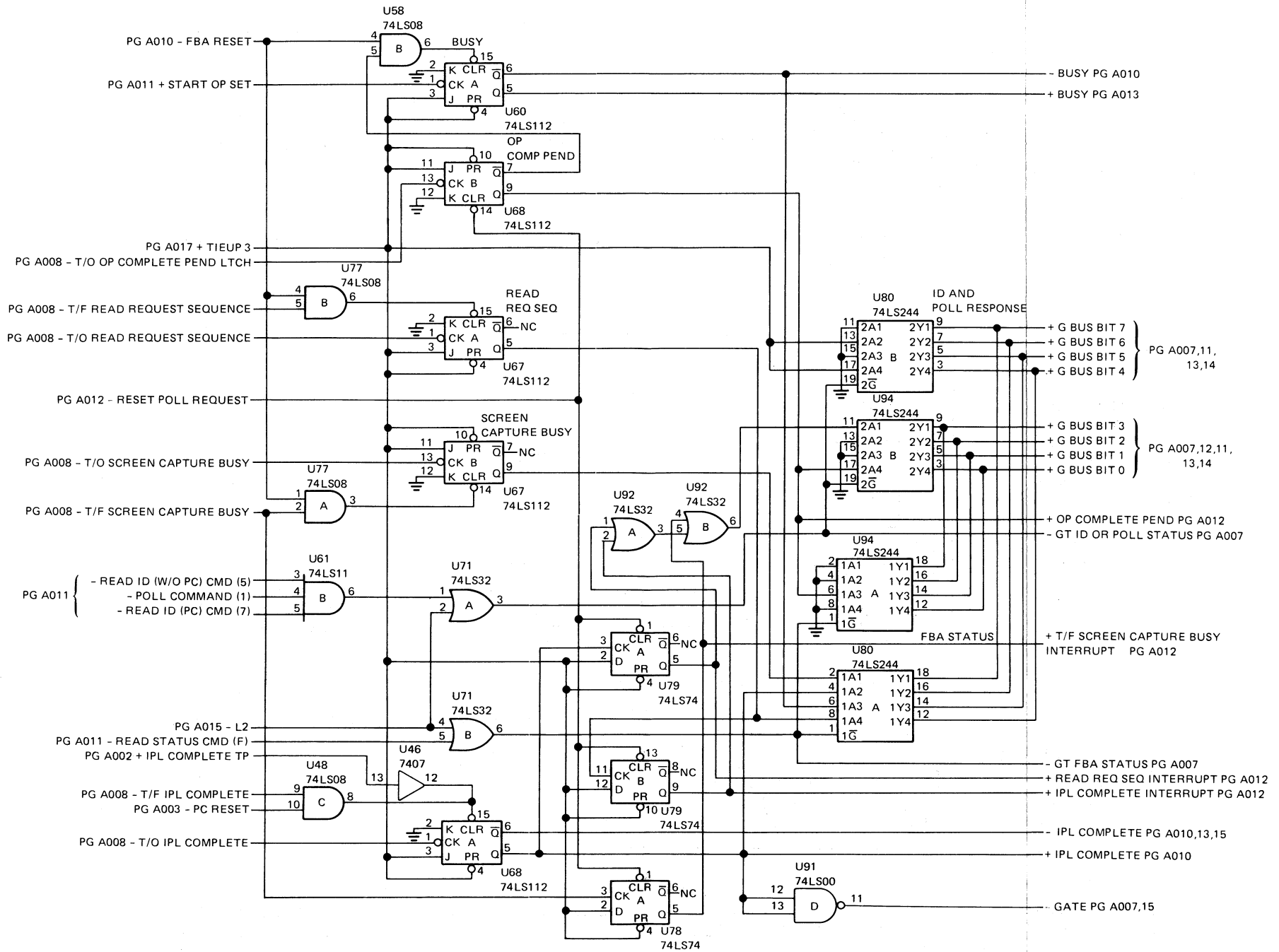
Figure D-14. Personal Computer Adapter (Status ID and Poll Response PG A009)
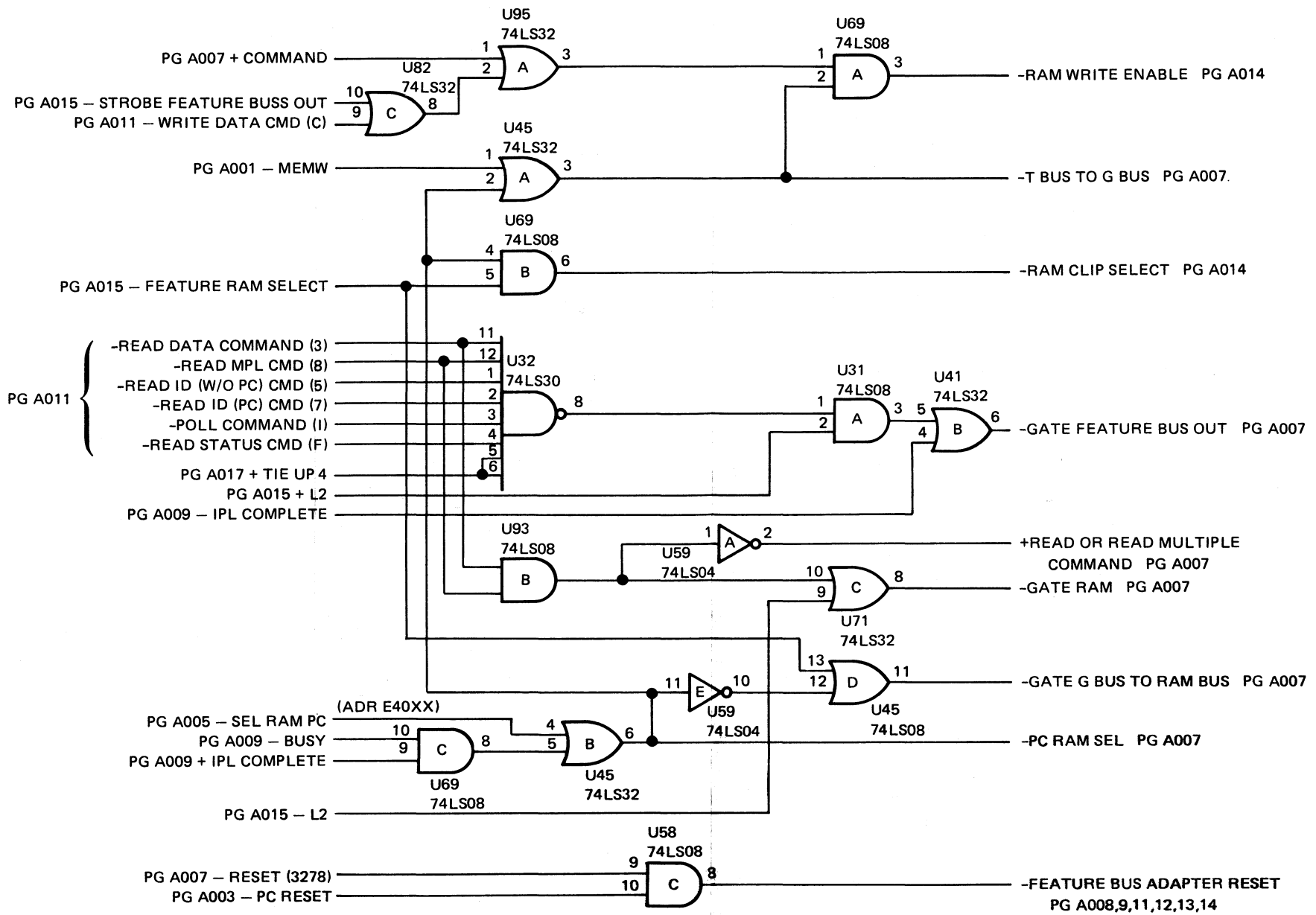
Figure D-15. Personal Computer Adapter (RAM Control PG A010)
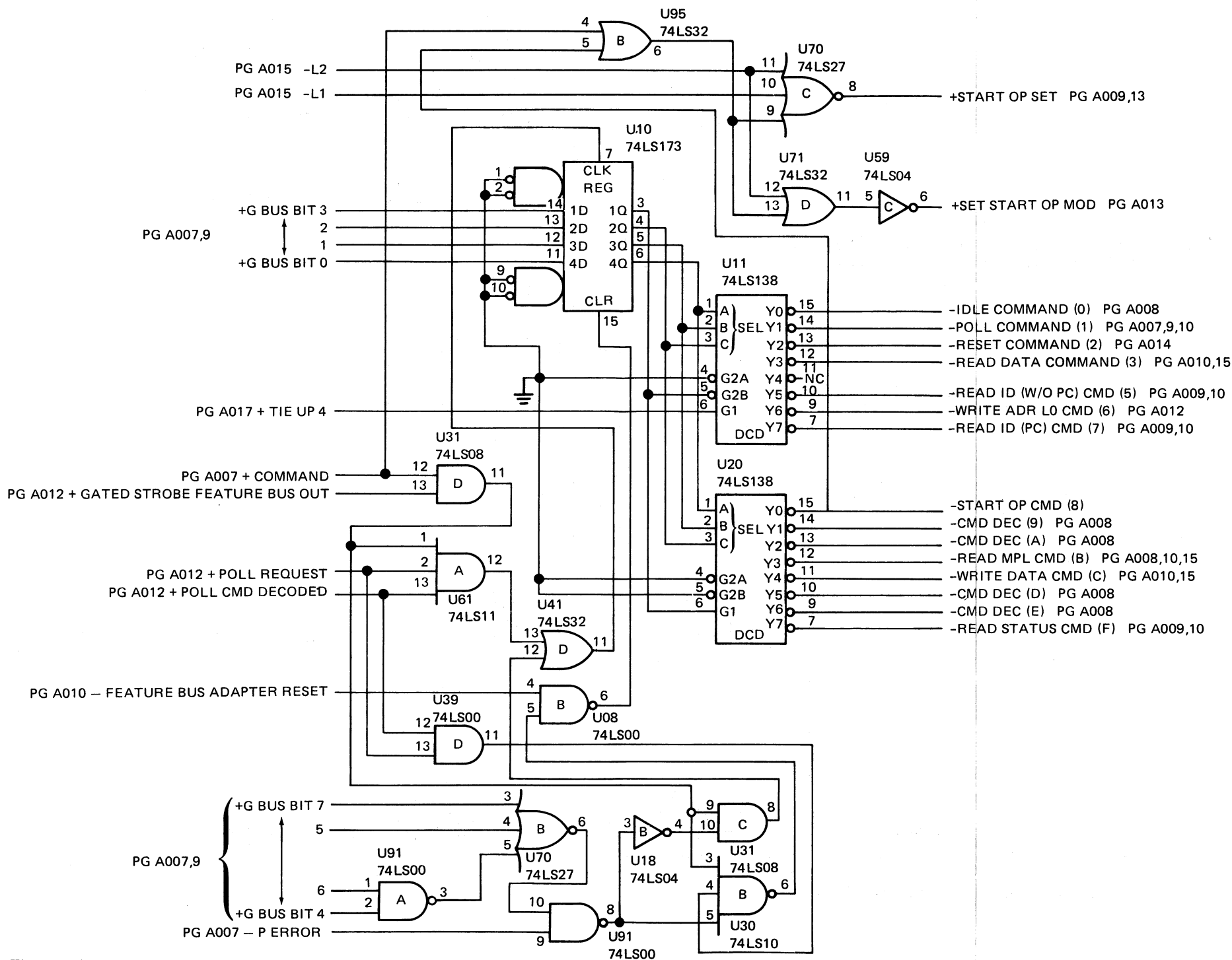
Figure D-16. Personal Computer Adapter (Feature Bus Command Decode PG A011)
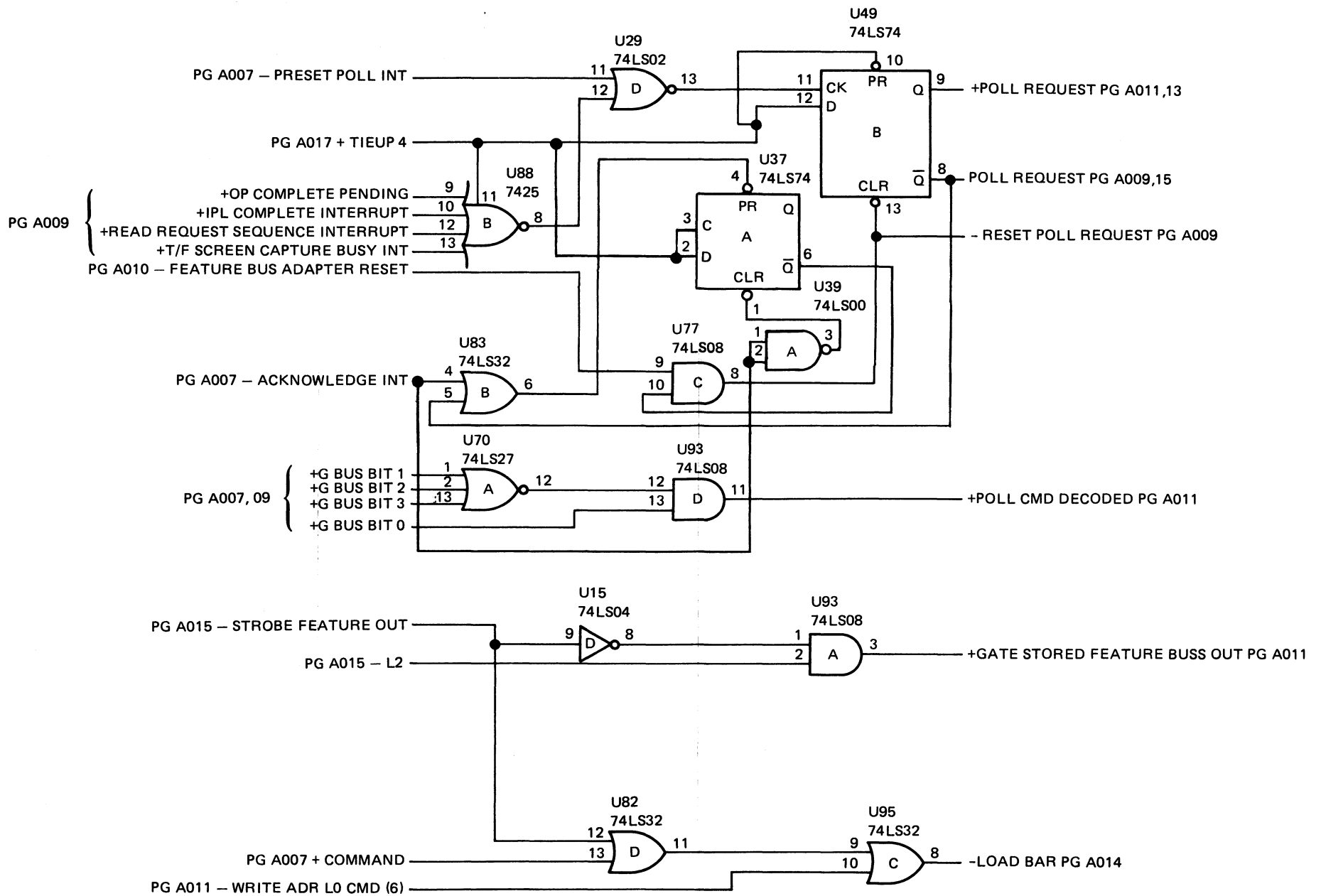
Figure D-17. Personal Computer Adapter (Poll Request PG A012)
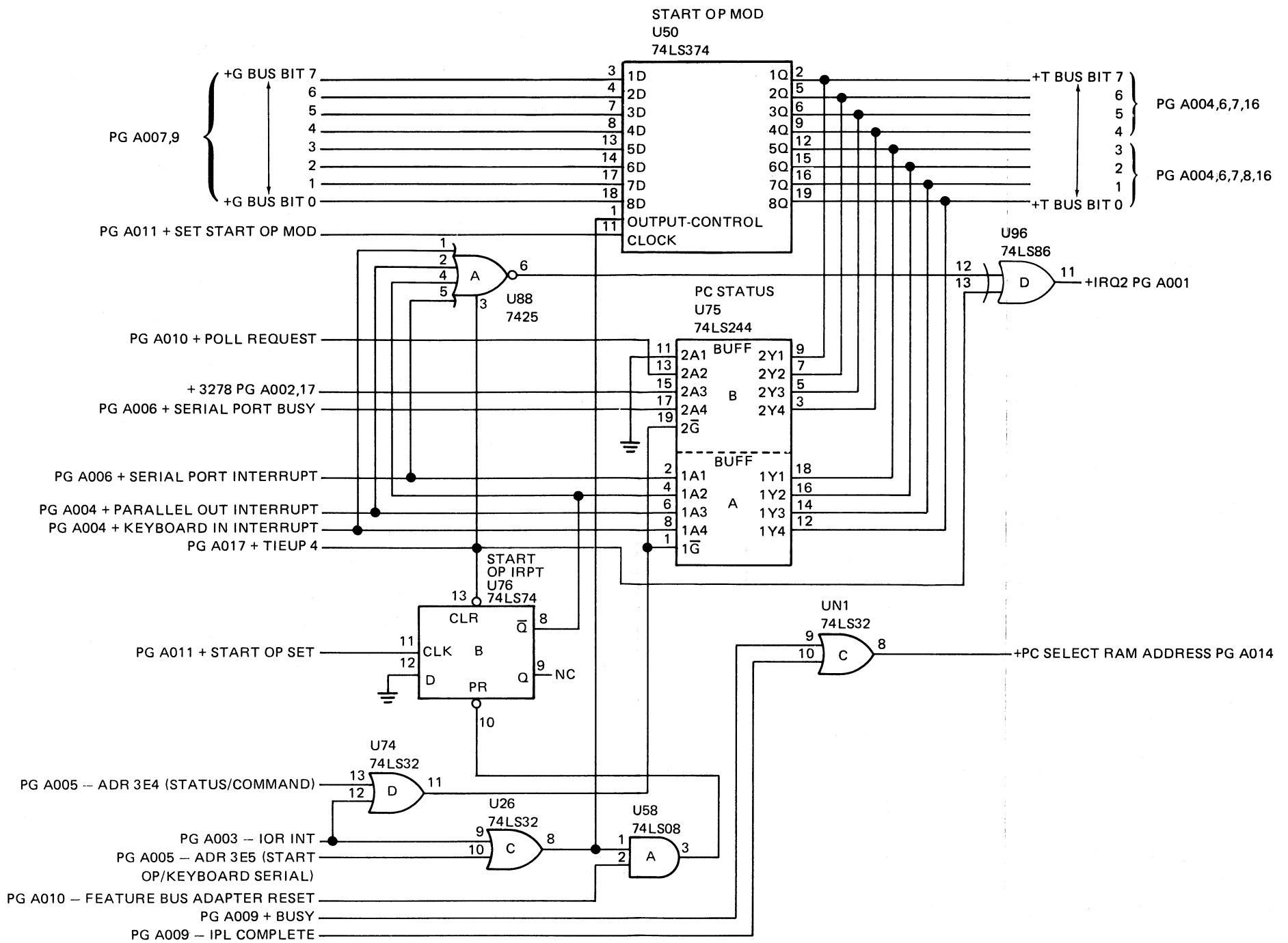
Figure D-18. Personal Computer Adapter (Start OP, MOD, and Personal Computer Status PG A013)
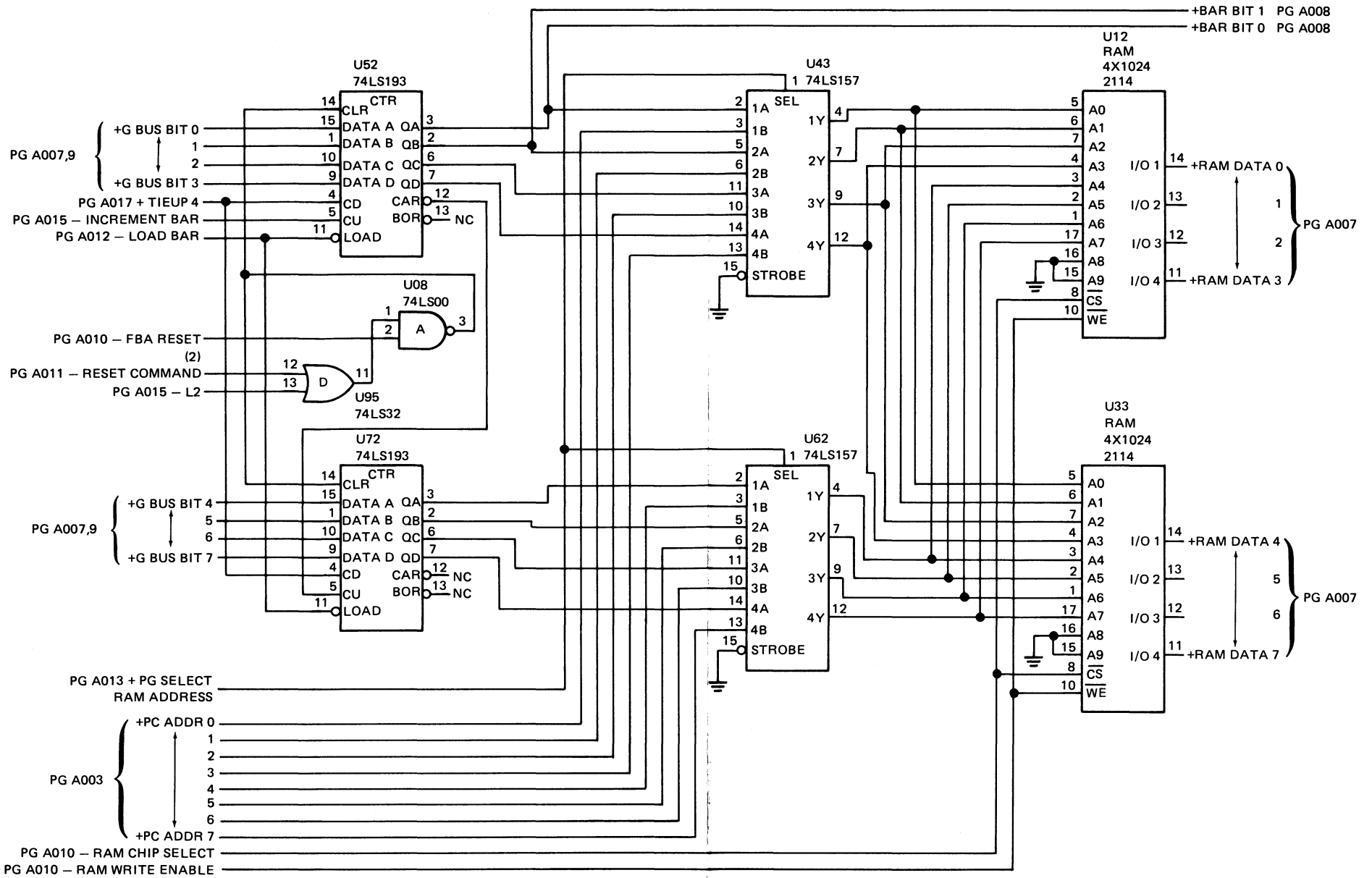
Figure D-19. Personal Computer Adapter (RAM BAR Counter Address Select PG A014)
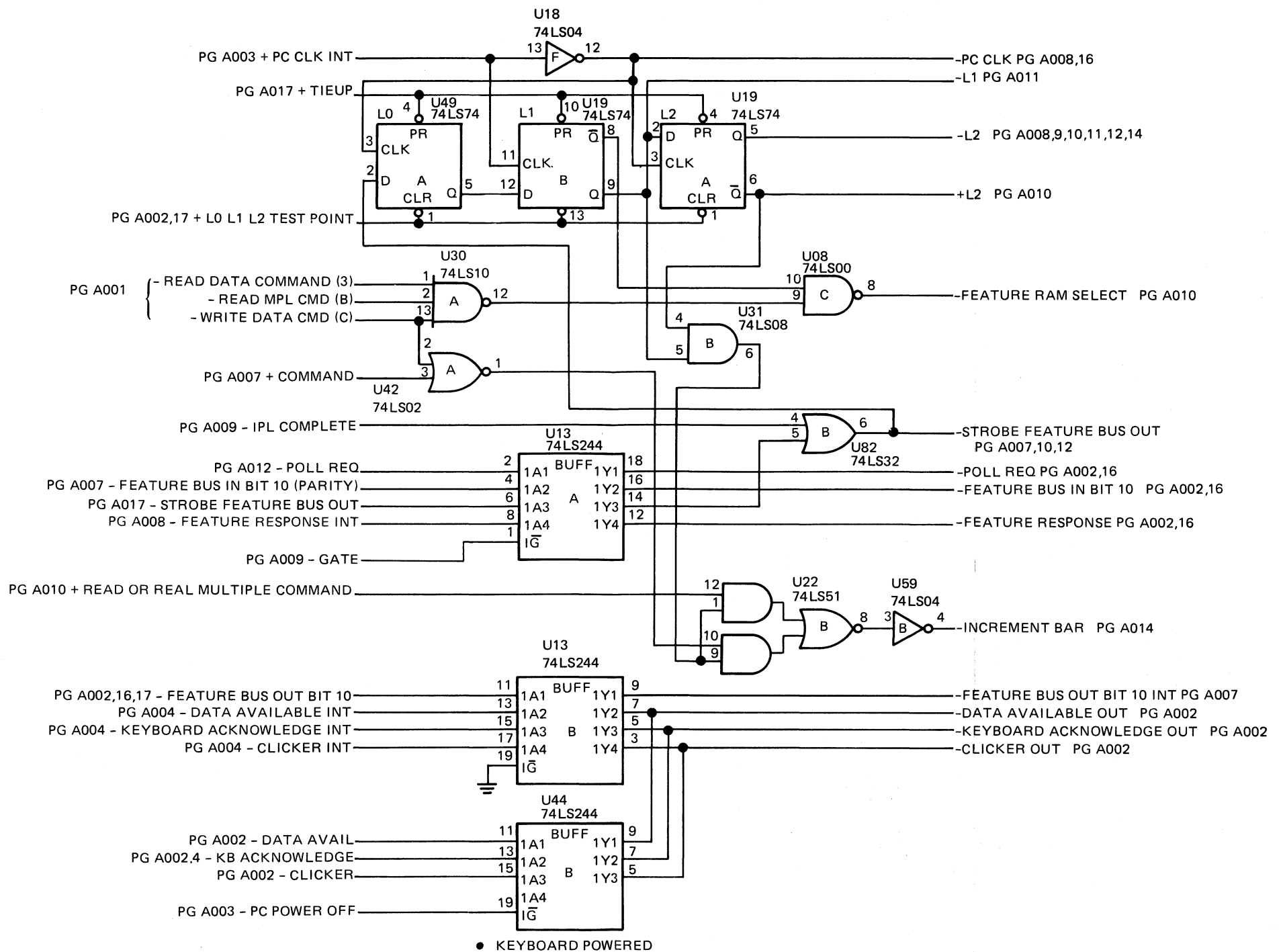
Figure D-20. Personal Computer Adapter (L0, L2, Latches PG A015)
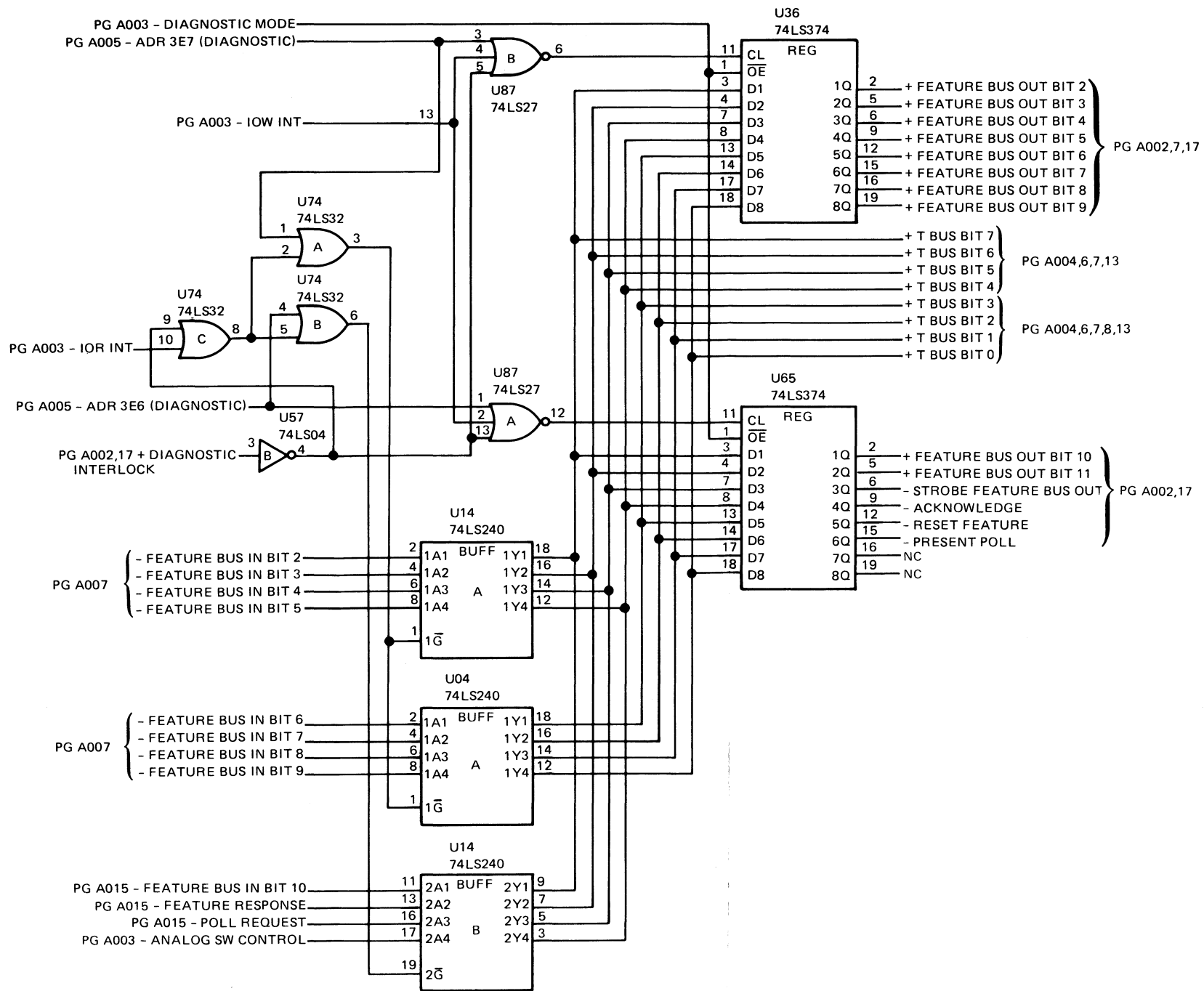
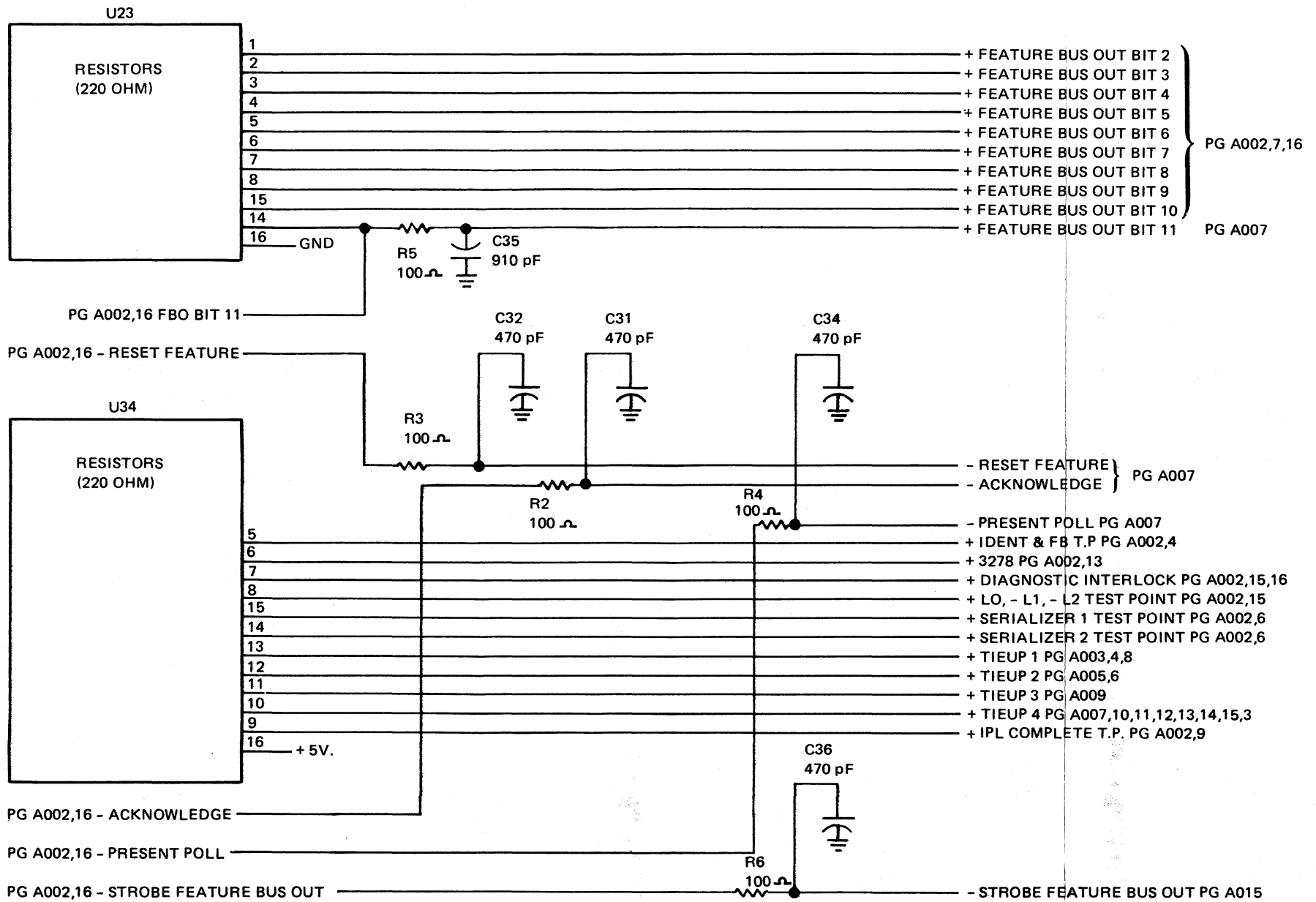Figure D-21. Personal Computer Adapter (Diagnostic Buffers PG A016)

Figure D-22. Personal Computer Adapter (FBO Termination and Pullup Resistors PG A017)

Appendix E. Setup for Data Transfer

The host, the IBM 3274 Control Unit, and the Personal Computer all require preparation for the **data transfer** sample application programs. Table E-1 outlines data transfer needs.

Table E-1.   Data Transfer Requirements

Machine	Screen Capture Requirements	File Transfer Requirements
3274 Control Unit	1. Configuration C (release 46 or higher) or configuration D (release 60 or higher) 2. Customization for the IBM 3270 Personal Computer Attachment	Same as for screen capture
IBM Personal Computer	1. System disk (DOS 1.1 or 2.0) 2. Disk with HOST.EXE file 3. System unit with 128K bytes	Same as for screen capture

Table E-1. Data Transfer Requirements (continued)

Machine	Screen Capture Requirements	File Transfer Requirements
Host Computer (CMS)	None	1. If the IBM 3278 does not have an extended character set adapter (FC 3610 or FC 3620), or if the 3279 does not have the extended function (FC 3850), then Service Level 206 (PUT 8305) must be installed on VM/SP. 2. Access to PCXFER MODULE, PROFILE PCXFER, PCXFER EXEC. Optional Access to PCXFER MACLIB, ISPF 5668-960 (for menus), ISPF/PDF 5664-172, and PCXFER HELPCMS (for information).

Table E-1. Data Transfer Requirements (continued)

Machine	Screen Capture Requirements	File Transfer Requirements
Host Computer (TSO)	None	1. TSO with ACF/VTAM, Release 1.3, or TSO with ACF/TCAM, Release 2.4, PTF # UZ90256, UZ90257, UZ90258 (APAR # OZ69872), PTF # UZ67877 (APAR # OZ73530). 2. Access to PCXFER.CLIST, PCXFER.LOAD, PCXFER.PROFILE. Optional access to PCXFER.PANEL, ISPF 5668-960 (for menus), ISPF/PDF 5664-268, and PCXFER.HELP (for information).

Customizing the Control Unit for Data Transfer

Look in the left side of the operator information area (OIA) to see
what type of control unit your display station is attached to. Try to
match one of the symbols below:

Symbol	Meaning
$\boxed{4}\!-\!^{A}$ or $\boxed{4}\!-\!^{B}$	IBM 3274 Control Unit
$\boxed{6}\!-\!^{A}$ or $\boxed{6}\!-\!^{B}$	IBM 3276 Control Unit Display Station
$I\!\!-\!^{A}$ or $I\!\!-\!^{B}$	IBM Integrated Display Adapter

If your display station is not attached to a 3274 Control Unit, you
cannot do screen capture or file transfer.

If your display station is attached to a 3274 Control Unit, how do
you know if it is customized? Type in HOST while in personal com-
puter mode. Two copyrights appear on the screen, and then the
screen switches to host computer mode. If this does not happen, your
control unit might not be customized.

Remember, your 3274 Control Unit must have Configuration C
(Release 46 or higher) or Configuration D (Release 60 or higher) to
support data transfer. Refer to the *IBM 3274 Control Unit Planning,
Setup, and Customizing Guide,* GA27-2824, for customization
information.

Preparing the Personal Computer for Data Transfer

HOST.EXE, the Personal Computer data transfer application program, comes on the customization diskette with this book. For convenience, you might copy HOST.EXE onto your daily application disk. Then, you won't need to keep shuffling diskettes.

Remember, screen capture to the Personal Computer printer is similar to the 3270 local-copy function and to the IBM Personal Computer print-screen function. However, the 3270 host-initiated local-copy function *is not* supported for hard-copy output to the IBM Personal Computer printer.

Uploading the CMS File Transfer Sample Application Programs

To prepare the CMS host, the sample application programs must be sent to the host from the IBM Personal Computer Attachment Option data transfer diskette.

To check whether the application programs are already uploaded, type in HELP PCXFER. A help panel is displayed on the screen. If no panel appears, you need to upload the application programs.

CMS Requirements

Your CMS host must use VM/SP, Release 1.0 (or later), for the file transfer sample application programs to work. Structured fields must be supported by your console. Structured fields are supported if you have an ECSA card installed in your display or if VM service level #206 PUT 8305 has been installed in your VM system.

VCNA Requirements

If you have VCNA, the LOGMODE table must specify EXTENDED
HIGHLIGHTING. You do this by setting byte 1 (zero reference) of
the PSERVIC entry for the display to X'CO'. Other fields for the
LOGMODE table should be specified as described in Chapter 3 of
the *VM/VCNA: Installation, Operation and Use* manual, SC27-0502.

Note: This change specifies that your display has an ECSA feature.
If your 3278 does not have an ECSA feature, programs that require
the feature will cause a PROG error at the display. Either the session
will be disconnected from VM or the application will receive an error
message. If the session is disconnected, the user may reconnect it by
using a LOGMODE table with byte 1 of the PSERVIC entry set to
X'40'.

Since VCNA uses VTAM as its communication link, certain VTAM
requirements apply for VCNA. If VTAM uses BSC, the VTAM system
definition data set (SYS1.VTAMLST) must specify that BSC trans-
parency is to be used when sending data to the display. You can do
this by specifying the 'EDATS' value for the FEATUR2 keyword on
the TERMINAL macro describing the display containing the IBM
3270 Personal Computer Attachment. For example:

NK32A311 TERMINAL ADDR=60604040,
    POLL=40404040,DLOGMOD=T3278M2,
    FEATUR2=EDATS

Contact the person responsible for maintaining your ACF/VTAM
system data sets to ensure that these changes are properly specified
and that the NCP is reactivated with the updated system definition.

Note: The FEATUR2=EDATS keyword is used only by VTAM, not
by the NCP. Therefore, changing this keyword in the VTAM system
definition data set does *not* require rerunning the NCP SYSGEN
procedure and does *not* require reloading the NCP load module.

UPLOAD Program Requirements for CMS

Before you upload, you must check to make sure your host executes the commands in the upload program. The UPLOAD program issues the following CMS commands:

    ERASE fn ft A
    (which *must* be an ERASE MODULE, not an EXEC)
    XEDIT fn ft A (NOPROFILE
    XEDIT fn ft A (PROFILE macroname
    SET BLIP OFF
    SET MSG OFF
    SET WNG OFF
    SET EMSG OFF
    SET IMSG OFF
    SET LINEDIT OFF

These commands must function exactly as specified in these manuals:

- *IBM Virtual Machine/System Product: CMS Command and Macro Reference,* SC19-6209

- *IBM Virtual Machine/System Product: CP Command Reference for General Users,* SC19-6211.

Otherwise, you might not be able to install the file transfer sample application program on your CMS host.

In addition, UPLOAD creates the EXEC2 EXECs PCXFBOOT and PCXFER. The UPLOAD program and the file transfer sample application program will not run unless your CMS supports EXEC2 EXECs. The PCXFBOOT EXEC and the PCXFER EXEC issue the following EXEC commands:

    &TRACE OFF
    &TRACE ERR
    * comment
    &exec variable = &exec variable
    &IF word1 = word2 executable-statement
    &TYPE word1 word2 ...
    &GOTO label
    &BEGTYPE n
    &READ ARGS
    &EXIT return-code

Your EXEC2 EXEC processor must execute these statements exactly as specified in *IBM Virtual Machine/System Product: EXEC2 Reference*, SC24-5219. The CMS EXEC2 processor must support the &RETCODE and &ARGSTRING variables. Otherwise, you might not be able to install the file transfer sample application program on your CMS host.

The PCXFBOOT EXEC and the PCXFER EXEC issue the following CMS commands:

ERASE fn ft A (which must be an ERASE MODULE,
not an EXEC)
GLOBAL MACLIB libname1 libname2
GLOBAL TXTLIB libname1 libname2
ASSEMBLE fn
LOAD fn (START
MACLIB GEN libname fn1 fn2 fn3 fn4
EXEC fn args
CP SET options

The EXECs must execute these commands exactly as specified in the following manuals:

• *IBM Virtual Machine/System Product: CMS Command and Macro Reference*, SC19-6209

• *IBM Virtual Machine/System Product: CP Command Reference for General Users*, SC19-6211.

Otherwise, you cannot install the file transfer sample application program on your CMS host. Refer to the HELPME.CMS file on the CMS data transfer diskette for more information.

CMS Upload Procedure

If your CMS host will execute all the commands issued by the UPLOAD program, follow the procedure in Table E-2 to upload the file transfer sample application programs.

Table E-2.   CMS Upload Procedure

User Action	Computer Response
In host computer mode, make sure you: 1. Log on to CMS. 2. IPL CMS. 3. Can issue CMS commands. Skip this step if you have already done this.	
Check to see if the programs are already uploaded. Enter HELP PCXFER (Skip this step if you have already checked.)	If you receive an error message, the host is not customized. Continue with this procedure.
If you are not in personal computer mode, switch over to it.	
For backup, make a DISKCOPY of the data transfer diskette. (Skip this step if you have already made backup copies.)	

Table E-2. CMS Upload Procedure (continued)

User Action	Computer Response
Insert the Data Transfer: VM/CMS diskette. (Make sure the diskette does not have a write protect tab on it, since a checkpoint file is written to the diskette.)	
Type UPLOAD CMS Press ENTER	The customization process begins. If you do not receive any status messages within 15 minutes, refer to the HELPME file on the supplied diskettes. Allow at least 1-1/2 hours for this uploading process.
If you want to stop the UPLOAD program once files start to be sent to the host, press the ATTN key repeatedly.	
If you have problems uploading, refer to the HELPME.CMS file supplied in the diskette with this book.	
	Customization completion message.

Upload Error Messages for CMS

- A 2% % appears in the operator information area if your 3274 Control Unit is not customized.

- A ⬜ 69 in the operator information area means that your display station is attached to a 3276 Control Unit, which does not support data transfer.

- If nothing happens, and I $\underline{\Delta}$ or I $\underline{B}$ is displayed in the left of the operator information area, your display station is attached to an integrated display adapter (IDA). The IDA does not support data transfer functions for the IBM 3270 Personal Computer Attachment. See your supervisor or system programmer.

- Restart the customization process if your host session is interrupted. The customization resumes as close as possible to the point of interruption.

- If you receive error messages or your customization is not completed successfully, see the HELPME file on the diskettes supplied with this book. You might want a hard copy if you have access to a printer. If not, enter TYPE HELPME.CMS. Then, press the DUP key to stop the file from scrolling.

Uploading the TSO File Transfer Sample Application Programs

To prepare the TSO host, the sample application programs must be sent to the host from the IBM Personal Computer Attachment Option data transfer diskette.

To check whether the application programs are already uploaded, type in EX PCXFER. If a message "data set PCXFER.CLIST not in catalog" appears, you need to upload the application programs.

TSO Requirements

Your TSO host must use ACF/VTAM Version 2, Release 1 (or later), for the TSO file transfer sample application program to work.

Note: If your TSO host is using ACF/TCAM to communicate with the display, the file transfer sample application program cannot be used.

If VTAM uses BSC, the VTAM system definition data set (SYS1.VTAMLST) must specify that BSC transparency is to be used when sending data to the display. You can do this by specifying the 'EDATS' value for the FEATUR2 keyword on the TERMINAL macro describing the display containing the IBM 3270 Personal Computer Attachment. For example:

```
NK32A311 TERMINAL ADDR=60604040,
   POLL=40404040,DLOGMOD=T3278M2,
   FEATUR2=EDATS
```

Contact the person responsible for maintaining your ACF/VTAM system data sets to ensure that these changes are properly specified and that the NCP is reactivated with the updated system definition.

Note: The FEATUR2=EDATS keyword is used only by VTAM, not by the NCP. Therefore, changing this keyword in the VTAM system definition data set does *not* require rerunning the NCP SYSGEN procedure and does *not* require reloading the NCP load module.

UPLOAD Program Requirements for TSO

Before you upload, you must check to make sure your host executes the commands in the upload program.

The upload program issues the following TSO commands:

```
PROF NOCHAR NOLINE NOINTERCOM NOWTPMSG
DELETE (data-set-name) PURGE
EDIT data-set-name NEW NONUM BLKSIZE (3120)
```

These commands must function exactly as specified in *OS/VS2 TSO Command Language Reference,* GC28-0646. Otherwise, you might not be able to install the file transfer sample application program on your TSO host.

The PCXFBOOT command list issues the following TSO command procedure statements:

```
PROC 0 DEBUG
CONTROL options
IF condition THEN statement
WRITE text
ERROR OFF | statement
DO ... END
SET variable=value
GOTO label
WRITENR text
READ variable
EXIT CODE(value)
```

The TSO host should execute these statements exactly as specified in *OS/VS2 TSO Command Language Reference,* GC28-0646. Otherwise, the PCXFBOOT command list cannot work.

If your PCXFBOOT command list fails:

1. Edit the PCXFBOOT.CLIST data set.

2. Change the commands to your TSO system commands.

3. Rerun the PCXFBOOT command list.

The PCXFBOOT command list issues the following TSO commands:

PROFILE PAUSE
DELETE (data-set-name-list) PURGE
ASM data-set-name NOTERMINAL
LINK data-set-name
ATTRIB
ALLOC
CALL
LINK data-set-name LOAD(data-set-name)
FREE ATTR(attribute-list-name) DD(dd-name)
ISPEXEC CONTROL DISPLAY REFRESH
ERROR

The command procedures running on the TSO host must execute
these commands exactly as specified in *OS/VS2 TSO Command
Language Reference,* GC28-0646. Otherwise, the PCXFBOOT
command list cannot work.

If your PCXFBOOT command list cannot work, refer to the
HELPME.TSO file on the TSO data transfer diskette. The
HELPME.TSO file gives suggestions for modifying the
PCXFBOOT.CLIST data set for your host.

You must also be able to allocate data sets on a default volume
under your TSO user ID. Otherwise, the UPLOAD program cannot
work.

The UPLOAD program creates data sets that start with your defined
user prefix. If you want to create the data sets with a different start-
ing qualifier, issue the TSO PROFILE command to change your
user prefix.

TSO Upload Procedure

If your TSO host will execute all the commands issued by the UPLOAD program, follow the procedure in Table E-3 to upload the file transfer sample application programs.

Table E-3.   TSO Upload Procedure

User Action	Computer Response
In host computer mode, make sure: 1. You log on to TSO. 2. The TSO terminal monitor program controls the display. If you have already done this, skip this step.	
Check to see whether the programs are already uploaded. Enter EX PCXFER (Skip this step if you have already checked.)	If you receive an error message, the host is not customized. Continue with this procedure.
If you are not in personal computer mode, switch over to it.	
For backup, make a DISKCOPY of the data transfer diskette. (Skip this step if you have already made backup copies.)	

Table E-3.   TSO Upload Procedure (continued)

User Action	Computer Response
Insert the Data Transfer: TSO diskette. (Make sure the diskette does not have a write-protect tab on it, since a checkpoint file is written to the diskette.)	
Type UPLOAD TSO Press ENTER	The customization process begins. If you do not receive any status messages within 15 minutes, refer to the HELPME file on the supplied diskettes. Allow at least 1-1/2 hours for this uploading process.
If you want to stop the UPLOAD program once files start to be sent to the host, press the ATTN key repeatedly.	
If you have problems uploading, refer to the HELPME.TSO file supplied on the diskette with this book.	
	Customization completion message.

Note: The upload procedure cannot execute under ISPF Option 6 or under the control of the Session Manager Program Product.

Upload Error Messages for TSO

- A 2% % appears in the operator information area if your 3274 Control Unit is not customized.

- A 〔〕 69 in the operator information area means that your display station is attached to a 3276 Control Unit, which does not support data transfer.

- If nothing happens, and I $\overset{\triangle}{}$ or I $\underline{B}$ is displayed in the left of the operator information area, your display station is attached to an integrated display adapter (IDA). The IDA does not support data transfer functions for the IBM 3270 Personal Computer Attachment. See your supervisor or system programmer.

- Restart the customization process if your host session is interrupted. The customization resumes as close as possible to the point of interruption.

- If you receive error messages or your customization is not completed successfully, see the HELPME file on the diskettes supplied with this book: You might want a hard copy if you have access to a printer. If not, enter TYPE HELPME.TSO. Then, press the DUP key to stop the file from scrolling.

Appendix F. Data Transfer Formats and Translation Tables

This appendix explains the data formats and translations of the supplied data transfer sample application programs. It is divided into three sections:

● **Screen Capture Formats and Tables**

   You use this section for the /E, /N, and /U options of HOST.EXE. and for the target-filespec = disk and target filespec = printer.

● **File Transfer Tables**

   This section contains ASCII-to-EBCDIC and EBCDIC-to-ASCII translation tables for the TRAN option on the PCXFER command and the PROFILE entry and for the LIST file format.

● **Personal Computer File Formats**

   This section contains technical descriptions of EDIT, UNFM, VAR, BAS, and LIST file formats for the personal computer and ASCII-to-EBCDIC and EBCDIC-to-ASCII translation tables for the LIST file format.

Screen Capture Formats and Tables

When you capture a screen, you capture the screen in the form of records and data printer codes. To write a program to process screen images (UNFM or EDIT), you use these formats:

- **Screen Capture Output – Unformatted**

  The records in the destination file for unformatted screen-capture output (/U option) have the format described in Table F-1. The characters will be in 3278/3279 buffer encodings. (Refer to Table F-5.)

Table F-1.   Format of Unformatted Screen Capture Output

Offset	Length	Contents
0	2	Number of bytes following the length field
2	1	Buffer type: 00 = character buffer 01 = extended attribute buffer (EAB)
3	1	Row length: Length of each row of the display may be 40, 80, or 132
4	n	Buffer contents: See Table F-1 for character buffer values, Table F-4 for attribute bytes, and Table F-5 for EAB values.

- **Screen Capture Output – Edit Format (to Printer or Diskette)**

  The records in the destination file for formatted screen-capture output (without /U) have the formats described in Tables F-2 through F-4. The first record (Table F-2) is the header unless you specify /N. The last record (Table F-4) is the trailer unless you specify /N. The characters will be in IBM Personal Computer ASCII codes.

Note: Hexadecimal values are indicated by X; for example, hexadecimal 0D0A is X'0D0A'.

Table F-2. Format of Edit Record 1

Offset	Length	Contents
0	14	Hyphens
14	1	Space
15	30	Start of Screen Image Captured (message)
45	1	Space
46	8	mm/dd/yy (mm=month; dd=day of month; yy=year)
54	1	Space
55	8	hh:mm:ss (hh=hour; mm=minute of hour; ss=second of minute)
63	1	Space
64	14	Hyphens
78	2	X'0D0A' (ASCII carriage return/line feed)

Table F-3.   Format of Edit Records 2 to n + 1

Offset	Length	Contents
0	y	ASCII values corresponding to the characters visible on the display screen. Null and/or space characters at the end of each row are suppressed. For the ASCII values used, see Table F-6 if the destination file is a printer, and Table F-7 if the destination is a diskette file.
y	2	X'0D0A' (ASCII carriage return/line feed)

Table F-4.   Format of Edit Records n + 2

Offset	Length	Contents
0	29	Hyphens
29	1	Space
30	19	End of Screen Image (message)
49	1	Space
50	28	Hyphens
78	2	X'0D0A' (ASCII carriage return/line feed)

Tables F-5 through F-7 show the hexadecimal values of the buffer contents of the screen you capture.

- Table F-5 gives the unformatted codes (with /U option and target-filespec=personal computer filespec), which you can capture only on disk.

- Table F-6 gives the ASCII codes of edit output format (without /U and target-filespec=LPT1) that you capture to a printer.

- Table F-7 gives the ASCII codes of edit output format (without /U and target-filespec=filename) that you capture to a disk.

Table F-5. Screen Capture Unformatted Codes

	0x	1x	2x	3x	4x	5x	6x	7x
x0	NUL	SP	0	&	à	ä	À	Ä
x1	EM	=	1	−	è	ë	È	Ë
x2	FF	'	2	.	ì	ï	Ì	Ï
x3	NL	"	3	,	ò	ö	Ò	Ö
x4	STP	/	4	:	ù	ü	Ù	Ü
x5	CR	\	5	+	ã	â	Ã	Â
x6		|	6	¬	õ	ê	Õ	Ê
x7		¦	7	—	ÿ	î	Y	Î
x8	>	?	8	°	à	ô	A	Ô
x9	<	!	9		è	û	E	Û
xA	[	$	ß	^	é	á	E	Á
xB	]	¢	§	~	ì	é	I	É
xC	)	£	#	··	ò	í	O	Í
xD	(	¥	@	`	ù	ó	U	Ó
xE	}	Pts	%	´	ü	ú	Y	Ú
xF	{	☼	—	ﻝ	ç	ñ	C	Ñ

Table F-5.   Screen Capture Unformatted Codes (continued)

	8x	9x	Ax	Bx	Cx	Dx	Ex	Fx
x0	a	q	A	Q				
x1	b	r	B	R				
x2	c	s	C	S				
x3	d	t	D	T				
x4	e	u	E	U				
x5	f	v	F	V				
x6	g	w	G	W				
x7	h	x	H	X				
x8	i	y	I	Y				
x9	j	z	J	Z				
xA	k	ae	K	Æ				
xB	l	ø	L	Ø				
xC	m	à	M	Å				
xD	n	ç	N	C				
xE	o	⁻;	O	;				
xF	p	⁻*	P	*				

Note: For attribute bytes, see Table F-8.

Table F-6. Screen Capture Edit Format (to Printer) Codes

	0x	1x	2x	3x	4x	5x	6x	7x
x0			SP	0	@	P	`	p
x1			!	1	A	Q	a	q
x2			″	2	B	R	b	r
x3			#	3	C	S	c	s
x4			$	4	D	T	d	t
x5			%	5	E	U	e	u
x6			&	6	F	V	f	v
x7			′	7	G	W	g	w
x8			(	8	H	X	h	x
x9			)	9	I	Y	i	y
xA			*	:	J	Z	j	z
xB			+	;	K	[	k	{
xC			,	<	L	\	l	¦
xD			–	=	M	]	m	}
xE			.	>	N	∧	n	~
xF			/	?	O	–	o	

All nulls are translated to X'20' (SP).
All attribute bytes are translated to X'20' (SP).
All other screen codes are translated to X'2D' (-).

Table F-6. Screen Capture Edit Format (to Printer) Codes (continued)

	8x	9x	Ax	Bx	Cx	Dx	Ex	Fx
x0								
x1								
x2								
x3								
x4								
x5								
x6								
x7								
x8								
x9								
xA								
xB								
xC								
xD								
xE								
xF								

Note: Only 00 to 7F codes are sent to the printer.

Table F-7. Screen Capture Edit Format (to Disk) Codes

	0x	1x	2x	3x	4x	5x	6x	7x
x0	NUL		SP	0	@	P	`	p
x1			!	1	A	Q	a	q
x2			”	2	B	R	b	r
x3			#	3	C	S	c	s
x4			$	4	D	T	d	t
x5		§	%	5	E	U	e	u
x6			&	6	F	V	f	v
x7			’	7	G	W	g	w
x8			(	8	H	X	h	x
x9	PT	EM	)	9	I	Y	i	y
xA	NL		*	:	J	Z	j	z
xB			+	;	K	[	k	{
xC	FF	DUP	,	<	L	\	l	¦
xD			−	=	M	]	m	}
xE		FM	.	>	N	^	n	~
xF	☼		/	?	O	—	o	

All other screen codes are translated to X'20D' (-).

Table F-7. Screen Capture Edit Format (to Disk) Codes (continued)

	8x	9x	Ax	Bx	Cx	Dx	Ex	Fx
x0		É	á					
x1	ü	Æ	í					
x2	é		ó					
x3	â	ô	ú	|				
x4	ä	ö	ñ					
x5	à	ò	Ñ					
x6	å	û						
x7		ù						
x8	ê	ÿ						
x9	ë	Ö						
xA	è	Ü	¬					
xB	ï	¢						
xC	î	£						
xD	ì	¥						
xE	Ä	PTS						
xF	Å							

Note: For attribute bytes, see Table F-8.

Table F-8 shows the attribute bytes of the buffer contents for edit or for unformatted output for screen capture. Table F-9 shows the extended attribute bytes (EAB) of the buffer contents for screen capture when you specify the /E option.

Table F-8. Screen Capture UNFM and EDIT 3278/3279 Field Attribute Bytes

1	1	U/P	A/N	D/SPD	Rsvd	MDT
7	6	5	4	3 2	1	0

Bit	Contents
MSB 7, 6	1
5	0 = Unprotected 1 = Protected
4	0 = Alphanumeric 1 = Numeric
3, 2	00 = Display/not selector-light-pen-detectable 01 = Display/selector-light-pen-detectable 10 = Intensified display/selector-light-pen-detectable 11 = Nondisplay (All data in this field is captured as space characters.)
1	0
LSB 0	0 = Field has not been modified 1 = Field has been modified by the operator

Table F-9. Screen Capture 3278/3279 Extended Attribute Bytes

Highlight		Color			Program Symbol Set		
7	6	5	4	3	2	1	0

Bit	Contents
MSB 7, 6	Highlighting: 00 Default 01 Blink 10 Reverse video 11 Underscore
5, 4, 3	Color 000 Default 001 Blue 010 Red 011 Pink 100 Green 101 Turquoise 110 Yellow 111 White
LSB 2, 1, 0	Program Symbol set: 000 Default 001 APL/Text 010 Program Symbol set A 011 Program Symbol set B 100 Program Symbol set C 101 Program Symbol set D 110 Program Symbol set E 111 Program Symbol set F

File Transfer

Tables F-11 and F-12 are translation tables for the personal computer file formats EDIT, BAS, VAR, and UNFM using the TRAN option for the PCXFER command or PROFILE entry. Tables F-13 and F-14 are translation tables for the personal computer file format LIST using the TRAN option. You can use these tables to find out what is being translated in the supplied file transfer sample application programs or to write your own file transfer programs.

Files That Modify Translation Tables

The (fn ft fm) and (dsname) options of TRAN allow you to change the way PCXFER translates a file. (fn ft fm) and (dsname) identify a file that contains changes to the translation table used during file transfer. The file should have .TR commands to specify which characters in the translation table should be modified. The figure below shows the format of a .TR command

```
.TR ECHAR ACHAR [ECHAR ACHAR] [ECHAR ACHAR] ...
```

The purpose of the different options in the .TR command is described in Table F-10.

Table F-10. .TR Command Options

Option	Purpose
.TR	Indicates that one or more changes should be made to the translation table. If .TR does not appear in the first three characters of a record, PCXFER ignores that record.
ECHAR	Represents an EBCDIC character. You can specify this character by using either a 1-character value: A % a or a 2-character hexadecimal value: C1 6C 81
ACHAR	Represents an ASCII character. You can specify this character by using either a 1-character value: A % a or a 2-character hexadecimal value: 41 25 61

When you transfer a file from the host to the personal computer, PCXFER translates all instances of each EBCDIC character to the ASCII character that follows it. When you transfer a file from the personal computer to the host, PCXFER translates all instances of each ASCII character to the EBCDIC character that precedes it.

If a character does not appear in a .TR statement, PCXFER translates it using the values specified in Tables F-11 through F-14.

If you specify an EBCDIC or ASCII character more than once, the last occurrence of the character (reading from left to right in each record and down the file) is used. For example, if PCXFER finds the following statement:

.TR 5A 6A 5A 7A

Then, PCXFER translates X'5A' to X'7A' when transferring to the personal computer, and translates X'6A' and X'7A' to X'5A' when transferring from the personal computer.

When you specify the TRAN option of PCXFER or the PROFILE, all characters are translated except for control characters. Examples of control characters include X'0D0A' at the end of EDIT format file records and the printer control characters in LIST format files.

Below are examples of files that modify translation tables:

1.

```
/*WHEN TRANSFERRING TO THE PC, TRANSLATE */
/*ALL UPPER CASE CHARACTERS TO LOWER CASE*/
/*WHEN TRANSFERRING FROM THE PERSONAL    */
/*COMPUTER, TRANSLATE ALL LOWER CASE     */
/*CHARACTERS TO UPPER CASE               */
.TR A a B b C c D d E e F f G g H h I i
.TR J j K k L l M m N n O o P p Q q R r
.TR S s T t U u V v W w X x Y y Z z
```

2.

```
/*WHEN TRANSFERRING TO THE PERSONAL      */
/*COMPUTER, TRANSLATE X'F0' THROUGH X'FF'*/
/*TO X'20'. ALSO TRANSLATE X'40 to       */
/*X'20'. WHEN TRANSFERRING FROM THE       */
/*PERSONAL COMPUTER, TRANSLATE X'20' TO   */
/*X'40'                                   */
.TR F0 20 F1 20 F2 20 F3 20 F4 20 F5 20
.TR F6 20 F7 20 F8 20 F9 20 FA 20 FB 20
.TR FC 20 FD 20 FE 20 FF 20 40 20
```

3.

```
/*THIS FILE CAUSES THE TRANSLATION TABLE */
/*TO TRANSLATE AS THE TRANSLATION TABLE  */
/*FOR LIST FORMAT FILES                  */
.TR 8B 7B 9B 7D C0 C5 D0 CC
```

4.

```
/*THIS FILE CAUSES THE TRANSLATION TABLE */
/*TO TRANSLATE AS THE TRANSLATION TABLE  */
/*FOR FORMATS OTHER THAN LIST FORMAT     */
.TR 8B C5 9B CC C0 7B D0 7D
```

Table F-11. ASCII-to-EBCDIC Translation Table (PCXFER FROM TRAN)

	0x	1x	2x	3x	4x	5x	6x	7x
x0	00	10	40	F0	7C	D7	79	97
x1	01	11	5A	F1	C1	D8	81	98
x2	02	12	7F	F2	C2	D9	82	99
x3	03	13	7B	F3	C3	E2	83	A2
x4	37	3C	5B	F4	C4	E3	84	A3
x5	2D	3D	6C	F5	C5	E4	85	A4
x6	2E	32	50	F6	C6	E5	86	A5
x7	2F	26	7D	F7	C7	E6	87	A6
x8	16	18	4D	F8	C8	E7	88	A7
x9	05	19	5D	F9	C9	E8	89	A8
xA	25	3F	5C	7A	D1	E9	91	A9
xB	0B	27	4E	5E	D2	AD	92	8B
xC	0C	1C	6B	4C	D3	E0	93	4F
xD	0D	1D	60	7E	D4	BD	94	9B
xE	0E	1E	4B	6E	D5	5F	95	A1
xF	0F	1F	61	6F	D6	6D	96	07

Table F-11. ASCII-to-EBCDIC Translation Table (PCXFER FROM TRAN) (continued)

	8x	9x	Ax	Bx	Cx	Dx	Ex	Fx
x0	20	30	41	58	76	9F	B8	DC
x1	21	31	42	59	77	A0	B9	DD
x2	22	1A	43	62	78	AA	BA	DE
x3	23	33	44	63	80	AB	BB	DF
x4	24	34	45	64	8A	AC	BC	EA
x5	15	35	46	65	C0	4A	6A	EB
x6	06	36	47	66	8C	AE	BE	EC
x7	17	08	48	67	8D	AF	BF	ED
x8	28	38	49	68	8E	B0	CA	EE
x9	29	39	51	69	8F	B1	CB	EF
xA	2A	3A	52	70	90	B2	CC	FA
xB	2B	3B	53	71	9A	B3	CD	FB
xC	2C	04	54	72	D0	B4	CE	FC
xD	09	14	55	73	9C	B5	CF	FD
xE	0A	3E	56	74	9D	B6	DA	FE
xF	1B	E1	57	75	9E	B7	DB	FF

Table F-12. EBCDIC-to-ASCII Translation Table (PCXFER TO TRAN)

	0x	1x	2x	3x	4x	5x	6x	7x
x0	00	10	80	90	20	26	2D	BA
x1	01	11	81	91	A0	A9	2F	BB
x2	02	12	82	16	A1	AA	B2	BC
x3	03	13	83	93	A2	AB	B3	BD
x4	9C	9D	84	94	A3	AC	B4	BE
x5	09	85	0A	95	A4	AD	B5	BF
x6	86	08	17	96	A5	AE	B6	C0
x7	7F	87	1B	04	A6	AF	B7	C1
x8	97	18	88	98	A7	B0	B8	C2
x9	8D	19	89	99	A8	B1	B9	60
xA	8E	92	8A	9A	D5	21	E5	3A
xB	0B	8F	8B	9B	2E	24	2C	23
xC	0C	1C	8C	14	3C	2A	25	40
xD	0D	1D	05	15	28	29	5F	27
xE	0E	1E	06	9E	2B	3B	3E	3D
xF	0F	1F	07	1A	7C	5E	3F	22

Table F-12. EBCDIC-to-ASCII Translation Table (PCXFER TO TRAN) (continued)

	8x	9x	Ax	Bx	Cx	Dx	Ex	Fx
x0	C3	CA	D1	D8	7B	7D	5C	30
x1	61	6A	7E	D9	41	4A	9F	31
x2	62	6B	73	DA	42	4B	53	32
x3	63	6C	74	DB	43	4C	54	33
x4	64	6D	75	DC	44	4D	55	34
x5	65	6E	76	DD	45	4E	56	35
x6	66	6F	77	DE	46	4F	57	36
x7	67	70	78	DF	47	50	58	37
x8	68	71	79	E0	48	51	59	38
x9	69	72	7A	E1	49	52	5A	39
xA	C4	CB	D2	E2	E8	EE	F4	FA
xB	C5	CC	D3	E3	E9	EF	F5	FB
xC	C6	CD	D4	E4	EA	F0	F6	FC
xD	C7	CE	5B	5D	EB	F1	F7	FD
xE	C8	CF	D6	E6	EC	F2	F8	FE
xF	C9	D0	D7	E7	ED	F3	F9	FF

Table F-13. ASCII-to-EBCDIC Translation Table for LIST (PCXFER FROM TRAN LIST)

	0x	1x	2x	3x	4x	5x	6x	7x
x0	00	10	40	F0	7C	D7	79	97
x1	01	11	5A	F1	C1	D8	81	98
x2	02	12	7F	F2	C2	D9	82	99
x3	03	13	7B	F3	C3	E2	83	A2
x4	37	3C	5B	F4	C4	E3	84	A3
x5	2D	3D	6C	F5	C5	E4	85	A4
x6	2E	32	50	F6	C6	E5	86	A5
x7	2F	26	7D	F7	C7	E6	87	A6
x8	16	18	4D	F8	C8	E7	88	A7
x9	05	19	5D	F9	C9	E8	89	A8
xA	25	3F	5C	7A	D1	E9	91	A9
xB	0B	27	4E	5E	D2	AD	92	C0
xC	0C	1C	6B	4C	D3	E0	93	4F
xD	0D	1D	60	7E	D4	BD	94	D0
xE	0E	1E	4B	6E	D5	5F	95	A1
xF	0F	1F	61	6F	D6	6D	96	07

Table F-13. ASCII-to-EBCDIC Translation Table for LIST (PCXFER FROM TRAN LIST) (continued)

	8x	9x	Ax	Bx	Cx	Dx	Ex	Fx
x0	20	30	41	58	76	9F	B8	DC
x1	21	31	42	59	77	A0	B9	DD
x2	22	1A	43	62	78	AA	BA	DE
x3	23	33	44	63	80	AB	BB	DF
x4	24	34	45	64	8A	AC	BC	EA
x5	15	35	46	65	8B	4A	6A	EB
x6	06	36	47	66	8C	AE	BE	EC
x7	17	08	48	67	8D	AF	BF	ED
x8	28	38	49	68	8E	B0	CA	EE
x9	29	39	51	69	8F	B1	CB	EF
xA	2A	3A	52	70	90	B2	CC	FA
xB	2B	3B	53	71	9A	B3	CD	FB
xC	2C	04	54	72	9B	B4	CE	FC
xD	09	14	55	73	9C	B5	CF	FD
xE	0A	3E	56	74	9D	B6	DA	FE
xF	1B	E1	57	75	9E	B7	DB	FF

Table F-14. EBCDIC-to-ASCII Translation Table for LIST (PCXFER TO TRAN LIST)

	0x	1x	2x	3x	4x	5x	6x	7x
x0	00	10	80	90	20	26	2D	BA
x1	01	11	81	91	A0	A9	2F	BB
x2	02	12	82	16	A1	AA	B2	BC
x3	03	13	83	93	A2	AB	B3	BD
x4	9C	9D	84	94	A3	AC	B4	BE
x5	09	85	0A	95	A4	AD	B5	BF
x6	86	08	17	96	A5	AE	B6	C0
x7	7F	87	1B	04	A6	AF	B7	C1
x8	97	18	88	98	A7	B0	B8	C2
x9	8D	19	89	99	A8	B1	B9	60
xA	8E	92	8A	9A	D5	21	E5	3A
xB	0B	8F	8B	9B	2E	24	2C	23
xC	0C	1C	8C	14	3C	2A	25	40
xD	0D	1D	05	15	28	29	5F	27
xE	0E	1E	06	9E	2B	3B	3E	3D
xF	0F	1F	07	1A	7C	5E	3F	22

Table F-14. EBCDIC-to-ASCII Translation Table for LIST (PCXFER TO TRAN LIST) (continued)

	8x	9x	Ax	Bx	Cx	Dx	Ex	Fx
x0	C3	CA	D1	D8	C5	CC	5C	30
x1	61	6A	7E	D9	41	4A	9F	31
x2	62	6B	73	DA	42	4B	53	32
x3	63	6C	74	DB	43	4C	54	33
x4	64	6D	75	DC	44	4D	55	34
x5	65	6E	76	DD	45	4E	56	35
x6	66	6F	77	DE	46	4F	57	36
x7	67	70	78	DF	47	50	58	37
x8	68	71	79	E0	48	51	59	38
x9	69	72	7A	E1	49	52	5A	39
xA	C4	CB	D2	E2	E8	EE	F4	FA
xB	7B	7D	D3	E3	E9	EF	F5	FB
xC	C6	CD	D4	E4	EA	F0	F6	FC
xD	C7	CE	5B	5D	EB	F1	F7	FD
xE	C8	CF	D6	E6	EC	F2	F8	FE
xF	C9	D0	D7	E7	ED	F3	F9	FF

Personal Computer File Formats

The personal computer file formats determine what a personal computer file will look like when it is sent to the personal computer. The personal computer file formats are what you look for when you receive the file from the personal computer. You use the personal computer file formats as part of the PCXFER command options or the PROFILE entry.

EDIT File Formats

This format is called EDIT format because it is the format used by the IBM Personal Computer DOS Editor "EDLIN." The maximum record length is 65535 bytes.

The EDIT files have the following format:

Variable-Length Records				X'1A'
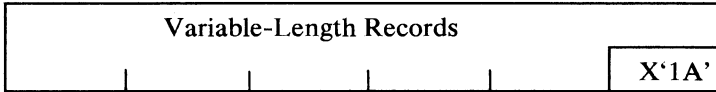
The end of an EDIT file is marked in one of three ways:

1. A value X'1A' after a variable-length record can mark the end of the file (the recommended way)

2. An X'00' can be used

3. If there is no data after the last variable-length record, the end of file is at the end of that record.

Each variable-length record is in the following format:

Contents of the Record	X'0D0A'
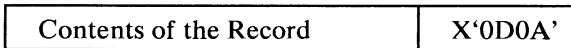
X'0D0A' is an ASCII carriage return/line feed.

UNFM File Formats

UNFM files are treated as one continuous string of bytes without any record organization. The size of a file is used to find where the string ends.

The UNFM files have the following format:

Unformatted File

When a file of this type is transferred to a CMS file or to a TSO data set, it is broken into records based on the size of the records of the CMS file or TSO data set. For example, if you transferred a UNFM file to a CMS file or to a TSO data set with 80-byte variable-length records, every 80 bytes of the UNFM file would be treated as a record.

The unformatted file has the following format:

80-byte record	80-byte record
80-byte record	Remainder record

If this file were then transferred back to the personal computer as a UNFM file, the new personal computer file would be identical with the original UNFM file.

VAR File Formats

In VAR file formats, the records are of variable length. Each record has a 2-byte field, followed by the contents of the record. This is similar to OS variable-length records, except that the 2-byte length at the beginning of a personal computer variable-length record is stored with its least significant byte first. (All 2-byte values are stored this way on the IBM Personal Computer.) The value in the 2-byte field is the length of the contents of the record only. The value does not include the two bytes of length information. The maximum size of the contents of a record is 65535.

The VAR files have the following format:

Variable-Length Records
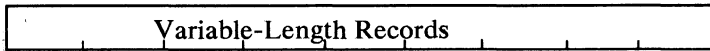
Each variable-length record is in the following format:

Two-Byte
Length

Length	Contents of the record
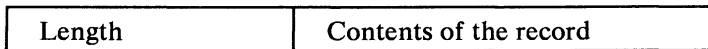
The size of the file is used to tell where the file ends.

BAS File Formats

The format of a BAS file is determined by the first byte of the file. Depending on this first byte, the file will be in either UNFM or EDIT format.

The UNFM BAS file has the following formats:

X'FE'	

X'FF'	

If the first byte of the file is X'FF' or X'FE', the personal computer file format is UNFM. We check for these values because they are the values that BASIC uses to identify internal format and protected format BAS files on the IBM Personal Computer.

The EDIT BAS file has the following format:

Any other	

If the first byte of the file is not X'FF' or X'FE, the personal computer file is in EDIT format. You can generate these files from BASIC by saving your BASIC program with the ASCII option.

LIST File Formats

LIST file formats are files that are formatted for a printer. If the LIST file is being transferred from the personal computer to the host, it should be formatted for the IBM Personal Computer Printer. If the LIST file is being transferred from the host to the personal computer, it should be formatted for a host printer.

Note: LIST file formats should be used only for transferring a file that will be printed on a printer. If a LIST file is transferred to one computer and then transferred back to the original computer, it will not compare byte for byte, but it still will print correctly.

LIST files on the personal computer must be in EDIT format. (See "Edit File Formats.") These EDIT files may have special characters to control the printer. These characters are:

X'0C' — Form Feed

X'09' — Tab

X'08' — Backspace

X'0D' — Carriage Return

X'0D0A' — Carriage Return Line Feed

LIST files on the host contain a 1-byte carriage-control character at the beginning of each record. The carriage-control characters that the PCXFER program supports are:

Action before Printing	Action after Printing	Action without Printing	Action Taken
+	X'01'		Print only (no space)
X'40'	X'09'	X'0B	Space one line
0	X'11'	X'13'	Space two lines
X'60'	X'19'	X'1B'	Space three lines
1	X'89'	X'8B'	Skip to channel 1 (form feed)
		X'03'	Null

The characters in the "Action before Printing" column cause the specified action to take place before printing the record in which the carriage-control character was found. The characters in the "Action after Printing" column cause the action to take place after the record containing the carriage-control character is printed. The characters in the "Action without Printing" column cause the action to take place without printing the record in which the carriage-control character was found.

As LIST files are transferred from the personal computer:

1. Tab characters X'09' are expanded to the next 8-byte boundary. For example, the line

   X'01 02 03 09 0B 07 01 02 09 03'

   would become

   9 bytes   17 bytes

   X'01 02 03 20 20 20 20 20 0B 07 01 02 20 20 20 20 03'

2. The IBM Personal Computer Printer control characters X'0C' (Form Feed), X'0D' (Carriage Return), and X'0D0A' (Carriage Return Line Feed) are replaced by host printer control characters which will perform the same functions.

3. All backspace characters, X'08', are deleted.

   Table F-13 is the translation table used for ASCII-to-EBCDIC translation for LIST files when TRAN is specified.

As LIST files are transferred to the personal computer:

1. The first character of each record is interpreted as follows:

Action before Printing	Action after Printing	Action without Printing	Action Taken
+	X'01'		Print only (no space)
X'40'	X'09'	X'0B	Space one line
0	X'11'	X'13'	Space two lines
X'60'	X'19'	X'1B'	Space three lines
1	X'89'	X'8B'	Skip to channel 1 (form feed)
		X'03'	Null

The characters in the "Action before Printing" column cause the specified action to take place before printing the record in which the carriage-control character was found. The characters in the "Action after Printing" column cause the action to take place after the record containing the carriage-control character is printed. The characters in the "Action without Printing" column cause the action to take place without printing the record in which the carriage-control character was found.

2. When all records have been transferred to the personal computer, an end-of-file X'0D0A1A" is transferred to indicate the end of the file.

Table F-14 is the translation table used for EBCDIC-to-ASCII translation for LIST file formats when TRAN is specified.

Appendix G. File Transfer Data Streams and Error Messages

File Transfer

The **file transfer** function moves data between the host and the personal computer, using structured-field format. All requests from the user for file transfers are directed to the host. The host communicates with the personal computer to effect the transfer in the proper direction. The maximum number of bytes that can be sent in one transmission in either direction is 2K bytes (K equals 1024).

The 3270 outbound data stream containing structured fields begins with a Write Structured Field (WSF) command hexadecimal F3 or 11. Multiple structured fields can be sent with one WSF command.

WSF	Structured Field 1	Structured Field 2		Structured Field *n*
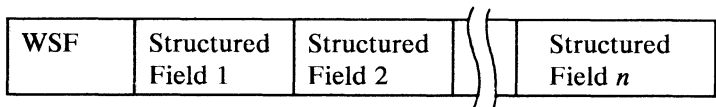
The 3270 inbound data stream containing structured fields begins with an attention identifier (AID):

AID	Structured Field
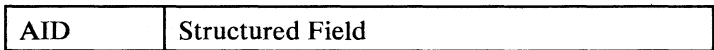
The structures used by the IBM 3270 Personal Computer Attachment follow the 3270 data stream format. (For more information on structured fields, refer to the *IBM 3274 Control Unit Description and Programmer's Guide*, GA23-0061.)

The structures used for file transfer have a common format:

Structured Field

Length (2 bytes)	'D0'	Type (1 byte)	Parameters and Data
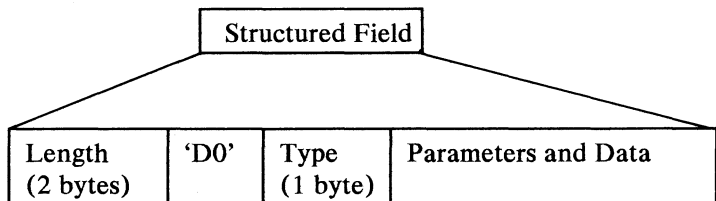
The structures used for file transfer defined in this appendix must be coded as shown. All constant values are given in hexadecimal. Variables are explained following each data string.

Prior to a request from the host application to the personal computer, the host application must verify (with the 3274 Control Unit) that the personal computer interface is operational. This is done with a read partition query structured field. It requires a specific query reply to be returned.

The QUERY and QUERY REPLY structures verify that a path exists between the host application and the personal computer application. The host application inquires about the personal computer application.

If the personal computer application enables the path to the IBM 3274 Control Unit (for example, using HOST.EXE), the IBM 3274 Control Unit responds to a QUERY with a QUERY REPLY. This QUERY REPLY contains the IBM 3270 Personal Computer Attachment code and the replies of any other attached features. If the path is not enabled, the IBM 3274 Control Unit responds to a QUERY with a QUERY REPLY that contains any other attached features.

When the IBM Personal Computer powers off, the interface to the IBM 3274 Control Unit is disabled. If a host application attempts to exchange data with a personal computer application, the IBM 3274 Control Unit returns a Data Stream Error — OP CHECK. (Refer to the *IBM 3274 Control Unit Description and Programmer's Guide,* GA23-0061, for more information about OP CHECK.)

The format of the Query and Query Reply structured fields follows:

● OUTBOUND = Read Partition Query

Byte	Name/Value	Description
0–1	LL/'0005'	Field length
2	C/'01'	Read partition
3	PID/'FF'	Partition ID
4	/'02'	Query

- INBOUND = Query Reply

Byte	Name Value	Description
0–1	LL/'0006'	Field length
2	C/'81'	Query reply
3	/'93'	3270 Personal Computer Attachment unique
4–5	/'0800'	Message limit in bytes

Message Limit = The 2K length restriction enforced by the IBM 3274 Control Unit on structures to and from the IBM 3270 Personal Computer Attachment, across the feature bus.

(Refer to the *IBM 3274 Control Unit Description and Programmer's Guide*, GA23-0061, for more information.)

Data Compression

Data compression takes place when there are more than three sequential repetitions of the same data code. A 1-byte compression header precedes the data.

Compression Header

The compression header has the following format:

Bit	Meaning
7 – MSB	0 – no compression 1 – repeated codes compressed
6 – 0	The length of the data bytes minus 1.

If a data code is sequentially repeated three or more times, the repeated codes are replaced with a compression header and the character to be repeated. For example, if the data to be sent were ABCDEEEEEEFGGGGGGGG, the data string would be:

```
| 0 0000100 | A | B | C | C | D | 1 0000101 | E | 0 0000000 | F | 1 0000111 | G |
```

Compression Header
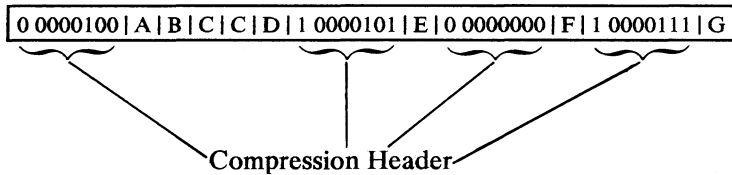
File Transfer from Host to Personal Computer

Requests and responses in the following sequences are used to transfer files from the host to the personal computer.

The following structures detail the message data sent and received by the personal computer application through the personal computer application program interface (API).

The DATA part of the insert and get character strings are defined by the host file transfer application file formats for the personal computer. All numbers given in the request and reply function are hexadecimal values.

Create

This function initializes a transfer in the personal computer from the host.

Host Structure (Request)

```
LL DO 05 XX 01 04 20 81 08 LO 27 04 DBS 28 L1 NAME
11 09 01 07 30 FILSIZ 03 L2 FILSPEC
```

LL	=	a 2-byte length field (the length of the structure, including LL).
XX	=	11.
LO	=	a 1-byte length field (8 + the length of the format NAME).
DBS	=	a 2-byte field containing the data block size.
L1	=	a 1-byte length field containing (2 + the length of the format NAME).
NAME	=	a variable-length field containing the format NAME (in ASCII). Refer to "Personal Computer File Formats" in Appendix F.
FILSIZ	=	a 4-byte field containing the file size in data blocks.
L2	=	a 1-byte field containing (2 + the length of the personal computer file specification).
FILSPEC	=	a variable-length field containing the personal computer file specification (in ASCII).

Personal Computer Structure for an Unsuccessful Transmission (Reply)

```
0009 DO 0508 69 04 xx xx
```

12 00	— Duplicate file name
1A 00	— File name invalid
1C 00	— File size invalid
2A 00	— Path not found
45 00	— Record format not allowed
4A 00	— Record length invalid
52 00	— Space not available
5D 00	— Unsupported type
62 00	— Parameter missing
63 00	— Parameter not supported
65 00	— Parameter value not supported
71 00	— Invalid flag value

Open

This function forms a logical connection between an application on the host system and a file on the personal computer system. Once the connection has been made, requests and data may flow from the host to the personal computer.

Host Structure (Request)

```
LL D0 00 12 01 06 01 01 04 03 0A 00 00 00 00 11 01
01 00 50 05 52 03 FX 08 L0 28 L1 NAME 03 L2 FILSPEC
```

LL	=	a 2-byte length field (the length of the structure, including LL).
FX	=	F0 – No compression F1 – Compression
L0	=	a 1-byte length field (8 + the length of the format NAME).
L1	=	a 1-byte length field containing (2 + the length of the format NAME).
NAME	=	a variable-length field containing the format NAME (in ASCII).
L2	=	a 1-byte length field (2 + the length of the personal computer file specification) (in ASCII).
FILSPEC	=	a variable-length field containing the personal computer file specification.

Personal Computer Structure for a Successful Transmission (Reply)

```
0005 D0 00 09
```

Personal Computer Structure for an Unsuccessful Transmission (Reply)

```
0009 D0 00 08 69 04 xx xx
```

01 00	–	Open failed exception
02 00	–	Arrival sequence not allowed
1A 00	–	File name invalid
1B 00	–	File not found
1C 00	–	File size invalid
20 00	–	Function/open error
2A 00	–	Path not found
5D 00	–	Unsupported type
60 00	–	Command syntax error
62 00	–	Parameter missing
63 00	–	Parameter not supported
65 00	–	Parameter value not supported
71 00	–	Invalid format

Insert

This function writes the next record into the personal computer file.

Host Structure (Request)

```
000A D0 47 11 01 05 00 80 00 LL D0 47
04 C0 NN 61 LD DATA
```

LL	= a 2-byte length field (the length of the structure from LL to the end of DATA).
NN	= hexadecimal A0 – data compressed 80 – data not compressed
LD	= a 2-byte length field (5 + the length of the data).
DATA	= data being sent. (See "Personal Computer File Formats," in Appendix F.)

Personal Computer Structure for a Successful Transmission (Reply)

```
000B D0 47 05 63 06 DATBLK
```

DATBLK = a 4-byte field containing the data block number received. (For the first data block, DATBLK = 00 00 00 01.)

Personal Computer Structure for an Unsuccessful Transmission (Reply)

```
0009 D0 47 08 69 04 xx xx
```

02 00 – Arrival sequence not allowed
3E 00 – Operation not authorized
47 00 – Record not added, storage limit
5D 00 – Unsupported type
60 00 – Command syntax error
62 00 – Parameter missing
63 00 – Parameter not supported
65 00 – Parameter value not supported
6E 00 – Data element missing
70 00 – Record length = 0
71 00 – Invalid flag value

Close

This function performs the logical termination of a connection between a file on the host system and a previously opened file on the personal computer system.

Host Structure (Request)

```
0005 D0 41 12
```

Personal Computer Structure for a Successful Transmission (Reply)

```
0005 D0 41 09
```

Personal Computer Structure for an Unsuccessful Transmission (Reply)

```
0009 D0 41 08 69 04 xx xx
```

03 00 – Close of an unopened file
47 00 – Record not added to file
5D 00 – Unsupported type
60 00 – Command syntax error
63 00 – Parameter not supported
71 00 – Invalid format

File Transfer from Personal Computer to Host

Requests and responses in the following sequences are used to transfer files from the personal computer to the host.

Listfile

Listfile asks for the characteristics of the file at the personal computer to be sent to the host.

Host Structure (Request)

```
LL DO 11 11 01 04 40 11 03 L2 FILSPEC
```

LL	=	a 2-byte length field (the length of the structure, including LL).
L2	=	a 1-byte length field (2 + the length of the personal computer file specification).
FILSPEC	=	a variable-length field containing the personal computer file specification (in ASCII).

Personal Computer Structure for a Successful Transmission (Reply)

```
LL DO 11 05 11 07 20 FILSIZ 27 04 DBS 28 L1 NAME
```

LL	=	a 2-byte length field (the length of the structure, including LL).
FILSIZ	=	a 4-byte field containing the file size in data blocks. For a nondiskette file, this field contains FFFF FFFF.
DBS	=	a 2-byte field containing the data block size.
L1	=	a 1-byte field (2 + the length of the format NAME).
NAME	=	a variable-length field containing the format NAME (in ASCII).

Personal Computer Structure for an Unsuccessful Transmission
(Reply)

```
0009 D0 11 08 69 04 xx xx
```

1A 00	— File name invalid
1B 00	— File not found
2A 00	— Path not found
5D 00	— Unsupported type
60 00	— Command syntax error
62 00	— Parameter missing
63 00	— Parameter not supported
65 00	— Parameter value not supported
71 00	— Invalid flag value

Open

This function forms a logical connection between an application on
the host system and a file on the personal computer system. Once
the connection has been established, requests may flow from the host
to the personal computer and data may flow back from the personal
computer to the host.

Host Structure (Request)

```
LL D0 00 12 01 06 01 01 04 03 0A 00 01 00 00 00 00 01
00 50 05 52 03 FX 08 L0 28 L1 NAME 03 L2 FILSPEC
```

LL	= a 2-byte field (the length of the structure, including LL).
L0	= 4 + the length of the format name.
L1	= a 1-byte length field containing (2 + the length of the format NAME).
NAME	= a variable-length field containing the format name (in ASCII).
L2	= a 1-byte field (2 + the length of the personal computer file specification).
FILSPEC	= a variable-length field containing the personal computer file specification (in ASCII).

Personal Computer Structure for a Successful Transmission
(Reply)

```
0005 D0 00 09
```

Personal Computer Structure for an Unsuccessful Transmission (Reply)

0009 D0 00 08 69 04 xx xx

01 00 — Open failed exception
02 00 — Arrival sequence not allowed
1A 00 — File name invalid
1B 00 — File not found
1C 00 — File size invalid
20 00 — Function/open error
2A 00 — Path not found
5D 00 — Unsupported type
60 00 — Command syntax error
62 00 — Parameter missing
63 00 — Parameter not supported
65 00 — Parameter value not supported
71 00 — Invalid format

Set Cursor and Get

This function sets the logical block pointer (cursor) to the next block and retrieves a record from the personal computer file.

Host Structure (Request)

00 0F D0 45 11 01 05 00 06 00 09 05 01 03 00
00 09 D0 46 11 01 04 00 80

Personal Computer Structure of Set for an Unsuccessful Transmission (Reply)

00 09 D0 45 08 69 04 xx xx

02 00 — Arrival sequence not allowed
5D 00 — Unsupported type
60 00 — Command syntax error
62 00 — Parameter missing
63 00 — Parameter not supported
65 00 — Parameter value not supported
71 00 — Invalid flag value

Personal Computer Structure for a Successful Transmission (Reply)

```
LL DO 46 05 63 06 DATBLK CO NN 61 LD DATA
```

LL	=	a 2-byte field (the length of the structure, including LL).
DATBLK	=	a 4-byte field, the data block number being sent.
NN	=	hexadecimal
		A0 — data compressed
		80 — data not compressed
LD	=	a 2-byte length field (5 + the length of the data).
DATA	=	the data being sent.

Personal Computer Structure of Get for an Unsuccessful Transmission (Reply)

```
0009 DO 46 08 69 04 xx xx
```

```
02 00  — Arrival sequence not allowed
22 00  — Get past end of file
3E 00  — Operation not authorized
5D 00  — Unsupported type
60 00  — Command syntax error
62 00  — Parameter missing
63 00  — Parameter not supported
65 00  — Parameter value not supported
71 00  — Invalid format
```

Close

This function terminates a connection between a file on the host system and a previously opened file on the personal computer system.

Host Structure (Request)

```
0005 DO 41 12
```

Personal Computer Structure for a Successful Transmission (Reply)

```
0005 D0 41 09
```

Personal Computer Structure for an Unsuccessful Transmission (Reply)

```
0009 D0 41 08 69 04 xx xx
```

```
                        03 00  —  Close of an unopened file
                        5D 00  —  Unsupported type
                        60 00  —  Command syntax error
                        71 00  —  Invalid flag value
```

Delete

This function is used to abort a file transfer and to delete the temporary personal computer file created by an OPEN prior to CLOSE.

Host Structure (Request)

```
LL D0 0B 12 03 L2 FILSPEC
```

LL   = a 2-byte field (the length of the structure, including LL).
L2   = a 1-byte field (2 + the length of the personal computer file specification).
FILSPEC = a variable-length field containing the personal computer file specification (in ASCII).

Personal Computer Structure for a Successful Transmission (Reply)

```
0005 D0 0B 09
```

Personal Computer Structure for an Unsuccessful Transmission (Reply)

```
0009 D0 0B 08 69 04 xx xx
```

```
02 00  — Arrival sequence not allowed
1A 00  — File name invalid
2A 00  — Path not found
5D 00  — Unsupported type
60 00  — Command syntax error
62 00  — Parameter missing
63 00  — Parameter not supplied
71 00  — Invalid flag value
```

Sample File Transfer Program Error Messages

Usually, the only messages you see from the file transfer sample application programs are self-explanatory. There are some "impossible to occur" messages with error codes only. These "impossible" messages can occur if you modify and test the sample programs or if you encounter a bug in the sample program.

The error messages in this section can give you a direction in which to search for a solution to the error, but do not give you the solution. Refer to the publications below if you need more information about an error message. You will also find the earlier sections of this appendix about the data stream helpful.

- *IBM Virtual Machine/System Product: System Programmer's Guide*, SC19-6203

- *IBM Virtual Machine/System Product: CMS Command and Macro Reference*, SC19-6209

- *IBM 3270 Information Display System: 3274 Control Unit Description and Programmer's Guide*, GA23-0061

- *OS/VS2 MVS Data Management Macro Instructions*, GA26-3873

- *OS/VS2 Guide to Writing a Terminal Monitor Program or a Command Processor*, GC28-0648

- *OS/VS2 MVX Supervisor Services and Macro Instructions*, GC28-0683.

These "impossible" messages are listed by category:

- Personal computer program error

- Unexpected personal computer response

- Data stream error

- CMS macro failure or command failure

- TSO macro failure

- Console I/O error

- 3274 Control Unit error

- Unexpected storage request error (GETMAIN macro)

- Unexpected storage request error (DMSFREE macro)

- Unexpected attention identifier.

Personal Computer Program Error

PC Program Error, Error code = 'xxx', Error info = 'error info'

This message provides information for a user writing an application program on the IBM Personal Computer that communicates with the CMS or TSO file transfer program. Table G-1 describes the program error codes. Refer to the data stream sections of this appendix to understand the descriptions of the error codes. The DATBLK section is the sequence X'6306' DATBLK; the DATA section is the sequence X'CO' NN X'61' LD DATA.

Table G-1. Personal Computer Program Error Codes

Error Code	Error Description	Error Information
42	The personal computer program is planning to send blocks that are bigger than the 3274 control unit wil support, currently 2048 bytes. If the personal computer program indicates in the DBS field of its response to a LISTFILE request that it will be sending blocks greater than 2032 bytes (16 bytes of overhead are sent with every block), this message occurs.	The first two bytes of the error information contain the maximum length in bytes allowed by the 3274 Control Unit. Bytes 3 and 4 contain the length specified by the personal computer program.
46	The SET CURSOR AND GET reply is missing a DATA or DATBLK section.	
47	The personal computer's response to a GET request does not contain a DATA section.	The first 55 bytes of the personal computer's reply to the GET request.
48	The personal computer response to a GET request does not contain a DATBLK section.	The first 55 bytes of the personal computer's reply to the GET request.

Table G-1. Personal Computer Program Error Codes (continued)

Error Code	Error Description	Error Information
49	The compressed data sent by the personal computer after a GET request was invalid. The CMS and TSO file transfer programs verify that the lengths of the repeated and non-repeated data fields in the compressed data match the length of the data. A length of 2 is used for each repeated data field, and (2 + the length of the non-repeated data) is used for each nonrepeated data field.	The first 55 bytes of the personal computer's reply to the GET request.
50	The personal computer returned an invalid reply to a CREATE request.	The first 55 bytes of the personal computer's reply to the CREATE request.
51	The personal computer returned an invalid reply to the CREATE and OPEN requests.	The first 55 bytes of the personal computer's reply to the CREATE and OPEN requests.
52	The personal computer returned an invalid reply to the LISTFILE request.	The first 55 bytes of the personal computer's reply to the LISTFILE request.
53	The personal computer returned an invalid reply to an OPEN request.	The first 55 bytes of the personal computer's reply to the OPEN request.

Table G-1. Personal Computer Program Error Codes (continued)

Error Code	Error Description	Error Information
54	The personal computer returned an invalid reply to a CLOSE request.	The first 55 bytes of the personal computer's reply to the CLOSE request.
55	The personal computer returned an invalid reply to an INSERT request.	The first 55 bytes of the personal computer's reply to the INSERT request.
56	The personal computer returned an invalid reply to a SET request.	The first 55 bytes of the personal computer's reply to the SET request.
57	The personal computer returned an invalid reply to a GET request.	The first 55 bytes of the personal computer's reply to the GET request.
58	The personal computer returned an invalid reply to a SET CURSOR AND GET request.	The first 55 bytes of the personal computer's reply to the SET CURSOR AND GET request.
59	The DATA section of the personal computer's reply to a GET request is invalid.	The first 55 bytes of the personal computer's reply to the GET request.
60	The DATBLK section of the personal computer's reply to a GET request is invalid.	The first 55 bytes of the personal computer's reply to the GET request.

Table G-1. Personal Computer Program Error Codes (continued)

Error Code	Error Description	Error Information
203	A structured field was read from the 3270 Personal Computer Attachment at a time it was not expected. There is an error in the personal computer program, or the CMS and personal computer programs are not synchronized with each other. If the programs are not synchronized, the problem can be fixed by restarting the programs.	

Unexpected PC Response

A structured field was read from the IBM Personal Computer Attachment at a time it was not expected. There is an error in the personal computer program, or the TSO and personal computer programs are not synchronized with each other. If the programs are not synchronized, the problem can be fixed by restarting both programs.

Data Stream Error

Data Stream Error, Error code = 'xxx', Request = 'name', Major RC = 'xx xx'

The CMS, TSO, and personal computer file transfer programs use a protocol to communicate as they transfer files. The data stream sections in this appendix describe this protocol. This error message occurs if the personal computer program responds to a request with a major return code that the CMS or TSO program did not expect. Below is a list of the specific error codes:

Data stream error, error code = 63, request = CLOSE, major RC = 'xx xx'

Data stream error, error code = 64, request = LISTFILE, major RC = 'xx xx'

Data stream error, error code = 65, request = CREATE, major RC = 'xx xx'

Data stream error, error code = 66, request = INSERT, major RC = 'xx xx'

Data stream error, error code = 67, request = SET, major RC = 'xx xx'

Data stream error, error code = 68, request = GET, major RC = 'xx xx'

Data stream error, error code = 69, request = CREATE/OPEN,
major RC = 'xx xx'

Data stream error, error code = 70, request = OPEN,
major RC = 'xx xx'

CMS Macro Failure or Command Failure

CMS Macro Failure Occurred, Error code = 'xxx',
Macro name = 'name', Macro RC = 'RC', CMS-fileid = 'name'

The CMS file transfer program uses the CMS file access macros des-
cribed in *IBM Virtual Machine/System Product: CMS Command and
Macro Reference*, SC19-6209. If one of these macros returns a code
that the file transfer program does not expect, this message occurs.
The specific error codes are:

140: CMS FSSTATE macro failed on input file

141: CMS FSOPEN macro failed on input file

142: CMS FSREAD macro failed on input file

240: CMS FSWRITE macro failed on output file

241, 258: CMS FSSTATE macro failed on output file

242: CMS FSOPEN macro failed on output file

243: CMS FSCLOSE macro failed on output file

244, 245: CMS FSERASE macro failed on output file

CMS Command Failure occurred, Error code = 259, Command
name = LISTFILE, Command RC =

The CMS command LISTFILE failed. The return codes is 'RC'. Refer
to the *IBM Virtual Machine/System Product: CMS Command and
Macro Reference*, SC19-6209.

TSO Macro Failure

TSO Macro Failure Occurred, Error code = 'xxx', Macro name = 'name', Macro RC = 'RC'

The TSO file transfer program uses the TSO macros described in *OS/VS2 MVS Data Management Macro Instructions,* GC26-3873, and *OS/VS2 Guide to Writing a Terminal Monitor Program or a Command Processor,* GC28-0648. If one of these macros returns a code that the file transfer program does not expect, this message occurs. The specific error codes are:

140: TSO STATE error; could not determine the input data set characteristics

141: TSO OPEN failed on input data set

142: TSO GET failed on input data set

143: TSO PUT failed on output data set

145: TSO OPEN failed on output data set

146: TSO CLOSE failed

220: TSO TGET failed

Console I/O Error

Console I/O Error Occurred, Error code = 'xxx', Error info = 'error info'

Table G-2 describes the CMS error codes that can occur. The Diagnose commands X'24' and X'58' referred to are described in *IBM Virtual Machine/System Product: CMS Command and Macro Reference,* SC19-6203.

Table G-2. Console I/O Error Codes

Error Code	Error Description	Error Information
170	The IBM 3270 Personal Computer Attachment is not properly connected to the user's virtual machine.	The condition code returned by a Diagnose X'24' instruction, which determined that the IBM 3270 Personal Computer Attachment was not properly connected.
175	A write to the IBM 3270 Personal Computer Attachment did not work correctly. Only part of the message was written.	The channel status word (CSW) at the time the error was detected.
177	No channel end or device end was returned after a write to the IBM 3270 Personal Computer Attachment.	The CSW at the time the error was detected.
178 179 180	Channel errors occurred during a write to the IBM 3270 Personal Computer Attachment.	The CSW at the time the error was detected.
181 182 183	A Diagnose X'58' request failed, for an unknown reason, during a write to the IBM 3270 Personal Computer Attachment.	The CSW at the time the error was detected.

Table G-2. Console I/O Error Codes (continued)

Error Code	Error Description	Error Information
184 185 186 187 195 196 197 210 211 212 213	The IBM 3270 Personal Computer Attachment is not operational for some reason.	The CSW at the time the error was detected.
188 189 190 214 215 216	A unit check occurred during a write to the IBM 3270 Personal Computer Attachment.	The first 8 bytes are the CSW at the time that the error occurred. The last byte is sense information indicating what caused the unit check. The *IBM 3270 Information Display System 3274 Control Unit Description and Programmer's Guide,* GA23-0061, explains the sense information.
191 192	Channel errors occurred during a read from the IBM 3270 Personal Computer Attachment.	The CSW at the time the error was detected.
193 194	A Diagnose X'58' request failed, for an unknown reason, during a read from the IBM 3270 Personal Computer Attachment.	The CSW at the time the error was detected.

Table G-2. Console I/O Error Codes (continued)

Error Code	Error Description	Error Information
198	A Read Modified did not get any information back from the IBM 3270 Personal Computer Attachment.	
199 200	A unit check occurred during a read from the IBM 3270 Personal Computer Attachment.	The first 8 bytes are the CSW at the time the error occurred. The last byte is sense information indicating what caused the unit check. The *IBM 3270 Information Display System 3274 Control Unit Description and Programmer's Guide*, GA23-0061, explains the sense information.
204 205 206	Channel errors occurred while the console screen was being cleared.	The CSW at the time the error was detected.
207 208 209	A Diagnose X'58' request failed, for an unknown reason, while the console screen was being cleared.	The CSW at the time the error was detected.

3274 Control Unit Error

3274 Control Unit Error Occurred, Error code = 'xxx', Error info = 'error info'

The following error codes can occur:

171: A Read Partition Query to the 3274 controller did not work correctly. The reply was not in the correct format.

176: The 3274 did not answer a Read Partition Query within a certain amount of time. Error information is the number of seconds that the program waited for the answer.

Unexpected Storage Request Error — GETMAIN

Unexpected Storage Request Error, Error code = 230, GETMAIN, RC = 'RC'

The TSO file transfer program uses the GETMAIN macro described in the *OS/VS2 MVS Supervisor Services and Macro Instructions,* GC28-0683. If the macro returns with a code that the file transfer program does not expect, this message occurs.

Unexpected Storage Request Error — DMSFREE

Unexpected Storage Request Error, Error code = 230, DMSFREE, RC = 'RC'

The CMS file transfer program uses the DMSFREE macro described in the *IBM Virtual Machine/System Product: System Programmer's Guide,* SC19-6203. If the macro returns with a code that the file transfer program does not expect, this message occurs.

Unexpected Attention Identifier

Unexpected Attention Identifier, (AID) = 'AID received'

The TSO file transfer program has found an unexpected attention identifier, or AID byte, in an incoming message.

Appendix H. Advanced Diagnostics

Introduction

This appendix is an addendum to the Advanced Diagnostics in the *IBM Personal Computer Hardware and Service* manual.

The numbered exit points in the following procedures refer to exit points from the problem determination procedures in Chapter 6. Whenever a problem determination procedure leads to an exit point, you may continue detailed problem isolation using the additional procedures with the corresponding exit point in this appendix.

Persons assigned to maintain the IBM Personal Computer 3270 Attachment Option should understand the wiring diagrams of the distribution box and all interconnecting cables. See Figures D-2 through D-5, in Appendix D.

Read Figure D-3 carefully when testing the feature bus cable for continuity and shorts. In this figure, the feature bus cable is not wired in the conventional manner. The wires do not run to the same connector pins at both ends of the cable. With this unique wiring method, feature bus cable problems can be diagnosed without a multimeter or any other test equipment. Since the physical signal path changes when the ends are swapped, a faulty cable presents different failure symptoms after the cable ends are swapped.

Advanced Diagnostics Follow-Up Procedure

From Problem Determination Procedure 2

EXIT POINT 225

A 301 error message that stays on the screen indicates either a faulty keyboard cable or a faulty IBM Personal Computer 3270 Adapter.

Check that the keyboard pigtail is connected properly. See Figure 6-4. Also check the keyboard signal path from the keyboard DIN connector through the distribution box to the personal computer card connector for continuity and shorts. See Figure D-2.

If you do not find any trouble, replace the IBM Personal Computer 3270 Adapter.

EXIT POINTS 235, 255, 265

Remove all nonessential adapters and memory modules. If the problem persists, perform the diagnostics in the *IBM Personal Computer Hardware and Service* manual.

From Problem Determination Procedure 3

EXIT POINT 315

Test the distribution box from connector B to the 79-pin connector
for continuity and shorts. If no trouble is found, replace the IBM
Personal Computer 3270 Adapter. See Figures D-2 through D-5 for
wiring diagrams of the distribution box and of the keyboard adapter
cable pigtail.

EXIT POINT 325

Repair or replace the feature bus cable.

EXIT POINT 365

Test the video cable for continuity and shorts. If no trouble is found,
replace the monochrome display and parallel printer adapter. If the
problem persists, have the display serviced. See Figures D-2 through
D-5 for wiring diagrams.

EXIT POINT 375

Test the video cable for continuity and shorts. If no trouble is found,
replace the color/graphics monitor adapter. If the trouble persists,
have the display serviced.

From Problem Determination Procedure 4

EXIT POINT 415

Test the distribution box keyboard connectors A and C to the 79-pin connector for continuity and shorts. Also test the keyboard adapter cable pigtail for continuity and shorts. If no trouble is found, replace the IBM Personal Computer 3270 Adapter. See Figures D-2 through D-5 for wiring diagrams of the distribution box and of the keyboard adapter cable pigtail.

EXIT POINT 425

Repair or replace the keyboard adapter cable.

EXIT POINT 439

Test the keyboard adapter cable pigtail to the 79-pin connector for continuity and shorts. If no trouble is found, replace the IBM Personal Computer 3270 Adapter. See Figures D-2 through D-5 for wiring diagrams of the distribution box and of the keyboard adapter cable pigtail connector.

EXIT POINTS 437, 435

Replace the IBM Personal Computer 3270 Adapter.

From Problem Determination Procedure 5

EXIT POINT 505

Replace the IBM Personal Computer 3270 Adapter.

EXIT POINT 515

Test the distribution box keyboard connectors A and C to the 79-pin connector for continuity and shorts. If no trouble is found, replace the IBM Personal Computer 3270 Adapter. See Figures D-2 through D-5 for wiring diagrams of the distribution box and of the keyboard adapter cable pigtail.

EXIT POINT 525

Replace the IBM Personal Computer 3270 Adapter.

From Problem Determination Procedure 6

EXIT POINT 605

Replace the IBM Personal Computer 3270 Adapter.

EXIT POINT 615

Replace the IBM Personal Computer 3270 Adapter. Following are the error codes:

Error	Source of Error
1950	Keyboard serializer
1951	Buffer memory
1952	Feature bus circuitry

EXIT POINTS 635, 645

Repair or replace the feature bus cable.

From Problem Determination Procedure 7

EXIT POINT 715

Repair or replace the feature bus cable.

EXIT POINT 725

Test the feature bus cable for shorts and continuity.

If no trouble is found, test the distribution box from connector B to the 79-pin connector for continuity and shorts.

If no trouble is found, replace the IBM Personal Computer 3270 Adapter. See Figures D-2 through D-5 for wiring diagrams of the distribution box and of the cables.

EXIT POINT 735

Test the feature bus cable and the video cable for continuity and shorts. See Figure D-3 for the wiring diagram of the cable and of the distribution box.

If no trouble is found, test the distribution box from connector B to the 79-pin connector for continuity and shorts. If no trouble is found, replace the IBM Personal Computer 3270 Adapter.

If, after replacing the IBM Personal Computer 3270 Adapter and testing the distribution box, you still have the problem, have the system unit serviced.

From Problem Determination Procedure 8

EXIT POINT 820

Following are the operator information area error codes for the feature bus:

Code	Source of Error
235	*Invalid status or command queue failure.* The feature bus adapter has returned invalid status, or a command queue to the feature bus adapter has failed after retry.
236	*Lost OP complete.* More than 1 second has elapsed since the 3274 initiated an operation to the personal computer requiring an OP complete and that status was not received (for example, doing a keyboard system reset during a file transfer).
237	*Message protocol error.* The 3274 has detected a protocol error in communicating with the personal computer.
238	*Inbound message too long.* While processing an inbound structured field message from the personal computer, the 3274 received more than 2048 bytes of data before an end-of-message indicator was received.

From Problem Determination Procedure 9

EXIT POINT 915

Test the video cable and the feature bus cable for continuity and shorts. See Figures D-3 and D-4 for wiring diagrams. Repair or replace the faulty cable.

EXIT POINT 925

Test the distribution box from connector B to the 79-pin connector for continuity and shorts. If no trouble is found, replace the IBM Personal Computer 3270 Adapter. See Figures D-3 through D-5 for wiring diagrams of the distribution box.

EXIT POINT 975

Test the video cable for continuity and shorts. If no trouble is found, replace the color/graphics monitor adapter. If the trouble persists, have the display serviced. See Figures D-2 through D-5 for wiring diagrams.

Appendix I. Parts List

Following are the part numbers for the IBM 3270 Personal Computer Attachment.

Part	Major Unit Code	Part Number
Feature Bus cable	324	4752127
Video cable	324	4752128
Keyboard Adapter cable	324	4752129
Distribution box	324	4752146
Card guide	324	1652473
IBM Personal Computer 3270 Adapter		
For 3278 Display with System Unit Model 5150	324	6931963 or 4757530 or 1899619
For 3278 Display with System Unit Model 5160	324	6931963
For 3279 Color Display with System Unit Model 5150	324	8233718 or 6931963
For 3279 Color Display with System Unit Model 5160	324	6931963
IBM 3270 Personal Computer Attachment User's Guide		8501207

Appendix J. Repack Instructions

Follow these instructions in sequence when returning the system unit for repair. For instructions on relocating the Personal Computer system, refer to Section 6 of the *IBM Personal Computer Guide to Operations* manual.

Return all IBM cards and cables. DO NOT return other manufacturers' equipment with the system unit.

Step 1

1. Lift the lever.

2. Remove the diskettes from the diskette drive unit.
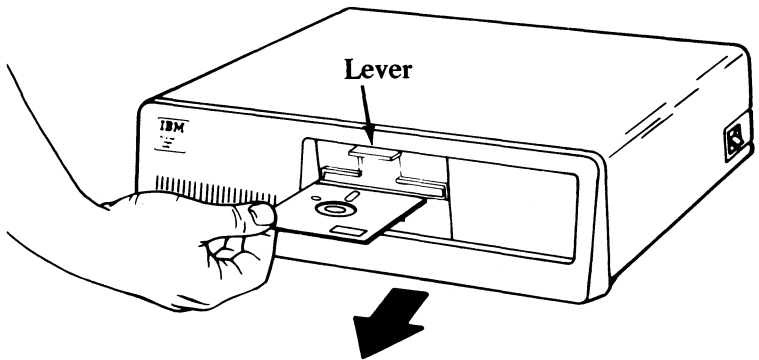
If you have an IBM Personal Computer Expansion Unit, go to Step 2. If not, go to Step 3.

Step 2

Warning: Normal shipping and handling can cause a permanent loss of all data on the fixed disk(s). You should back up all files onto diskettes before continuing. Depending on the amount of data stored, you might require about 32 diskettes to back up each fixed disk. Refer to the *IBM Disk Operating System* manual for a description of the BACKUP command.

Once you have backed up your fixed disk(s), follow these steps to secure them from moving:

1. Insert your diagnostic diskette.

2. Set the expansion unit (if attached) On/Off switch to On.

3. Set the system unit On/Off switch to On.

4. Remove the system diskette from drive A of the system unit (if used).

5. Insert the IBM Personal Computer Diagnostic diskette into drive A of the system unit.

6. From the keyboard, type A:COMMAND then press ENTER.

7. The following message appears on your screen:

   SELECT AN OPTION
   0--RUN DIAGNOSTIC ROUTINES
   1--FORMAT DISKETTE
   2--COPY DISKETTE
   3--PREPARE FIXED DISK FOR RELOCATION
   9--EXIT TO SYSTEM DISKETTE
   ENTER THE ACTION DESIRED
   ?

8. Enter 3.

   The disk head moves over the highest available cylinder, the position used when moving your system.

9. The following message appears on your screen:

   FIXED DISK(S) READY FOR SHIPPING

Step 3

1. Set the system unit On/Off switch to Off.

2. Set the display On/Off switch to the Off position (0).

3. Set the On/Off switches of any other devices attached to the system unit to the Off position.

4. Remove the system unit power cord from the wall outlet.

5. Remove the system unit power cord from the system unit.

Power Cord Socket

System Unit Power Cord

Power Outlet
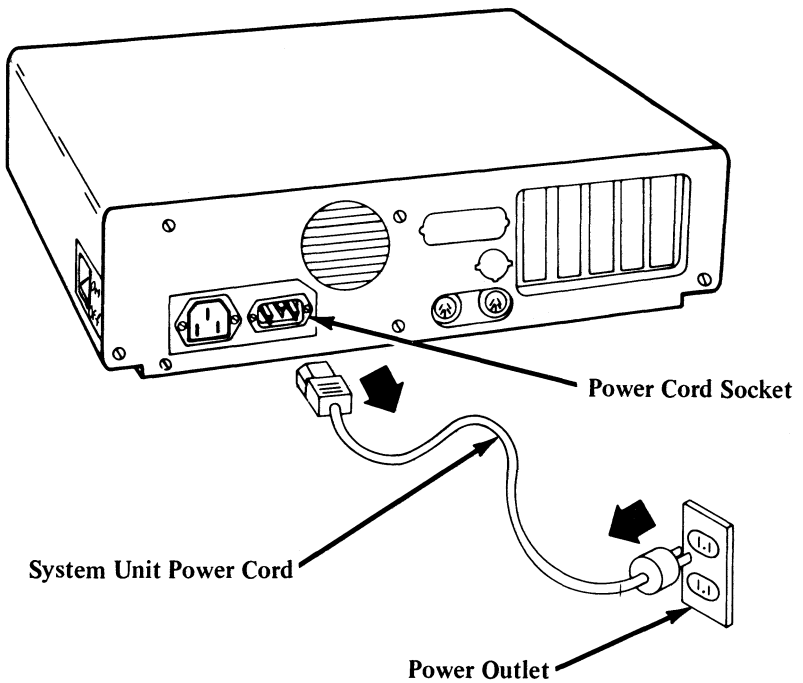
Step 4

1. At the rear of the display, remove the video cable by squeezing the spring latches (on the top and bottom) toward each other and pulling the cable connector out.

2. Remove the feature bus cable in the same way.

3278 Display

Video Test Switch

Feature Bus Cable

Video Cable

3279 Color Display

Feature Bus
Cable

Keyboard
Adapter Cable

Video Cable
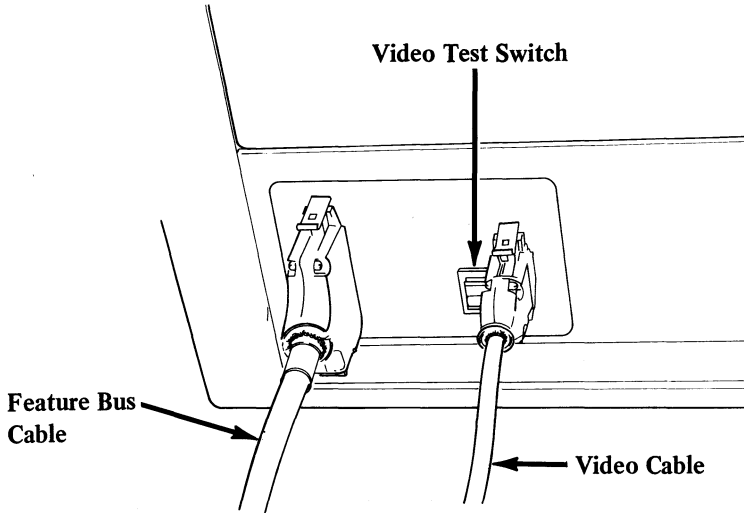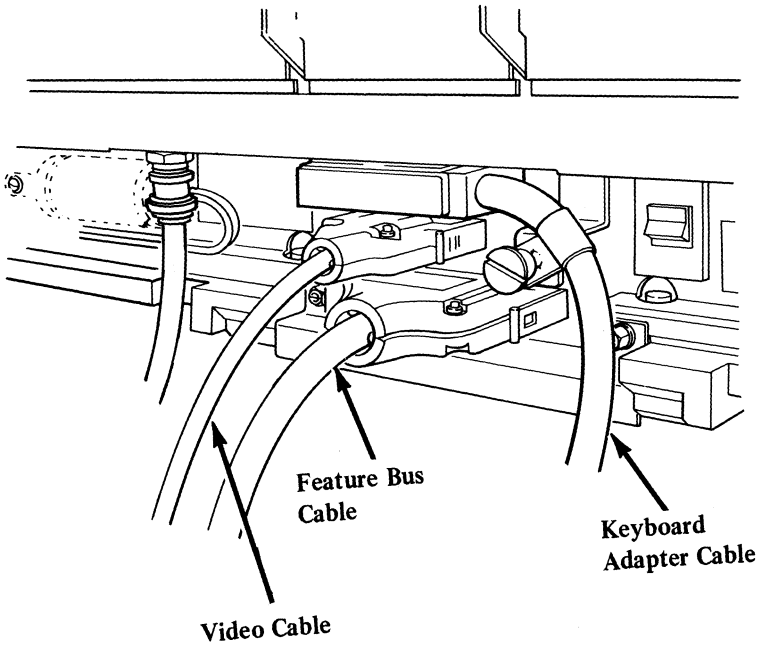
Step 5

1. Unscrew the wing screw by turning it counterclockwise (↶). Pull the keyboard cable connector out. Reinsert the wing screw into the stud.

2. Remove the feature bus cable by squeezing the spring latches toward each other and pulling the cable connector out.

3. Remove the keyboard adapter cable by squeezing the spring latches toward each other and pulling the cable connector out.

4. Pull the keyboard adapter cable pigtail lead from the keyboard socket.

5. Unscrew the two screws on the video cable, and pull the video cable out.
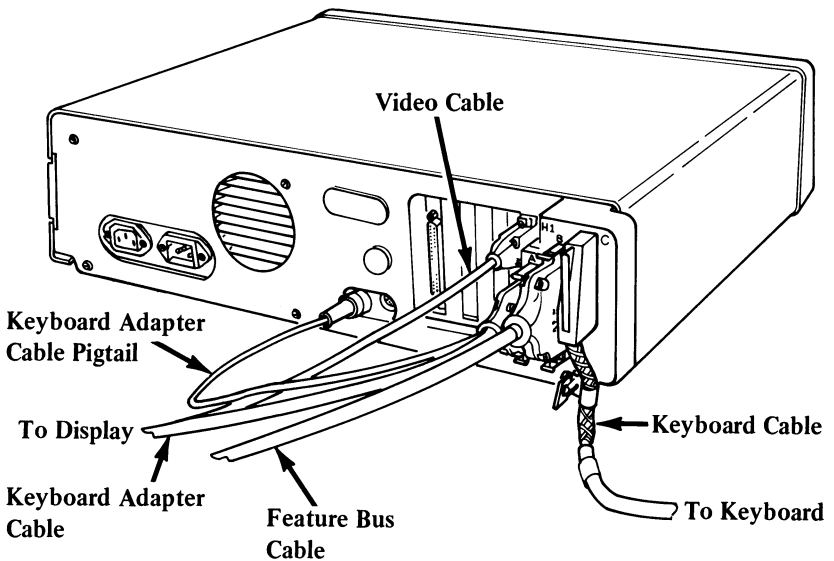
Step 6

1. Coil the keyboard adapter cable, the video cable, and the feature bus cable, and insert each cable into its plastic shipping bag. (See figure below.) Do the same for the power cord.
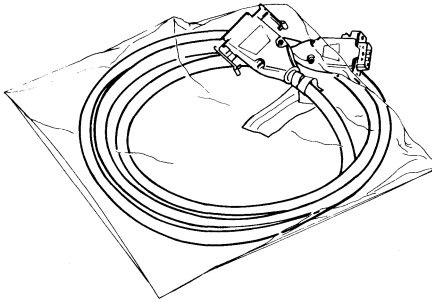
2. Remove any other cables from the system unit and keep them.

3. Remove the distribution box by removing the two screws and pulling the distribution box out. Put the distribution box into its shipping carton.

Step 7

Note: Use all the packing materials (corner braces, foam cushions, etc.), and pack all parts in the original cartons if available; cushion well to prevent damage if you use different cartons.

1. Put the system unit in its shipping bag.
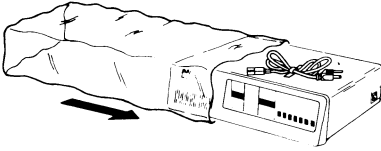
2. Set the keyboard adapter cable, the video cable, the feature bus cable, and the distribution box in the center well in the bottom foam cushion.
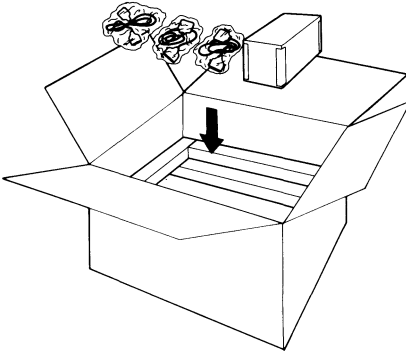
3. Lower the system unit onto the foam cushion.
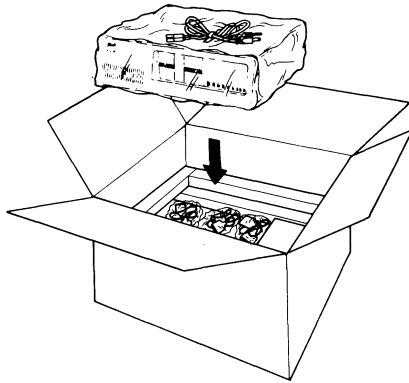
4. Place the top foam cushion over the system unit.
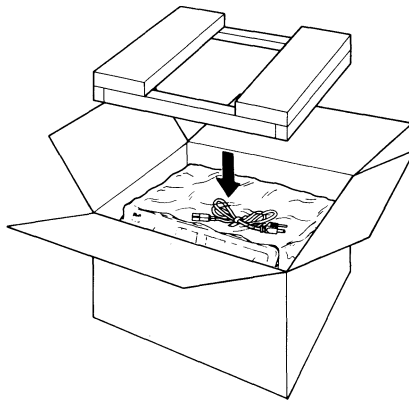
5. Close and tape the shipping carton.

Glossary of Terms and Abbreviations

This glossary includes terms and definitions from the *IBM Vocabulary for Data Processing, Telecommunications, and Office Systems*, GC20-1699.

A

ACF/TCAM. Advanced Communication Function for the Telecommunications Access Method.

address bus. A set of wires or signals carrying the binary-coded address from the Intel 8088 microprocessor throughout the rest of the IBM Personal Computer System Unit.

addressing. (1) The assignment of addresses to the instructions of a program. (2) The means whereby the originator or a control station selects the unit to which it is going to send a message.

Advanced Communication Function for the Telecommunications Access Method (ACF/TCAM). A program product that provides single-domain network capability and, optionally, multiple-domain capability.

AEN. Address Enable.

AID. Attention identifier.

alphameric. Synonym for *alphanumeric*.

alphanumeric. Pertaining to a character set that contains letters, digits, and usually other characters, such as punctuation marks. Synonymous with *alphameric*.

Alt key functions. Keyboard functions printed on the front of the key that are selected when the Alternate (Alt) key is pressed with the desired key.

American National Standard Code for Information Interchange (ASCII). The standard code used for exchanging information among data processing systems and associated equipment.

American National Standards Institute (ANSI). An organization for the purpose of establishing voluntary industry standards.

ANSI. American National Standards Institute.

APAR. Authorized program analysis report.

application. A program that is written by or for a user and that applies to the user's work, for example a payroll application program.

ASCII. American National Standard Code for Information Interchange.

assembler. A computer program used to assemble. Synonymous with *assembly program.*

assembler language. A source language that includes symbolic machine language statements in which there is a one-to-one correspondence with the instruction formats and data formats of the computer.

assembly program. Synonym for *assembler.*

Asynchronous Communications Adapter. The adapter that provides a channel to data processing or input/output devices outside of your immediate system. These can be connected by telephone, with a plug-in modem, or directly by cable when the device is nearby.

attachment option enhancements diskette. The diskette that contains supplementary sample application programs, such as the XLATKBD program, the BASIC Application Program Interface, and the PASCAL Application Program Interface.

attention identifier (AID). A code in the inbound 3270 data stream that identifies the source or type of data that follows.

attribute byte. In 3270 applications, the byte used for data security to indicate whether a certain field can be or has been changed.

authorized program analysis report (APAR). A report of a problem caused by a suspected defect in a current unaltered release of a program.

B

back up. To duplicate data from a fixed disk drive or diskette to another diskette to ensure availability of the data in the event of loss of or damage to the original. Do not confuse this term with the DOS 2.0 fixed disk command. (See DOS 2.0 manual).

BASIC. Beginner's all-purpose symbolic instruction code.

beginner's all-purpose symbolic instruction code (BASIC). A high-level, widely used computer programming language.

binary. Pertaining to a selection, choice, or condition that has two possible values or states.

binary digit. Synonym for *bit.*

binary synchronous communication (BSC). (1) Communication using binary synchronous line discipline. (2) A uniform procedure, using a standardized set of control characters and control character sequences, for synchronous transmission of binary-coded data between stations.

BIOS. Basic Input/Output System.

bit. In binary notation, either of the characters 0 and 1. Synonymous with *binary digit.*

break. A personal computer function that stops whatever action is in progress, such as stopping a program in the middle of execution.

BSC. Binary synchronous communication.

buffer. (1) An area of storage that is temporarily reserved for use in performing an input/output operation, into which data is read or from which data is written. Synonymous with *input/output area.* (2) A portion of storage for temporarily holding input or output data.

bus. One or more conductors used for transmitting signals or power.

byte. (1) A binary character operated upon as a unit and usually shorter than a computer word. (2) The representation of a character.

C

carriage control character. The first character of an output record (line) that is to be printed; for example, the carriage control character can determine how many lines should be skipped before the next line is printed.

CLK. Clock.

CMS. Conversational monitor system.

Color/Graphics Monitor Adapter. A medium-resolution monitor adapter designed to attach a wide variety of TV frequency monitors and TV sets.

control unit. A device that controls input/output operations at one or more devices, such as the 3274 Control Unit, the 3276 Control Unit Display Station, or the Integrated Display Adapter (IDA).

conversational monitor system (CMS). A virtual machine operating system that provides general interactive time sharing, problem solving, and program development capabilities, and operates only under the control of the VM/370 control program.

cursor. The movable spot of light, on a display screen, that indicates where the next character will be entered, replaced, or deleted.

customization. The procedure performed in personal computer mode that prepares your IBM 3270 Personal Computer Attachment DOS diskette from the IBM Personal Computer DOS diskette and the Customization diskette.

D

data. All information entered into or used by a computer.

data compression. A technique that saves storage space by eliminating gaps, empty fields, redundancies, or unnecessary data to shorten the length of records or blocks.

data stream. The commands, control codes, orders, attributes, and data or structured fields for 3270 devices transmitted inbound to an application program or outbound to a terminal.

data transfer. The transfer of data between host applications and personal computer applications by screen capture or file transfer.

default. A value that is assumed when none has been specified.

diagnostic. Pertaining to the detection and isolation of a malfunction or mistake.

DIN connector. One of the connectors specified by the DIN standardization committee.

disk. The term that refers to both the diskette and the fixed disk in this manual.

disk operating system (DOS). A program that interacts with the system processing unit and the disk/diskette drive to control the flow of data. A DOS program is the link between you and your system hardware. You must be in DOS to perform operations affecting entire diskettes or multiple diskettes.

diskette. A personal computer storage device consisting of a flexible magnetic disk inside a protective plastic jacket.

diskette drive. A device that uses diskettes for mass storage and retrieval of data.

display. An output unit for the visual display of data.

DOS. Disk operating system.

dynamicizer. Synonym for *serializer.*

E

EAB. Extended attribute buffer.

EBCDIC. Extended binary-coded decimal interchange code.

ECSA. Extended Character Set Adapter.

edit format. A screen capture output format that copies information as it appears on the screen.

enabled. Pertaining to a state of the processing unit that allows the occurrence of certain types of interruptions. Synonymous with *interruptible.*

extended attribute buffer (EAB). The buffer in which the extended field attribute for the 3270 Kenji display field is stored.

extended binary-coded decimal interchange code (EBCDIC). A coded character set consisting of 8-bit coded characters.

Extended Character Set Adapter. The storage that provides the additional control and buffering necessary for the extended character set in the APL/TEXT feature and for the field and character attributes for extended color, programmed symbols, and extended highlighting.

F

field. In a record, a specified area used for a particular category of data, for example, a group of card columns in which a wage rate is recorded.

file. A collection of data. This data can be programs, word processing files, or computational information. Files are stored either in the host computer or on personal computer diskettes. Files are also called *data sets*.

file transfer. The function that allows you to send and receive files or data sets between the personal computer and the host when the file transfer code resides in your host.

fixed disk. One type of personal computer data storage. This storage device is housed in the system unit. A fixed disk is composed of rigid material with a magnetic coating. It is used for mass storage and retrieval of data.

G

gate. (1) A combinational circuit with only one output channel. (2) A device having one output channel and one or more input channels, such that the output channel state is completely determined by the input channel states, except during switching transients. (3) A combinational logic element having at least one input channel.

H

hardware. The physical equipment used in data processing, as opposed to programs, procedures, and associated documentation. (Contrast with *software*.)

header. An additional line at the beginning of a screen image captured in edit format.

hertz (Hz). A unit of frequency equal to one cycle per second.

hexadecimal. Pertaining to a selection, choice, or condition that has 16 possible values or states. These values or states usually contain 10 digits and 6 letters, A through F. Hexadecimal digits are equivalent to a power of 16.

HOST command. The command that switches the display to host computer mode and activates both the file transfer and the screen capture sample application programs in the personal computer.

host computer. A large, central computer that provides services such as computation, data base access, and special programs or programming languages.

host computer mode. A mode of operation where the display is in session with the host application. The control unit processes your input and sends it to the host in this mode. The operator information area is present.

Hz. Hertz.

I

IDA. Integrated display adapter.

IML. Initial machine load.

initial machine load (IML). The procedure that prepares the control unit for operation.

initial program load (IPL). The first process in operating your personal computer attachment, which causes the operating system to commence operation.

input/output (I/O). (1) Pertaining to a device or to a channel that may be involved in an input process, and, at a different time, in an output process. (2) Pertaining to a device whose parts can be performing an input process and an output process at the same time.

input/output area. Synonym for *buffer*.

integrated display adapter (IDA). A type of control unit.

interactive system productivity facility (ISPF). A facility that provides menu panels for transferring files with the IBM 3270 Personal Computer Attachment.

interface. A shared boundary. An interface might be a hardware component to link two devices or it might be a portion of storage or registers accessed by two or more computer programs.

interrupt. (1) A suspension of a process, such as the execution of a computer program, in such a way that the process can be resumed. (2) To stop a process in such a way that it can be resumed. (3) In data transmission, to take an action at a receiving station that causes the transmitting station to terminate a transmission.

interruptible. Synonym for *enabled*.

I/O. Input/output.

IOR. I/O Read command.

IOW. I/O Write command.

IPL. Initial program load.

ISPF. Interactive system productivity facility.

K

k. An abbreviation for the prefix kilo, 1000 in decimal notation.

K. When referring to storage capacity, to the tenth power, 1024 in decimal notation.

keyboard reference cards. In this manual, the cards that fold out to show the IBM Personal Computer Keyboard functions mapped to your 3278/3279 keyboard. These cards are used for reference in personal computer mode.

kHz. Kilohertz.

kilohertz (kHz). A unit of frequency equal to 1000 hertz.

L

logging on. The procedure by which you are linked to a multiple-user host computer system. The procedure requires a user identification (userid) and a password.

M

magnetic slot reader. A device that reads precoded information from a magnetic stripe as it passes through a slot in the reader.

megahertz (MHz). A unit of frequency equal to one million hertz.

MEMR. Memory Read command.

MEMW. Memory Write command.

menu. A list of available operations, from which you select the operation you want.

MHz. Megahertz.

mode switch. A function that allows you to switch operating modes. You can switch from personal computer mode to host computer mode, or vice versa, by holding ALT and pressing PA1 (for text keyboards) or holding ALT and pressing insert (⍂) (all other keyboards).

monitor. A television-type display, such as the IBM Monochrome Display.

Monochrome Display and Parallel Printer Adapter. A high-resolution monochrome alphanumeric adapter with parallel printer adapter. The adapter provides the interface to the IBM Monochrome Display and a parallel interface for the IBM 80 CPS Matrix Printer.

N

NCP. Network control program.

network control program. A program, generated by the user from a library of IBM-supplied modules, that controls the operation of a communication controller.

O

OIA. Operator information area.

operator information area (OIA). The bottommost line of your screen where you receive information about the status of your personal computer attachment in host computer mode.

panel. A screen full of information.

parameter. A variable that is given a constant value for a specific application and that may denote the application.

PCXFER command. The command that activates the file transfer sample application program in the CMS or TSO host.

PCXFER.PROFILE data set. The data set that contains the default PCXFER command options for TSO file transfer.

personal computer. A small home or business computer complete with a system unit and keyboard, and available with a variety of options such as a monochrome display and a dot matrix printer.

personal computer file format. The format that determines how a file will appear in the personal computer after it is transferred from the host.

personal computer mode. A mode of operation where the display is in session with the personal computer application. The personal computer program running in the system unit processes your input.

personal computer printer. A desktop printer attached exclusively to your IBM 3270 Personal Computer Attachment.

POST. Power-on self-test.

power-on self-test (POST). This test is automatically performed whenever the system unit On/Off switch is switched to the On position. A sequence of responses, including a cursor, a beep, and a prompt, occur.

problem determination. The procedures that tell you how to isolate and correct problems that occur during setup and operation of the IBM 3270 Personal Computer Attachment.

PROFILE PCXFER file. The file that contains the default PCXFER command options for CMS file transfer.

program function key (PF key). A key that passes a signal to a program to call for a particular operation. On most 3278/3279 keyboards, the program function keys are located in the rightmost keypad.

program temporary fix (PTF). A temporary solution or bypass of a problem diagnosed by IBM field engineering as the result of a defect in a current unaltered release of the program.

Programmed Symbol set (PSS). A collection of symbols, defined by the user or the application program, that are loaded into the same read/write storage.

PSS. Programmed Symbol set.

PTF. Program temporary fix.

pushdown list. Synonym for *stack*.

Q

query reply. An inbound structured field in response to a read partition query structured field that defines the specific characteristics of the device queried.

R

RAM. Random access memory.

random access memory (RAM). Storage that can be both read from and written to.

record. A collection of related data or words treated as a unit; for example, in stock control, each invoice could constitute one record.

register. A storage device having a specified storage capacity, such as a bit, a byte, or a computer word, and usually intended for a special purpose.

request for price quotation (RPQ). A customer request for a price quotation on alterations or additions to the functional capabilities of a computing system, hardware product, device, or program product. The RPQ may be used to solve unique data processing problems.

reset. (1) To cause a counter to take the state corresponding to a specified initial number. (2) To put all or part of a data processing device back into a prescribed state. (3) Contrast with *set*.

RPQ. Request for price quotation.

Rst. Drvr. Reset Driver.

S

screen. The display surface.

screen capture. A function with which you can copy the contents of the host screen image to the personal computer printer, diskette, or fixed disk.

selector pen. A penlike instrument that can be attached to a display station to select items on the screen or generate an attention.

self-loading diskette. A diskette that can be inserted to power up the system unit or used with a keyboard system reset.

serializer. A device that converts a space distribution of simultaneous states representing data into a corresponding time sequence of states. Synonymous with *dynamicizer.*

set. To cause a counter to take the state corresponding to a specified number. Contrast with *reset.*

shift function. The set of key functions printed on the keyface at the top of the key and initiated by pressing Shift + the desired key.

software. Programs, procedures, rules, and any associated documentation pertaining to the operation of a computer system. (Contrast with *hardware.*)

SRA. Science Research Associates.

stack. A list that is constructed and maintained so that the next item to be retrieved and removed is the most recently stored item still in the list, that is, last-in-first-out (LIFO). Synonymous with *pushdown list.*

system diskette. This diskette is prepared by adding other files for your typical system and application needs to your IBM 3270 Personal Computer Attachment DOS diskette.

system expansion slots. The slots that allow options to be attached to the IBM Personal Computer System Unit.

system unit. The part of your IBM 3270 Personal Computer Attachment that interprets between the display and the keyboard. It accomplishes all the processing and controlling operations for the attachment.

T

time sharing option (TSO). An optional configuration of the operating system that provides conversational time sharing from remote stations.

.TR command. The command that specifies which characters in the translation table should be modified for use with PCXFER.

trailer. An additional line at the end of a screen image captured in edit format.

TSO. Time sharing option.

U

unformatted. A screen capture output format that copies the display station's buffers for storage in machine code on a disk.

upload program. The program that sends the file transfer sample application programs from the CMS or TSO data transfer diskette to the host.

V

virtual machine system product. A functional simulation of a computer and its associated devices.

virtual telecommunications access method. A set of programs that control communication between terminals and applications running under certain operating systems.

VM/SP. Virtual machine system product.

VTAM. Virtual telecommunications access method.

W

word. A character string or a binary element string that it is convenient for some purpose to consider as an entity.

X

XLATKBD program. A program that changes the standard mappings between the personal computer keyboard and the 3278/3279 keyboard.

Index

E

F

P

U

/U option 5-11
undetermined failures 6-8, 6-9
unexpected attention identifier G-27
unexpected PC response G-21
unexpected storage request error (DMSFREE) G-27
unexpected storage request error (GETMAIN) G-27
UNFM and EDIT 3278/3279 field attribute bytes F-12
UNFM file format
   choosing 5-40
   for CMS 5-33
   for TSO 5-37
   using F-27
unformatted codes for screen capture F-6
unformatted output for screen capture 5-10, F-2
upload program
   checking for uploaded programs 5-8
   CMS and TSO host sample application programs 5-8
   CMS error messages E-11
   CMS procedure E-10
   CMS requirements E-5
   TSO error messages E-17
   TSO procedure E-15
   TSO requirements E-7

V

VAR file format
   choosing 5-39
   for CMS 5-33
   for TSO 5-37
   using F-28
VCNA requirements for data transfer E-6
video cable 2-8
   attaching to a 3278 2-29
   attaching to a 3279 2-30
   pin connections D-7
   removing from a 3278 J-4
   removing from a 3279 J-5

W

white (highlighted) keys 3-3
wing screw
    attaching 2-45
    removing 2-43
wraptest for data transfer 6-5, 6-9

1

19xx errors 6-7, 6-32

3

3270 attachment interrupt handler extension interface A-30
3270.EXE file 3-23
3270 interrupt handler 3-25
3270 Personal Computer Attachment
    capabilities 1-1
    definition 1-1
    error codes and messages 6-28
    prerequisites 1-6
3270 Personal Computer Attachment Option
    installing 2-14
    parts supplied 2-7
3270ATT command 3-24
3270ATT.EXE file 3-25
    copying to application disk 3-27
    copying to system fixed disk 3-26
3270DIAG.EXE file 6-3
3270DIAG file 6-3
3274 Control Unit
    error G-27
    file transfer setup requirements E-1
    screen capture setup requirements E-1
3276 Control Unit Display Station
    screen capture error message 5-14
3278 Display Station 2-5
    brightness control 2-50
    cabled for 3270 Personal Computer Attachment 2-47
    contrast control 2-50
    opening the front cover 2-36
    problems 6-6, 6-14

IBM 3270 Personal Computer Attachment

Personal Computer Mode Keyboard Reference Cards

This package contains 16 Personal Computer Mode Keyboard Reference Cards, which are described in Chapter 3 of the *IBM 3270 Personal Computer Attachment User's Guide*. You select the card in this package that matches your keyboard and insert it in the back of the user's guide.

To select this card:

1. Choose, from Figures 3-1 to 3-16, the figure that matches your keyboard.

2. Read the note in the figure to find which keyboard reference card you use.

3. Remove the card from this package.

4. Insert the card in the back of the *IBM 3270 Personal Computer Attachment User's Guide.*

5. Fold the card out against the edge of the manual for reference.

6. Save the remaining keyboard reference cards for possible future use.

Refer to Chapter 3 of the *IBM 3270 Personal Computer Attachment User's Guide* for more information.

User's Comment Form

User's Guide   8501207
Order No. SA23-0169-1

Your comments assist us in improving our products.
IBM may use and distribute whatever information
you supply in any way it believes appropriate without
incurring any obligation to you. You may, of course,
continue to use the information you supply.

Comments:

If you wish a reply, provide your name and address in
this space.

Name   _____

Address   _____

City   _____ State _____

Zip Code _____ Telephone No. _____

Fold and Tape   **Please Do Not Staple**   Fold and Tape

‖‖‖‖

BUSINESS REPLY MAIL

FIRST CLASS   PERMIT NO. 40   ARMONK, N.Y.

POSTAGE WILL BE PAID BY ADDRESSEE:

International Business Machines Corporation
Department 52Q
Neighborhood Road
Kingston, New York 12401

IBM ®

International Business Machines Corporation

Neighborhood Road
Kingston, New York 12401