**Personal Computer Family
Service Information Manual**

Preface

The purpose of this *Service Information Manual* (SIM) is to provide its user with the most frequently used service-related maintenance and reference information.

The SIM is not required to service the Personal Computer family of products. The SIM has been made available as a convenience to the user.

The SIM is divided into sections by product-specific information for each machine type with additional sections for general Personal Computer information.

This document can also be ordered by specifying Bill of Forms (BOF) 2481. Other items included in this BOF are diskettes, service summary cards, tabs, binders, and plastic diskette holders. Individual form numbers for these additional items are:

Diskettes
IBM Advanced Diagnostic for the 5150, 5155, and 5160, Version 2.25	SA38-0033
IBM Advanced Diagnostic for the 5162 and 5170, Version 2.07	SA38-0034

Service Summary Cards
5162 and 5170 Service Summary Card	SA38-0035
5150, 5155, and 5160 Service Summary Card	SA38-0036

Printer Supplement	SA38-0040
Tabs	SA38-0038
Plastic Diskette Holders 5.25-Inch (2 U/M)	SA38-0015

IBM / Technical Newsletter

**IBM Personal Computer Family
Service Information Manual**

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This Technical Newsletter contains revised pages for the PC SIM. Remove pages as indicated below and replace with current TNL pages.

Remove	Add
Page 4-15 to 4-16	Page 4-15 to 4-16
Page 17-1 to 17-2	Page 17-1 to 17-2
Page 17-3 to 17-4	Page 17-3 to 17-4
Page 18-27 to 18-28	Page 18-27 to 18-28
Page 18-47 to 18-48	Page 18-47 to 18-48

Note: *Please file this cover letter at the back of the manual to provide a record of changes.*

IBM Corporation, Dept. 90A, Bldg. 234-2, Boca Raton, Florida 33429-1328

* INSTRUCTIONS *

The *Personal Computer Family Service Information Manual* should be assembled in the following manner:

- Tabs should be inserted at the beginning of each appropriate chapter.
  - The plastic Summary Card Holder (located at the back of the tabs) should be inserted in Chapter 21, "Service Summary Cards."
  - The Service Summary Cards should be inserted into the plastic Summary Card Holder.
- Plastic Diskette Holders should be inserted in Chapter 20, "Advanced Diagnostic Diskettes."
  - The Advanced Diagnostic Diskettes should be inserted in the plastic Diskette Holders.

The assembled manual should then be placed in the three-ring binder provided with this package.

Safety

The following information has been included in this publication for the use and safety of IBM personnel.

General Safety during Work

Use these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during maintenance and after completing it.

- Use only field-supply items (such as adhesives, cleaning fluids, lubricants, paints, and solvents) that have been approved by IBM, that is, are supplied under an IBM part number.

- When lifting any heavy object:

  1. Ensure that you can stand safely without slipping.

  2. Balance the weight of the object between your two feet.

  3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.

  4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that you think are too heavy for you.*

- Do not perform any action that causes hazards to the customer or that makes the equipment unsafe.

- Put removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.

- Always keep your tool case away from walk areas so that other persons will not trip over it; for example, put it under a desk or table.

- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or are rolled up above the elbows. If your hair is long, fasten it.

- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.

  Remember: A metal object lets more current flow if you touch a live conductor.

- Insert the ends of your necktie or scarf inside other clothing or fasten the necktie with a clip, preferably nonconductive, approximately 8 cm (3 in) from the ends.

- Wear safety glasses when you are:

  - Using a hammer to drive pins or similar parts

  - Drilling with a power hand-drill

  - Using spring hooks or attaching springs

  - Soldering parts

  - Cutting wire or removing steel bands

  - Cleaning parts with solvents, chemicals, or cleaning fluids

  - Working in any other conditions that might be hazardous to your eyes.

- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.

- After maintenance, reinstall all safety devices such as shields, guards, labels, and ground wires. Exchange any safety device that is worn or defective for a new one.

  Remember: Safety devices protect personnel from hazards. You destroy the purpose of the devices if you do not reinstall them before completing your service call.

- Reinstall all covers correctly before returning the machine to the customer.

Safety with Electricity

Observe these additional rules when working on equipment powered by electricity:

- Find the room emergency power-off (EPO) switch or disconnecting switch. If an electrical accident occurs, you can then operate the switch quickly.

- Do not work alone under hazardous conditions or near equipment that has hazardous voltages. Always inform your manager of any possible problem or if you must work alone.

- Disconnect all power:
  - Before removing or installing main units
  - Before working near power supplies
  - Before doing a mechanical inspection of power supplies
  - Before installing changes in machine circuits.

- Before you start to work on the machine, unplug the machine's power cable. If you cannot unplug the cable easily, ask the customer to switch off the wall box switch that supplies power to the machine, and either:
  - Lock the wall box switch in the off position, or
  - Attach a DO NOT OPERATE tag, Z229-0237, to the wall box switch.

  Note: A non-IBM attachment to an IBM machine can be powered possibly from another source and controlled by a different disconnecting switch or circuit breaker. If you determine that this condition is present, ensure that you remove (eliminate) this hazard before you start work.

- If you need to work on a machine that has *exposed* electrical circuits, observe the following precautions:
  - Ensure that another person, who is familiar with the power-off controls, is near you.

    Remember: Another person must be there to switch off the power, if necessary.

  - CAUTION:
    Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical circuits.

    Use only those tools and testers that are suitable for the job you are doing.

  - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.

    Remember: There must be a complete circuit to cause electrical shock. By observing the above rule, you may prevent a current from passing through the vital parts of your body.

  - When using testers, set the controls correctly and use the IBM-approved probe leads and accessories intended for that tester.

  - CAUTION:
    Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this wrong type of mat to protect yourself from electric shock.

    Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

- Observe the special safety precautions when you work with very high voltages; these instructions are given in IBM safety service memorandums (SMs) and the safety sections of maintenance information. Use extreme care when measuring high voltages.

- Do not use worn or broken tools and testers.

- Ensure that electrical hand tools, such as power drills and Wire-Wrap[1] tools, are inspected regularly.

- *Never assume* that power has been disconnected from a circuit. First, *check* that it has been switched off.

- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, nongrounded power extension cables, power surges, and missing safety grounds.

- Do not touch live electrical circuits with the glass surface of a plastic dental mirror. The surface is conductive; such touching can cause personal injury and machine damage.

- Unless the maintenance information specifically lets you, do not service the following parts *with power on them* when they are removed from their normal operating places in a machine:

    Power supply units
    Pumps
    Blowers and fans
    Motor generators

  and similar units. (This rule ensures correct grounding of the units.)

- If an electrical accident occurs:
  - Use caution; do not become a victim yourself.
  - Switch off power.

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[1] Trademark of the Gardner-Denver Co.

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- **Send another person to get medical aid.**
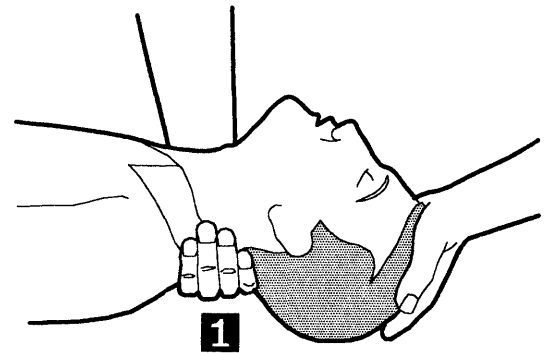- **If the victim is not breathing, decide whether to give rescue breathing.**

These actions are described below.

Emergency First Aid

When giving rescue breathing after an electrical accident:

- *Use Caution.* If the victim is still in contact with the electrical-current source, remove the power; to do this, you may need to use the room emergency power-off (EPO) switch or disconnecting switch.

  If you cannot find the switch, use a dry wooden rod or some other nonconductive object to pull or push the victim away from contact with the electrical-current source.

- *Work Quickly.* If the victim is unconscious, he or she possibly needs rescue breathing. If the heart has stopped beating, the victim may also need external cardiac compression.
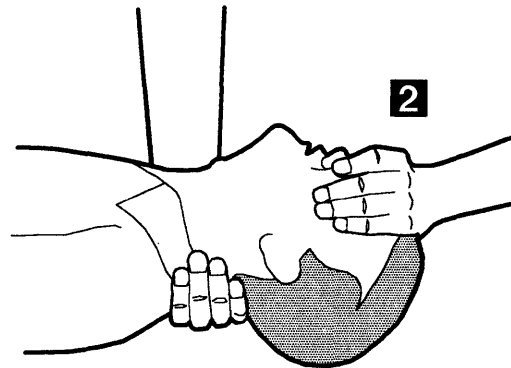
  Only a trained and certified person[2] should perform external cardiac compressions.

- *Get Medical Aid.* Call a rescue group, an ambulance, or a hospital immediately.

Rescue Breathing Procedures

Determine if the victim needs rescue breathing:

1. Prepare the victim:

   a. Ensure that the victim's airway is open and not obstructed. Check the mouth for objects (such as chewing gum, food, dentures, or the tongue) that can obstruct the flow of air.

   b. Place the victim on his or her back, then put one hand under the victim's neck and the other hand on the victim's forehead.

   c. Lift the neck with one hand **1** and press the forehead backward with the other hand.

2. *Look, listen, and feel* to determine if the victim is breathing freely:

   a. Put your cheek near the victim's mouth and nose.

   b. Listen and feel for the breathing-out of air. At the same time, look at the victim's chest and upper abdomen to see if they move up and down.

If the victim is not breathing correctly and you decide that you want to give rescue breathing:

3. Continue to press on the victim's forehead with your hand and pinch together the victim's nostrils **2** with the thumb and finger.

4. **CAUTION:**
   Use extreme care when giving rescue breathing to a victim who possibly has breathed-in toxic fumes. *Do not breathe-in air that the victim has breathed-out.*

   Open your mouth wide and take a deep breath. Make a tight seal with your mouth[3] around the victim's mouth **3** and blow into it.

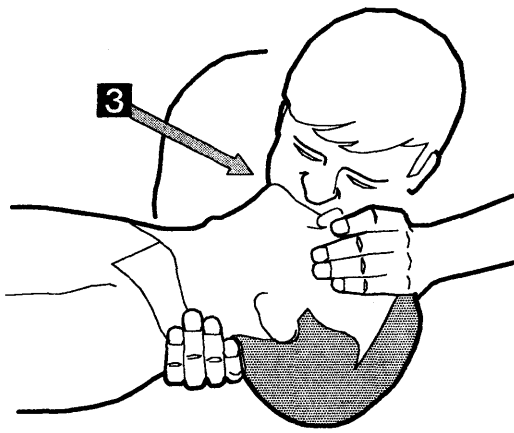2 If you want to be trained in giving this aid, ask a suitable organization (such as the Red Cross) in your area.

3 A rescue-breathing face covering (mask) or similar unit can be used if you have been taught how to use it.

5. Remove your mouth and let the victim breathe out while you check that the victim's chest �...4 moves down.

6. Repeat steps 4 and 5 once every 5 seconds until the victim breathes normally again or until medical aid comes.
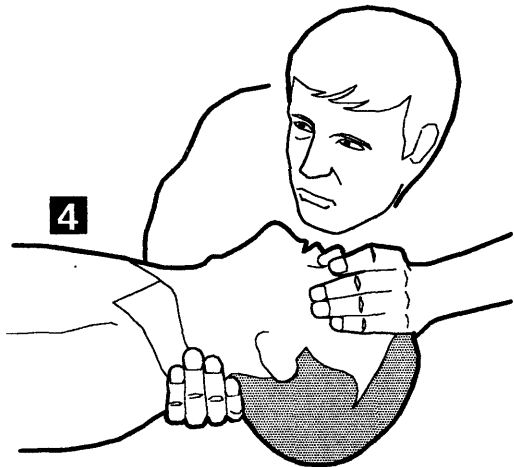
Reporting Accidents

Report to your manager or to your IBM site all accidents, possible hazards, and accidents that nearly occurred.

Remember: An accident that nearly occurred can be caused by a design problem. Quick reporting ensures quick solving of the problem.

Report also each small electric shock, because the conditions that caused it need only differ slightly to cause serious injury.

Contents

Chapter 1. General Information

How to Use This Manual

The purpose of this *Service Information Manual* (SIM) is to provide its users with the most frequently used Personal Computer service-related maintenance and reference information.

The SIM is not required to service the Personal Computer family of products. This SIM has been made available as a convenience to the servicer. This manual is not designed to provide total product support; its purpose is to supplement the *Hardware Maintenance Library* (HMS/HMR).

Also included with this manual are two advanced diagnostic diskettes and Service Summary Cards for use with the 5150, 5155, 5160, 5162, and 5170.

The advanced diagnostics should be used to:

- Test each area of the system
- Isolate problems to specific areas of the system through the use of error codes
- Verify correct installation and operation of the system.

Information about many Personal Computer options is available in this manual. However, if additional option information is required, refer to the *Hardware Maintenance Service* (HMS) manual for your machine.

Note: K is used interchangeably with Kb to mean 1024 bytes.

Safety Inspection Guide

The intent of this inspection guide is to assist you in identifying potentially unsafe conditions on products included in this manual. Each machine, as it is designed and built, has required safety items installed to protect the users and service personnel from injury. This guide addresses only those items. However, good judgment should be used to identify potentially unsafe conditions not covered by this inspection guide.

If any unsafe conditions are present, a determination must be made on how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power; primary voltage on the frame can cause serious or fatal electrical shock.
- Explosive hazards; a damaged CRT face or bulging capacitor can cause serious injury.
- Mechanical hazards; loose or missing hardware can cause serious injury.

IBM Personal Computer, 5150/5160-Based Systems

To inspect the IBM Personal Computer:

1. Set the power switch to off and disconnect the power cord from the electrical outlet.
2. Check the exterior covers for damage (loose, broken, or sharp edges).
3. Check the power cord for the following:
   a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohms or less between the external ground pin and the frame ground as specified in the *Hardware Maintenance Library*.
   b. The cord set should be the appropriate molded type as specified in the *Hardware Maintenance Library*.
   c. Insulation must not be frayed or worn.
4. Remove the cover-mounting screws from the rear panel, and remove the cover.
5. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
6. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
7. Check for worn, frayed, or pinched cables.
8. Ensure that the voltage specified on the voltage tag (back panel of the machine) matches the voltage of the power receptacle. If in doubt, the voltage should be verified.
9. Examine the power supply and verify the following:
   a. Ensure that the non-removable fasteners in the power-supply cover have not been removed or tampered with.
   b. Ensure that the grommet is installed where the internal power cables come through the frame of the power supply.
10. Check for the following labels:
    a. Caution. Hazardous Area. Do not remove this cover. Trained service people only. No serviceable components inside.

IBM Personal Computer AT® 5170-Based Systems

To inspect the IBM Personal Computer AT:

1. Set the power switch to off and disconnect the power cord.
2. Check exterior covers for damage (loose, broken, or sharp edges).
3. Check the power cord for the following:
   a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohms or less between the external ground pin and the frame ground as specified in the *Hardware Maintenance Library*.
   b. Insulation must not be frayed or worn.
4. Remove the back panel from the system unit.
5. Remove the five cover-mounting screws from the rear panel, and remove the cover.
6. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
7. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
8. Check for worn, frayed, or pinched cables.
9. Ensure that the voltage specified on the voltage tag (back panel of the machine) matches the voltage of the power receptacle. If in doubt, the voltage should be verified.
10. Examine the power supply and verify the following:
    a. On universal power supplies, ensure that the input voltage selection switch is set correctly.
    b. Ensure that tamper-resistant fasteners in the power supply cover have not been removed or tampered with.
    c. Ensure that the grommet is installed where the internal power cables come through the frame of the power supply.
11. Check for the following labels:
    a. "Battery warning: Do not dispose of battery unit in fire or water. See instruction for disposal in the battery installation instructions."
    b. Caution. Hazardous Area. Do not remove this cover. Trained service people only. No serviceable components inside.
12. Check the condition of the battery.

Diskette Description

The recording medium is a flexible, magnetic disk enclosed in a protective jacket. The protected disk, free to rotate within the jacket, is continuously cleaned by the soft fabric lining of the jacket during normal operation. Read/write/erase head access is made through an opening in the jacket. Openings for the drive hub and diskette index hole are also provided. The following figure is a drawing of the diskette used with the IBM 5.25-Inch Diskette Drive.
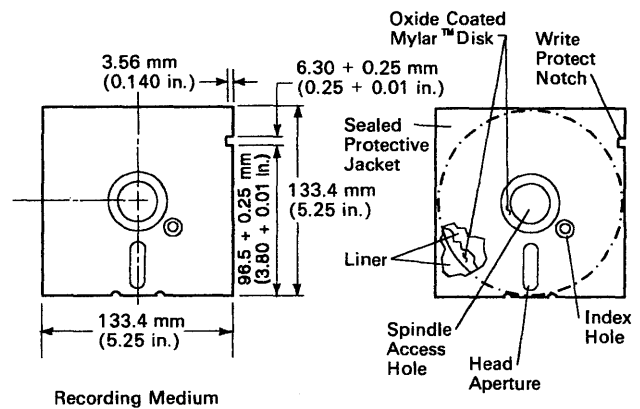
LEX41771

Figure 1-1. 5.25-Inch Diskette, Simplified

[1]Trademark of E. I. du Pont de Nemours and Co., Inc.

Types of 5.25-Inch Diskettes

You can use the following types of diskettes to read and write information:

- Single-sided (160Kb/180Kb)
- Double-sided (320Kb/360Kb)
- High-capacity (1.2Mb).

It is important to remember that if you write on a single-sided or double-sided diskette using a high-capacity diskette drive, you might not be able to read the diskettes in a single- or double-sided diskette drive.

Types of 3.5-Inch Diskettes

Distinguishing features

720Kb diskette

Locking tab
(In closed position,
allows writing
on diskette)

1.44Mb diskette

Locking tab
(In closed position,
allows writing
on diskette)

Note:
Format 1.0Mb media to 720Kb
Format 2.0Mb media to 1.44Mb

LEX42345

Figure   1-2. 3.5-Inch Diskette Types

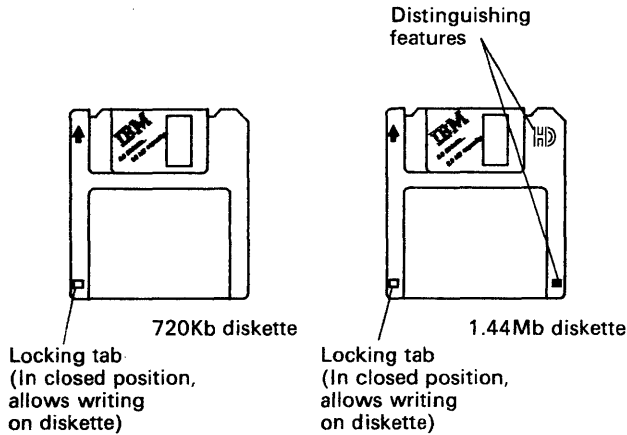The 3.5-inch diskette consists of a metal positive drive disk attached to the bottom of the circular magnetic recording surface. This assembly is permanently encased in a hard plastic shell. The 1Mb and 2Mb 3.5-inch diskettes can be differentiated by examining the top surface of the plastic case. The 2Mb 3.5-inch diskette has the letters HD in the top upper right corner of the plastic case and a square opening on the top lower right corner. The 1Mb 3.5-inch diskettes have no such marking.

The slim, compact size of the 3.5-inch diskette and the permanent hard plastic shell in which it is encased provide easy transportability. A metal shutter at the front of the diskette covers and protects the magnetic recording surface when the diskette is not in use.

When the diskette is properly inserted into the system, metal shutter end first, the shutter is opened automatically to allow read or write activities. A write protect sensor on the bottom of the plastic case can be positioned to protect the data stored on the diskette. When the square opening on the top lower left corner of the diskette is open (you can see through the hole), the diskette is write protected and cannot be written.

The write protect interlock is located on the bottom right corner of the plastic shell.

It is important to note that some 3.5-inch diskettes containing valuable programs, such as system diagnostics,

will not have this selectable write protect interlock in order to prevent accidental overwriting.

Note: 720Kb diskette drives can use only the 1Mb diskettes.

Media/Drive Compatibility Table

The following table identifies the minimum supported level of DOS required to read, write, or format the applicable media in the installed diskette drives.

DOS levels are downward compatible with respect to diskette formatting; therefore, prior formats are supported.

	Operation	5.25-Inch Drives	5.25-Inch Drives	3.5-Inch Drives
		PCjr™ PC XT™ Portable 4869	AT XT 286	Convertible 4865 External Internal B
5.25-inch diskette formatted to:				
160Kb	Read, Write, Format	DOS 1.00 DOS 1.00 DOS 1.00	DOS 3.00 No No	N/A
180Kb	Read, Write, Format	DOS 2.00 DOS 2.00 DOS 2.00	DOS 3.00 No No	N/A
320Kb	Read, Write, Format	DOS 1.10 DOS 1.10 DOS 1.10	DOS 3.00 No No	N/A
360Kb	Read, Write, Format	DOS 2.00 DOS 2.00 DOS 2.00	DOS 3.00 DOS 3.00 DOS 3.00	N/A
1.2Mb	Read, Write, Format	No No No	DOS 3.00 DOS 3.00 DOS 3.00	N/A
3.5-inch diskette formatted to:				
720Kb	Read, Write, Format	N/A	N/A	DOS 3.20 DOS 3.20 DOS 3.20

Figure   1-3. Media/Drive Compatibility Table

To use this chart, find your diskette drive and IBM Personal Computer across the top of the table. Then, coming down the left column, find your media. The intersection of the read, write, format row and your diskette drive and IBM Personal Computer column identifies the minimum DOS level required to support the function. Where N/A appears, it indicates either unreliable operation will occur or the product cannot perform the function.

Diskette Care

The figure below shows proper and improper ways of handling your diskettes. Proper handling will greatly reduce the possibility of damaging them.

Proper		
Felt Tip Only	Grasp by Corner	When Not in Use

Improper		
Don't Bend	No Pencils, No Clips, No Ball Points	Don't Touch Disk
No Sun Not Too Hot	No Magnets	No Cleaning
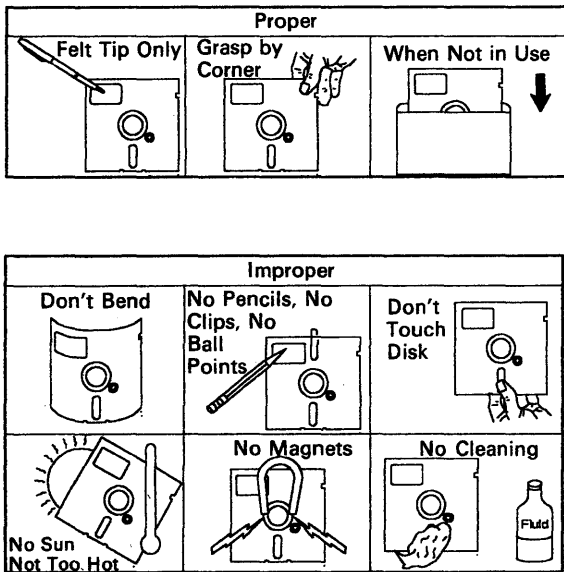
LEX40287

Figure   1-4. Diskette Handling Procedures

Handling Static-Sensitive Devices

Some of the components that make up the options for your IBM Personal Computer can be damaged by electrostatic discharges. To prevent this damage, the options are wrapped in a conductive, anti-static bag; certain precautions must be taken before removing an option from its bag:
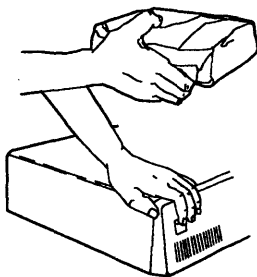
LEX40288

Figure   1-5. Option Static Charge

1. Wear the ESD wrist band any time ESD sensitive devices are handled. This will place your body, the option, and the system unit at the same ground potential, thus preventing an accidental static discharge.
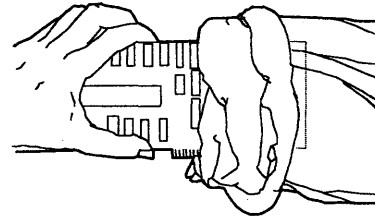
LEX40289

Figure   1-6. Anti-Static Bag Removal

2. Carefully remove the option from its anti-static bag. Be sure to grasp circuit boards by the edges only; do not touch the component pins or solder joints. Grasp diskette drives by their frames to avoid touching the electronics board. Grasp chips by their narrow ends only, not by their pins.
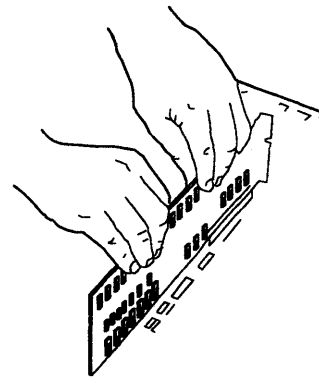
LEX40290

Figure   1-7. Option Insertion

3. When inserting an option adapter into the system board, hold the adapter by its top edge or upper corners.

1-4

Chapter 2. 4860 PCjr
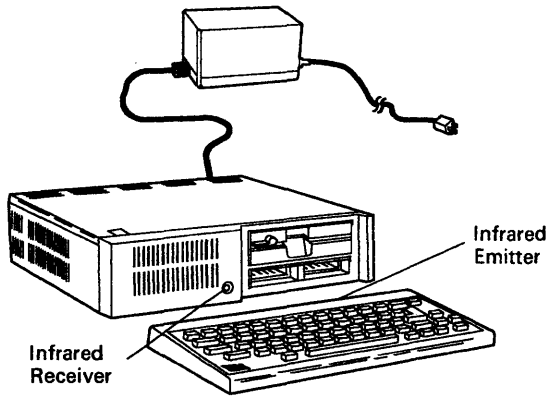
Figure 2-1. 4860 PCjr

The 4860 is a low-cost, compact, desktop microcomputer. It is available in two models, the 04 and 67. It utilizes an 8088 Microprocessor, 64Kb of random access memory (RAM), and two cartridge slots. Features include a 360Kb disk drive and memory expansion up to 512Kb.
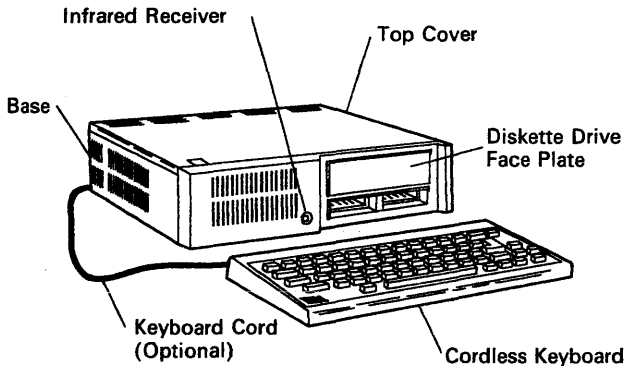
Figure 2-2. 4860 PCjr (Front view)
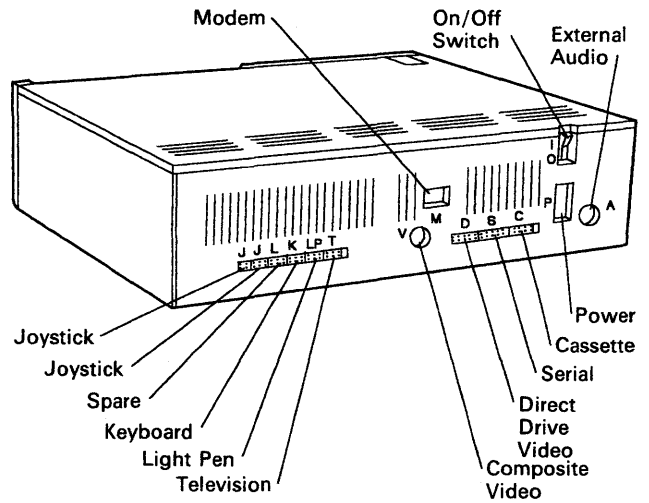
Figure 2-3. 4860 PCjr (Rear view)

Unit Specifications

Size	
Height	97 mm (3.8 in)
Length	354 mm (13.9 in)
Depth	290 mm (11.4 in)
Weight	
With Diskette Drive	3.71 kg (8 lb 4 oz)
W/o Diskette Drive	2.61 kg (5 lb 8 oz)
Environment	
Air Temperature	
System On	15.6° to 32.2°C
	(60° to 90°F)
System Off	10° to 43°C
	(50° to 110°F)
Humidity	
System On	8% to 80%
System Off	8% to 80%
Heat Output	283 BTU/hr max.
Noise Level	45 dBa
Electrical	
Nominal	120V AC
Minimum	104V AC
Maximum	127V AC
kva	0.082 max.

Figure 2-4. 4860 System Unit Specifications

Interface Locations

Interface	Location
Compact printer	Compact printer
Diskette drive	Diskette-drive adapter
Display	System board and 64Kb memory and display expansion
Graphics printer	Parallel printer attachment
Internal modem	Internal modem
Joystick	System board
Keyboard	System board
Light pen	System board
Memory	System board and 64Kb memory and display expansion
RS232C	System board
Sound	System board

Figure   2-5. 4860 Interface Locations

System Board
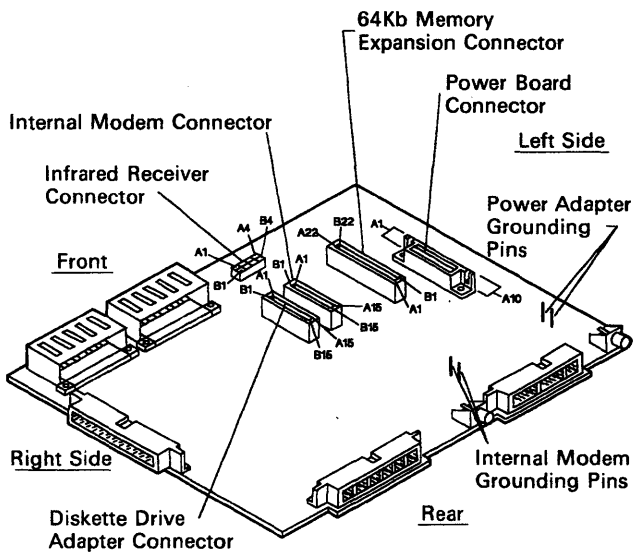
LEX40068

Figure   2-6. 4860 System Board

The system board contains the following major functional components:

*   8088 Microprocessor
*   64Kb read-only memory (ROM)
*   128Kb ROM cartridge interface
*   64Kb dynamic RAM
*   64Kb memory and display expansion interface
*   Serial port (RS232)
*   Audio alarm (beeper)
*   Sound subsystem
*   Cassette interface
*   Joystick interface
*   Keyboard interface
*   Modem interface
*   Diskette interface
*   Video/graphics subsystem
*   Light pen interface
*   I/O expansion bus
*   9-level interrupt.

Power Supply
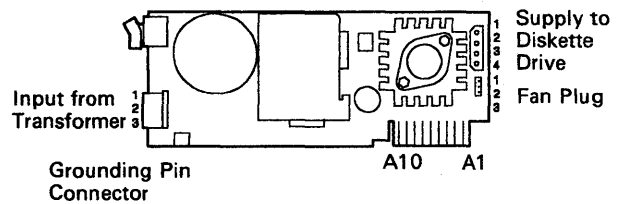
LEX40069

Figure   2-7. 4860 Power Board (Component Side)

The system power supply is a 33-watt, three-voltage-level, two-stage supply. The first stage is an external power transformer that provides a single fuse-protected, extra-low, AC-voltage output. The second stage is an internal, printed circuit board, which is vertically mounted into the system board. The second stage converts the transformer's AC output into three DC output levels.

Power is supplied to the system board through a printed circuit board edge connector. The diskette drive is powered through a separate 4-pin connector mounted on the front edge of the power board. The power for the diskette drive fan is provided by a 3-pin, Berg-type connector mounted directly below the diskette drive connector. Power is removed from the system board and diskette drive by a switch mounted on the rear of the power board. Both the switch and the transformer connector are accessible from the rear of the system.

Cordless Keyboard
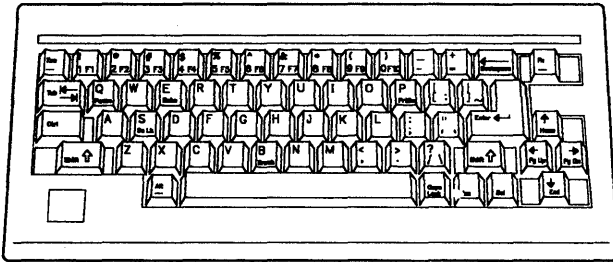
Figure 2-8. 4860 Cordless Keyboard

The keyboard is a low-profile, 62-key, detached keyboard with full-travel keys. The keys are arranged in a standard typewriter layout with the addition of a function key and cursor-control keys.

The keyboard is battery powered and communicates to the system unit with an infrared (IR) link. The IR link makes the remote keyboard a truly portable hand-held device. An optional cord connection to the system unit is available. Power is sent to the keyboard and serially encoded data is received by the system unit through the optional cord. When connected, the cord's keyboard connector removes the battery power, and the -CABLE CONNECT signal disables the infrared receiver circuit. The disabling of the circuit also allows other infrared devices to be used without interfering with the system. The data, which is received through the IR link or by the cord, have the same format.

The keyboard electronics are designed with low-power, complementary metal-oxide semiconductor (CMOS) integrated circuitry for battery power operations. Four AA-size batteries are required. Because the keyboard is normally in the standby power-down mode, which uses very little power, no on/off switch is needed.

The 4860 Keyboard was manufactured in two versions. The old Chicklet version was replaced with the version that is currently in use. The new keyboard is electronically identical to the older version but is improved mechanically for easier use. It has bigger keys that are easier to press, and the key designations are on the key tops rather than printed on the keyboard itself.

The 4860 Keyboard is a field replaceable unit (FRU); nothing on it can be repaired. Batteries in the keyboard are the customer's responsibility. A failing keyboard should be replaced.

General Information

Connector Guides

PCjr connector guides help eliminate the possibility of connector pins being broken on the 4860 PCjr Planar Board. The connector guides snap into the back cover of the system unit. The installation of these guides requires no tools; however, the system unit and attached devices must be powered off, as the cables need to be removed to facilitate installation of the guides. P/N6447163 provides guides along with instructions necessary for installation. The part is a no-cost item and can be ordered through normal parts distribution. If system unit diagnostics require the use of service plugs, the connector guides must be carefully removed and reinstalled at the completion of the repair activity.

PCjr Diskette Drive Inserts

There is no specified part number for a shipping insert for the PCjr diskette drive. Use the generic insert P/N6447190 available from distribution. Trim off approximately 0.5 inch, or remove the back tab of the generic insert. This will allow clearance for the latch lever to swing into the lock position without interference.

4860 PCjr Diagnostics

Error Codes

You might have an error code or an audio response during the power-on self test (POST). If you have both an error code and an audio error, disregard the audio error and perform advanced diagnostics on the FRU indicated.

POST Error	Problem Area	Probable Cause
No beep. No image or image on screen wrong.	Power	System Board or Power Board
One beep. No image or image on screen wrong.	Display	System Board or 64Kb Memory and Display Expansion
Two beeps. No image or image on screen wrong.	Power	System Board or Power Board
Three beeps. No image or image on screen wrong.	Memory	64Kb Memory and Display Expansion
Advanced POST or portion of it goes into loop.	System Board	System Board
No beep. ERROR OAXX	Memory	System Board
No beep. ERROR OBXX	Memory	64Kb Memory and Display Expansion
No beep. ERROR OCXX	Memory	64Kb Memory and Display Expansion
No beep. ERROR 1YXX	Memory	System Board
No beep. ERROR 2000	Keyboard	Keyboard
No beep. ERROR 21XX	Infrared	Infrared Receiver
No beep. ERROR 22XX	Keyboard	Keyboard
No beep. ERROR 23XX	Cassette or Serial	System Board
No beep. ERROR 24XX	Modem	Internal Modem
No beep. ERROR 25XX	Cartridge	
No beep. ERROR 26XX	Diskette Drive	Diskette Drive Adapter
No beep. ERROR 27XX	Cluster	Cluster Adapter
No beep. ERROR 28XX	Speech	Speech Adapter
Any ERROR message not listed in this table.	Service Plug	Ensure that Service Plug is good and installed correctly. Repeat advanced POST. If same message, replace System Board.

Figure 2-9. 4860 PCjr Advanced POST Error Table

General Diagnostic Tips

Required Items for Diagnostics

In order to perform all of the advanced diagnostics, you must have:

- A system unit
- A known good display television receiver
- A service plug, P/N6447196
- A POST-loop plug, P/N6447197
- A parallel printer attachment wrap plug, P/N8529228
- A serial wrap plug, P/N6447198
- A Triplet Model 310 Multimeter (or equivalent).

How to Perform Advanced POST

Before you perform advanced POST, do the following:

1. Set the system unit's power switch to off.
2. Set the display's power switch to off.
3. Connect the power transformer's power cord to a functioning, properly grounded outlet.
4. Install all connectors securely in their proper locations.
5. Remove any cartridge, cassette, or diskette from the system unit and attached devices.
6. If the cordless keyboard is being used without its optional keyboard cord:
   - Position the keyboard within 12 inches of the front of the system unit.
   - Remove any obstructions between the infrared (IR) emitter in the back of the keyboard and the IR receiver on the system unit.
7. Plug the service plug into the system unit J connectors.
8. Turn the display's brightness, contrast, and volume controls to midrange.
9. Set the display's power switch to on.
10. Set the system unit's power switch to on.

Advanced POST begins as soon as the system unit power switch is set to on. It takes as long as 1 minute to complete. While advanced POST is running:

- You see a stable IBM logo and 16-color test pattern on your screen.
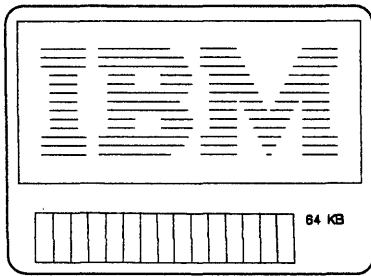
Figure 2-10. Screen Test Pattern

If advanced POST detects a failure, you will receive an incorrect audio response (no beep, two beeps, or three beeps), an incorrect screen, an error message, or any combination of these. In these cases, see Figure 2-9 on page 2-4 for the recommended action.

After you have followed the above steps once, all you have to do when asked to perform advanced POST is:

1. Set the system unit's power switch to off.
2. Wait 5 seconds.

How to Perform Advanced Tests

Advanced tests are the tests you choose from the advanced-test menu. The advanced-test menu is stored in the system unit's read-only memo ry (ROM).

When you are asked to bring up the advanced-test menu, follow these steps:

1. Set the system unit's power switch to on.
2. Wait until advanced POST completes and the BASIC screen appears.
3. Press and hold the Ctrl and Alt keys, and then press the Ins key.
4. Release all keys when the screen goes blank.

The IBM logo appears, the diskette drive (if attached) red light switches on for a moment, and you hear one beep. Then the advanced-test menu appears.
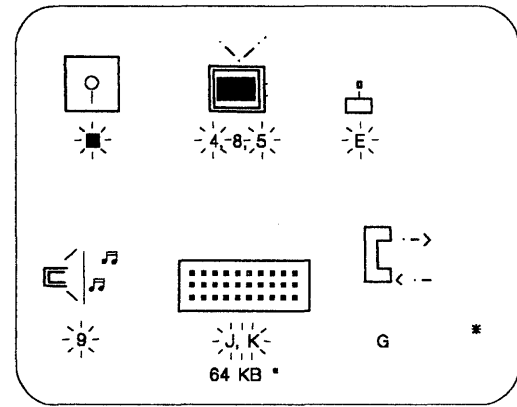
LEX40137

Figure 2-11. Advanced-Test Menu

The advanced-test menu consists of symbols, with each symbol representing one area of the IBM PCjr. The letters or numbers below the symbols are IDs of tests you can perform. A quick way to determine if you are looking at the advanced-test menu or the customer-level-test menu (they look similar) is to observe the ID under the joystick symbol. The advanced-test level has an *E* there. The customer-level has a *6*.

	Diskette-Drive Test Type MPNP
	Display and Light Pen Test
	Joystick Test
	Sound Test
	Graphics Printer Test
	Internal Modem Test
	Compact Printer Test*
RS232	Serial Port Test
	Keyboard Test
	Cluster Test
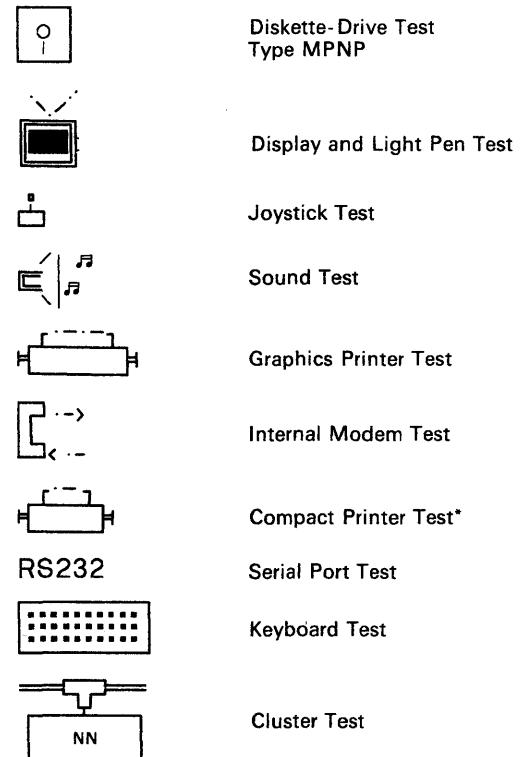
LEX40138

Figure 2-12. Advanced Test Symbols

Some symbols and IDs appear on the advanced-test menu only when their particular options are attached to the system unit.

If you see an * in the lower right-hand corner of the advanced-test menu, the menu has another page of symbols. When the cursor is moved to the last ID on the screen, moving it again causes this next menu page to appear.

On the last menu page, an Ω is in the lower right-hand corner. When the cursor is moved to the last ID on this screen, moving it again causes the first menu page to reappear.
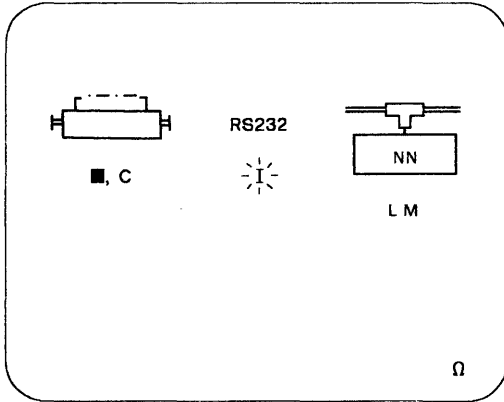
LEX40139

Figure 2-13. Last Menu Page

When the IBM PCjr senses the presence of a device interface, the ID under the symbol for that device blinks. The device interface is the electronic circuitry necessary for the system unit to control a particular device. In Figure 2-14, the interfaces for diskette drive, display, joystick, and sound are sensed.
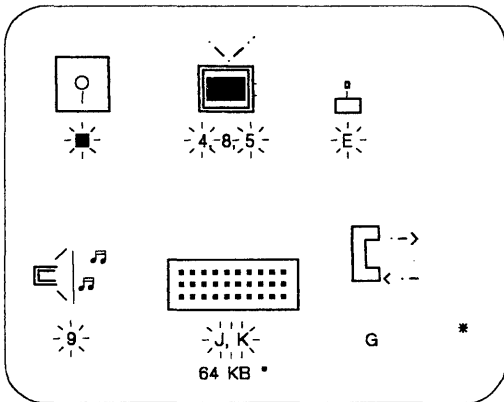
LEX40140

Figure 2-14. Interface Device Sensory

The IDs for joystick and sound always blink because their interfaces are on the system board. The blinking does *not* mean a joystick or external speaker is installed.

The diskette drive interface is on the diskette drive adapter. The ID under the diskette drive symbol therefore blinks only when the diskette drive adapter is installed.

The IDs *4* and *5* under the display symbol blink all the time. ID *8* blinks when the 64Kb memory and display expansion is present.

While the advanced-test menu is on your screen, a memory test is running continuously. The number incrementing at the bottom of the screen shows what segment of memory is being tested. If a memory failure is detected, the number stops incrementing and the * next to it is replaced by an error message. If this failure occurs, make a note of the error message and go to PIC "Memory."
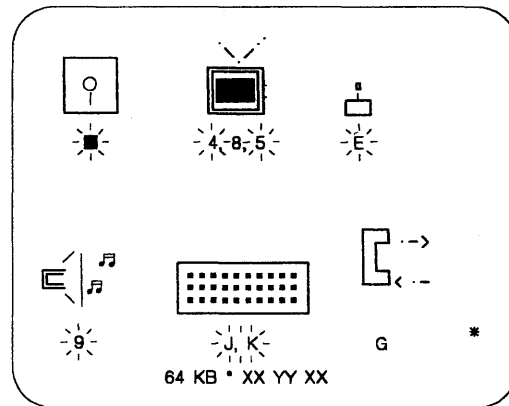
LEX40141

Figure 2-15. Memory Segment Testing

You move the cursor to the test's ID by pressing the Ins key. When you are ready to start the test, press the Enter key and the test begins.

The test is finished when a message appears under the symbol's ID. If * appears, no failure was detected.
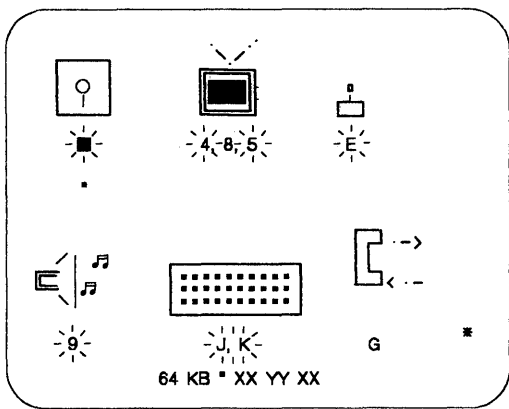
LEX40142

Figure 2-16. Test Completion

If something other than * appears, a failure was detected.

If you want to stop a test that is running, press the FN key, and then press the B key. Depending on which test is running, you can get one of several responses after pressing FN-B. The following table lists the responses.

Test Running	Response to Pressing FN-B
Diskette drive Graphics printer Compact printer Internal modem Sound	(If the system unit beeps, press FN-B again.) Test may not stop immediately. Message is "FFFF."
Display RS232	Test stops immediately. Message is "FFFF."
Keyboard	The FN and B keys must be shown on the screen before using them to abort the test. Test stops immediately. Message is *.
Joystick Light pen	Test stops immediately. Message is *.

Figure 2-17. Response Messages

The "FFFF" message lets you know that the test was stopped before completion.

When you want to remove the advanced-test menu from your screen, press and hold the Ctrl and Alt keys, and then press the Del key.

Customer Error Codes

When requesting service, customers may reference an error code found in the Error Message Table on page 6-17 of the *Guide to Operations* (GTO) manual. These are not advanced diagnostic error codes and cannot be found in the *Hardware and Maintenance Service* (HMS) manual. A list of the codes follow:

Error	Action
A D G X	Have system serviced.
B	Keyboard problem; move away from bright light.
C	Cassette problem; if the cassette is not in use, press Enter and continue.
E	Modem problem; if modem is not required, press Enter to continue.

These errors are for reference only. Actual failures should be determined by using the advanced diagnostics.

Power Diagnostic Tips

Diskette Drive Voltage at the Power Board

The voltages at the diskette drive power cable connector on the power board should be within the ranges listed below.

	Low V DC	High V DC
Pin 1 to Pin 2	+11.4	+12.6
Pin 4 to Pin 3	+4.7	+5.3

Figure 2-18. Diskette Drive Power Board Voltage Levels
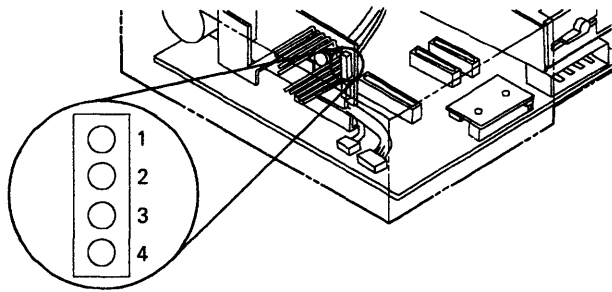
LEX40143

Figure 2-19. Diskette Drive Pin Placement

Diskette Drive Fan Voltage at the Power Board

The voltages at the diskette drive fan connector on the power board should be within the ranges listed below.

	Low V DC	High V DC
Pin 2 to Pin 1	+11.4	+12.6
Pin 2 to Pin 3	+11.4	+12.6

Figure 2-20. Fan Power Board Voltage Levels
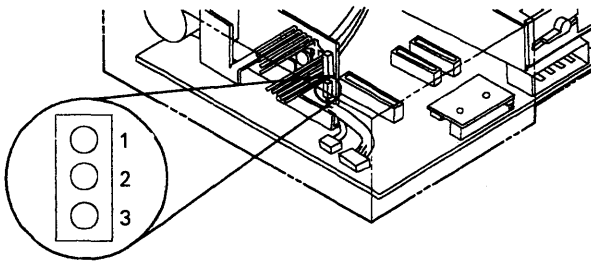
LEX40144

Figure 2-21. Fan Power Board Pin Placement

Display Voltage at the System Board

The voltages at connector D should be within the ranges listed below.

	Low V DC	High V DC
Pin A2 to Pin A4	1.9	2.3
Pin A2 to Pin A5	1.8	2.3
Pin A2 to Pin A6	0.0	1.0
Pin A2 to Pin A7	1.7	2.3
Pin A2 to Pin B1	0.1	0.3
Pin A2 to Pin B3	0.3	0.5

Figure 2-22. Display Board Voltage Levels
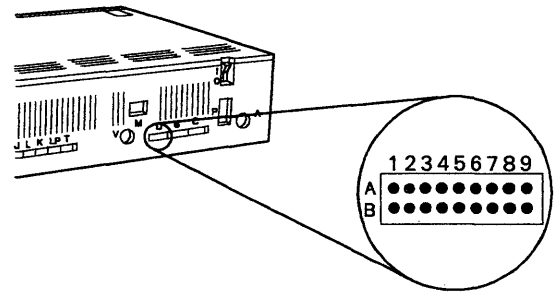
LEX40145

Figure 2-23. Display Board Pin Placement

Continuity of Color Display Adapter Cable

9-pin Connector from Position	2 × 9-pin Connector to Position
1	B9
2	B5
3	A5
4	A7
5	A4
6	A6
Not used	
8	B3
9	B1

Figure 2-24. Color Display Adapter Cable Connections
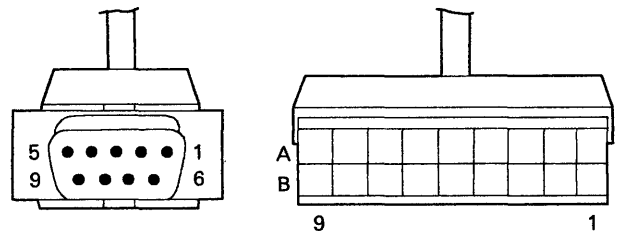
LEX40146

Figure 2-25. Color Display Connector Locations

2-8

Continuity of Serial Device Adapter Cable

25-pin Connector from Position	2 × 8-pin Connector to Position
1	B1
2	A4
3	A8
4	A3
5	A7
6	A6
7	B2
8	A5
20	A2

Figure   2-26. Serial Device Adapter Cable Continuity

LEX40147

Figure   2-27. Serial Device Adapter Cable Pin Placement

Continuity of Keyboard Cable

2 × 3 Connector from Pin	Keyboard Plug to Pin
A2	5
B2	2
B3	4

Figure   2-28. Keyboard Cable Continuity Connections

LEX40148

Figure   2-29. Keyboard Cable Pin Placements

Chapter 3. 5140 PC Convertible
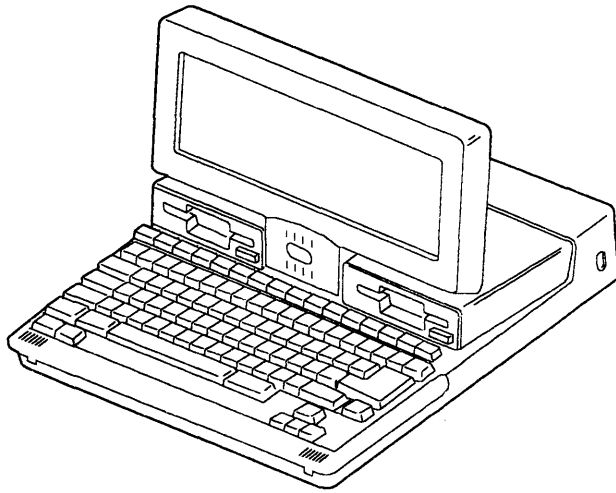
LEX41040

Figure 3-1. 5140 PC Convertible

System Information

The IBM 5140 PC Convertible is a portable personal computer designed for professional applications and personal productivity. It is designed to enhance personal computing capability with multiple power options. The uniqueness of the system unit is the integration of microprocessor, display diskette drives, keyboard, memory, battery power supply, and optional modem within a full function system that can be carried in one hand and used in most environments. The IBM 5140 maintains compatibility with 5.25-inch drive systems through asynchronous communications and 3.5-inch drive options (IBM 4865) on existing PCs.

The IBM PC Convertible features an 80C88 Microprocessor and 256Kb of user memory. User memory can be expanded to 512Kb with the addition of 128Kb memory cards installed by the user. The 3.5-inch diskette drive is a double-sided drive with 720Kb of (formatted) storage capacity.

The 80-column × 25-line detachable liquid crystal display features a bonding process that reduces glare and increases visibility.

Unit Specifications

Size	
Height	68.0 mm (2.68 in)
Length	374.0 mm (14.72 in)
Width	312.0 mm (12.28 in)
Weight	5.5 kg (12.17 lb)
Environment	
Air Temperature	
System On	10° to 40°C
	(50° to 105°F)
System Off	0.6° to 51.7°C
	(33 to 125°F)
Humidity	
System On	5 to 95%
System Off	5 to 95%
Electrical	(AC adapter input range)
	90-265V, 50/60 Hz AC

Figure 3-2. 5140 Specifications

Power Sources

Several sources for power are available for the 5140 PC Convertible. They are:

IBM PC Convertible AC Adapter

The AC Adapter is designed to be used by the system while simultaneously charging the internal battery. The AC Adapter supports 110V AC or 220V AC operation.

Battery Pack

The battery pack contains eight rechargeable NiCad cells packaged into a single unit. It resides inside the system unit and plugs onto the power supply card under the unit's covers. When fully charged, the battery pack will provide approximately eight hours of operation. This time will vary depending upon the amount of usage of the higher consumption devices, such as diskette drives.
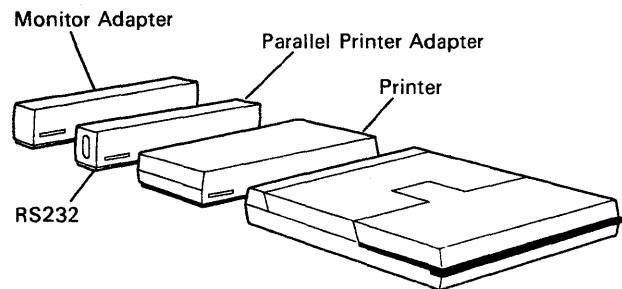
IBM PC Convertible Battery Charger

The battery charger is designed to be used to trickle charge the internal batteries of the system. It does not provide sufficient power output to allow system operation while the batteries are being charged.

IBM PC Convertible Automobile Power Adapter

The Automobile Power Adapter is designed to power the system unit while simultaneously charging the system battery pack. The adapter attaches to the system unit and plugs into the cigarette lighter outlet in a vehicle with a 12V negative-ground electrical system.

Options

Monitor Adapter

Parallel Printer Adapter

Printer

RS232

LEX41041

Figure 3-3. Option Configuration

IBM PC Convertible Printer

The IBM PC Convertible Printer is a matrix printer designed to attach to the back of the IBM PC Convertible and to draw its power from the system unit's battery pack. An all-points-addressable (APA) mode is provided for graphics.

IBM PC Convertible Monochrome Display

The IBM PC Convertible Monochrome Display is a 9-inch composite video display with 80 × 25 and 40 × 25 text modes and 640 × 200 and 320 × 200 graphics support.

IBM PC Convertible Color Display

The IBM PC Convertible Color Display is a 13-inch RGBI direct drive display with 320 × 200 lines graphics support and text modes of 40 × 25 and 80 × 25. The display includes a speaker for external audio output.

IBM PC Convertible Cathode Ray Tube (CRT) Display Adapter

The IBM PC Convertible CRT Display Adapter attaches to the IBM PC Convertible and is operable when the system is powered with the AC Adapter. The IBM PC Convertible Monochrome Display, the IBM PC Convertible Color Display, the IBM Personal Computer Color Display, and the IBM PCjr Color Display are supported.

IBM PC Convertible Internal Modem

The IBM PC Convertible Internal Modem gives users the capability of communication between the IBM PC Convertible and other compatible systems over existing telephone lines at speeds of either 300 or 1200 baud.

IBM PC Convertible Serial/Parallel Adapter

The IBM PC Convertible Serial/Parallel Adapter provides an RS232C asynchronous communications interface and a parallel printer interface.

Supported Options

The IBM Personal Computer options that are supported on the IBM 5140 are:

- IBM 5152 Graphics Printer
- IBM 4201 Proprinter
- IBM Personal Computer Printer Cable
- IBM 5153 PC Color Display
- IBM 4863 PCjr Color Display
- IBM Communications Adapter Cable.

Diagnostic Tip

Error Code 5103

When running diagnostics on the 5140 PC and it responds with a 5103 error, make sure that there is paper in the printer, the ribbon is installed correctly, and the ribbon cassette is not out of ribbon. Any of these conditions can cause a 5103 error.

Chapter 4. 5150 PC
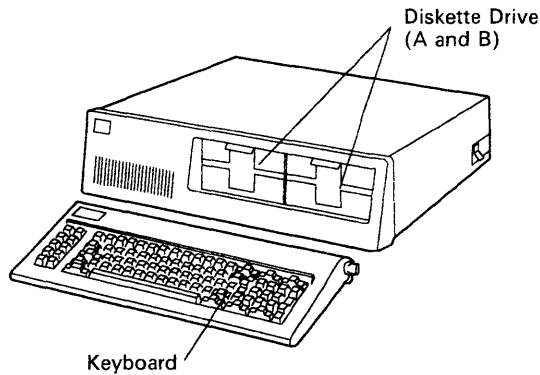
LEX40071

Figure 4-1. 5150 PC

The 5150 PC uses a 16-bit 8088 Processor, 16Kb to 640Kb of RAM. It uses 0, 1, or 2 diskette drives with a storage range of 160Kb to 320Kb. The 5150 has five I/O slots and a 4-channel direct memory access (DMA) 40Kb ROM.

Unit Specifications

System Unit Size	
Height	142 mm (5.5 in)
Length	500 mm (19.6 in)
Depth	410 mm (16.1 in)
Weight	11.4 kg (25 lb)
Power Cable	
Length	1.83 m (6 ft)
Size	18 AWG
Environment	
Air Temperature	
System On	15.6° to 32.2°C
	(60° to 90°F)
System Off	10° to 43°C
	(50° to 110°F)
Humidity	
System On	8% to 80%
System Off	20% to 80%
Heat Output	365 BTU/hr max.
Noise Level	56 dBa

Figure 4-2 (Part 1 of 2). 5150 PC1 Specifications

Electrical	
Nominal	120V AC
Minimum	104V AC
Maximum	127V AC
kva	0.22 max.

Figure 4-2 (Part 2 of 2). 5150 PC1 Specifications

System Board
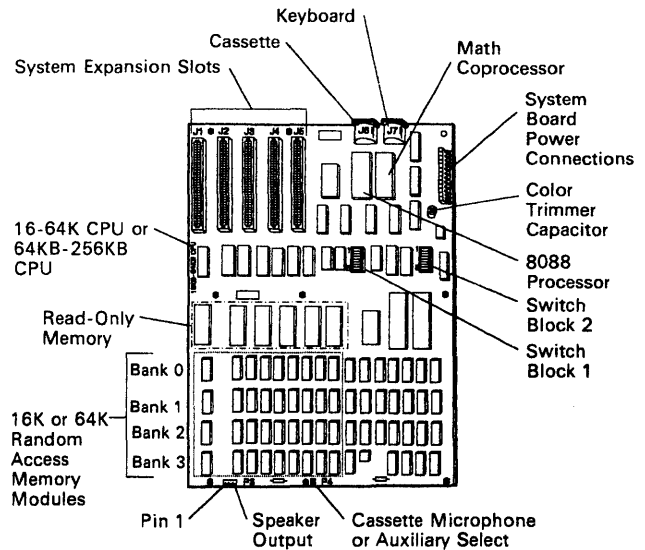
LEX40072

Figure 4-3. 5150 System Board

The system board fits horizontally in the base of the system unit. It is a multilayer, single-land-per-channel design with ground and internal planes provided. DC power and a signal from the power supply enter the board through two 6-pin connectors. Other connectors on the board are for attaching the keyboard, audio cassette, and speaker. Five 62-pin card edge sockets are also mounted on the board. The I/O channel is bussed across these five I/O slots.

Two dual in-line package (DIP) switches (two eight-switch packs) are mounted on the board and can be read under program control. The DIP switches provide the system software with information about the installed options, how much storage the system board has, what type of display adapter is installed, what operation modes are desired when power is switched on (color or black-and-white, 80- or 40-character lines), and the number of diskette drives attached.

The system board consists of five functional areas: the microprocessor subsystem and its support elements, the read-only memory (ROM) subsystem, the read/write (R/W) memory subsystem, integrated I/O adapters, and the I/O channel. The read/write memory is also referred to as random access memory (RAM).

Microprocessor

The heart of the system board is the Intel 8088 Microprocessor. This is an 8-bit external-bus version of Intel's 16-bit 8086 Microprocessor and is software-compatible with the 8086. Thus, the 8088 supports 16-bit operations, including multiply and divide, and supports 20 bits of addressing. It also operates in maximum mode, so a co-microprocessor can be added as a feature. The microprocessor operates at 4.77 MHz.

Power Supply
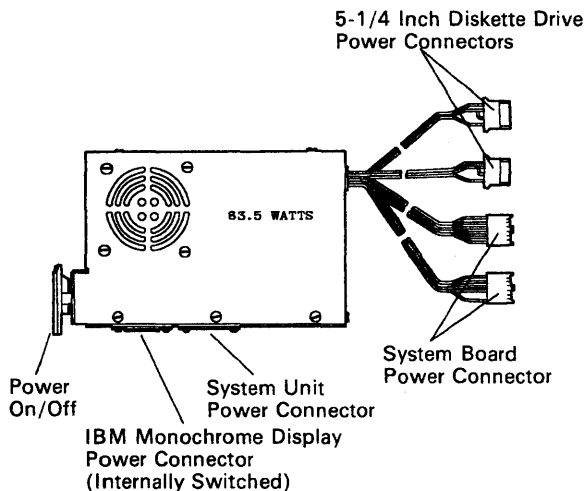
LEX40073

Figure 4-4. Power Supply

The system power supply is located at the right rear of the system unit. It is an integral part of the system-unit chassis. Its housing provides support for the rear panel, and its fan furnishes cooling for the whole system.

It supplies the power and reset signal necessary for the operation of the system board, installed options, and the keyboard. It also provides a switch AC socket for the IBM Monochrome Display and two separate connectors for power to the 5.25-inch diskette drives.

The two different power supplies available are designed for continuous operation at 63.5 watts. They have a fused 120V AC or 220/240V AC input and provide four regulated DC output voltages: 7 A at

+5V DC, 2 A at +12V DC, 0.3 A at -5V DC, and 0.25 A at -12V DC. These outputs are overvoltage, overcurrent, open-circuit, and short-circuit protected. If a DC overload or overvoltage condition occurs, all DC outputs are shut down as long as the condition exists.

The +12V DC and -12V DC power the EIA drivers and receivers on the Asynchronous Communications Adapter.

The +12V DC also powers the system's dynamic memory and the two internal 5.25-inch diskette drive motors. It is assumed that only one drive is active at a time. The +5V DC powers the logic on the system board and diskette drives and allows about 4 A of +5V DC for the adapters in the system-unit expansion slots. The -5V DC is for dynamic memory bias voltage; it tracks the +5V DC and +12V DC very quickly at power on and has a longer delay on power off than the +5V DC and +12V DC outputs. All four power supply DC voltages are bussed across each of the five system-unit expansion slots.

Keyboard

The IBM Personal Computer keyboard has a permanently attached cable that connects to a DIN connector at the rear of the system unit. This shielded 5-wire cable has power (+5V DC), ground, two bidirectional signal lines, and one wire used as a reset line. The cable is approximately 182.88 cm (6 ft) long and coiled, like that of a telephone handset.

The keyboard uses a capacitive technology with a microprocessor (Intel 8048) performing the keyboard scan function. The keyboard has two tilt positions for operator comfort (5- or 15-degree tilt orientation).

The keyboard has 83 keys arranged in three major groupings. The central portion of the keyboard is a standard typewriter keyboard layout. On the left side are 10 function keys. These keys are defined by the software. On the right is a 15-key keypad. These keys are also defined by the software but have legends for the functions of numeric entry, cursor control, calculator pad, and screen edit.

The keyboard interface is defined so that system software has maximum flexibility in defining certain keyboard operations. This is accomplished by having the keyboard return scan codes rather than American Standard Code for Information Interchange (ASCII) codes. In addition, all keys are typematic (if held down, they will repeat) and generate both a make and a break scan code. For example, key 1 produces scan code hex 01 on make and code hex 81 on break. Break codes are formed by adding hex 80 to make codes. The keyboard I/O driver can define keyboard keys as shift keys or typematic, as required by the application.

The microprocessor in the keyboard performs several functions, including a power-on self test when requested by the system unit. This test checks the microprocessor ROM, tests memory, and checks for stuck keys. Additional functions are keyboard scanning, buffering of up to 16 key scan codes, maintaining bidirectional serial communications with the system unit, and executing the handshake protocol required by each scan-code transfer.

5150/5160-Based System Diagnostics

General Diagnostic Tips

Power-On Self Test

Each time you set the system unit's power switch to on, the power-on self test (POST) executes. The POST takes 13 to 90 seconds to complete, depending on the options installed.

The POST checks the following:

- System board
- Memory expansion adapters
- Keyboard
- Primary display
- Diskette drive and adapter
- Fixed disk drive and adapter (if available).

To start the POST:

1. Turn on all external devices, including printer, display, and plotter.
2. Set the power switch on the expansion unit (if attached) to on.
3. Set the system unit power switch to on.
4. Turn the brightness and contrast knobs fully clockwise. (If you have a color monitor, ensure that it is set to on.)
5. Watch (and listen) for the following responses:
   a. A cursor appears on the display in approximately 4 seconds.
   b. While the memory is being tested, the memory size appears in the top left corner of the screen and increases in 64Kb increments until the total system memory is tested. This is not applicable to the 5150 PC.
   c. One short beep is heard when the POST is successfully completed.
   d. The IBM Personal Computer basic screen appears if a diskette or an operating system is not automatically loaded from a fixed disk drive.

Vertical Mounting Not Supported

IBM does not support operating the 5160 in a vertical position. Loss of customer data could occur if the system is operated in this manner.

Power Diagnostic Tips

Dead Machine Tips

- Verify that the outlet has good power and that power cord is good.
- Disconnect all external I/O cables from PC (external I/O may cause power problems).
- If installed, remove the math coprocessor.
- Remove disk drive power connectors one at a time from the disk drive logic board (a failing logic board may cause power problems).
- Check voltages exiting power supply to system board.
- Check system board ohm resistance.

System Board Power

1. Set the power switch on the system unit to off.
2. Set your meter to the 12V DC scale.
3. Refer to Figure 4-6 on page 4-4 and connect the common lead to pin 5 and the voltage lead to pin 1 of the system board power connector.
4. Set the power switch on the system unit to on.
5. Check for a voltage reading of 2.4V DC to 5.2V DC.

Leave your meter set on the 12V DC scale and check the rest of the power supply voltages to the system board (see Figure 4-5.)

Voltage Connectors			
Min V DC	Max V DC	-Lead	+ Lead
+ 4.8	+ 5.25	5	10
+ 4.6	+ 5.5	9	6
+ 11.5	+ 12.6	7	3
+ 10.9	+ 13.2	4	8

Figure 4-5. Power Supply Voltages
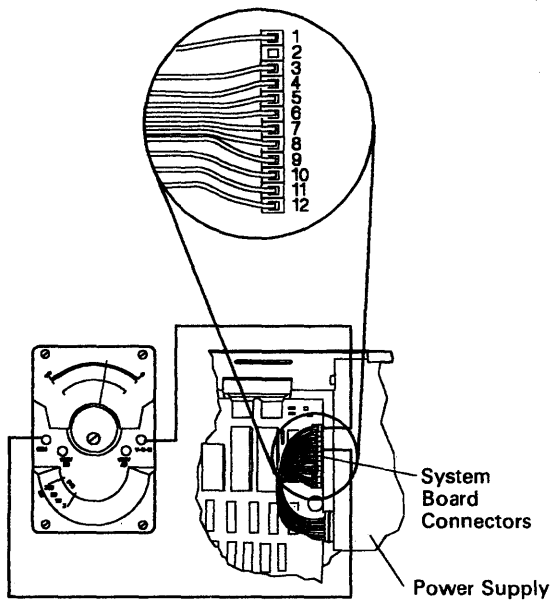
LEX40155

Figure   4-6. Board Power Connectors

Power Supply Voltage Checks

If the power supply is not connected to the system board or the disk/diskette drives, the power supply voltages cannot be correctly measured unless loaded with a 1.5-ohm, 25-watt resistor. The resistor must be connected across the power supply connector P 9 pins 1 and 6.
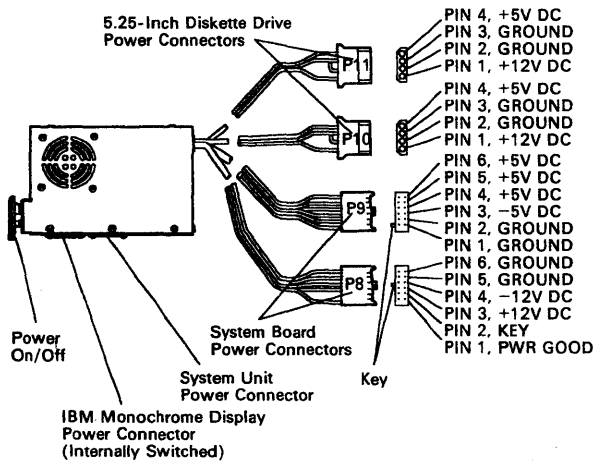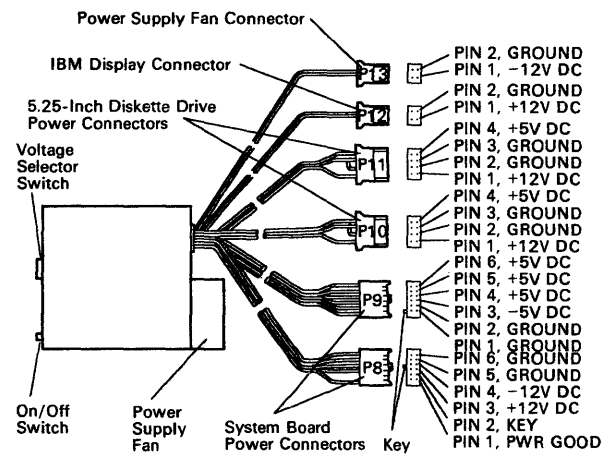
There is a 3-ohm, 25-watt wire-wound resistor P/N0337213 available. Use two resistors in parallel to obtain 1.5-ohms resistance.

LEX40156

Figure   4-7. Voltage Checks

LEX40157

Figure   4-8. 5155 Portable PC

System/Memory Diagnostic Tips

Failing Memory Module Isolation

There are times when diagnostics do not show when a memory problem is present on a machine. If a customer program or another diagnostic fails, the following procedure may be helpful in identifying the failing memory module.

A failing memory module can be isolated by changing the configuration switch settings. Each bank of memory modules is either 64Kb or 16Kb depending on the system board. When a memory failure is detected, reducing the size of memory by an entire bank can be achieved by changing the system configuration switches.

The following procedure should be used while running memory diagnostics:

1. Configure the switch settings to reduce one bank of memory at a time until the memory error is no longer present.
2. When the error is no longer present, the last bank of modules eliminated is the failing bank.
3. The failing module can be identified by configuring the machine back to the switch settings of the last failure. Then, swap out individual modules of the failing bank until the error goes away.
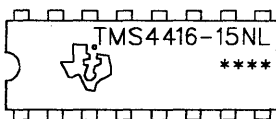
4-4

Potential Memory Module Problem on Adapter Cards

Replace adapter cards containing potentially defective soldered memory modules and pluggable memory modules on the Enhanced Graphics Adapter (EGA) Expansion card when diagnostics indicate an adapter or memory module failure.
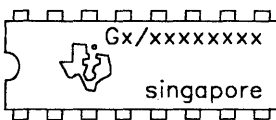
Machines and Devices Affected

Type	Device Description
4450	EGA Expansion Card
4455	EGA Card
5150	PS AT Card
5160	PS XT Card
5161	Extended Graphics Adapter (XGA) Card
5170	All Points Addressable (APA) Card
5271	
5273	
5373	
5531	
7531	
7532	

Replace memory modules numbered 8535 through 8544 that are labeled plant code G when diagnostics indicate a memory module or adapter failure. When the memory modules are soldered, refer only to the number code 8635 through 8544 on the top of the memory module and replace the adapter card if applicable. When the memory modules are pluggable, refer to both top and bottom view and replace all of the affected modules during a repair action. The affected modules do not affect data.

```
 TMS4416-15NL        **** = 8535 Through 8544
                            Numbering
         ****
```

Top View

```
   Gx/xxxxxxxx        G = Plant Affected
      singapore
```

Bottom View

LEX41870

64Kb memory module locations are designated by location numbers on the adapter card. Refer to the

Hardware Maintenance and Service (HMS) manual maintenance analysis procedures (MAPs) for bank and module locations.

- EGA Memory Expansion card

  (P/N6323468) has pluggable memory modules (P/N8854219) located in bank 01, 02, and 03.

The following adapters have soldered modules:

	Modules Positions
EGA Card (P/N8654215)	U1, 2, 10, 11, 40, 41, 50, and 51
APA Card (P/N8654390)	U65, 78, 91, and 103
PS XT Card (P/N8654381)	U10, 23, 36, 49, 62, and 75
XGA AT Card (P/N2683118)	U11, 12, 24, 25, 38, 39, 52, 53, 63, 64, 74, and 75.

5150/4450 Failing Memory Module Bit/Bank Location
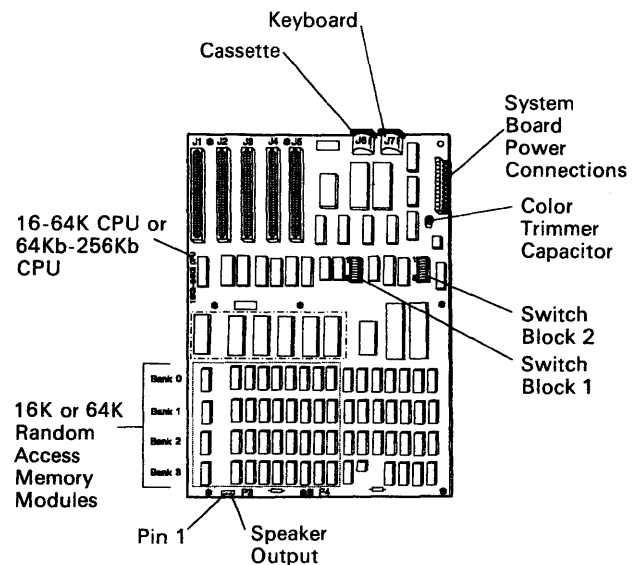
LEX40149

Figure 4-9. 5150/4450 Memory Module Bit/Bank Location

16Kb to 64Kb System Unit

When there is a memory failure, the address of the failure appears as a 4-character alphanumeric error code, followed by 201. If the first character of the error code is 0, you have a system board failure. The second character 0, 4, 8, or C indicates which bank has the failing module. The third and fourth characters of the 4-character error code indicate which bit (module) of the bank failed (P, 0, 1, 2, 3, 4, 5, 6, 7). For example,

error code 0C40 201 means that the module indicated by the arrow in Figure 4-10 on page 4-6 (bank 3, bit 6) is the one that failed.
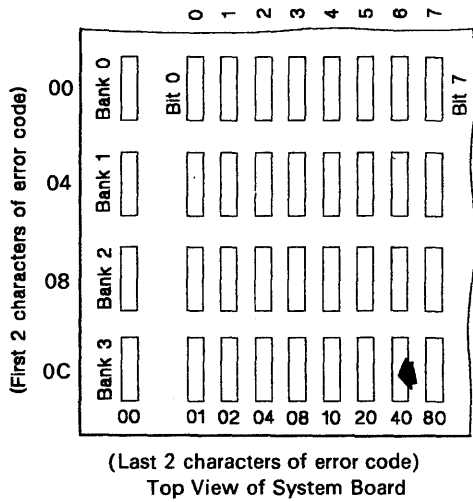

(Last 2 characters of error code)
Top View of System Board

LEX40150

Figure 4-10. System Board (Top View)

64Kb to 256Kb System Unit

When there is a memory failure, the address of the failure appears as a 4-character alphanumeric error code, followed by 201. If the first character of the error code is 0, 1, 2, or 3, you have a system board failure. The 0, 1, 2, or 3 indicates which bank has the failing module. The third and fourth characters of the 4-character error code indicate which bit (module) of the bank failed (P, 0, 1, 2, 3, 4, 5, 6, or 7). For example, error code 3040 201 means that the module indicated by the arrow in Figure 4-11 (bank 3, bit 6) is the one that failed.

(Last 2 characters of error code)
Top View of System Board
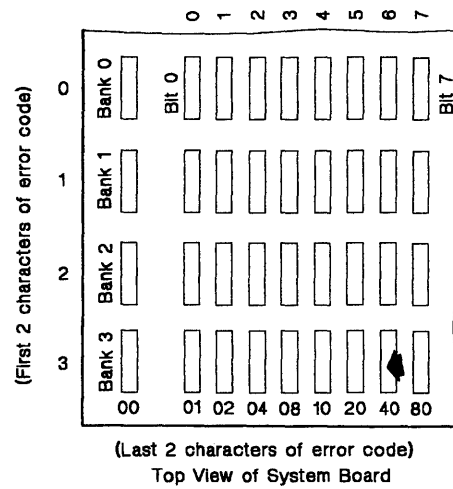
LEX40151

Figure 4-11. System Board (Top View)

5160/5155/XT370/5531/4455 Failing Memory Module Bit/Bank Location
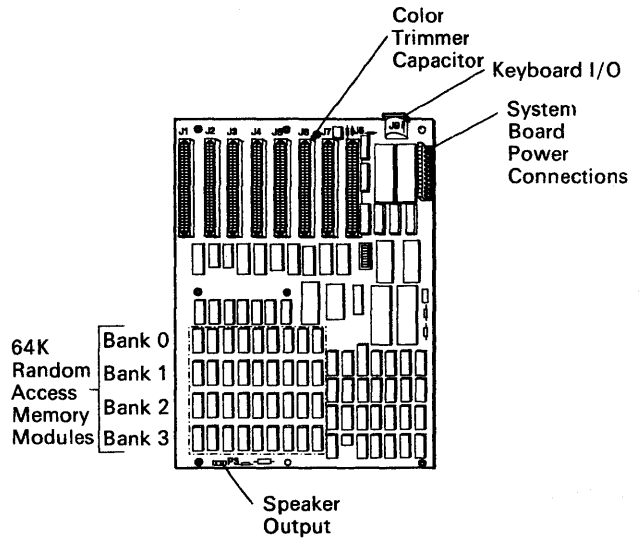
Note: Banks 0 and 1 may contain 256K RAM modules on 5160 modules 088, 089, 267, 268, 277, and 278.

LEX41700

Figure 4-12. 5160/5155/XT370/5531/4455 Bit/Bank Location

When there is a memory failure, the address of the failure appears as a 7-character alphanumeric error code, followed by 201. If the first character of the error code is 0, 1, 2, or 3, you have a system board failure. The 0, 1, 2, or 3 indicates which bank has the failing module. The sixth and seventh characters of

the 7-character error code indicate which bit (module) of the bank failed (P, 0, 1, 2, 3, 4, 5, 6, 7). For example, error code 3C000 40 201 means that the module indicated by the arrow in Figure 4-13 (bank 3, bit 6) is the one that failed.

Memory error, memory lock, or a blank display may occur if you plug one or more chips in wrong when you are replacing the system board or system memory.
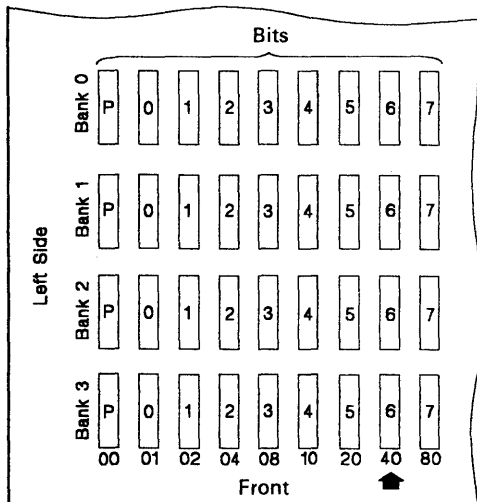

LEX40153

Figure 4-13. System Board (Top View)

256Kb/640Kb System Board Memory Problems

The E-2 jumper located next to the power supply on the system board is needed to support 256Kb modules in banks 0 and 1. Without this jumper, 640Kb on the system board will appear in POST and diagnostics as 256Kb.

256Kb/640Kb System Board Labeled Wrong

PC XT 5160s (Models 088, 089, 267, 277, 278) have some system boards labeled wrong. The boards are labeled 64Kb/256Kb. They should be labeled 256Kb/640Kb. A 256Kb/640Kb board can be identified by looking for the presence of a module in position U84. The 64Kb/256Kb board has no module in this position.

Interrupt Level Information

Interrupt levels are used by PCs to prioritize operations. Diagnostics will not necessarily fail on a PC with interrupt conflicts, yet the operator will keep getting errors. Although the customer is responsible for solving interrupt conflicts, an IBM service representative can use this information to reduce diagnostic time, NTFs, unnecessary parts replacements, and callbacks.

To determine whether an unusual PC problem is caused by conflicting interrupt levels, follow these steps:

A. Load the advanced diagnostics diskette, go to the list of installed devices, and copy that list.
B. Examine the adapter cards installed in the system unit and expansion unit. If any cards are located that are not on the list from Step 1, add them to the list.
C. Sort the list into the following interrupt levels:

1. Keyboard
2. Enhanced Graphics Adapter
   3278/79 Emulation Adapter
   Primary PC Network Adapter
3. ALT ASYNC Communications Adapter (COM2)
   ALT BISYNC Communications Adapter (COM2)
   ALT Serial/Parallel Adapter—Serial Port
   ALT PC Network Adapter
   SDLC Communications Adapter
   PC Cluster Adapter (selected by a jumper)
   Display Station Emulation Adapter (selected by a jumper)
4. ASYNC Communications Adapter (COM1)
   BISYNC Communications Adapter (COM1)
   Serial/Parallel Adapter—Serial Port
   SDLC Communications Adapter
5. Fixed Disk Adapter (except in Personal Computer AT)
   ALT Serial/Parallel Adapter—Parallel Port
   Display Station Emulation Adapter (selected by a jumper)
6. Diskette Drive Adapter
7. Printer Adapter Monochrome and Printer Adapter
   Cluster Adapter (selected by a jumper)
   Serial/Parallel Adapter—Parallel Port
   General Process Interface Bus (GPIB) Adapter(s)
   Data Acquisition Adapter(s).

D. If you find two cards with the same interrupt, remove one of them and see whether the failure symptom disappears.

These steps are similar to the intermittent problem steps in the HMS manual. The most important point of this tip is that when a failure symptom is isolated to

one adapter card, that card is not necessarily defective, but may be incompatible with the other cards in the PC. Incompatibility can also be caused by factors other than interrupt (such as memory address and DMA). Also, conflicting interrupts will not always cause failures.

Note: Some adapter cards have a jumper for interrupt selection. For those cards and for cards not listed here (including non-IBM cards), see the card's setup guide or technical specifications. Due to rapid product announcements, this list cannot describe all the available IBM PC option cards.

Math Coprocessor Installation (5150 Only)

Installation of the math coprocessor feature requires the replacement of the 8088 Processor module on the system board and addition of an 8087 Math Coprocessor module. If the 8088 Processor is soldered to a 16Kb/64Kb system board (P/N8529205 or P/N8529328), which prevents installation of a new 8088, the board must be replaced with a new 16Kb/64Kb system board from stock. See ECA004.

Speaker Continuity

1. Set the power switch on the system unit to off.
2. Set your meter to the ohms × 1 scale.
3. Remove the speaker connector from the system board.
4. Connect the meter leads to the speaker, as shown, to check for continuity.
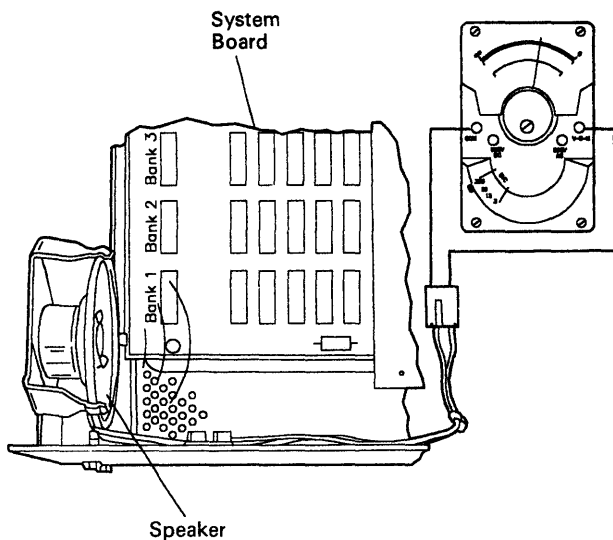
LEX40160

Figure   4-14. Speaker Continuity Check

Keyboard Voltage Check at System Board

Pin TTL Signal	Signal Level
1 + Keyboard Clock	+ 5 V DC
2 + Keyboard Data	+ 5 V DC
3 -Keyboard Reset (Not used by keyboard)	
Power Supply Voltages	**Voltage**
4 Ground	0
5 + 5 Volts	+ 5 V DC

Figure   4-15. Keyboard Interface Connector Specifications
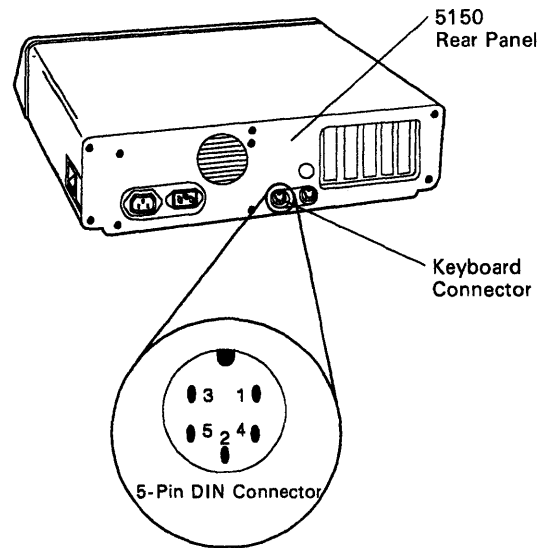
LEX40161

Figure   4-16. Keyboard Connector Location

5155 Portable Keyboard Voltage Check

Keyboard Cable Connections

LEX40162

Figure 4-17. Keyboard Cable Connections

LEX40163

Figure 4-18. Modular Connector Location

Diskette Drive/Fixed Disk Drive Diagnostic Tips

Hard-Sector Diskettes

Hard-sectored, double-index-hole diskettes will not work with IBM PC products. Soft-sectored, single-index-hole diskettes must be used.

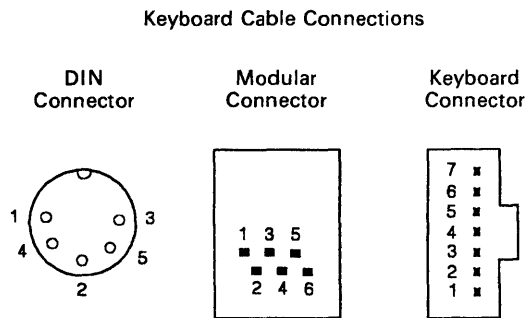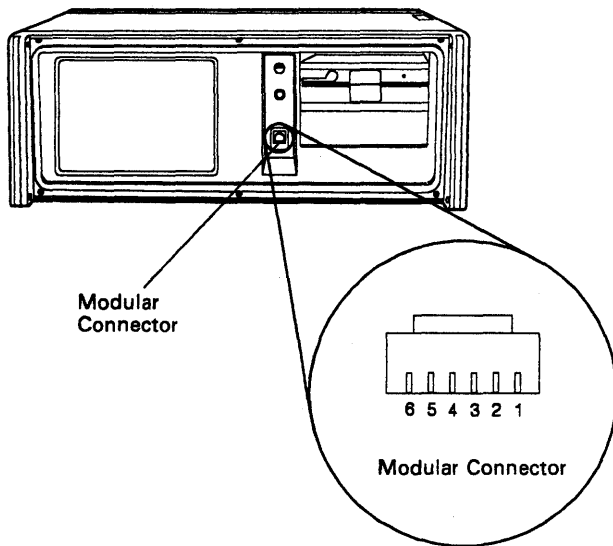## Diskette Drive Type 2 Read/Write Errors

If you are experiencing read/write errors on PCs equipped with Type 2 diskette drives, check the file control card on the diskette drive. If the numbers stamped or printed along the left edge of the card are 010, remove capacitor C39 from the card. This capacitor is mounted on the lower left corner of the card. This is the opposite end from the power connector. The capacitor is mounted between modules 4B and 5B. This capacitor is generating noise on the card, which causes the errors.

Terminating Resistor on Replacement Drives

When replacing a disk/diskette drive, the terminating resistor should be installed on the replacement drive, if one was installed on the defective drive.

Intermittent problems can occur if the disk/diskette drive cable is not terminated. The cable is terminated by the use of a terminator resistor installed on the unit logic card. When replacing a disk/diskette drive, check to see whether a terminator is installed on the defective drive. If so, install a terminator resistor on the replacement drive. The terminator resistor should be installed on the drive that is the last physical unit on the cable. Both the disk and diskette drive cables must have terminating resistors.

Diskette Drive Errors

Read/write errors can occur when the display is mounted on the system unit. The errors might be caused by the flyback transformer in the display. The problem can occur with both the color and monochrome monitors. The transformer creates a magnetic field around the PC, which causes the errors. The preferred solution to the problem is to move the display; if this cannot be done, replace the failing diskette drive. Some of the diskette drives are less susceptible than others to this problem.

Track 40 Error/Type 3 Drives

The Type 3 diskette drive will not read data from track 40 of diskettes. The IBM specifications allow the use of tracks 0 – 39 and the Type 3 drive meets these specifications. The use of track 40 or above is not supported by IBM. Some software vendors have used track 40 in their software packages.

The Type 3 drive can be identified by a large heat sink on the rear of the drive logic board. Further identification can be made by checking for an E at the beginning of the serial number. The serial number on the Type 3 drive is located inside the drive on the right front corner and is visible through the top of the drive with the diskette removed and the diskette latch open.

DISKCOPY Problems Using Type 3 Diskette Drive

DOS DISKCOPY might not function correctly under certain unique circumstances, when using the same diskette drive for both source and target diskettes on the PC (5150) and PC XT (5160).

The DOS DISKCOPY procedure might not function correctly on a Personal Computer or Personal Computer XT which has a Type 3 diskette drive(s), less than 416Kb of memory, and is using an unformatted target diskette. To prevent this problem, use formatted target diskettes when running DISKCOPY. After using DISKCOPY, a directory should be run to ensure that all files were copied. If the use of formatted diskettes is not an acceptable solution, exchange the diskette drive. See ECA015.

Diskette Drive Inserts

Diskette drive inserts can be ordered from Parts Distribution, using P/N6447190. The inserts prevent head damage when the unit is shipped. An insert should be placed inside the diskette drive for the following conditions:

- Shipping a machine to and from a repair center
- Returning a machine to customers when transportation is involved
- Returning defective drives.

This insert should be used on the 5150 and 5160 Types 1, 2, and 3 diskette drives only.

Diskette Drive Cable Continuity

1. Set the meter on the ohms × 1 scale.
2. Refer to Figure 4-19 and check the continuity of the signal cable. The meter should indicate approximately 0 ohms.

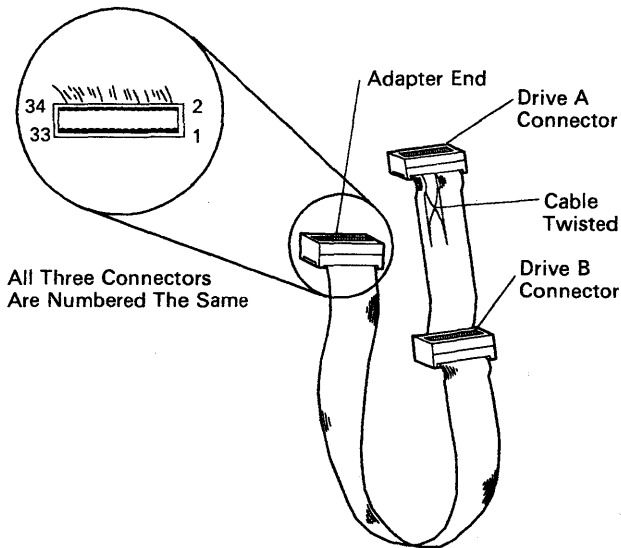| Diskette Drive A Signal-Cable Connector		Diskette Drive A Signal-Cable Connector	
Even Pin Diskette	Numbering Adapter	Odd Pin Diskette	Numbering Adapter
2	2	1	1
4	4	3	3
6	6	5	5
8	8	7	7
10	16	9	9
12	14	11	15
14	12	13	13
16	10	15	11
18	18	17	17
20	20	19	19
22	22	21	21
24	24	23	23
26	26	25	25
28	28	27	27
30	30	29	29
32	32	31	31
34	34	33	33
Diskette Drive B Signal-Cable Connector		Diskette Drive B Signal-Cable Connector	
Even Pin Diskette	Numbering Adapter	Odd Pin Diskette	Numbering Adapter
2	2	1	1
4	4	3	3
6	6	5	5
8	8	7	7
10	10	9	9
12	12	11	11
14	14	13	13
16	16	15	15
18	18	17	17
20	20	19	19
22	22	21	21
24	24	23	23
26	26	25	25
28	28	27	27
30	30	29	29
32	32	31	31
34	34	33	33

Figure 4-19. Diskette Drive Connector Adapters

Diskette Drive Cable

Check the diskette drive signal cable for shorts as follows:

1. Set the power switch on the system unit (and expansion unit, if attached) to off.
2. Disconnect the diskette drive signal cable from the Diskette Drive Adapter and the diskette drive.
3. Carefully inspect the cable connectors for bent or broken contacts. Inspect the connectors on the adapter and on the diskette drive logic board for cracks or corrosion.
4. Set the meter on the ohms × 1K scale.
5. Using the adapter end of the cable, check for shorts by touching the other meter probe to pin 2. The meter should indicate infinity. Check pin 2 to pin 3, pin 3 to pin 4, and so on until all pins have been checked.
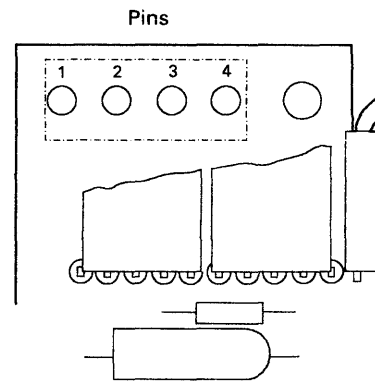

LEX40158

Figure   4-20. Diskette Drive Cable Connectors

Diskette Drive Power

Check the diskette drive power connector for the voltages shown in the table below.

Diskette Drive Power Connector			
Min V DC	Max V DC	-Lead	+ Lead
+ 4.8	+ 5.2	2	4
+ 11.5	+ 12.6	3	1

Figure   4-21. Diskette Drive Power Connector Voltages

LEX40159

Figure   4-22. Connector Pins

Moving System with Fixed Disk

Warning: Normal shipping and handling can result in permanent loss of all data on the fixed disk drives and increase the possibility of shipping damage for a 5160 or a 5161.

To prepare the system unit and expansion unit fixed disk for moving, use the following procedure.

Load the diagnostic routines and select Option-3, Prepare Fixed Disk for Relocation. This moves the disk head over the highest available cylinder (beyond the data area). This is the designated position when moving the system or expansion unit.

Fixed Disks Ready for Shipping appears on the monitor when the relocation routine completes successfully. The system or expansion unit is now ready to be prepared for shipment.

Determining Available Space on Fixed Disk

DOS CHKDSK checks for the amount of usable space on the disk surface. Do not replace the fixed disk if the usable area exceeds the specified disk capacity; that is, 10 or 20 megabytes. The following process may be used to determine the number of bytes required for different capacity drives:

Note: 1 byte = 1.024

1.024 x Disk Capacity = Total Number of Bytes Required

Examples follow:

1.024 × 10,000,000 = 10,240,000 bytes (10Mb)
1.024 × 20,000,000 = 20,480,000 bytes (20Mb)
1.024 × 30,000,000 = 30,720,000 bytes (30Mb)

After determining the number of bytes required, refer the customer to the DOS manual to run the CHKDSK procedure.

To calculate the number of good bytes on the disk, do the following:

Subtract Bytes in Bad Sectors
From   Bytes Total Disk Space.

If the resulting number is greater than the calculated total number of bytes required (above), the drive is good. This tip also applies to the 5170 hard files.

Insufficient Storage Space

The following information may be used in conjunction with the advanced diagnostics in diagnosing problems encountered involving insufficient storage space on the 5160 20Mb Fixed Disk.

Note: The customer should have backed up the system and the data files prior to beginning any repair actions. Backup may not be possible after the repair action has taken place.

* Ensure that when the customer runs the DOS CHKDSK, the number of Bytes in Bad Sectors is subtracted from Bytes Total Disk Space. If the resulting number is 20,480,000 bytes (20Mb) or greater, the fixed disk drive is good and should not be replaced.

If the resulting number is less than 20Mb:

* Ensure that a 20Mb Fixed Disk Adapter is installed. (Check for the presence of the drive type switch block.)

* Ensure that the switch settings on the Fixed Disk Adapter card are set for the correct drive type.

Upon completion of the repair action, the customer may need to do the following:

1. Perform the DOS FDISK command.
2. Run the DOS CHKDSK command to ensure that the fixed disk has 20Mb or more of usable storage space.
3. Run the DOS FORMAT command.
4. Do a restore of the system and data files.

20Mb Type 13 Identification Label

5160 Models 088 and 089 contain a 20Mb fixed disk drive. The 20Mb Type 13 drive manufactured by IBM can be identified by the designation WD25 on a label at the upper left-hand side of the black cover enclosing the drive when the Type 13 sticker is not present.

10Mb Fixed Disk Noise

IBM-manufactured Personal Computer fixed disks of 10Mb, serial number F274092 or lower, could create a high-pitched noise.

IBM-manufactured fixed disks with a serial number of F274092 or lower could produce a high-pitched noise from the static eliminator during normal customer operation. This will not cause any operational problems. If your system is exhibiting this noise problem, ensure that all data/programs on the fixed disk are backed up. Replace the fixed disk.

The drive can be identified by a black cover over the disk area and a label at the rear of the drive which reads Manufactured by IBM. See ECA019.

Formatting a Fixed Disk Drive

Warning: Formatting will destroy all data on the fixed disk drive. After formatting your fixed disk drive, the drive will have to be made ready to accept data. Refer to your disk operating system manual for the needed commands. The backup data may then be loaded onto the fixed disk drive.

Before replacing a failing fixed disk drive, first try to format it, then run the diagnostic tests again. After formatting it, perform the diagnostic tests. Because formatting destroys all data on the drive, do it as the last step before replacing the drive. After you format the drive, you may reload the data from your backup diskette.

To format a fixed disk drive:

1. Set the power switch on the system unit (and expansion unit, if attached) to off.
2. Install the fixed disk drive and connect any data and control connectors that were disconnected during testing.
3. Insert your advanced diagnostics diskette in drive A.
4. Set the power switch on the expansion unit (if attached) and system unit to on.
5. After the diskette loads, press 0 (RUN DIAG-NOSTIC ROUTINES), then Enter.
6. Depending on the configuration of your system, questions about attached devices might appear on your screen. Press Y or N as required, then press Enter.
7. Press Y or N (IS THE LIST CORRECT?) then Enter. (If the list is not correct, follow the instructions on your screen and correct the list before answering yes. If you cannot correct the list, you still must answer yes before you can continue.)
8. When the System Checkout menu appears, press 0 (RUN TEST ONE TIME), then Enter.
9. Select 17 (FIXED DISK DRIVE(S) & ADAPTER), then press Enter.
10. Press 2 (FORMAT FIXED DISK), then Enter.
11. When ENTER DRIVE ID C/D appears, press C or D (depending on which drive you want to format), then press Enter.
12. When ARE YOU SURE YOU WANT TO ConTINUE appears, press Y, then Enter.
13. Before turning system over to customer or transferring customer data to fixed disk, perform the DOS FDISK and then the DOS FORMAT. This will further ensure proper operation of the fixed disk. See your DOS manual for FDISK and FORMAT procedures.

Installing Fixed Disk Drive Cable

10Mb Fixed Disk Drive

When installing the cable P/N8529271 from the 10Mb or 10Mb/20Mb Adapter card to the 10Mb fixed disk drive, the cable must be plugged into the adapter with the trace wires facing up, away from the system board.

20Mb Fixed Disk Drive

When installing the cable P/N6480086 from the 10Mb/20Mb Adapter card to the 20Mb fixed disk drive, the cable must be plugged into the adapter with the trace wire facing down, toward the system board.

Communications Diagnostic Tips

ASYNC Card Jumper

Expansion slot 8 on the system board is slightly different in that any card placed in that slot is expected to respond with a Card Selected Signal. Only one IBM card provides this signal, the Asynchronous (ASYNC) Communications Adapter. To provide this signal, the ASYNC Communications card must have Jumper J-13 installed. Any card placed in that slot that does not provide a Card Selected Signal will not be recognized as being installed.

1101 Errors

When running the asynchronous diagnostics on a 5150 PC or a 5160 PC XT, the ASYNC card P/N8529150 must be set for RS232C Interface. Otherwise, 1101 errors will result during testing. After testing, return the card to its original position if the customer uses current loop interface.

Down-Level DSEA (IBM Customer Engineer Only)

There are two levels of the PC Display Station Emulation Adapter (DSEA). The early level, P/N6851163, was shipped only to IBM internal accounts. It has a twinaxial connector attached directly to the adapter bracket. The new level was shipped to customers and is P/N6851206. It has a 15-pin D-type shell connector attached to the adapter bracket. IBM customer engineers service the new level of adapter only. Internal sites with the early level card must go through AAS to acquire the new level.

Communication Problems with Professional Graphics Controller

Machines Affected: 5160, 5161, and 5170

Early level professional graphics controllers (PGCs), FRU P/N6181765, may be subject to communication difficulties when installed in a system with communication adapters. Affected PGCs may limit transmission speed to 300 baud. Text received at higher speeds may be garbled. The current level of PGC allows transmission speeds up to 9600 baud.

Early level cards have the assembly number 6323697 printed on the left edge of the component side of the memory card (the only card whose component side is completely visible). Later level cards have the 6323697 covered and the assembly numbers 6448811 or 62X0914 printed under the J2 connector. J2 is located in the upper left component side of the same card.

The current level card corrects these communication performance problems by allowing line speeds up to 9600 baud.

Early level cards (assembly number 6323697) that exhibit these communication limitations should be replaced with the new FRU, number 62X0912. See ECA013.

Note: PGCs with the assembly number 62X0914 are the only level PGCs that will operate in the PC AT Model 339. The Model 339 uses an 8 MHz system clock and requires the 62X0914 assembly to operate.

Configuring Personal Computer with Displaywriter Attachment

Refer to the IBM *Displaywriter Personal Computer Attach Program Description Operations* manual, G544-2280. In Chapter 3, "Customer Setup," the referenced documentation fails to instruct the customer on how to configure the Asynchronous Communications Adapter properly in conjunction with this feature. The adapter should be set to COM1. The Asynchronous Communications Adapters are already configured from the supplier for COM1 and RS232C. The feature will fail to operate with the adapter configured in the current loop mode. Refer to the *Hardware Maintenance and Service* manual for the adapter configurations.

Communication Problems when DSEA Is Installed

5150 (PC) and 5160 (PC XT) communications-related problems can be caused by down-level system boards.

Some PC and PC XT communications-related problems cannot be resolved with normal diagnostics when the Display Station Emulation Adapter (DSEA) is installed. Symptoms include, but are not limited to:

- No communications at all
- One or more units dropping offline at any time
- Seemingly unrelated error codes (301, 516, 508, 548, and others) at various times or simultaneously on a single unit.

If all ASYNC, BISYNC, SDLC, and/or DSEA parameters are correct, look at the system board to identify the processor module, located in position U35 (5150) or U28 (5160). If the module is an AMD 8237 or 9517, look for the presence of a 74LS32 module in one of the following locations on the system board.

On the 5150 System Board, the 74LS32 module will be located in position U101 or the spare position. On the 5160 System Board, the 74LS32 module will be located in position U90 or the spare position. System boards without the 74LS32 module in one of the above locations, and experiencing problems with DSEA, should be replaced. See ECA005.

5150/5160-Based System Diagnostic Information

For a Symptom-to-FRU Index and additional diagnostics information, refer to the Service Summary cards supplied with this manual.

5150 PC Switch Settings

Switches in your system are set to reflect the addition of memory and other installed options. Switches are located on the system board, Extender card, and memory expansion options.

The switches are dual in-line package (DIP) switches and are easily set with a ballpoint pen. Refer to the charts on the following pages to determine the correct switch settings for your system. Slide DIP switches are set by sliding the switch with a ballpoint pen, while rocker switches are set by pressing the rocker to the desired position, as shown in Figure 4-23.
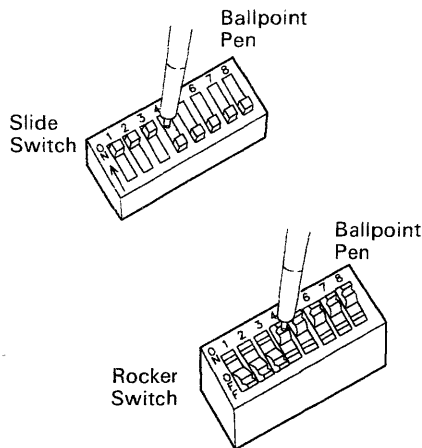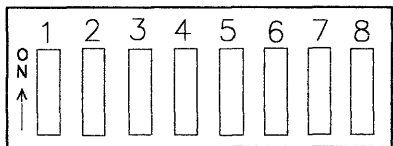
LEX40186

Figure 4-23. DIP Slide and Rocker Switch

Note: The system board type (16Kb/64Kb CPU system board or 64Kb/256Kb CPU system board) is printed on the left edge of the system board.

The following figures show switches on the system board. These settings are necessary for the system to address the attached devices and to specify the amount of memory on the system board.
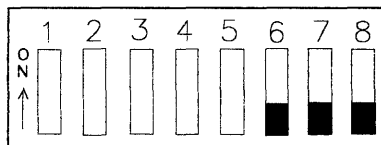
Switch Block 1

LEX40187

Switch Position	Switch Function
1-7-8	Number of 5.25-inch diskette drives installed.
2	Math coprocessor: off if coprocessor is installed; must be on if coprocessor is not installed.
3-4	Amount of memory on the system board.
5-6	Type of display adapters installed.

Note: Total system memory includes memory options.

Switch Block 2

LEX40188

Switch Position	Switch Function
1-2-3-4-5	Amount of memory options installed.
6-7-8	Always in the off position.

Monitor Type Switch Settings

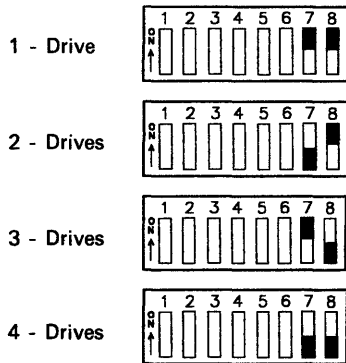The following shows the settings for positions 5 and 6:
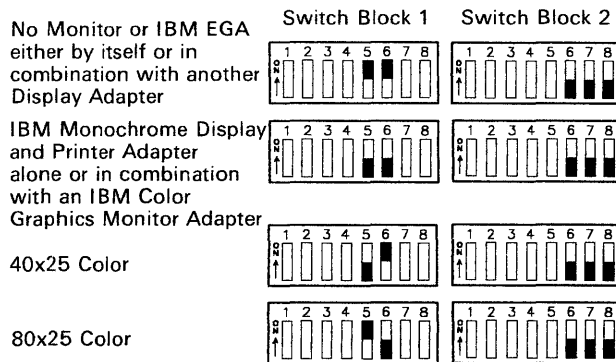
LEX40311

Figure 4-24. Monitor Type Switch Settings

Diskette Drive Switch Settings

The following are the settings for positions 7 and 8, switch 1 is always on:

LEX40240

| Figure 4-25. 5.25-Inch Diskette Drive Switch Settings

Extender Card Switch Settings

The following chart shows the switch settings of the extender card switch block in conjunction with memory of various sizes:

System Memory	Extender Card Switch Block	Memory Segment
16K to 64K		1
96K to 128K		2
160K to 192K		3
224K to 256K		4
288K to 320K		5
352K to 384K		6
416K to 448K		7
480K to 512K		8
544K to 576K		9
608K to 640K		A

LEX40194

Figure 4-26. Extender Card Switch Settings

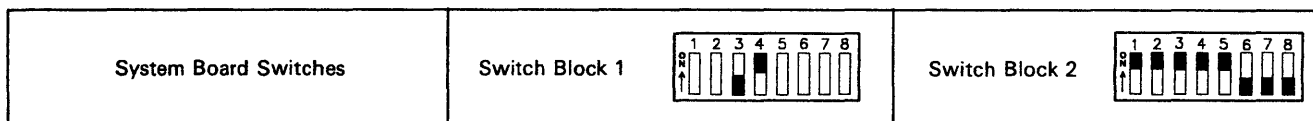# Switch Settings: System Board Memory (16Kb-64Kb CPU)

The following figures show switch settings for a range of system board memory from 16Kb to 64Kb, plus additional memory up to 576Kb.
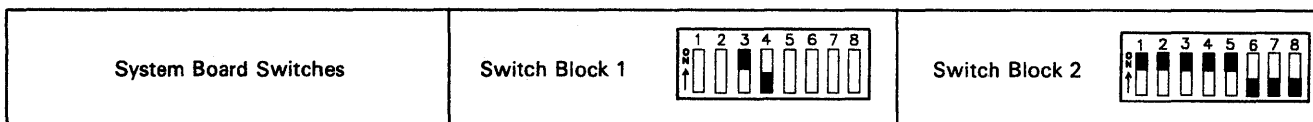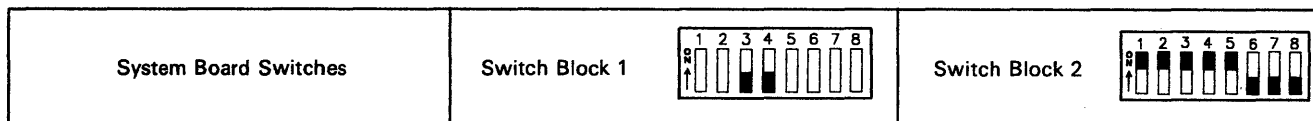
16Kb Total Memory
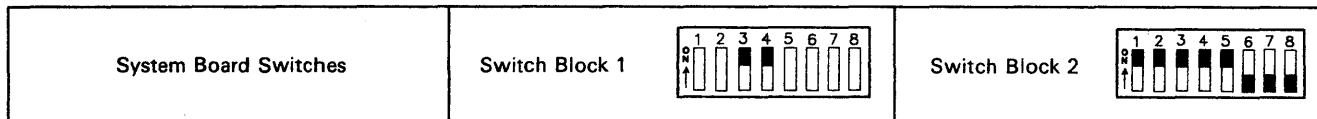
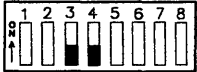LEX40195

32Kb Total Memory

LEX40196

48Kb Total Memory

LEX40197

64Kb Total Memory

LEX40198

96Kb Total Memory (32Kb + 64Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 32K option			
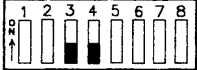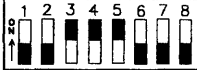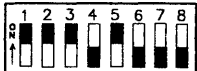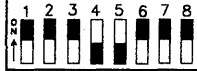
128Kb Total Memory (64Kb + 64Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed			
1 - 64K option			
2 - 32K options			

4-18

160Kb Total Memory (96Kb + 64Kb on System Board)
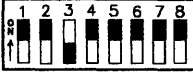
System Board Switches	Switch Block 1	Switch Block 2
	ON ↑ [1 2 3 4 5 6 7 8]	ON ↑ [1 2 3 4 5 6 7 8]

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed 1 - 32K option	ON ↑ [1 2 3 4 5 6 7 8]		ON ↑ [1 2 3 4 5 6 7 8]
1 - 64K option 1 - 32K option		ON ↑ [1 2 3 4 5 6 7 8]	ON ↑ [1 2 3 4 5 6 7 8]
3 - 32K options			ON ↑ [1 2 3 4 5 6 7 8] ON ↑ [1 2 3 4 5 6 7 8] ON ↑ [1 2 3 4 5 6 7 8]

LEX40201

192Kb Total Memory (128Kb + 64Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K option installed 1 - 64K option			
2 - 64K options			
1 - 64/256K option with 64K installed 2 - 32K options			
1 - 64K option 2 - 32K options			
1 - 64/256K option with 128K installed			

LEX40202

4-20

224Kb Total Memory (160Kb + 64Kb on System Board)
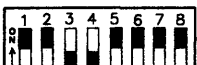
System Board Switches	Switch Block 1	Switch Block 2

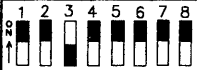|	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed 1 - 64K option 1 - 32K option			
2 - 64K options 1 - 32K option			
1 - 64/256K option with 128K installed 1 - 32K option			

LEX40203

256Kb Total Memory (192Kb + 64Kb on System Board)

System Board Switches	Switch Block 1		Switch Block 2
	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed	1 2 3 4 5 6 7 8		
1 - 64/256K option with 128K installed 1 - 64K option	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	
1 - 64/256K option with 64K installed 2 - 64K options	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8	
3 - 64K options		1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8	
1 - 64/256K option with 128K installed 2 - 32K options	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8

LEX40204

4-22

288Kb Total Memory (224Kb + 64Kb on System Board)
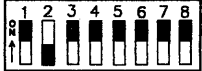
System Board Switches	Switch Block 1	Switch Block 2
	ON ↑ 1 2 3 4 5 6 7 8	ON ↓ 1 2 3 4 5 6 7 8

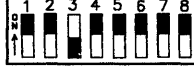|	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed 1 - 32K option	ON ↑ 1 2 3 4 5 6 7 8		ON ↑ 1 2 3 4 5 6 7 8
1 - 64/256K option with 128K installed 1 - 64K option 1 - 32K option	ON ↑ 1 2 3 4 5 6 7 8	ON ↑ 1 2 3 4 5 6 7 8	ON ↑ 1 2 3 4 5 6 7 8

LEX40205

320Kb Total Memory (256Kb + 64Kb on System Board)
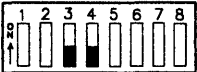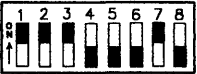
System Board Switches	Switch Block 1	Switch Block 2
	Switch Block 1	Switch Block 2

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 128K installed 2 - 64K options	(switch diagram)	(switch diagram) (switch diagram)	
1 - 64/256K option with 192K installed 1 - 64K option	(switch diagram)	(switch diagram)	
1 - 64/256K option with 192K installed 2 - 32K options	(switch diagram)		(switch diagram) (switch diagram)
*1 - 64/256K option with 256K installed	(switch diagram)		

LEX40206

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

352Kb Total Memory (288Kb + 64Kb on System Board)
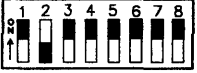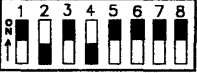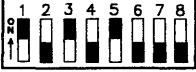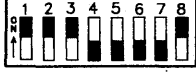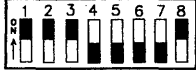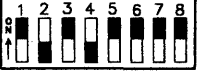
System Board Switches	Switch Block 1	Switch Block 2

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed 1 - 64K option 1 - 32K option			
*1 - 64/256K option with 256K installed 1 - 32K option			

LEX40207

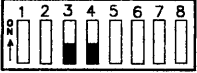* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

384Kb Total Memory (320Kb + 64Kb on System Board)

System Board Switches	Switch Block 1	`ON↑ 1 2 3 4 5 6 7 8`	Switch Block 2	`ON↑ 1 2 3 4 5 6 7 8`

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed 2 - 64K options	`ON↑ 1 2 3 4 5 6 7 8`	`ON↑ 1 2 3 4 5 6 7 8` `ON↑ 1 2 3 4 5 6 7 8`	
*1 - 64/256K option with 256K installed 1 - 64/256K option with 64K installed	*`ON↑ 1 2 3 4 5 6 7 8` `ON↑ 1 2 3 4 5 6 7 8`		
*1 - 64/256K option with 256K installed 1 - 64K option	*`ON↑ 1 2 3 4 5 6 7 8`	`ON↑ 1 2 3 4 5 6 7 8`	
*1 - 64/256K option with 256K installed 2 - 32K options	*`ON↑ 1 2 3 4 5 6 7 8`		`ON↑ 1 2 3 4 5 6 7 8` `ON↑ 1 2 3 4 5 6 7 8`

LEX40208

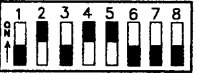* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

4-26

416Kb Total Memory (352Kb + 64Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*1 - 64/256K option with 256K installed 1 - 64/256K option with 64K installed 1 - 32K option			
*1 - 64/256K option with 256K installed 1 - 64K option 1 - 32K option			

LEX40209

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

448Kb Total Memory (384Kb + 64Kb on System Board)
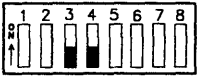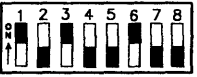
System Board Switches	Switch Block 1		Switch Block 2	
	1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8	

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*1 - 64/256K option with 256K installed 1 - 64/256K option with 64K installed 1 - 64K option	1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	
*1 - 64/256K option with 256K installed 2 - 64K options	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8	
*1 - 64/256K option with 256K installed 1 - 64/256K option with 128K installed	1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8		

LEX40210

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

4-28

480Kb Total Memory (416Kb + 64Kb on System Board)
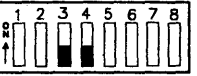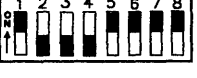
System Board Switches	Switch Block 1	Switch Block 2
	[switch diagram]	[switch diagram]

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*1 - 64/256K option with 256K installed 1 - 64/256K option with 128K installed 1 - 32K option	[switch diagrams]		[switch diagram]

LEX40211

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

512Kb Total Memory (448Kb + 64Kb on System Board)

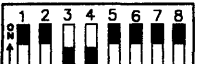| System Board Switches	Switch Block 1	Switch Block 2
	[switch diagram]	[switch diagram]

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*1 - 64/256K option with 256K installed 1 - 64/256K optin with 128K installed 1 - 64K option	[switch diagrams]	[switch diagram]	
*1 - 64/256K option with 256K installed 1 - 64/256K option with 192K installed	[switch diagrams]		

LEX40212

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

544Kb Total Memory (480Kb + 64Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*1 - 64/256K option with 256K installed *1 - 64/256K option with 192K installed 1 - 32K option			

LEX40213

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

576Kb Total Memory (512Kb + 64Kb on System Board)
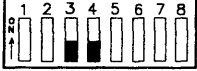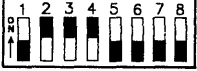
System Board Switches	Switch Block 1	Switch Block 2

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*1 - 64/256K option with 256K installed 1 - 64/256K option with 192K installed 1 - 64K option			
*2 - 64/256K option with 256K installed			

LEX40214

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

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608Kb Total Memory (544Kb + 64Kb on System Board)
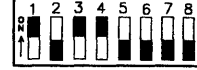
System Board Switches	Switch Block 1	Switch Block 2
	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*2 - 64/256K option with 256K installed 1 - 32K option	1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8		1 2 3 4 5 6 7 8

LEX40215

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

640Kb Total Memory (576Kb + 64Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2
	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*2 - 64/256K option with 256K installed 1 - 64K option	1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	
*2 - 64/256K option with 256K installed 1 - 64/256K option with 64K installed	1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8 1 2 3 4 5 6 7 8		

LEX40216

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

Switch Settings: System Board Memory (64Kb-256Kb CPU)

64Kb Total Memory

System Board Switches	Switch Block 1		Switch Block 2	
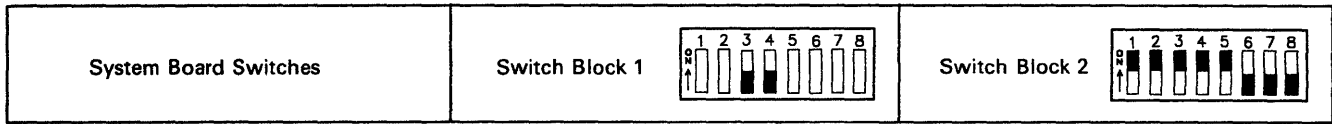
LEX40217

128Kb Total Memory

System Board Switches	Switch Block 1		Switch Block 2	
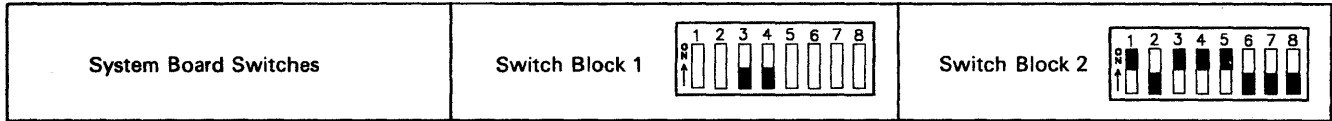
LEX40218

192Kb Total Memory

System Board Switches	Switch Block 1		Switch Block 2	
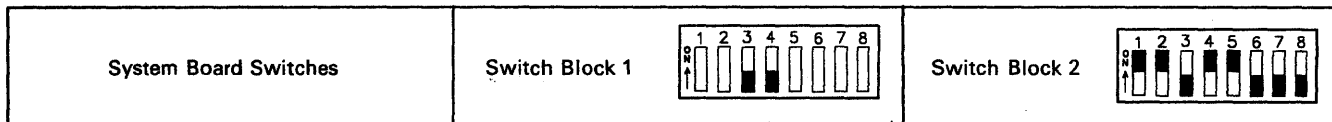
LEX40219

256Kb Total Memory
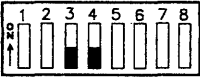
System Board Switches	Switch Block 1		Switch Block 2	
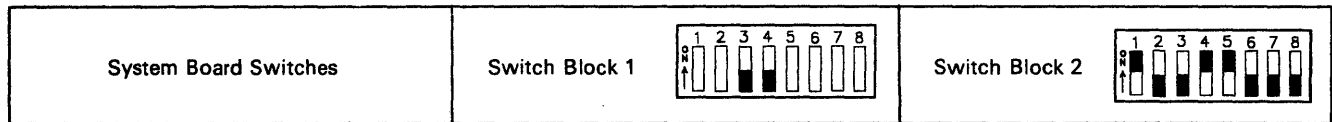
LEX40220

288Kb Total Memory (32Kb + 256Kb on System Board)
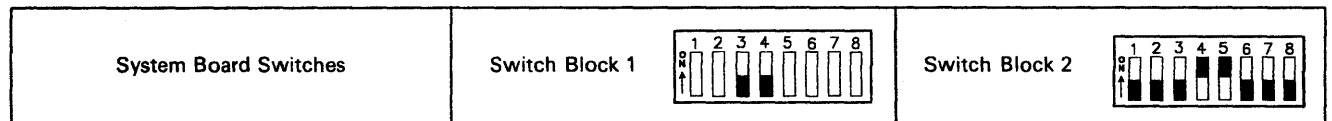
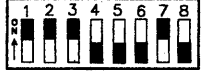| System Board Switches	Switch Block 1		Switch Block 2	

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 32K option			

LEX40221

320Kb Total Memory (64Kb + 256Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2
System Board Switches	(switches: 1 2 3 4 5 6 7 8)	(switches: 1 2 3 4 5 6 7 8)

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed	(switches: 1 2 3 4 5 6 7 8)		
1 - 64K option		(switches: 1 2 3 4 5 6 7 8)	
2 - 32K options			(switches: 1 2 3 4 5 6 7 8) (switches: 1 2 3 4 5 6 7 8)

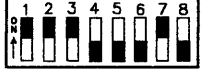LEX40222

352Kb Total Memory (96Kb + 256Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2
	(switches 1–8)	(switches 1–8)

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed 1 - 32K options	(switches 1–8)		(switches 1–8)
1 - 64K option 1 - 32K option		(switches 1–8)	(switches 1–8)
3 - 32K options			(switches 1–8) (switches 1–8) (switches 1–8)

LEX40223

384Kb Total Memory (128Kb + 256Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2
	ON ↑ [1 2 3 4 5 6 7 8]	ON ↑ [1 2 3 4 5 6 7 8]

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed 1 - 64K option	ON ↑ [1 2 3 4 5 6 7 8]	ON ↑ [1 2 3 4 5 6 7 8]	
2 - 64K options		ON ↑ [1 2 3 4 5 6 7 8] ON ↑ [1 2 3 4 5 6 7 8]	
1 - 64/256K option with 64K installed 2 - 32K options	ON ↑ [1 2 3 4 5 6 7 8]		ON ↑ [1 2 3 4 5 6 7 8] ON ↑ [1 2 3 4 5 6 7 8]
1 - 64K option 2 - 32K options		ON ↑ [1 2 3 4 5 6 7 8]	ON ↑ [1 2 3 4 5 6 7 8] ON ↑ [1 2 3 4 5 6 7 8]
1 - 64/256K option with 128K installed	ON ↑ [1 2 3 4 5 6 7 8]		

LEX40224

416Kb Total Memory (160Kb + 256Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2
System Board Switches	Switch Block 1 — switches 1-8 (4,5 ON)	Switch Block 2 — switches 1-8

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed 1 - 64K option 1 - 32K option	(switch settings)	(switch settings)	(switch settings)
2 - 64K options 1 - 32K option		(switch settings) (switch settings)	(switch settings)
1 - 64/256K option with 128K installed 1 - 32K option	(switch settings)		(switch settings)

LEX40225

4-36

448Kb Total Memory (192Kb + 256Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed			
1 - 64/256K option with 128K installed 1 - 64K option			
1 - 64/256K option with 64K installed 2 - 64K options			
3 - 64K options			
1 - 64/256K option with 128K installed 2 - 32K options			

LEX40226

480Kb Total Memory (224Kb + 256Kb on System Board)
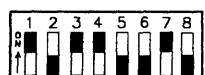
System Board Switches	Switch Block 1	Switch Block 2
	(switches 1-8)	(switches 1-8)

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed 1 - 32K option	(switches 1-8)		(switches 1-8)
1 - 64/256K option with 128K installed 1 - 64K option 1 - 32K option	(switches 1-8)	(switches 1-8)	(switches 1-8)

LEX40227

512Kb Total Memory (256Kb + 256Kb on System Board)
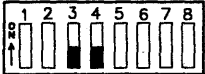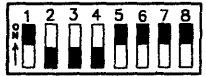
System Board Switches	Switch Block 1	Switch Block 2

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 128K installed 2 - 64K options			
1 - 64/256K option with 192K installed 1 - 64K option			
1 - 64/256K option with 192K installed 2 - 32K options			
*1 - 64/256K option with 256K installed			

LEX40228

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

544Kb Total Memory (288Kb + 256Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2
	1 2 3 4 5 6 7 8 (switch diagram)	1 2 3 4 5 6 7 8 (switch diagram)
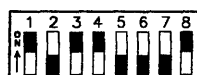
	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed 1 - 64K option 1 - 32 option	1 2 3 4 5 6 7 8 (switch diagram)	1 2 3 4 5 6 7 8 (switch diagram)	1 2 3 4 5 6 7 8 (switch diagram)
*1 - 64/256K option with 256K installed 1 - 32 option	* 1 2 3 4 5 6 7 8 (switch diagram)		1 2 3 4 5 6 7 8 (switch diagram)

LEX40229

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

4-40

576Kb Total Memory (320Kb + 256Kb on System Board)

System Board Switches	Switch Block 1	Switch Block 2
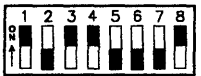
	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed 2 - 64K options		 	
*1 - 64/256K option with 256K installed 1 - 64/256K option with 64K installed	 		
*1 - 64/256K option with 256K installed 1 - 64K option			
*1 - 64/256K option with 256K installed 2 - 32K options			

LEX40230

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

608Kb Total Memory (352Kb + 256Kb on System Board)

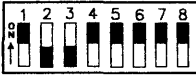| System Board Switches	Switch Block 1	Switch Block 2
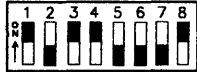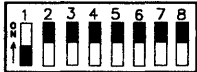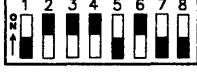
	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*1 - 64/256K option with 256K installed 1 - 64/256K option with 64K installed 1 - 32K option			
*1 - 64/256K option with 256K installed 1 - 64K option 1 - 32K option			

LEX40231

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

640Kb Total Memory (384Kb + 256Kb on System Board)

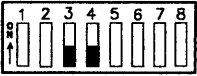| System Board Switches	Switch Block 1	Switch Block 2

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*1 - 64/256K option with 256K installed 1 - 64/256K option with 64K installed 1 - 64K option			
*1 - 64/256K option with 256K installed 2 - 64K options			
*1 - 64/256K option with 256K installed 1 - 64/256K option with 128K installed			

LEX40232

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

Chapter 5. 5155 Portable
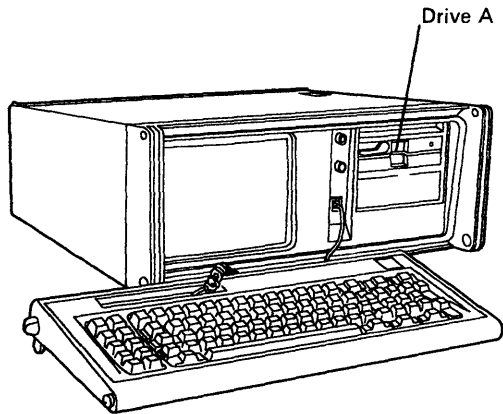
Drive A

LEX41803

Figure 5-1. 5155 Portable

The 5155 consists of a lightweight casing with a carrying handle containing a built-in 9-inch amber composite display and one 5.25-inch Slimline, double-sided diskette drive (with space available for an optional second drive). The system board is the same as that of the 5160 PC XT with 256Kb of memory.

Unit Specifications

Size	
Height	204 mm (8 in)
Width	500 mm (20 in)
Depth	430 mm (17 in)
Weight	13.6 kg (30 lb)
Power Cable	
Length	1.83 m (6 ft)
Size	18 AWG
Environment	
Air Temperature	
System On	15.6° to 32.2°C
	(60° to 90°F)
System Off	10° to 43°C
	(50° to 110°F)
Humidity	
System On	8% to 80%
System Off	20% to 80%
Heat Output	650 BTU/hr max.

Figure 5-2 (Part 1 of 2). 5155 Specifications

Noise Level	49.5 dBa
	System unit with
	monochrome display
	and expansion unit
	attached.
Electrical	
Nominal	120V AC
Minimum	104V AC
Maximum	127V AC
kva	0.32 max.

Figure 5-2 (Part 2 of 2). 5155 Specifications

Power Supply
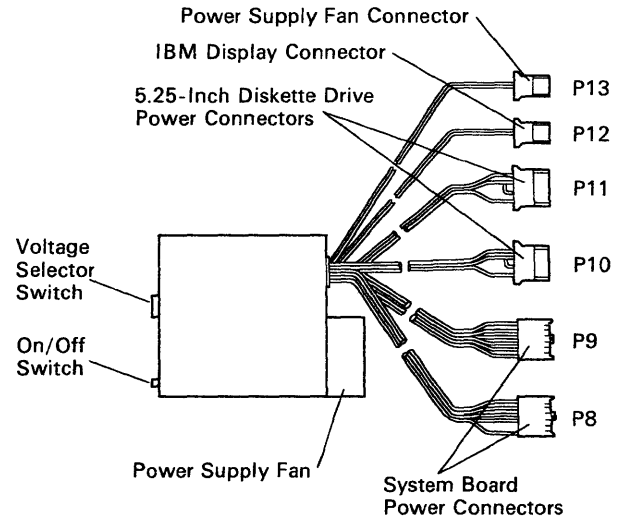
LEX40075

Figure 5-3. 5155 Power Supply and Connectors

The system unit's power supply is a 114-watt, switching regulator that provides five outputs. It supplies power for the system unit and its options, the power supply fan, diskette drive, composite display, and keyboard. All power levels are protected against overvoltage and overcurrent conditions. The input voltage selector switch has 115V AC and 230V AC positions. If a DC overload or overvoltage condition exists, the power supply automatically shuts down until the condition is corrected, and the power supply is switched off and then on.

The internal 5.25-inch diskette drive uses the +5V DC and the +12V DC power levels. Both the +12V DC and -12V DC power levels are used in the drivers and receivers of the optional communications adapters. The display uses a separate +12V DC power level.

The +5V DC, -5V DC, +12V DC, and -12V DC power
levels are bussed across the system expansion slots.

Keyboard

The IBM Portable Personal Computer keyboard cable
is a detachable, 4-wire, shielded cable that connects to
a modular connector in the front panel of the system
unit. The cable has power (+5V DC), ground, and two
bidirectional signal lines in it. It is 762 mm (30 in)
long and is coiled.

All other functions of the keyboard are identical to the
5150 keyboard.

5155 PC Portable Diagnostic Information

For diagnostic information, refer to "5150/5160-Based
System Diagnostics" on page 4-3. For a
Symptom-to-FRU Index and further diagnostic informa-
tion, refer to the Service Summary cards supplied with
this manual.

5155 PC Portable Switch Settings

For 5155 PC switch setting information, refer to "5160
PC XT Switch Settings" on page 6-3.

Note: 5155 PC and 5160 PC XT switch settings are
the same.

Chapter 6. 5160 PC XT
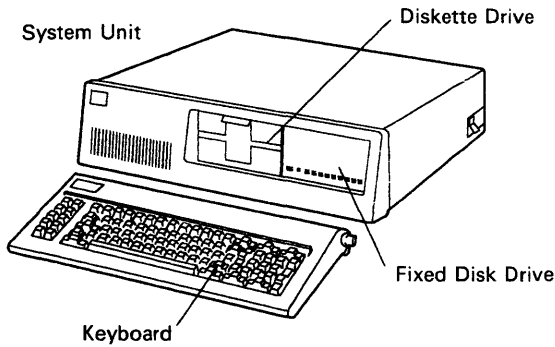
LEX40076

Figure 6-1. 5160 PC XT

The 5160 Personal Computer XT is an extended version of the 5150 Personal Computer. A typical PC XT features one 5.25-inch, 360Kb diskette drive, 256Kb memory, Asynchronous Communications Adapter, and a 10Mb or 20Mb fixed disk drive. There are numerous configurations ranging from stand-alone models to host interactive models.

Unit Specifications

System Unit	
Size	
Height	142 mm (5.5 in)
Length	500 mm (19.6 in)
Depth	410 mm (16.1 in)
Weight	14.5 kg (32 lb)
Power Cable	
Length	1.83 m (6 ft)
Size	18 AWG
Environment	
Air Temperature	
System On	15.6° to 32.2°C
	(60° to 90°F)
System Off	10° to 43°C
	(50° to 110°F)
Humidity	
System On	8% to 80%
System Off	20% to 80%
Heat Output	750 BTU/hr max.

Noise Level	49.5 dBa System unit with monochrome display and expansion unit attached.
Electrical	
Nominal	120V AC
Minimum	104V AC
Maximum	127V AC
kva	0.41 max.

Figure 6-2 (Part 2 of 2). 5160 Specifications

System Board
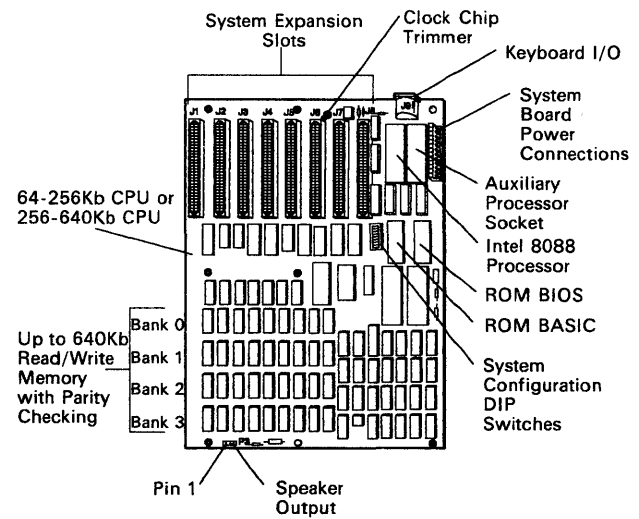
LEX40077

Figure 6-3. 5160 System Board Component Diagram

The system board fits horizontally in the base of the system unit of the Personal Computer XT and Portable Personal Computer. It is a multilayer, single-land-per-channel design with ground and internal planes provided. DC power and a signal from the power supply enter the board through two 6-pin connectors. Other connectors on the board are for attaching the keyboard and speaker. Eight 62-pin card-edge sockets are also mounted on the board. The I/O channel is bussed across these eight I/O slots. Slot J8 is slightly different from the others in that any card placed in it is expected to respond with a card selected signal whenever the card is selected.

A dual in-line package (DIP) switch (one 8-switch pack) is mounted on the board and can be read under program control. The DIP switch provides the system

programs with information about the installed options, how much storage the system board has, what type of display adapter is installed, what operation modes are desired when power is switched on (color or black-and-white, 80- or 40-character lines), and the number of diskette drives attached.

The system board contains the adapter circuits for attaching the serial interface from the keyboard. These circuits generate an interrupt to the microprocessor when a complete scan code is received. The interface can request execution of a diagnostic test in the keyboard.

The system board consists of five functional areas: the processor subsystem and its support elements, the read-only memory (ROM) subsystem, the read/write (R/W) memory subsystem, integrated I/O adapters, and the I/O channel.

Microprocessor

The heart of the system board is the Intel 8088 Microprocessor. This is an 8-bit external-bus version of Intel's 16-bit 8086 Microprocessor and it is software-compatible with the 8086. Thus, the 8088 supports 16-bit operations, including multiply and divide, and supports 20 bits of addressing. It also operates in maximum mode so a co-microprocessor can be added as a feature. The microprocessor operates at 4.77 MHz.

Standard Features	5160 Models													
	068	078	086	087	088	089	267	268	277	278	568	588	589	788
128Kb Memory				x										
256Kb Memory	x	x	x				x	x	x	x	x	x	x	x
512Kb/640Kb* Memory					x	x								
360Kb Diskette Drive, Full-High	1	2	1	1							1	1	1	1
360Kb* Diskette Drive, Half-High					1	1	1	1	2	2				
10Mb Fixed Disk Drive			1	1							1	1	1	
20Mb* Fixed Disk Drive									1	1				
10Mb/20Mb Fixed Disk Drive Adapter			1	1	1	1					1	1	1	
ASYNC Comm Adapter			1	1	1	1								1
83-Key Keyboard	x	x	x	x	x		x		x		x	x	x	x
101-Key Keyboard*							x	x	x					
PC/370 – M Card											x	x	x	
PC/370 – P Card											x	x	x	
PC/3277 – EM Card											x	x		
Color Graphics Adapter														x
Printer/Register Adapter, Unique														x
Internal Modem Adapter, Unique														x
Extender Card	x	x	x	x							x	x	x	x
* Denotes features that are supported only on 5160 Models 088, 089, 267, 268, 277, and 278.														

Power Supply
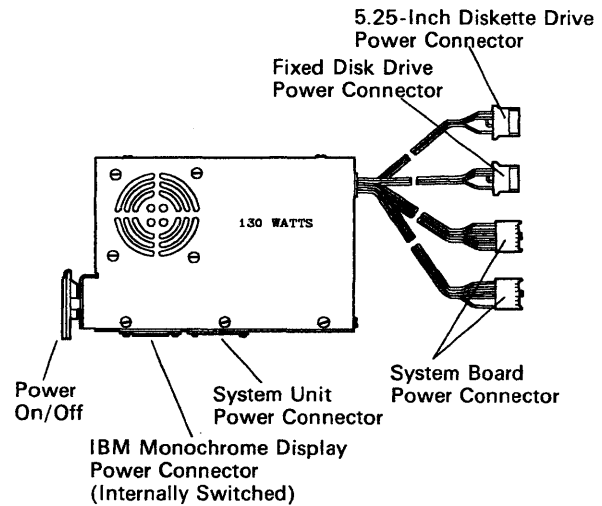
LEX40078

Figure 6-4. 5160 Power Supply

The system DC power supply is a 130-watt, four voltage-level switching regulator. It is integrated into the system unit and supplies power for the system unit, its options, and the keyboard. The supply provides 15 A of +5V DC, ±5%; 4.2 A of +12V DC, ±5%; 300 mA of -5V DC, ±10%; and 250 mA of -12V DC, ±10%. All power levels are regulated with overvoltage and over-current protection. There are two power supplies, 120V AC and 220/240V AC. Both are fused. If DC overcurrent or overvoltage conditions exist, the supply automatically shuts down until the condition is corrected. The supply is designed for continuous operation at 130 watts.

The system board takes approximately 2 to 4 A of +5V DC, thus allowing approximately 11 A of +5V DC for the adapters in the system expansion slots. The +12V DC power level is designed to power the internal 5.25-inch diskette drive and the 10Mb fixed disk drive. The -5V DC level is used for analog circuits in the diskette adapter's phase-lock loop. The +12V DC and -12V DC are used for powering the Electronic Industries Association (EIA) drivers for the communications adapters. All four power levels are bussed across the eight system expansion slots.

The IBM Monochrome Display has its own power supply, receiving its AC power from the system unit's power system. The AC output for the display is switched on and off with the power switch and is a nonstandard connector, so only the IBM Monochrome Display can be connected.

Keyboard

The 83-key keyboard is standard on all 5160 models, excluding Models 089, 268, and 278.

The 101-key keyboard is standard on 5160 Models 089, 268, and 278.

Both the 83-key keyboard and the 101-key keyboard are interchangeable only on 5160 Models 088, 089, 267, 268, 277, and 278. Models 088, 267, and 277 are identical to Models 089, 268, and 278, respectively, with the exception of the keyboards.

5160 PC XT Diagnostic Information

For diagnostic information, refer to "5150/5160-Based System Diagnostics" on page 4-3. For a Symptom-to-FRU Index and additional diagnostics information, refer to the Service Summary cards supplied with this manual.

5160 PC XT Switch Settings

Figure 6-5 shows switches on the system board. These settings are necessary for the system to address the attached devices and to specify the amount of memory on the system board.
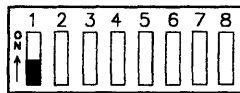
LEX40233

Figure 6-5. Switch Block

Switch Position	Switch Function
1	Normal operation, off (set to on to loop POST).
2	Math coprocessor: off if coprocessor is installed; on if coprocessor is not installed.
3-4	Amount of memory on the system board.
5-6	Type of monitor you are using.
7-8	Number of 5.25-inch diskette drives attached.

Math Coprocessor Switch Settings

Figure 6-6 shows the settings for position 2:
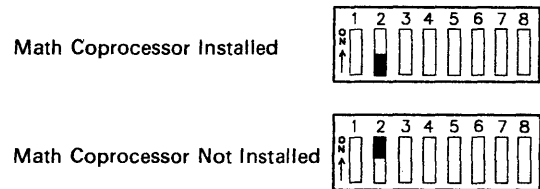
LEX40234

Figure 6-6. Math Coprocessor Switch Settings

System Board Memory Switch Settings

The following figures show the settings for positions 3 and 4 for the amount of memory on the system board.
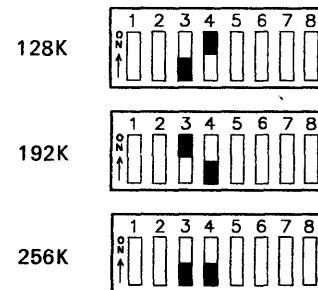
LEX40235

Display Adapter Switch Settings

The following figures show the settings for positions 5 and 6:

No Display or IBM EGA either by itself or in combination with another Display Adapter	Switch Block 1

IBM Monochrome Display and Printer Adapter alone or in combination with an IBM Color Graphics Monitor Adapter

40x25 Color

80x25 Color
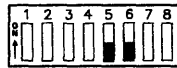
LEX43131

Figure 6-7. Monitor Type Switch Settings

Note: See Chapter 10, "3270 PC Products," for 3270 unique switch settings.

10/20Mb Fixed Disk Drive Adapter Card Switch Settings

Type 1

Type 2

Type 13

Type 16

Drive C   Drive D

LEX41701

Note: Type 1 is an IBM 10Mb Fixed Disk Drive.

Diskette Drive Switch Settings

The following are the settings for positions 7 and 8:

1 - Drive
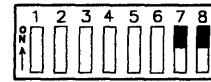
2 - Drives
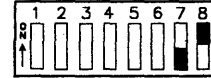
3 - Drives

4 - Drives

LEX40240

Memory Option Switch Settings

5160 PC XT with a 256Kb/640Kb system board; Models 088, 089, 267, 268, 277, 278 only.
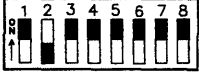
PC XT ™ With 256/640 System Board (Note 1)	
Total Memory (Note 2)	System Board Switch Settings
256K	ON↑ 1 2 3 4 5 6 7 8
512K	ON↑ 1 2 3 4 5 6 7 8
576K	ON↑ 1 2 3 4 5 6 7 8
640K	ON↑ 1 2 3 4 5 6 7 8

Note 1: The system board's identifier is located on its left edge.

Note 2: Memory adapters are not supported on 256/640K system boards.

LEX41702

Memory Option Switch Settings
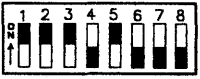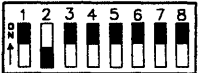
5160 PC XT with a 64Kb/256Kb system board.

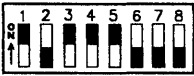### 288Kb Total Memory (32Kb + 256Kb on System Board)

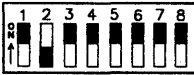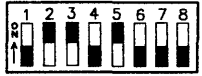|	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 32K option			ON ↑ [1 on] [2 off] [3 4 5 6 7 8 on]

LEX40241

320Kb Total Memory (64Kb + 256Kb on System Board)

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed	ON ↑ [1 on] [2 off] [3 4 off] [5 off] [6 7 on] [8 off]		
1 - 64/256K option		ON ↑ [1 on] [2 off] [3 4 5 6 7 8 on]	
2 - 32K options			ON ↑ [1 on] [2 off] [3 4 5 6 7 8 on] ON ↑ [1 on] [2 off] [3 4 5 6 7 8 on]

LEX40242

352Kb Total Memory (96Kb + 256Kb on System Board)

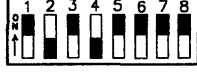|	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed 1 - 32K option			
1 - 64K option 1 - 32K option			
3 - 32K options			

LEX40243

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed 1 - 64K option	ON ↑ 1 2 3 4 5 6 7 8	ON ↑ 1 2 3 4 5 6 7 8	
2 - 64K options		ON ↑ 1 2 3 4 5 6 7 8 ON ↑ 1 2 3 4 5 6 7 8	
1 - 64/256K option with 64K installed 2 - 32K options	ON ↑ 1 2 3 4 5 6 7 8		ON ↑ 1 2 3 4 5 6 7 8 ON ↑ 1 2 3 4 5 6 7 8
1 - 64K option 2 - 32K options		ON ↑ 1 2 3 4 5 6 7 8	ON ↑ 1 2 3 4 5 6 7 8 ON ↑ 1 2 3 4 5 6 7 8
1 - 64/256K option with 128K installed	ON ↑ 1 2 3 4 5 6 7 8		

LEX40244

6-8

416Kb Total Memory (160Kb + 256Kb on System Board)

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 64K installed 1 - 64K option 1 - 32K option	[switch settings: ON ↑ — 1 2 3 4 5 6 7 8]	[switch settings: ON ↑ — 1 2 3 4 5 6 7 8]	[switch settings: ON ↑ — 1 2 3 4 5 6 7 8]
2 - 64K options 1 - 32K option		[switch settings: ON ↑ — 1 2 3 4 5 6 7 8] [switch settings: ON ↑ — 1 2 3 4 5 6 7 8]	[switch settings: ON ↑ — 1 2 3 4 5 6 7 8]
1 - 64/256K option with 128K installed 1 - 32K option	[switch settings: ON ↑ — 1 2 3 4 5 6 7 8]		[switch settings: ON ↑ — 1 2 3 4 5 6 7 8]

LEX40245

448Kb Total Memory (192Kb + 256Kb on System Board)

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed	switch diagram		
1 - 64/256K option with 128K installed 1 - 64K option	switch diagram	switch diagram	
1 - 64/256K option with 64K installed 2 - 64K options	switch diagram	switch diagram switch diagram	
3 - 64K options		switch diagram switch diagram switch diagram	
1 - 64/256K option with 128K installed 2 - 32K options	switch diagram		switch diagram switch diagram

LEX40246

480Kb Total Memory (224Kb + 256Kb on System Board)

	64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed 1 - 32K option	switch diagram		switch diagram
1 - 64/256K option with 128K installed 1 - 64K option 1 - 32K option	switch diagram	switch diagram	switch diagram

LEX40247

512Kb Total Memory (256Kb + 256Kb on System Board)

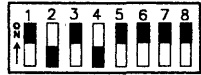|	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 128K installed 2 - 64K options	[switch block 1 2 3 4 5 6 7 8]	[switch block 1 2 3 4 5 6 7 8] [switch block 1 2 3 4 5 6 7 8]	
1 - 64/256K option with 192K installed 1 - 64K option	[switch block 1 2 3 4 5 6 7 8]	[switch block 1 2 3 4 5 6 7 8]	
1 - 64/256K option with 192K installed 2 - 32K options	[switch block 1 2 3 4 5 6 7 8]		[switch block 1 2 3 4 5 6 7 8] [switch block 1 2 3 4 5 6 7 8]
*1 - 64/256K option with 256K installed	* [switch block 1 2 3 4 5 6 7 8]		

LEX40248

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

544Kb Total Memory (288Kb + 256Kb on System Board)

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed 1 - 64K option 1 - 32K option	[switch block 1 2 3 4 5 6 7 8]	[switch block 1 2 3 4 5 6 7 8]	[switch block 1 2 3 4 5 6 7 8]
*1 - 64/256K option with 256K installed 1 - 32K option	* [switch block 1 2 3 4 5 6 7 8]		[switch block 1 2 3 4 5 6 7 8]

LEX40249

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

576Kb Total Memory (320Kb + 256Kb on System Board)

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
1 - 64/256K option with 192K installed 2 - 64K options	ON↑ `1 2 3 4 5 6 7 8`	ON↑ `1 2 3 4 5 6 7 8` ON↑ `1 2 3 4 5 6 7 8`	
*1 - 64/256K option with 256K installed 1 - 64/256K option with 64K installed	* ON↑ `1 2 3 4 5 6 7 8` ON↑ `1 2 3 4 5 6 7 8`		
*1 - 64/256K option with 256K installed 1 - 64K option	* ON↑ `1 2 3 4 5 6 7 8`	ON↑ `1 2 3 4 5 6 7 8`	
*1 - 64/256K option with 256K installed 2 - 32K options	* ON↑ `1 2 3 4 5 6 7 8`		ON↑ `1 2 3 4 5 6 7 8` ON↑ `1 2 3 4 5 6 7 8`
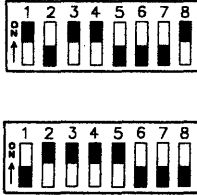
LEX40250

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

608Kb Total Memory (352Kb + 256Kb on System Board)

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*1 - 64/256K option with 256K installed 1 - 64/256K option with 64K installed 1 - 32K option	(switch diagrams)		(switch diagram)
*1 - 64/256K option with 256K installed 1 - 64K option 1 - 32K option	(switch diagram)	(switch diagram)	(switch diagram)
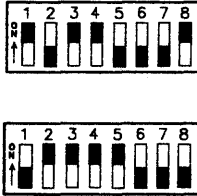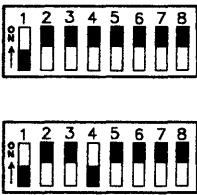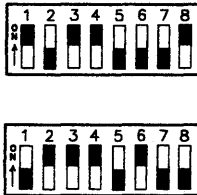
LEX40251

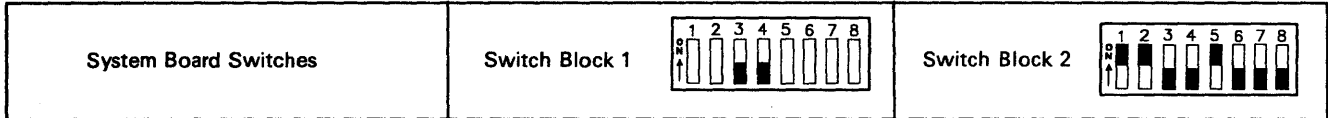* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

640Kb Total Memory (384Kb + 256Kb on System Board)

	*256K Option or 64/256K Option Card Switches	64K Option Card Switches	32K Option Card Switches
*1 - 64/256K option with 256K installed 1 - 64/256K option with 64K installed 1 - 64K option	(switch diagrams)	(switch diagram)	
*1 - 64/256K option with 256K installed 2 - 64K options	(switch diagram)	(switch diagrams)	
*1 - 64/256K option with 256K installed 1 - 64/256K option with 128K installed	(switch diagrams)		

LEX40252

* The switch setting for the 256Kb option is the same as that for the 64Kb/256Kb option with 256Kb installed.

Extender Card Switches

Set the switches on the extender card to reflect total system memory.

System Memory	Extender Card Switch Block
16K to 64K	
96K to 128K	
160K to 192K	
224K to 256K	
288K to 320K	
352K to 384K	
416K to 448K	
480K to 512K	
544K to 576K	
608K to 640K	

LEX40253

Note: Model 5160 XT/370 (20Mb) must have extender card switches set for 608Kb to 640Kb.

Figure   6-8. Extender Card Switch Settings

5160 DunsPlus System
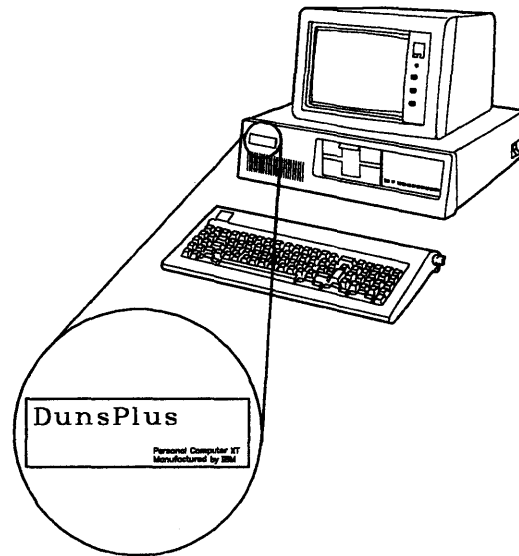
LEX40109

Figure   6-9. 5160 DunsPlus System

The DunsPlus* system consists of a unique 5160 IBM Personal Computer XT (Model 788), IBM 5153 Color Display, and an IBM 5152 Graphics Printer, or an optional NEC* letter-quality printer and its own unique software. It can be used for desktop computing as well as access to data bases on remote computers. The IBM customer engineer will install both the hardware and software for the DunsPlus system.

The DunsPlus system is a specially designed IBM PC XT built by IBM exclusively for the Dun & Bradstreet Company. Maintenance is accomplished by IBM customer engineers using the *DunsPlus Installation and Service* manual, the *PC XT Hardware and Maintenance Service* (HMS) manual, and the DunsPlus support center. Both installation and service are guided by the *DunsPlus Installation and Service* manual. The DunsPlus support center will screen both installation and service calls. The IBM customer engineer will supply DunsPlus with type and serial numbers on installations or element exchange incidents and major code on FRU replacement incidents. The feedback to DunsPlus is accomplished via direct entry into the DunsPlus system Communications Link/Electronic Call Reporting Procedure (guided by the *DunsPlus Installation and Service* manual).

* Registered Trademark

Installation

Installation of a DunsPlus system is accomplished by following the directions in the *DunsPlus Installation and Service* manual, which is included in the customer ship group. The IBM customer engineer will be required to install both the hardware and software for each DunsPlus system. The IBM customer engineer must bring to each installation a copy of the *PC XT HMS* manual and the current advanced diagnostic diskette (Version 2.05 or later).

To install:

1. Unpack and assemble the system unit, including connection of the DunsPlus system cables.
2. Run system diagnostic tests, including the modem loop-back test, to verify proper operation.
3. Format the fixed disk and install the DunsPlus supplied software using the DunsPlus Installation and Service Diskette.
4. Perform the Communications Link/Electronic Call Reporting Procedure provided by DunsPlus.

Any problems encountered while installing a DunsPlus system should be handled by calling the DunsPlus support center hotline. The telephone numbers for DunsPlus support will be supplied to the IBM service representative via IBM dispatch.

Hardware Installation

Before starting any DunsPlus installation, the IBM customer engineer should be familiar with the *DunsPlus Installation and Service* manual. This manual is part of the customer ship group and will be included in the first container to be opened (marked OPEN FIRST). After the initial installation, and after each service call, the servicer is required to do a communication link checkout. This is accomplished by following the procedure in the *DunsPlus Installation and Service* manual. The checkout procedure for the communication link is part of the DunsPlus software package. The DunsPlus software must be installed prior to running the communication link checkout procedure.

Software Installation

The IBM customer engineer will install the DunsPlus software from the customer-supplied diskettes onto the fixed disk in the DunsPlus system. This will be accomplished by first inserting the DunsPlus Installation and Service Diskette, switching power on, and then following the prompts on the menu driven screens. The step-by-step instructions on installing the DunsPlus software are included in the *DunsPlus Installation and Service* manual.

DunsPlus Installation and Service Manual

A copy of the *DunsPlus Installation and Service* manual will be shipped with each system and an additional two copies will be shipped to each IBM BO servicing DunsPlus installations. The DunsPlus Installation and Service Diskette is included with the manual.

Maintenance

The DunsPlus system will be serviced in a unique manner. IBM customer engineers will provide on-site installation of the hardware and software, and on-site service of the hardware. The hardware is the same as other PC XTs, except for two new adapters that have their own diagnostics and PICs.

Both installation and service will be directed by the *DunsPlus Installation and Service* manual in conjunction with the *PC XT HMS* manual. Some of the DunsPlus diagnostics are installed on the advanced diagnostic diskette and some are installed on the fixed disk. The diagnostics installed on the fixed disk are maintained by DunsPlus. The unique diagnostics that are on the advanced diagnostic diskette can only be invoked after the diagnostic program senses it is being run on a DunsPlus system.

A DunsPlus support center will provide an interface between a DunsPlus user and IBM customer engineer. The DunsPlus support center will provide the IBM customer engineer with FRU/element exchange information when placing a service call. The IBM customer engineer will also be furnished with the DunsPlus host dialing sequence to be used in testing the communication link and to report service call information at the completion of each service call.

The *DunsPlus Installation and Service* manual and its own special diskette will be shipped with each system as part of the shipping group.

Service Calls

Service calls are placed via DunsPlus customer support, which screens the calls prior to notifying IBM. Installations are handled in the same manner. Using this technique, DunsPlus customer support will not only minimize installation problems but also reduce unnecessary service calls. Whenever possible, the IBM customer engineer will be asked to bring a particular FRU to a service call (again minimizing outage).

Electronic Call Reporting

The IBM customer engineer will supply the DunsPlus support center (via direct entry into the DunsPlus system) the following information:

- Machine type and serial for repairs, element exchange, and installations
- Major code for FRU replacement incidents.

Internal IBM incident reporting will remain the same.

DunsPlus Hardware

Two new pieces of hardware and a specific hardware rule are part of the DunsPlus system:

- The Internal Modem Adapter is a microprocessor-based modem that operates at 300 or 1200 bps and provides auto-dial and auto-answer capabilities.
- The Printer/Register Adapter is like the Parallel Printer Adapter with special register for DunsPlus system security. It is not interchangeable with a Parallel Printer Adapter.

Internal Modem Adapter
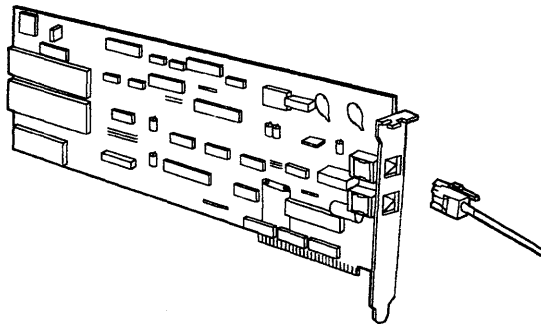
LEX40044

Figure 6-10. Internal Modem Adapter

The Internal Modem Adapter contains auto-call logic that is used by the customer to establish a connection with the host system. The DunsPlus documentation may refer to autocall as Dialer or Auto-Dialer. The Internal Modem Adapter functions as an alternate Asynchronous Communications Adapter with a built-in modem. The advanced diagnostic tests identify this adapter as Alt Async Communications Adpt on the Installed Devices screen. When the advanced diagnostics have finished testing the adapter, they will direct the IBM customer engineer to the *DunsPlus Installation and Service* manual to complete the communication link test. The part number for the Internal Modem Adapter will be included in the *DunsPlus*

Installation and Service manual. The adapter is easily identified by the two modular telephone jacks on the rear of the adapter. The telephone plugs into the bottom receptacle and the wall connector plugs into the top receptacle.

Printer/Register Adapter
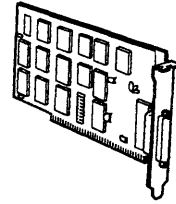
LEX40110

Figure 6-11. Printer/Register Adapter

The Printer/Register Adapter is included in the DunsPlus system. It contains the normal Parallel Printer Adapter as well as an 8-bit register used by the DunsPlus system for security. This 8-bit register stores the users' identification, which allows them access to the DunsPlus network. The part number for the Printer/Register Adapter is included in the *DunsPlus Installation and Service* manual.

Printers

Two printers are available for the DunsPlus system:

- The standard IBM 80 CPS Graphics Printer (5152)
- The NEC Model 3550 Letter-Quality Printer, which is a FRU.

Both printers are serviced on an exchange basis through IBM Service.
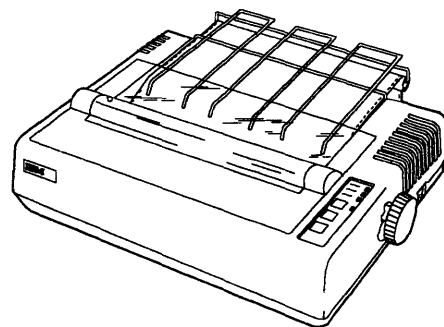
LEX40111

Figure 6-12. IBM 5152 Printer
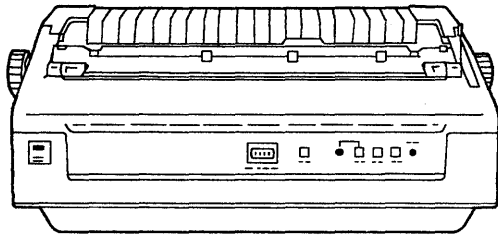
LEX40112

Figure 6-13. NEC 3550 Printer

FRU Locations

The FRU locations on the PC XT board are fixed.
They are shown in Figure 6-14 and are as follows:

Position 1   Color/Graphics Monitor Adapter
Position 2   Open
Position 3   Open
Position 4   Internal Modem Adapter
Position 5   Fixed Disk Adapter
Position 6   Diskette Drive Adapter
Position 7   Printer/Register Adapter
Position 8   Asynchronous Communications Adapter.
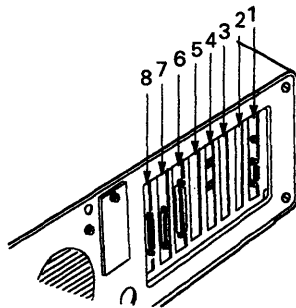
LEX40113

Figure 6-14. PC XT Board FRU Locations

5160 XT/370
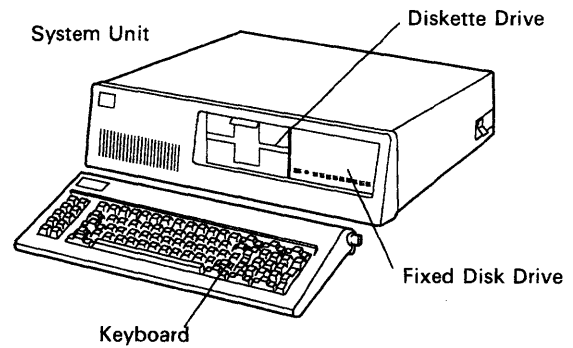
LEX40128

Figure 6-15. 5160 XT/370

The XT/370 is an extended version of the 5160 XT with
256Kb of memory on the system board. The system
unit has two XT/370 Adapter cards plugged into the
system board:

- The Processor card (PC/370-P) in expansion slot 4
- The 512Kb Memory card (PC/370-M) in expansion
  slot 3.

Options available include:

- A Remote Display Terminal Device Emulation
  Adapter card
- IBM 3278/79 Emulation Adapter.

Note: A Remote Display Terminal Device Emulation
Adapter card can be in expansion slot 2.

The XT/370 can be used as a 10Mb system (one fixed
disk drive in the system unit) or a 20Mb system (two
fixed disk drives in an expansion unit).

Note: Older models of the PC XT/370 might contain a
PC/3277EM card. (This option provides 3277-2 emu-
lation when the PC XT/370 is attached to a host
system.)

Unit Specifications

System Unit	
Size	
Height	142 mm (5.5 in)
Length	500 mm (19.6 in)
Depth	410 mm (16.1 in)
Weight	14.5 kg (32 lb)
Power Cable	
Length	1.83 m (6 ft)
Size	18 AWG
Environment	
Air Temperature	
System On	15.6° to 32.2°C (60° to 90°F)
System Off	10° to 42°C (50° to 110°F)
Humidity	
System On	8% to 80%
System Off	20% to 80%
Heat Output	650 BTU/hr
Noise Level	49.5 dBa System unit with monochrome display and expansion unit attached.
Electrical	
Nominal	120V AC
Minimum	104V AC
Maximum	127V AC
Keyboard	
Size	
Height	57 mm (2.2 in)
Length	500 mm (19.6 in)
Depth	200 mm (7.87 in)
Weight	2.9 kg (6.5 lb)

Figure 6-16. 5160 XT/370 Specifications

PC/3277EM Card
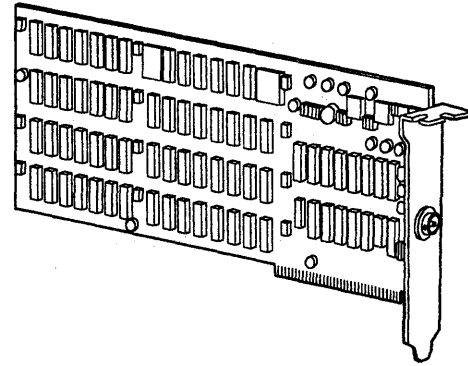
LEX40129

Figure 6-17. PC3277EM Card (Used in PC XT/370 only)

The PC/3277EM card allows the PC XT/370 to emulate a 3277-2 terminal when the PC XT/370 is linked to a host system. This card also allows additional functions to those of the 3277 when supported with suitable software. These additional functions include the ability to print single screens, complete listings, or other files on the PC XT printer, and the ability to transfer data between the PC XT/370 and the host system disks.

PC/370-P Card
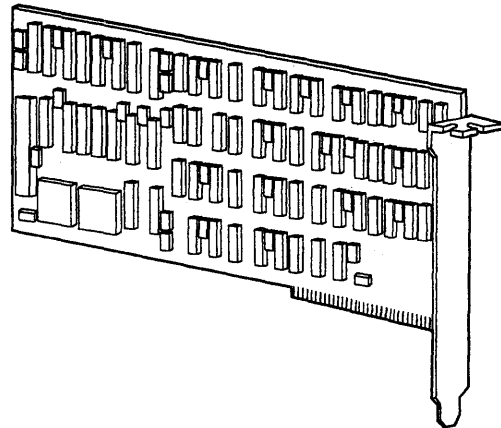
LEX40130

Figure 6-18. PC/370-P Card

The PC/370-P card is the center of the S/370 operations for the PC XT/370. The PC/370-P card contains the microprocessors and control circuits that enable the PC XT/370 to execute S/370 instructions.

PC/370-M Card
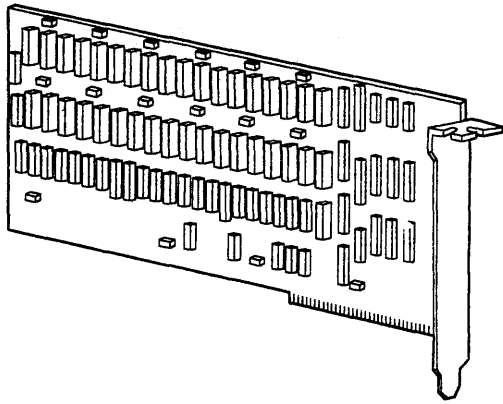
LEX40131

Figure   6-19. PC/370-M Card

The PC/370-M card contains 512Kb of parity-checked,
random access memory (RAM), which can be used by
either the PC/370-P card or by the PC XT. This pro-
vides 512Kb of memory for use in S/370 mode, or a
total of 640Kb of memory for use in PC XT mode.

Chapter 7. 5161 Expansion Unit
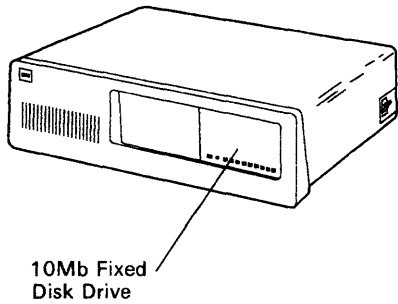
LEX40079

Figure 7-1. 5161 Expansion Unit
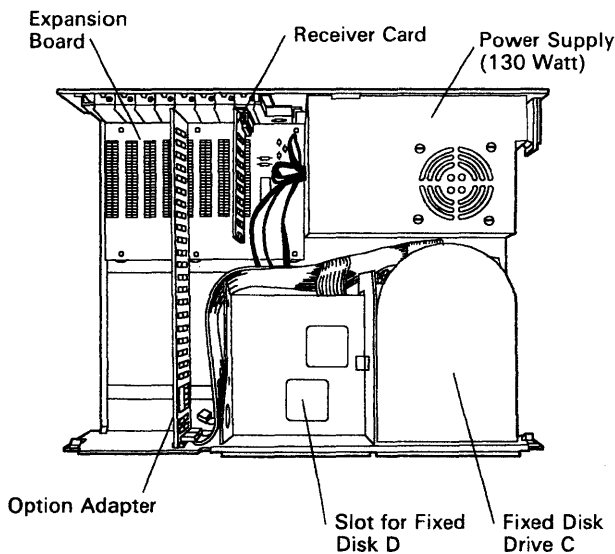
LEX40080

Figure 7-2. 5161 Expansion Unit (Cover Removed)

Note: This unit is not supported on 5160 Models 088, 089, 267, 268, 277, and 278.

The 5161 Expansion Unit provides additional configuration flexibility for the 5150 Personal Computer and the 5160 Personal Computer XT. Each expansion unit contains a 10Mb fixed disk drive and eight option extension card slots. One additional 10Mb fixed disk drive may be installed for a total of 20Mb of fixed disk storage. The power supply used in the expansion unit is a PC XT 130-watt power supply.

The IBM Expansion Unit option enhances the system unit by adding expansion slots in a separate unit. This option consists of an Extender card, expansion unit cable, and the expansion unit. The expansion unit con-

tains a power supply, an expansion board, and a Receiver card. This option utilizes one expansion slot in the system unit to provide seven additional expansion slots in the expansion unit.

Unit Specifications

Size	
Height	142 mm (5.5 in)
Length	500 mm (19.6 in)
Depth	410 mm (16.1 in)
Weight	14.9 kg (33 lb)
Power Cable	
Length	1.83 m (6 ft)
Size	18 AWG
Signal Cable	
Length	1 m (3.28 ft)
Size	22 AWG
Environment	
Air Temperature	
System On	15.6° to 32.2°C
	(60° to 90°F)
System Off	10° to 43°C
	(50° to 110°F)
Humidity	
System On	8% to 80%
System Off	20% to 80%
Heat Output	750 BTU/hr
Noise Level	49.5 dBa
	Expansion unit attached
	to system unit with
	monochrome display
Electrical	
Nominal	120V AC
Minimum	104V AC
Maximum	127V AC
kva	0.41 max.

Figure 7-3. 5161 Specifications

Expansion Board

Expansion Unit Expansion Slots

Expansion Board Power Connectors

J1 J2 J3 J4 J5 J6 J7 J8

Color Trimmer Capacitor
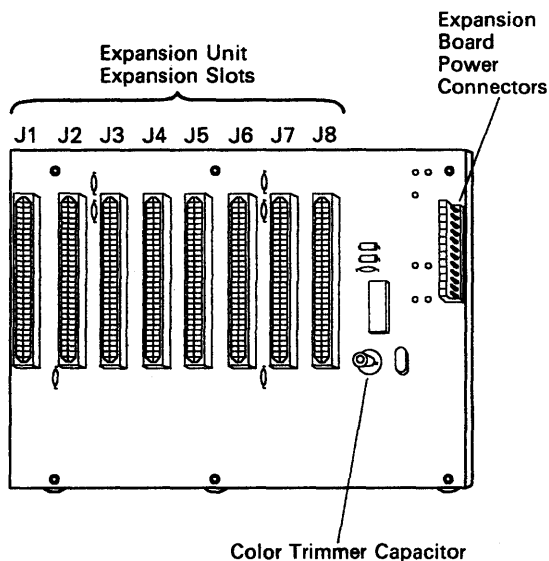
LEX40081

Figure 7-4. 5161 Expansion Board

The expansion board is a support board that carries the I/O channel signals from the option adapters and Receiver card.

Decoupling capacitors provided on the expansion board aid in noise filtering.

Using Expansion Slot 8

Any card placed in expansion slot 8 is expected to respond with a card select signal. Only one IBM card provides this signal, the Asynchronous Communications Adapter. In order to provide this signal, jumper J13 must be installed on the card. Any card not providing this signal will not be recognized.

Expansion Unit Cable

LEX40082

Figure 7-5. Expansion Unit Cable

The expansion unit cable consists of a 56-wire, foil-shielded cable terminated on each end with a 62-pin D-shell male connector. Either end of the expansion unit cable can be plugged into the extender card or the receiver card.

Extender Card Switch Settings

The following chart shows the switch settings of the extender card switch block in conjunction with memory of various sizes. The adapter is found inside the system unit, not in the 5161 Expansion Unit.

System Memory	Extender Card Switch Block	Memory Segment
16K to 64K		1
96K to 128K		2
160K to 192K		3
224K to 256K		4
288K to 320K		5
352K to 384K		6
416K to 448K		7
480K to 512K		8
544K to 576K		9
608K to 640K		A

LEX40194

Figure 7-6. Extender Card Switch Settings

Extender Card, P/N6323445
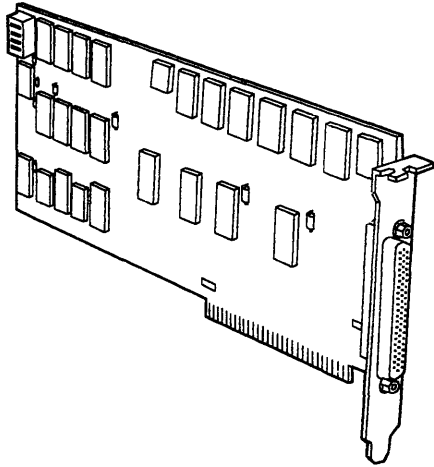
LEX40083

Figure 7-7. Extender Card (Right View)

The Extender card is a four-plane card. It redrives the I/O channel to provide sufficient power to avoid capacitive effects of the cable. The Extender card presents only one load per line of the I/O channel.

The Extender card has a wait-state generator that inserts a wait state on memory-read and memory-write operations (except refreshing) for all memory contained in the expansion unit. The address range for wait-state generation is controlled by switch settings on the Extender card.

The dual in-line package (DIP) switch on the Extender card should be set to indicate the maximum contiguous read/write memory in the system unit.

Receiver Card, P/N8529251
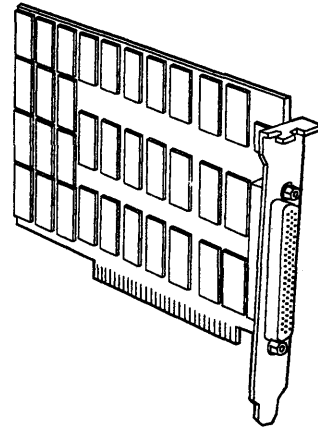
LEX40084

Figure 7-8. Receiver Card (Right View)

The Receiver card is a four-plane card that fits in expansion slot 8 of the expansion unit. It redrives the I/O channel to provide sufficient power for additional options and to avoid capacitive effects. Directional control logic is contained on the Receiver card to resolve contention and direct data flow on the I/O channel. Steering signals are transmitted back through the expansion unit cable for use on the Extender card.

Chapter 8. 5162 PC XT Model 286
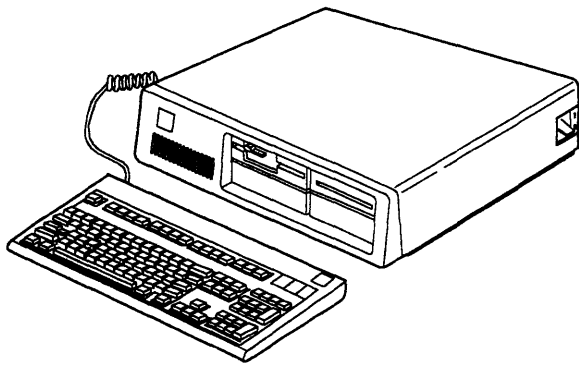
LEX42627

Figure   8-1. 5162 PC XT

The IBM Personal Computer XT Model 286 is an enhancement of the Personal Computer XT family. A standard configuration includes an Intel 80286 6 MHz Microprocessor with zero wait-state, 640Kb of memory, one diskette drive, and one fixed disk. Extensive special features and software are available which provide compatibility with the rest of the IBM PC family.

Unit Specifications

System Unit	
Size	
Height	142 mm (5.5 in)
Length	500 mm (19.6 in)
Depth	410 mm (16.1 in)
Weight	12.7 kg (28 lb)
Power Cable	
Length	1.8 m (6 ft)
Environment	
Air Temperature	
System On	15.6° to 32.2°C
	(60° to 90°F)
System Off	10° to 43°C
	(50° to 110°F)
Humidity	
System On	8% to 80%
System Off	20% to 80%
Heat Output	824 BTU/hr max.

Noise Level	46 dBa
	System Unit without
	display or printer
	attached
Electrical	
Range 1 (57-63 Hz)	
Nominal	115V AC
Minimum	90V AC
Maximum	137V AC
Range 2 (47-53 Hz)	
Nominal	230V AC
Minimum	180V AC
Maximum	265V AC
Lithium Battery	6.0V DC
	1 amp/hr capacity
	UL Approved

Figure   8-2 (Part 2 of 2). 5162 Specifications

5162 PC XT Standard Features

The following are standard features of the 5162 Model 286:

- Power supply
  - 157-watt
  - Internally switched to support 115V AC or 230V AC.
- System board
  - 80286 Microprocessor
  - 6 MHz Clock
  - 8 Expansion Slots
    - 5 with a 36-pin and 62-pin card edge socket
    - 3 with only the 62-pin card edge socket.
  - 640Kb base random access memory (RAM)
  - Complementary metal oxide semiconductor (CMOS) RAM to maintain the system setup configuration
  - Battery to keep CMOS active when power is off.
- Speaker
- Half-high 1.2Mb diskette drive
- 20Mb fixed disk drive
- 101/102-key keyboard.

Incompatible Adapters

Certain option adapters are not compatible when used in the same system.

The following adapters should not be installed together in the 5162 System Unit:

- Synchronous Data Link Control (SDLC)
- Alternate Binary Synchronous Communicatons (Alt. BSC).

Problems might occur in the system because of adapters that share the same interrupt level. Check the adapter interrupt levels to be sure that they do not conflict. If the adapters have selectable interrupt levels, be sure their jumpers are not set for the same level.

Some options not supported by the IBM Personal Computer XT Model are:

- Expansion Unit
- AT 128Kb Memory Expansion
- AT 512Kb Memory Expansion
- AT 128Kb/640Kb Memory Expansion
- AT Fixed Disk and Diskette Drive Adapter
- 256Kb Memory Expansion
- 64Kb/256Kb Memory Expansion
- 64Kb Memory Module Kit
- Full-high diskette drives
- AT 30Mb Fixed Disk Drive
- AT 20Mb Fixed Disk Drive
- 10Mb fixed disk drive
- AT Prototype card
- Diskette Drive Adapter
- Fixed Disk Adapter
- 8087 Math Coprocessor
- Professional Graphics Adapter and Display
- Game Control Adapter
- Color printer
- Other keyboards.

System Differences

This section shows the differences between the PC XT 5162 and the rest of the PC family.
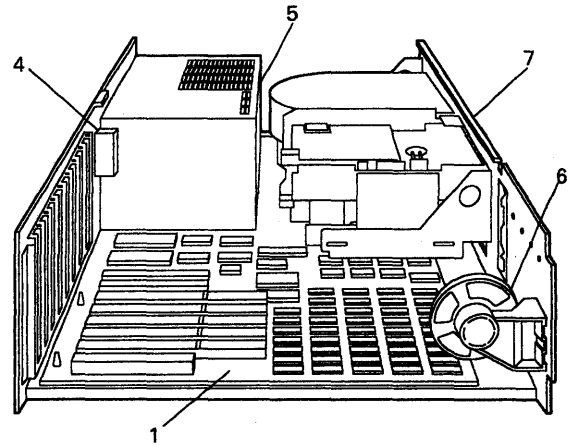
LEX42454

Figure 8-3. 5162 System Unit (Left Side View, Cover Removed)
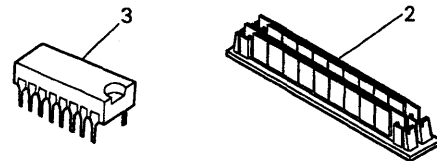
LEX42651

Figure 8-4. 5162 System Unit Memory Modules

Asm - Index	Description
2 - 1	System Board
- 2	256Kb Memory Module Package
- 3	64Kb × 4 Memory Module
- NS	Parity Module, System Board
- 4	Battery Holder
- 5	Power Supply
- 6	Speaker Assembly
- 7	Base Frame Assembly

System Board

The 640Kb System Board uses two 256Kb memory module packages and a 128Kb memory blank consisting of two parity modules and four 64Kb × 4 memory modules.
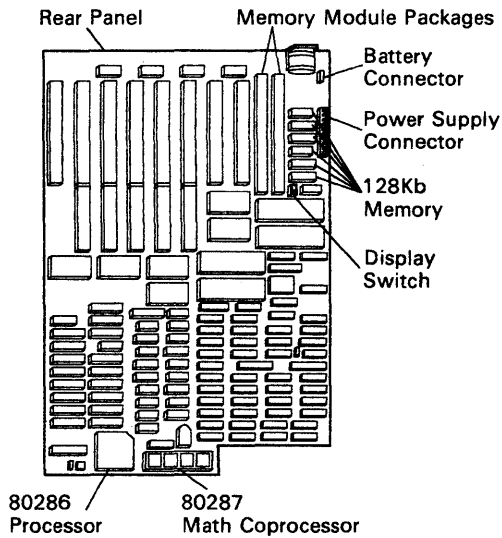
LEX42455

Figure 8-5. 5162 System Board

Keyboard

The 5162 PC XT Keyboard is a 101/102-key keyboard. This keyboard has a serial interface and attaches to a 5-pin connector in the back of the 5162 via a 9-foot coiled cable.

Cabling

The keyboard cable connects to the system with a 5-pin DIN connector and to the keyboard with a six-position SDL connector. The following table shows the pin configuration and signal assignments.
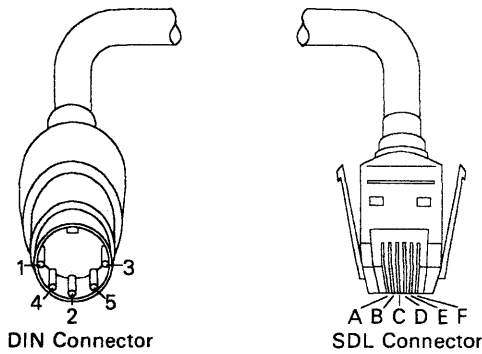
DIN Connector Pins	SDL Connector Pins	Signal Name	Signal Type
1	D	+KBD CLK	Input/Output
2	B	+KBD DATA	Input/Output
3	F	Reserved	
4	C	Ground	Ground
5	E	+5.0 Vdc	Power
	A	Not used	
Shield	Shield	Frame Ground	

LEX42456

Figure 8-6. 5162 Keyboard Connectors

Serial/Parallel Adapter

One Serial/Parallel Adapter is standard in the 5162. This adapter provides one serial port and one parallel port.

20Mb Fixed Disk Drive

The fixed disk drive used in the 5162 PC XT can store up to 20Mb of data. Reading from and writing to this drive is initiated in the same way as the other models of PC XT; however, the 5162 PC XT Fixed Disk and Diskette Drive Adapter may be addressed from different BIOS locations.

High-Capacity Diskette Drive

One 5.25-inch high-capacity diskette drive in addition to the standard high-capacity diskette drive can be installed in a 5162 to provide an online diskette capacity of 2.4Mb. The two drives attach to the Fixed Disk and Diskette Drive Adapter.

The second high-capacity diskette drive has the same characteristics as the standard high-capacity diskette drive.

The second high-capacity diskette drive is installed below the standard high-capacity diskette drive in the 5162 and addressed as drive B. It is mutually exclusive with the 5.25-inch 360Kb diskette drive, 3.5-inch internal diskette drive, and the 4865 Model 002 External 3.5-inch Diskette Drive.

The high-capacity diskette drive uses a different 5.25-inch diskette from that used in the IBM PC configurations with the 8088 Microprocessor to achieve a 1.2Mb capacity. This drive can also read from both sides of a double-sided, 320Kb/360Kb-capacity, 5.25-inch diskette or from one side of a single-sided, 160Kb/180Kb-capacity, 5.25-inch diskette. However, if these diskettes have been written on by a high-capacity diskette drive they might not be readable.

Note: Diskettes designed for use in this drive cannot be used in either a 160Kb/180Kb or 320Kb/360Kb diskette drive in the 1.2Mb mode.

5.25-Inch 360Kb Diskette Drive

One 5.25-inch 360Kb diskette drive can be installed in a 5162 System Unit in addition to the standard high-capacity diskette drive. It attaches to the Fixed Disk and Diskette Drive Adapter and is offered to read and write 5.25-inch diskettes that are to be used in IBM Personal Computer configurations that do not have a 5.25-inch (1.2Mb) high-capacity diskette drive.

This diskette drive can read and write single-sided (160Kb/180Kb capacity) and double-sided (320Kb/360Kb capacity), double-density, soft-sectored, 5.25-inch diskettes. This drive is required in the 5162 to maintain diskette portability only if writing is to be done to single- and/or double-sided diskettes that are also used in IBM Personal Computer configurations without a 5.25-inch high-capacity diskette drive. Such diskettes can be read-only using the high-capacity diskette drive.

3.5-Inch Internal Diskette Drive

One 3.5-inch internal diskette drive with a 720Kb capacity can be installed in a 5162 unit to provide approximately 2Mb of online diskette storage when a second 5.25-inch high-capacity diskette drive, the 5.25-inch 360Kb diskette drive, or the 4865 Model 002 External 3.5-inch Diskette Drive is not installed. This 3.5-inch drive is a half-height drive that is installed below the standard high-capacity diskette drive. It attaches to the Fixed Disk and Diskette Drive Adapter and is addressed as B.

This 3.5-inch diskette drive reads and writes the 3.5-inch doubled-sided, high-capacity (2 HC) diskette and is housed in a rigid plastic case that contains a built-in write-protect switch. The plastic cases have an integrated protection mechanism (a metal, spring-loaded slide cover) for the area of the diskette that will be accessed by the read/write heads of the diskette drive. DOS Version 3.2 is required to use a 3.5-inch diskette drive.

Fixed Disk and Diskette Drive Adapter

One Fixed Disk and Diskette Drive Adapter is present in slot 6 and is the only Fixed Disk and Diskette Drive Adapter that can be installed in a 5162 configuration.

Up to three drives, two diskette drives, and one fixed disk drive can be attached to this adapter. The two attached diskette drives can be:

- Two 5.25-inch high-capacity diskette drives
- One high-capacity diskette drive and one 5.25-inch 360Kb diskette drive
- One high-capacity diskette drive and one 3.5-inch diskette drive (3.5-inch internal diskette drive or 4865 Personal Computer 3.5-Inch External Diskette Drive Model 002).

The External Diskette Drive Adapter provided with the 4865 Model 002 External 3.5-Inch Diskette Drive also attaches to the Fixed Disk and Diskette Drive Adapter.

Power Supply

The system power supply located *inside* the system unit provides power for the system board, the adapters, the diskettes drives, the fixed disk drive, the keyboard, and the IBM Monochrome Display.

Inputs

The power supply can operate at 110V AC, 4.6A or 220/240V AC, 2.3A at frequencies of either 60 ±3 Hz or 50 ±3 Hz. The power supply automatically adjusts to input voltages of 110V AC or 220V AC. The following figure shows the input requirements.

Range	Voltage (V AC)	Current (Amps)
115V AC	Minimum 90 Maximum 137	Maximum 4.6
230V AC	Minimum 180 Maximum 265	Maximum 2.3

Figure 8-7. 5170 Input Requirements

Outputs

The power supply provides +5, -5, +12, and -12V DC. The following figure shows the load current and regulation tolerance for these voltages. The power to the IBM Monochrome Display is controlled by the power supply.

Warning: The voltage provided to the monochrome display from the power supply is the same as the input line voltage to the power supply. Ensure that the monochrome display is the correct model for the input line voltage.

Nominal Output	Load Current (A) Minimum	Maximum	Regulation Tolerance
+5V DC	4.0	20.0	+5% to -4%
-5V DC	0.0	0.3	+10% to -8%
+12V DC	1.0	4.2	+5% to -4%
-12V DC	0.0	0.25	+10% to -9%

Figure 8-8. 5162 DC Load Requirements

DC Output Protection

An overcurrent condition will not damage the power supply.

Output Voltage Sequencing

Under normal conditions, the output voltage levels track within 50 milliseconds of each other when power is applied to or removed from the power supply, provided at least minimum loading is present.

No-Load Operation

No damage or hazardous conditions occur when primary power is applied with no load on any output level. In such cases, the power supply may switch off, and a power-on reset will be required. The power supply requires a minimum load for proper operation.

Power-Good Signal

The power supply provides a power-good signal to indicate proper operation of the power supply.

When the supply is switched off for a minimum of 1 second and then switched on, the power-good signal is generated, assuming there are no problems. This signal is a logical AND of the DC output-voltage sense signal and the AC input-voltage sense signal. The power-good signal is also a TTL-compatible high level for normal operation and a low level for fault conditions. The AC fail signal causes power-good to go to a low level at least 1 millisecond before any output voltage falls below the regulation limits. The operating point used as a reference for measuring the 1 millisecond is normal operation at minimum line voltage and maximum load.

The DC output-voltage sense signal holds the power-good signal at a low level when power is switched on until all output voltages have reached their minimum sense levels. The power-good signal has a turn-on delay of at least 100 milliseconds but not longer than

500 milliseconds and is capable of sourcing 2 milliamperes and sinking 10 milliamperes.

The following figure shows the minimum sense levels for the output voltages.

Level (V DC)	Minimum (V DC)
+5	+4.5
-5	-4.3
+12	+10.8
-12	-10.2

Figure 8-9. 5162 Sense Levels

Connectors

The following figure shows the pin assignments for the power-supply output connectors.

Load Point	Voltage (V DC)
P8-1	Power Good*
P8-2	+5
P8-3	+12
P8-4	-12
P8-5	Ground
P8-6	Ground
P9-1	Ground
P9-2	Ground
P9-3	-5
P9-4	+5
P9-5	+5
P9-6	+5
P10-1	+12
P10-2	Ground
P10-3	Ground
P10-4	+5
P11-1	+12
P11-2	Ground
P11-3	Ground
P11-4	+5
* See Power-Good Signal	

Figure 8-10. 5162 Power Supply Output Connectors

Battery

The 5162 battery is a 6-volt, life-long lithium battery, which is attached to the battery connector at the back of the system board.

The 5162 battery is considered a FRU part, P/N72X8498, which carries the one-year warranty of the 5162 system unit. The battery FRU part carries the normal 90-day parts warranty.

When replacement of the battery is required, follow the directions below:

- Power off the system.
- From the rear of the system unit, remove the screw in the battery holder door.
- Replace the battery using caution to insert the battery in the correct position with the battery terminals facing into the system unit.

Note: 5162 System Units are shipped with the battery in the reserve position to prolong life expectancy of the battery.

Disregard the battery replacement instructions and part number provided in the *5162 Guide to Operations* manual, Section 3.

Screw

Battery Holder
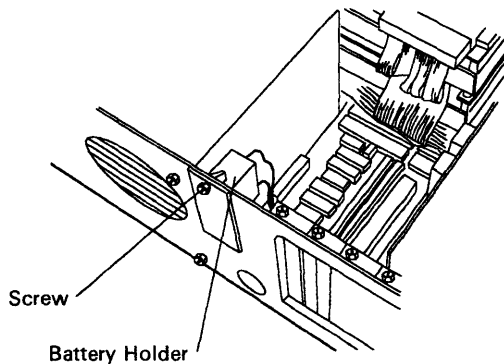
LEX42457

Figure 8-11. 5162 Battery Location

5162 PC XT/286 Diagnostic/Switch Setting Information

Error Codes

You might have an error code or an audio response during power-on self test (POST). If you have both an error code and an audio error, disregard the audio error and perform advanced diagnostics on the FRU indicated.

Power-On Self Test

The POST is initiated automatically with each power on of the system. The POST can be invoked at any time by pressing the Ctrl key, the Alt key, and the Del key at the same time, then releasing them.

The POST is a series of system checks and initialization that verifies the correct operation of the base

system. Two classifications of malfunctions that can be detected during the POST are critical and non-critical.

Critical malfunctions prevent the system from operating at all or could cause incorrect results that are apparent to the user.

Non-critical malfunctions are those that cause incorrect results that might not be apparent to the user.

If a critical error is detected during the POST, an attempt is made to indicate the error and all testing will halt. On a non-critical error, an error code is displayed and the testing is stopped. Testing can be continued on a non-critical error by pressing the F1 key.

After a successful POST, in which no critical errors are detected, a single short beep will be generated. Control is then given to the system boot strap loader.

It is important to remember that the POST does not test all areas, but only those that allow the system to be operational enough to run the advanced diagnostics program.

5162 PC XT/286 Diagnostics

For a Symptom-to-FRU Index and additional diagnostic information, refer to the Service Summary Cards supplied with this manual.

Memory Switch Settings

The switches on the memory options are divided into two sections:

- Switches 1-5 determine the starting address for the expansion memory installed on the option.
- Switches 6, 7, and 8 are not used on the 512Kb/2Mb Memory Expansion option.

Starting Address (Switches 1 through 5)

The switch settings can be determined through the following procedure. Assume you have 3.5Mb of expansion memory installed in your system and you are installing another memory option.

1. Establish your starting address by adding the amount of expansion memory already installed (3.5Mb) to the starting address for expansion memory.

   3.5M (Amount of expansion memory installed)
   + 1.0M (Starting address for expansion memory)
   _____
   4.5M (Starting address for next option)

   LEX42507

2. In the following table, find the values that, when added, equal 4.5Mb.

Switch Number	Value in Open (Off) Position
1	8M
2	4M
3	2M
4	1M
5	.5M

4.0M (Switch 2 set to Off Position)
+ .5M (Switch 5 set to Off Position)
_____
4.5M (Switch Setting for new option)

↑ 1 2 3 4 5 6 7 8
ON □■□□□■□□□
    OPEN
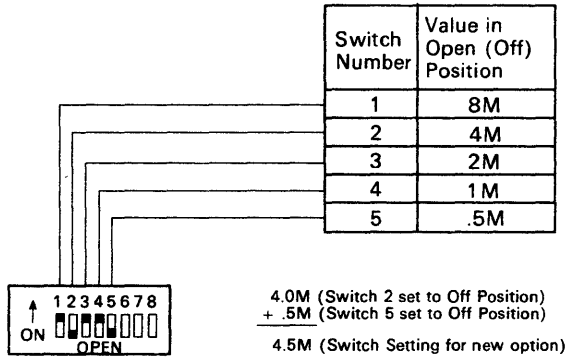
LEX42508

Figure 8-12. Memory Switch Settings

Memory Module Package

1. Power off the system.
2. Remove the system unit cover.
3. Find the failing memory module package on the system board (MAP 0200: Memory, in the *HMS* manual).
4. Grasp the memory module packages and lift them from the system board.

Note: Some memory module packages are held in place by two retention tabs. The rear memory module package must be removed first. Gently spread the two tabs apart while lifting at a slight angle on the memory module package.

Retention Tab
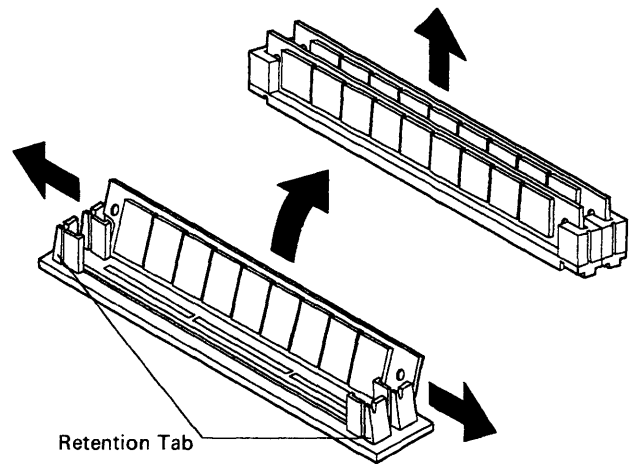
LEX42509

Figure 8-13. Memory Module Package

5162 PC XT/286 Switch Setting Information

For further information on Memory Expansion Adapter switch settings, refer to Chapter 17.

Chapter 9. 5170 Personal Computer AT
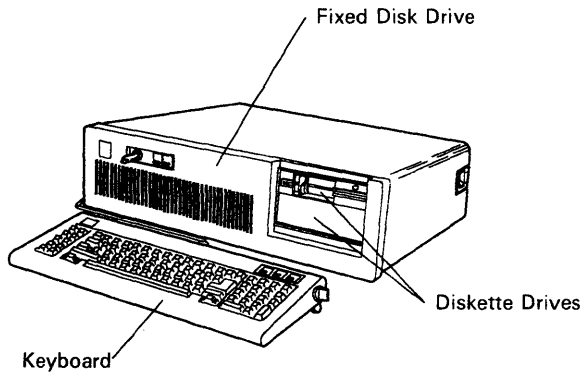
LEX41703

Figure 9-1. 5170 Personal Computer AT

The 5170 Personal Computer AT features the 32-bit, 80286 Processor, 7-channel direct memory access (DMA), 128Kb read-only memory (ROM), 256Kb or 512Kb random access memory (RAM) on system board, RAM expandable to 3Mb with 512Kb Memory Expansion options, eight I/O slots, keyboard, one 1.2Mb high-capacity diskette drive, a 20Mb or 30Mb fixed disk drive, and a keylock for security.

System Differences

This section shows the differences between the IBM Personal Computer AT and the rest of the IBM Personal Computer family.

5170 Base Models

There are five base models of the Personal Computer AT; the different models can be identified by serial number ranges.

Model	Serial Number Range
068	5000000 - 5999999
099	0000001 - 0999999
239	6000000 - 6999999
319/339	7000000 - 7999999

Unit Specifications

System Unit	
Size	
Height	162 mm (6.8 in)
Length	540 mm (21.3 in)
Depth	439 mm (17.3 in)
Weight	19.05 kg (42 lb)
Power Cable	
Length	1.8 m (6 ft)
Size	18 AWG
Environment	
Air Temperature	
System On	15.6° to 32.2°C
	(60° to 90°F)
System Off	10° to 43°C
	(50° to 110°F)
Humidity	
System On	8% to 80%
System Off	20% to 80%
Altitude	2133.6 m
	7000 ft max.
Heat Output	1100 BTU/hr
Noise Level	42 dBa
	Meets Class 3
Electrical	
VA - 450	
Range 1	
Nominal	120V AC
Minimum	104V AC
Maximum	127V AC
kva	.635 max.
Range 2	
Nominal	230V AC
Minimum	200V AC
Maximum	240V AC
kva	0.575 max.

Figure 9-2. 5170 Specifications
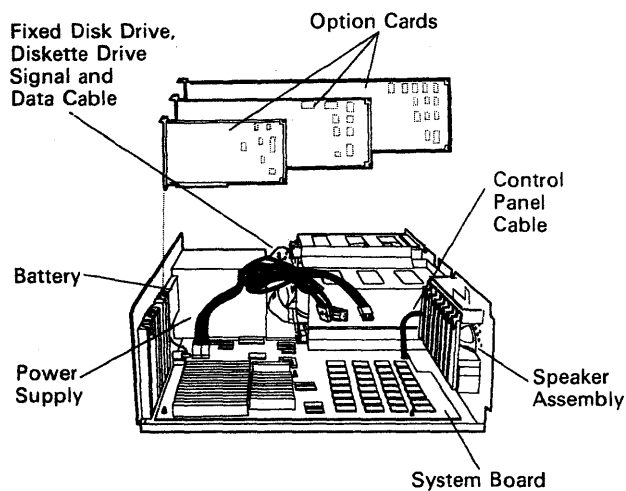
Figure   9-3. 5170 System Unit (Rear View, Cover
          Removed)

LEX40086

Figure   9-4. 5170 System Unit RAM Modules

LEX40087

System Board

The IBM Personal Computer AT system board uses an
Intel 80286 Microprocessor that is generally compat-
ible with the Intel 8088 Microprocessor used in the
rest of the IBM Personal Computers.

The system board expansion slots in the IBM Personal
Computer AT have a 36-pin connector in addition to
the 62-pin connector. Adapters designed to make use
of the 36-pin connector are not compatible with the
rest of the IBM Personal Computers.

Figure   9-5. 5170 System Unit (Front View, Cover
          Removed)

LEX40088

Keyboard

The IBM Personal Computer AT utilizes two styles of
keyboards. The 84-key unit is used on the Models 068,
099, 239, and 319. The 101-key enhanced unit is used
on the Model 339 only. However, it may be used on
the Model 319, but it is not supported on the other
models.

20Mb Fixed Disk Drive

The fixed disk drive used in the IBM Personal Com-
puter AT can store up to 20Mb of data. Reading from
and writing to this drive is initiated in the same way
as with the Personal Computer XT; however, the IBM
Personal Computer AT Fixed Disk and Diskette Drive
Adapter may be addressed from different BIOS
locations.

30Mb Fixed Disk Drive

The 30Mb disk drive is a standard feature on Models
239, 319, and 339 and is available as an option on other
models. The 30Mb fixed disk drive can be purchased
as a 30Mb upgrade kit and installed in Models 068 and
099. The 30Mb upgrade kit includes the 30Mb fixed
disk drive and two BIOS modules to be installed on the
system board.

9-2

High-Capacity Diskette Drive

This diskette drive is capable of reading and writing diskettes in 160Kb/180Kb, 320Kb/360Kb, and 1.2Mb modes. However, if a diskette formatted in either the 160Kb/180Kb or 320Kb/360Kb mode is written on by this diskette drive, that information can only be read by a high-capacity diskette drive.

Note: Diskettes designed for use in this drive cannot be used in either a 160Kb/180Kb or a 320Kb/360Kb diskette drive in the 1.2Mb mode.

Hardware Considerations

The following are hardware features of the IBM Personal Computer AT that are not supported by the rest of the IBM Personal Computer Family.

Adapters

The IBM Personal Computer AT 128Kb Memory Expansion Option, the IBM Personal Computer AT 512Kb Memory Expansion Option, the IBM Personal Computer AT Prototype Adapter, and the IBM Personal Computer AT Fixed Disk and Diskette Drive Adapter use the additional 36-pin system board expansion slot and are not compatible with the rest of the IBM Personal Computer Family.

The IBM Personal Computer AT does not support:

- Expansion unit
- IBM Asynchronous Communications Adapter
- IBM 64Kb/256Kb Memory Expansion Adapter
- IBM Printer Adapter
- Other keyboards.

Incompatible Adapters

Certain option adapters conflict with each other when used in the same system. The following adapters should not be installed together in your system unit:

- Synchronous Data Link Control (SDLC)
- Alternate Binary Synchronous Communications (Alt. BSC).

System Board
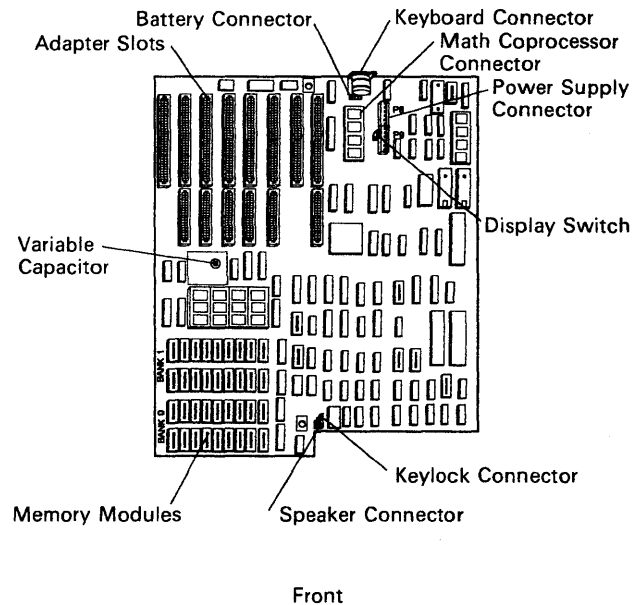
Front

LEX40089

Figure 9-6. 5170 System Board (Full Size, Front View)

Full-Size Dimensions: 13.5 × 12.
Down-Size Dimensions: 13.5 × 9.5 (not shown).

The system board has the following components:

- Intel 80286 Microprocessor
- System support function:
  - 7-channel direct memory access (DMA)
  - 16-level interrupt
  - System clock
  - Three programmable timers.
- 64Kb ROM subsystem, expandable to 128Kb
- Either a 256Kb or a 512Kb RAM subsystem
- Speaker attachment
- Complementary metal oxide semiconductor (CMOS) memory RAM to maintain system configuration
- Real-time clock
- Battery backup for CMOS configuration table and real-time clock
- Keyboard attachment
- Eight input/output (I/O) slots:
  - 6 with a 36- and a 62-pin card-edge socket
  - 2 with only the 62-pin card-edge socket.

Memory

The full-size system board has four banks of memory sockets, each supporting nine 128Kb × 1 modules for a total maximum memory size of 512Kb with parity checking.

The down-size system has two rows of nine 256Kb × 1 memory modules for a total of 512Kb of memory with parity checking.

Microprocessor

The Intel 80286 Microprocessor has a 24-bit address bus, a 16-bit data bus and extensive instruction set, DMA and interrupt support capabilities, a hardware fixed-point multiply and divide, integrated memory management, four-level memory protection, 1 gigabyte (1,073,741,824 bytes) of virtual address space for each task, and two operating modes: the 8086-compatible real-address mode and the protected virtual-address mode.

Interface

The keyboard uses a bidirectional serial interface to carry signals between the keyboard and system unit.

Sequencing Key Code Scanning

The keyboard is able to detect all keys that are pressed, and their scan codes will be sent to the interface in correct sequence, regardless of the number of keys held down. Keystrokes entered while the interface is inhibited (when the keylock is on) will be lost. Keystrokes are stored only when the keyboard is not serviced by the system.

Buffer

The keyboard has a 16-character first-in/first-out (FIFO) buffer where data is stored until the interface is ready to receive it.

A buffer-overrun condition will occur if more than 16 codes are placed in the buffer before the first keyed data is sent. The 17th code will be replaced with the overrun code, hex 00. (The 17th position is reserved for overrun codes). If more keys are pressed before the system allows a keyboard output, the data will be lost. When the keyboard is allowed to send data, the characters in the buffer will be sent as in normal operation, and new data entered will be detected and sent.

Keys

All keys are classified as make/break, which means when a key is pressed, the keyboard sends a make code for that key to the keyboard controller. When the key is released, its break code is sent (the break code for a key is its make code preceded by hex F0).

All keys are typematic. When a key is pressed and held down, the keyboard continues to send the make code for the key until the key is released. The rate at which the make code is sent is known as the typematic rate (typematic rate is described under Set Typematic Rate/Delay). When two or more keys are held down, only the last key pressed repeats at the typematic rate. Typematic operation stops when the last key pressed is released, even if other keys are still held down. When a key is pressed and held down while the interface is inhibited, only the first make code is stored in the buffer. This prevents buffer overflow as a result of typematic action.

Power Supply

The system's power supply is contained inside the system unit and provides power for the system board, adapters, diskette drives, fixed disk drives, keyboard, and the IBM Monochrome Display.

Inputs

The power supply can operate at a frequency of either 60 ± 3 Hz or 50 ± 3 Hz, and it can operate at 110V AC, 5 A or 220/240V AC, 3.0 A. The voltage is selected with the switch above the power-cord plug at the rear of the power supply. The following figure shows the input requirements:

Range	Nominal Voltage (V AC)	Current (Amps)
115V AC	Minimum 100 Maximum 125	Maximum 5.0
230V AC	Minimum 200 Maximum 240	Maximum 3.0

Figure 9-7. 5170 Input Protection

Note: The maximum in-rush current is 100 A.

Outputs

The power supply provides +5, -5, +12, and -12V DC. The following figure shows the load current and regulation tolerance for the voltages.

Nominal Output	Load Current (A) Minimum	Maximum	Regulation Tolerance
+5V DC	7.0	19.8	+5% to -4%
-5V DC	0.0	0.3	+10% to -8%
+12V DC	2.5	7.3	+5% to -4%
-12V DC	0.0	0.3	+10% to -9%

Figure 9-8. 5170 DC Load Requirements

Note: The power supply also supplies either 115V AC or 230V AC for the IBM Monochrome Display.

Output Protection

If any output becomes overloaded, the power supply will switch off within 20 milliseconds. An overcurrent condition will not damage the power supply.

Dummy Load

If no fixed disk drive is connected to the power supply, a dummy load may be connected to P10. The dummy load is 5 ohms, 50-watt resistor.

Output Voltage Sequencing

Under normal conditions, the output voltage levels track within 300 milliseconds of each other when power is applied to, or removed from, the power supply, provided at least minimum loading is present.

No-Load Operation

No damage or hazardous conditions occur when primary power is applied with no load on any output level. In such cases, the power supply may switch off, and a power-on cycle will be required. The power supply requires a minimum load for proper operation.

Power-Good Signal

The power supply provides a power-good signal to indicate proper operation of the power supply.

When the supply is switched off for a minimum of 1 second and then switched on, the power-good signal is generated, assuming there are no problems. This signal is a logical AND of the DC output-voltage sense signal and the AC input-voltage sense signal. The power-good signal is also a TTL-compatible high level for normal operation or a low level for fault conditions. The AC fail signal causes power-good to go to a low level at least 1 millisecond before any output

voltage falls below the regulation limits. The operating point used as a reference for measuring the 1 millisecond is normal operation at minimum line voltage and maximum load.

The DC output-voltage sense signal holds the power-good signal at a low level when power is switched on until all output voltages have reached their minimum sense levels. The power-good signal has a turn-on delay of at least 100 milliseconds but not longer than 500 milliseconds. The following figure shows the minimum sense levels for the output voltages.

Level (V DC)	Minimum (V DC)
+5	+4.5
-5	-4.3
+12	+10.8
-12	-10.2

Figure 9-9. 5170 Sense Levels

Fan-Out

Fan-out is the number of inputs that one output can drive. The power-good signal can drive six standard TTL loads.

General Information

Speaker

The system unit has a 2.25-inch permanent-magnet speaker, which can be driven from:

- The I/O-port output bit
- The timer/counter's clock-out
- Both.

Jumper

The system board has a 3-pin, Berg-strip connector. The placement of a jumper across the pins of the connector determines whether the system board's second 256Kb of RAM is enabled or disabled.

The following shows how the jumper affects RAM.

Jumper Positions	Function
1 and 2	Enable second 256Kb of system board RAM
2 and 3	Disable second 256Kb of system board RAM

Figure 9-10. 5170 RAM Jumper

Note: See Figure 9-14 on page 9-7. The normal mode is the enable mode. The disable mode permits the second 256Kb of RAM to reside on adapters plugged into the I/O bus.

System Unit Keylock
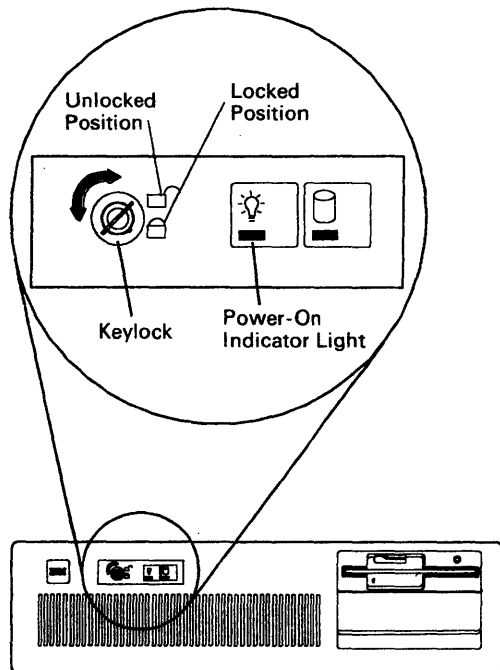
LEX40091

Figure 9-11. 5170 System Unit Keylock

The keylock deactivates the keyboard and locks the cover on for security. You can lock the system whether the power is on or off. Turn the key clockwise to lock the system or counterclockwise to unlock it. The key may be removed in either position.

When the system unit's power is on, the green power-on indicator light is on.

Duplicate keys for system unit keylock devices are the responsibility of the customer. Key reorder information is located in the *5170 Guide to Operations* manual.

Customers can obtain information for ordering IBM Personal Computer AT replacement keys and their cost by writing to the address listed below. The lock manufacturer is identified by information on the tag included with the keys. Include the lock number (1501419) and the tag number with your correspondence.
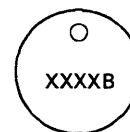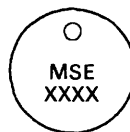
LEX40092

Chicago Lock Co.	Fort Lock Co.
4311 W. Belmont Ave.	3000 North River Road
Chicago, IL 60641	River Grove, IL 60171

Figure 9-12. Replacement Key Addresses

General Diagnostic Tips

Power-On Self Test

Each time you set the system unit's power switch to on, the power-on self test (POST) executes. The POST takes 13 to 90 seconds to complete, depending on the options installed.

The POST checks the following:

- System board
- Memory Expansion Adapters
- Keyboard
- Primary display
- Diskette Drive and Adapter
- Fixed Disk Drive and Adapter (if available).

To start the POST:

1. Turn on all external devices, including printer, display, and plotter.
2. Set the system unit power switch to on.
3. Turn the brightness and contrast knobs fully clockwise. (If you have a color monitor, ensure that it is set to on.)
4. Watch (and listen) for the following responses:
   a. A cursor appears on the display in approximately 4 seconds.
   b. The keyboard status lights blink on, then off.
   c. While the memory is being tested, the memory size appears in the top left corner of the screen and increases in 64Kb increments until the total system memory is tested.
   d. The keyboard status lights again blink on, then off.
   e. One short beep is heard when the POST is successfully completed.
   f. The IBM Personal Computer basic screen appears if a diskette or an operating system is not automatically loaded from a fixed disk drive.

9-6

5170 System Setup

The setup program is on the advanced diagnostics diskette. You need to know what options are installed in your system unit to run the setup program.

To set up the system:

1. Remove the system unit's cover.
2. Make a list of the option adapters installed in your system.
3. Look at the labels on the front of the fixed disk drives and make a note of the type of drives installed.
4. Look at the front bezel of the diskette drive and make a note of the type of drive installed. (The bezel of a double-sided diskette drive has an asterisk; the bezel of a high-capacity drive is not marked.)
5. Ensure that the jumpers in your system are installed correctly.
6. Ensure that all switches are set correctly.

   Note: If you receive an error code, troubleshoot any error identifications other than 16X first. If the only error code you receive is 16X, and you cannot correct the setup program, check battery voltage.

7. Insert the advanced diagnostics diskette into drive A.
8. Set the system unit's power switch to on.

   The setup program will prompt you for the following information:

Time	Allows you to set or change the time.
Date	Allows you to set or change the date.
Diskette Drives	Select the number and type (high-capacity or double-sided) installed.
Fixed Disk Drives	Select a number and type (20Mb or 30Mb) of fixed disk installed.
Memory Amount	Select the amount of base and expansion memory installed.
Display	Set the primary display if two display adapters are installed.

   Note: If Menu 2 - Select an Option appears after the POST, select option 4 (SETUP) and verify that the options are correctly set.

Jumper

The system board has a 3-pin, Berg-strip connector. The placement of a jumper across the pins of the connector determines whether the system board's second 256Kb of RAM is enabled or disabled.

Jumper Positions	Function
1 and 2	Enable second 256Kb of system board RAM
2 and 3	Disable second 256Kb of system board RAM

Figure 9-13. 5170 Jumper Positions for Full-Size System Board Only

The RAM jumper in the disable position (256Kb RAM) allows the user to utilize additional RAM provided on option cards without fully populating the system board.

Note: All 20Mb drives manufactured by IBM or for IBM are Type 2 and 30Mb drives are Type 20. Also, to enter the correct type (20) for a 30Mb drive requires diagnostics at Level 2.0 or higher and the correct level of BIOS.
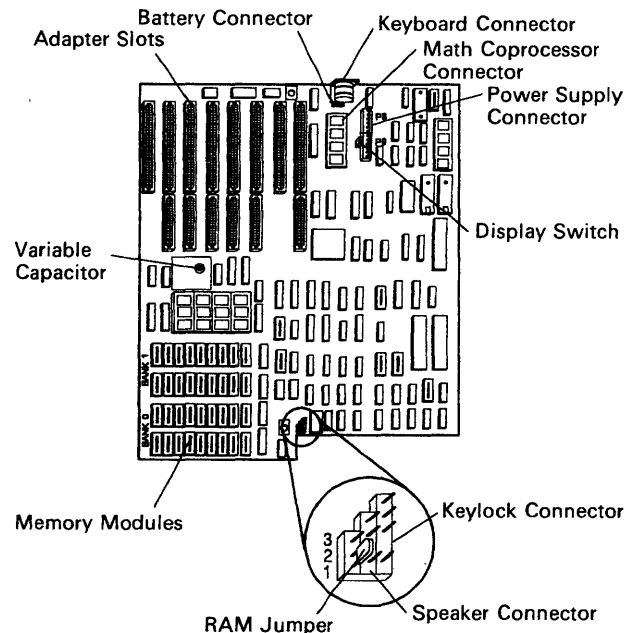
LEX40164

Figure 9-14. 5170 System Board (Full Size, Top View)

Full-Size Dimensions: 13.5 × 12.
Down-Size Dimensions: 13.5 × 9.5 (not shown).

Input Voltage Requirements

The 115/230V AC selector switch at the rear of the system unit's power supply must be set for the voltage present at the outlet.

Switch Position	Voltage Range
115V AC	100 to 125V AC
230V AC	200 to 240V AC

Figure 9-15. Input Voltage Switch Page
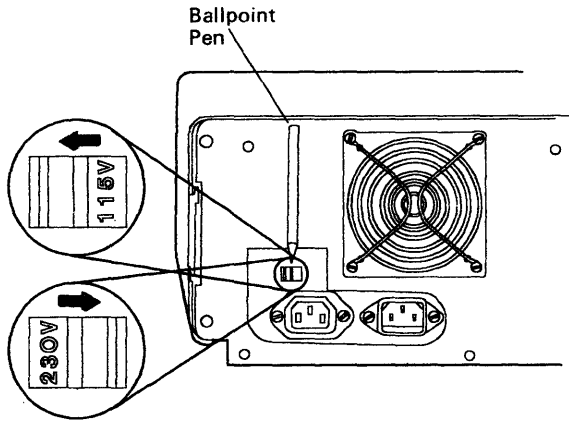
Figure 9-16. Input Voltage Switch Location

Removal of Locked Cover

To remove the top cover when the lock is in the locked position, the 5170 must remain on a flat surface. (The five cover screws in the rear of the system unit must be removed before performing this procedure.) Locate the system unit to gain access to approximately 3 inches of the bottom of the unit at the front side. There is a small gap between the frame and the top cover underneath the system unit. While standing in front of the system unit, insert a screwdriver in this gap from the bottom going up approximately 2 to 3 inches in line with the lock. Pull the screwdriver toward you and in an upward motion. This will raise the cover lip over the lock latch, and the top cover can now be removed. To run diagnostics under this condition, remove one wire from the lock switch. This will enable the keyboard.

Power Diagnostic Tips

Power Supply Failures

Some 5170 power supplies might fail after being powered on for 2 or more hours, then properly work after power off and the machine cools down. If this problem is experienced, the power supply must be replaced.

System Board Voltage

To check the system board voltage:

1. Set the system unit's power switch to off.
2. Remove the system unit's cover.
3. Set your meter to the 12V DC scale. Connect the common lead to pin 5 and the voltage lead to pin 1 on the system board's power connector P8.
4. Set the system unit's power switch to on.
5. Check for a voltage of 2.4V to 5.2V DC.

Check the rest of the power supply voltages at the system board:

1. Set your meter to the 12V DC scale.
2. Refer to Figure 9-17 and check the system board's power connectors for the correct voltages.

Voltage Connectors			
Min V DC	Max V DC	-Lead	+Lead
+4.8	+5.25	P8-5	P9-4
+4.6	+5.5	P9-3	P8-6
+11.5	+12.6	P9-1	P8-3
+10.9	+13.2	P8-4	P9-2

Figure 9-17. Correct Voltage at Connectors
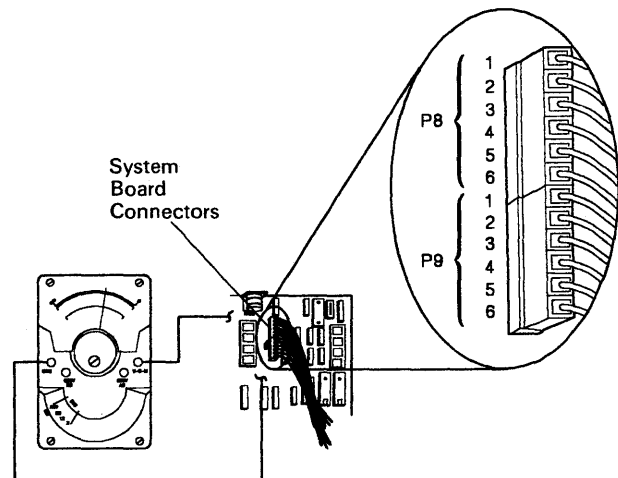
Figure 9-18. System Power Supply

Battery Voltage

To check battery voltage:

1. Set the system unit's power switch to off.
2. Remove the system unit's cover.
3. Disconnect battery from system board.
4. Set your meter to the 12V DC scale. Connect the common lead to pin 1 and the voltage lead to pin 4 on the battery connector. Check for a voltage of 6.0V DC minimum.

Note: A 161 Battery Defective or New Battery Installed message appears during the first POST after a battery installation or replacement. If you just installed a new battery, run the setup program.

When checking the battery voltage, you must disconnect the battery from the system board. The drain from the system board will cause various readings if you attempt to check the voltage with it plugged into the system board.
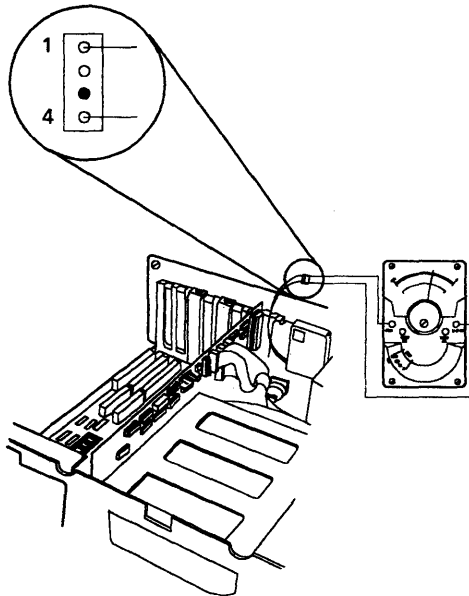
LEX40182

Figure   9-19. Battery Voltage Check

System/Memory Diagnostic Tips

Blank Display/No Beep During Power-On Reset (POR)

Some 5170 planar boards were manufactured in error with the math coprocessor socket installed with the notch to the rear of the board. The installation instructions state to align the coprocessor notch to the socket notch. If the coprocessor is installed with the notch to the rear, the system will fail during power-on diagnostics, the display will be blank, and there will be no beep. Installing the coprocessor with the notch to the front of the planar will correct this problem.

Interrupt Levels

Interrupt levels are used by PCs to prioritize operations and are also known as groups or interrupt requests (IRQs). Diagnostics will not necessarily fail on a PC with interrupt conflicts, yet the operator will keep getting errors. Although the customer is responsible for solving interrupt conflicts, an IBM customer engineer can use this information to reduce diagnostic time, no trouble founds (NTFs), unnecessary parts replacements, and callbacks.

To determine if an unusual PC problem is caused by conflicting interrupt levels, follow these steps:

1. Load the advanced diagnostics diskette, go to the list of installed devices, and copy that list.
2. Examine the adapter cards installed in the system unit and expansion unit. If any cards are located that are not on the list from Step 1, add them to the list.
3. Sort the list into the following interrupt levels:

   Note: Some adapter cards have a jumper for interrupt selection. For those cards and for cards not listed here (including non-IBM cards), see the card's setup guide or technical specifications. Due to rapid product announcements, this list cannot describe all the available IBM PC option cards.

   a. Keyboard
   b. Enhanced Graphics Adapter
      3278/79 Emulation Adapter
      Primary PC Network Adapter
   c. ALT ASYNC Communications Adapter (COM2)
      ALT BISYNC Communications Adapter (COM2)
      ALT Serial/Parallel Adapter—Serial Port
      ALT PC Network Adapter
      SDLC Communications Adapter
      PC Cluster Adapter (selected by a jumper)

Display Station Emulation Adapter (selected by jumper)
d. ASYNC Communications Adapter (COM1)
BISYNC Communications Adapter (COM1)
Serial/Parallel Adapter—Serial Port
SDLC Communications Adapter
e. Fixed Disk Adapter (except in Personal Computer AT)
ALT Serial/Parallel Adapter—Parallel Port
Display Station Emulation Adapter (selected by a jumper)
f. Diskette Drive Adapter
g. Printer Adapter Monochrome and Printer Adapter PC
Cluster Adapter (selected by a jumper)
Serial/Parallel Adapter—Parallel Port
GPIB Adapter(s)
Data Acquisition Adapter(s).

4. If you find two cards with the same interrupt, remove one of them and see if the failure symptom disappears.

These steps are similar to the intermittent problem steps in the *Hardware Maintenance and Service* (HMS) manual. The most important point of this tip is that when a failure symptom is isolated to one adapter card, that card is not necessarily defective, but might be incompatible with the other cards in the PC. Incompatibility can also be caused by factors other than interrupt (such as memory address and DMA). Also, conflicting interrupts will not always cause failures.

New 5170 System Boards

The memory module sockets located on system boards P/N8286112, P/N6480170, and P/N6480072 have been redesigned. The contacting surface for the memory modules is located below the top of the pin holes and is not visible from the top of the socket. The new style socket provides a good contact surface for the memory module and is functionally equivalent to the old style.

Note: When replacing a system board, remember to reinstall the math coprocessor (if present) in the new system board.

Memory Error Isolation

This hint is to help diagnose memory and/or parity check errors if memory bank and bit position is not found during either the power-on self test (POST) or memory diagnostics.

Read each step of the following instructions before beginning:

1. Set the system unit's power switch to off.
2. Remove all installed Memory Expansion Adapters.
3. Set the system unit's power switch to on.

4. Run the setup program.
(Ensure that the memory size is correctly set.)
5. Repeat the diagnostic test that failed.

Note: If the diagnostic test passes on bare system memory configuration, you might have a memory failure on one of your Memory Expansion Adapters.

6. Set the system unit's power switch to off.
7. Install one Memory Expansion Adapter at a time to test.

Note: If you have a 128Kb Memory Expansion Adapter, install it first.

8. Set the system unit's power switch to on.
9. Run the setup program.
(Ensure that the memory size is correctly set.)
10. Repeat the diagnostic test that failed.

When a memory error is present and location cannot be isolated, it is best to break down the system's memory in sections to locate the most probable point of origin.

Parity Checks

Parity check 1 indicates a system board parity error. Parity check 2 indicates a Memory Expansion Adapter parity error.

If the memory test ended without returning a 10-character error message, the message might be a parity check message, as in Figure 9-20.

PARITY CHECK X
XXXXX
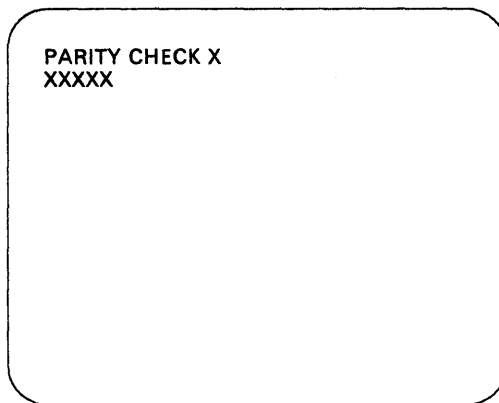
LEX40167

Figure 9-20. Parity Check Message

After a parity check error, the memory is scanned to see if a failing address can be identified. If identified, the address is displayed as a 5-character alphanumeric code under the parity check message. If the failing address cannot be identified, five question marks are displayed under the parity check message.

The first character of a parity check error code identifies the failing bank. For example, error code 40000 indicates that bank 1 of the system board is failing.

First Character of Parity Error	Failing Memory Bank
0, 1, 2, or 3	System board bank 0
4, 5, 6, or 7	System board bank 1

Figure 9-21. Parity Check Code

If the first character of the parity check error code is 0, 1, 2, 3, 4, 5, 6, or 7, replace the 18 memory modules in the failing bank. If the same parity check error code occurs, replace the system board.

If the first character of the parity check error is 8 or 9, replace the 18 memory modules of the base Memory Expansion Adapter. If the same error code occurs, replace the adapter.

Parity Check 2 ????? Message on 5170 Models 068-099

The 5170 Models 068 and 099 system units with system board P/N8286112, an Enhanced Graphics Adapter, and the 0.5Mb to 2Mb Memory Expansion Adapter installed will experience a Parity Check 2 ????? message if a soft boot (Ctrl, Alt, Del) function is performed.

If you have a system with the above configuration and error message, install ECA024.

Memory Errors Bit/Bank Locations

First Two Characters of Error Code				Problem Area
00,	01,	02,	or 03	
04,	05,	06,	07	System Board
08	or	09		128Kb Memory Expansion Adapter
10,	11,	12,	13,	512Kb Memory Expansion Adapter 1
14,	15,	16,	17	
18,	19,	1A,	1B,	512Kb Memory Expansion Adapter 2
1C,	1D,	1E,	1F	

Figure 9-22 (Part 1 of 2). Memory Problem Area Location

First Two Characters of Error Code				Problem Area
20,	21,	22,	23,	512Kb Memory Expansion Adapter 3
24,	25,	26,	27	
28,	29,	2A,	2B,	512Kb Memory Expansion Adapter 4
2C,	2D,	2E,	2F	
30,	31,	32,	33,	512Kb Memory Expansion Adapter 4
34,	35,	36,	37	

Figure 9-22 (Part 2 of 2). Memory Problem Area Location

System Board Errors

A 10-character error code that begins with 00, 01, 02, 03, 04, 05, 06, or 07, indicates a system board memory failure.

The first 2 characters of your error code indicate which bank has the failing memory module. The last 4 characters indicate the failing module of the bank. For example, error code 04002 8000 corresponds to the failing module indicated by the arrow in the Figure 9-23.

Refer to Figure 9-23 and find the failing module for your error code.
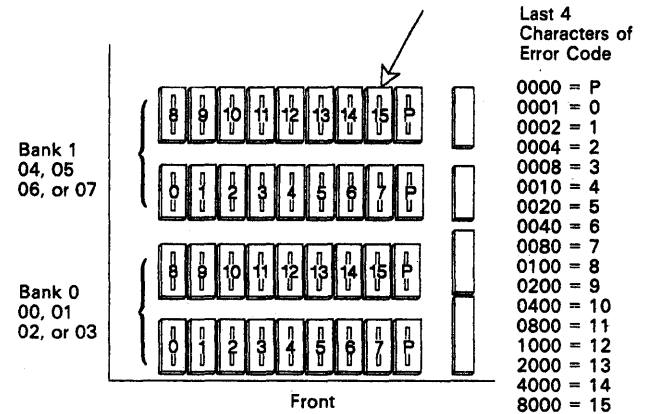
LEX40168

Figure 9-23. System Board (Top View)

Note: Replace both parity (P) modules in the failing bank if the last 4 characters of your error code are 0000.

128Kb Memory Expansion Errors

A 10-character error code that begins with 08 or 09 indicates a 128Kb Memory Expansion Adapter failure. The last 4 characters of your error code indicate the failing module of the bank. For example, error code 080002 0004 corresponds to the failing module indicated by the arrow in the Figure 9-24.

Find the 128Kb Memory Expansion Adapter (it is the only Memory Expansion Adapter with no switches).

Refer to Figure 9-24 and find the failing module for your error code.

Last 4 Characters of Error Code

```
0000 = P
0001 = 0
0002 = 1
0004 = 2
0008 = 3
0010 = 4
0020 = 5
0040 = 6
0080 = 7
0100 = 8
0200 = 9
0400 = 10
0800 = 11
1000 = 12
2000 = 13
4000 = 14
8000 = 15
```
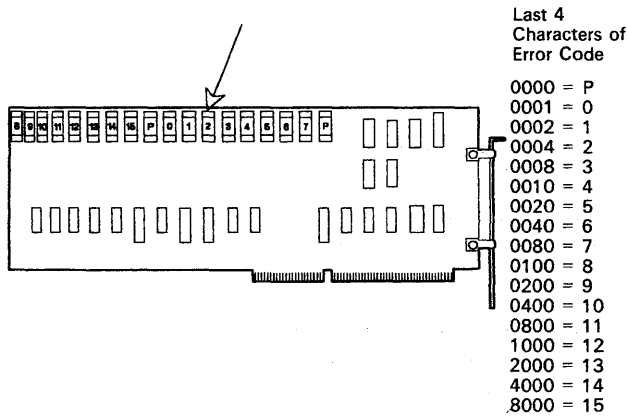
LEX43139

Figure 9-24. Failing Module Location

Note: Replace both parity (P) modules if the last 4 characters of your error code are 0000.

512Kb Memory Expansion Errors

Refer to Figure 9-25 and find the first 2 characters of your error code (make a note of the failing bank, 0 or 1).

Compare the switch settings shown for those characters with those of all 512Kb Memory Expansion Adapters in your system. The failing adapter is the one with switch settings that match those in Figure 9-25.

First 2 Characters Of Error Code	Bank	Memory Expansion Adapter Switch Settings							
		1	2	3	4	5	6	7	8
10, 11, 12, 13	0	On	On	On	Off	On	On	On	On
14, 15, 16, 17	1	On	On	On	Off	On	Off	On	Off
18, 19, 1A, 1B	0	On	On	On	Off	Off	On	On	On
1C, 1D, 1E, 1F	1	On	On	On	Off	Off	Off	On	Off
20, 21, 22, 23	0	On	On	Off	On	On	On	On	On
24, 25, 26, 27	1	On	On	Off	On	On	Off	On	Off
28, 29, 2A, 2B	0	On	On	Off	On	Off	On	On	On
2C, 2D, 2E, 2F	1	On	On	Off	On	Off	Off	On	Off
30, 31, 32, 33	0	On	On	Off	Off	On	On	On	On
34, 25, 36, 37	1	On	On	Off	Off	On	Off	On	Off

Figure 9-25. Failing Adapter Location

The first 2 characters of your error code indicate which bank has the failing memory module. The last 4 characters indicate the failing memory module of the bank. For example, error code 100002 0080 corresponds to the failing module indicated by the arrow in Figure 9-26. Refer to Figure 9-26 and find the failing module for your error code.

Last 4 Characters of Error Code

Bank 0
Bank 1

```
0000 = P
0001 = 0
0002 = 1
0004 = 2
0008 = 3
0010 = 4
0020 = 5
0040 = 6
0080 = 7
0100 = 8
0200 = 9
0400 = 10
0800 = 11
1000 = 12
2000 = 13
4000 = 14
8000 = 15
```
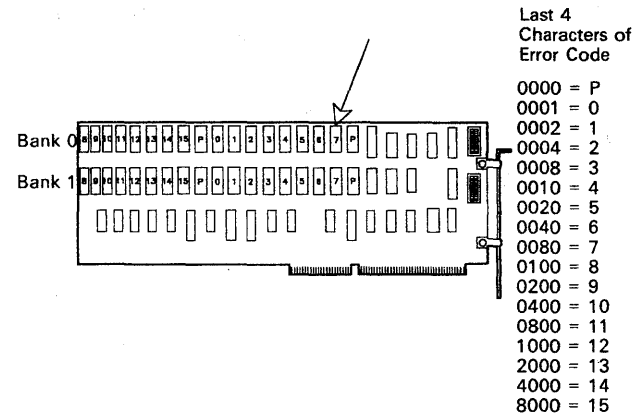
LEX40170

Figure 9-26. Failing Module Location

Note: Replace both parity (P) modules if the last 4 characters of your error code are 0000.

Parity 1 Check

Some planar boards, P/N8286112 with the RAM jumper, J18, were installed on the wrong pins. For a 256Kb planar, this jumper should be on pins 2 and 3, and for a 512Kb planar on pins 1 and 2. If the jumper is installed wrong and an Enhanced Graphics Adapter (EGA) is installed, the system will get parity 1 checks on a soft boot operation (Ctrl, Alt, Del). The system might not fail diagnostics with the standard configuration. There might be adapters other than the EGA that will produce this failure.

System Clock

If the 5170 is operating under DOS and the time and date are changed, the system clock is not updated. You must go to the time and date function to update the system clock. If the system clock is not operating correctly, the system board must be changed.

Keylock Switch Continuity

To check keylock switch continuity:

1. Set the system unit's power switch to off.
2. Remove the system unit's cover.
3. Disconnect the control panel cable from the system board.
4. Set your meter to the ohms × 1 scale.
5. Check the control panel's switch, as shown in Figure 9-27.
   - Keylock locked = continuity (0 ohms)
   - Keylock unlocked = no continuity (infinity).
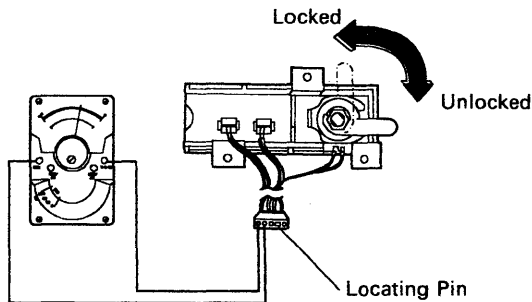
LEX40183

Figure 9-27. Keylock Switch Continuity Check

Speaker Continuity

To check speaker continuity:

1. Set the system unit's power switch to off.
2. Set your meter to the ohms × 1 scale.
3. Disconnect the speaker cable from the system board.
4. Refer to Figure 9-28 and check the continuity of the speaker.
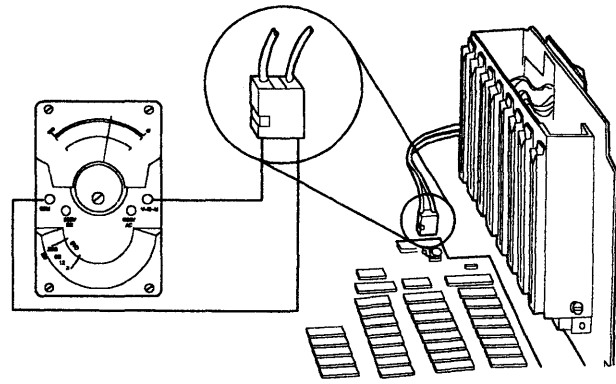
LEX40184

Figure 9-28. Speaker Continuity Check

Keyboard Failures

If a keyboard failure occurs at setup time, remove the keyboard covers and check to see whether the cable is plugged into the connector. The apparent cause for the cable coming loose is that the black insulation extends too far inside the keyboard. To relieve the pressure on the connection, you can trim the insulation to within 0.5 inch of the opening where it comes through the keyboard or split the insulation the same distance. This problem will be fixed on future keyboards.

Keyboard Cable Continuity

To check keyboard cable continuity:

1. Set the system unit's power switch to off.
2. Disconnect the keyboard cable from the keyboard.
3. Refer to Figure 9-29 on page 9-14 and check the keyboard cable for continuity.

Note: Check the continuity of wires 1, 2, 4, and 5 (wire 3 is not used).
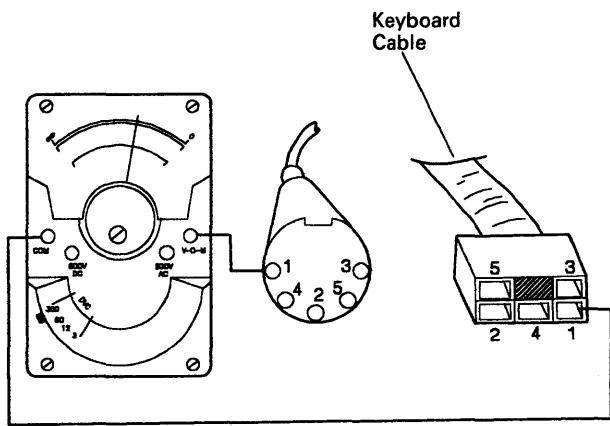
Figure   9-29. Keyboard Cable Continuity Check

Diskette Drive/Fixed Disk Drive Diagnostic Tips

Diskette Drive Motor Speed Adjustment

To adjust the diskette drive motor speed:

1. Insert the advanced diagnostics diskette into drive A.
2. Set the system unit's power switch to on.
3. Advance to Diagnostic Menu 9.
4. In Menu 9, select option 4 (Speed Test), for the diskette drive you are testing. The drive-motor speed and the adjustment specification appear on the screen.
5. The indicated speed should be 1640 to 1695. If it is not, continue to Step 6.
6. The adjustment for the drive-motor speed is a variable resistor on the diskette drive circuit board (on the underside of the diskette drive). To adjust the speed, carefully insert an insulated screwdriver into the resistor's slot. Turn the screw until the speed shown on the screen is within the required specifications.
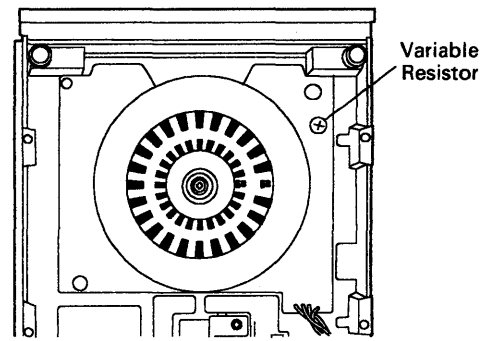
Figure   9-30. Diskette Drive (Bottom View)

Erroneous Diskette Drive Failures

If a diskette drive failure is reported and replacing the drive and/or the adapter card does not resolve the problem, remove the cables from the fixed disk drive and remove the fixed disk from the setup table. Rerun the diagnostics and/or have the customer rerun the job. If no failures occur, replace the fixed disk drive.

Formatting Scratch Diskettes

The 5170 Advanced Diagnostic Diskette includes an option to format a scratch diskette for diagnostic use. When performing this routine the proper diskette media must be used to ensure reliable results. Otherwise, CRC errors might occur during the format routine.

Use the following diskettes for reliable results:

• 1.2Mb drive: use only high-capacity scratch diskettes.
• 360Kb drive: use only dual-density scratch diskettes.

Note: The 5170 Diagnostic Diskette is a dual-density diskette. Dual-density diskettes (P/N6023450) and high-density diskettes (P/N6109660) can be ordered through administrative personnel as a supply item, not as a repair part or tool. Customers experiencing diskette format errors under DOS should verify that they are correctly using the DOS format parameters for the drive-type and media-type being used. Refer to the DOS manual for media interchangeability rules under DOS.

Diskette/Disk File Limitations

Floppy diskettes are limited to 64, 112, or 224 files in their root directory, depending on the type of diskette and the type of format used. Fixed disks can have up to 512 files in the root directory, depending on the size of the DOS partition.

If the allowed number is exceeded in either case, disk full errors will result. The problem can be resolved by placing the excess files in subdirectories. See the DOS technical reference for additional information.

Disk/Diskette Adapter Replacement

The Disk/Diskette Adapter, P/N8286125, has a resistor pack on the card guide edge of the adapter. This resistor pack is located approximately 1.5 inches from the top of the adapter and is labeled Z2.

Caution should be used when replacing this adapter because the resistor could hit the card guide and crack or break the resistor. If this happens, a damaged resistor could cause solid or intermittent 17XX errors, fixed disk type failures. When replacing the dual card, P/N8286125, the redesigned guide that has been provided should be used. This guide is beveled to prevent component damage.

Diskette Drive Signal Cable Continuity

To check continuity of the diskette drive signal cable:

1. Set the system unit's power switch to off.
2. Check the diskette drive's signal cable for continuity. The line numbers at one end of the cable match the line numbers at the other end, except for those in Figure 9-31.

Diskette Drive A Signal Cable Connector		Diskette Drive B Signal Cable Connector	
Pin Numbering		Pin Numbering	
Drive End	Adapter End	Drive End	Adapter End
10	16	10	10
11	15	11	11
12	14	12	12
14	12	14	14
15	11	15	15
16	10	16	16

Figure   9-31. Signal Cable Line Numbers
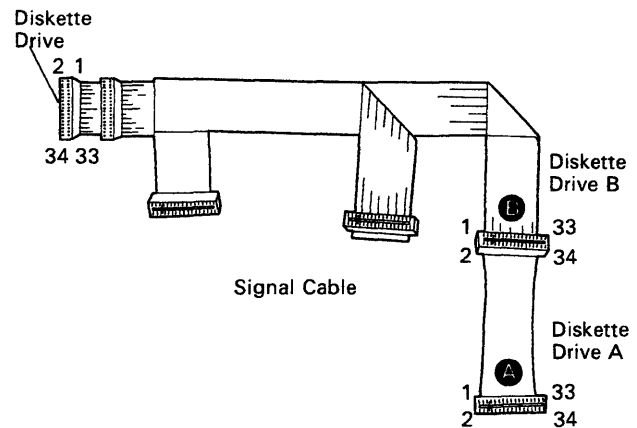
LEX40181

Figure   9-32. Signal Cable Line Numbers

Format D: Drive When C: Was Specified

DOS sometimes formats what a user believed to be the D: drive when the C: drive was specified. This usually happens after one of the fixed disks has been replaced or a diagnostic format has been run on one of the hard files. This only occurs on systems with two fixed disk drives.

When FDISK is not run before Format, DOS will not recognize the first drive as C:, but will think the next drive (D:) is C: and format it. The safest way to avoid the problem is to always run FDISK before formatting. Choose option 4 Display Partition Data, and if there is no partition, use option 1 Create DOS Partition to create one.

When DOS boots up, it first asks the BIOS how many fixed disks are installed on the machine. If any are found, DOS will then go out and read the partition table from each drive to see if any space on that disk is assigned to DOS. If so, it will then assign that drive a drive letter sequentially starting with C: if there are two or fewer diskette drives, or the next available drive letter if there are more than two diskette drives.

Note what happens when the first drive has not been FDISKed and the FORMAT C: command is given. DOS will not find any space allocated for it on the first drive and will go to the next drive and look there for a DOS partition. If one is found there, it assumes it to be the first drive, names it C:, and begins formatting as instructed.

Program for Parking Heads on Fixed Disk

Shutdown.exe on the customer diagnostics diskette in the *Guide to Operations* manual is for parking the heads on the fixed disk. It is a stand-alone version of the Prepare System for Moving module. Shutdown.exe should be copied to the fixed disk before executing. If executed from the diskette drive, Shutdown.exe will cause the diskette drive to run continuously.

Caution Preparing System for Move

Do not use PC diagnostics (customer or advanced) to prepare the system for moving on a Personal Computer AT 5170. Using the PC diagnostics for this purpose can damage the data on the fixed disk. The failing symptom would be that the system fails to boot from the fixed disk. To recover from this situation, you must reformat the fixed disk because the data on cylinder zero has been altered. If the label on the diagnostic diskette does not say Personal Computer AT, do not use the diskette on any model of the Personal Computer AT.

Personal Computer AT — Diagnostics Error 1712

Error 1712 occurs while running advanced diagnostics against the fixed disk drives. This error can occur on a system that has no legitimate problem if one of the following situations exists:

1. The technician boots DOS 3.1 from the fixed disk and then invokes COMMAND from the diagnostic diskette in drive A.

2. The technician boots a copy of the diagnostic diskette that was made by doing a COPY *.* of the diagnostics to a diskette that previously had DOS 3.1 resident.

Either of these situations will result in an error 1712 while performing test 4, ERROR DETECTION AND CORRECTION test, from the fixed disk diagnostic menu.

The correct method of performing diagnostic tests is to boot the original diagnostic diskette on the machine to be tested.

Fixed Disk Problems

The following service tips and techniques can be useful for diagnosing fixed disk problems on the Personal Computer AT (5170). They are recommended for use during initial setup and at the beginning of a service call.

Before using the service aid, check the following items:

* Setup configuration record
* Placement of drive terminator resistors
* DOS level (must be 3.0 or above)
* Cable continuity
* Power supply voltage switch setting
* Power supply voltages.

General Tips for Fixed Disk Problems

1. Run PREPARE SYSTEM FOR MOVING (Option 3 on the main diagnostic menu) prior to moving the system unit or removing/replacing a fixed disk drive. This will move the read/write heads off the data area of the disk to prevent damage to the media.

2. When formatting the fixed disk drive with the advanced diagnostics, use CONDITIONAL FORMAT. If CONDITIONAL FORMAT will not run, perform an UNCONDITIONAL FORMAT followed by a SURFACE ANALYSIS. If an UNCONDITIONAL FORMAT is performed, the defective cylinder/head information found on the front label of the fixed disk must be entered at the start of the routine.

3. Any new cylinder/head locations flagged as defective during CONDITIONAL FORMAT or SURFACE ANALYSIS should be noted on the label at the front of the fixed disk.

4. It is recommended that DOS FDISK and DOS FORMAT be performed (by the customer or a customer engineer) on a replaced fixed disk prior to returning the system to the customer or prior to leaving the customer location. This will further ensure proper functioning of the replaced drive.

5. To enable booting from the fixed disk, DOS FORMAT loads the three system files at the beginning of the fixed disk DOS partition. This requires five contiguous error-free cylinders at the beginning of the partition. If cylinders 0, 1, 2, 3, or 4 have any defective tracks flagged, the DOS 3.0 format routine will fail with a track 0 error or a Disk Unsuitable For System Disk error. To resolve this situation, the customer can move the beginning of the DOS partition beyond the defective cylinder by redoing DOS FDISK with new values. Otherwise, the disk must be replaced. DOS 3.1 will automatically start loading the system files beyond the defective cylinder. It will be transparent to the customer.

To use the following Symptom/Action table, locate the symptom in the column on the left. Read across the row and perform the steps in the order given until the problem is resolved.

With the exception of System Won't Boot from Fixed Disk, all symptoms and actions are applicable to either fixed disk drive C or D.

	Steps					
Symptom	**1**	**2**	**3**	**4**	**5**	**6**
Post Error 1780 or 90	2	4	7	8		
Post Error 1782	5	6	8			
Cold Start Problem	1	3	2	7	8	
System Won't Boot from Fixed Disk	2	1	3	4	7	8
Read/Write Errors	2	1	3	7	8	
Fixed Disk Write Fault or 1706 Error Code	2	6	8			
Files or Data Lost	2	1	3	7	8	
Intermittent Errors	2	3	1	4	7	8
Track 0 Error during DOS Format	1	3	2	7	8	

Figure   9-33. Symptom/Action Table

Fixed Disk Trouble Shooting

Perform the following steps to determine the cause of fixed disk problems:

1. Initial checkout
   a. Power off the system unit and remove the system unit cover.
   b. Power on the system unit and load the Personal Computer AT Advanced Diagnostics Diskette and select the FIXED DISK DRIVE(S) and ADAPTER test.
   c. Select Option 6, READ VERIFY.
   d. If a 1706 error occurs, see Fixed Disk Write Fault in Figure 9-33.
   e. If any tracks or cylinders between 1 and 10 are flagged defective or shown as UNABLE TO READ, refer to Step 4 on page 9-16 and Step 5 on page 9-16 of "General Tips."
   f. If more than 20 tracks are shown as UNABLE TO READ, go to Step 6 on page 9-18 of "General Tips."
   g. Return to the Symptom/Action Table.
2. Power Supply Connector Check
   a. Power off the system unit and remove the system unit cover.
   b. Power on the system unit, load the advanced diagnostics diskette, and select the FIXED DISK DRIVE(s) and ADAPTER test.
   c. Select Option 5, RUN ALL TESTS.
   d. Lightly tap the power supply connector at the fixed disk drive with an insulated tool or a pencil (see Figure 9-34).

Fixed Disk Drive C

Power Connector

Fixed Disk Drive D
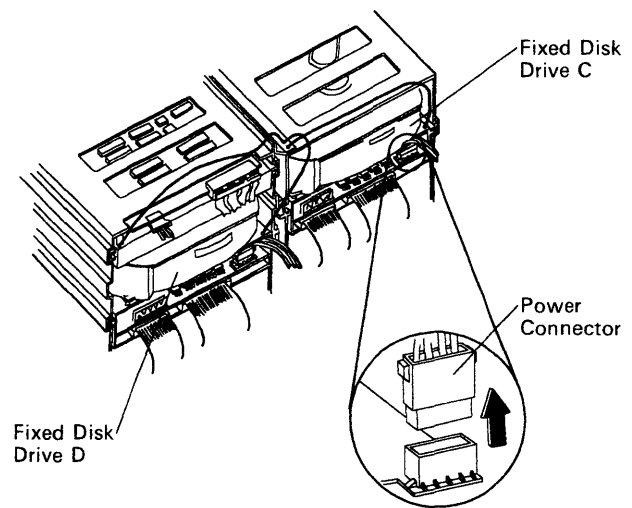
Figure   9-34. Power Connector

   e. If no error occurs return to the Symptom/Action Table.
   f. If an error occurs the power connector might be loose. To correct this problem, gently squeeze the female power connector contacts together to create a tighter connection.
   g. Repeat Step 2; if no error occurs, go to Step 8.
   h. If errors continue, return to the Symptom/Action Table.
3. Fixed Disk Drive Vertical Operation
   a. Run PREPARE SYSTEM FOR MOVING to move the read/write heads off the data area, then power down the system.
   b. Carefully stand the system unit on end (power on/off switch pointing up.) Ensure that the power supply end is up (see Figure 9-35 on page 9-18).

   CAUTION:
   You might need two people to move the system unit. It weighs approximately 50 pounds.
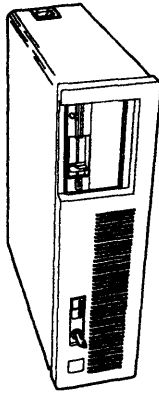
LEX40173

Figure 9-35. Vertical Operation

   c. Power on the system unit and load the advanced diagnostics diskette and select the FIXED DISK DRIVE(S) AND ADAPTER test.

   d. Select option 5, RUN ALL TESTS.

   e. Select option 6, READ VERIFY.

   f. If no error occurs, return to the Symptom/Action Table.

   g. If an error occurs, run PREPARE SYSTEM FOR MOVING and shut off power. Restore the system to the horizontal position and go to 6.

4. Fixed Disk/Diskette Drive Adapter Visual Checks

   a. Visually inspect resistor pack Z2 for cracks or damage (see Figure 9-36).

LEX40174

Figure 9-36. Fixed Disk/Diskette Adapter Visual Checks

   b. Inspect data cable connections for proper seating (see Figure 9-37). Resistor pack 24 might be interfering with the connector.

LEX40175

Figure 9-37. Data Cable Connection

   c. If either visual defect is found, go to Step 5 of this section. Otherwise, return to the Symptom/Action Table.

5. Replace Fixed Disk/Diskette Drive Adapter

   a. Remove the Fixed Disk/Diskette Drive Adapter.

   b. Carefully install the replacement adapter to avoid damage to resistor pack Z2 and ensure proper connector seating.

   c. If the replacement card fails, reseat the card, all cables, and retest the adapter prior to replacing it.

     Note: Damaged or defective adapters might cause read/write errors on the fixed disk. If READ VERIFY still shows any tracks as UNABLE TO READ, a CONDITIONAL FORMAT might be required to remove the bad data.

   d. Go to Step 8 on page 9-19 of this section.

6. Replace Fixed Disk Drive

   a. Load the advanced diagnostics and select option 3, PREPARE SYSTEM FOR MOVING.

   b. Remove the failing fixed disk drive and install the replacement.

   c. Power on the system unit and load the advanced diagnostics and select the FIXED DISK DRIVES(S) AND ADAPTER test.

   d. Select option 5, RUN ALL TESTS.

   e. Select option 6, READ VERIFY.

   f. If the replacement drive fails, remove and reseat all cables and retest the drive prior to replacing it.

   g. Go to Step 8 on page 9-19 of this section.

     Note: If UNABLE TO READ problems persist after the fixed disk is replaced, it might indicate a defective disk drive or the problem

9-18

might be caused by a defective Fixed Disk/Diskette Drive Adapter or power supply.

7. Fixed Disk Drive Format

Warning: Formatting results in a complete loss of data on the fixed disk drive; refer to the DOS manual and ensure that all customer information has been backed up.

Note: CONDITIONAL FORMAT, UNCONDITIONAL FORMAT, and SURFACE ANALYSIS will post the current cylinder number as they move through their routines. If the time between cylinders is greater than *5 seconds* replace the Fixed Disk/Diskette Drive Adapter (see Step 5 on page 9-18) and perform a CONDITIONAL FORMAT. If the time between cylinders still exceeds *5 seconds* replace the fixed disk drive.

  a. Load the advanced diagnostics diskette and select the FIXED DISK DRIVE(S) AND ADAPTER test.
  b. Select option 1, CONDITIONAL FORMAT.

   Note: CONDITIONAL FORMAT will mark those tracks listed on the front drive label and tracks identified as bad during a surface analysis as unusable. Any defective tracks that are not already listed on the drive label should be added to the list.

  c. If no error occurs during CONDITIONAL FORMAT, go to Step 7g, this section.
  d. If an unrecoverable error occurs during CONDITIONAL FORMAT, select option 2, UNCONDITIONAL FORMAT.
  e. Use the label on the front of the fixed disk drive as input for the bad track data at the start of the routine.
  f. After an UNCONDITIONAL FORMAT, retry the CONDITIONAL FORMAT. If the CONDITIONAL FORMAT fails, replace the fixed disk drive. See Step 6 on page 9-18 in this section and retry the CONDITIONAL FORMAT. If it still fails, replace the Fixed Disk/Diskette Adapter. See Step 5 on page 9-18 in this section.
  g. If this is a replacement fixed disk drive, repeat Step 3 on page 9-17 in this section and then go to Step 8 in this section.
  h. If this is not a replacement fixed disk drive, go to Step 8 in this section.

8. Final Checkout
  a. Re-check all cable connections.
  b. Install the system unit cover.
  c. Power on the system unit, load the advanced diagnostics, and select the FIXED DISK DRIVE(S) AND ADAPTER test.
  d. Select option 5, RUN ALL TESTS.
  e. Select option 6, READ VERIFY.
  f. If any errors occur refer to the *Personal Computer AT Hardware Maintenance and Service* manual.

If DOS is installed, ensure that the system will boot properly from the fixed disk.

If this is a replacement fixed disk and DOS is not installed, it is recommended that DOS FDISK and DOS FORMAT be performed (by the customer or an IBM customer engineer) to load the DOS system files. Ensure that the system will then boot properly from the fixed disk before returning the system to the customer or leaving the customer location.

  g. Return to the main diagnostic menu and select option 3, PREPARE SYSTEM FOR MOVING.
  h. Power the system unit off.

Formatting a 5170 Fixed Disk (20Mb/30Mb)

Before replacing a fixed disk, attempt to format the disk as follows:

Warning: Formatting results in complete loss of data. Refer to the DOS manual and back up all data if possible.

1. Ensure that all power and data cables connected to the diskette drive(s) and fixed disk are tight.
2. Load advanced diagnostics, select option SYSTEM CHECKOUT, and verify that the installed option list is correct.
3. Select option 17, FIXED DISK AND ADAPTER.
4. Select FORMAT MENU, enter desired drive, and select CONDITIONAL FORMAT.
5. Always perform conditional format first. If CONDITIONAL FORMAT fails to complete, UNCONDITIONAL FORMAT should be performed.

   Note: UNCONDITIONAL FORMAT should always be followed by a SURFACE ANALYSIS.

6. Tracks found to be defective since the last SURFACE ANALYSIS will be displayed at the end of the CONDITIONAL FORMAT or SURFACE ANALYSIS. The defective cylinder and head should be added to the defective track label on the front of the fixed disk.
7. Before turning the system over to the customer or transferring customer data back onto the fixed disk, perform the DOS FDISK, then DOS FORMAT. (See the DOS manual for FDISK and FORMAT description.)

Types of Format

SURFACE ANALYSIS: The SURFACE ANALYSIS procedure does a complete read/write operation on all tracks. SURFACE ANALYSIS will flag any tracks that are determined defective during the read/write operations. SURFACE ANALYSIS *does not* save a record of previously flagged tracks.

CONDITIONAL FORMAT: The CONDITIONAL FORMAT procedure identifies and flags defective tracks by performing a SURFACE ANALYSIS. It also saves a record of all defective tracks flagged as defective during manufacturing as well as any found defective during the last CONDITIONAL FORMAT or SURFACE ANALYSIS. CONDITIONAL FORMAT writes the sector IDs and reads them back for verification.

UNCONDITIONAL FORMAT: UNCONDITIONAL FORMAT does not perform a SURFACE ANALYSIS. This format should be performed only when CONDITIONAL FORMAT is not successful. UNCONDITIONAL FORMAT ignores error conditions and writes the necessary sector IDs without reading them back for verification. The SURFACE ANALYSIS must always be performed after UNCONDITIONAL FORMAT is used to ensure that there are no defective areas left unflagged.

The purpose of UNCONDITIONAL FORMAT is to remove any erroneous defect flags caused by a faulty Fixed Disk Adapter card or other system malfunction. These erroneous defect flags, if not removed, would make the fixed disk appear to have too many defective areas and cause unnecessary replacement of the fixed disk.

Failure to Recognize Drive C

If you experience this problem, you should remove all cards from the system unit except the Disk/Diskette Attachment card and the Display Attachment card. Retry the load operation both by power on and soft load several times. If diagnostics and read verify do not indicate a problem, but the problem persists, replace the fixed disk drive.

DOS Loading Problems

Cylinders 1, 2, 3, and 4 must be defect free for DOS 3.0 to operate correctly. If any of these tracks are found to be defective, the fixed disk should be replaced. DOS 3.0 requires that the disk have at least 14 contiguous non-defective tracks to load. If one of these tracks is defective when you attempt to load DOS, you will receive a cylinder zero-- defective error (logical cylinder zero, not physical cylinder zero). If a customer does not want the fixed disk replaced for this problem, perform FDISK and answer *no* to the question: Do

you wish to use the entire fixed disk for DOS and try loading DOS starting at cylinder 004 or higher? If this does not resolve the problem, the fixed disk must be replaced.

Software Loading Problems

A limited number of Personal Computer software applications might fail to load or cause the system to hang up. However, these software applications might not fail on all systems. For instance, the same application might run on one 5170 and fail on another.

Software applications that use and/or check for the presence of a math coprocessor must be installed using the information in the technical reference manuals.

This information can be found in the BIOS listing under the interrupt 11 preamble. The technical reference manuals for some systems indicate that Bit-1 of the AX register is not used. However, it is used to detect the presence of a math coprocessor.

Other techniques used can yield unreliable results and are not supported by IBM.

Users' questions should be referred to their software vendor or point of sale.

Backup/Restore Problems

A DOS 3.0 backup command error might manifest itself in different ways: as a file sharing error or an out-of-sequence error during a restore operation. If errors of these types are experienced or suspected, a patch diskette is available upon request through the point of sale.

Fixed Disk/Diskette Drive Voltage

To check the voltage of a fixed disk/diskette drive:

1. Check the voltages at the diskette drive's power connector as shown below.

   Note: If the system unit has two diskette drives, check the voltages at both connectors.

2. Check the voltages at the failing fixed disk drive's power connector as shown below.

Power Connectors			
Min V DC	Max V DC	-Lead	+Lead
+4.8	+5.2	2	4
+11.5	+12.6	3	1

Figure 9-38. Correct Voltage at Connectors
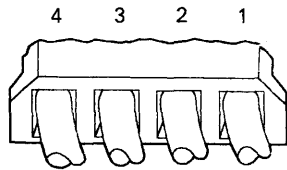
LEX40178

Figure 9-39. Power Connector Locations

Fixed Disk Signal/Data Cables Continuity

To check continuity of the fixed disk signal/data cables:

1. Turn the system unit's power switch to off.
2. Remove the system unit's cover.
3. See Figure 9-40 and check the fixed disk drive's data and signal cables for continuity.
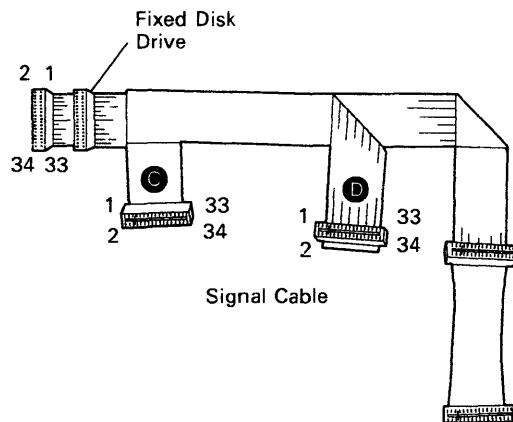
LEX40179
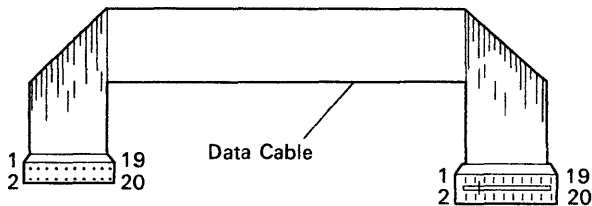
LEX40180

Figure 9-40. Signal/Data Cable Continuity Check Points

Stack Errors Using DOS 3.1 and 3.2

A fatal stack error can occur in DOS Release 3.1 and 3.2.

DOS 3.2 defaults to nine stack pages: nine successive depressions of the pause key cause an error. The depression of any other key resumes operation and clears the stack. The situation also occurs with DOS 3.1. However, no error message is given.

5170 Model Identification

A variety of problems can occur if replacement parts for Personal Computers are installed in the wrong model. The following is an example:

* Installing a 5170 Model 239 System Board (P/N6480170) in a 5170 Model 339 will result in the incorrect operation of the 101-key keyboard.

In order to avoid such situations, the model number of the machine being repaired should be known. The model number can be determined by checking the bar code label located on the rear panel of the machine. The 5170 model numbers 339 and 239 will be indicated on this label. The absence of a model number on a 5170 indicates it is a Model 099 or 068.

5170 System Information

The following is a cross-reference that will assist in identifying the correct replacement system board for base models of the Personal Computer AT. The base models are 068, 099, 239, 319, and 339.

Serial No. Range	FRU No.	Model	BIOS Part No.
0000001 - 5999999	8286112	068/ 099	6181028, 6191029, * 1503107, 1503108, * 1503109, 1503110, * 6180957, 6108958, * 6180959, 6180960, * 6181024, 6181025, * 6181026, 6181027,
6000000 - 6999999	6480170	239	6480090, 6480091, 6448894, 6448895, 6480090, 6480091,
7000000 - 7999999	6489922	319/ 339	61X9265, 61X9266 62X0820, 61X0821

* Indicates a set of four BIOS modules.

Any numbers other than the ones listed above on BIOS modules in a Personal Computer AT are for the Model 239. Also, there are two different system boards for this model: P/N6480170 (large board) and P/N6480072 (small board).

The BIOS modules sockets are located in positions U17, U27, U37, and U47 on the system board. If the system board has four BIOS modules, all sockets will be filled, but if there are only two BIOS modules they will be located in positions U27 and U47.

Since swapping BIOS modules between system boards can either downgrade or upgrade a system to a different model and possibly affect system performance, these modules should never be swapped from one system board to another.

The system board for Models 068 and 099 do not support the use of an IBM 30Mb Fixed Disk Drive. However, a customer may purchase a 30Mb fixed-disk upgrade kit. This kit will include a set of BIOS modules that when installed will convert the Model 068 or 099 System Board to a Model 239 System Board.

FRU No./ Memory Size	Type/ Mod.	Planar Bd. Memory Module	Full	Half	BIOS Date Codes
P/N8286112- 256Kb	068/ 099	128Kb	X		1/10/84
P/N6480170- 256Kb	068/ 099/ 239/ 599	128Kb	X		6/10/85
P/N6480072- 512Kb	239/ 739	256Kb		X	6/10/85
P/N6489922 512Kb	319/ 339	256Kb		X	11/15/85

Potential Overwriting Problem with Two Diskette Drives

A combination of changing diskettes and accessing the drives might cause the diskette drive change latch to be erroneously reset.

This could happen only if the user:

- Had diskettes in drives A and B
- Performs an operation on the diskette in drive A
- Changes diskettes in drive A (diskette change latch set)
- Performs an operation on diskette in drive B (accessing drive B, which will cause the diskette change latch for drive A to be reset).

The next operation performed on the diskette presently in drive A could use the file allocation table and directory of the diskette that was previously in drive A. This could result in the file allocation table, directory, or data being overwritten.

If the above symptoms occur, inspect the manufacturer's label on the rear of the drive. If the first 3 digits of the 9-digit number below the bar code are 345 or 346 and there is no label next to the manufacturer's label with P/N59X7184, replace the 1.2Mb diskette drive(s).

The 360Kb drive is software controlled and is not affected. Refer to ECA016.

Problem with Format A:/4 (DOS 3.2) and 5170 Model 339

DOS Release 3.2 command Format A:/4, used to format 360Kb diskettes on the 1.2Mb diskette drive, does not function properly on a 5170 Model 339. The format command displays large amounts of bad diskette space.

To circumvent the problem, enter the command DIR with the diskette mounted before issuing a format command.

5250 Remote Emulation Problem with SDLC Card

The remote 5250 Emulator either will not come up, or else it drops the line after a short period when using SDLC in a 5170.

There is a critical timing link between the CPU, the SDLC card, and the emulator program. Because of the timing incompatability, a data overrun condition is created by software, and the terminal drops. The same card will work perfectly in a 5150 or a 5160, and with 3270 emulation on any PC.

A patch is needed for the 5250 Emulation Program. This patch is on the HONE Equal System as item number 434CH. DOS Debug should be used, and prior knowledge of this program is required. Marketing should be contacted for this patch.

Remote emulation cannot be run on the 5170 Model 339, because the Enhanced Keyboard is not supported.

S/370 Channel Emulator

Diagnostic Information

Additional diagnostics, beyond the normal PC AT diagnostics, are required to service this feature. For this reason, a separate Problem Determination Diskette and a *Hardware Maintenance and Service* (HMS) manual are included with each S/370 Channel Emulator ship group. These diagnostics and the *Guide to Operations* (GTO) manual should be kept and made available to you at the installation by the customer. The HMS will direct you on how to use the menu-driven tests that will isolate failures in this feature to the card or cable and verify proper operation.

The ship group diagnostics perform extensive checks on the internal operations of the card while connected to devices (no disconnection required). A channel wrap test, also available on the Problem Determination Diskette, can be run from the 5170 by following instructions located in the HMS. This diagnostic test can be run using 3090, 308X, or 43XX wrap connectors. This choice is provided through a simple menu-driven selection.

When the wrap diagnostic test must be run, it is is a IBM customer engineer (CE) responsiblity to obtain one of the following pairs of wrap connectors:

- 3090 Wraps - P/N5479141 and P/N5479139.
- 308X Wraps - P/N6028031 and P/N6028032
- 43XX Wraps - P/N8483772 and P/N8483773.

Since channel problem isolation requires I/O isolation from the 5170 containing this feature, a CE trained on the attached device should perform the channel wrap

diagnostic test when needed. This test will aid in isolation to the failing FRU for channel-related problems in the S/370 Channel Emulator or the attached I/O device. The test will identify the failing line providing the line name and the channel cable pin number. An ohmmeter can then be used to isolate the FRU with the failing line.

Successful completion of the internal card test verifies proper operation of 90% of this feature. Successful wrap tests conducted with the wrap plugs attached at the end of the interface cable verify proper operation of the entire feature. For a 3820 attachment, any simple customer job, when successfully sent to the printer from the remote host, will verify the proper operation of the complete system attachment.

5170 PC AT Switch Settings
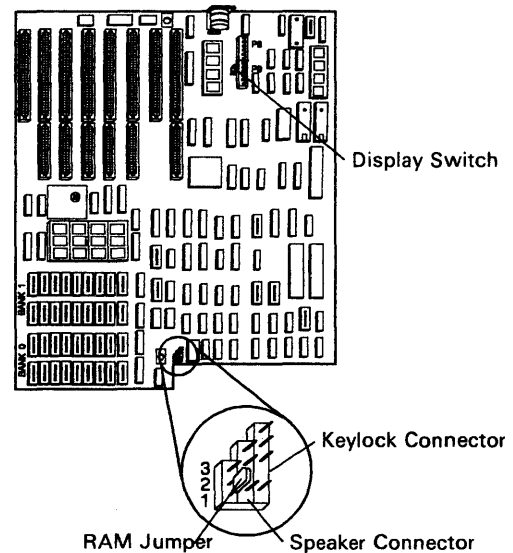
LEX40254

Figure 9-41. 5170 System Board (Full Size, Front View)

Full-Size Dimensions: 13.5 x 12.
Down-Size Dimensions: 13.5 x 9.5 (not shown).

Jumper

The system board has a 3-pin, Berg-strip connector. The placement of a jumper across the pins of the connector determines whether the system board's second 256Kb of RAM is enabled or disabled.

Jumper Positions	Function
1 and 2	Enable second 256Kb of system board RAM
2 and 3	Disable second 256Kb of system board RAM

Figure 9-42. Jumper Positions

The RAM jumper in the disable position (256Kb RAM), enables the user to utilize additional RAM provided on option cards without fully populating the system board.

Note: The normal position is enable mode. The disable mode permits the second 256Kb of RAM to reside on adapters plugged into the I/O bus. This also pertains to cards like the Enhanced Graphics which have memory to support their function.

Type of Display Adapter Switch
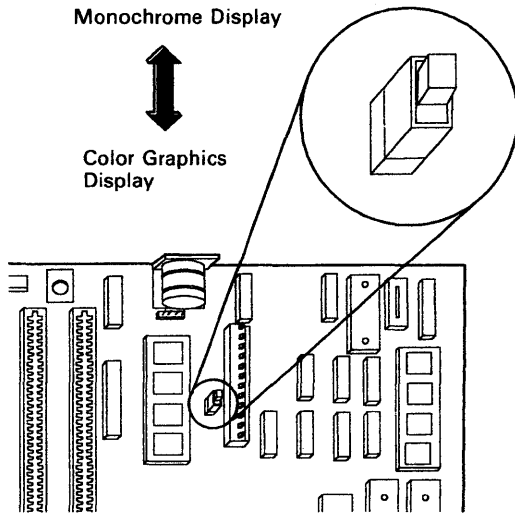
LEX40090

Figure 9-43. 5170 System Board Video Switch
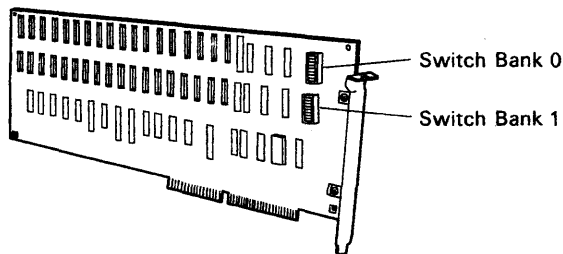
LEX40256

Figure 9-44. 5170 Memory Expansion Switch Bank Location
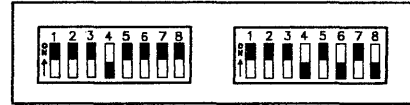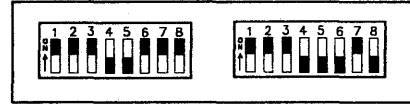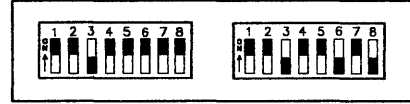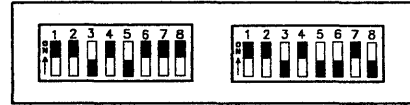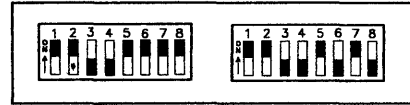
LEX40257

Figure 9-45. 512Kb Memory Expansion Adapter Switch Settings

5170 Memory Adapters Switch Settings

Definitions:

Base Memory	Memory Address 0 – 640Kb
Reserved Memory	Memory Addresses 640Kb – 1Mb
Expansion Memory	Memory Addresses 1Mb and up.

The purpose of the eight position switches on the Memory Expansion Adapters is:

Switches 1 – 5	Starting address in the expansion memory area
Switches 6 – 8	Special assignments for each type of memory option.

Switches 1 – 5

The first Memory Expansion card will always have a starting address of 1Mb. Other Memory Expansion Adapters' starting addresses are dependent upon the amount of memory previously installed in the system.

Switch Settings	The off position will enable:
1	8Mb
2	4Mb
3	2Mb
4	1Mb
5	0.5Mb

Example: Assume you have 3.5Mb of expansion memory installed in your system and you are installing another memory option.

1.0Mb	Starting address for expansion memory
3.5Mb	Amount of expansion memory installed
4.5Mb	Starting address of new memory option to be installed

New memory option should have switches 2 and 5 off and 1, 3, and 4 on.

The 512Kb Memory Expansion Card has two banks of eight switches each. Switches 1 – 5 on both banks are set the same.

Switches 6, 7, and 8

Switches 6, 7, and 8 are dependent on the type of memory option.

128Kb Memory Expansion Adapter

- No switches
- Adds 128Kb to base memory.

128Kb/640Kb Memory Expansion Adapter

This card, fully populated, will provide 128Kb to the base memory and 512Kb to expansion memory.

128Kb/640Kb with only 128Kb installed:

Switches	6	7	8
	Off	On	Off

Adds 128Kb to base memory.

128Kb/640Kb fully populated or with only 512Kb of system expansion memory installed:

Switches	6	7	8
	On	On	Off

Adds 512Kb to expansion memory.

512Kb Memory Expansion Option

	Bank 0			Bank 1		
Switches	6	7	8	6	7	8
	On	On	On	Off	On	Off

This card adds 512Kb to expansion memory.

512Kb/2Mb Memory Expansion Option

This option adds from 512Kb to 2Mb of expansion memory.

0.5Mb to 3Mb or 0.5Mb to 6Mb Memory Expansion Option

Switches 6 and 7 are set for the amount of base memory in the system.

Switches	6	7
256Kb	On	Off
512Kb	Off	On
640Kb	Off	Off

640Kb must be allocated to base memory. If the system has less than 640Kb of base memory, a portion of memory on the Expansion Adapter card is used as base memory. When switches 6 and 7 are set for the actual amount of base memory in the system, the system determines the amount of memory needed from the Expansion Adapter card to bring base memory up to 640Kb.

If multiple 0.5Mb to 6Mb Memory Expansion cards are installed, the card with the highest address has switches 6 and 7 set for the actual base memory in the system. Switches 6 and 7 on the other cards are set to indicate 640Kb of base memory.

There cannot be any gap between newly added memory and existing memory in the expansion memory area. If multiple memory expansion cards are used, the 0.5Mb to 6Mb Expansion card must always be the last card if a portion of its memory is used for base memory.

Switch 8—Used to enable (switch on) or disable (switch off) the I/O ports on the card.

0.5Mb to 3Mb or 0.5Mb to 6Mb Memory Expansion Adapter Setup

Note: The 0.5Mb to 3Mb *Hardware Maintenance and Service* (HMS) manual has been replaced with the 0.5Mb to 6Mb HMS.

The *Hardware Maintenance Service* manual for the 0.5Mb to 6Mb Memory Expansion Adapter (G570-2239) might be confusing. The switches on the adapter are rocker type switches. A red dot is at each end of the switch. To set the switch, depress the red dot at the appropriate on or off end. The opposite end will protrude, making the red dot visible. Example: A switch set to the off position will have the dot visible at the on-side of the switch.

After installing a 0.5Mb to 6Mb Memory Expansion Adapter, you must run the setup function location on the diagnostic diskette.

Boot the system using the diagnostic diskette and at the menu screen select Option 4 (Set-Up Function).

When the following screen is displayed:

```
          BASE MEMORY IS COMPOSED OF
      --  256KB
      --  512KB
      --  640KB OF BASE MEMORY ConSISTING
          AND 128KB on THE 128KB MEMORY
          EXPANSIon OPTIon.
          BASE MEMORY SIZE IS XXXKB
          IS THIS CORRECT (Y/N)

  ?
  **
```

Note: The line BASE MEMORY SIZE IS XXXKB will display 256, 512, or 640 in the XXX position. If XXX displays 640, answer *yes*. The next screen will ask for expansion memory size.

If XXX displays any other number, answer *no*. The next screen will display:

```
      ENTER CORRECT BASE MEMORY SIZE
      (256, 512, 640)
      ?
```

Enter 640 at this screen.

The following screen will appear:

```
      EXPANSIon MEMORY SIZE
      0
      512
      1024
      1536
      2048


      *
      *
      ENTER THE CORRECT EXPANSIon MEMORY SIZE
      ?
```

To enter the correct expansion memory size, perform the following two calculations:

1. 640Kb minus the amount of base memory installed in your system board (256Kb, 512Kb, or 640Kb).
2. Amount of memory installed in your Expansion Adapter card minus the number found in Step 1.

   Note: The amount of memory installed in your Expansion Adapter card is 512Kb for 0.5Mb, 1024Kb for 1Mb, 2048 for 2Mb (2 × 1024), 3072Kb for 3Mb (3 × 1024), and so on.

The correct expansion memory size will be equal to the number found in Step 2.

Example: You are installing a 0.5Mb to 3Mb Memory Expansion Adapter with 3Mb of storage installed. Your system board has 512Kb of storage.

The correct expansion memory size is:

1. 640Kb — 512Kb = 128Kb
2. (3 × 1024Kb) — 128Kb = 3072Kb — 128Kb = 2944Kb

Expansion memory size is 2944Kb.

5170 AT/370
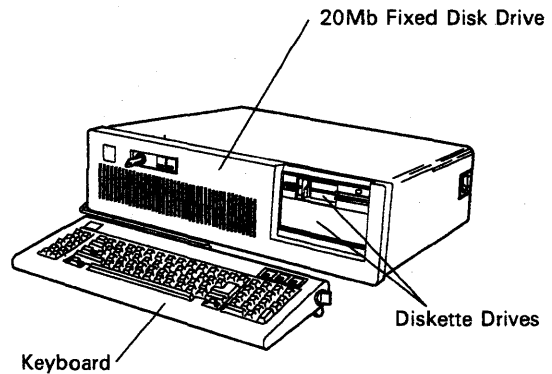
LEX40132

Figure 9-46. 5170 AT/370

The AT/370 is an extended version of the 5170 AT, with 512Kb of memory on the system board. The system unit has an AT/370 Adapter, which consists of two cards plugged into adjacent expansion slots in the system board:

- The 512Kb Memory card (PC/370-M2)
- The Processor card (PC/370-P2).

Options available include:

- A Remote Display Terminal Device Emulation Adapter card
- 3278/79 Emulation Adapter.

Unit Specifications

System Unit	
Size	
Height	162 mm (6.8 in)
Length	540 mm (21.3 in)
Depth	439 mm (17.3 in)
Weight	19.05 kg (42 lb)
Power Cable	
Length	1.8 m (6 ft)
Size	18 AWG
Environment	
Air Temperature	
System On	15.6° to 32.2°C
	(60° to 90°F)
System Off	10° to 43°C
	(50° to 110°F)
Humidity	
System On	8% to 80%
System Off	20% to 80%
Altitude	2133.6 m (7000 ft) max.
Heat Output	1100 BTU/hr
Noise Level	42 dBa
Meets Class 3	
Electrical	
VA - 575	
Range 1	
Nominal	120V AC
Minimum	104V AC
Maximum	127V AC
Range 2	
Nominal	230V AC
Minimum	200V AC
Maximum	240V AC

Figure   9-47. 5170 AT/370 Specifications

PC/370-P2 Card
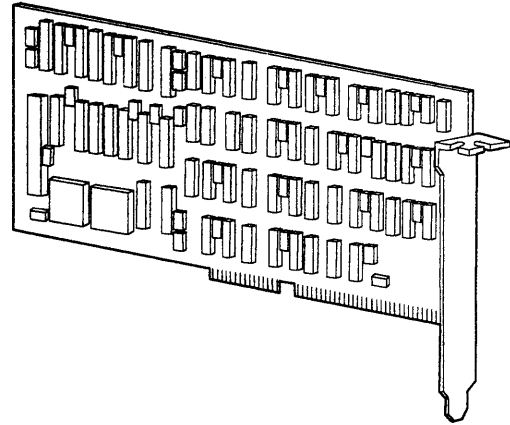
LEX40133

Figure   9-48. PC/370-P2 Card

The PC/370-P2 card is the center of the S/370 operations for the PCAT/370. The PC/370-P2 card contains the microprocessors and control circuits that enable the PCAT/370 to execute S/370 instructions.

3278/79 Emulation Adapter
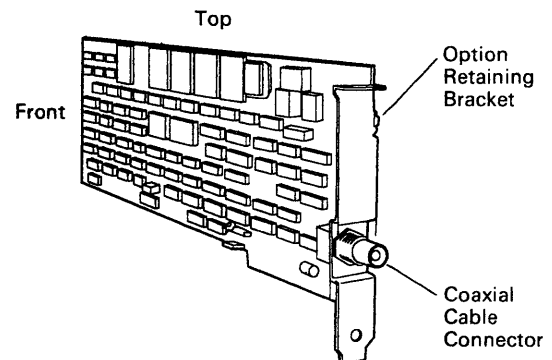
LEX40134

Figure   9-49. IBM Personal Computer 3278/79 Emulation Adapter

The 3278/79 Emulation Adapter allows the PCAT/370 to emulate a 3278/79 terminal when the PCAT/370 is linked to a host system. This card also allows additional functions to those of the 3278/79 when supported with suitable software. These additional functions include the ability to print single screens, complete listings or other files on the Personal Computer AT printer, and the ability to transfer data between the PCAT/370 and the host system disks.

PC/370-M2 Card
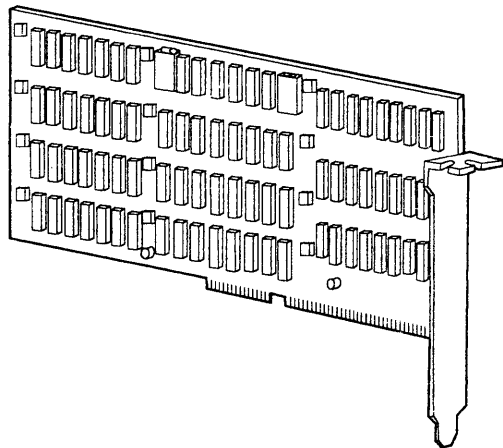
LEX40135

Figure 9-50. PC/370-M2 Card

The PC/370-M2 card contains 512Kb of parity-checked RAM, which can be used by either the PC/370-P2 card or by the Personal Computer AT. In S/370 mode, this applies 480Kb of memory for program use and 32Kb of control storage for microcode use. From the IBM Personal Computer AT, only 128Kb of S/370 memory is addressable at any one time.

Personal Computer AT Store Controller

This section contains information specific to the Personal Computer AT Store Controller. Additional system information that is common to the base system (5170 AT) can be found in the 5170 product specific section. Information that is unique to the store controller is included in this section. Unique parts for the store controller can be found in the parts section of this document under the title of 5170 AT Store Controller.
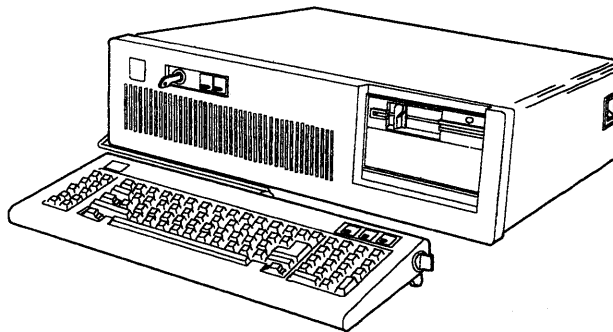
LEX42628

Figure 9-51. Store Controller

The store controller system unit (based on the 5170 Personal Computer AT) operates with the 4680 Operating System Programs. These licensed programs provide the 5170 Model 8XX Store Controller with the capability to control the IBM 4683 Point of Sale Terminal with a multitasking, multiuser environment necessary for the user to run application programs, manage system services, and define system configuration data. Attachment is provided for the 5170 Keyboard and a display unit. The display can be either the 5151 Monochrome Display or a 5153 Color Display. This system can attach to a host system via any of the communication adapters; however, it is not host dependent.

Model 899	Includes a new system board and a Store Loop Adapter. All other available features are the same as the Model 099.
Model 839	Includes a new system board and a Store Loop Adapter. All other available features are the same as the Model 239.
Model 849	Includes a new system board and a Store Loop Adapter. All other available features are the same as the Model 339.
Model 819	This is a special bid model. It is the same as the Model 849 with the IBM 30Mb Hard File and the Serial/Parallel card removed.
Model 820	This is a special bid model. It is the same as the Model 849 with the IBM 30Mb Hard File, the Serial/Parallel card, and the Loop Adapter card removed. It has the Token-Ring Adapter added (FC 3391 and FC 3390).

Input to the system is via a keyboard (same as the appropriate base Models 099, 239, 339, and 849).

Loop Adapter, P/N6347798

This is an S-Loop Adapter and allows the store con-
troller to drive up to 64 4683 Model 001s. Each 4683
Model 001 can have a 4683 Model 002 attached. The
4683 Terminal can have multiple I/O devices attached.
This adapter is standard in the store controller models
of the 5170 Personal Computer AT.

A store controller can support up to two loop adapters.
If your controller has two adapters installed, one must
be jumpered to serve loop 1, and the second adapter
must be jumpered as loop 2. A marked decal is on the
end of the adapter to which the loop cable connects.

Multiprotocol Communications Adapter, P/N6236178

This adapter, a new feature available for all 5170
models, provides the capability to select under program
control the desired communication protocol to be used.
Supported protocols are asynchronous, binary synchro-
nous, or SDLC. The interface is an EIA RS232C. In
asynchronous mode, a programmable baud generator
allows operation from 50 to 9600 baud. The user can
select 5-, 6-, 7-, or 8-bit characters with 1, 1.5, or 2 stop
bits. In synchronous mode, the adapter operates in
half-duplex. The maximum transmission rate is 9600
bits per second (bps), as generated by the attached
modem or other data communication equipment. The
interrupt levels are programmable.

4683 Model 2 Attachment Adapter Kit, FC 8314

This feature code can be installed in a PC-5150,
PC-5160, PC-5170 (Model 339), and the Personal
System/2 Model 8530. It allows direct attachment of
one or two 4683 Model 002 Point of Sale Terminals
(POSTs). In this configuration, the PC operates as a
store controller and the 4683-002 as a POST for the
small store environment.

The small store configuration uses DOS 3.3 or later as
an operating system. Application code is provided by
the user; IBM provides I/O driver code to interface
between PC-DOS and the 4683-002 I/O devices. The
driver code is a licensed program that is not warranted
by IBM. It will be the user's responsibility to get it
serviced.

The 4683-002 diagnostics have also been modified to
run from the PC under PC-DOS. A new problem deter-
mination manual, *IBM 4683 Model 002 Attachment
Adapter System Problem Determination Manual,*
SA27-3790, is shipped with each feature. This docu-
ment tells how to run and interpret the diagnostic and
verification tests, and how to configure the user's
system for the unique I/O configuration. The diag-

nostic results (error messages/symptoms) will be com-
patible with the diagnostic results for the 4680 system.
The IBM customer engineer must be aware, however,
that the PC controller and the 4683-2s will be offline to
the user while the diagnostics are being run. It is pos-
sible for the application coder to include the capability
of running the application and the diagnostics concur-
rently, but this should not be assumed.

System Board

The system board for the Models 839 and 899 uses a 6
MHz oscillator. The Models 819 and 849 use an 8 MHz
oscillator. All of these models use the Intel 80286 E
Step Microprocessor. When operating the controller
with the 4680 program products, the E Step Micro-
processor allows multitasking. Due to this program
requirement other system boards part numbers cannot
be used in the store system environment.

4800 Baud Modem

A special 4800 baud RPQ modem is being used with the
5170 Personal Computer AT Store Controller. This is
an under-the-cover modem. It operates at 4800 bps
with a backup half-speed of 2400 bps. The interface is
EIA RS232. It operates synchronously and uses auto-
matic adaptive equalization. There is a voltage surge
protection on telecommunication line connections. A
User's Guide, GA27-3782, is supplied with the feature.
With the *User's Guide* is a diagnostic diskette,
P/N6164858, which allows stand-alone testing of the
modem.

Loop Cables

The loop cabling used in the 4680 Store System com-
plies with the IBM Cabling System. These cables have
a modular connector on one end and a data connector
on the other. The data connectors are self-shorting
when disconnected. However, note that if the cable is
disconnected at the modular connector end, at the ter-
minal or controller, the loop will be opened. If the
loop is opened, all the terminals on that loop will go
offline. The standard loop cable from the Controller
Loop Adapter card is P/N6316840.

A different loop cable, P/N63X4998, is part of the
special bid for the Model 819. When either end of this
cable is disconnected the loop is opened. The customer
should supply a shorting plug at each receptacle.

Note: The customer receptacle is not serviced by
IBM. The service strategy for the controller loop
cable is to replace the cable assembly.

Chapter 10. 3270 PC Products

This section contains information specific to the 3270 PC products. Additional system information that is common to the base system (5160/5170) can be found in the 5160 or 5170 product specific section. Switch settings and error codes unique to the 3270 PC products are included in this section. All other switch settings common to the 5160/5170 based systems can be found in those systems' switch setting chapters. Unique 3270 parts can be found in the 3270 parts section.

System Units

The following chart shows system units referenced in this chapter and their components.

3270 PC
5271 System Unit 5272 Color Display or 3295 Plasma Display or 5151 Monochrome Display

3270 PC/G
5371 System Unit 5278 Model 1 DAU 5279 Color Display

3270 PC/GX
5371 System Unit 5378 Model C01 DAU and 5379 Model C01 Color Display or 5378 Model M01 DAU and 5379 Model M01 Monochrome Display or 5151 Monochrome Display

3270 Personal Computer AT
5273 System Unit 5272 Color Display or 5151 Monochrome Display

3270 PC AT/G
5373 System Unit 5278 Model 2 DAU 5279 Color Display

3270 PC AT/GX
5373 System Unit 5378 Model M01 DAU and 5379 Model M01 Monochrome Display or 5378 Model C01 DAU and 5379 Model C01 Color Display or 5151 Monochrome Display
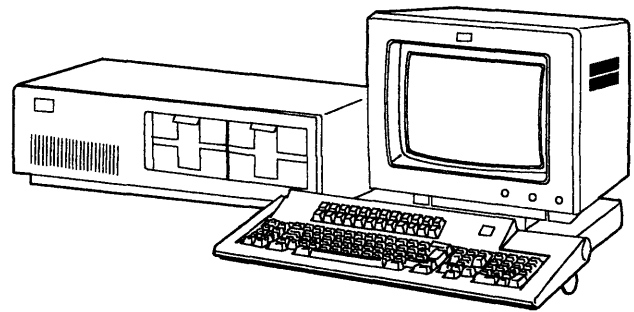
3270 PC

LEX41758

Figure 10-1. 3270 PC

The IBM 3270 Personal Computer is an intelligent work station based on the PC XT. The 3270 Personal Computer attaches to a 3274 Control Unit and consists of the 5271 System Unit, a monochrome (5151) or color (5272) display element, a Converged* or Enhanced Keyboard, and the 3270 Personal Computer Control Program and PC DOS.

The IBM 3270 Personal Computer can operate as a 3278/3279 Main Frame Interactive (MFI) terminal and/or as a local stand-alone processor. With the 3270 PC Control Program and the appropriate application programs, the user is able to operate with several advanced functions, including the ability to concurrently view and operate up to four MFI host applications and one IBM Personal Computer application.

*The Converged Keyboard provides a combination of the 3278 and Personal Computer keyboard functions.

5271 Models

- Model 002

    - 256Kb random access memory (RAM) on system board
    - 5151/5272 Display Adapter
    - 5271 Keyboard and Keyboard Adapter
    - One 360Kb Diskette Drive and Diskette Drive Adapter
    - 3270 Systems Adapter (DFCA).

- Model 004

    - Includes Model 002 features, plus
    - Second 360Kb diskette drive
    - Printer/Memory/Adapter with 128Kb RAM.

- Model 006

  - Includes Model 002 features, plus
  - One 10Mb Fixed Disk and Fixed Disk Adapter
  - Printer/Memory/Adapter with 128Kb RAM.

- Model 024

  - 256Kb RAM on system board
  - 3295 Plasma Display Adapter
  - 5271 Keyboard and Plasma Keyboard Adapter
  - Two 360Kb Diskette Drive and Diskette Drive Adapters
  - 3270 Systems Adapter (DFCA)
  - Printer/Memory/Adapter with 128Kb RAM.

- Model 026

  - 256Kb RAM on system board
  - 3295 Plasma Display Adapter
  - 5271 Keyboard and Plasma Keyboard Adapter
  - One 360Kb Diskette Drive and Diskette Drive Adapter
  - One 10Mb Fixed Disk and Fixed Disk Adapter
  - 3270 Systems Adapter (DFCA)
  - Printer/Memory/Adapter with 128Kb RAM.

- Model 030

  - 640Kb RAM on system board
  - 5151/5272 Display Adapter
  - 5271 Keyboard and Keyboard Adapter
  - One 360Kb Half-High Diskette Drive and Diskette Drive Adapter
  - Printer Adapter
  - 3270 Systems Adapter (DFCA).

- Model 050

  - Includes Model 030 features, plus
  - Second 360Kb Half-High Diskette Drive.

- Model 070

  - Includes Model 030 features, plus
  - One 20Mb Fixed Disk and Fixed Disk Adapter.

- Model 031 (requires 3270 Control Program 3.0)

  - 256Kb RAM on system board
  - 5151/5272 Display Adapter
  - 5271 Keyboard and Keyboard Adapter
  - One 360Kb Half-High Diskette Drive and Diskette Drive Adapter
  - Expanded Memory Adapter (XMA) with 1Mb memory (includes Printer Adapter)
  - 3270 Systems Adapter (DFCA).

- Model 051 (requires 3270 Control Program 3.0)

  - Includes Model 031 features, plus
  - Second 360Kb Half-High Diskette Drive
  - Printer/Memory/Adapter with 128Kb RAM.

- Model 071 (requires 3270 Control Program 3.0)

  - Includes Model 031 features, plus
  - One 20Mb Fixed Disk and Fixed Disk Adapter.

- Model P30 (requires 3270 Control Program 3.0)

  - Includes Model 030 features, **except**
  - Enhanced Keyboard (101-Key) and Cable Adapter replaces the 5271 Keyboard.

- Model P50 (requires 3270 Control Program 3.0)

  - Includes Model 050 features, **except**
  - Enhanced Keyboard (101-Key) and Cable Adapter replaces the 5271 Keyboard.

- Model P70 (requires 3270 Control Program 3.0)

  - Includes Model 070 features, **except**
  - Enhanced Keyboard (101-Key) and Cable Adapter replaces the 5271 Keyboard.

- Model P31 (requires 3270 Control Program 3.0)

  - Includes Model 031 features, **except**
  - Enhanced Keyboard (101-Key) and Cable Adapter replaces the 5271 Keyboard.

- Model P51 (requires 3270 Control Program 3.0)

  - Includes Model 051 features, **except**
  - Enhanced Keyboard (101-Key) and Cable Adapter replaces the 5271 Keyboard.

- Model P71 (requires 3270 Control Program 3.0)

  - Includes Model 071 features, **except**
  - Enhanced Keyboard (101-Key) and Cable Adapter replaces the 5271 Keyboard.

3270 Personal Computer AT
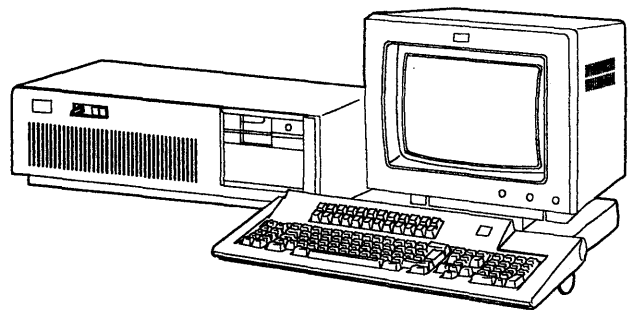
LEX41240

Figure 10-2. 3270 Personal Computer AT

The IBM 3270 Personal Computer AT is an addition to the IBM 3270 Information Display family based on the IBM Personal Computer AT. It is an intelligent work station which attaches to a 3274 Control Unit. The work station consists of the 5273 System Unit, a monochrome (5151) or color (5272) display, a Converged* or Enhanced Keyboard, and the 3270 Personal Computer Control Program and PC DOS.

The 5273 is a Personal Computer AT Related Product and uses the same frame, power supply, system board, diskette drives, hard file, covers, and some of the option cards from the Personal Computer AT. It also uses unique option cards, which when combined with the 3270 Personal Computer Control Program provide 3270 host connect capability in addition to base Personal Computer Personal Computer AT function.

The IBM 3270 Personal Computer AT can operate as a 3278/3279 Main Frame Interactive (MFI) terminal and/or as a local stand-alone processor. With the 3270 PC Control Program and the appropriate application programs, the user can operate with several advanced functions, including the ability to concurrently view and operate up to four MFI host applications and multiple PC DOS sessions.

*The Converged Keyboard provides a combination of the 3278 and Personal Computer keyboard functions.

Models

5273 Models

- Model 020

  - 512Kb RAM on system board
  - 5151/5272 Display Adapter
  - 5271 Keyboard and Keyboard Adapter
  - One 1.2Mb diskette drive and Fixed Disk and Diskette Drive Adapter
  - Serial/Parallel Adapter
  - 3270 Systems Adapter (DFCA).

- Model 041

  - 512Kb RAM on system board
  - 128Kb Memory Adapter
  - 5151/5272 Display Adapter
  - 5271 Keyboard and Keyboard Adapter
  - Two 1.2Mb diskette drives and Fixed Disk and Diskette Drive Adapters
  - Serial/Parallel Adapter
  - 3270 Systems Adapter (DFCA).

- Model 042

  - Includes Model 041 features, plus
  - Extended Graphics Adapter (XGA).

- Model 061

  - 512Kb RAM on system board
  - 128Kb Memory Adapter
  - 5151/5272 Display Adapter
  - 5271 Keyboard and Keyboard Adapter
  - One 1.2Mb diskette drive and Fixed Disk and Diskette Drive Adapter
  - One 20Mb fixed disk drive
  - Serial/Parallel Adapter
  - 3270 Systems Adapter (DFCA).

- Model 062

  - Includes Model 061 features, plus
  - Extended Graphics Adapter (XGA).

- Model 070 (requires 3270 Control Program 3.0)

  - 512Kb RAM on system board
  - 8 MHz system board
  - 128Kb Memory Adapter
  - 5151/5272 Display Adapter
  - 5271 Keyboard and Keyboard Adapter
  - One 1.2Mb diskette drive and Fixed Disk and Diskette Drive Adapter
  - One 30Mb fixed disk drive
  - Serial/Parallel Adapter
  - 3270 Systems Adapter (DFCA).

- Model 071 (requires 3270 Control Program 3.0)

  - 512Kb RAM on system board (configured as 256Kb)
  - 8 MHz system board
  - 5151/5272 Display Adapter
  - 5271 Keyboard and Keyboard Adapter
  - One 1.2Mb diskette drive and Fixed Disk and Diskette Drive Adapter
  - One 30Mb fixed disk drive
  - Expanded Memory Adapter (XMA) with 1Mb memory (includes Printer Adapter)
  - 3270 Systems Adapter (DFCA).

- Model P70 (requires 3270 Control Program 3.0)

  - Includes Model 070 features, **except**
  - Enhanced Keyboard (101-Key) and Cable Adapter replaces the 5271 Keyboard.

- Model P71 (Requires 3270 Control Program 3.0)

  - Includes Model 071 features, **except**
  - Enhanced Keyboard (101-Key) and Cable Adapter replaces the 5271 Keyboard.

Diagnostic Tips and Information on the 3270 PC and the 3270 PC AT

5271

False 2801 Error Code

If you have replaced a long DFCA (DCA/TCA) with the new short adapter card, then the Keyboard Timer Adapter might have to be replaced. If you receive the error message 2801 error, press F1 to continue after POST, and you can press F1 and have the host session established, then you have a false 2801 error. ECA001 directs you to order P/N1497249 (1 EPROM) and replace the pluggable EPROM on the Keyboard Timer Adapter.

XMA Documentation Error

Related documentation for the XMA has an error. The XMA, jumpered as LPT2 on a 5271 with a fixed disk, is not supported. There is an interrupt level conflict. See the RETAIN tip for further information.

XMA Diagnostics

Current diagnostics for the XMA (P/N4466857) with the piggy-back memory (P/N4466858) might give a false 8505 error code. The diagnostic routine for this card uses an address range of D000-DFFF for part of its testing. If any other adapter in the system unit has RAM or read only storage (ROS) that utilizes this memory range, then you might get a false 8505 error code. See the RETAIN tip for further information.

Keyboard

The correct part number for the replacement keyboard is P/N1389098. Use this as the replacement keyboard for either the metal bottom or the plastic bottom keyboard.

Corrections to the HMS and GTO Manuals

HMS 3.0: The switch settings in Section 6, page 3, are for the 256Kb/640Kb system board.

GTO 3.0: The switch settings for the DFCA card are in error. Refer to the HMS manual for correct settings.

GTO 3.0: The system board switch settings in Appendix D, page 15, are in error. Refer to Appendix B, page 5, for the correct settings.

GTO 3.0: The system board part numbers in Appendix D, page 24, are reversed. Refer to the HMS manual for correct part numbers.

5273

Dropping Keystrokes

If keystrokes intermittently drop while typing at a moderate to fast speed and the control program is not loaded, then the problem is probably due to an early level of the Keyboard Adapter card. ECA001 directs you to order P/N8649458 (2 EPROMs) and replace the pluggable EPROMs on the Keyboard Adapter card.

XMA Error

Incorrect positioning of the system board RAM jumper can give XMA errors. The *3270 PC AT GTO* manual incorrectly states the position of the jumper. With the XMA installed, the jumper (J18) should be on pins 2 and 3. When setup is run, make sure the base memory size is set for 640Kb.

Error Codes 301, 401, and 501

When running the advanced diagnostics for the PC AT on a 5372, false error codes will appear when running all options. To verify proper operation of the keyboard and display, the 3270 PC AT Diagnostics should be used.

ECA History — 3270 PC Family

5271

- ECA001, False 2801 Error Codes.

5273

- ECA001, Dropping Keystrokes in PC Mode.

3270 PC/G
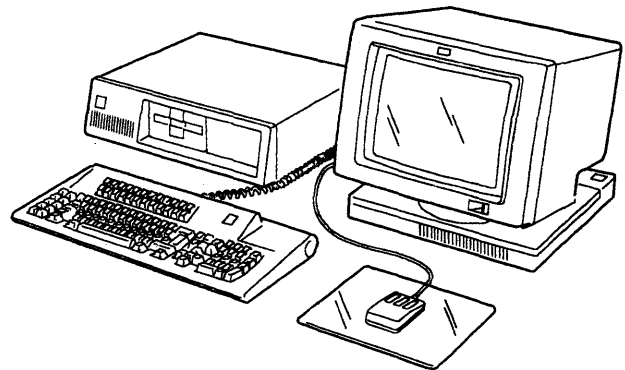
3270-PC/G

LEX40962

Figure 10-3. 3270 PC/G

The IBM 3270 PC/G Color Graphics Workstation (5278/5279/5371) is an interactive graphics/general purpose color work station and a member of the 3270 PC Information Display family. It comprises:

- 5371 System Unit
- Converged Keyboard
- 5279 14-inch Color Display
- 5278 Display Attachment Unit.

The 3270 PC/G Color Graphics Workstation with its associated programming provides comprehensive graphics facilities both for host-interactive applications and Personal Computer applications. These graphics capabilities are in addition to the other family functions such as advanced screen management and the ability to run multiple sessions concurrently.

The Graphics Control Program (GCP) provides complete programming support for the 5279 display, attached to a 5371 System Unit. GCP is built on, and includes, the 3270 PC Control Program functions. GCP resides at the work station.

The Graphical Data Display Manager (GDDM) provides host graphics functions that extend the output graphics capability of the 5279 by allowing the user to interact with the graphics presentation. GDDM resides at the host.

Models

5371 models are:

- Model 012

  - 384Kb RAM, expandable to 640Kb on the PC/G
  - Diskette Adapter and one dual-sided diskette drive
  - 3270 System Adapter
  - Display Unit Adapter
  - Keyboard/Tablet/Mouse Adapter
  - Printer Adapter.

- Model 014

  - Includes Model 012 features, plus
  - 128Kb additional RAM, expandable to 640Kb on the PC/G
  - Second dual-sided diskette drive.

- Model 016

  - Includes Model 012 features, plus
  - 256Kb additional RAM, expandable to 640Kb on the PC/G
  - 10Mb hard file plus adapter card.

Special Features

- 5277 Mouse
- 5083 Tablet Model 002
  - Cursor
  - Stylus.
- 5152 Graphics Printer
- 3852 Model 001 Color Ink Jet Printer
- IEEE-488 Adapter
- RS232C Adapter
- APL Keyboard
- PC Bus Extension Adapter (Models 012 and 014 only).

Configuration Features

The 5371 System Unit is based on a 5160 System Unit for the IBM Personal Computer XT. Thus, it has many hardware features and some I/O devices that are identical to those for other IBM Personal Computer configurations. Certain adapter features (Display Unit Adapter, Keyboard/Tablet/Mouse Adapter, and Printer/Memory Adapter) and I/O devices (5279 and 5379 displays, 5278 and 5378 display attachment units, and the 5277 Mouse) are designed for 3270 Personal Computer G and GX graphics work stations only.

Unit Specifications

Dimensions	
Height	142 mm (5.6 in)
Width	500 mm (19.6 in)
Depth	410 mm (16.25 in)
Weight	
Model 12	12.7 kg (27.9 lb)
Model 14	14.3 kg (31.5 lb)
Model 16	15 kg (33 lb)
Environment	
Air Temperature	15.6° to 32.2°C
	60° to 90°F for system on
	10° to 43°C
	50° to 110°F for system off
Cooling System Unit	Air-cooled via a fan in the 5371
Humidity	50% to 80% system on
	20% to 80% system off
Noise level	51 dBa without printer
	66 dBa with printer
Electrical	100 to 127V, 50 or 60 Hz

Figure 10-4. Unit Specifications for the 3270 PC/6

A power source is required for the 5371 System Unit, 5279 Color Display, 5378 Display Attachment Unit, any installed printer, 5161 Expansion Unit, and each color plotter installed. The 5278 Display Attachment Unit receives power from the 5279 display and the 5379 display receives power from the 5378 Display Attachment Unit. Note that printers and plotters must be placed at least 305 mm (1 ft) away from the display to avoid interference. Also, in a 3270 PC/GX configuration with two displays, the 5379 and 5151 displays can interfere with each other if placed too closely together.

System Expansion Slots

Six full-feature (numbered 1 to 6) and two special-feature (numbered 7 and 8) expansion slots are standard on the system board in all 5371 models to contain memory and adapter features. The full-feature slots will accept full-feature or the smaller special-feature cards. The special-feature slots will accept only the special-feature cards.

Standard and optional features must be installed in specific slots in the 5371 and 5161 units. Slot assignments for standard features of 5371 models are shown below (a blank indicates an available slot):

Slot	Feature	5371 Model		
		12	14	16
1	Display Unit Adapter	X	X	X
2	3270 System Adapter	X	X	X
3	64Kb/256Kb memory expansion option	X 128Kb	X 256Kb	X 192Kb
4	Keyboard/Tablet/ Mouse Adapter	X	X	X
5	Fixed Disk Drive Adapter			X
6	Diskette Drive Adapter	X	X	X
7	Printer Adapter	X	X	
7	Printer/Memory Adapter	X		X 128Kb
8	(Available)			

3270 PC/GX
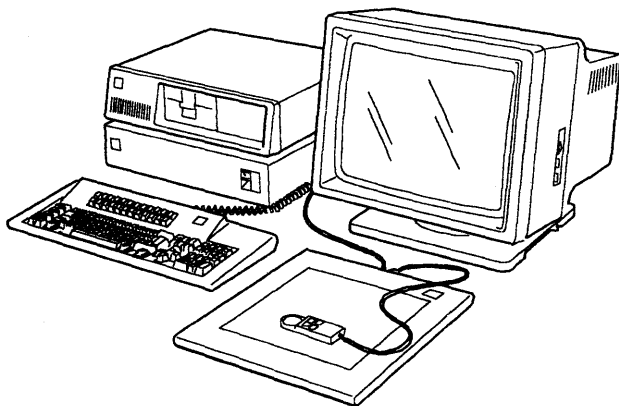
3270-PC/GX

LEX40960

Figure 10-5. 3270 PC/GX

The IBM 3270 PC/GX Color Graphics Workstation (5378/5379/5371) is an intermediate/high-end graphics work station. It provides high performance and large-screen, high resolution alternatives to the 3270 PC/G. It comprises:

- 5371 System Unit
- Converged Keyboard
- 5379 19-inch Color/Mono Display
- 5378 Display Attachment Unit.

The 3270 PC/GX Color/Mono Graphics Workstation provides high performance graphics plus the ability to handle general purpose tasks of a work station with text and alphanumeric data. The graphic functions are available through local programming as well as via interaction with host programming.

The graphics control program (GCP) provides complete programming support for the 5379 display, attached to a 5371 System Unit. GCP is built on and includes the 3270 PC Control Program functions. GCP resides at the work station.

Host graphic functions are provided by GDDM Release 4 and enhanced with additional 5379 functions such as 3-D, 16 colors, and a decreased impact to the host system performance (offload of vector to faster conversion from the host to the work station). Graphical Data Display Manager (GDDM) resides at the host.

Models

5371 models are:

- Model 012

  - 384Kb RAM, expandable to 576Kb on the PC/GX
  - Diskette Adapter and one dual-sided diskette drive
  - 3270 System Adapter
  - Display Unit Adapter
  - Keyboard/Tablet/Mouse Adapter
  - Printer Adapter.

- Model 014

  - Includes Model 012 features, plus
  - 128Kb additional RAM, expandable to 576Kb on the PC/GX
  - Second dual-sided diskette drive.

- Model 016

  - Includes Model 012 features, plus
  - 192Kb additional RAM
  - 10Mb hard file plus the adapter card.

Special Features

- 5277 Mouse
- 5083 Tablet Model 002
  - Cursor
  - Stylus.
- 5152 Monochrome Printer
- 3852 Model 001 Color Ink Jet Printer
- IEEE-488 Adapter
- RS232C Adapter
- APL Keyboard
- PC Bus Extension Adapter (Models 012 and 014 only).

Models Available

Models 160, A60, 161, A61, 162, and A62 of the 5373 System Unit with a 6 MHz 80286 Microprocessor are offered for a 3270 PC AT/G or AT/GX configuration. The A models are provided with the 3270 PC APL Keyboard, while the others are provided with the 3270 PC standard keyboard. The six models provide three standard configurations to select from on the basis of user need. The models differ only in the standard features included and otherwise are physically and functionally identical.

The following are 5373 models:

5373 Model 161

- 80286 Microprocessor (6 MHz)
- 640Kb RAM
- Eight system expansion slots
- One Display/Mouse/Tablet Adapter
- Fixed Disk and Diskette Drive Adapter
- One 5.25-inch High-Capacity Diskette Drive
- One 20Mb fixed disk drive
- One Serial/Parallel Adapter
- One 3270 Systems Adapter
- 3270 PC Standard Keyboard.

5373 Model 162

- 80286 Microprocessor (6 MHz)
- 1024Kb RAM
- Eight system expansion slots
- One Display/Mouse/Tablet Adapter
- Fixed Disk and Diskette Drive Adapter
- One 5.25-inch High-Capacity Diskette Drive
- One 20Mb fixed disk drive
- One Serial/Parallel Adapter
- One 3270 Systems Adapter
- Math Coprocessor Option
- 3270 PC Standard Keyboard.

The 5373 Model A61 provides the same features as the 5373 Model 161 except for the keyboard, which is the 3270 PC APL Keyboard. Similarly, the 5373 Model A62

provides the same features as the 5373 Model 162 and the 3270 PC APL Keyboard. These four configurations are designed for host attachment as supported by the 3270 PC graphics control program Version 3.2 or 3.21.

5373 Models A29 and A39

- 80286 Microprocessor (8 MHz)
- 1024Kb RAM
- Eight system expansion slots
- Display/Mouse/Tablet Adapter
- Fixed Disk and Diskette Drive Adapter
- One 5.25-inch High-Capacity Diskette Drive
- One 30Mb diskette drive
- One Serial/Parallel Adapter
- One Advanced 3278/79 Emulation Adapter
- Math Coprocessor Option
- 3270 PC APL Keyboard.

5373 Models E29 and E39

- 80286 Microprocessor (8 MHz)
- 1024Kb RAM
- Eight system expansion slots
- Display/Mouse/Tablet Adapter
- Fixed Disk and Diskette Drive Adapter
- One 5.25-inch High-Capacity Diskette Drive
- One 30Mb diskette drive
- One Serial/Parallel Adapter
- One Advanced 3278/79 Emulation Adapter
- Math Coprocessor Option
- Enhanced (101-Key) Personal Computer Keyboard.

System Expansion Slots

Eight system expansion slots (numbered 1 through 8) are standard on the system board to contain memory and adapter features. Slots 1 and 7 consist of one 62-pin socket each and support 8-bit transfer operations. These two slots are functionally equivalent to the full-feature slots in 5150, 5155, 5160, 5271, and 5371 system units.

The other six slots each consist of one 62-pin connector and one 36-pin connector and support 16-bit transfer operations. Some 5373 features require the two-connector slots (128Kb Memory Expansion Option, 512Kb Memory Expansion Option, 128Kb/640Kb Memory Expansion Option, 512Kb/2Mb Memory Expansion Option, and Fixed Disk and Diskette Drive Adapter, which support 16-bit data transfers).

Standard features are installed in specific slots as shown following (a blank indicates an available slot). Optional features can be installed in any available slot.

Slot	Feature	5373 Model			
		160/ A60	161/ A61	162/ A62	A/E29 A/E39
1	3270 Systems Adapter		X	X	X
2	128Kb Memory Expansion Option		X		
3	512Kb Memory Expansion Option			X	
3	512Kb/2Mb Memory Expansion Option				X
4	(Available)				
5	(Available)				
6	Display/Mouse/ Tablet Adapter	X	X	X	X
7	Serial/Parallel Adapter	X	X	X	X
8	Fixed Disk and Diskette Drive Adapter	X	X	X	X

5279 Color Display and 5278 Display Attachment Unit
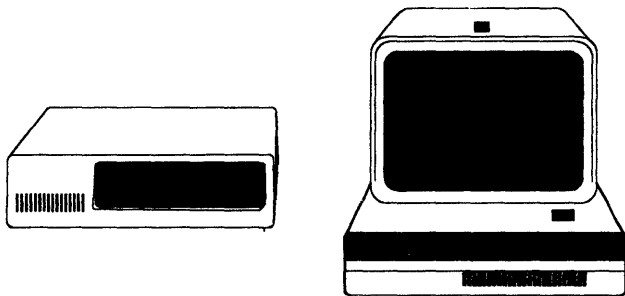
LEX42657

Figure 10-6. 5279 Color Display and 5278 Display Attachment Unit

The 5279 Color Display and 5278 Display Attachment Unit are stand-alone units in a 3270 PC/G or 3270 PC AT/G work station configuration. The 5279 is an all-points-addressable (APA), medium-resolution color display that is designed for general graphics work, such as the creation of simple pictures, pie charts, bar charts, histograms, foils, and layout diagrams. A standard tilt and swivel stand or the optional tilt and swivel stand with height adjustment can be selected to hold the 5279 display, which can be mounted on the 5278 unit.

The 5278 Display Attachment Unit Model 001 is designed for use with the 3270 PC/G configuration and attaches to the 5371 System Unit. The 5278 Display Attachment Unit Model 002 is functionally like the 5278 Model 001 but designed for use with the 3270 PC AT/G configuration and attaches to the 5373 System Unit. When the 5278 Model 001 is attached to a 5373 unit, interference can be caused on part of the screen under certain circumstances and customers should evaluate this front-of-screen effect for acceptability in their own environment.

The 5278 Display Attachment Unit provides alphameric and graphics processing functions, buffer storage for the 5279 display, and emulation of the Color/Graphics Monitor Adapter for other IBM Personal Computers. The 5278 contains hardware to assist in drawing lines and filling areas to draw a graphics picture.

The 5278 unit connects to the 5371 or 5373 System Unit via the IBM-supplied 1-m (3-ft) signal cable and to the 5279 via the IBM-supplied 680-mm (26.7-in) signal cable. The 5278 receives power from the 5279 unit, which has a 1.8-m (6-ft) power cord and requires its own power source.

Unit Specifications

The 5278 unit has the following dimensions and weight:

- Width 411 mm (16.2 in)
- Depth 380 mm (15 in)
- Height 37 mm (1.5 in)
- Weight 8.2 kg (18 lb)

The 5279 display has the following characteristics:

- Screen size is 14 inches (diagonal measurement) with a viewing area of 240 mm (9.4 in) × 181 mm (7.1 in).
- Screen viewing are displays 32 rows of 80 characters (2560 characters) or 49 rows of 80 characters (3920 characters) as selected during customization of the 3270 PC Graphics Control Program, Version 1.
- Screen resolution is 720 pels horizontal and 512 pels vertical (76 pels per inch).
- Display refresh time is 42 times per second noninterlaced.
- Characters are displayed using 9 × 10 pels (or 8 × 10 pels in a DOS session) in a 9 × 16 box.
- Graphics and alphameric information is displayed in up to eight colors and the Color/Graphics Monitor Adapter is emulated.
- Screen has an antiglare coating and high brightness to minimize reflections.
- Brightness controls are provided.
- Voltage is 100 to 127 volts, 50 or 60 Hz.

- Dimensions are:
  - Width 411 mm (16.2 in)
  - Depth 400 mm (15.7 in)
  - Height 315 mm (12.4 in) without stand, or 359 mm (14.1 in) with standard stand, or 372.5 mm (14.7 in) to 522.5 mm (20.5 in) with adjustable stand.
- Weight is 18.2 kg (40 lb) or 25 kg (55 lb) with lift/tilt/swivel stand.
- Tilt is -5 to +20°.
- Swivel is ± 40°.

Environmental requirements for the 5279 and 5278 are:

- Temperature
  - 15.6° to 32.2°C (60° to 90°F) for system on
  - 10° to 43°C (50° to 110°F) for system off.
- Humidity
  - 8% to 80% for system on
  - 20% to 80% for system off.

5379 Displays and 5378 Display Attachment Units
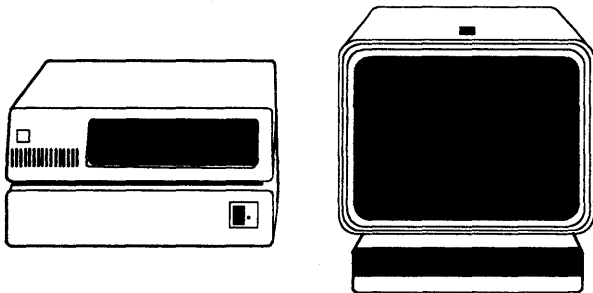
LEX42656

Figure 10-7. 5379 Display and 5378 Display Attachment Unit

A 5379 Display and 5378 Display Attachment Unit are standard units in a 3270 PC/GX or 3270 PC AT/GX work station configuration. The 5379 Monochrome Display Model M01 or 5379 Color Display Model C01 can be selected for a 3270 PC/GX or 3270 PC AT/GX configuration. The 5379 units are all-points-addressable (APA), high-resolution displays that provide higher resolution and higher performance than the 5279 Color Display. The 5379 Color Display is designed for precision graphics work where color offers an advantage, such as map drawing, electronic design, and complex business graphics. The 5379 Monochrome Display is designed for high-precision graphics work and text applications, such as engineering drawings and page composition.

The 5379 Display is mounted in an enclosure that contains a convenient moveable tilt and swivel mechanism that enables the display to be positioned to suit the user's needs.

The 5378 Monochrome Display Attachment Unit Model M01 supports the 5379 Monochrome Display, and the 5378 Color Display Attachment Unit Model C01 supports the 5379 Color Display. The 5378 units provide higher performance than the 5278 Display Attachment Unit because of the inclusion of a graphics processor (Motorola 68000 Microprocessor) in the 5378 unit. The microprocessor performs vector, character, and image processing. The 5378 also contains 128Kb of memory for vector lists, standard and user-defined characters, character buffers, and system functions. This memory is shared by the 68000 and 8088/80286 Microprocessors.

The 5378 units have the following physical characteristics:

- Width 495 mm (19.5 in)
- Depth 406 mm (16 in)
- Height 130 mm (4.7 in)
- Weight 14 kg (31 lb).

The 5378 unit connects to the 5371 or 5373 System Unit via an IBM-supplied 1-m (3.3-ft) signal cable and to the 5379 display via IBM-supplied 2-m (6.6-ft) cables. The 5378 has a 1.8-m (6-ft) power cable and requires its own power source. The 5378 unit can be stacked over or under the 5371, 5373, or 5161 unit.

The 5379 Monochrome Display and 5379 Color Display have the following characteristics:

- Screen size is 19 inches (diagonal measurement) with a viewing area of 280 mm (11 in) × 280 mm (11 in).
- Screen viewing area can display 50 rows of 80 characters (4000 characters) for the alphameric layer.
- Screen resolution is 1024 pels vertical and 1024 pels horizontal for the graphics layer (93 pels per inch). This is equal to the resolution of the 5080 Graphics System Display. A resolution of 960 horizontal pels and 1000 vertical pels is supported by the 3270 PC Graphics Control Program, Version 1, in a viewing area 261 mm × 279 mm (10.3 in × 11 in)
- Display refresh time is 52 frames per second non-interlaced.
- For the 5379 Color Display, up to 16 colors for the graphics layer and up to eight colors for the alphameric layer are supported.
- For the 5379 Monochrome Display, up to four intensities for the graphics layer and up to two intensities for the alphameric layer are supported.
- Characters are displayed using 12 × 20 character box.

- Brightness control for the color and monochrome displays and degauss control for the color display are provided.
- Voltage is 100 to 127 volts, 50 or 60 Hz.
- Screen has an antiglare coating and high brightness to minimize reflections, and images are distortion-free.
- Dimensions for both displays are:
  - Width 500 mm (19.7 in)
  - Depth 488 mm (19.2 in) for the color display and 525 mm (20.7 in) for the monochrome display
  - Height 460 mm (18.1 in)
- Weight is 35 kg (77 lb)
- Tilt is -5 to +15°.
- Swivel is ± 120°.

Environmental characteristics for the 5379 and 5378 units are:

- Temperature
  - 15.6° to 32.2°C (60° to 90°F) for system on
  - 10° to 43°C (50° to 110°F) for system off.
- Humidity
  - 8% to 80% for system on
  - 20% to 80% for system off.

5277 Mouse and 5083 Tablet Model 002

One 5277 Mouse or one 5083 Tablet Model 002 can be attached to the 5371 unit in a 3270 PC/G or GX or to the 5373 in a 3270 PC AT/G or AT/GX configuration at a time. The 5083 or 5277 attaches to the 5371 (via the Keyboard/Tablet/Mouse Adapter) or 5373 (via the Display/Tablet/Mouse Adapter) via a 1.5-m (5-ft) signal cable and provides an alternative to the keyboard for controlling the cross-hair graphics cursor on the display screen.

5083 Tablet Model 002
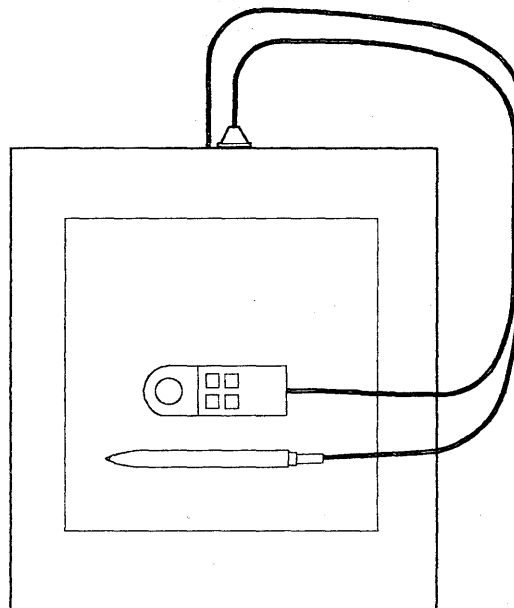
LEX42654

Figure 10-8. 5083 Tablet Model 002

The 5083 Tablet Model 002 provides higher-precision cursor positioning than the mouse. The tablet is 400 mm × 431.8 mm (15.8 in × 17 in) in size with an 20.3-mm (0.8-in) height, has an active area of 292 mm × 292 mm (11.5 in × 11.5 in), and weighs 2.9 kg (6.5 lb). It connects to the 5371 or 5373 unit via a 2-m (6.6-ft) signal cable.

The 5083 Tablet Model 002 can also be connected to the Asynchronous Communications Adapter in a 5150 or 5160 configuration or to the serial port of a Serial/Parallel Adapter in a 5170 configuration using the 5083 Tablet Model 002 Personal Computer Attach Cable and Power Supply.

The tablet provides a resolution of 200 lines per inch and offers a choice of two user-controlled inputs: the four-button cursor or the stylus. Both can be ordered but only one can be used at a time. The stylus or cursor is used to supply exact positions (x-y coordinates) on the tablet.

The tablet cursor is a convenient, hand-held, mouse-shaped unit with four buttons that can be assigned functions by application programs and a fine cross hair that permits the cursor unit to be positioned over a precise point on the tablet. The cross-hair cursor can be used to copy onto the display screen a drawing that is lying on the tablet. The tablet cursor can be used for general control of the graphics cursor on the display and for addressing specific areas of the screen.

5277 Mouse
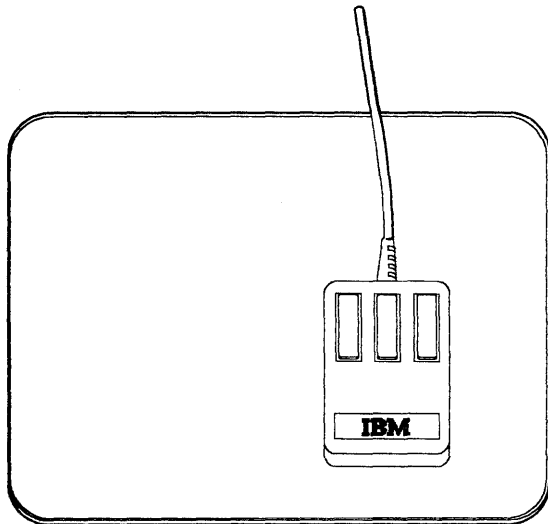
LEX42653

Figure 10-9. 5277 Mouse

The 5277 Mouse is an easy-to-use device for controlling the position of the graphics cursor on the display screen. The graphics cursor is controlled by moving the mouse on a thin pad printed with horizontal and vertical lines. As the mouse moves, it optically scans a pattern printed on the pad and sends movement coordinates to the 5371 or 5373 via the cable attaching the mouse to the 5371 or 5373 unit. Thus, the mouse supplies changes in position, and programming determines the response of the graphics cursor to the movement of the mouse.

The mouse has three keys that initiate an action when pressed. Two of these keys can be assigned specific functions by application programming (like the function keys on the keyboard), such as function selection and function initiation. The mouse is 66 mm × 99 mm (2.6 in × 3.9 in) in size, 25 mm (1 in) high, and weighs 168 g (6 oz).

5378 Card Plugging Chart		
Board*	Position	Description
A1	A2	Update Control Card 8223584
A1	B2	System Control Card 8223717
A1	C2	Graphics Processor Card 6243723
A1	D2	Display Bus Receiver Card 8233700
B1	A2	Clock and Video Driver Card 8223671
B1	B2	Bit Plane Card 5147884
B1	C2	Bit Plane Card 5147884
B1	D2	Bit Plane Card 5147884
B1	B2	Bit Plane Card 5147884
B1	C2	Bit Plane Card 5147884
B1	D2	Bit Plane Card 5147884

*A = Color
B = Mono

3270 Unique Error Codes

3270 Personal Computer, G, and GX system board settings are the same as for 5160. For 3270 displays, positions 5 and 6 (display adapter switch settings) should be set in the on position.

3270 Personal Computer AT, G, and GX system board settings are the same as the 5170.

Indication	FRU
28XX DFCA Card	DFCA Card (3270 Emulation Adapter Card)
32XX Display Adapter Card	Display Adapter Card Programmed Symbols Adapter Card All-Points-Addressable Adapter Card Extended Graphics Adapter Card (3270 Personal Computer Personal Computer AT Only) Top Card Connector

Indication	FRU
44XX Display Attachment Unit	5278 Display Attachment Unit and 5279 Display 5378 Display Attachment Unit and 5379 Display
(3270 PC/G and GX AT-based)	Display/Mouse/Tablet Adapter Card EMA Extended Memory Adapter Card
(3270 PC/G and GX XT-based)	Display Adapter Card
45XX IEEE Interface Adapter Card	IEEE Interface Adapter Card (IEEE—488)

Diagnostic Tips and Information on PC/G, PC/GX, AT/G, and AT/GX

The PC/G Customer Diagnostic Diskette is to be used by the CE for diagnostics. This diskette is stored in the *Guide to Operations* manual at the customer site.

False 2801 Errors during POST When Using 5371 System Units

If you have replaced a long DFCA card with a short DFCA card, the Keyboard/Mouse/Tablet Adapter card has to be updated. For this fix, see ECA040.

5378 Card Socket Column Pin Locations
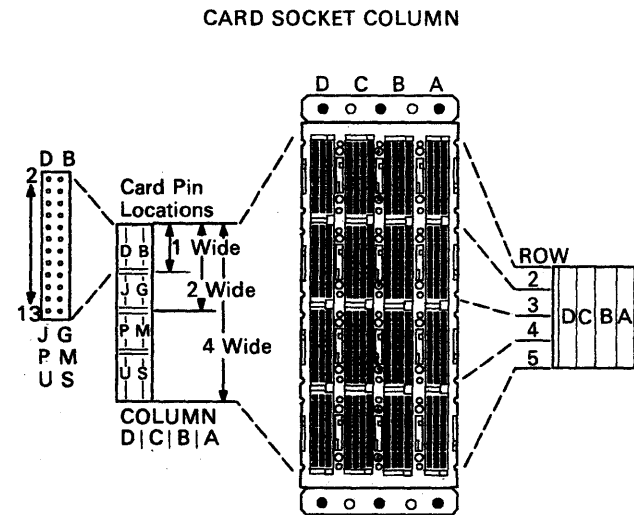
LEX42686

Figure 10-10. 5378 A and B Gate Pin Locator

A good way to remember the card pin locations D, J, P, U, B, G, M, and S within a row is to use this saying: Dow Jones Prices Up Buy General Motors Stock.

5378 Display Attachment Unit boards can be wrongly inserted, which will damage cards.

When replacing the 5378 A1 or B1 board, the following orientation procedure must be followed to avoid incorrect insertion.

Follow the procedure in the 5378, 9 MIM, Section 5780 and 5790, Removing the 5378 Gate-A and -B Logic Board. When installing boards, look for an angled corner to the land pattern and install the board with this corner farthest away from the fan and to the top of the housing. The A1 board has this corner to the bottom of the housing.

When powering up only the 5378/5379 and not the 5371, the test pattern is not displayed. A blank screen exists; however, the customer application runs fine. Fix the A1D2 card in the 5378; display the Bus Driver card.

5371

Some early level 5371 units did not include a change to the Keyboard/Tablet Adapter card. The symptoms are:

1. Random/garbage characters from the keyboard after power on.
2. The problem is intermittent and will not occur at every power on.

The suspect adapter cards can be identified as follows:

1. They are approximately 1.5 inches short of a full-size card.
2. They will have no yellow wires on the solder side. Not every such adapter card will fail; replace only as necessary.

When installing a new Distributed Function Communication Adapter in a 5378 System Unit, you will require customer and advanced level diagnostics at Level 2.40 or later. Diagnostics at a lower level than this will produce an error of 2858. Even when there is no failure of the adapter, customer diagnostics are available under P/N1887728. Advanced level diagnostics are available under P/N1887729.

5378

If a power supply fails (no power light on), look for a voltage switch at the rear of the 5378 power supply in the upper right-hand corner. The front switch will state the voltage it is presently set for (115 for U.S.A./Canada or 22 for W.T.). Move the switch to the correct position and try the power supply again.

5379

Display is out of focus because of arcing of capacitors on CRT card, or high-voltage arcing across capacitors causes unstable display.

High-voltage arcing or focus problems can be caused by the CRT card capacitors. The two capacitors mounted on the side of the CRT card that faces away from the CRT tube are causing the arcing. A new card to correct the problem will be released as soon as possible. A temporary fix is to separate the two from each other as far as physically possible. If this does not correct the condition, obtain assistance through normal support.

5379

The deflection card, P/N4421622, has a plug compatibility problem with the XY-connector that comes from the CRT yoke. The problem will be experienced when a new card or CRT is being replaced.

The XY-connector was changed with units starting with S/N 2585 and is not compatible with the old style connector. The old style plug and connector is green; the new one is brown. CRT/Adapter kit, P/N59X6942, will correct this problem. Refer to ECA037.

For further diagnostic information, see the *IBM 3270 AT/G and GX Maintenance Information Manual*, SY33-0125-0.

Memory Option Switches

switch settings, 3270 PC

The following charts show the switch settings for the memory expansion options that can be installed in the IBM 3270 Personal Computer and the IBM 3270 Personal Computer G and GX.

These options are:

- 64Kb/256Kb Memory Expansion Option Adapter, referred to as the 64Kb/256Kb Adapter in the chart below.

- 128Kb Printer-Memory Adapter, referred to as the Printer-Memory Adapter in the chart below.

- 256Kb Printer-Memory Expansion card, referred to as the 256Kb Plug-On card in the chart below.

(The switches discussed are on the adapters.)

384Kb Total Memory
128Kb + (256Kb on system board)

	64Kb/256Kb Option Card Switches	Printer-Memory Adapter
(1) 64Kb/256Kb Option with 128Kb installed	1 2 3 4 5 6 7 8 1 0 1 1 0 1 0 0	
(1) Printer-Memory Adapter (128Kb)		1 2 3 4 0 1 0 1

448Kb Total Memory
192Kb + (256Kb on system board)

	64Kb/256Kb Option Card Switches	Printer-Memory adapter
(1) 64Kb/256Kb Option with 192Kb installed	1 2 3 4 5 6 7 8 1 0 1 1 0 0 1 0	
(1) Printer-Memory Adapter (128Kb) (1) 64Kb/256Kb Option with 64Kb installed	1 2 3 4 5 6 7 8 1 0 0 1 1 0 0 0	1 2 3 4 0 1 0 1

512Kb Total Memory
256Kb + (256Kb on system board)

	64Kb/256Kb Option Card Switches	Printer-Memory adapter
(1) 64Kb/256Kb Option with 256Kb installed	1 2 3 4 5 6 7 8 1 0 1 1 0 0 0 1	
(1) Printer-Memory Adapter (128Kb) (1) 64Kb/256Kb Adapter with 128Kb installed	1 2 3 4 5 6 7 8 1 0 0 1 0 1 0 0	1 2 3 4 0 1 0 1

576Kb Total Memory
320Kb + (256Kb on system board)

	64Kb/256Kb Option Card Switches	Printer-Memory Adapter
(1) Printer-Memory Adapter (128Kb) (1) 64Kb/256Kb Option with 192Kb installed	1 2 3 4 5 6 7 8 1 0 0 1 0 0 1 0	1 2 3 4 0 1 0 1
(1) 64Kb/256Kb Option with 256Kb installed (1) 64Kb/256Kb Option with 64Kb installed	1 2 3 4 5 6 7 8 1 0 1 1 0 0 0 1 1 2 3 4 5 6 7 8 0 1 1 1 1 0 0 0	

640Kb Total Memory
384Kb + (256Kb on system board)

	64Kb/256Kb Option Card Switches	Printer-Memory Adapter
(1) Printer-Memory Adapter (128Kb) with (1) 256Kb Plug-On card		1 2 3 4 1 0 0 1
(1) Printer-Memory Adapter (128Kb) (1) 64Kb/256Kb Adapter with 256Kb installed	1 2 3 4 5 6 7 8 1 0 0 1 0 0 0 1	1 2 3 4 0 1 0 1
(1) 64Kb/256Kb Adapter with 256Kb installed (1) 64Kb/256Kb Adapter with 128Kb installed	1 2 3 4 5 6 7 8 1 0 1 1 0 0 0 1 1 2 3 4 5 6 7 8 0 1 1 10 1 0 0	

3270 Personal Computer G and GX (AT-Based Only) Extended Memory Adapter

Personal Computer G and GX (AT-Based Only) Extended Memory

The memory needed for graphics display capability is provided by Memory Expansion Adapter cards. The type of IBM Memory Adapter approved for this is determined by the BIOS and graphics control program (GCP) level.

Two types of extended memory are used on the AT G and AT GX systems: Even Megabyte Aligned (EMA) memory and Contiguous memory. (Contiguous memory is the type used in the 5170 and other PC system types).

Information on EMA Memory Versus Contiguous Memory

EMA Memory	Contiguous Memory
1. Is used with system boards having BIOS dated prior to 11/15/85 and GCP before level 3.21.	Is used with system boards having BIOS dated 11/15/85 and after and with GCP at 3.21.
2. Is not in advanced diagnostic setup.	Is in advanced diagnostic setup.
3. Is not on the installed devices list.	Is on the installed list.
4. Is not tested during POST.	Is tested during POST.
5. Is tested using an EMA memory test on the G and GX.	Is tested using the normal memory test on the G and GX Diagnostic.
6. Switches are set using special switch settings in the *HMS* manual and this manual.	Switches are set using normal switch setting in the *5170 HMS* manual under expansion memory. **Exception:** See Contiguous memory note.
7. The 128Kb to 640Kb and the 512Kb Memory Adapter cards are approved for EMA use. Other IBM memory adapters might be used by your customers, but when these cards are used for EMA memory, they cannot access the total memory on the card.	The 128Kb to 640Kb, 512Kb, and 0.5Mb to 3Mb memory cards are approved for use with Contiguous memory.

Contiguous GCP Memory Note

If the 128Kb to 640Kb, 0.5Mb to 2Mb, or 0.5Mb to 3Mb Memory Adapter is switched to use split addressing (in which part of the adapter memory is used for base memory and part is used for expansion memory), precautions must be observed by your customer in the GCP Setup as below, and at least 1Mb must be installed on the adapter.

How to Configure GCP

GCP must be configured using the GCP Setup program to allocate the next lower increment of 512Kb. For example, if the card contains 3Mb memory and the base memory is currently 512Kb or 256Kb, then GCP must be configured for 2560Kb expanded memory. The remaining 384Kb or 128Kb of expanded memory can be used by the VDISK driver.

Split Addressing, Contiguous Memory Switch Settings

128Kb to 640Kb Memory Adapter Switch Settings

First Memory Adapter (Starting Address 1Mb), P/N6279116, Switch Settings:

    1 = On
    2 = On
    3 = On
    4 = Off
    5 = On
    6 = *
    7 = *
    8 = *.

Switches 6 and 7 are used for split addressing as follows:

- Base memory already installed 256Kb. Sw 6 = on, 7 = off.
- Base memory already installed 512Kb. Sw 6 = off, 7 = on.
- Base memory already installed 640Kb. Sw 6 = off, 7 = off.

Switch 8 = on enables I/O ports; 8 = off disables I/O ports. Use of memory adapters with Even Megabyte Aligned (EMA) and Contiguous GCP memory.

0.5Mb - 2Mb Memory Adapter, P/N59X7294, Switch Settings

First memory adapter (Starting Address 1Mb) Switch Settings

    1 = On
    2 = On
    3 = On
    4 = Off
    5 = On
    6 = On
    7 = On
    8 = On.

0.5Mb - 3Mb Memory Adapter, P/N55X3619, Switch Settings

First memory adapter (Starting Address 1Mb) Switch Settings:

    1 = On
    2 = On
    3 = On
    4 = Off
    5 = On
    6 = *
    7 = *
    8 = *.

Use of on and off indicates which side of the switch is depressed.

Switches 6 and 7 are used for split addressing as follows:

- Base memory already installed 256Kb. Sw 6 = on, 7 = off.
- Base memory already installed 512Kb. Sw 6 = off, 7 = on.
- Base memory already installed 640Kb. Sw 6 = off, 7 = off.

Switch 8 = on enables I/O ports; 8 = off disables I/O ports. Use of memory adapters with Even Megabyte Aligned (EMA) and Contiguous GCP memory.

Even Megabyte Aligned (EMA) GCP Memory Switch Settings

EMA memory was used with BIOS dated earlier than 11/15/85. EMA memory is used by GCP at addresses 12Mb to 13Mb and 14Mb to 15Mb. The amount of EMA memory is therefore limited and the 0.5Mb to 2Mb and 0.5Mb to 3Mb cards cannot use all their memory capability.

512Kb Memory Adapter, P/N8286115

The use of the 512Kb Memory Adapter is supported on these machines.
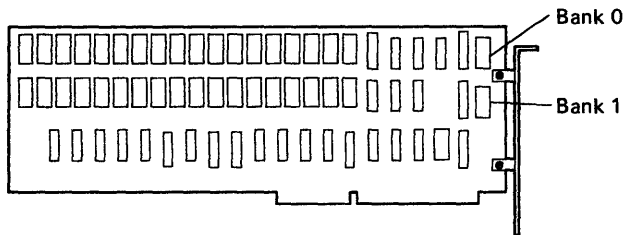
LEX41762

Figure 10-11. EMA Extended Memory Adapter Card Switches
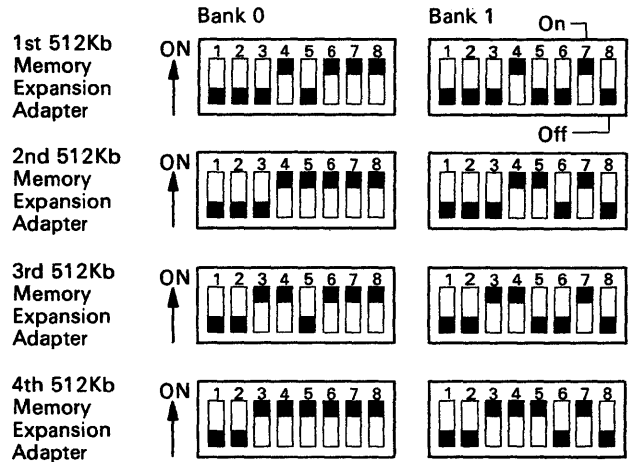
LEX41763

Figure 10-12. EMA Extended Memory Adapter Cards Switch Settings

128Kb/640Kb Memory Adapter, P/N6279116

The 128Kb/640Kb Memory Adapter can be used on 5373 machines to fill the base memory to 640Kb and provide 512Kb of EMA memory.

Switch settings (Starting Address 14.5Mb and using top up of base memory to 640Kb):

    1 = Off
    2 = Off
    3 = Off
    4 = On
    5 = Off
    6 = On
    7 = On
    8 = Off.

As stated previously, IBM does not support the use of 0.5Mb to 2Mb or the 0.5Mb to 3Mb Memory Adapter cards when using EMA memory, but if your customer has these cards installed, the switch settings below will allow you to reset the switches if they were changed for testing or other reasons.

0.5Mb – 2Mb Memory Adapter, P/N59X7294

The 0.5Mb – 2Mb card if fully populated will give 1Mb of EMA storage if the starting address is set to 13Mb.

Switch settings for a fully populated card:

    1 = Off
    2 = Off
    3 = Off
    4 = On
    5 = On
    6 = Off
    7 = Off
    8 = Off.

0.5Mb – 3Mb Memory Adapter, P/N55X3619

The 0.5Mb – 3Mb card if **fully** populated will give 1Mb of EMA storage if the starting address is set to 13Mb.

Note: The address switches should be set **not** to use split addressing.

Switch settings (* = either on or off) for a fully populated card:

    1 = Off
    2 = Off
    3 = On
    4 = Off
    5 = On
    6 = Off
    7 = Off
    8 = *.

The 0.5Mb – 3Mb card if populated with 2Mb will give 1Mb of EMA storage if the starting address is set to 14Mb.

Note: The address switches should be set **not** to use split addressing.

Switch settings (* = either on or off):

    1 = Off
    2 = Off
    3 = Off
    4 = On
    5 = On
    6 = Off
    7 = Off
    8 = *.

Chapter 11. Tempest Products
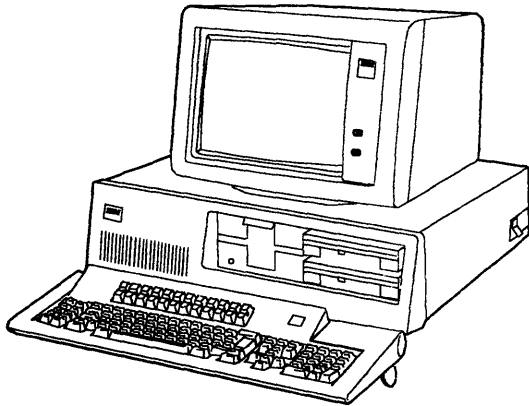
LEX42458

Figure 11-1. Tempest System (PC XT-Based)

Product Description

TPC products are personal computers designed to qualify under the federal government's Tempest program. The Tempest process prevents data that is being processed within the system from emanation into the surrounding environment, where it is subject to electronic detection. The Tempest process is made possible through the addition of specially designed filters and covers.

All electronic emission problems are the responsibility of the customer. The customer must identify the problem and the failing unit (system unit, display, keyboard) and further identify the failing component in the system unit. Service personnel will then replace the failing component. NSD will ensure that covers and cable connectors are properly installed and that the defective component identified by the customer is replaced. Any additional customer assistance for electronic emission failures and non-hardware problems will be provided by the normal support structure.

The following table shows Tempest to Standard conversion:

Machine Types

Tempest	Standard
4450	5150
4451	5151
4453	5153
4454	5182
4455	5160
4456	5271
4457	5272
4458	5161
4459	5170
4460	5273

Removable Hard File Cartridge Handling Information

The following is a list of procedures associated with the handling of the removable hard file cartridges. Please review this list and be aware that not following these precautions can result in cartridge and/or disk drive damage and possible loss of data.

1. Use only beige-colored cartridges in 5Mb drives and gray-colored cartridges in 10Mb drives.

2. Do not drop cartridge. (Dropped cartridges must not be reloaded as disk drive damage can result.)

3. A suspected bad cartridge must not be loaded into any other drive. (A cartridge that has been damaged can damage any drive it is loaded into.)

4. Do not attach anything (such as labels) to the bottom of the cartridge.

5. Do not expose the cartridge to magnetic fields, excessive heat, moisture, or contaminated environments.

6. Keep cartridge in its protective sleeve when not in use.

7. Allow the cartridge to stabilize to room temperature for at least one hour before use.

8. If the disk drive fails to ready after cartridge load, clean the cartridge's armature plate (round metal plate located on bottom of cartridge) with a dry, lint-free cloth. A cartridge cleaning kit is now available: order P/N101A999.

9. If you have any question in your mind about the condition of a cartridge—*DO NOT LOAD IT*—disk drive damage can result.

10. Do not unload cartridges from the disk drive until the indicator light on the drive has stopped flashing. *SEVERE DAMAGE CAN RESULT.*

Note: The disk surface can be examined for obvious flaws by carefully opening the disk access door and turning the disk spindle.
CAUTION: DO NOT TOUCH THE DISK SURFACE.

Removable Hard File Disk Format Command

Do not use diagnostics to format removable cartridges.

The format option No. 2 of the Advanced Diagnostics, Test 17 (Fixed Disk Drive(s) and Adapter Test), must not be used to format the removable hard file cartridges.

The DOS format command is the only approved method of formatting removable cartridges. If diagnostics are used to format the cartridge, special factory-written tracks will be overwritten, making the cartridge unusable.

Note: In order to write data on the 10Mb removable hard file cartridge, the write-protect tab must be removed. This is unlike the 5Mb removable hard file cartridge for which the write-protect tab must remain on the cartridge to write data.

5Mb Removable Hard File Disk Cartridge Temperature

Due to the normal operating temperature of the 5Mb removable hard file, disk cartridges installed in machines a long time will have a buildup of heat. The disk cartridge will appear to be warm when unloaded from the disk drive. Caution must be observed, however, not to touch the metal armature plate or drive spindle (located on the bottom of the cartridge) as it can be hot to the touch: 130°F.

5Mb Removable Hard File Ready Cycle Error Codes

The 4456 5Mb Removable Hard Disk Drive has a ready cycle that is dependent on the temperature differential between the drive spindle and the disk cartridge. This cycle can be as short as 30 seconds and as long as 5 minutes. If the disk drive has not become ready prior to the system unit's completion of the power-on self test (POST), a 1701 error will be indicated on the system's display. Wait until Drive C and Drive D are ready (indicated by the light being out on the front of the drive) and re-IPL the system using the control-alternate-delete keyboard sequence.

Trying to load diagnostics against a drive that is not ready will also give the same indication. Again the

system must be re-IPLed to clear the 1701 error indication.

Note: A defective removable hard file and/or adapter card can also present a 1701 error code when diagnostics are loaded. Press F1 to continue, as noted on the display, to load the diagnostic diskette.

Removable Hard File Addressing and Termination

When a C or D removable disk drive unit is replaced, ensure that the address jumper and termination are correct. To do this, turn the disk drive assembly upside down and notice the pins located on the back right corner of the circuit board. These pins are marked 1 through 8. (See Figure 11-2.)

The upper drive (viewing as installed in machine) must have a jumper on pins 1 and 2.

The lower drive (viewing as installed in machine) must have a jumper on pins 2 and 3.

The Blue R-Pac must be installed on the lower drive only. Do not install an R-Pac on the upper drive.
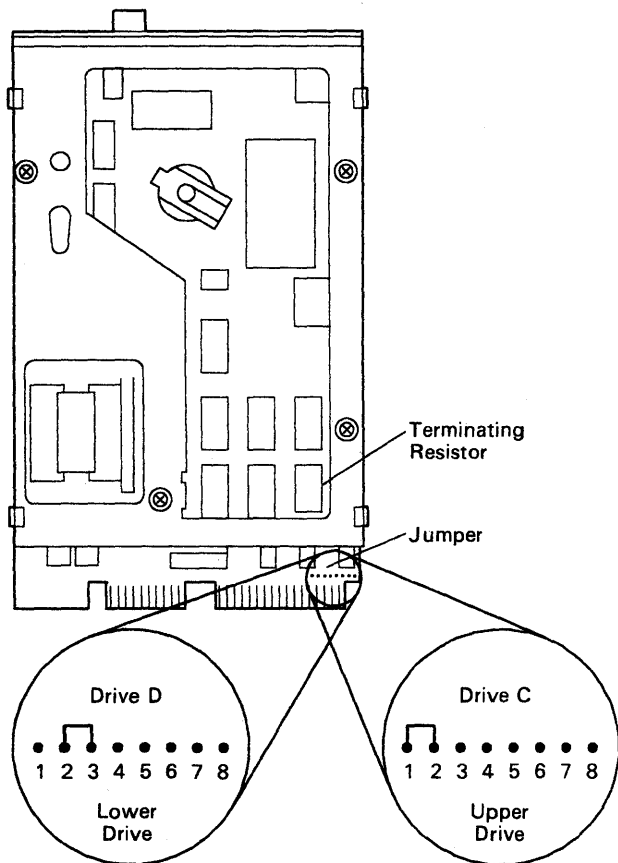
Figure 11-2. Removable Cartridge Disk Drive (Bottom View)

Jumper Settings for Removable Hard File Adapters

Jumper positions for the Removable Hard File Adapter (Adapter card), P/N101A315, for use with the 5Mb removable hard file must be set as follows: (A-B), (E-F), (G-H). See Figure 11-3.

The 10Mb Removable Hard File Adapter jumpers are set the same as the 5Mb with the exception of two added jumpers on positions (O-P) and (S-T). See Figure 11-3.

If additional jumpers are needed, order P/N1650667.

Note: Two different style adapters are currently available to the field; both are shown in Figure 11-3.
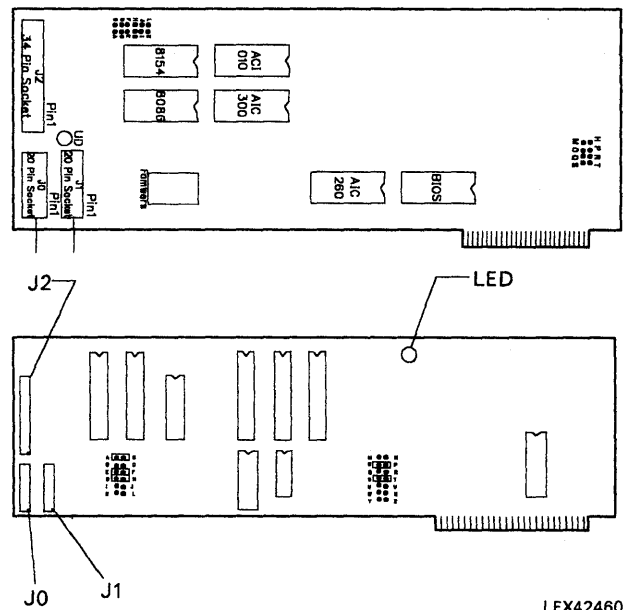
Figure 11-3. Removable Hard File Adapter (Adapter Card)

5Mb Removable Hard File Drive to Adapter Cabling

Cabling in the *4456 MIM* is not clear, and the following information is provided to assist in proper cabling of the removable disk drive assembly to the Removable Disk Drive Adapter.

Cable connectors are not labeled and caution must be taken to identify the connectors before their removal from either the drive or the Adapter card. (This will make the reinstallation of the cables much easier.) It is important that the cables be installed correctly for the proper operation of the 5Mb Hard Disk System.

Cables can be installed incorrectly and drives might appear to function normally.

If ECA008 is installed, the cabling has been changed to a prefolded cable assembly. On this cable assembly, the connectors are now keyed at the disk drive; however, care must be used to ensure proper installation of the Adapter card.

Control Cable (Wide Cable Attached to Both Drives)

The larger cable connected to both drives is the control cable. This cable attaches to both Drives C and D, and depending on the manufacturing date, can go to either Drive C or Drive D first. The connectors on this cable have locators to prevent them from being plugged in backward. The blue tracer on the cable faces to the left with the drive installed in the 4456 System Unit (as viewed from the front of the machine).

The other end of the control cable attaches to the Adapter card, on the 34-pin socket (J2) with the blue tracer down.

Data Cables (Narrow Cables, One Attached to Each Drive)

The remaining two cables are data cables. These cables do not have locators, so ensure that the blue tracer on these cables also faces to the left when disk drives are installed in the 4456 System Unit (as viewed from the front of the machine). The Drive C cable attaches to the 20-pin socket (J0) on the Adapter card, with the blue tracer down. The Drive D cable attaches to the 20-pin socket (J1) on the adapter card, again with the blue tracer down. (Use extreme caution when reinstalling the Adapter card because the data cables can easily be jarred loose.)

The power cords can be attached without consideration as to which goes to which drive.

A final check, before power is applied, is that the blue tracers on the cables face to the left on both drives and down on the Adapter card, as viewed from the front of the 4456. See Figure 11-4.
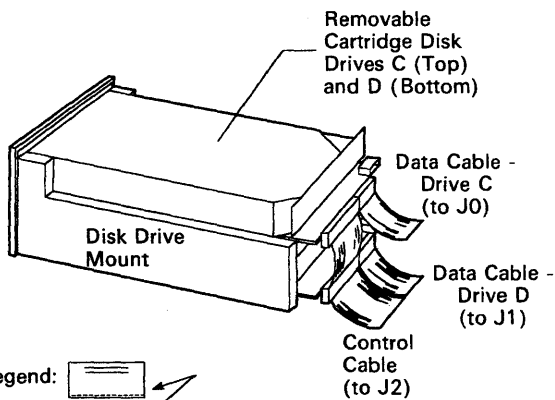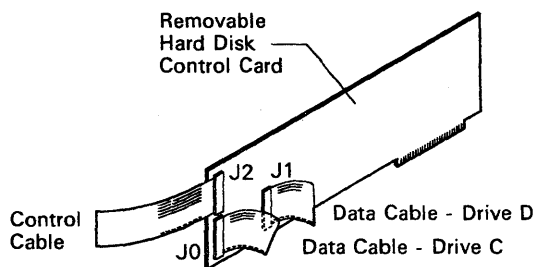
LEX42630

Figure 11-4. 5Mb Hard File Cabling

Adapter Cards, Cables, Filters

The following is provided to assist in obtaining the current part numbers for the 4456 System Unit's adapter cards, cables, and filters. This list is for the one-box configuration only. The listing is by card-slot position as installed in the system unit, with reference to pages 4-102-2 and 4-102-3 in the *4456 Maintenance Information Manual*. Slot J1 is located next to the system side cover, while J8 is next to the system's power supply. (See Figure 11-5.)
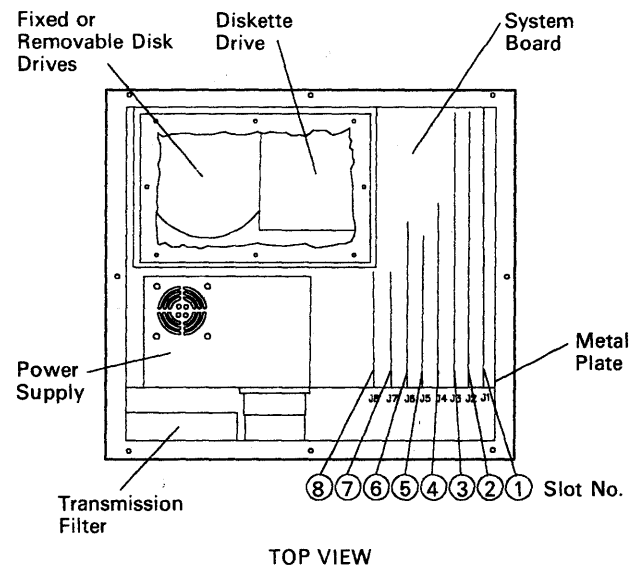
LEX42461

Figure 11-5. TPC3 Adapter Card Location

Slot J1 - Tempest System Unit with Color Display

103A418	Adapter card, Display/XGA/Video Out (sometimes called the Tri-Plex card)
102A217	Cable/Filter Primary Display, Adapter card to back panel
102A217	Cable/Filter Secondary Display, Adapter card to back panel
102A196	Cable/Filter Video, Adapter card to back panel

Slot J1 - Tempest System Unit with Mono Display

8654386	Card, Monochrome Display Adapter
100A534	Cable/Filter Mono Display, Adapter card to back panel

Slot J2 - Tempest System Color or Mono Display

8654378	Card, Distributed Function Communications Adapter

11-4

| 100A077 | Cable, Adapter card to filter |
| 100A009 | Filter, Cable to back panel |

Slot J3 - Tempest System Color or Mono Display

| 100A189 | Card, Communications Adapter (sometimes called Frontier card) |
| 100A490 | Cable/Filter, Adapter card to back panel |

Slot J4 - Tempest System Color or Mono Display

107A868	Card, Memory/PTR/KBD/ASCI Adapter (sometimes called Slot Saver card)
102A241	Cable, Adapter card to filters
102A245	Filter/Keyboard, Cable assembly to back panel
102A248	Filter/Printer, Cable assembly to back panel
102A252	Filter/ASYNC, Cable assembly to back panel

Slot J5 - Tempest System Color or Mono Display

101A315	Card, 5Mb Removable Hard File Adapter
102A784	Card, 10Mb Removable Hard File Adapter
112A794	Data and Control Cable assembly, Adapter card to hard disk drives

Slot J6 - Tempest System Color and Mono Display

| 8549152 | Card, Diskette Drive Adapter |
| 8529159 | Cable Signal, Adapter card to diskette drive |

Slot J7 - Spare No. 1

Slot J8 - Spare No. 2

Switch Settings

System Board TPC3

Switch Number	Switch Setting	Description
1	Off On	Normal operation Loop POST
2	Off On	N/A Math coprocessor not installed
3 and 4	Off, Off	256Kb Memory for WIS Workstation
5 and 6	On, On	WIS Workstation Display
7 and 8	On, On Off, On	1 diskette drive 2 diskette drives
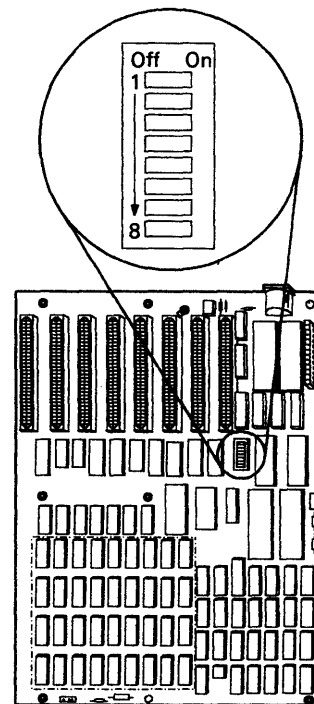
LEX42462

Figure 11-6. System Board Switch Location

Memory/Printer/Keyboard/Serial Port Adapter (Slot Saver)

Memory switch settings and jumper connections are described in the following paragraph.

The eight memory switch settings on the DIP switch are:

- 51, 52, and 53 set the start address at 256Kb.
- 54 and 55 indicate 128Kb without memory board or 384Kb with memory board installed on adapter.
- 56 and 57 are unused and their position can be on or off.
- 58 indicates parity.

For 128K (without memory board)

1	2	3	4	5	6	7	8
0	0	0	0	0	0	0	1

For 384K (with memory board)

1	2	3	4	5	6	7	8
0	0	0	1	1	0	0	1

LEX 42463

Figure 11-7. Slot Saver Memory Switch Settings

Refer to Figure 11-8 to identify the following jumper connections:

Serial Enable   P1 IN
                         P2 IN

IRQ7 Enable   IN

Serial Control lines   1 AB
                         2 AB
                         3 AB

LPT1   IN
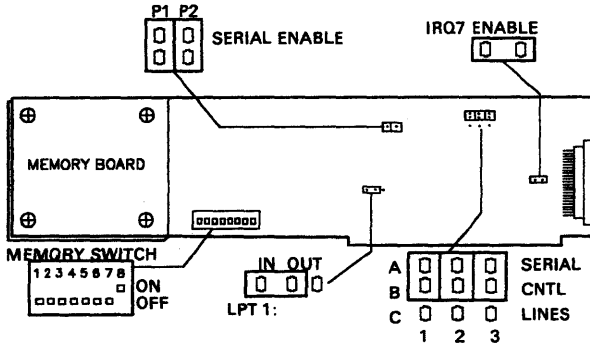
LEX42464

Figure 11-8. Slot Saver Jumper Connections

Switch No.	1	2	3	4	5	6	7	8
Switch 1 Setting	Off	Off	Off	Off	On	On	On	On
Switch 2 Setting	Off	On	Off	Off	Off	Off	Off	Off
Switch 3 Setting	On	Off	On	Off				
Switch 4 Setting	Off	On	Off	Off	Off	Off		
Switch 5 Setting	On	On	Off	Off				
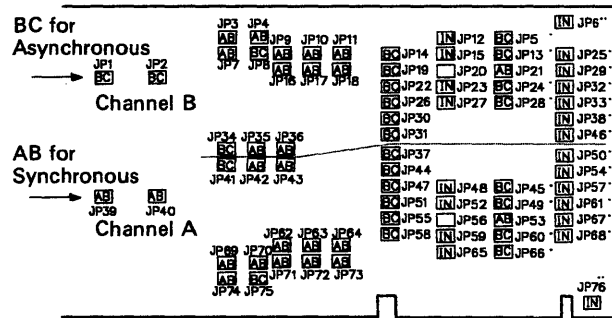
LEX42465

Figure 11-9. Advanced Communications Adapter Card Switch and Jumper Settings

Advanced Communications Adapter Card Switch and Jumper Settings

The following figures show switch settings and jumper positions of the Advanced Communications Adapter card (sometimes referred to as the Frontier or Adcom card). This card provides a communications interface through connectors Channel A and Channel B on the back of the work station. All replacement cards should be verified for correct switch and jumper settings prior to installation in a work station.

This configuration sets the card for MIL 188C, which is similar to RS5232 protocol. Two types of jumpers are on the card: the 2-pin, which is indicated as IN or Blank, and the 3-pin, which is indicated as either AB or BC.

Any variance from this preset configuration is the customer's responsibility.

Single Enclosure System Workstation Connector Panel (Tempest, Color and Monochrome)

Asynchronous Communications #2

Parallel Printer

Primary Monitor (Color or Monochrome Workstation)

Secondary Montitor (Color Workstation)

Auxiliary Display Device* (Color Workstation)

Keyboard

Synchronous Communications Channel A

Asynchronous Communications #1 Channel B

IBM 3270 Controller

*The RGB cable must be used to attach auxiliary display devices

LEX42466

Figure 11-10. TPC3 Connector Panel

Tempest Filter and Cabling (Internal) Diagram TPC3

102A241 Keyboard, Printer, Async Cable ASM

102A248 Parallel Printer

102A252 Async

Keyboard 102A245

100A490 Frontier

Auxiliary Display 102A196 Device

100A077 Coax Cable

102A217 (2x) Pri or Sec Color Monitor or 100A534 Display Filter ASM Mono

100A009 TCA (3278)
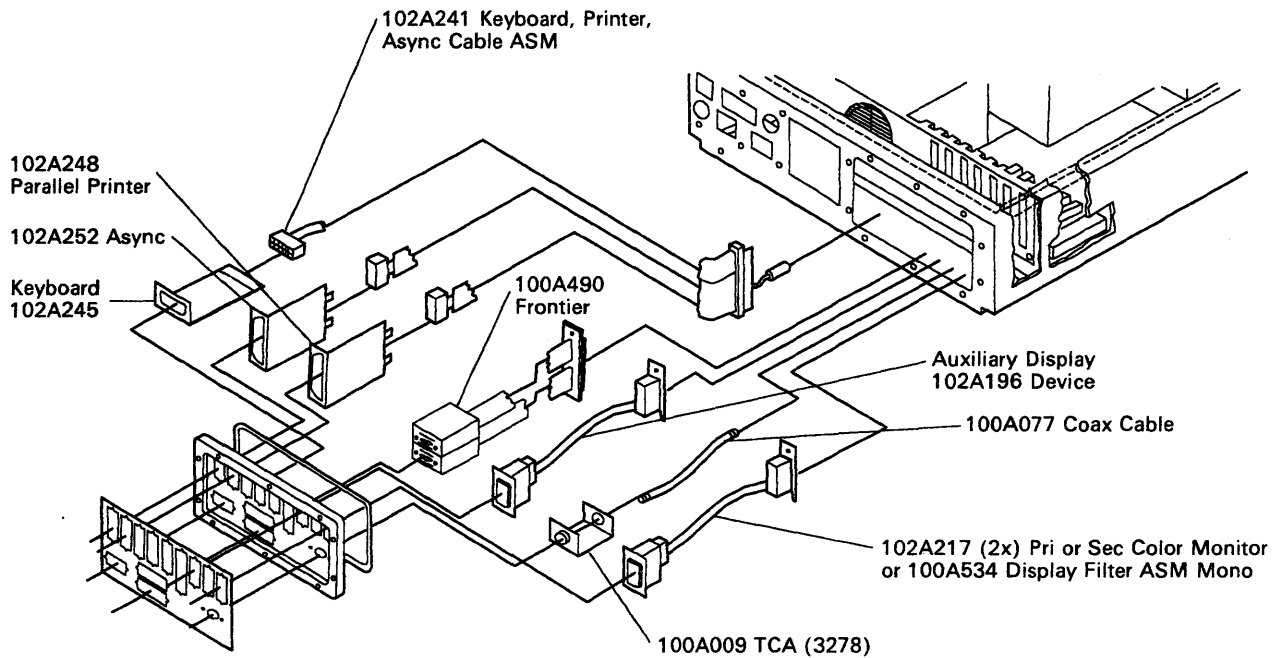
LEX42467

Figure 11-11. TPC3 Internal Cabling

Covers

Removing the eight captive screws from the top of the system unit (Figure 11-12) allows access to the inside of the system unit.

Once inside the system unit, you can gain access to the disk/diskette drive assembly by removing the nine hex nuts from the drive enclosure (Figure 11-13).

All outside and inside covers must be in place and securely fastened (no missing hardware such as screws, gaskets, nuts, and latches) at the completion of service calls. Cable connectors must be securely fastened and cable shields must be undamaged. The equipment must be securely grounded.

(Rear View)
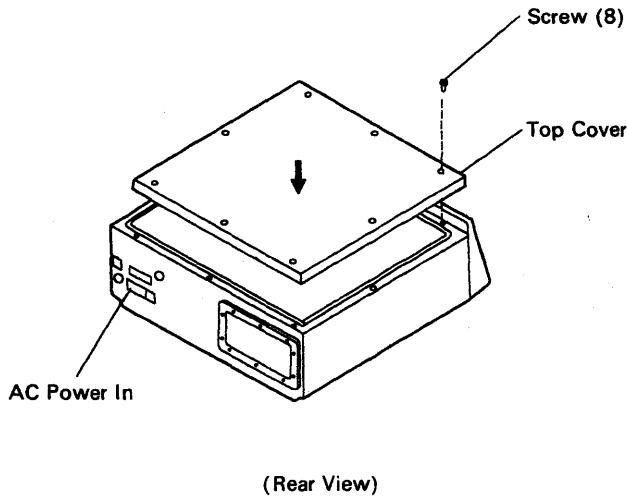
LEX42468

Figure 11-12. TPC3 Covers

(Front View)
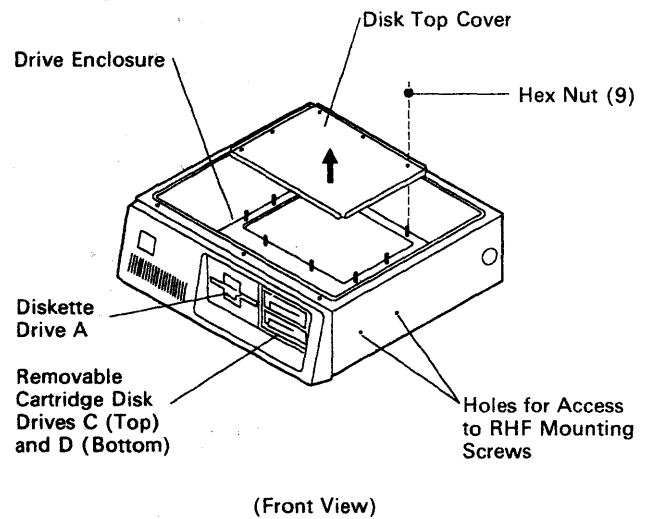
LEX42469

Figure 11-13. TPC3 Covers

Tempest System (PC AT-Based)
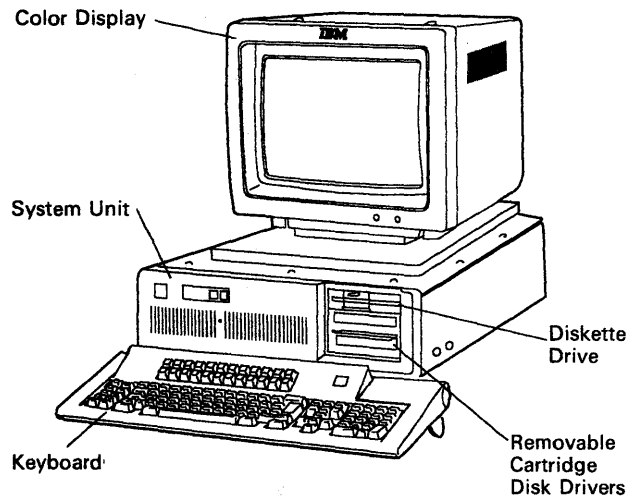
LEX42470

Figure 11-14. Tempest System (PC AT-Based)

The IBM Tempest Personal Computer TPC4 (4459) is based on an IBM Personal Computer AT which has been modified to meet Tempest requirements. The TPC5 (4460) is based on an IBM 3270 Personal Computer AT which has been modified to meet Tempest requirements. The 4460 operates as a 3270 Personal Computer AT; most of the modifications are transparent when using the computer.

11-8

The Tempest Personal Computer TPC5 (4460) is supplied with the following standard features:

- Tempest System Unit with 512Kb random access memory (RAM) (256Kb enabled with optional Expanded Memory Adapter)
- 64Kb read-only memory (ROM)
- 1.2Mb high-capacity or 360Kb double-sided diskette drive
- Tempest Keyboard with 122 keys
- Tempest Color/Graphics Display (Model 5272)
- IBM Display/Extended Graphics Adapter
- IBM Distributed Function Communications Adapter.

The following optional features may be included:

- 80287 Math Coprocessor
- 30Mb fixed disk drive
- One or two 10Mb Internal Removable Cartridge Disk Drives and Adapter
- IBM Serial/Parallel Adapter
- IBM Programmed Symbols Adapter
- IBM Expanded Memory Adapter (1Mb; can be expanded to 2Mb).

Note: Maximum hard disk drives available: two 30Mb fixed disk drives and no removable cartridge disk drives, or one 30Mb fixed disk drive and two removable cartridge disk drives.

System Setup

The system setup procedures for the TPC4 (4459) and TPC5 (4460) are the same as described in the *IBM Personal Computer AT HMS* and *IBM 3270 Personal Computer AT HMS* manuals, with the exception of the differences noted below.

If the TPC4 or TPC5 is equipped with removable cartridge disk drives, they are not to be counted as fixed disk drives when the setup program requests the number of fixed disk drives. However, they will appear in the list of options installed as fixed/removable disk drives when running diagnostics.

Input Voltage Requirements

The IBM Personal Computer TPC4 (4459) and TPC5 (4460) can be used with either 110 or 220 line voltage. The voltage selector switch must be set for the proper line voltage.

CAUTION:
Ensure that the system power is set to off and the power cord is disconnected from the voltage source before attempting to access the 115V-230V selector switch.

Note: When replacing the system board, check the display switch and the RAM jumper on the system board.

The display switch should be toward the front for a color display and toward the rear for monochrome.

When the TPC5 is equipped with an Expanded Memory Adapter (XMA), the second 256Kb RAM must be disabled.

Jumper Position	Function
Pins 1 and 2	Enable second 256Kb RAM
Pins 2 and 3	Disable second 256Kb RAM
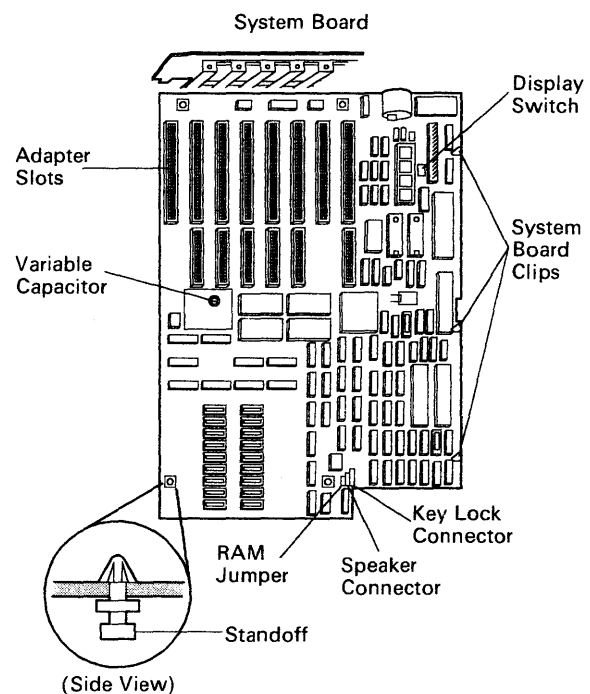
LEX42471

Figure 11-15. System Board

Option Adapter Assignments

To maintain Tempest integrity, all option adapters must be replaced in the slots as the TPC4 and TPC5 are delivered. Make note of the slot for each adapter to be removed and replace in the slot from which it was removed.

Card slot numbers are written on the rear face of the system unit's bulkhead.
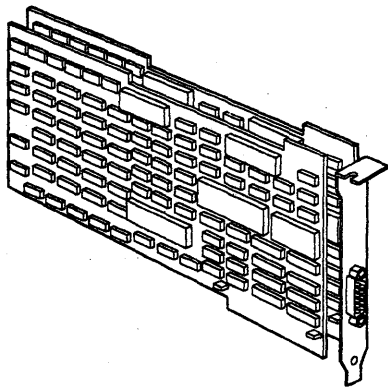
Display Adapter and
Extended Graphics Adapter

Distributed Function Communication Adapter

J2   LED

J0   J1
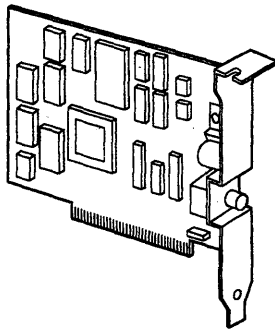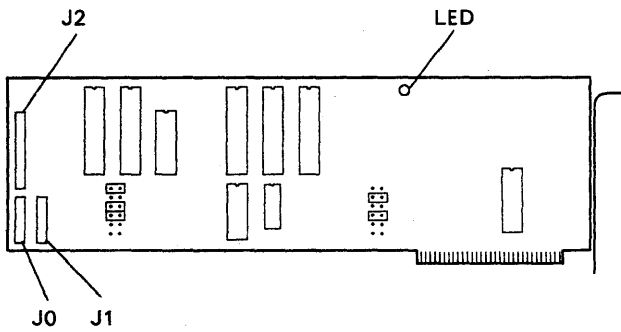
LEX42472

Figure 11-16. TPC415 Common Adapter Cards

TPC4 and TPC5 Covers and Rear I/O Panel

System Unit Power

Display Power Connector

Twin Cover Indentions

Captive Screw

Top Cover

Top Cover Tempest Gasket

Serial Numbers

Access Cover

I/O Panel

(Rear View) TPC 5

Serial Port

Parallel Port

Display

Keyboard

Distributed Function Communication Connector (Coaxial)

Serial Number

Display Power Connector

System Unit Power

Bulkhead

Tempest Gasket

Access Cover (for 115V-230V Selector Switch)

I/O Panel (See I/O Panel Detail)

Mounting Screw

I/O Panel and Filters

(Rear View) TPC 5

LEX42473

Figure 11-17. Personal Computer TPC5.

Note: Unlike the IBM 3270 Personal Computer AT, TPC5 has no removable plastic back panel.

Be careful not to damage the Tempest gaskets.
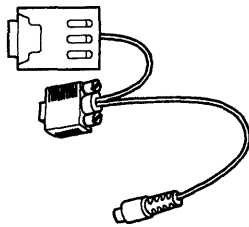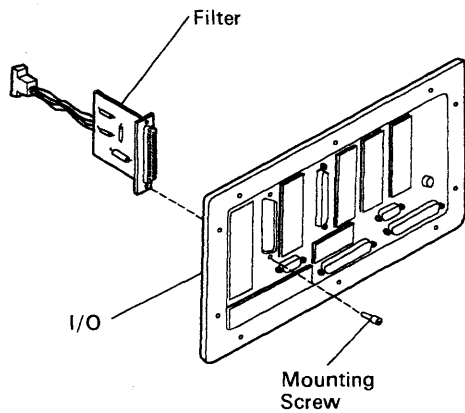
LEX42474

Figure 11-18. Tempest Gaskets and Keyboard Filter Assembly

Debug Guide for 5Mb and 10Mb Removable Hard Files Used with IBM Systems 4455, 4456, 4459, and 4460

Introduction

This debug guide is intended to be an aid in isolating problems with 5Mb and 10Mb removable hard files (RHFs) found in the IBM 4455, 4456, 4459, and 4460 system units. The information contained in this document will give a better understanding as to how the drives normally initialize (ready) and which part of the controller/drive/cartridge subsystem might be malfunctioning.

It is recommended that the following pages (11-12 through 11-15) be read before attempting any problem identification. This will give you a better idea of the proper initialization process. It will also give appropriate warnings and alert you to the types of problem indications that you might see.

On page 11-14 is the debug flow chart for the 5Mb RHF subsystem. On page 11-14 is the same type debug flow chart for the 10Mb RHF subsystem. On page 11-15 is an operational test flow chart that is to be used for problem analysis of both drives after the drives have initialized.

This document is not all-inclusive, but does cover the majority of symptoms experienced in a system with a defective drive, controller, cable, or cartridge.

Note: Do not under any circumstances remove system components without first powering off the system unit and attached devices.

Debug Guide Reference Information

Drive Addressing and Termination

Before replacing or installing new drives:

1. Make sure the drive address jumper is in the proper position.

   • Drive C jumper, position 1, pin 1 to 2.
   • Drive D jumper, position 2, pin 2 to 3.

2. Make sure that a terminating resistor pack (R-Pack) is installed in Drive D only for dual drive configurations or in Drive C for single drive configurations.

Normal Drive Initialization (Ready Cycle)

Normal drive initialization occurs as follows:

1. A known good cartridge is inserted into the drive and the drive door is closed. The LED indicator will light (red).

2. Approximately 10 seconds later the spindle motor will start. If the spindle starts immediately after closing the door, the drive is defective and should be replaced.

3. Approximately 20 seconds after closing the door, the read/write (R/W) head stepper motor will rotate counterclockwise until it reaches the outermost disk cylinder.

4. The R/W head stepper motor will then rotate clockwise until it reaches the innermost disk cylinder, then return to cylinder zero. At this time the LED indicator light goes to its initialized (ready) state (off for the 5Mb drive, green for the 10Mb drive).

Note: The total length of time required to complete the ready cycle can range from 30 seconds to 5 minutes. (See "Initialization Time (5Mb Drives Only)" on page 11-13.)

Visual Inspection of Removable Cartridge

Warning: Any debris in the cartridge will cause a head crash. Do not touch or blow into the cartridge. This method of inspection is only visual. Under no circumstances should any foreign particles enter the cartridge. Use extreme caution when inspecting the disk. Perform this inspection in as clean an environment as possible.

1. Open the cartridge R/W head access door by pulling the sliding out (away from the center of the cartridge) while simultaneously moving it to the side. Hold the door open.

2. Inside is a metallic disk. The disk should appear uniformly smooth and reflective.

3. A head crash can appear as a circular break in the uniform surface of the disk (rings scratched into the surface of the disk).

4. Inspect both sides of the metallic disk surface.

5. If the cartridge has suffered a crash, it must be discarded. Using a crashed cartridge in a drive will contaminate the drive, which in turn will crash other cartridges.

6. If a crashed cartridge is located, replace all drives in which the cartridge might have been used. Inspect all additional cartridges that might have been used in these bad drives.

Note: This method allows only partial inspection of the media surface. If you suspect a cartridge has been crashed, DO NOT USE IT.

Run-Out

1. During initialization the drive takes a measurement of the cartridge which is referred to as run-out. Run-out is the measurement of how accurately the cartridge is seated in the drive, as compared to when the cartridge was originally created in the factory.

2. Two factors affect run-out:

   • Dirt on the cartridge hub or on the drive spindle can cause the cartridge to seat improperly. Use of a cleaning cartridge, P/N101A999, with Freon, P/N8549396, will eliminate this problem.

   • If a cartridge has been mishandled (dropped), the hub can slip on the drive spindle, causing the disk to run off-center. It is sometimes possible to get a cartridge with this type of run-out to initialize by removing the cartridge from the drive, rotating the hub 90 degrees, and reinserting the cartridge into the drive. This might need to be repeated three times to

check four positions of the cartridge with respect to the drive motor.

Note: Discard a cartridge that continues to suffer from run-out. If a customer has data on the cartridge, rotate the hub until you can get the cartridge through driver initialization, then back up all of the data from the cartridge. After the data is saved, discard the failing cartridge.

Drive/Controller Fault Isolation

1. This procedure will help with isolating not ready conditions to the drive(s), controller, cables, or the cartridge(s) in question.

2. To test the drive(s), make sure the system power is off. Remove the machine cover and removable hard file mounting screws. Pull the drive(s) forward and remove the flat cables from the drive(s). Leave only the power cables connected. Power the system on with cartridges installed in the drive(s). The drive(s) should spin up, then go to a ready state (5Mb = LED off; 10Mb =. LED green).

   a. If both drives go to a ready state, isolate to the failing component by replacing the controller card followed by the cables. Failure of the RHF subsystem to ready is caused by the controller card and/or cables.

   b. If one drive goes to ready state and the other one does not, swap the cartridges and attempt to initialize the drives. If the Does Not Ready problem remains on the same drive, replace the drive. If the problem, however, moves to the other drive, replace the cartridge in the failing drive.

   c. If both drives fail, retest with known good cartridges (cartridges that are known to work in another machine).

Initialization Time (5Mb Drives Only)

1. In a 5Mb RHF drive, if a cold (room temperature) cartridge is placed in a hot drive, the cartridge must have time to come to temperature before the drive will ready. This can take up to five minutes.

2. If the drive has not initialized after five minutes and the LED indicator is on solid, do the following:

   a. Press the button on the drive and wait for the LED indicator to stop flashing.
   b. Open the drive door, eject the cartridge, rotate the cartridge hub 90 degrees, reinsert, and close the door.
   c. If the drive still does not ready, go to "Drive/Controller Fault Isolation."

Debug Guide for the 5Mb Removable Hard File (Drive Will Not Ready)

001

- Remove cartridge(s) from drive(s).
- Power off the system.
- Power on the system.

Is the drive LED off?

Yes	No
*	*
*	002 - Replace drive. See "Drive Addressing
*	and Termination" on page 11-12.

003
Perform "Visual Inspection of Removable Cartridge" on page 11-13.

Is the cartridge OK? (Not crashed)

Yes	No
*	*
*	004 - Inspect all cartridges; determine which
*	drive(s) might have used crashed car-
*	tridges. Replace all drives that have
*	contacted crashed cartridges.

005
Insert cartridge and close the door.

Is the LED on?

Yes	No
*	*
*	006 - Replace drive. See "Drive Addressing
*	and Termination" on page 11-12.

007
Observe the RHF drive LED.

Does the LED go to fast blink, then slow blink, then off?

Yes	No
*	*
*	008 - Go to step 10 in this Debug Guide.

009
See "Run-Out" on page 11-13.

010
(from step 008 in this Debug Guide)
Does the LED go directly to slow blink, then off?

Yes	No
*	*
*	011 - Go to step 13 in this Debug Guide.

012
Replace the drive. See "Drive Addressing and Termination" on page 11-12.

013
(From step 011 in this Debug Guide)
Does the LED go from solid on to off within 2 minutes? (Might take longer, see "Initialization Time (5Mb Drives Only)" on page 11-13.)

Yes	No
*	*
*	014 - Power off system unit and perform
*	"Drive/Controller Fault Isolation" on
*	page 11-13.

015
Drive is ready. Go to "Debug Guide for Removable Hard Files Operational Testing Flow Chart" on page 11-15.

Debug Guide for the 10Mb Removable Hard File (Drive Will Not Ready)

001

- Remove cartridges from drives.
- Power off system unit.
- Power on system unit.

Is the drive LED off?

Yes	No
*	*
*	002 - Replace drive. See "Drive Addressing
*	and Termination" on page 11-12.

003
Perform "Visual Inspection of Removable Cartridge" on page 11-13.

Is the cartridge OK? (Not crashed)

Yes	No
*	*
*	004 - Inspect all cartridges; determine which
*	drive(s) might have used crashed car-
*	tridges. Replace all drives that have
*	contacted crashed cartridges.

005
Insert cartridge and close the door.

Is the LED on, solid red?

Yes	No
*	*
*	006 - Replace the drive. See "Drive
*	Addressing and Termination" on
*	page 11-12.

007
After approximately 30 seconds does the LED change to green?

Yes	No
*	*
*	008 Go to step 010 in this Debug Guide.

009
Drive is ready. Go to "Debug Guide for Removable Hard Files Operational Testing Flow Chart" on page 11-15.

010
(From step 008 in this Debug Guide)
Is the LED blinking fast?
Yes   No
*   *
*   011   Power off the system unit and perform
*   "Drive/Controller Fault Isolation" on
*   page 11-13.
012
See "Run-Out" on page 11-13.

Debug Guide for Removable Hard Files Operational Testing Flow Chart

001

- Power off system unit.
- Insert IBM Advanced Diagnostics in Drive A.
- Power on system unit.

Note: Do not format cartridges using advanced diagnostics; factory-written data will be destroyed. Use only the DOS format command to format cartridges.

- Select option O from main menu.
- . Check options list for: 17 - Fixed Disk Drives(s) and Adapter.

Is Option 17 listed?
Yes   No
*   *
*   002 - Problem is controller card or cables.
*   Isolate to failing component by
*   replacing the controller card followed
*   by the cables.
003
- Answer Y < enter >
- Select option O: Run Tests One Time.
- Select Test option 17.
- For 4455 and 4456 test, Select O: Run Fixed Disk Test.
- For 4459 and 4460 test, Select 5: Run All Tests.
- Test Drive C, then Drive D.

Did the diagnostics run successfully?
Yes   No
*   *
*   004 - See step 006 in this Debug Guide.
005
Operational Test complete.

006
(From step 004 in this Debug Guide)
Do both Drives C and D fail?
Yes   No
*   *
*   007 - See step 009 in this Debug Guide.
008
Problem is controller card or cables. Isolate to failing component by replacing the controller card followed by the cables.

009
(From step 007 in this Debug Guide)
Does only one drive (C or D) fail?
Yes   No
*   *
*   010 - You have reached this step in error.
*   Restart at step 001 in this Debug Guide.
011
- Swap cartridges C <-> D.
- Power off/on the system.
- Run diagnostics as above.

Did error follow cartridge?
Yes   No
*   *
*   012 - Replace the failing drive.
013
Replace cartridge.

Chapter 12. Industrial Products

5531 XTC Industrial Computer
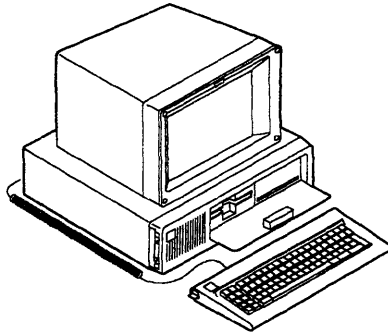
LEX40114

Figure 12-1. 5531 XTC

The IBM 5531 Computer is an industrialized version of the IBM Personal Computer XT to be used in a plant floor environment that is more demanding than a typical office location. This computer has been designed to operate in areas with extreme temperatures, vibration shocks, voltage surges, and excessive dust conditions.

The IBM 5531 Industrial Computer supports all of the functions of the IBM Personal Computer XT.

Environmental Condition Specifications

Electrical	
130 watts	
AC Operating Voltages	104 min. to 127 max., 57 Hz to 63 Hz
Transients, such as lightning strike	2500V max. with 16 microsecond nominal pulse width are filtered.
Temperature	
System On	4° to 46.1°C (39.2° to 115°F)
System Off	4° to 51.7°C (39.2° to 125°F)
Relative Humidity	8% to 80% Noncondensing

Figure 12-2. Environmental Condition Specifications

Note: 10Mb Fixed Disk Drive, P/N6421781, meets criteria for the industrial environment and is the *only* drive approved for use in the 5531 System Unit.

Thermal Warning

If the internal operating temperature of the IBM Industrial Computer exceeds its design limits, the message "THERMAL WARNING" will appear on line 25 of the display. The system will continue to run with this message displayed and the system beeper will sound at 10 second intervals for 10 minutes. If there is no response to the warning from the operator, the system will automatically shut down.

If the temperature returns to normal before the 10 minutes elapse, the timer and beeper reset and the message "THERMAL NORMAL" is displayed. If it does not return to operating temperature, the system will need to be turned off and allowed to cool.

Card Retainer Bracket

The card retainer bracket is a feature used to prevent the adapter cards from loosening.
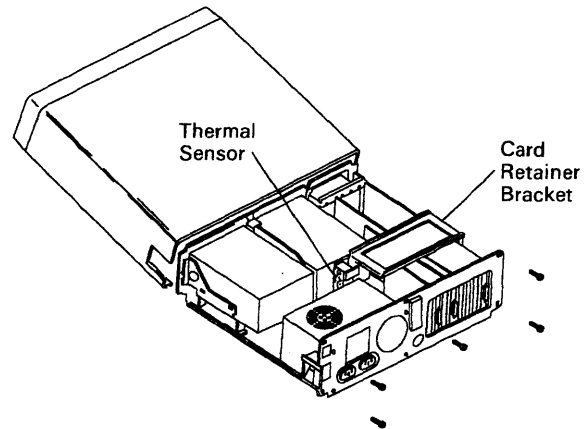
LEX40115

Figure 12-3. Card Retainer Bracket

Power Adapter Card

The Power Adapter is a distribution board that supplies power to the fans.
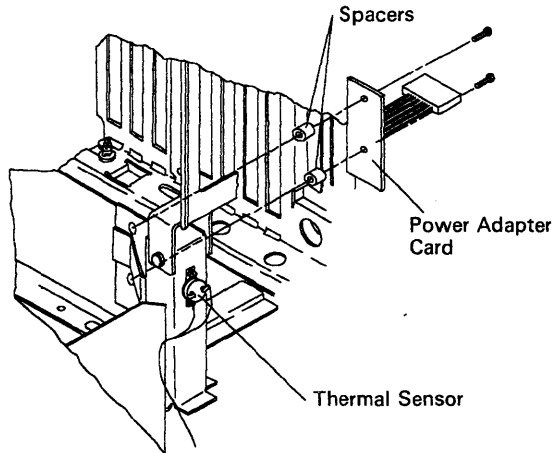
LEX40116

Figure 12-4. Power Adapter Card

System Unit Filter

The system unit filter protects the system from any particles that might enter and damage the system unit. The filter is located on the front side of the system unit along with a cooling fan.
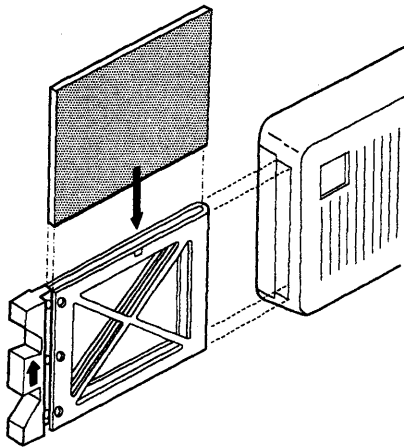
LEX40117

Figure 12-5. System Unit Filter

Combination Adapter Card

The 4 in × 7 in Combination Adapter card has three connectors, two of which are accessible from the rear of the machine (async port, parallel port). The third connector (thermal sensor) is accessible internally.

The Combination Adapter card supports all of the following functions:

* Asynchronous Communication Port (jumpered for EIA or current loop)
* Parallel Printer Port
* Battery-Backed Clock (24-hour realtime clock with a four-year calendar)
* Thermal Sensor.

The figure below shows the required jumpering for the Combination Adapter card. Take special note of the jumpers for EIA and current loop.
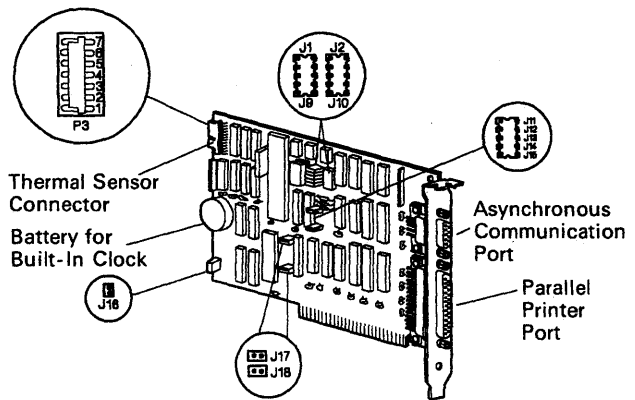
LEX40118

Figure 12-6. Combination Adapter Card

Operation Specifications

Operation	Installed Jumpers
EIA Communications (RS232C)	J1, J3, J5, J7, J9
Current Loop	J2, J4, J6, J8, J10
Communications 1 (Address module set for primary operation)	J11, J14
Communications 2 (Address module set for secondary operation)	J12, J15
Always jumpered	J16, J17, J18
If Combination card is installed in system board expansion slot J8)	J13

Figure 12-7. Operation Specifications

12-2
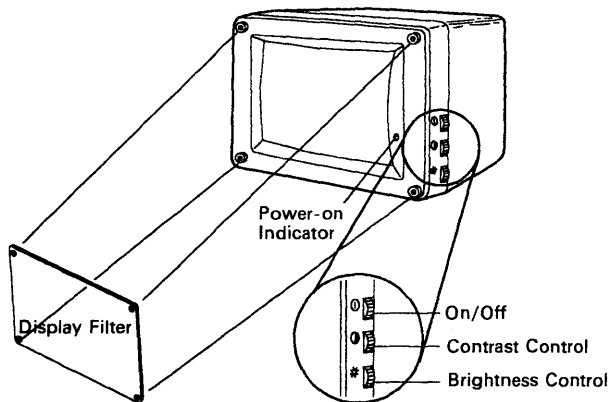
5532 Color Display

Figure 12-8. 5532 Color Display

The 5532 is an industrialized version of the 5153 Color Display. The 5532 is equipped with filters located on the bottom of the display to filter out any particles that might enter and damage the display unit. The 5532 Color Display is also equipped with a display screen filter to protect the display and reduce glare.

7531 Industrial Computer
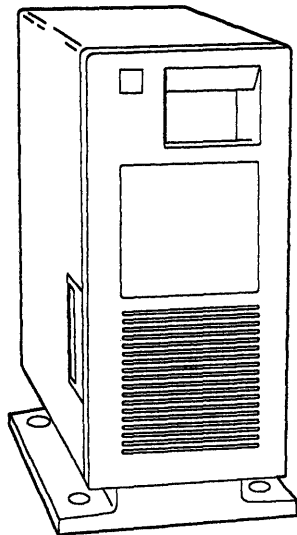
Figure 12-9. 7531 Industrial Computer

7532 Industrial Computer
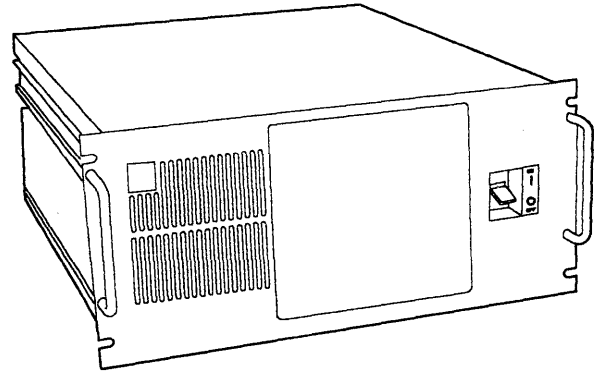
Figure 12-10. 7532 Industrial Computer

The 7531 and 7532 Industrial Computers are IBM Personal Computer ATs repackaged to meet industrial environment requirements.

Repackaging provides the following enhancements:

*   A fan that provides positive pressure as well as additional cooling
*   A filter for prevention of particulate contamination
*   Additional bracing to prevent adapter and option cards from vibrating loose
*   Locking door to cover access area for the diskette drives and reset switch.

The 7531 resides in a floor-standing enclosure that can be bolted to the floor to provide extra stability.

The 7532 is designed to mount in an industry standard 19-inch rack.

Models

There are two models of 7531/7532 Industrial Computers, the Model 041 and Model 111. The Model 041 serial number range is 99,999 and below. The Model 111 serial number range is 100,000 and above.

The Model 041 contains the following hardware:

*   Personal Computer AT 6 MHz system board with 512Kb RAM
*   1.2Mb diskette drive
*   Keyboard
*   Disk/Diskette Adapter card
*   Security keylock
*   Clock/calendar with battery backup.

The Model 111 contains the same hardware configuration as the Model 041 with the following exceptions:

- Personal Computer AT 8 MHz system board with 512Kb RAM
- 3.5-inch 20Mb fixed disk drive.

Environmental Condition Specifications

Electrical	
	90-137V AC, 50 to 60 Hz
	180-230V AC, 50 to 60 Hz
	192 watt power supply
	5.0 amps max. at 120V AC
	3.0 amps max. at 220/240V AC
Temperature	
System On	0° to 50°C
	(32° to 122°F)
System Off	0° to 55°C
	(32° to 131°F)
Relative Humidity	8% to 80%
	Noncondensing

Figure 12-11. Environmental Condition Specifications

Thermal Warning

If the internal operating temperature of the 7531 or 7532 exceeds its design limits, the message "THERMAL WARNING" will appear on line 25 of the display. (See "Thermal Warning" on page 12-1 for a more detailed description.)

System Unit Filter

Replacement of the filter is the customer's responsibility. If intermittent problems are experienced on the 7531/7532, check the condition of the filter.

Keyboard

The 7531/7532 Model 041 Keyboard has 101 keys and requires a special utility diskette to be loaded when the system is installed. The utility updates the DOS 3.0 diskette to enable the system to recognize the additional keys. The keyboard utility diskette is located in the appropriate system unit *Operator's Guide*.

It might be necessary to reload this diskette due to a software or fixed disk failure. This is normally the customer's responsibility; however, the following procedure should be used to reload the keyboard utility diskette:

1. Load DOS 3.0 using Drive A.
2. When the DOS prompt appears on the screen, remove the DOS diskette from Drive A and replace it with the keyboard utility diskette.
3. Type AUTOEXEC. and press the Enter key.
4. Follow the instructions on the screen to update DOS.
5. When you have completed the instructions, the DOS prompt should appear on the screen.

The 7531/7532 Model 111 also uses a 101-key keyboard but does not require the keyboard utility.

Note: The Model 041 and Model 111 keyboard FRU part numbers are different and should not be interchanged.

Options

IBM Combination Adapter II

The Combination Adapter II is a serial/parallel adapter that supports the following features:

- Jumper selectable serial port (RS232 or RS422)
- Parallel port
- Eight digital inputs (one reserved for the thermal sensor)
- Three programmable timers.

Note: The thermal assembly consists of a bracket, thermal sensor, and cabling.

A 128Kb Memory Expansion Option is available that plugs onto the Combination Adapter II. This gives the customer the ability of adding 128Kb of memory to the system without using an additional adapter slot.

Remote Terminal Interface (RTI)

The RTI is an adapter that provides an interface to connect industrial computers (5531, 7531, 7532, and 7552) to the IBM 7552 through the keyboard port on the 7552. When the 7552 is configured without diskette, keyboard, or display, an industrial computer is required to be used as a remote terminal to load programs and provide operator interface for the 7552. A 12-foot cable is included with this feature to connect the industrial computer to the 7552. The *Operator's Guide* shipped with the RTI feature contains all the information necessary to install, operate, and repair this feature.
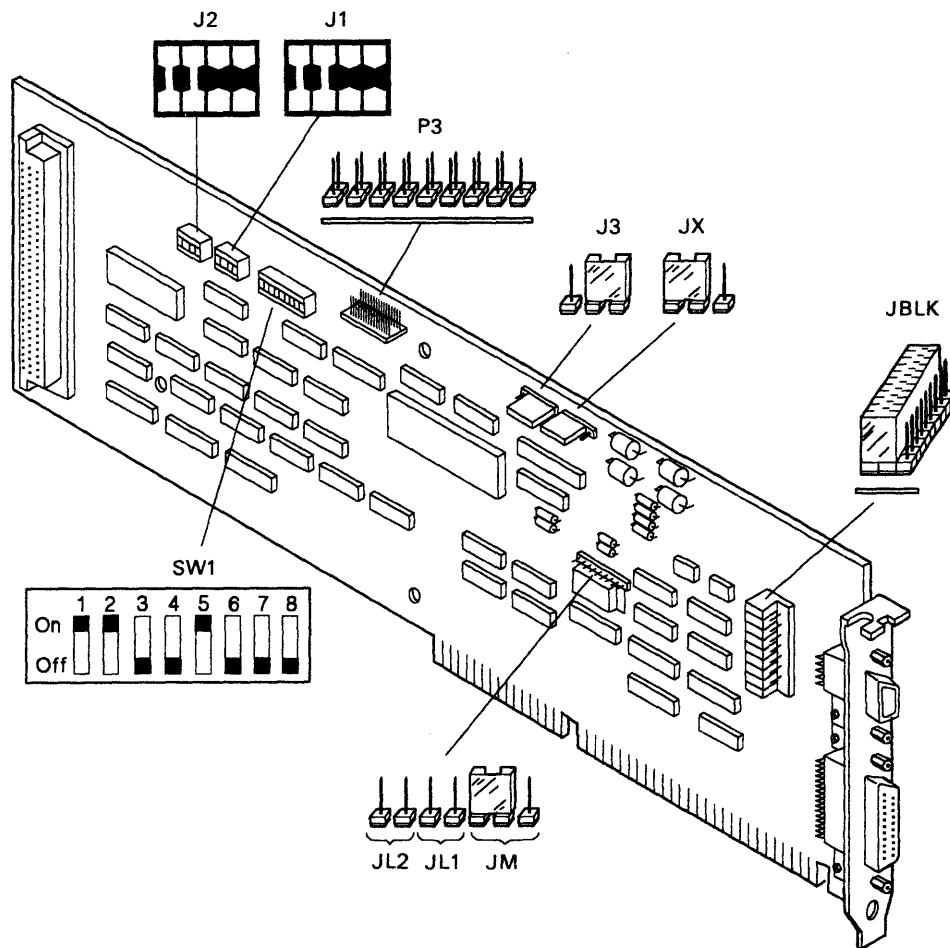
Figure 12-12. Combination Adapter II

LEX41739

The following table shows the definition (function) of the jumpers and the switch. The IBM Combination Adapter II, as shipped by IBM, is configured to the defaults shown in the table.

Jumper	Function	Default
JBLK	Defines the 9-pin shell connector as either EIA RS232C or EIA RS422A	RS232C
J1	Selects between primary or alternate serial port operation	Alternate
J2	Selects between primary or alternate parallel port operation	Alternate
J3	Enable or disable the system latch (If enabled, it will allow a nonmaskable interrupt)	Disabled
JM	Reserved	A to B
JX	Select Mode 0 or Mode 2 timer operation	Mode 0
JL1	Reserved	No Jumper
JL2	Reserved	No Jumper
SW1	Selects the interrupt level at which the timer port will operate	Level 4

Note: Each of the jumpers described in the table above is shown as they appear on the card in their default state.

JBLK

RS-232-C   RS-422-A   RS-232-C   RS-422-A

1 2 3   1 2 3

31 32 33   31 32 33

Alternate Setting   Primary Setting

J2   J1   J2   J1

1   1   1   1

Parallel   Serial   Parallel   Serial

J3   [A B C] System Latch Disabled   [A B C] System Latch Enabled

JX   Mode 0   Mode 2   Mode 0   Mode 2
      1 [   ] 3   Selecting Mode 0 allows for use   1 [   ] 3
                     of all three timers. Selecting
                     Mode 2 disables timers 1 and 2.

JL2   JL1   JM   JL2, JL1, and JM are reserved for system
[   ]   [   ]   [   ]   use. Jumper must be in place as shown.
                   A B C

LEX41740

Figure 12-13. Switch Settings and Jumper Positions

SW1

The interrupt level you select depends on the configuration of your Combination Adapter II. In the table below, find the description that matches your Combination Adapter II, then choose one of the specified interrupt levels (IRQ x).

If your Combination Adapter II is configured as follows:	Then use IRQ x:
Parallel port is set for alternate Serial port is set for alternate	4 or 7
Parallel port is set for primary Serial port is set for alternate	3 or 7
Parallel port is set for alternate Serial port is set for primary	4 or 5
Parallel port is set for primary Serial port is set for primary	3 or 5

The interrupt request level (IRQ) is set with SW1. Shown are the switch settings on SW1 for each IRQ. Note that SW1 is set at IRQ 4 when shipped.
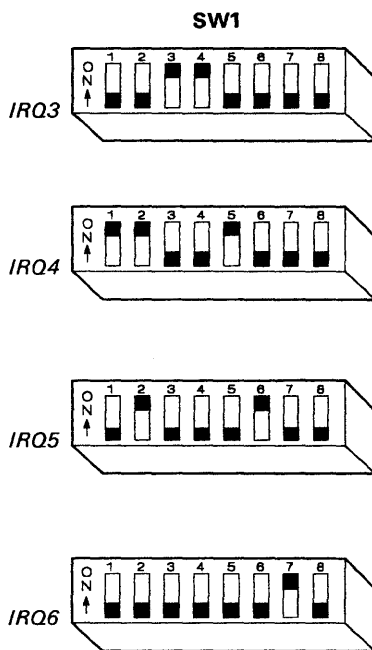
LEX41741

Figure 12-14. Switch Settings

20Mb Fixed Disk Drive

P/N6128190 meets criteria for the industrial environment and is the *only* drive approved for use in the 7531/7532 system units.

320Kb/360Kb and 1.2Mb Diskette Drives

Only P/N6523462 (320Kb/260Kb diskette drive) and P/N6523461 (1.2Mb diskette drive) should be used in 7531/7532 system units. These drives are functionally the same as AT drives but have a different face plate.

Accessories

Rack mount kits are available for the 7532 keyboard and display (7534 or 5532). There are no spare parts for these accessories. The only maintenance available is per call. Customers with warranty claims (3 months) should contact their point of sale.

7534 Industrial Enhanced Color Display
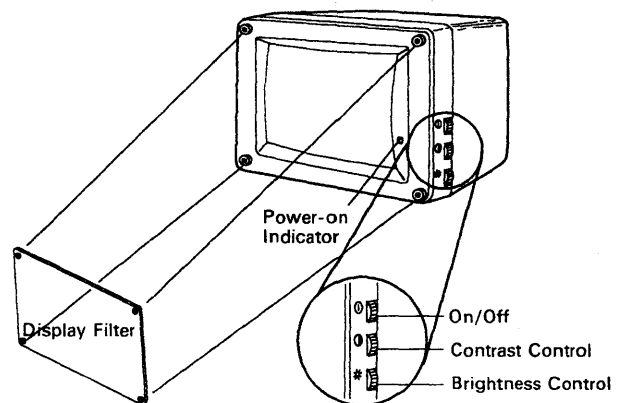
LEX40119

Figure 12-15. 7534 Industrial Enhanced Color Display

The 7534 Industrial Graphics Display is a high-resolution color monitor repackaged to meet industrial environment requirements. It is equipped with a cooling fan, air filter, and protective screen. It is the customer's responsibility to replace the filter.

A clear screen cover is standard on the 7534. Two optional covers are available as accessories. The customer is responsible for removing the optional screen covers when the element is exchanged.

A rack mount kit is available as an accessory. There are no spare parts for this accessory. The only maintenance available is per call.

7544 Industrial Enhanced Color Display
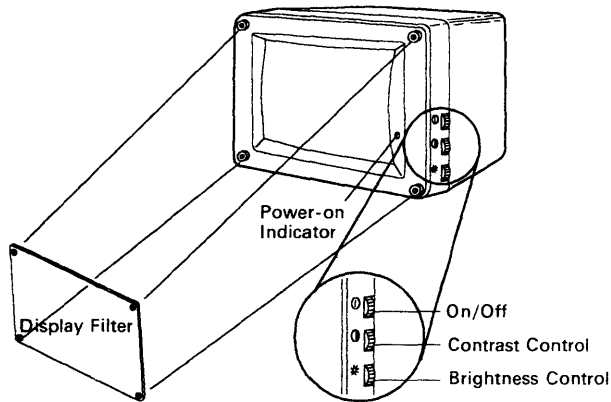
LEX40119

Figure 12-16. 7544 Industrial Enhanced Color Display

Product Description

The 7544 is a 13-inch Industrial Color Graphics Analog Display. It is designed for industrial plant floor environments, where a display that has resistance to harsh physical conditions is required. The 7544 is designed to provide an improved level of color graphics when used with the VGA Display Adapter for users of the IBM Industrial Computer System.

The 7544 has the following features:

* 640 × 480 pel maximum addressability (graphics mode)
* 720 × 400 pel maximum addressability (text mode)
* Non-interlaced
* 256 displayable colors from a palette of 256K colors
* EGA mode compatibility
* Three vertical modes: 350, 400, and 480 scan lines.

Compatibility

The 7544 is an analog display and therefore not supported by existing display adapters. The display adapter is a high-function VGA Adapter, and is required to support the 7544.

7552 Industrial Computer
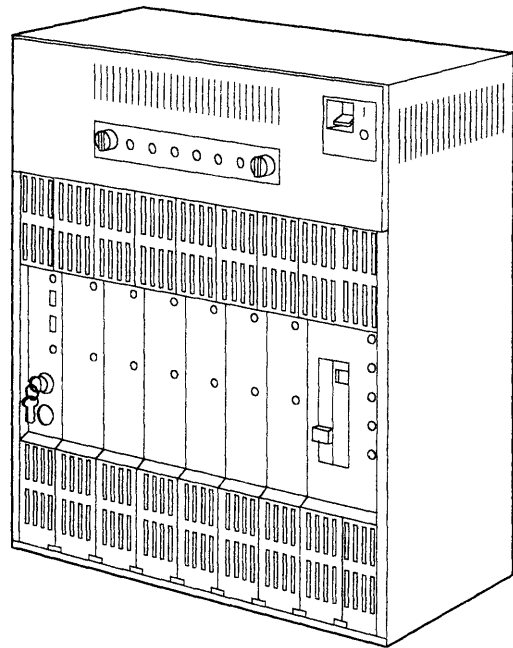
LEX42361

Figure 12-17. IBM 7552 Model 140 Industrial Computer

IBM 7552

The IBM 7552 is a Personal Microcomputer designed to operate in the industrial environment. The system can be rack mounted, wall mounted, or mounted in an optional floor stand. The temperature specifications and physical design will also allow it to be mounted in NEMA type enclosures that are common in the industrial environment.

The design of the 7552 is taken from that of programmable logic controllers that are common on the plant floor. It has an open frame and all FRUs/CRUs are accessed from the front, plugged into a back plane, and encased in protective shrouds.

The processor is based on the AT planar, built on two pluggable cards, a processor, and a system resource card.

The power supply is designed with a battery backup to provide for continuous operations under short-term (1.5 sec.) power disturbances.

The 7552 will utilize Personal Computer option cards for all supported options. The PC feature cards will be adapted to the 7552 form factor and bus through the

use of a PC Adapter card and card cradle which adjust to fit any size PC option adapter.

The customer is responsible for installation planning, setup, and problem determination to the CRU level, and replacement of the battery and filters.

Models

- Model 040

    - Frame, back plane, power supply
    - Processor card with 512Kb RAM
    - System Resource card
    - Battery.

- Model 140

    - Same as Model 040
    - Disk/Diskette Adapter card
    - 10Mb 3.5-inch hard file.

Features

- 512Kb/3Mb Memory Expansion card
- Disk/Diskette Adapter
- 1 or 2 10Mb hard files
- 3.5-inch 740Kb diskette drive
- EGA
- PC Network Adapter
- DAC and distribution panel
- BISYNC Adapter
- A Real-Time Interface Coprocessor (ARTIC) card
- GPIB
- SDLC Adapter
- Remote Terminal Interface (RTI).

Maintainability Features

System Verification and Initialization (SVAI) with the aid of the hex display on the system resource card will alert the operator of the following conditions:

While no errors are detected, the hex displays will show the checkpoint number of the SVAI test that is executing. If all tests run successfully, the display will be set to 00 upon completion.

If a catastrophic error is detected, the error code is displayed and alternates with EE.

If no catastrophic errors are detected, the error code will be displayed with alternate EO. Up to three errors will be displayed, each with a delay for readability. If more than three errors are detected, then only the last three are displayed. These types of errors require operator intervention before SVAI will continue with the boot load.

Minimum System Requirements

The minimum 7552 configuration that will support advanced diagnostics is a system unit with keyboard, diskette drive and adapter card, and display with adapter card.

Advanced diagnostics are also supported through the use of the Remote Terminal Interface (RTI) installed in an IBM Industrial Computer (7531, 7532, 7552, and 5531).

It is the customer's responsibility to provide one of the above configurations when advanced maintenance is required on a 7552.

SVAI Error Codes

Error Code	Description
C0	Channel Check
C1	Temperature Check
C2	Power Supply Check
DF	No Processor Card Detected
E1	No System Resource Card Detected
E2	Flag Error in Processor
E3	Register Error in Processor
E4	CMOS RTC Error
E5	ROM Checksum Error
E6	CMOS Shutdown Byte Test Error
E7	Processor Timer 1 Test Failed (Bit On)
E8	System Resource Timer 1 Failed (Bit On)
E9	Processor Timer 1 Failed (Bit Off)
EA	System Resource Timer 1 Failed (Bit Off)
EB	DMA 0 Initialization Error
EC	DMA 1 Initialization Error
ED	DMA Page Register Test Failed
EF	Memory Refresh Test Error
F0	8042 Buffer Full
F1	8042 Self Test
F3	CMOS Memory Error
F4	Protected Mode Register Failure

Environmental

The environmental specifications for the 7552 are as follows:

	W/O Hardfile and Diskette	With Hardfile	With Diskette
Temperature			
Operating	0 – 60°C	0 – 60°C	0 – 60°C
Non Operating	-55 – 85°C	-55 – 85°C	-55 – 85°C
Humidity			
Non-condensing	5 – 95%	5 – 95%	5 – 95%

The 7552 is classified FCC Class A:

A computing device that is marketed for use in commercial, industrial, or business environment; exclusive of a device that is marketed for use by the general public or that is intended for use in the home.

7494 Entry Level Facility (ELF) Data Collection Terminal
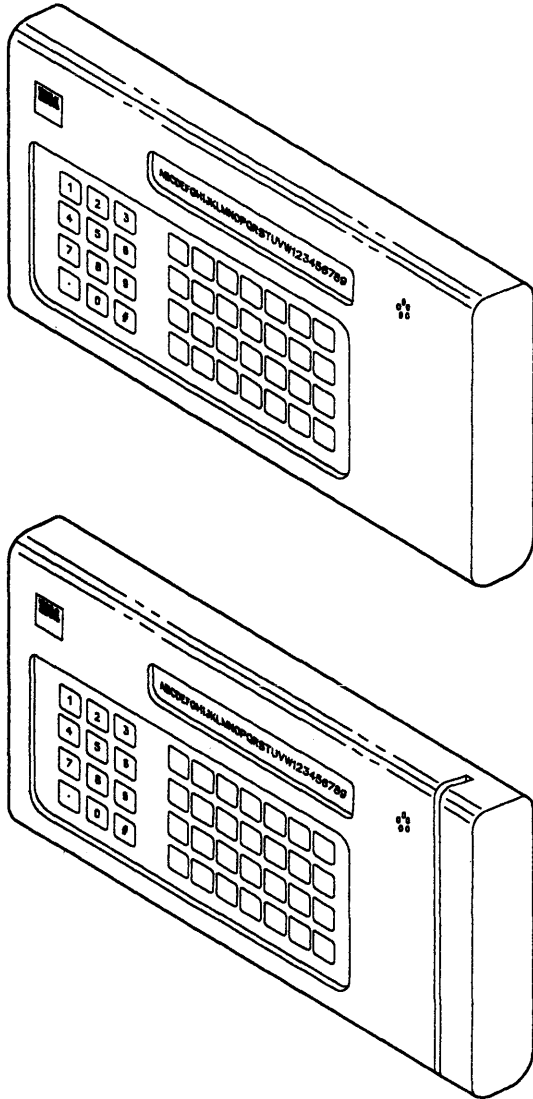
LEX41873

Figure 12-18. 7494 (ELF) Data Collection Terminal

The 7494 ELF Data Collection Terminal is designed to support worker-oriented transactions such as attendance reporting, data reporting, and data inquiry.

Technical Information

- **Display**
  - 40 alphanumeric characters
  - Reflective liquid crystal display (LCD)
  - Online: height of 0.218 inches.
- **Memory available to user**
- **Feedback**
  - Visual: LCD display
  - Audible: good/bad transaction keyboard input.
- **Time display:** hour/minute, hour/tenths, or hour/hundredths in a 12 or 14 hour format.
- **Capacitive backup**
  - 48 hours for RAM
  - 2 hours for the clock (time and date).
- **Fast clocking:** badge reading without pressing a function key.
- **Self-test diagnostics at power on**
- **Low power detect for orderly shutdown**
- **Transaction buffering:** transmit on being polled.
- **Power Options**
  - AC 12 to 24 volts
  - DC 10 to 35 volts.

Service Information

The first two releases of the 7494 ELF had three model types each. These models correspond to the three RPQ numbers as shown below.

Model 001 or 012 = 8X0012
Model 002 or 013 = 8X0013 (with visual light bar code reader)
Model 003 or 014 = 8X0014 (with magnetic badge reader)

The latest release has four RPQ number types as shown below.

8X0050 (Model 050)   (with no badge reader)
8X0051 (Model 051)   (with visible light bar code reader)
8X0052 (Model 052)   (with infrared bar code reader)
8X0053 (Model 053)   (with magnetic badge reader)

The CE can find the models' types printed on the back of the enclosure by unlocking the terminal, removing it from the base, and then removing the four screws from the back plate. The model or RPQ numbers are on the back of the terminal behind the removed plate.

Service is not provided for 7494 ELF accessories. Customers are to be directed to point of sale for replacement procedures. Accessories include:

High resolution bar code wand
Low resolution bar code wand
Wall mount with power supply
Desk mount with power supply.

Chapter 13. 5126 Technician Terminal

5126 System
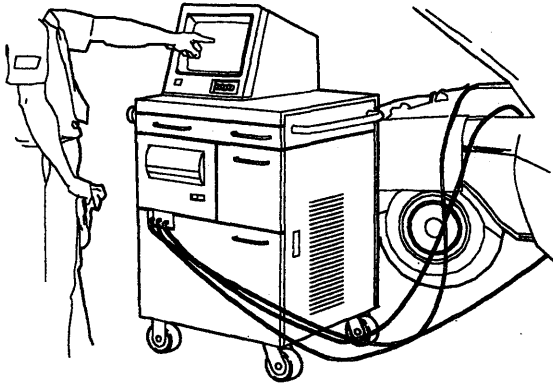
LEX42362

Figure 13-1. IBM 5126 Technician Terminal

The 5126 is a Personal Computer AT-based product developed as a special bid for General Motors (GM) and designed to GM specifications for use in its service bay environment. The 5126 will be sold to Electronic Data Systems (EDS), a subsidiary of GM, which will market the 5126 to the GM dealerships.

The 5126 is used to diagnose electrical/electronic engine and body systems on GM automobiles starting with model year 1982. Initially, the 5126 will be used by the Buick division of GM, but it will migrate to other divisions in the future. The 5126 guides the GM service technician through diagnostics procedures to isolate problems and then verify their completed repairs. The 5126 communicates asynchronously over switched lines with a host system at the GM Information Center, via an internal modem, to receive current GM diagnostic software and repair information and to transmit repair activity data.

Unit Specifications

Technician Terminal Size	
Height	1365 mm (53.75 in)
Width	686 mm (27 in)
Depth	660 mm (26 in)
Weight	152 kg (334 lb)
Electrical Requirements	
Voltage	125V AC
Frequency	60 Hz
Current	6 amps max.
Environment (System On)	
Air Temperature	10.0°C to 43.3°C (50°F to 110°F)
Relative Humidity	8% to 80% Noncondensing

Figure 13-2. 5126 Specifications

Features Unique to the 5126

- Infrared touch sensor assembly (special frame surrounding the monitor screen)
  - Used by the operator to interface with the system.
- Power Control Device (PCD)
  - Used for power distribution and remote power-on through communications.
- Assembly Line Data Link (ALDL)/Touch Adapter card
  - Interfaces with the vehicle under test and contains the touch controller microcode.
- Probe Adapter card
  - Used for voltage, current, and resistance measurements.
- Power Adapter card
  - Used for additional power supply connections.
- System Unit Fan Assembly
  - Used for additional air circulation and to filter the incoming air.
- Thermal switch
  - Input device to the processor for internal system temperature.
- Mobile cabinet
  - Area where all hardware is housed.

Touch Sensor Input System
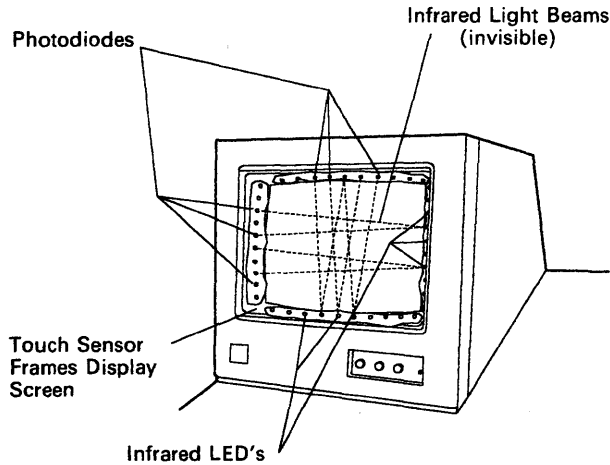
LEX42363

Figure 13-3. Touch Sensor Input System

The touch sensor is an infrared-transparent frame that mounts to the front of the enhanced graphics display. The touch sensor produces a lattice of infrared beams just in front of the surface of the monitor. These infrared beams are obstructed whenever the monitor screen is touched. The coordinates of the touched location are transmitted to the Personal Computer AT controller via the touch controller located on the Assembly Line Data Link (ALDL) card.

Power Control Device
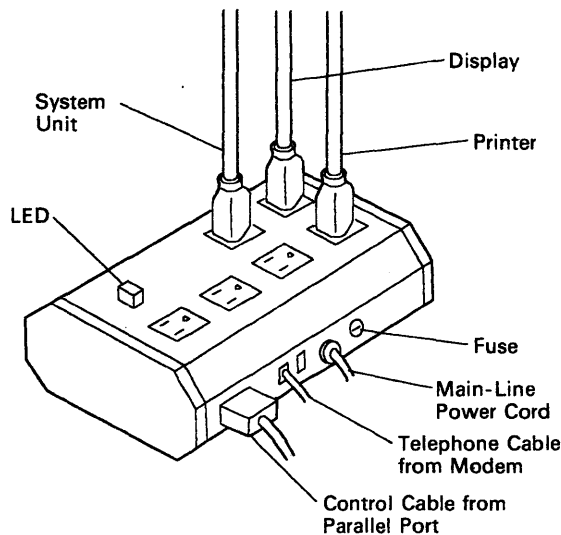
LEX42364

Figure 13-4. Power Control Device

The power control device is used for power distribution and has remote power-on capabilities. The power control device contains the following: one current sensing receptacle, one CPU receptacle, four peripheral receptacles, two phone line jacks, and a 25-pin D connector. For power distribution, the color monitor plugs into the current sensing receptacle. When the display is powered on, it causes all other devices plugged into the power control device also to power on. To receive service updates and transmit repair data to the GM Information Center, the GM service technician would connect the 5126 to a telephone line after his normal workday. A ring signal will cause the power control device to power up the 5126. After all information has been communicated, the power control device will power down the 5126 when the phone line goes to an On-Hook condition.

Assembly Line Data Link/Touch Adapter
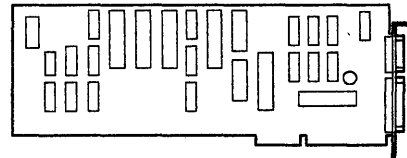
LEX42365

Figure 13-5. Assembly Line Data Link/Touch Adapter

The ALDL card occupies slot 5 of the system unit and interfaces with the automobile under test. The ALDL interface connector is located in the automobile under the dash near the steering column. This interface relays dynamic data to the 5126. This data is a real time presentation of the automobile's state. The 5126 then analyzes the data using stored values and specifications previously defined by GM service engineers. The ALDL card also contains an EPROM module for the touch controller hardware.

Probe Adapter Card
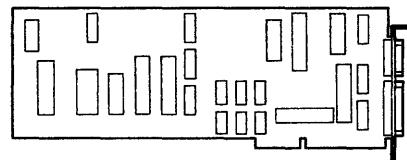
LEX42401

Figure 13-6. Probe Adapter Card

The Probe Adapter card is a multifunction attachment card located in slot 6 of the system unit. It allows a

13-2

GM service technician to further isolate a failure on a vehicle to a part or component that can be repaired, replaced, or adjusted. The functions performed by the Probe Adapter card are controlled by a service procedure interactively requesting the GM technician to take readings, inject source voltage/ground, or verify circuit paths as operational. The data obtained by the Probe Adapter card is presented to the GM service technician via the service procedure in visual or printed form for analysis.

Power Adapter Card
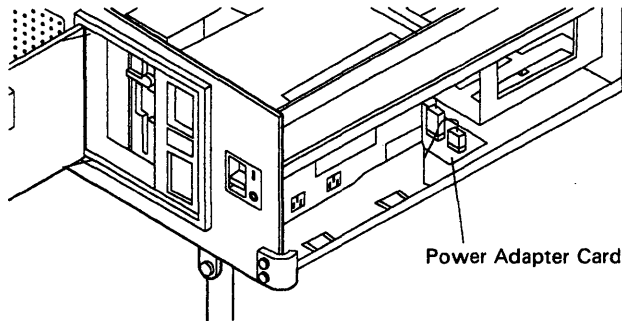
LEX42366

Figure 13-7. Power Adapter Card

The Power Adapter card is located between the rear of the power supply and the fixed disk drive. Its purpose is to provide additional power supply connections and to extend the power supply wires to the system board. There are no active electronic components on this card; it functions solely as a power distribution board for the power supply.

System Unit Fan Assembly
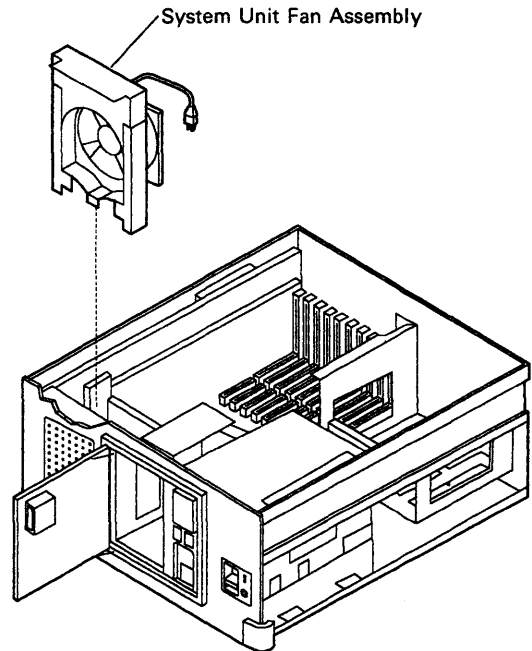
LEX42367

Figure 13-8. System Unit Fan Assembly

The system unit fan assembly contains a fan for additional air circulation and has a user-removable air filter. This filter protects the system unit from any particles that might enter and damage the system unit. The customer is responsible for cleaning and changing this filter, which fits into a slide-out filter retainer at the front of the system unit.

Thermal Switch

Thermal Switch   to ALDL/Touch Adapter
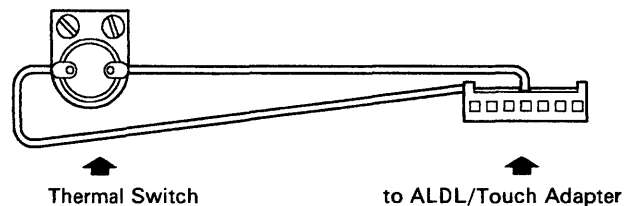
LEX42368

Figure 13-9. Thermal Switch

A thermal switch is located on the front of the disk drive mounting plate. Two wires connect the switch to a Berg connector on the ALDL/Touch Adapter. If the temperature gets too high in the system unit, this normally closed switch opens, producing a processing interrupt. This causes programming to issue a warning message on the display stating the 5126

Chapter 13. 5126 Technician Terminal **13-3**

internal temperature is too great and the air filter should be checked.

Card Locations

There are two possible card configurations in the system unit. They are shown as follows:

As shipped by IBM:

Slot 1	IBM Internal Modem
Slot 2	Open
Slot 3	Serial/Parallel Adapter
Slot 4	Enhanced Graphics Adapter (EGA)
Slot 5	Assembly Line Data Link (ALDL)/Touch Adapter
Slot 6	Probe Adapter
Slot 7	Open
Slot 8	Disk/Diskette Adapter

As shipped by EDS:

Slot 1	IBM Internal Modem
Slot 2	Enhanced Graphics Adapter (EGA)
Slot 3	Serial/Parallel Adapter
Slot 4	128Kb Memory Card
Slot 5	Assembly Line Data Link (ALDL)/Touch Adapter
Slot 6	Probe Adapter
Slot 7	Open
Slot 8	Disk/Diskette Adapter

System Unit Rear Panel Cables

LEX42369

Figure 13-10. System Unit Rear Panel Cables

1.	Telephone line in	Slot 1 - Internal Modem
2.	Telephone line out	Slot 1 - Internal Modem to PCD
3.	Printer cable	Slot 3 - Serial/Parallel, Serial
4.	PCD interface	Slot 3 -Serial/Parallel, Parallel
5.	Enhanced Color Display	Slot 4- Enhanced Graphics Adapter
6.	Touch Sensor	Slot 5 - ALDL/Touch Adapter
7.	ALDL cable	Slot 5 - ALDL/Touch Adapter
8.	Battery cable	Slot 6 - Probe Adapter
9.	Probe cable	Slot 6 - Probe Adapter
10.	Keyboard cable	Keyboard connector
11.	Speaker cable	Through opening near keyboard connector

Maintenance

The 5126 is serviced in a unique manner. A GM national help desk includes the Technical Assistance Center (TAC) that provides telephone aid to the end user with problems or questions about the operation of the 5126. TAC offers primary software/application support to GM dealerships and helps decide if a problem is software or hardware related. If the problem is an operational one, the TAC will instruct the end user on the proper procedure. If the problem is determined to be application software, GM will perform its own software maintenance. If the problem is determined or suspected to be caused by defective hardware, the TAC will pass the call to the CAMS Central Support Center (CCSC). The CCSC is another function of the GM help desk. The CCSC will contact IBM for on-site service. The CCSC will include in the comment section of the call its 800 WATS number and the most provable fix for the reported problem.

The CE is required to call the end users of the 5126 to advise them of the estimated time of arrival (ETA). It is the end user's responsibility to inform the CCSC about the status of the call. If the CE has a question regarding the reported failure which the end user cannot answer, the CE may call the CCSC for clarification. The CE is required to call the CCSC after the call has been completed to inform it of what was done to resolve the problem and what part(s) were replaced.

If the battery cable, probe cable, or suppression unit needs replacement, the end user will order it through GM.

It is important that the CE performs a system checkout using the Problem Isolation Charts (PICs) in the *Maintenance Information Manual* (MIM) each time the 5126

is serviced. It is especially important for the ALDL, probe, and modem that the CE follows the PICs in the *MIM* before responding to on-screen prompts to ensure that all related portions of the associated adapter cards are tested. While running diagnostics, the CE will be prompted when to use the docking station connectors, probe align station, or one of the wrap plugs.

Chapter 14. Personal Computer/Series 1

4950 System
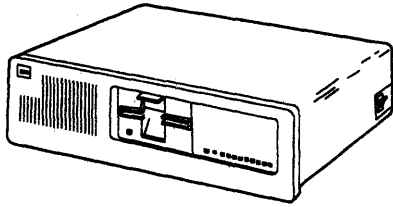
LEX40101

Figure 14-1. 4950 System, Model A
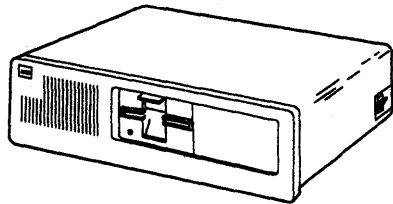
LEX40102

Figure 14-2. 4950 System, Model B

The IBM 4950 is a new Series/1 system built around the IBM Personal Computer XT and an additional 16-bit microprocessor. This system utilizes EDX, RPS, and customer applications that are written for the Series/1 operating system.

The 4950 system unit is available in two models:

* Model A—16-bit microprocessor, I/O controller, 5.25-inch diskette drive, and 10Mb fixed fisk.
* Model B—has no fixed disk drive and might have an optional second diskette drive.

Note: Detailed service documentation in the form of a *Maintenance Information Manual* (MIM) is shipped with the system.

Basic System Configuration

The unit contains:

* Series/1 Processor card with 256Kb of read/write (R/W) memory
* One 5.25-inch diskette drive
* One 5.25-inch 10Mb fixed disk drive
* Standard adapter cards for the diskette, fixed disk, display(s), and printer
* IBM Personal Computer Monochrome Display and Keyboard.

Expanded System Configuration

The expanded system configuration is a system unit and additional hardware. The system unit contains:

* One or two 5.25-inch diskette drives
* Series/1 Processor card with 256Kb to 512Kb of memory
* Expansion card to interface with expansion unit
* Terminal/Host Adapter card supports a maximum of four 3101s
* Standard Adapter card for the diskette, fixed disk, display(s), and printer.

Other hardware also in the expanded system configuration includes:

* 3101 terminal
* Expansion unit containing:
  - Two 5.25-inch fixed disk drives
  - Fixed Disk Adapter card
  - Receiver card to interface with the system unit.
* 4971 printer unit (optional)
* Adapter card features (optional).

Figure 14-3 on page 14-2 shows a typical system configuration. It includes four 3101 terminals attached locally via the Terminal/Host Adapter card through the rear of the system unit. These terminals can serve as local operator consoles for the 4950 system. Two additional 3101 terminals can be operated remotely through the use of two optional asynchronous (RS232C) adapter cards.
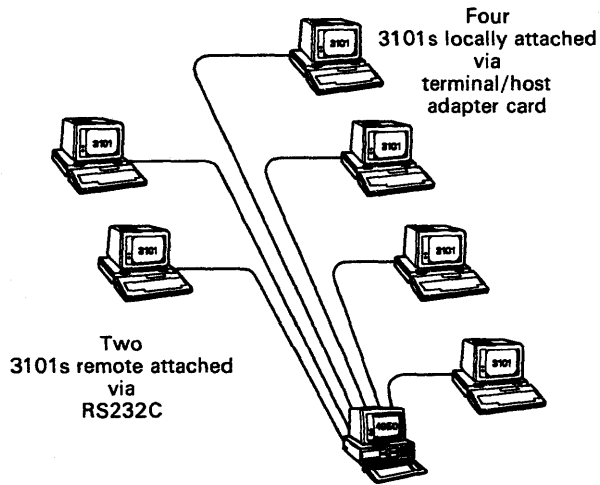
Figure 14-3. Typical System Configuration

Figure 14-4 is an example of a 4950 system interfacing with Series/1. The host Series/1 can be attached to the 4950 system remotely through the optional Personal Computer BSC Adapter card.
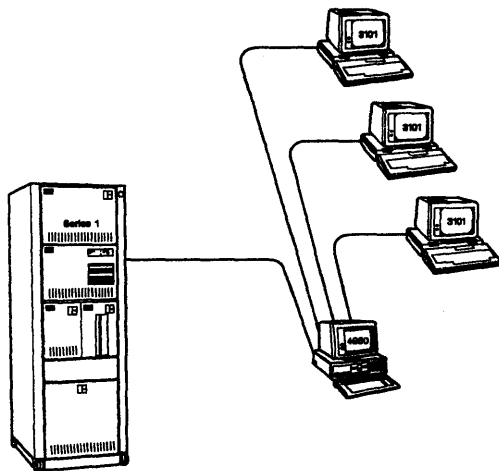
Figure 14-4. 4950 System Interfacing with Series/1

Adapter Cards

The adapter cards have recommended plug-in slots on the system board. The table below shows the slots (1 – 8) into which the cards might be installed.

Adapter Card	System Board Card Slot							
	1	2	3	4	5	6	7	8
Series/1 processor				X				
Fixed disk			X					
Diskette						X		
Terminal/host		X						
Primary ASYNC								X
Printer	X			X		X		
Monochrome	X			X				
BSC	X			X				
SDLC	X			X				
Expansion			X					

Figure 14-5. System Board Adapter Card Usage

Expansion Unit Adapter Cards

The expansion unit adapter cards have recommended plug-in slots on the expansion board. The cards might be installed in these slots (1 – 8).

Adapter Card	System Board Card Slot							
	1	2	3	4	5	6	7	8
Fixed disk					X			
Primary ASYNC	X	X	X	X		X	X	
Alternate ASYNC	X	X	X	X		X	X	
Printer	X	X	X	X		X	X	
BSC	X	X	X	X		X		
SDLC	X	X	X	X		X		
Receiver								X

Figure 14-6. Expansion Unit Adapter Card Usage

Warning: The BSC card (when configured as a secondary attachment) and the SDLC card cannot be used at the same time.

The printer card should not be plugged into slot 8; it will not work properly.

Terminal/Host Adapter Card

Setup Switches

1 2 3 4 5 6 7 8
ON
OFF

(See Note)

Port-Adapter Cable Connector

Rear Bracket

Display Connector Port 0

System Board Connector

Display Connector Port 1
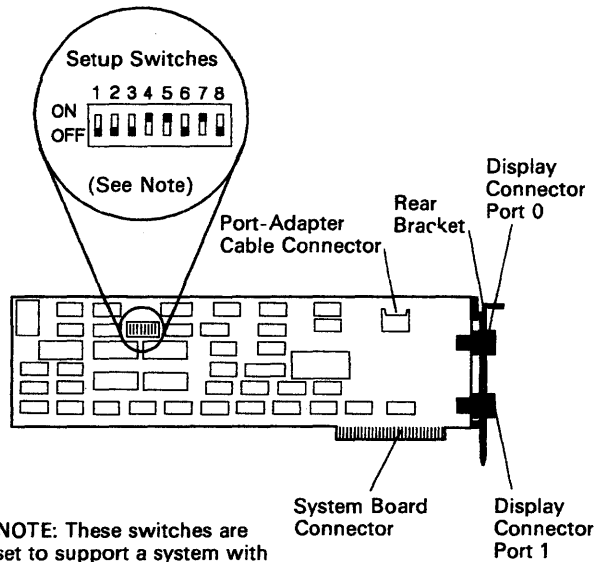
NOTE: These switches are set to support a system with from one to four display terminals attached to this card. Switches 4, 5, and 7 are on; the other switches are off.

LEX40105

Figure 14-7. Terminal/Host Adapter Card

The switches on the Terminal/Host Adapter card are set up to support a system with one to four display terminals attached to this card. In the event you should need to verify the switch setting, refer to the Location Diagrams section of the *MIM* for proper settings.

Series/1 Processor Card

Front Bracket

Memory Modules

Rear Bracket

System Board Connector
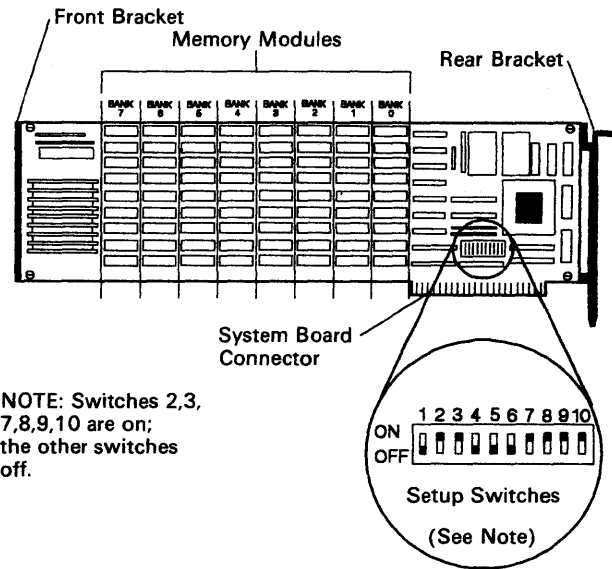
NOTE: Switches 2,3, 7,8,9,10 are on; the other switches off.

1 2 3 4 5 6 7 8 9 10
ON
OFF

Setup Switches

(See Note)

LEX40106

Figure 14-8. Series/1 Processor Card

Although there are no jumpers to be installed, there is a set of switches that reside on the Series/1 Processor card. These switches are set at the plant site. In the event you should need to verify the switch settings, refer to Location Diagrams section of the *MIM* for the proper settings. The *MIM* replaces the traditional *HMS* manual and will be shipped with each system.

Note: Setup switches 2, 3, 7, 8, 9, and 10 are on, the other switches are off.

3101 Display Terminal

Display

Logic Element

Keyboard
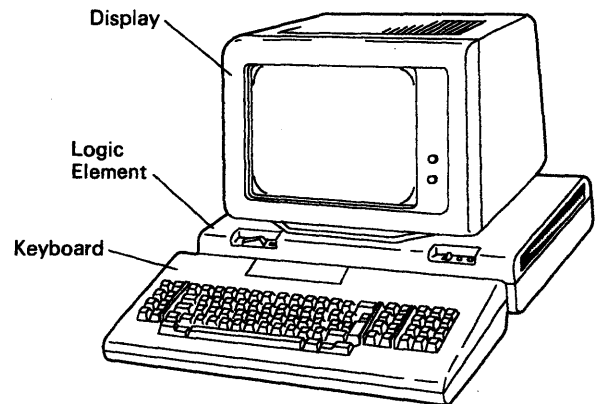
LEX41804

Figure 14-9. 3101 Display Terminal

Two models (013 and 023) of the 3101 can be used with the 4950 Terminal/Host Adapter card. Four local 3101s can be attached to the Terminal/Host card. Two more 3101s can be used with RS232C interface.

The 3101 consists of three separate elements:

* Keyboard with 87 keys
* Logic unit
* Display unit.

4971 Printer
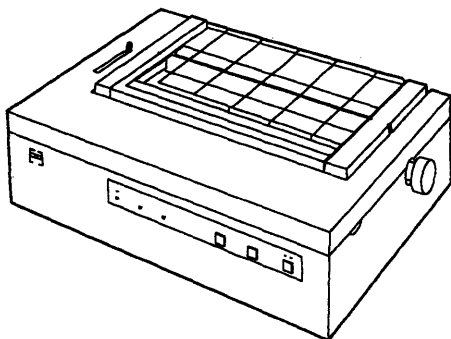
LEX40108

Figure 14-10. 4971 Printer

The 4971 Printer has a wire matrix printhead that bidirectionally prints at a speed of 120 characters per second (cps). The three models available (Models 001, 002, and 003) correspond to a voltage and frequency range particular to a set of countries.

Series/1 to Personal Computer Channel Attachment
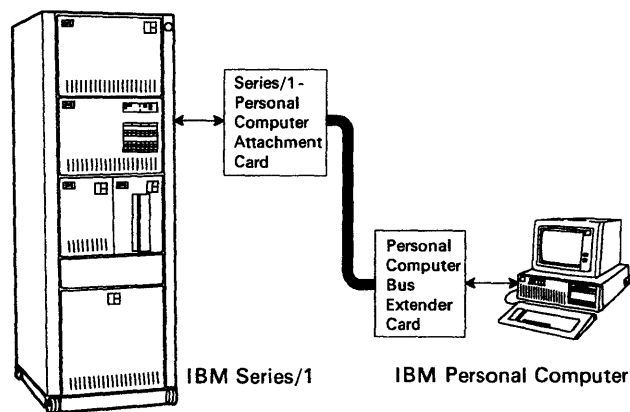
LEX41745

Figure 14-11. Series/1 to Personal Computer Channel Attachment

The IBM Series/1-Personal Computer Channel Attachment enables you to attach the IBM Personal Computer, Personal Computer XT, or Personal Computer AT to the Series/1. This attachment is used as a communication device between the Series/1 and other devices, such as a local area network.

The IBM Series/1 to Personal Computer channel attachment consists of an extender card installed in the IBM Personal Computer system unit, a cable extending from the extender card to the Series/1, and an attachment card in the Series/1.

Various options can be installed in the IBM Personal Computer system unit with the IBM Series/1 to Personal Computer Channel Attachment installed. However, the IBM 5161 Expansion Unit must not be attached to an IBM Personal Computer system unit with the IBM Series/1 to Personal Computer Channel Attachment installed.

System Configuration

A minimum system for this attachment is a:

* Personal Computer, Personal Computer XT, or Personal Computer AT with:
  - Keyboard
  - Display unit
  - Diskette drive
  - 128Kb of storage.

- Series/1 Processor
  - 32Kb of main storage
  - Diskette unit
  - Alternate console.

Extender Card
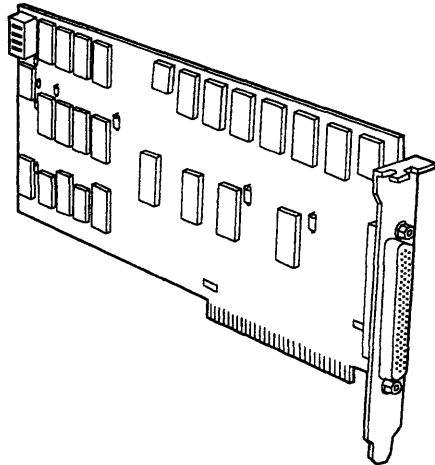
LEX40083

Figure 14-12. Extender Card

The usual application of the Extender card, also called the Expansion Adapter card, is to redrive signals from the Personal Computer to the PC Expansion Unit housing additional adapters and/or memory. The card also contains a wait-state generator that inserts a wait-state on memory operations (except refresh) housed in the expansion unit. By setting the DIP switches on the Extender card, the total read/write memory located in the system unit is indicated. Any memory located outside the system unit (in the expansion unit) will have a wait-state inserted during memory operations. The Extender card can be installed in any unused slot of the system board.

For use with the Series/1-Personal Computer Channel Attachment, the Extender card redrives the Personal Computer channel to the Series/1 attachment instead of a PC Expansion Unit. Therefore, because all memory for the PC is housed in the system unit, the DIP switches should always be set as follows:

- Switch 1 - Off
- Switch 2 - On
- Switch 3 - Off
- Switch 4 - On.

This allows memory configuration changes in the Personal Computer without resetting the switches on the Extender card.

Series/1 Attachment Card

*This bit is always logical Ø (hardwired).

LEX41747

Figure 14-13. Series/1 Attachment Card

The Series/1 Attachment card contains a microprocessor with 16Kb of read-only storage (ROS) and 128Kb of random access memory (RAM). Of the 128Kb, 64Kb is shared by the Series/1 and the PC to exchange data. This 64Kb is referred to as the two-port buffer. Also included on the card is the logic necessary to control access to and from the storage shared by the Series/1 and PC.

Note: All switches except those shown as optional must be as shown.

Switch Block No. 1

Switch	Function	Setting No.
1	Device address bit 8	Optional
2	Device address bit 9	Optional
3	Device address bit 10	Optional
4	Device address bit 11	Optional
5	Device address bit 12	Optional
6	Device address bit 13	Optional
7	Device address bit 14	Off
8	On = PC, PC XT; Off = PC AT	Optional

Note: Device address bit 15 = 0.

Switch Block No. 2

Switch	Function	Setting No.
1	Reserved	Off
2	Reserved	Off
3	Reserved	Off
4	On = ALT IPL Off = NO ALT IPL	Optional
5	On = PRI IPL Off = NO PRI IPL	Optional
6	Reserved	Off

| 7 | Reserved | Off |
| 8 | Reserved | On |

Switch Block No. 3

Switch	Function	Setting No.
1	Reserved	On
2	Reserved	Off
3	Reserved	Off
4	Reserved	Off
5	Reserved	Off
6	Reserved	Off
7	Reserved	On
8	Reserved	On

* This bit is always logical 0 (hardwired).

5170/495 System
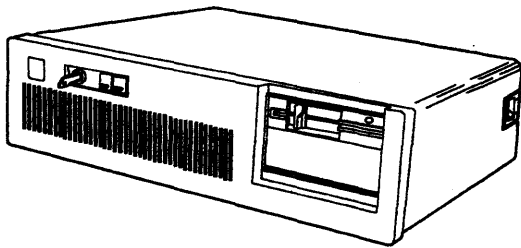
LEX41748

Figure 14-14. 5170/495 System

The 5170 Model 495 is an entry-level Series/1 system. It consists of a Series/1 coprocessor and communications attachment residing in an IBM Personal Computer AT. The system allows the use of RPS and EDX programming languages in a desktop environment.

The Series/1 Processor card contains from 256Kb to 512Kb of storage for processing Series/1 software. The communications attachment or Terminal/Host Attachment card provides communications capability and the power-on self test for the feature. The system is capable of supporting two Terminal/Host Attachment cards. A single Terminal/Host Attachment card can support up to six asynchronous communications attachments. A configuration of two Terminal/Host Attachment cards can support up to eight terminals including the PC console. The PC processor is used to handle I/O transactions via an I/O translation program called I/O Executive (IOX). Parallel printer support is standard.

Basic System Configuration

5170 Model 495 consists of the following standard features:

* Personal Computer AT
  - 512Kb of PC storage
  - Serial/Parallel Attachment card
  - 20Mb disk drive
  - 1.2Mb diskette drive
  - Disk/Diskette Attachment card.
* Series/1 enhancement unique features
  - Series/1 Processor card
    - 256Kb of S/1 storage.
  - Terminal/Host Attachment card
    - Four asynchronous RS422 ports
    - Two asynchronous RS232C ports.
      * Port No. 4 may be optionally configured for bisynchronous communication (RS232C).

Optional Features

* Personal Computer AT
  - Second disk or diskette drive (Personal Computer AT)
  - PC Communications attachments (mutually exclusive)
    - Second Serial/Parallel Attachment card
    - Bisynchronous Communications Attachment (BSC)
    - Synchronous Data Link Control (SDLC).
* Series/1 Feature
  - Additional 256Kb of S/1 storage
  - Second Terminal/Host Attachment card.

The figure below shows a typical system configuration. It includes four 3161 terminals attached locally via the Terminal/Host Adapter card through the rear of the system unit. These terminals can serve as local operator consoles for the 5170/495 system. Two additional 3161 terminals can be operated remotely through the use of the asynchronous (RS232C) port.

Four 3161s
Locally Attached
Via Terminal/Host
Adapter Card

Two 3161s
Remote Attached
Via RS232C

5170/495 System Unit
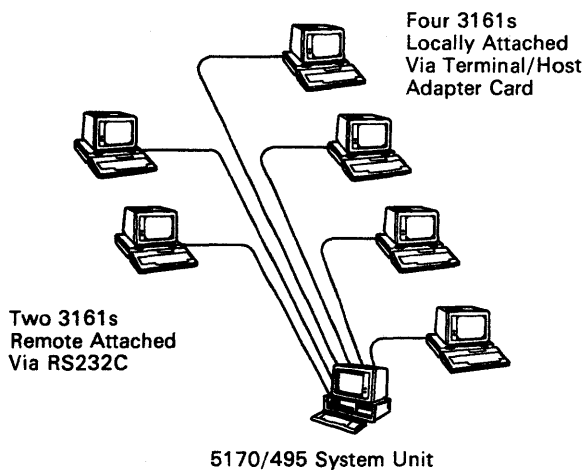
LEX41749

Figure 14-15. Typical System Configuration

Figure 14-16 is an example of a 5170/495 system interfacing with Series/1. The host Series/1 can be attached to the 5170/495 system remotely through port No. 4 of the Terminal/Host Attachment card.
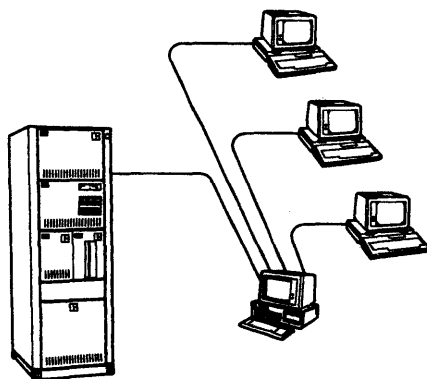
LEX41750

Figure 14-16. 5170/495 System Interfacing with Series/1

Adapter Cards

The adapter cards have recommended plug-in slots on the system board. The table shows the slots (1 – 8) into which the cards can be installed.

Adapter Card	System Board Card Slot							
	1	2	3	4	5	6	7	8
Series/1 Processor						X		
Terminal/Host (1st)					X			
Terminal/Host (2nd)				X				
Disk Diskette								X
Serial/Parallel (1st)							X	
BISYNC	X	X	X					
SDLC	X	X	X					
Serial/Parallel (2nd)	X	X	X					

Figure 14-17. System Board Adapter Card Usage

Switch Settings

Series/1 Processor Card

The switches must be set as shown in Figure 14-18.

Warning: To prevent damage to the Series/1 Processor card, the card must be installed in slot 6 to provide clearance for the cooling fans located on the front of the card.
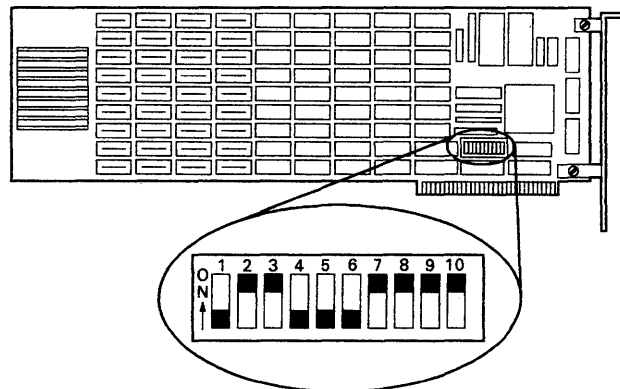
LEX41751

Figure 14-18. Series/1 Processor Card

Terminal/Host Adapter Card

The IBM Series/1 System Unit can have two Terminal/Host Adapter cards installed. IBM recommends that the first Terminal/Host Adapter card be installed in slot 5. The switches and jumper J1 must be set as shown. Jumper J2 is set according to the type of installed modem.

Jumper J2	
No Modem or IBM Modem Jumper Pins	Non-IBM Modem Jumper Pins
Pin 1 to Pin 2 and Pin 5 to Pin 6	Pin 2 to Pin 3 and Pin 4 to Pin 5

Jumper J2	
No Modem or IBM Modem Jumper Pins	Non-IBM Modem Jumper Pins
Pin 1 to Pin 2 and Pin 5 to Pin 6	Pin 2 to Pin 3 and Pin 4 to Pin 5
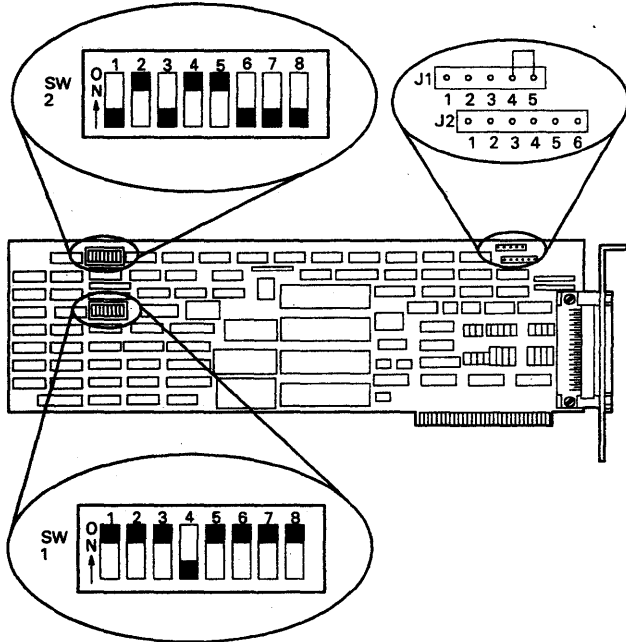
LEX41752

Figure 14-19. Terminal Host Adapter Card
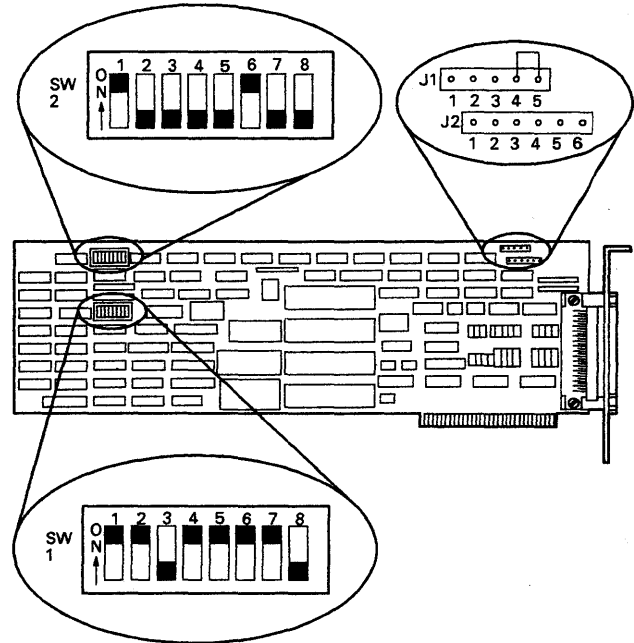
LEX41753

Figure 14-20. Terminal/Host Adapter Card (Second)

Terminal/Host Adapter Card (Second)

IBM recommends that the second Terminal/Host Adapter card be installed in slot 4. The switches and jumper J1 must be set as shown. Jumper J2 is set according to the type of installed modem.

Chapter 15. Display Units

4863 PCjr Color Display

FRU Exchange Element, P/N6133803
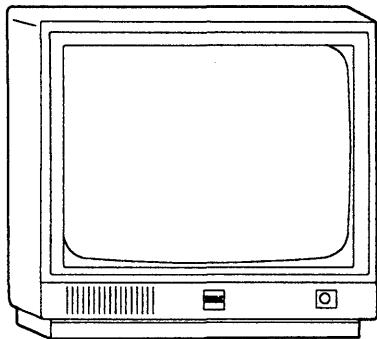
LEX40096

Figure 15-1. 4863 PCjr Color Display

This 330-mm (13-in) diagonal measurement, high contrast direct-drive display is capable of clearly displaying 16 colors in a 40 × 25 character mode. It has an on/off switch as well as user adjustable controls for volume, vertical hold, vertical size, contrast, and brightness. An audio amplifier is contained within the display to utilize driving system's sound output. An internal speaker is provided for audio output and an earphone jack is furnished at the front of the display.

Unit Specifications

Size	
Width	354 mm (13.95 in)
Depth	392 mm (15.04 in)
Height	322 mm (12.90 in)
Weight	12 kg (26 lb)
Power	
Requirements	127V AC max.
	60 Hz
	110 watts
	0.80 max. amps
	0.102 kva
Heat Output	375 BTU/hr max.
Relative Humidity	8% to 80%

Figure 15-2. 4863 Specifications

5151 Monochrome Display

FRU Exchange Element, Model 001, P/N8529171
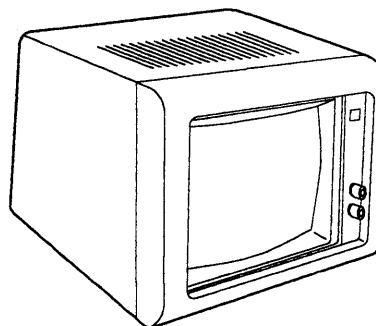
LEX40097

Figure 15-3. 5151 Monochrome Display

The high resolution IBM Monochrome Display connects to the system unit through two cables. One cable is a signal cable from the display adapter to the display, and the other provides power to the display from the system unit. This arrangement eliminates the need for a wall outlet and allows the system-unit power switch to control power to the display. This display unit has a 28.3-cm (11.5-in) diagonal, 90° deflection cathode ray tube (CRT). The display can be placed on the system unit or on a nearby table or desk. Brightness and contrast controls are on the front surface and are easily accessible to the operator.

The characteristics of the display are as follows:

- Screen
  - High-persistence, green phosphor (P39)
  - Etched surface to reduce glare
  - Presentation of 80 characters wide × 25 rows deep
  - Characters are defined in a 14-pel-high × 9-pel-wide matrix.
- Video Signal
  - Maximum bandwidth of 16.257 MHz at -3 dB.
- Vertical Drive
  - Screen refreshed at 50 Hz with 350 lines of vertical resolution and 720 lines of horizontal resolution.
- Horizontal Drive
  - Positive level, TTL-compatibility, at a frequency of 18.432 KHz.

Unit Specifications

Size	
Height	280 mm (11 in)
Length	380 mm (14.9 in)
Depth	350 mm (13.7 in)
Weight	7.9 kg (17.3 lb)
Heat Output	130 BTU/hr
Power Cable	
Length	0.914 m (3 ft)
Size	18 AWG
Signal Cable	
Length	1.22 m (4 ft)
Size	22 AWG

Figure 15-4. 5151 Specifications

5153 Color Display

FRU Exchange Element, Model 001, P/N8529227
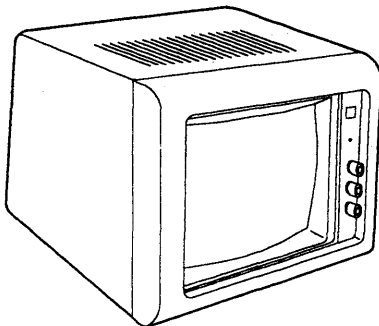
LEX40098

Figure 15-5. 5153 Color Display

The IBM Color Display connects to the system unit with a signal cable of approximately 1.07 m (3.5 ft) in length. This signal cable is a direct-drive interface from the Color/Graphics Monitor Adapter.

A second cable provides power to the display from an electrical outlet. The display unit has its own power control and indicator and will accept either 120-volt 60-Hz or 220-volt 50-Hz power. The power supply in the display automatically switches to match the applied power.

The display has a 340-mm (13-in) CRT. The display can be placed on the system unit or on a nearby table or desk. The front panel of the display has a power-on control, power-on indicator, brightness control, and contrast control. The rear panel has the vertical hold and vertical size controls.

The characteristics of the IBM Color Display are as follows:

- High contrast (black)
- Displays up to 16 colors when used with the IBM Color/Graphics Monitor Adapter
- Presentation of 80 characters wide × 25 rows deep
- Characters are defined in a 8-pel-high × 8-pel-wide matrix.

Unit Specifications

Size	
Height	297 mm (11.7 in)
Length	392 mm (15.4 in)
Depth	407 mm (15.6 in)
Weight	11.8 kg (26 lb)
Heat Output	240 BTU/hr
Power Cable	
Length	1.83 m (6 ft)
Size	18 AWG
Signal Cable	
Length	1.07 m (3.5 ft)
Size	22 AWG

Figure 15-6. 5153 Specifications

5154 Enhanced Color Display

FRU Exchange Element, Model 001, P/N6321035
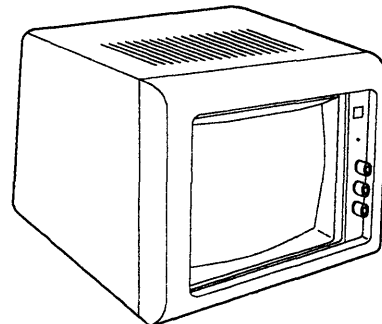
LEX40099

Figure 15-7. 5154 Enhanced Color Display

The IBM Enhanced Color Display is an advanced color display capable of operating in two separate modes. Mode 1 is a 16-color, 640 × 200-pel overscan mode with a horizontal scan frequency of 15.75 kHz. Mode 2 is a 64-color, 640 × 350-pel mode with a horizontal scale frequency of 21.8 kHz. Both modes are non-interlaced. The monitor determines which mode to operate in by decoding the vertical sync polarity.

The IBM Enhanced Color Display attaches to the system unit by a signal cable that is approximately 1.07 m (3.5 ft) in length. This signal cable provides a direct-drive interface from the IBM Personal Computer.

The IBM Enhanced Color Display attaches to either a Color Graphics Adapter card for mode 1 operation or to an Enhanced Graphics Adapter for mode 1 or mode 2 operation.

A second cable provides AC power to the display from a standard wall outlet. The display has its own power control and indicator. Three models are provided. Model 001 is the northern hemisphere operation and operates on 120 volts 50/60 Hz. Model 002 is for northern hemisphere operation and operates on 220/240 volts 50/60 Hz. Model 003 is for southern hemisphere operation and operates on 220/240 volts 50/60 Hz.

The display has a 13-inch, high-contrast CRT. The CRT and analog circuits are packaged in an enclosure so the display can sit either on top of the system unit or on a nearby table top or desk. Front panel controls and indicators include: power-on control, power-on indicator, brightness, and contrast controls. Additional controls on the rear of the display are vertical size 1 and vertical size 2. There are two service controls on the rear of the unit, black level adjustment, and contrast default value adjustment.

Unit Specifications

Size	
Height	297 mm (11.7 in)
Length	392 mm (15.4 in)
Depth	407 mm (15.6 in)
Weight	14.5 kg (32 lb)
Heat Output	300 BTU/hr
Power Cable	
Length	1.83 m (6 ft)
Size	18 AWG
Signal Cable	
Length	1.07 m (3.5 ft)

Figure 15-8. 5154 Specifications

5175 Professional Graphics Display

FRU Exchange Element, Model 001, P/N6181764
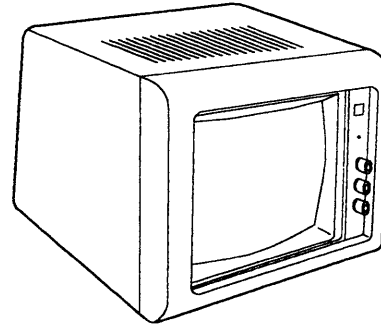
LEX40100

Figure 15-9. 5175 Professional Graphics Display

The IBM Personal Computer Professional Graphics Display is a 640 × 480-pel color raster display for medium- and high-function graphics and alphanumerics. It operates with separate red, green, and blue analog signals and can support more than 4000 colors.

The professional graphics display attaches to the system unit through a signal cable that is approximately 1.5 m (4.9 ft) in length. This cable provides a direct-drive connection from the IBM Professional Graphics Controller. The cable consists of shielded, twisted-pair lines, and has a 9-pin, subminiature, D-shell connector at the system-unit end.

A second cable provides power to the display from a standard wall outlet. The display has its own power control and indicator. Depending on the model number, it accepts either 100 to 127V AC at 50 to 60 Hz, or 200 to 240V AC at 50 to 60 Hz.

The display has a 340-mm (13-in) cathode ray tube (CRT). The CRT and analog circuits are enclosed so the display can be placed on top of the system unit or on a nearby table or desk. Front-panel controls and indicators are the power-on indicator, power-on control, and contrast and brightness controls.

Unit Specifications

Size	
Height	297 mm (11.7 in)
Length	392 mm (15.4 in)
Depth	407 mm (15.6 in)
Weight	14.5 kg (32 lb)
Heat Output	300 BTU/hr
Power Cable	
Length	1.8 m (6 ft)
Size	18 AWG
Signal Cable	
Length	1.5 m (4.9 ft)
Size	28 AWG

Figure 15-10. 5175 Specifications

5272 Color Display

FRU Exchange Element Model 001, P/N6931932
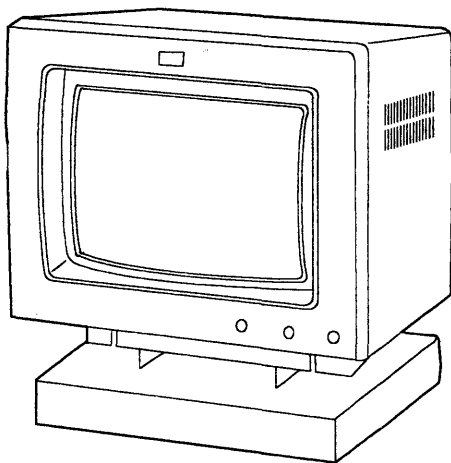
LEX43140

Figure 15-11. 5272 Color Display

The IBM Personal Computer Display is a 730 × 350-pel display, which in host mode provides a 1,920-character screen of 80 characters × 24 lines. A 25th line is available for an operator information area. When the 5271 operates in 3270 PC stand-alone mode, 2,000 characters are displayed as 80 characters × 5 lines. The character cell is 9 × 14.

4055 InfoWindow Display
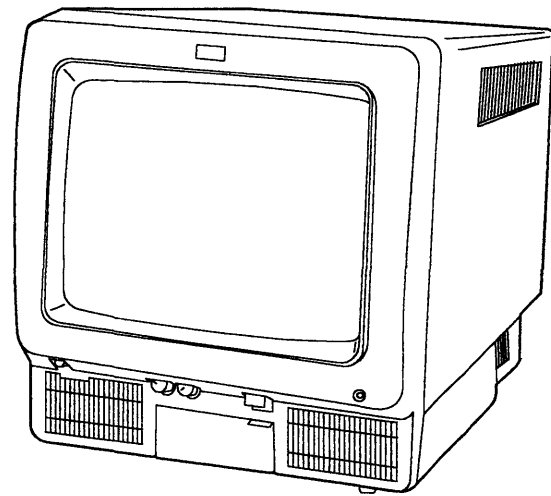
LEX42412

Figure 15-12. InfoWindow Display

The 4055 InfoWindow System is an interactive, multi-media, Personal Computer (PC)-based system which is used primarily for education and merchandising. The InfoWindow System is made up of an IBM PC, OEM videodisc player, and the IBM 4055 display.

The 4055 display consists of a 13-inch color CRT with a touch screen mounted over the face of the display. The 4055 display contains logic cards to provide the synchronization and control logic for the touch-sensitive screen, voice synthesis, videodisc player, audio beep, PC interface, and video graphics.

The 4055 is available in one model only.

The 4055 provides display of selected National Television Standards Commission (NTSC) composite video images and stereo sound stored on a videodisc, and red green blue (RGB) computer graphics stored in an IBM Personal Computer. An overlay function which mixes the composite video and RGB graphics for display on a single screen provides extensive flexibility to vary the displayed image. Users interact with the system using a touch-sensitive monitor screen and/or a Personal Computer keyboard. A synthetic voice function provides additional flexibility for audio communications. Real-time data processing is available from the attached PC.

- Color 13-inch display
- Touch screen support
- Automatic time and date
- High resolution graphics (640 × 200, 640 × 350)
- Selection of one of two composite video sources

15-4

- Support of one videodisc player using the RS232C interface
- Support for one or two videodisc players on the IEEE-488 interface
- Display up to 16 colors simultaneously from a 64-color palette
- Two internal stereo speakers
- Stereo audio output jacks
- Stereo headphones jack
- Voice synthesis from internal ROM or PC disk
- Text/graphics compatibility with IBM PC.

The 4055 display supports the following customer-supplied optional devices:

- Auxiliary composite video display
- Projection screen or slave monitor
- Stereo amplifier
- Stereo headphones.

The 4055 InfoWindow Display attaches to any model of IBM Personal Computer (5150), IBM Personal Computer XT (5160), IBM Personal Computer AT (5170), or Personal System/2 (8530) that supports the following minimum configuration. (Actual system requirements depend on the application to be run).

- PC Disk Operating System (DOS) 3.2 (or later)
- One Dual-Sided Diskette Adapter
- 256Kb storage
- Enhanced Graphics Adapter (EGA) card
- Enhanced Graphics Adapter Jumper card
- Graphics Memory Expansion (GME) card
- General Purpose Interface Bus (GPIB) card.

Unit Specifications

Size	
Height	371 mm (14.5 in)
Width	361 mm (14.1 in)
Depth	442 mm (17.2 in)
Weight	19.5 kg (43 lb)
Power Requirements	120V AC, 50/60 Hz, 1.65 amps
Power Dissipation	200 watts 682 BTUs/hr
Temperature	
Operating	15.6° to 32.2°C (60° to 90°F)
Nonoperating	-40° to 60°C (-40° to 140°F)
Relative Humidity	
Operating	8% to 80%
Storage	5% to 100% (non-condensing)
Maximum Wet Bulb	22.8°C (73°F)

Figure 15-13. 4055 Specifications

Unique PC Feature

Enhanced Graphics Adapter Jumper Card

The Enhanced Graphics Adapter (EGA) Jumper card provides an external synchronization from the 4055 InfoWindow Display to allow text and graphics stored on the IBM Personal Computer or IBM Personal System/2 (8530) to overlay motion or still frame video stored on a videodisc player and displayed on the 4055 InfoWindow Display.

The EGA Jumper card attaches to the feature connector of the EGA card and to the GPIB card.

Diagnostic Information

Advanced diagnostics are on a separate diskette located in the *IBM EGA Card and EGA Jumper Card Hardware and Maintenance Service* manual, SK2T-0298.

Advanced diagnostics for the 4055 InfoWindow and the related PC cards are also on a separate diskette located in the *IBM InfoWindow Hardware Maintenance and Service* manual, SK2T-0296, which is shipped with every 4055 InfoWindow.

Error codes associated with the 4055 InfoWindow Display are 82XX. Refer to device type 4055 in the Hardware Support Facility data base, accessible via RETAIN, for the latest diagnostic and service hints.

Step 1

Set the jumpers and switches on the IBM EGA card.

1. Find the IBM EGA card.
2. Find jumpers P1 and P3 on the IBM EGA card.
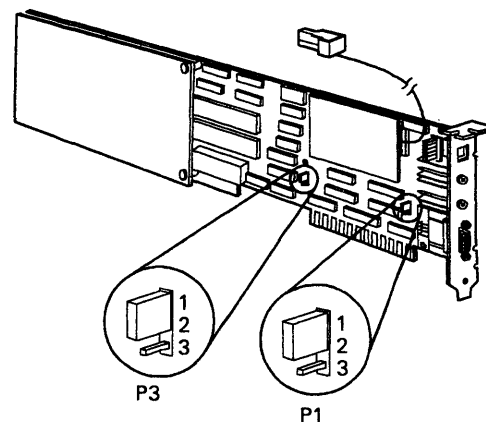
LEX42370

3. Compare the jumper settings to the settings in the illustration. For each plug, make sure a jumper is set over pins 1 and 2 but not over pin 3. If the jumpers are incorrectly set, correct them.

4. Find the switch block next to the card retaining bracket on the IBM EGA card.

Switch Block
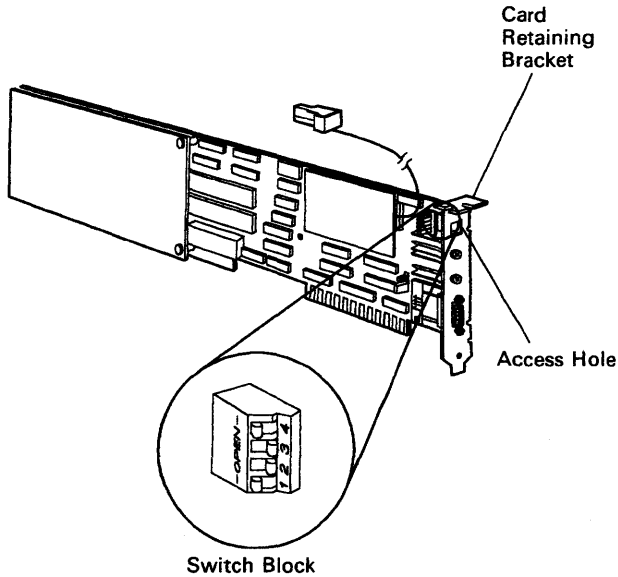
LEX42371

5. Make sure that switches 1 and 4 are set to open and switches 2 and 3 are set to closed. If these are incorrectly set, use the point of a ballpoint pen to reach through the access hole in the card retaining bracket to correct them. This setting is for an enhanced color display in high-resolution mode.

Note: If you are using graphics modes 0 through 3, you cannot use composite video in these modes. To see composite video in these modes, set switches 1, 2, and 3 to open and switch 4 to closed. This setting is for an 80 × 25 color display.

A computer program can also change these switch settings.

Step 2

Set the jumpers on the IBM PC GPIB card.

1. Find the IBM PC GPIB card.

2. On the IBM PC GPIB card, find the plug labeled A13/A14.
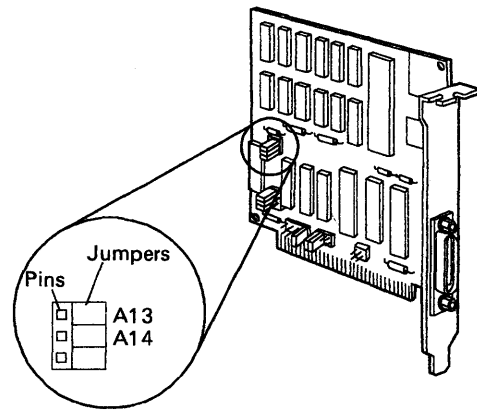
LEX42372

3. Compare the jumper settings to the settings in the illustration. Make sure the jumpers are set over the two rows of pins at the far right. If the jumpers are incorrectly set, correct them.

4. On the IBM PC GPIB card, find the plug labeled 2FX IE.
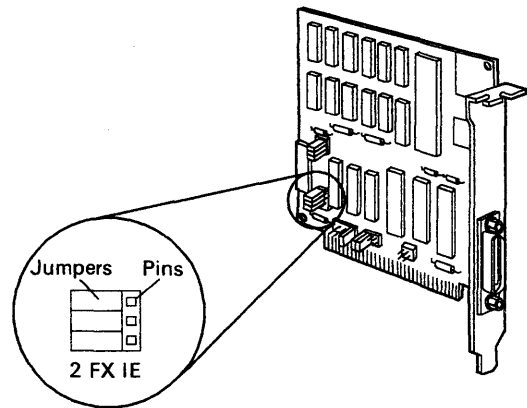
LEX42373

5. Compare the jumper settings to the settings in the illustration. Make sure the jumpers are set over the two rows of pins at the far left. If the jumpers are incorrectly set, correct them.

6. On the IBM PC GPIB card, find the plug labeled IRQ 2 3 4 5 7.

15-6
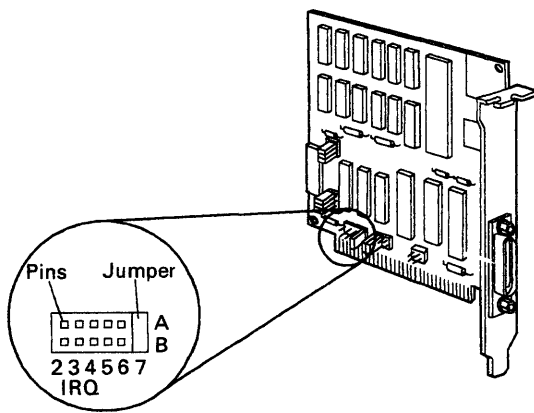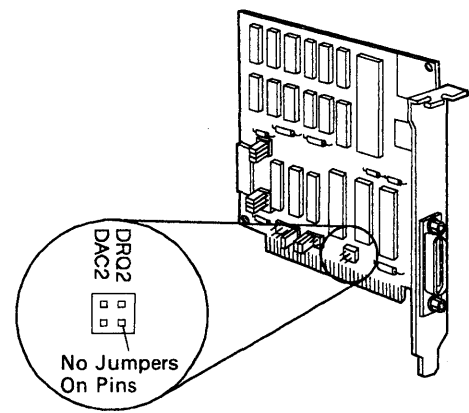
LEX42374

7. Compare the jumper settings to the settings in the illustration. Make sure the jumpers are set over the two rows of pins at the far right. If the jumpers are incorrectly set, correct them.

8. On the IBM PC GPIB card, find the plug labeled DRQ1/DAC1/DRQ3/DAC3.

LEX42375

9. Compare the jumper settings to the settings in the illustration. Make sure the jumpers are set over the two rows of pins at the far left. If the jumpers are incorrectly set, correct them. This setting is for DMA channel 1.

   Note: It is equally correct to use DMA channel 3 if you are using another IBM PC card that requires DMA channel 1.

   For DMA channel 3, make sure the jumpers are set over the two rows of pins at the far right.

10. On the IBM PC GPIB card, find the plug labeled DRQ2/DAC2.

LEX42376

11. Make sure no jumpers are installed on the pins. If any jumpers are installed, remove them.

Step 3

Attach the IBM EGA Jumper card wire connector to the IBM PC GPIP card.
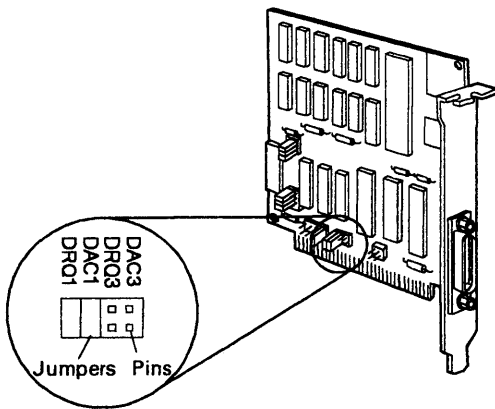
1. On the IBM PC GPIB card, find the plug labeled IRQ 2 3 4 5 6 7.

2. The IBM InfoWindow System can use interrupt levels 2, 3, or 4. The recommended level for the IBM InfoWindow System is 2. You might have another card in the IBM Personal Computer or the IBM Personal System/2 (8530) that requires interrupt level 2. This makes it necessary to choose another interrupt level. The IBM InfoWindow System should use the highest interrupt level (lowest number) that you have available.

LEX42377

3. Hold the wire connector so that the side with the attached wire is facing up.

LEX42378

4. Align the wire connector with the bottom row of pins (labeled B) on the IRQ 2 3 4 5 6 7 plug. The connector attaches to a set of three pins determined by the interrupt level:

- Interrupt level 2
  Align the connector with pins 2, 3, and 4.

- Interrupt level 3
  Align the connector with pins 3, 4, and 5.

- Interrupt level 4
  Align the cable with pins 4, 5, and 6.

Insert wire connector onto bottom (row B) pins.

A
B
2 3 4 5 6 7
I R Q

LEX42379

IBM PC Cards and IBM PC to IBM 4055 InfoWindow Interface Cables

LEX42593

15-8
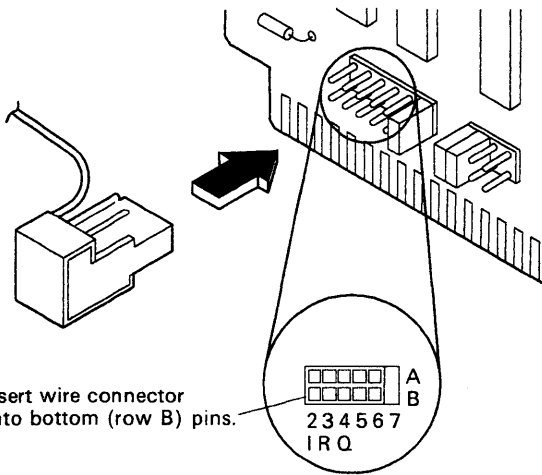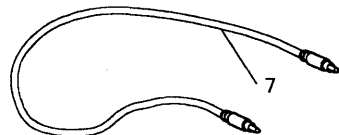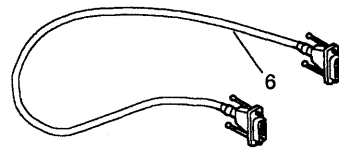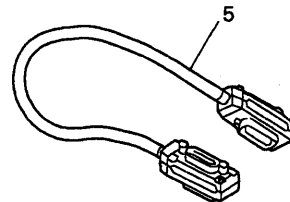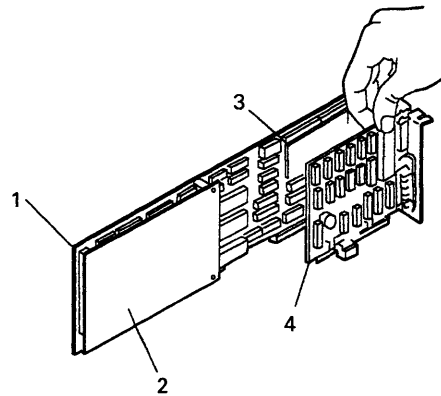
Figure No. Index	Part No.	Units Per Asm.	Description
1	8654215	1	Card, Enhanced Graphics Adapter (Memory Expansion and EGA Jumper card not included)
2	6323468	1	Card, Graphics Memory Expansion (memory modules not included)
3	8575153	1	Card, EGA Jumper
	6181770	1	Card, GPIB Adapter
	8654219	AR	Graphics Memory Module (Not illustrated) (Qty 1)
5	63X4882	1	Cable, PC IEEE-488 (Parallel) Interface
6	8575136	1	Cable, PC Graphics
7	8575135	1	Cable, PC Graphics Sync

Note: For industrial display information, refer to Chapter 12, Industrial Products.

For 5126 Technician Terminal display information, refer to Chapter 13, 5126 Technician Terminal.

Displays Diagnostic Tips

False Display Diagnostic Errors

If a 5170 has an Enhanced Graphics Adapter with a 5154 Enhanced Color Display, and a 5151 Monochrome Printer Adapter with a Monochrome Monitor installed, you might experience false diagnostic errors.

When the monochrome printer diagnostics are run prior to the EGA diagnostics, the mode of the EGA is reset to medium-resolution mode (640 × 200). If the EGA diagnostics are then invoked, all screens will be in medium-resolution mode rather than high-resolution mode (640 × 350).

The solution for this configuration is to always run the EGA diagnostics before running the monochrome printer diagnostics.

Professional Graphics Controller Memory Errors

There are 40 replaceable memory modules on the PGC card. If a memory failure is found while the PGC diagnostic test is running, a U XX error is posted to the screen. The XX in the error code will correspond to the failing memory module.

Use Figure 15-14 to locate the failing memory module.
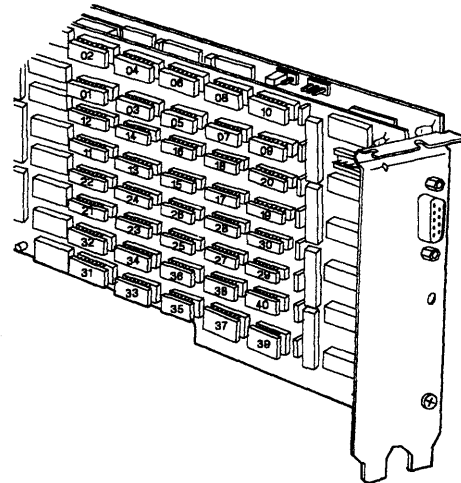
LEX40154

Figure 15-14. PGC Card Memory Modules

Unexpected Color Change on Displays

Early level EGA Memory Expansion card can cause the display to change colors unexpectedly. This primarily occurs when using certain graphics applications, such as PC Paintbrush and Drawing assistant. This condition can be corrected by replacing the Memory Expansion card (P/N6323468). Early level cards are identified by P/N1501531 etched on the back (or solder side) of the card. See ECA017.

Screen Noise or Snow with Professional Graphics Display

PGC card P/N62X0912 (FRU) fixed a contention problem when used in conjunction with communication adapters. (This FRU can be identified by the manufacturing assembly number 62X0914 near connector J-2.) A side effect of this fix is some visible noise or snow when the display memory is being updated in color graphics emulation (low-resolution) mode. An earlier level FRU (P/N6181765, manufacturing assembly number 6448811) might also exhibit these conditions.

This noise or snow might occur between screens. On PC and PC XT systems, this symptom is visible in a column about one-inch wide on the left side of the screen. On PC AT systems, the symptom is visible in a column about 1-inch wide on the right side of the screen. This is a normal operating condition in the color graphics emulation (low-resolution) mode, and is not to be considered an operating problem or defect.

The normal PGC high-resolution mode is not affected by these conditions. No engineering activity is planned.

5153 Color Display Signal Cable Length

The length specifications of the 5153 Color Display Monitor have been changed from 5 feet to approximately 3.5 feet. All displays manufactured after July 1984 will have this shorter cable. Vendor repaired or reworked units will also have this change. There is no functional difference between units with different signal cable lengths.

Chapter 16. Additional I/O

This chapter addresses I/O devices other than internal drives, keyboards, displays, and printers that can be used in a Personal Computer or Personal System/2-based system configuration.

3363 Optical Disk Drive
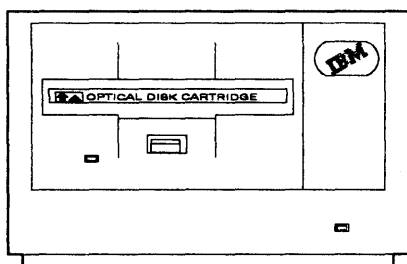
LEX42502

Figure 16-1. 3363 Optical Disk Drive

The IBM 3363 Optical Disk Drive is a new high-performance removable disk storage device. It utilizes the high-density characteristics of optical storage technology to achieve a very high capacity (200Mb) on a small 130-mm (5.25-in) removable disk.

The 3363 Optical Disk Drive uses a laser for both writing and reading. The 3363 allows the one-time writing of data on a single-sided, removable optical disk. The 3363 allows reading of the data on the disk many times.

The IBM 3363 Optical Disk Drive connects to the system unit through the required adapter card and a data/control cable and uses the system unit I/O bus.

The optical disk drive contains both the mechanical assemblies and the drive electronics cards. Neither the mechanical assemblies nor the electronics cards are individually replaceable.

The 3363 Optical Disk Drive attaches to the IBM PC, PC/XT, PC/AT, PC/3270, Portable, AT/3270, XT286, and all models of the PS/2. Support is not provided for the PCXT/370, PC/RT, Convertible, or the PCjr.

Only one adapter card is permitted on the Personal Computer system units. However, depending on the model, up to four adapter cards can be installed in the PS/2 system units.

Performance and Specifications

The following table contains performance data, specifications, and environmental information:

Average seek time (5700 tracks)	230 milliseconds
Maximum seek time (5700 tracks)	270 milliseconds
Average seek time (<51 tracks)	45 milliseconds
Average single track seek time	3.5 milliseconds
Motor start and stop time	5 seconds
Error rate at end of life (Recoverable)	1 error in 10^5 bits read
Error rate at end of life without prior use of Read − Verify (Unrecoverable)	1 error in 10^9 bits read
Error rate at end of life with prior use of Read − Verify (Unrecoverable)	1 error in 1012 bits read
Seek error rate	1 error in 10^6 seeks executed
Burst data rate at output of read amplifier	2.5Mb/ps
Effective data rate from adapter card to system unit	171.7Kb/ps
Rotation speed and direction	875 RPM counterclockwise
Latency	34.3 milliseconds
Temperature range	Operating +15.6° to +32.2°C (60° to 90°F) Shipping -40° to +60°C (-40° to 140°F) Storage +0.6° to +60°C (33.08° to 140°F)
Humidity range	Operating 8% to 80% Shipping 5% to 100% Storage 5% to 80%

Figure 16-2 (Part 1 of 2). Unit Specifications for the 3363 Optical Disk Drive

Wet bulb	Operating +23.8°C (74.84°F) max. Shipping +29.4°C (84.92°F) max. Storage +29.4°C (84.92°F) max.
Drive orientation	The drive should be operated with the media surface in the horizontal plane.
Outside cover dimensions	Height 141.5 mm (5.57 in) Width 227 mm (8.94 in) Depth 422.4 mm (16.62 in)
Weight, including drive unit, power supply, and cables	7.4 kg (16 lb)

Figure 16-2 (Part 2 of 2). Unit Specifications for the 3363 Optical Disk Drive

5173 IBM PC Network Baseband Extender

The IBM PC Network Baseband Extender is the extender unit for connecting IBM Personal Computers and IBM Personal System/2 models to the Baseband IBM PC Network. It supports both star and daisy chain cabling topologies and allows a Baseband IBM PC Network to link up to 80 work stations together with a maximum end-to-end length of 800 feet. It also increases the maximum daisy chain length from 200 feet to 400 feet.
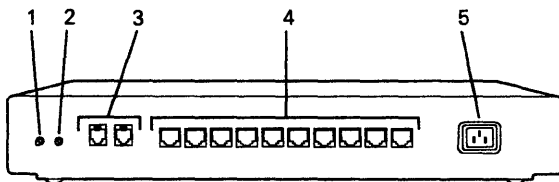
LEX42594

1. Test button.
2. Dual LED (red or green).
3. Two out ports (require a terminator connector in one and a wrap connector in the other).
4. In ports.
5. Power cord connector.

Figure 16-3. 5173 IBM PC Network Baseband Extender

The 5173 Extender Unit will support up to 80 nodes. The maximum distance from the 5173 to the farthest node is 400 feet. Figure 16-4 is an example of a typical baseband network using the 5173 to extend the maximum distance of the network and the total number of nodes beyond eight.

Manual testing of the 5173 Extender Unit can be performed by unplugging the extender power cord from the outlet. (Refer to Figure 16-3 for locations.) Disconnect all cables from the extender unit. Then, reconnect the power cord to the extender unit. The indicator light (2) should be green. If the indicator light is red, or is not illuminated, replace the extender unit. Next, insert a black wrap plug in either of the out ports (3) and one of the in ports (4). Press and hold the test button (1). The indicator light will go off momentarily and then return to green. If this does not occur, the extender has failed. Do this procedure for each of the remaining in ports to verify proper operation of the extender. After completing the test procedure, disconnect the power cord from the wall outlet. This will reset the extender to normal operating mode.
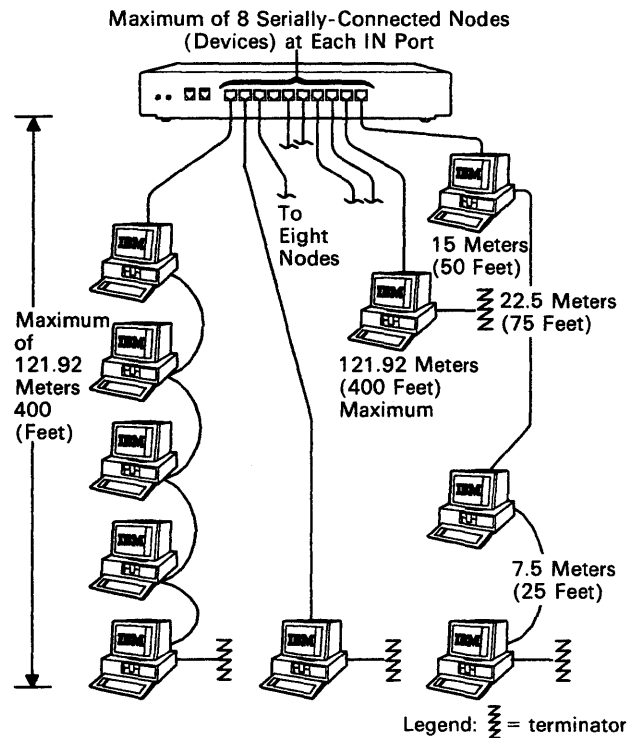
LEX42595

Figure 16-4. Network Picture with 5173 and Nodes

For detailed instructions on planning a baseband network, refer to the *IBM PC Network Baseband Planning Guide*.

16-2

This announcement also includes a new 25-foot cable that supports the new Baseband IBM PC Network.
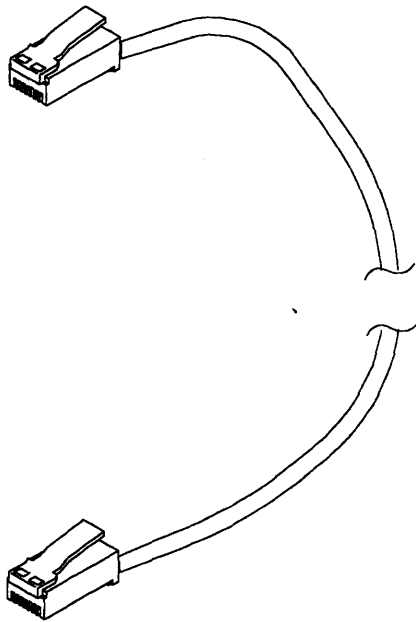
LEX42596

Figure 16-5. IBM PC Network Baseband Adapter Cable

Example of a Three-Node Configuration
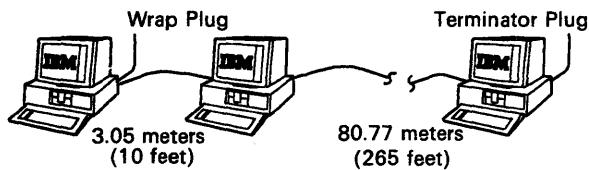
LEX42597

Figure 16-6. Three-Node Configuration

Example of Eight-Node Serially Connected Network
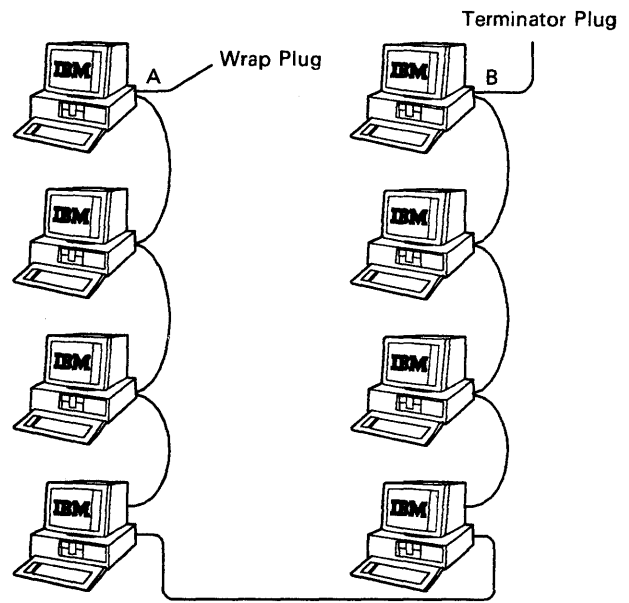
Maximum distance from A to B is 60.96 meters (200 feet).

LEX42598

Figure 16-7. Eight-Node Configuration

Maximum distance from A to B is 60.96 meters (200 feet).

Note: Maximum distances from the first to the last nodes in a serially connected configuration are as follows.

Number of Nodes	Maximum Distance
2	91.4 m (300 ft)
3	83.8 m (275 ft)
4	76.0 m (250 ft)
5 or 6	68.5 m (225 ft)
7 or 8	61.0 m (200 ft)

Figure 16-8. Maximum Distances from First to Last Nodes

Terminator Plug (Clear) (Figure 16-9)

The terminator plug (clear) is installed in the node at one end of a serial-connected configuration (in either port of the adapter card). In a stand-alone configuration, the terminator plug is connected at one end node and the wrap plug at the other. In a configuration that is attached to a 5173 Extender Unit, the terminator plug is installed in the nodes farthest from the extender unit.

Wrap Plug (Black) (Figure 16-9)

The wrap plug (black) is installed in a serially connected stand-alone network configuration at one end, and a terminator plug is installed at the other end, as shown in Figure 16-9. When a 5173 Extender Unit is in the network, the wrap plug is installed in either of the out ports on the 5173 Extender Unit.

Note: In any network, only one wrap plug will be installed. If there is a 5173 Extender Unit in the network, the wrap plug will be installed in one of the out ports of the 5173. The baseband network requires the use of a terminator plug on one end of the network and the use of a wrap plug on the other.
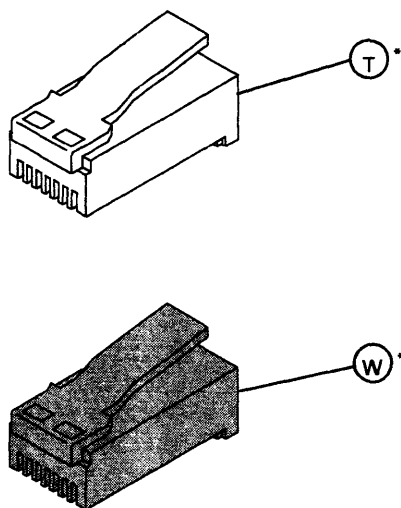
* Imprinted on end of plug.

LEX42599

Note: T = Terminal (clear)
         W = Wrap (black).

Figure 16-9. Terminator and Wrap Plugs

5178 Translator Unit
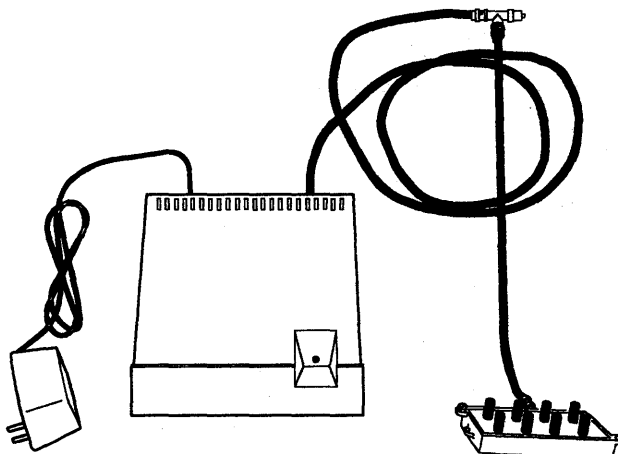
LEX42600

Figure 16-10. 5178 Translator Unit

This will address the IBM PC Network, which includes:

* 5178 Translator Unit
* PC attachment coaxial cables
* Network Adapter card
* Base expander
* Distance kits.

Refer to Figure 16-11 for a graphic network representation.

* 5178 Translator Unit **B**

  The components of the translator unit (Machine Type 5178) are:

  − Translator assembly (FRU, P/N8286173)

    The function of this translator assembly is to convert the transmit frequency of 50.75 MHz (transmitted by a PC) to a receive frequency of 219 MHz and put this signal out on the network.

  − PC Network 120V AC transformer (FRU, P/N8286176)

    This unit plugs into a standard electrical outlet and provides power to the translator assembly.

  − Connection hardware assembly (FRU, P/N8286174)

    This connection hardware assembly is composed of the following:

    − Expansion tap (connects the translator assembly to the eight-way splitter via two coaxial cables).

16-4

- Eight-way splitter (allows the attachment of up to eight PCs to the network).

- Coaxial cables (one 5-foot cable connects the translator assembly to the expansion tap and one 1-foot cable connects the expansion tap to the eight-way splitter).

PC attachment coaxial cables **E**

All PCs must attach to an eight-way splitter via coaxial cable.

PC attachment coaxial cables are available in 25-foot, 50-foot, 100-foot, or 200-foot lengths. The maximum length from an eight-way splitter to a PC is 200 feet. These cables are not part of any group or kit; they must be purchased separately from IBM, dealers, or vendors. The customer is responsible for the procurement, installation, and problem determination of the network cables and their associated connectors. The cables and their associated connectors are not field replaceable units (FRUs), and IBM Marketing will not repair or replace them as a maintenance item. A 90-day limited warranty will be supported by IBM service via Carry-In/Mail-In exchange at S/ECs or repair centers.

Network Adapter Card **A**

This card generates the transmit frequency and receives the translated signal from the translator assembly. Each personal computer system unit requires one network adapter card which is supplied with a 3-meter attachment cable. Warranty is 12 months from date of purchase and will follow the service/maintenance strategy of the system that it is housed in.

- Base expander **C**
  - Allows network expansion.
  - No more than one base expander.
  - Eight 8-way splitters can be attached to the base expander via a short, medium, or long distance cable kit.
  - The base expander functions are similar to an eight-way splitter's functions. PCs cannot be attached directly to the base expander.

- Short, medium, and long distance kits **D**
  - Short-distance kit
    - One 1-foot coaxial cable (connects an 8-way splitter to the base expander).
    - One 8-way splitter (eight PCs can be attached to each 8-way splitter).
  - Medium-distance kit
    - 400 feet (Two 200-foot sections of coaxial cable connect an 8-way splitter to the base expander; cables are not part of kit).
    - One attenuator (balances or attenuates the signal from the network).
    - One 8-way splitter.

- Long distance kit
  - 800 feet (Four 200-foot sections of coaxial cable connect an eight-way splitter to the base expander; cables are not part of kit).
  - Two attenuators.
  - One 8-way splitter.

The customer is responsible for the procurement, installation, and problem determination of the network distance kits and their associated components. These distance kits are not FRUs, and NSD will not repair or replace them as a maintenance item.
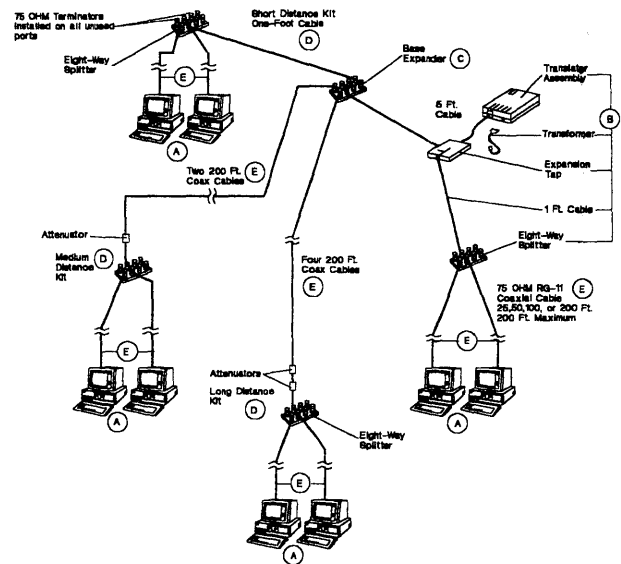
LEX42601

Figure 16-11. 5178 Network Representation

IBM 5841 1200 bps Modem
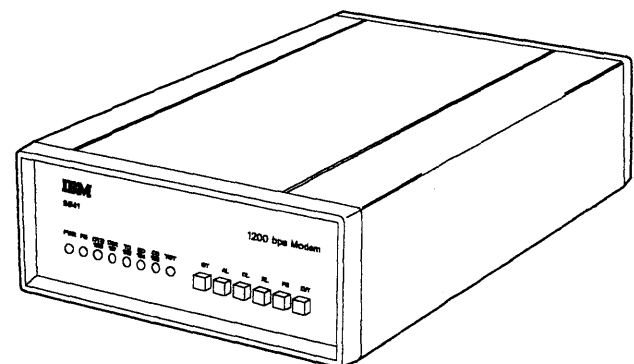
LEX41242

Figure 16-12. IBM 5841 1200 bps Modem

The IBM 5841 Modem is designed for use with the 5150, 5155, 5160, and 5170 as well as other data terminal equipment operating in Bell 212a/103 mode using CCITT V.22 for transmission. In addition to most features of the IBM Personal Computer 1200 bps Modem, the 5841 1200 bps Modem includes the following:

- Rear-panel controls for power on/off and modem configuration.
- Front-panel controls for initiation of built-in diagnostics and for selecting speed and Data/Talk mode.
- Indicators on the front panel provide visual status of power, speed, data-terminal-equipment interface, and test results.
- Storage of telephone directory information for up to 20 entries.
- Five-entry logon directory.
- Automatic dial of alternate number if no-answer.
- Bi-level password security for telephone directory entries.
- Automatic logon following call initiation.
- Automatic detection of tones for dial, busy, and carrier.
- Enquire online security password exchange option.

Synchronous Capabilities

- Transmission speeds of 600 bps or 1200 bps
- Internal, external, and slave clocking
- Manual dial.

Specifications

Height	50 mm (1.93 in)
Width	155 mm (6.15 in)
Depth	280 mm (11 in)
Voltage	120V AC: a-phase; 3-wire; 60 Hz

6157 Streaming Tape Drive
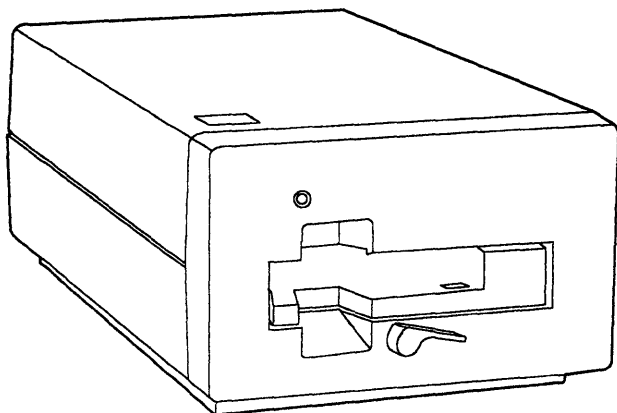
LEX42602

The IBM 6157 Streaming Tape was developed as part of the 6100 family of products to provide an external tape drive for hard file backup. Product design and plans were modified to support attachment to any product that meets requirements. The streaming tape includes an attachment cable and AC line cord. Host attach is via the industry standard QIC-2 interface. The 6157 records data on a 0.25-inch cartridge tape with a formatted capacity of up to 60Mb for the Model 001, and 150Mb for the Model 002.

There are no special features available for the 6157.

The 6157 utilizes a standard QIC-2 interface for attachment to the host system. This adapter is provided by the using host.

There are no stand-alone diagnostic capabilities in the 6157. Tests can be invoked only by the host software via the QIC-2 interface.

Unit Specifications

Burst Data Rate	5Mb/min.
Interface	QIC-2
Operating Temperature	10° to 40.6°C
Shipping Temperature	-40° to 60°C
Size	
Width	210 mm (8.3 in)
Depth	369 mm (14.5 in)
Height	136 mm (5.4 in)
Weight	Approx. 10 lb
Signal cable length	6.0 ft
Electrical	
kva	0.075 kva
Low voltage range	90 to 137V AC
	50/60 Hz UL/CSA
High voltage range	180 to 259V AC
	50/60 Hz EIF
	safety mark
Max Power Diss.	143 BTU/hr surge

6180 Color Plotter
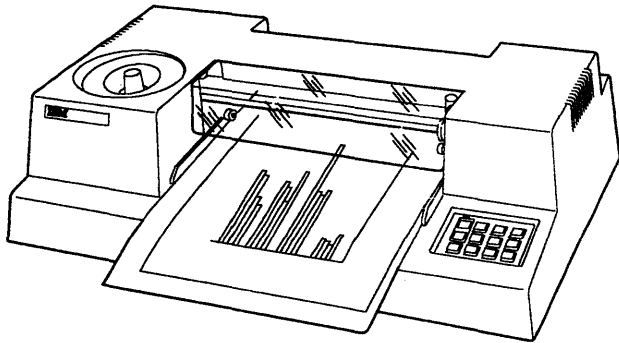
LEX42503

Figure 16-13. 6180 Color Plotter

The 6180 Color Plotter is an 8-pen, desktop size, high-resolution vector plotter capable of producing quality graphics on paper or transparency film with highly accurate registration and repeatability.

The 6180 connects via cable to the System/370, 43XX, and 30XX via the 5085 Graphics Processor Unit, the 3179 Model G10 or G20 via 3979 Model 001, the System/36 or System/38 via IBM PC using the Enhanced 5250 Emulator Version 2.1 as well as the IBM RT Personal Computer, 3270 PC Attachment, PC XT/370, IBM 3270 PC (Control Program Version 1.22 and 2.1), PC XT, PC Expansion Unit, Portable PC, PC AT, PC AT/370, 3270 Personal Computer AT (Control Program Version 2.1), 3270 PC AT/G, 3270 PC AT/GX, 3270 PC/G, 3270 PC/GX or IBM Personal Computer.

Attachment is via cable purchased from IBM as an accessory.

Model 001: Attachment capability that conforms to electrical interface specifications EIA RS232C and CCITT V24.

Model 002: Attachment capability that conforms to electrical interface specification IEEE488-1978.

Unit Specifications

Machine/Carton Dimensions	
Width	460.0 mm (18.4 in) 24 in
Depth	308.0 mm (12.3 in) 18.75 in
Height	124.0 mm (5.0 in) 15.5 in
Weight	
Net	5.5 kg (12.0 lb)
Shipping	11.34 kg (Approx 25.0 lb)
Operation Environment	
Temperature	10° to 40.6°C (50° to 105°F)
Relative Humidity	8% to 80%
Maximum Wet Bulb	26.7°C (80°F)
Nonoperating Environment	
Temperature	10° to 51.7°C (50° to 125°F)
Relative Humidity	8% to 80%
Maximum Wet Bulb	26.7°C (80°F)
Shipping	
Temperature	-40° to 60°C (-40° to 140°F)
Relative Humidity	5% to 100%
Maximum Wet Bulb	0.6° to 29.4°C (33° to 85°F) (No condensation)
Operating Altitude	2135 m (0 to 7000 ft)

7371 Color Plotter
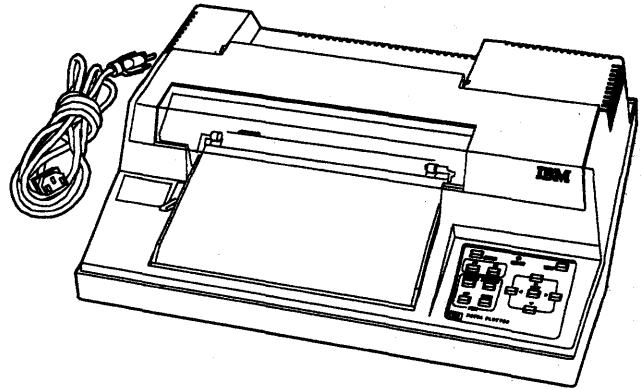
LEX42659

Figure 16-14. 7371 Color Plotter

The 7371 is a 2-pen, desktop, multicolor, multimedia, high-resolution vector plotter. It provides the capability to plot A/A4 size drawings on paper or transparency film with accurate registration and repeatability. The 7371 connects via cable to the S/370, 43XX, and 30XX via the 3179 Model G 3277 Graphics Attachment (with RPQ7H0284), 5085 Graphics Processor Unit, 3270 PC Attachment, XT/370 PC, 3270 PC, 3270-PC/G, 3270-PC/GX, Personal Computer XT, Personal Computer Expansion Unit, S/34, or S/36 (using 5292-2). Attachment is via cable purchased from IBM.

Unit Specifications

```
Width     431.8 mm (17.0 in)    Carton 22.0 in
Depth     342.9 mm (13.5 in)    Carton 17.75 in
Height    127.0 mm ( 5.0 in)    Carton 16.0 in
Weight      6.14 kg (13.5 lb)   Net
           10.23 kg (22.5 lb)   Shipping Gross

Environmental Specifications

Operating
Temperature                     10°-40.6°C (50°-105°F)
    Relative Humidity           8% to 80%
    Maximum Wet Bulb            26.7°C (80°F)
Altitude                        2135 m (7000 ft) max.

Non-Operating
Temperature                     10° to 51.7°C (50° to 125°F)
    Relative Humidity           8% to 80%
    Maximim Wet Bulb            26.7°C (80°F)

Shipping
Temperature                     40° to 60°C (-40° to 140°F)
    Relative Humidity           5% to 100%
    Maximum Wet Bulb            0.6° to 29.4°C
                                (33° to 85°F)
                                (No condensation)
```

7372 Color Plotter
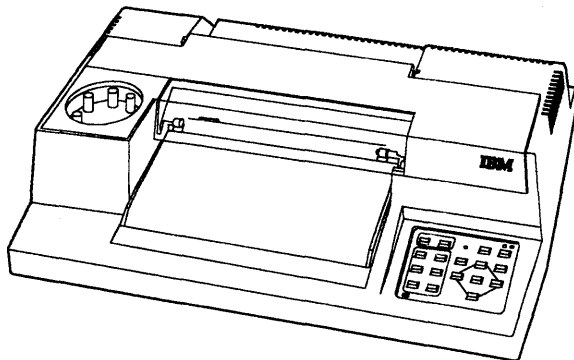
LEX42658

Figure 16-15. 7372 Color Plotter

The 7372 is a 6-pen, desktop, multicolor, multimedia, high-resolution vector plotter. It provides the capability to plot A/A4 or B/A3 size drawings on paper or transparency film with accurate registration and repeatability. The 7372 connects via cable to the S/370, 43XX, and 30XX via the 3179 Model G, 3277 Graphics Attachment (with RPQ7H0284), 5085 Graphics Processor Unit, 3270 PC Attachment, XT/370 PC, 3270 PC, 3270-PC/G, 3270-PC/GX, Personal Computer XT, Personal Computer AT, 3270-PC AT, 3270-PC AT/G, 3270-PC AT/GX, Personal Computer Expansion

Unit, S/34, S/36, or S/38 (using 5292-2). Attachment is via cable purchased from IBM.

Unit Specifications

```
Width     571.5 mm (22.5 in)    Carton 27.0 in
Depth     368.3 mm (14.5 in)    Carton 19.0 in
Height    127.0 mm (5.0 in)     Carton 16.0 in
Weight      6.82 kg (15.0 lb)   Net Shipping Gross
           12.7 kg (28.0 lb)    Net Shipping Gross

Environmental Specifications

Operating
    Temperature                 10° to 40.6°C (50° to 105°F)
    Relative Humidity           8% to 80%
    Wet Bulb                    26.7°C (80°F)
    Altitude                    2135 m (7000 ft) max.

Non-operating
    Temperature                 10° to 51.7°C (50° to 125°F)
    Relative Humidity           8% to 80%
    Wet Bulb                    26.7°C (80°F)

Shipping
    Temperature                 40° to 60°C (-40° to 140°F)
    Relative Humidity           5% to 100%
    Wet Bulb                    0.6° to 29.4°C (33° to 85°F)
                                (No condensation)
```

Special Features

Cables: One interface cable for each plotter purchased can be ordered using the feature codes shown below when ordering plotters. Additional cables, if required, can be ordered by option part number.

Code	Part No.	Option
5020	2719979	RS232C cable for 5085 or 3277GA
5030	2719931	RS232C cable for PC, PC/XT, XT/370, 3270-PC, and PC Expansion Units
5040	2720020	For IEEE-488 Interface for 3179 Mdl G

Note: The IEEE-488 adapter on 3270-PC/G or 3270-PC/GX includes a cable for plotter attachment (purchase of cable is not required if only one plotter is attached). Additional plotters can be attached to the same IEEE-488 adapter (one cable feature code 5040 is required for each additional plotter).

For the 3270 PC AT/G and AT/GX, the IEEE cable is not included. Therefore 5040 (P/N2720020) is required for each attachment.

8228 Multistation Access Unit for IBM Token-Ring Network
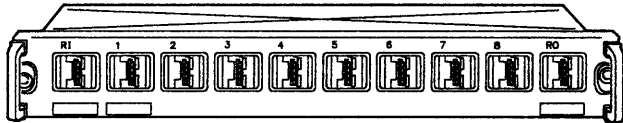
LEX42603

Figure 16-16. Multistation Access Unit for Token-Ring Network

The IBM 8228 is a multistation access unit that provides for the attachment of up to eight devices to the IBM Token-Ring Network. Cables from the attaching devices are simply plugged into the unit. The IBM 8228 can be interconnected to other IBM 8228s to form larger networks. The IBM 8228 can automatically bypass an attached device by reacting to the presence of a signal from the device.

The IBM 8228 is designed for installation in a standard 19-inch rack (not available from IBM) or in an optional component housing. The component housing is required for the installation of the IBM 8228 on a wall or table top. A cable bracket is included with the IBM 8228 and used to organize and identify the cables attached to a rack-mounted IBM 8228.

Reference IBM Token-Ring Network in order to understand interconnection of the components of the IBM Token-Ring Network.

Maintainability Features

The IBM 8228 has the capability to automatically bypass an attaching device. The IBM 8228 reacts to the presence or absence of a signal from the attaching device, and causes the attaching device and its associated cabling to be included or excluded from the network.

Each one of the eight plug positions on the IBM 8228 is self-wrapping when its cable is removed.

Using the Token-Ring Network Problem Determination Procedures (PDPs), the customer will be able to isolate a ring failure to a failing IBM 8228 or segment of cable.

Chapter 17. PC Family Options and Adapters

System to Adapter Compatibility

The following chart identifies the adapters supported by each system.

Option Compatibility Chart

This chart represents items that are sold by IBM to function in the stated machine type. As noted in the legend, certain items might not function or were not tested in certain models of the noted machines. Many switch settings/jumpers are included in the drawings.

Option Name	Option No.*	FRU No.	Machine Type (Vertical)				
			5150	5155	5160	5162	5170
Color Graphics	1504910	8529146	X		X		
Color Graphics	1504910	8286097	X	X	X	X	X
Mono/Printer	1504900	8529148	X		X	X	X
Printer Adapter	1505200	8529149	X	X	X		
SDLC (Old)	1502090	8529295	X	X	X		
SDLC (New)	1501205	8286099	X	X	X	X	X
BISYNC (Old)	1502075	8529296	X	X	X		
BISYNC (New)	1501204	8286098	X	X	X	X	X
ASYNC	1502074	8529150	X	X	X		
Diskette Adapter	1503780	8529152	X	X	X		
64Kb/256Kb Memory Card	1501013	8286096	X	X	1		
256Kb Memory Card	1501209	6134136	X	X	1		
Game Control Adapter	1501300	8529151	X	X	X		X
Prototype Card	1501400	8529213	X	X	X		
Prototype Card	6450220	8286138			X	X	
Serial/Parallel	6450215	8286147				X	X
3295 Display Adapter	6487863	2683119	X		X		X
EGA Card	1501200	8654215	X		X	X	X

Figure 17-1 (Part 1 of 3). System to Adapter Compatibility Chart

Option Name	Option No.*	FRU No.	Machine Type (Vertical)				
			5150	5155	5160	5162	5170
DAC Adapter	6451502	6181768	X	X	X	X	X
GPIB Adapter	6451503	6181770	X	X	X	X	X
1200 bps Modem	6164805	6164804	X	X	X	X	X
2400 bps Modem	6164829	6164828	X	X	X	X	X
Voice Communication Adapter	2684839	2684438	X		X	X	X
Personal Telephone Manager Adapter	6428982	6428171	X		X	X	X
3117 PC Adapter	65X2017	6456806	X		X	X	X
DSEA	6072534	6851206	X	X	X	2	2
EDSEA	55X3365	55X3367	X	X	X	X	X
PS/2 3278/79 Emulator	83X9670	8665792	X		X	X	X
3278/79 Emulator	8665789	8665792	X		X	X	X
3278 Attachment	8501206	4757530	X		X		
3279 Attachment	4418820	8233718	X				
8100 PC Attachment	6113477	6113477	X		1		X
Cluster Adapter	1501206	6323472	X	X	X		X
PC Network Adapter	6450213	8286171	X	X	X	X	X
Token-Ring Adapter	6339100	69X7856	X	X	X	X	X
Token-Ring II	67X0438	67X0395	X	X	X	X	X
4700 Input Adapter	6236049	6236047	X		X		X
4700 Output Adapter	6236052	6236050	X		X		X
4700 Security Card	6236054	6236053	X		X		X
5161 Extender Card	N/A	6323445	X	X	1		
PGA	6451501	62X0912	X		X	X	X
AT Math Coprocessor	6450211	8286127				X	X
PC Math Coprocessor	1501002	8529147	X	X	X		
512Kb/2Mb Memory Card	6450343	59X7294				X	X
128Kb/640Kb Memory Card	6450338	59X7316				X	X
Optical Disk Adapter		63X4157	X	X	X	X	X
Personal Page Printer Adapter	75X8248	75X8247				X	X
PS/2 Display Adapter	1887744	1887743	X	X	X	X	X

Figure 17-1 (Part 2 of 3). System to Adapter Compatibility Chart

Option Name	Option No.*	FRU No.	Machine Type (Vertical)				
			5150	5155	5160	5162	5170
1Mb Memory Card	55X3679	55X3619				X	X
2Mb Expanded Memory Card	2685193	1497250			X		X
0.5Mb/6Mb Memory Card	55X3560	55X3619				X	X
512Kb Memory Card	6450203	8286115					3
128Kb Memory Card	6450209	8286116					3
10Mb/20Mb Fixed Disk Adapter	6450327	6489914			X		
High Speed Card	6456730	6456750	X		X	X	X
PC Network II	1501220	72X8105	X	X	X	X	X
PC Network Baseband	1501221	72X8101	X	X	X	X	X
4865 Diskette Drive Adapter Group	6450245	2683198				X	X
Music Adapter	81X8630	81X8620	X		X	X	X
Music Midi Adapter	81X8630	81X8624	X		X	X	X
4250/PC Print Adapter	6193065	6193068				X	X
S/370 Channel Emulator	6193413	70X5061					X
ARTIC	85X2706	76X1013	X	X	X	X	X
6157 Tape Adapter	59X4146	92X6063	X		X	X	X
5364 Driver Card	4234548	4234520			X		X

Figure 17-1 (Part 3 of 3). System to Adapter Compatibility Chart

Legend:

X = Option is supported in indicated machine.
1 = Not supported in 5160 models that contain 256Kb/640Kb system boards.
2 = Tested in 5170 Models 068, 099, and 239 only.
3 = Supported in Models 068, 099, and 239 only.
4 = Supported in 5160 models with 256Kb/640Kb system boards.

Note: The 5150 System Board BIOS Module date must be later than 10/19/81 to support some features.

*An Option No. is the part number ordered by the customer for the product.

Options Parameters (5150, 5160, 5161)

Option or Adapter	Description
Monochrome Display and Printer Adapter Diskette Drive Adapter 32Kb Memory Expansion Option* 64Kb Memory Expansion Option* 64/256Kb Memory Expansion Option* 256Kb Memory Expansion Option* Math Coprocessor PC Network Adapter	Can be installed in the system unit only
Fixed Disk Drive Adapter (5160, 5161)	Can be installed in the expansion unit
BSC Adapter ** Game Control Adapter SDLC Communications Adapter ** Cluster Adapter Asynchronous Communications Adapter Prototype Card Printer Adapter	May be installed in the system unit or expansion unit.
GPIB Adapter Data Acquisition Adapter	Can be installed in the system unit or expansion unit. When sharing an interrupt level these adapters must be installed in the same unit.
Color/Graphics Monitor Adapter	Can be installed in the system unit. Can be installed in the expansion unit only if some other display adapter is installed in the system unit.
Professional Graphics Controller	May be installed in the system unit. Can be installed in the expansion unit only if some other display adapter is installed in the system unit.

*Denotes options/features **not** supported on 5160 Models
088, 089, 267, 268, 277, and 278.

**SDLC and Alternate BSC are incompatible.

Figure 17-2. PC Family Option Parameters

Option to Adapter Compatibility

Some adapters perform multiple functions. The following chart identifies the options supported by each adapter.

	Slimline Diskette Drive	Double-Sided Diskette Drive	5.25-inch Diskette Drives	High-Capacity Diskette Drive	10Mb Fixed Disk Drive	20Mb Fixed Disk Drive	30Mb Fixed Disk Drive	5151 Monochrome Display	5152 Graphics Printer	5181 Compact Printer	5182 Color Printer	5202 Quietwriter Printer	Proprinter (all)	RF Modulator	Light Pen	Joystick	5153 Color Display and 5154 Enhanced Graphics Display	5175 Professional Graphics Display	Data Acquisition and Control Adapter Distribution Panel
Diskette Drive Adapter	X		X																
Fixed Disk Drive Adapter					X	X													
Fixed Disk and Diskette Drive Adapter (30Mb requires AT FD/DD Adapter)		X		X		X	X												
Color Graphics Monitor Adapter														X	X		X		
Monochrome Display and Printer Adapter								X	X		X	X	X						
Printer Adapter									X		X	X	X						
Asynchronous Communications Adapter												X							
Serial/Parallel Adapter									X	X	X	X	X						
Game Control Adapter																X			
Enhanced Graphics Adapter								X							X		X		
Professional Graphics Controller																		X	
Data Acquisition and Control Adapter																			X
X - Adapter Compatible with Option																			

LEX41698

Figure 17-3. Option to Adapter Compatibility Chart

4860 PCjr Options

Internal Modem, P/N8654400
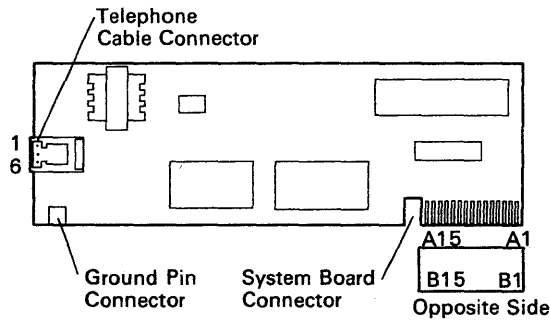
LEX40001

Figure 17-4. Internal Modem

The PCjr Smart 103 Internal Modem is a direct connect auto-dial, auto-answer modem that operates at either 300 bps or 110 bps via a modular phone-jack (USOC RJ11). The Smart 103 offers two modes of dialing:

- Dual-Tone Modulated-Frequency (DTMF) Touch Tone
- Pulse-dialing (rotary dial) by software command.

The 4860 PCjr Internal Modem interface is an RS232C.

Modem Power Specifications

Parameter	+5V DC Voltage	+12V DC Voltage
Tolerance	±5%	±10%
Ripple	50 mV, P-P	50 mV, P-P
Current, Maximum	300 ma	50 ma
Current, Nominal	150 ma	25 ma

Figure 17-5. PCjr Internal Modem Power Specifications

Attachable Joystick, P/N8286002
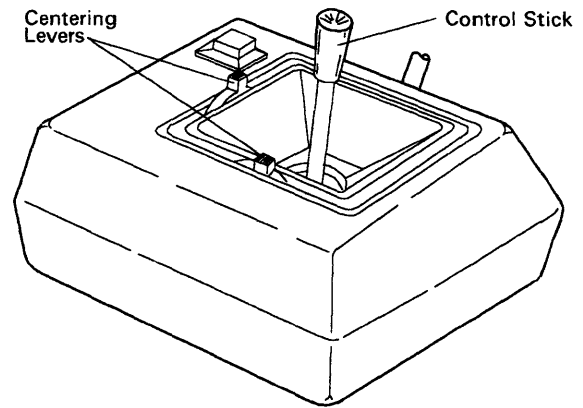
LEX40002

Figure 17-6. Attachable Joystick

The Attachable Joystick is an input device intended to provide the user with two-dimensional positioning control. Two pushbutton switches on the joystick give the user additional input capability.

Two modes of operation of the joystick are available. In the Spring Return mode, the control stick returns to the center position when released. The Free Floating mode allows smooth, force-free operation with the control stick remaining in position when released. Selection of these modes can be made for each axis independently. Two controls are provided for individual adjustment to the electrical center of each axis.

Adapter Cable for Cassette, P/N8285992
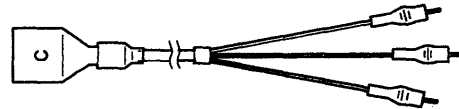
LEX40003

Figure 17-7. PCjr Adapter Cable for Cassette

Keyboard Cord, P/N8285983
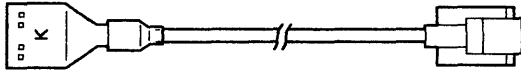
LEX40004

Figure 17-8. PCjr Keyboard Cord

Adapter Cable for Serial Devices, P/N8285993
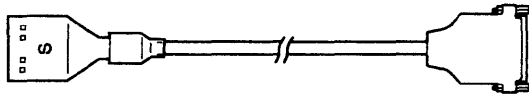
LEX40005

Figure 17-9. PCjr Adapter Cable for Serial Devices

Adapter Cable for the IBM Color Display, P/N8285991
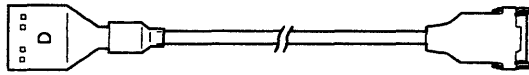
LEX40006

Figure 17-10. PCjr Adapter Cable for the IBM Color Display

Parallel Printer Attachment, P/N8285987
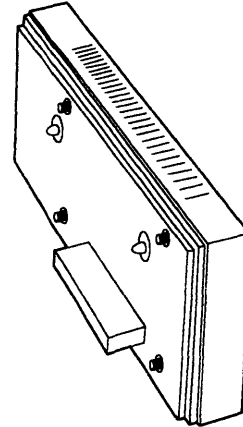
LEX40007

Figure 17-11. PCjr Parallel Printer Attachment

The Parallel Printer Attachment is provided to attach various I/O devices that accept 8 bits of parallel data at standard TTL-logic levels.

The Parallel Printer Attachment attaches as a feature to the right side of the system unit. It connects to the 60-pin input/output (I/O) connector where power and system-input signals are received. A parallel printer attaches to the Parallel Printer Attachment through a 25-pin female D-shell connector located on the rear edge of the attachment, where a cable and shield can be attached. The logic design is compatible with the IBM Personal Computer Printer Adapter.

Memory and Display Expansion, P/N8654227
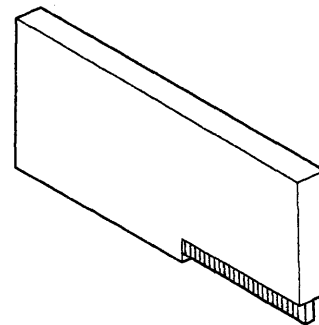
LEX40008

Figure 17-12. PCjr 64Kb Memory and Display Expansion

Chapter 17. PC Family Options and Adapters **17-7**

The 64Kb Memory and Display Expansion option enables the user to work with the higher density video modes while increasing the system's memory size by 64Kb to a total of 128Kb. The memory expansion option plugs into the 44-pin memory expansion connector on the system board. Only one 64Kb memory expansion is supported.

The memory expansion option does not require the user to reconfigure the system to recognize the additional memory.

Note: Newer boards do not require a shield.

Connector for Television, P/N8285989
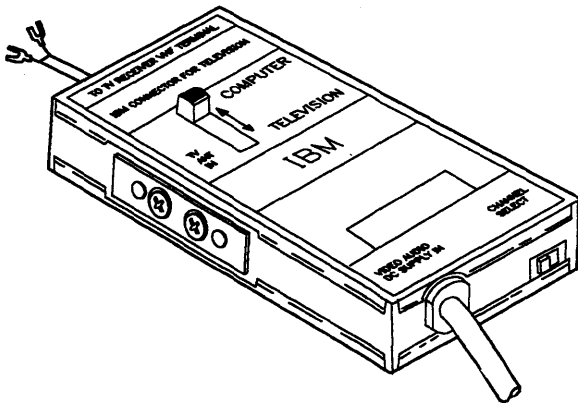
LEX40009

Figure 17-13. PCjr Connector for Television

The Connector for Television is a sealed radio frequency (RF) modulator that imposes the composite video and audio signals onto the RF carrier-wave supplied by the modulator. The connector unit has two 2-position switches. One switch selects between the computer's signal or the standard TV signal from an antenna as the input to the TV. The other switch selects either channel 3's or channel 4's carrier-wave frequency for input to the TV. This allows users to select the weaker TV channel for their area reducing the amount of interference with the computer's input signal. Signal input from the computer is provided by a five-conductor cable with a 6-pin IBM PCjr-dedicated connector. Two spade-lug terminals provide for TV-antenna-cable connection. One twin-lead flat-type TV-cable provides input to the TV.

Power Expansion Attachment, P/N6135680
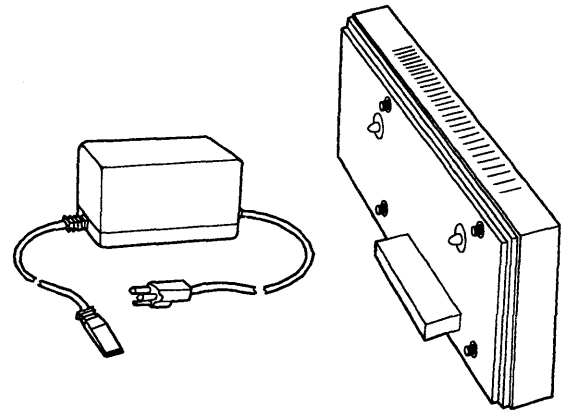
LEX40010

Figure 17-14. PCjr Power Expansion Attachment

The PCjr Power Expansion Attachment is a side-attach option card that provides 27 watts of additional power. The increased power capability is required to operate up to three additional side-attached options. A maximum of three side-attached options plus the PCjr Power Expansion Attachment can be attached to the PCjr. The PCjr Power Expansion Attachment is powered by its own desktop transformer and power cord. This is in addition to the transformer and power cord used by the PCjr System Unit. Turning on the power to the system unit also turns on the Power Expansion Attachment.

The Power Expansion Attachment *must* be the first option installed next to the system unit. The side-attached option can be installed on the PCjr.

The Power Expansion Attachment is required if one Cluster Attachment or two of any other combination of attachments are installed on the 4860.

17-8

Speech Attachment, P/N6135678
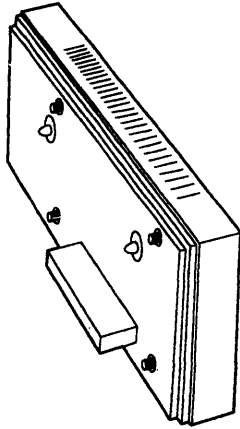
LEX40012

Figure 17-15. PCjr Speech Attachment

The Speech Attachment is a PCjr side-attached option. It can be installed directly on the system if it is the only attachment installed. It must be installed with a Power Expansion card if other side attachments are installed.

Speech data can be recorded on the PCjr diskette through a microphone that is user supplied and connects to the 3.5-mm jack on the rear of the attachment. The Speech Attachment will play through the audio output jack or the television speaker.

Memory Expansion Attachment, P/N6135679
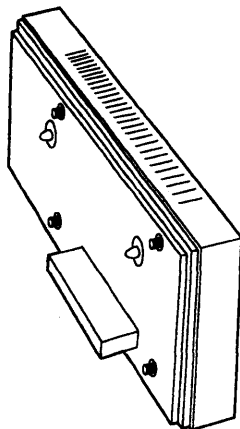
LEX40013

Figure 17-16. PCjr Memory Expansion Attachment

The IBM PCjr Memory Expansion Attachment is a side-attached option. Each memory expansion attachment adds 128Kb to the total system memory. One, two, or three memory attachments can be installed. Switches on the rear of each memory attachment *must* be set to reflect the installed memory configuration. Multiple attachments can be added to the side bus to provide up to 512Kb total memory.

Installation Requirements

- A 64Kb Memory and Display Expansion must be installed before you can install this option.
- A diskette drive must be installed before you can install this option.
- A memory allocation program shipped with the memory attachment must be installed on the customer's DOS diskette and be IPLed each time the PCjr is powered on.

PCjr Memory Expansion Attachment Switch Settings
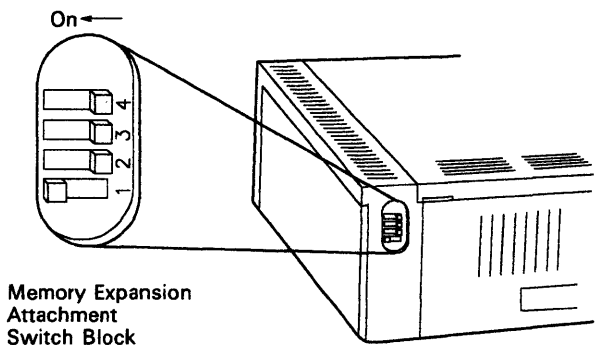
LEX41754

Figure 17-17. PCjr Memory Expansion Attachment Switch Settings

Set the 128Kb Memory Expansion Attachment switches as follows:

- Turn your IBM PCjr so the rear is toward you.
- Locate a 128Kb Memory Expansion Attachment switch block.
- Set switch number 1 to on if it is the first 128Kb Memory Expansion Attachment sidecar (closest to the PCjr).
- Set switch number 2 on if it is the second 128Kb Memory Expansion Attachment sidecar.
- Set switch number 3 on if it is the third 128Kb Memory Expansion Attachment sidecar.

Note: To set a switch on, move the switch to the left (away from the number printed on the switch block). A maximum of three side-attached options plus the PCjr Power Expansion Attachment can be attached to the PCjr.

Cluster Attachment, P/N6323471
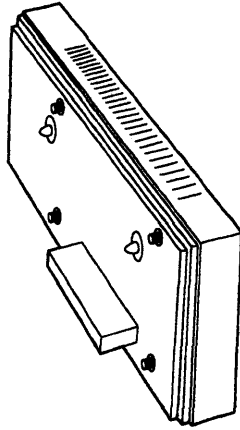
LEX42409

Figure 17-18. PCjr Cluster Attachment

The PCjr Cluster Attachment allows the 4860 to be included in a cluster network with other personal computers. When the Cluster Attachment is installed on a PCjr that has a diskette drive or other side attachments, the Power Expansion option is required.

Slimline Diskette Drive, P/N8285997

Terminating Resistor
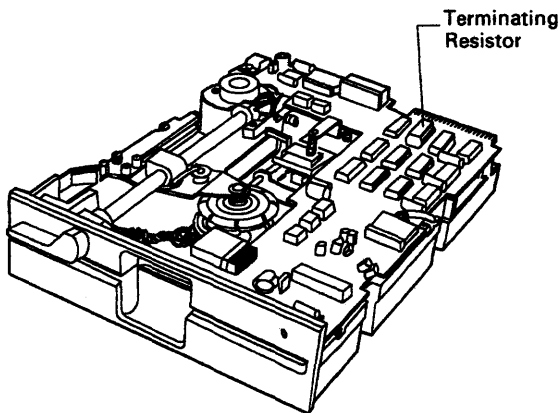
LEX40018

Figure 17-19. Slimline Diskette Drive

The PCjr uses one Slimline Diskette Drive on the Model 067, and the IBM Portable Personal Computer has space and power for one or two Slimline Diskette Drives. Each drive can use single-sided or double-sided diskettes with 40 tracks on each side. The drive is completely self-contained and consists of a read/write/erase system.

Operation

To load a diskette, the operator twists the latch at the front of the diskette drive counterclockwise and inserts the diskette into the slot. Plastic guides in the slot ensure that the diskette is in the correct position. Twisting the latch clockwise centers the diskette and clamps it to the drive hub. After 250 milliseconds, the servo-controlled DC motor starts and drives the hub at a constant speed of 300 rpm.

The head-positioning system, which consists of a 4-phase stepper-motor and band assembly with its associated electronics, moves the magnetic head so it comes in contact with the desired track of the diskette. The stepper-motor and band assembly uses one-step rotation to cause a one-track linear movement of the magnetic head. If the diskette is write-protected, a write-protect sensor disables the drive's circuitry, and an appropriate signal is sent to the interface.

Data is read from the diskette by the data-recovery circuitry, which consists of a low-level read amplifier, differentiator, zero-crossing detector, and digitizing circuits. All data decoding is done by the adapter card.

The diskette drive also has the following sensor systems:

* The track 00 switch, which senses when the head/carriage assembly is at track 00.
* The index sensor, which consists of a light emitting diode (LED) light source and phototransistor. This sensor is positioned so that a digital signal is generated when the index hole is detected.
* The write-protect sensor disables the diskette-drive write circuits whenever the diskette has a write-protect tab.

Figure 17-20 on page 17-11 shows the mechanical and electrical specifications of the Slimline Diskette Drive.

17-10

Slimline Diskette Drive Mechanical and Electrical Specifications

Size (max.)	
Height	42 mm (1.6 in)
Width	146 mm (5.8 in)
Depth	203 mm (8.0 in)
Weight	1.10 kg (2.4 lb)
Power	+12V DC ± 5%
	+5V DC ± 5%
Media	Industry-compatible
	5.25-in diskette
Tracks per Inch	48
Number of Tracks	40
Temperature (exclusive of media)	
Operating	10 to 50°C (41 to 122°F)
Nonoperating	-40 to 60°C
	(-40 to 140°F)
Relative humidity (exclusive of media)	
Operating	20 to 80%
	(noncondensing)
Nonoperating	5 to 95%
	(noncondensing)
Seek Time	6 ms track-to-track
Head Life	20,000 hours (normal use)
Media Life	3.0 X 10^6 passes
	per track
Disk Speed	
Long term	300 rpm ± 1.5%
Instantaneous	300 rpm ± 3.0%
Recording Mode	MFM

Figure 17-20. Slimline Diskette Mechanical and Electrical Specifications

PC Family Options

Refer to the chart in Figure 17-1 for the System to Option Compatibility Chart, unless otherwise noted.

5.25-Inch Diskette Drive
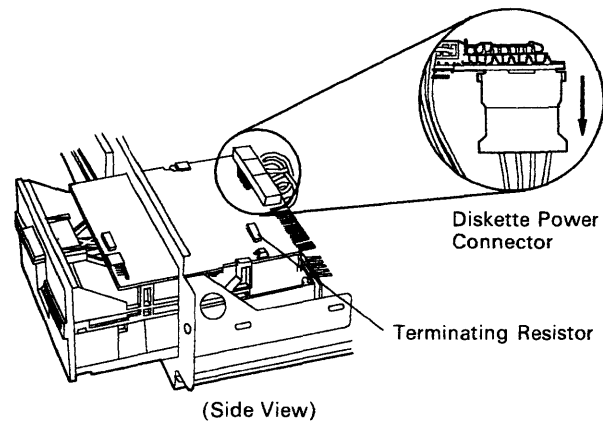
LEX40014

Figure 17-21. 5.25-Inch Diskette Drive (Side View)

The system unit has space and power for one or two 5.25-inch diskette drives. A drive can be single-sided or double-sided with 40 tracks for each side. The diskette drive is a self-contained unit consisting of a spindle drive system, a read positioning system, and a read/write/erase system.

The IBM 5.25-inch Diskette Drive uses a standard 133.4-mm (5.25-inch) diskette. Single-sided, double-density, soft-sectored diskettes are used for single-sided drives. Double-sided drives use double-sided, double-density, soft-sectored diskettes.

The 5.25-inch full-high diskette drive is supported on most 5150- and 5160-based systems, but it is not supported on the 5155.

- Single-sided, P/N8529153
- Double-sided, P/N8529206.

Operation

To insert a diskette, the operator raises the latch at the front of the diskette drive and inserts the diskette in the slot. Plastic guides in the slot ensure the diskette is in the correct position. Closing the latch centers the diskette and clamps it to the drive hub. After 250 milliseconds, the servo-controlled DC motor starts and drives the hub at a constant speed of 300 rpm. The head positioning system, which consists of a 4-phase stepper-motor and band assembly with its associated electronics, moves the magnetic head so it

Chapter 17. PC Family Options and Adapters **17-11**

comes in contact with the desired track of the diskette. The stepper-motor and band assembly uses one-step rotation to cause a one-track linear movement of the magnetic head. If the diskette is write-protected, a write-protect sensor disables the drive's write circuitry, and an appropriate signal is sent to the interface.

Data is read from the diskette by the data-recovery circuitry, which consists of a low-level read amplifier, differentiator, zero-crossing defector, and digitizing circuits. All data decoding is done by the adapter card.

The diskette drive also has the following sensor systems:

1. The track 00 switch, which senses when the head/carriage assembly is at track 00.

2. The index sensor, which consists of an LED light source and phototransistor. This sensor is positioned to generate a digital signal when an index hole is detected.

3. The write-protect sensor disables the diskette drive's electronic write circuits whenever a write-protect tab is applied to the diskette.

4. A terminating resistor should be installed on diskette Drive A only. This resistor indicates to the system which drive is Drive A.

5.25-Inch Diskette Drive Mechanical and Electrical Specifications

Size (max.)	
Height	86 mm (3.4 in)
Width	149 mm (5.9 in)
Depth	203 mm (8.0 in)
Weight	2.04 kg (4.5 lb)
Power	+12V DC ± 5%, (900 mA average) +5V DC ± 5%, (600 mA average)
Media	Industry-compatible 5.25-in diskette
Tracks per Inch	48
Number of Tracks	40
Temperature (exclusive of media)	
Operating	10 to 44°C (50 to 112°F)
Nonoperating	-40 to 60°C (-40 to 140°F)

Figure 17-22 (Part 1 of 2). 5.25-Inch Diskette Drive Mechanical and Electrical Specifications

Relative humidity (exclusive of media)	
Operating	20 to 80% (noncondensing)
Nonoperating	5 to 95% (noncondensing)
Seek Time	6 ms track-to-track
Head Life	20,000 hours (normal use)
Media Life	3.0×10^6 passes per track
Disk Speed	
Long term	300 rpm ± 1.5%
Instantaneous	300 rpm ± 3.0%
Recording Mode	MFM

Figure 17-22 (Part 2 of 2). 5.25-Inch Diskette Drive Mechanical and Electrical Specifications

Diskette Drive Adapter, P/N8529152
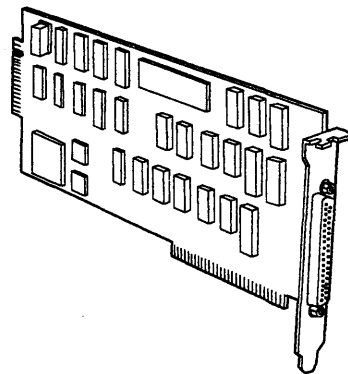
LEX40017

Figure 17-23. Diskette Drive Adapter (Right View)

The IBM Diskette Drive Adapter fits into one of the expansion slots in the system unit. It is connected to one or two diskette drives through an internal, daisy-chained flat cable. The adapter has a connector at the other end that extends through the rear panel of the system unit. This connector has signals for two additional external diskette drives; thus, the diskette drive adapter can attach four drives—two internal and two external.

The adapter is designed for double-density, MFM-coded, diskette drives and uses write precompensation with an analog phase-lock loop for clock and data recovery. The adapter is a general-purpose device using the NEC μPD765 or equivalent controller. Therefore, the diskette drive parameters are programmable. In addition, the attachment supports the diskette drive's write-protect feature. The adapter is

buffered on the I/O bus and uses the system board's direct memory access (DMA) for record data transfers. An interrupt level is also used to indicate when an operation is complete and that a status condition requires microprocessor attention.

In general, the diskette drive adapter presents a high-level command interface to software I/O drivers.

10Mb Fixed Disk Drive, P/N8529275

20Mb Fixed Disk Drive, P/N6489907
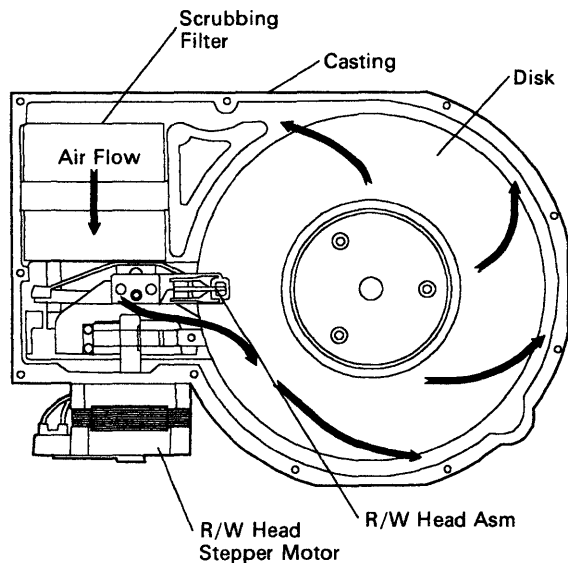
LEX40019

Figure 17-24. 10Mb Fixed Disk Drive and 20Mb Fixed Disk Drive (Top View, Cover Removed)

Note: Fixed disk drives can vary in appearance and connector location.
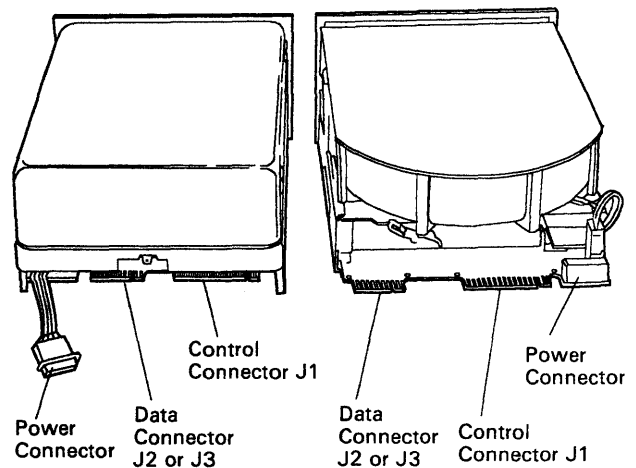
LEX40020

Figure 17-25. 10Mb Fixed Disk Drive, 5160-Based Systems (Rear View)

The 10Mb fixed disk drive is a random-access storage device that uses two nonremovable 5.25-inch disks for storage. Each disk surface employs one movable head to service 306 cylinders. The total formatted capacity of the four heads and surfaces is 10Mb (512 bytes per sector, 17 sectors per track, and a total of 1224 tracks).

The 20Mb fixed disk drive is a direct-access device that can store up to 20Mb (1Mb = 1,048,576 bytes) of formatted data. The average access time is 85 milliseconds using a servo positioner.

Operation

An impact-resistant enclosure provides mechanical and contamination protection for the heads, actuator, and disk. A self-contained recirculating system supplies clean air through a 0.3-micron filter. Thermal isolation of the stepper and spindle motor assemblies from the disk enclosure results in a very low temperature rise within the enclosure. This isolation provides a greater off-track margin and the ability to perform read and write operations immediately after power up with no thermal stabilization delay.

Figures 17-27 through 17-29 show the mechanical and electrical specifications of the 10Mb and 20Mb fixed disk drives.

Type 2

LEX42346

Type 13

LEX42347
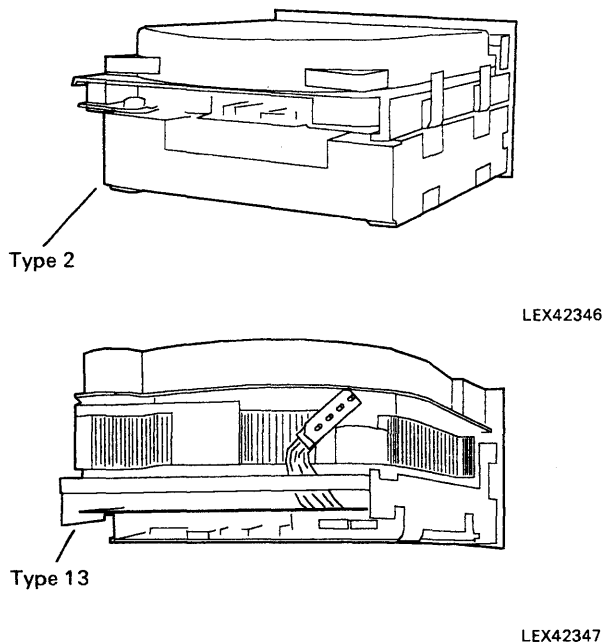
Figure 17-26. 20Mb Fixed Disk Drive, 5160-Based Systems

10Mb Fixed Disk Drive Mechanical and Electrical Specifications

Cylinders	306
R/W Heads	4
Formatted Capacity	10Mb
Bytes/Sector	512
Sectors/Track	17
Number of Tracks	1224
Track Density	345 tracks per length
Disk Speed	3600 rpm μ1%
Recording Mode	MFM

Figure 17-27. 10Mb Fixed Disk Drive Mechanical and Electrical Specifications

20Mb Fixed Disk Drive — Type 2 Mechanical and Electrical Specifications

Cylinders	615
R/W Heads	4
Formatted Capacity	20.1Mb
Bytes/Sector	512
Sectors/Track	17
Number of Tracks	2440
Track Density	580 tracks per inch
Disk Speed	3600 rpm ± 0.5%
Recording Mode	MFM

Figure 17-28. 20Mb Fixed Disk Drive — Type 2 Mechanical and Electrical Specifications

20Mb Fixed Disk Drive — Type 13 Mechanical and Electrical Specifications

Cylinders	306
R/W Heads	8
Formatted Capacity	21.3Mb
Bytes/Sector	512
Sectors/Track	17
Number of Tracks	2440
Track Density	350 tracks per inch
Disk Speed	3600 rpm ± 0.5%
Recording Mode	MFM

Figure 17-29. 20Mb Fixed Disk Drive — Type 13 Mechanical and Electrical Specifications

The Fixed Disk Drive Adapter (P/N8529269) has been replaced by P/N6489914. The switches must be set during installation, as shown in Figure 17-30.

Mb		Switch			
		Drive C		Drive D	
		1	2	3	4
10	Type 1	On	On	On	On
20	Type 2	Off	On	Off	On
20	Type 13	Off	Off	Off	Off
20	Type 16	On	Off	On	Off

Figure 17-30. Fixed Disk Drive Adapter Switch Settings

Fixed Disk Drive Adapter

← off on →

Switch

10/20Mb Adapter, P/N6489914
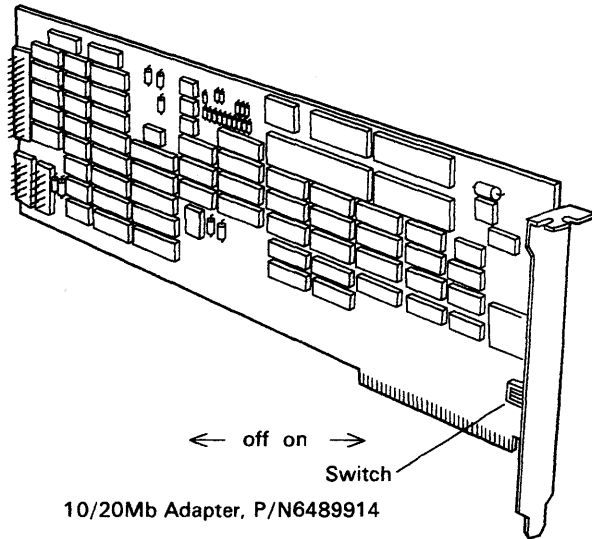
LEX43130

Figure 17-31. Fixed Disk Drive Adapters (Right View)

The Fixed Disk Drive Adapter attaches to one or two
fixed disk drive units through an internal daisy-
chained flat cable (data/control cable). Each system
supports a maximum of one Fixed Disk Drive Adapter
and two fixed disk drives.

Operation

The adapter is buffered on the I/O bus and uses the
system board direct memory access (DMA) for record
data transfers. An interrupt level also is used to indi-
cate operation completion and status conditions that
require processor attention.

The Fixed Disk Drive Adapter provides automatic
11-bit burst error detection and correction in the form
of 32-bit error checking and correction (ECC).

The device level control for the Fixed Disk Drive
Adapter is contained on a ROM module on the adapter.

Warning: The last cylinder on the fixed disk drive is
reserved for diagnostic use. Diagnostic write tests will
destroy any data on this cylinder.

5.25-Inch 360Kb Diskette Drive (Half-High)

P/N6489910 for 5160, P/N62X1036 for 5162, P/N8286131 for 5170

LED
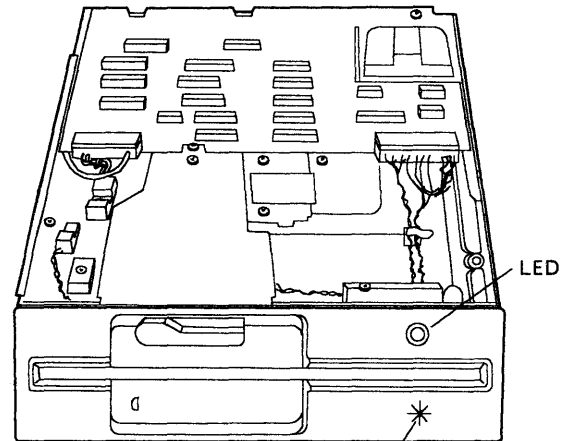
Asterisk denotes
360Kb Half-High
Diskette Drive

LEX40015

Signal
Connector

Power
Connector

Terminating
Resistor

Ground
Wire
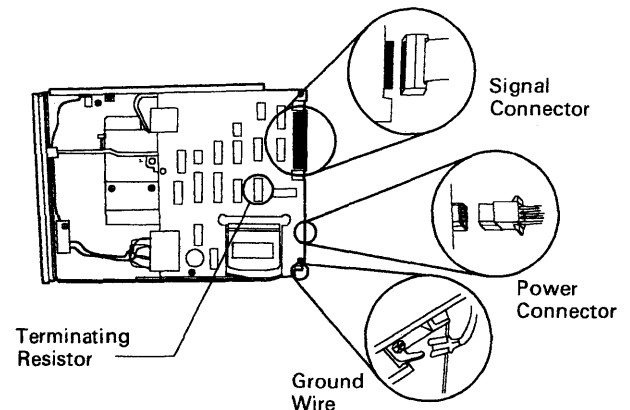
LEX40016

Figure 17-32. 5.25-Inch 360Kb Diskette Drive (Half-
High)

The 360Kb double-sided diskette drive has a gray bezel
and is supported on the IBM Personal Computer AT.
The 5.25-inch half-high 360Kb diskette drive has a
black bezel and is supported only on 5160 Models 088,
089, 267, 268, 277, and 278, and on the 5162. All data
format and access control is in the system.
Figure 17-33 on page 17-16 describes the type of
diskette required by this drive.

Characteristic	Requirements
Certification	Double-sided
	48 TPI
	40 tracks/surface
	Soft sector
Recording Density	5876 bits per inch
Jacket	Standard 5.25-inch

Figure 17-33. 360Kb Diskette Requirements

The signals for operating the diskette drive are generated through the IBM Personal Computer AT Fixed Disk/Diskette Drive Adapter and Personal Computer Diskette Drive Adapter.

5.25-Inch 360Kb Diskette Drive (Half-High)

Size (max.)	
Height	42 mm (1.6 in)
Width	146 mm (5.8 in)
Depth	203 mm (8.0 in)
Weight	1.10 kg (2.4 lb)
Power	+ 12V DC ± 5%
	+ 5V DC ± 5%
Media	Industry-compatible
	5.25-in diskette
Tracks per Inch	48
Number of Tracks	40
Temperature (exclusive of media)	
Operating	10 to 50°C (41 to 122°F)
Nonoperating	-40 to 60°C
	(-40 to 140°F)
Relative humidity (exclusive of media)	
Operating	20 to 80%
	(noncondensing)
Nonoperating	5 to 95%
	(noncondensing)
Seek Time	6 ms track-to-track
Head Life	20,000 hours (normal use)
Media Life	3.0×10^6 passes
	per track
Disk Speed	
Long term	300 rpm ± 1.5%
Instantaneous	300 rpm ± 3.0%
Recording Mode	MFM

Figure 17-34. 5.25-Inch 360Kb Diskette Drive (Half-High)

1.2Mb High Capacity Diskette Drive

P/N8286130 for 5170, P/N62X1028 for 5162
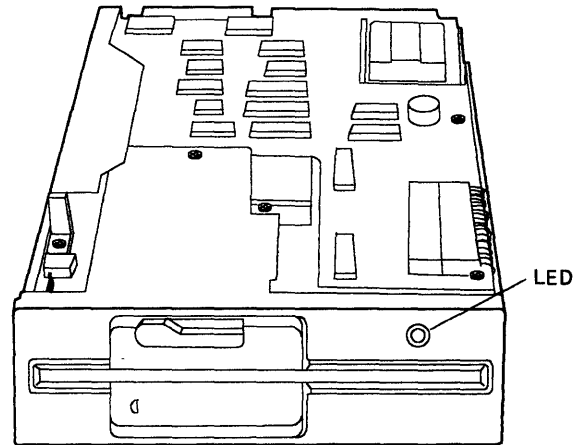
LEX40023
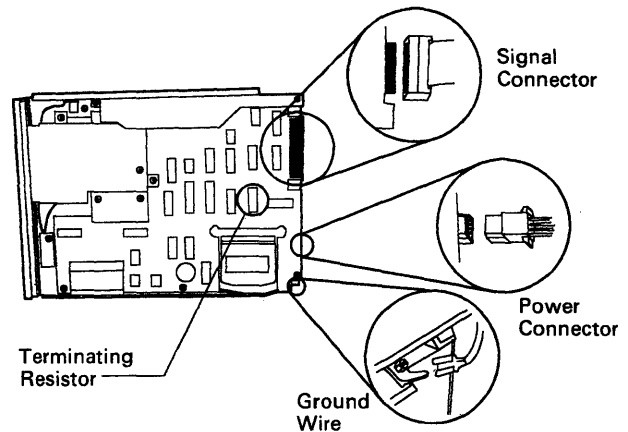
LEX40022

Figure 17-35. 1.2Mb High-Capacity Diskette Drive

The signals for operating the diskette drive are generated through the IBM Personal Computer AT Fixed Disk and Diskette Drive Adapter.

The IBM Personal Computer AT High-Capacity Diskette Drive is a direct-access device that can store 1.2Mb of data on a dual-sided 5.25-inch diskette. All data format and access control is in the system. The following figure describes the type of high-density diskette required by this drive. Diskettes that meet these specifications cannot be used in either a 160Kb/180Kb or a 320Kb/360Kb diskette drive.

Characteristic	Requirements
Certification	Double-sided 96 TPI 80 tracks/surface Soft sector
Recording Density	9646 bits per inch
Media Coercivity	600 to 650 oersteds
Jacket	Standard 5.25-inch

Figure 17-36. 1.2Mb High Capacity Diskette Requirements

The signals for operating the diskette drive are generated through the IBM Personal Computer AT Fixed Disk and Diskette Drive Adapter.

Note: This drive also can read diskettes formatted for a 320Kb/360Kb dual-sided drive or a 160Kb/180Kb single-sided drive.

Figure 17-37 shows the physical and performance specifications of the 1.2Mb high-capacity diskette.

1.2Mb High-Capacity Diskette Drive Physical and Performance Specifications

Size	
Height	41.0 mm (1.6 in)
Width	146.0 mm (5.8 in)
Depth	203.2 mm (8 in)
Weight	1.6 kg
Power Dissipation	11 W (TYP)
Temperature	
Operating	5 to 46°C (41 to 114.8°F)
Nonoperating	-40 to 60°C (-40 to 140°F)
Relative humidity	20 to 80%
Maximum Wet Bulb	29°C (84°F)
(Humidity noncondensing)	
Capacity	
Unformatted	1604Kb
Formatted	1.2Mb
(15 sectors per track)	
Density	
Recording	9646 BPI
Track	96 TPI
Cylinders	80
Tracks	160

Figure 17-37 (Part 1 of 2). 1.2Mb High-Capacity Diskette Drive Specifications

Encoding Method	MFM
Rotational Speed	360 rpm
Access Time	
Average	91 ms
Track-to-Track	3 ms
Settling Time	18 ms

Figure 17-37 (Part 2 of 2). 1.2Mb High-Capacity Diskette Drive Specifications

20Mb Fixed Disk Drive, P/N6278099

LEX40025

LEX40024
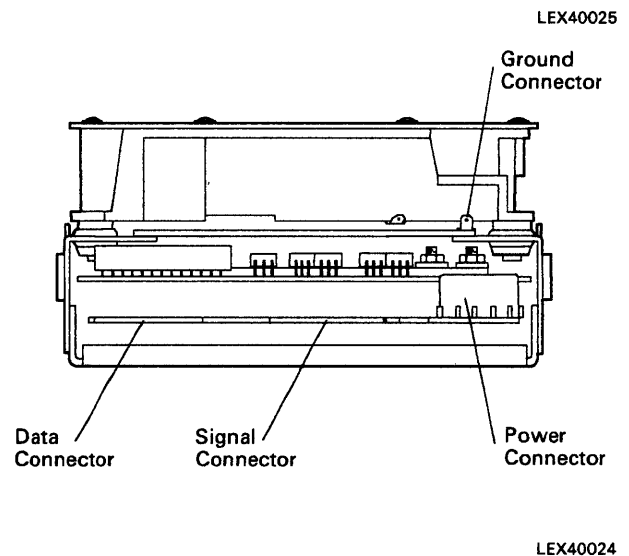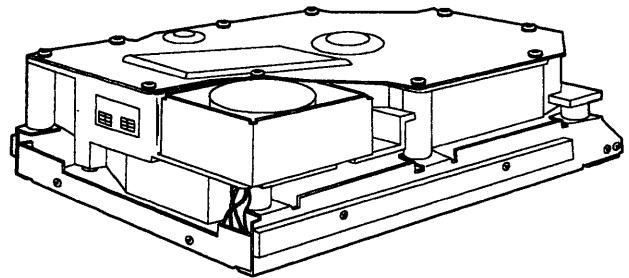
Figure 17-38. 20Mb Fixed Disk Drive

The IBM Personal Computer AT 20Mb Fixed Disk Drive is a direct-access device that can store up to 20Mb of formatted data. The average access time is 40 milliseconds using a quasi closed-loop servo positioner.

20Mb Fixed Disk Drive Internal and Performance Specifications

Rotational Speed	3573 rpm ±0.5%
Cylinders	615 + Landing Zone
R/W Heads	4
Index	1
Formatted Capacity	20Mb
Bytes/Sector	512
Sectors/Track	17
Transfer Rate	5Mb/ps
Access time Track-to-Track	2 ms
Track Density	750 TPI

Figure 17-39. 20Mb Fixed Disk Drive Specifications

30Mb Fixed Disk Drive Internal and Performance Specifications

Rotational Speed	3600
Cylinders	733 (Landing Zone 732)
R/W Heads	5
Index	1
Formatted Capacity	30Mb
Bytes/Sector	512
Sectors/Track	17
Transfer Rate	5Mb/ps
Track Density	750 TPI

Figure 17-40. 30Mb Fixed Disk Drive Specifications

5170 Fixed Disk and Diskette Drive Adapter, P/N8286125
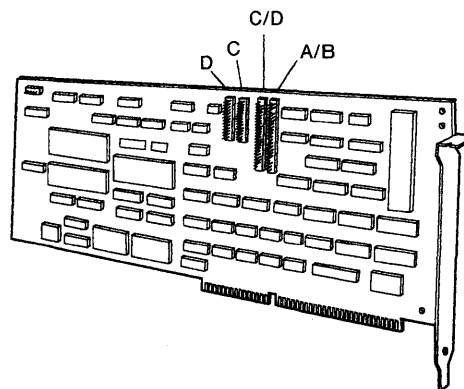
LEX40026

Figure 17-41. 5170 Fixed Disk and Diskette Drive Adapter

The IBM Personal Computer AT Fixed Disk and Diskette Drive Adapter connects to the system board using one of the system expansion slots. The adapter controls the 5.25-inch diskette drives and fixed disk drives. Connectors on the adapter supply all the signals necessary to operate up to two fixed drives and one diskette drive or one fixed drive and two diskette drives. The adapter will allow concurrent data operations on one diskette and one fixed disk drive.

The adapter operates when connected to a system board expansion slot.

Fixed Disk Function

The fixed disk function features 512-byte sectors; high-speed, programmed input/output (PIO) data transfers; error correction code (ECC) correction of up to 5 bits on data fields; multiple sector operations across track and cylinder boundaries; and on-board diagnostic tests. The adapter will support two fixed disks with up to 16 read/write heads and 1024 cylinders.

Monochrome Display and Printer Adapter, P/N8529148
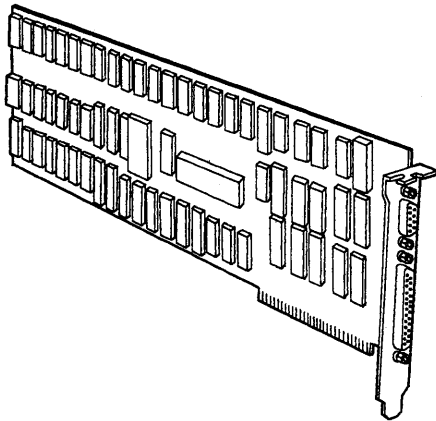
LEX40027

Figure 17-42. Monochrome Display and Printer Adapter

Monochrome Display Adapter Function

The IBM Monochrome Display and Printer Adapter is designed around the Motorola 6845 CRT Controller module. There are 4Kb of RAM on the adapter that are used for the display buffer. This buffer has two ports to which the system unit's microprocessor has direct access. No parity is provided on the display buffer.

The adapter supports 256 different character codes. An 8Kb character generator contains the fonts for the character codes.

The adapter:

- Supports 80-character × 25-line screen
- Has direct-drive output
- Supports 9-pel × 14-pel character box
- Supports 7-pel × 9-pel character
- Supports 18 KHz monitor
- Has character attributes.

Printer Adapter Function

The printer adapter portion of the IBM Monochrome Display and Printer Adapter is specifically designed to attach printers with a parallel-port interface, but it can be used as a general input/output (I/O) port for any device or application that matches its I/O capabilities.

The I/O signals are made available at the back of the adapter through a right-angle, printed-circuit-board-mounted, 25-pin, D-shell connector. This connector protrudes through the rear panel of the system unit or expansion unit, where a cable can be attached.

The output ports may also be read at the card's interface for diagnostic loop functions. This allows faults to be isolated to the adapter or the attaching device.

Printer Adapter, P/N8529149
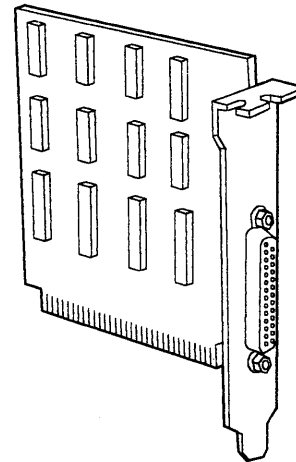
LEX40028

Figure 17-43. Printer Adapter (Right View)

A Stand-Alone Printer Adapter card is also available. It uses the same printer interface architecture as the Monochrome Display and Printer Adapter card.

Color/Graphics Monitor Adapter, P/N8286097

RF Modulator Connector

Light Pen Connector

Color Composite Signal Phono Jack

Color Direct Drive 9-Pin D-Shell Connector
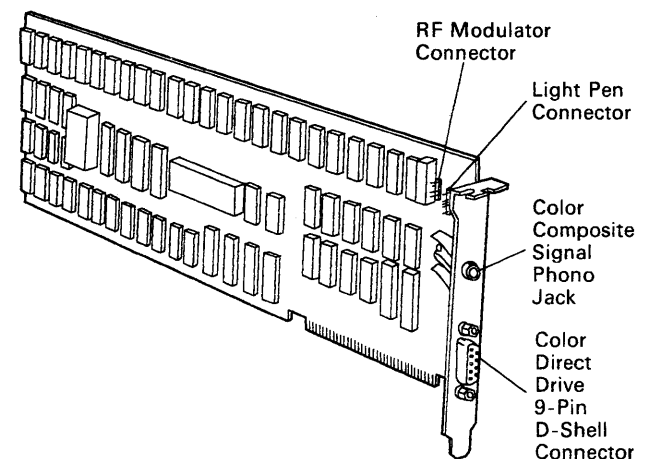
LEX41772

Figure 17-44. Color/Graphics Monitor Adapter

The IBM Color/Graphics Monitor Adapter is designed to attach to the IBM Color Display, a variety of television-frequency monitors, or home television sets (user-supplied RF modulator is required for home television sets). The adapter is capable of operating in black-and-white or color. It provides three video interfaces: a composite-video port, a direct-drive port, and a connection interface for driving a user-supplied RF modulator. A light pen interface is also provided.

The character attributes of reverse video, blinking, and highlighting are available in the black-and-white mode. In the color mode, 16 foreground and 8 background colors are available for each character. In addition, blinking on a per-character basis is available.

The Monitor Adapter contains 16Kb of storage. As an example, a 40-column × 25-row display screen uses 1000 bytes to store character information and 1000 bytes to store attribute/color information. This means that up to eight screens can be stored in the adapter memory. Similarly, in an 80-wide × 25-row mode, four display screens can be stored in the adapter memory. The entire 16Kb of storage in the display adapter are directly accessible by the processor, which allows maximum program flexibility in managing the screen.

The high-resolution mode is available only in black-and white because the entire 16Kb of storage in the adapter is used to define the on or off state of the pels.

Operation

The adapter operates in noninterlace mode at either 7 or 14 MHz, depending on the mode of the operation selected.

Characters are formed from a read only storage (ROS) character generator. The character generator contains dot patterns for 256 different characters. The character set contains the following major groupings of characters:

- 16 special characters for game support
- 15 characters for word-processing editing support
- 96 characters for the standard ASCII graphics set
- 48 characters for foreign-language support
- 48 characters for business block-graphics support (for drawing charts, boxes, and tables using single and double lines)
- 16 selected Greek characters
- 15 selected scientific-notation characters.

The color/graphics monitor function is on a single adapter card. The direct-drive and composite-video ports are right-angle mounted connectors on the adapter, and extend through the rear panel of the

system unit. The direct-drive video port is a 9-pin, D-shell, female connector. The composite-video port is a standard female phono jack.

Enhanced Graphics Adapter, P/N8654215, Switch Settings, Jumper Positions

Configuration Switches

The following diagram shows the location and orientations of the configuration switches on the IBM Enhanced Graphics Adapter (EGA).
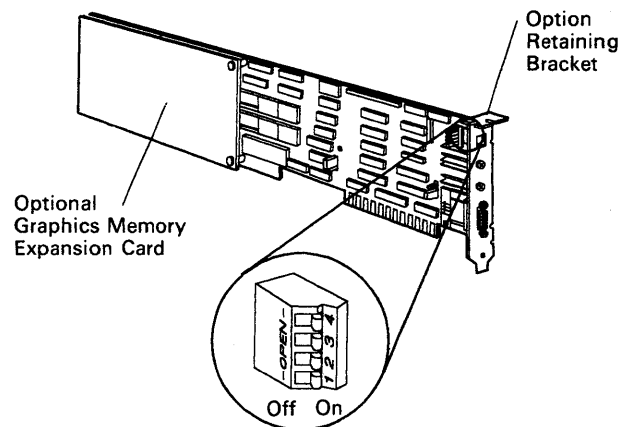
LEX40263

Figure 17-45. Configuration Switch Locations

The EGA is a graphics controller that supports both color and monochrome direct-drive displays in a variety of modes. In addition to the direct-drive port, a light pen interface is provided. Advanced features on the adapter include bit-mapped graphics in four planes and a random access memory (RAM) loadable character generator. Design features in the hardware substantially reduce the software overhead for many graphics functions.

The adapter contains 64Kb of storage configured as four 16Kb bit planes. Memory expansion options are available to expand the adapter memory to 128Kb or 256Kb.

The adapter is packaged on a single 333.50-mm (13-1/8 in) card. The direct-drive port is a right-angle mounted connector at the rear of the adapter and extends through the rear panel of the system unit. Also on the card are five large-scale integration (LSI) modules custom-designed for this controller.

Configuration Switch Settings

The configuration switches on the EGA determine the type of display support the adapter provides.

Note: The system configurations shown in the right column are the only acceptable combinations that can be installed.

Whenever you are using two displays, one of them must be a monochrome display.

System Configuration	Use:
The EGA will be the only display adapter you have installed in your system.	Table 1
The EGA and the IBM Monochrome Display and Printer Adapter will both be installed in your system, and the EGA will be the primary display adapter.	Table 2
The EGA and the IBM Monochrome Display and Printer Adapter will both be installed in your system, and the Monochrome Display and Printer Adapter will be the primary display adapter.	Table 3
The EGA and the IBM Color/Graphics Adapter will both be installed in your system, and the Enhanced Graphics Adapter will be the primary display adapter.	Table 4
The EGA and the IBM Color/Graphics Adapter will both be installed in your system, and the Color/Graphics Adapter will be the primary display adapter.	Table 5

Figure 17-46. Switch Setting Tables Guide

Table 1

SW1	SW2	SW3	SW4	Type of Display Attached and Initial Mode Selection*
Off	Off	On	Off	Monochrome
On	Off	Off	On	Color (40 x 25)
Off	Off	Off	On	Color (80 x 25)
On	On	On	Off	Enhanced Color (in Normal Color Mode)
Off	On	On	Off	Enhanced Color (in Enhanced Color Mode)

* Mode Selection can be changed by programming.

Figure 17-47. Table 1

Table 2

Switch Settings				Type of Display Attached and Initial Mode Selection	
SW1	SW2	SW3	SW4	Enhanced Graphics Adapter	Monochrome and Printer Adapter
On	Off	Off	On	Color (40 x 25)	Monochrome or None
Off	Off	Off	On	Color (80 x 25)	Monochrome or None
On	On	On	Off	Enhanced Color (in Normal Color Mode)	Monochrome or None
Off	On	On	Off	Enhanced Color (in Enhanced Color Mode)	Monochrome or None

Figure 17-48. Table 2

Table 3

Switch Settings				Type of Display Attached and Initial Mode Selection	
SW1	SW2	SW3	SW4	Enhanced Graphics Adapter	Monochrome and Printer Adapter
Off	On	On	On	None	Monochrome
On	On	On	On	Color (40 x 25)	Monochrome
Off	On	On	On	Color (80 x 25)	Monochrome
On	Off	On	On	Enhanced Color (in Normal Color Mode)	Monochrome
Off	Off	On	On	Enhanced Color (in Enhanced Color Mode)	Monochrome

Figure 17-49. Table 3

Table 4

Switch Settings				Type of Display Attached	
SW1	SW2	SW3	SW4	Enhanced Graphics Adapter	Color/ Graphics Adapter
Off	Off	On	Off	Monochrome	None
On	Off	On	Off	Monochrome	Color (40 × 25)
Off	Off	On	Off	Monochrome	Color (80 × 25)

Figure 17-50. Table 4

Table 5

Switch Settings				Type of Display Attached	
SW1	SW2	SW3	SW4	Enhanced Graphics Adapter	Color/ Graphics Adapter
On	On	Off	On	Monochrome or None	Color (40 × 25)
Off	On	Off	On	Monochrome or None	Color (80 × 25)

Figure 17-51. Table 5

Enhanced Graphics Adapter Jumper Descriptions

Located on the adapter are two jumpers designated P1 and P3. Jumper P1 changes the function of pin 2 on the direct drive interface. When placed on pins 2 and 3, jumper P1 selects ground as the function of direct drive interface, pin 2. For monochrome monitors use this position. In addition, this selection is for displays that support three color outputs, such as the IBM Color Display. When P1 is placed on pin 1 and 2, red prime output is placed on pin 2 of the direct drive interface connector. This supports the IBM Enhanced Color Display, which utilizes six color outputs on the direct drive interface.

Jumper P3 changes the I/O address port of the Enhanced Graphics Adapter (EGA) within the system. In its normal position, (pins 1 and 2), all EGA addresses are in the range 3XX. Moving jumper P3 to pins 2 and 3 changes the addresses to 2XX. Operation of the adapter in the 2XX mode is not supported in BIOS.

The following figure shows the location of the jumpers and numbering of the connectors:
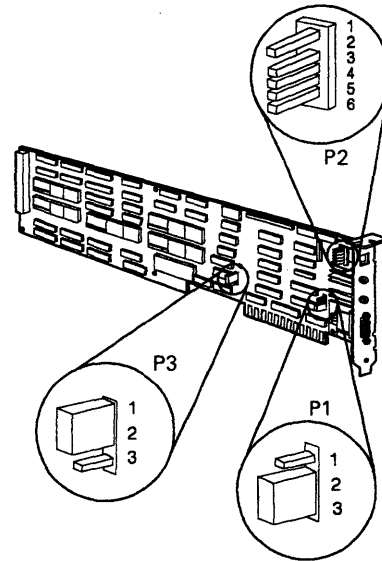
LEX40264

Figure 17-52. Jumper Location and Connector Numbers

Note: When the Monochrome Display/Printer Adapter is installed with an EGA, the EGA must be configured for a color display even if the Monochrome Display/Printer Adapter is only driving a printer.

Professional Graphics Controller, P/N62X0912
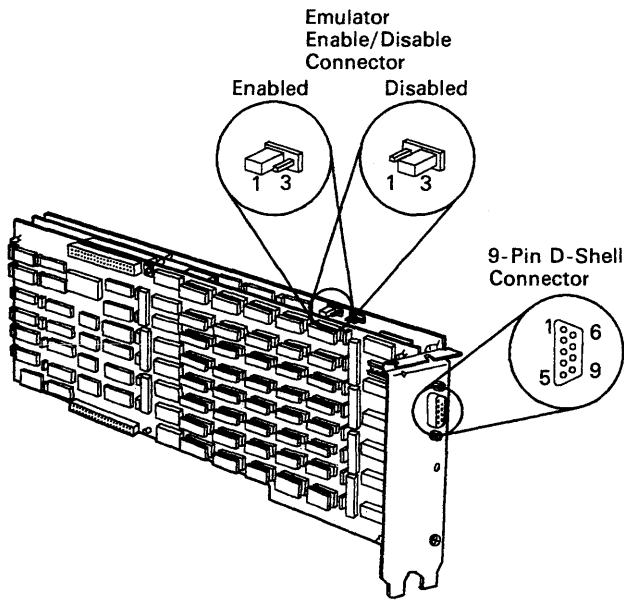
LEX40031

Figure 17-53. Professional Graphics Controller/Emulator Enable/Disable Jumper

The IBM Personal Computer Professional Graphics Controller is an adapter that provides a high-function graphics capability and acts as an IBM Color/Graphics Monitor Adapter, with the exception of the 160 × 100 color/graphics mode.

The operations of the Professional Graphics Controller are controlled by an 8088 Microprocessor. It carries out all communications through its data bus and address bus. The system-bus interface recognizes its own commands and passes only these commands to the controller. The interface allows the microprocessor to read or write to memory locations, using the IBM Professional Graphics Controller microprocessor's data and address busses.

When installed in position 1, the emulator jumper allows the Professional Graphics Controller to also function like an IBM Color/Graphics Monitor Adapter.

If there is an IBM Color/Graphics Adapter installed in the system, the emulator jumper must be in position 2.

The microprocessor controls and initializes several sections of the controller. It defines the requirements of the controller's hardware so the controller can imitate the actions of the IBM Color/Graphics Monitor Adapter. The microprocessor also regulates the emulator address control, which translates the system's I/O

address information and stores the associated data in the graphics emulator memory for screen display. Finally, it initializes the video control generator, which generates timing pulses and the horizontal and vertical synchronization (sync) pulses.

During operation, the microprocessor intercepts commands sent to the emulator and interprets them. The microprocessor can also accept and interpret the high-function graphics commands, writing the results in the display memory for screen display. Both the emulator and high-function graphics functions have access to the look-up table (LUT) and output section.

Professional Graphics Controller (PGC) can be installed in a:

- Personal Computer AT.
- Personal Computer XT.
- PC Expansion Unit as a secondary display. A primary display must be installed in the system unit.

The PGC cannot be installed in a:

- PC System Unit
- Portable PC System Unit
- PCjr.

The PGC requires two adjacent expansion slots.

Note: For PGC Memory Error Code failing module locations, see "Display Diagnostic Tips" in the Display chapter.

Math Coprocessor, P/N8529147
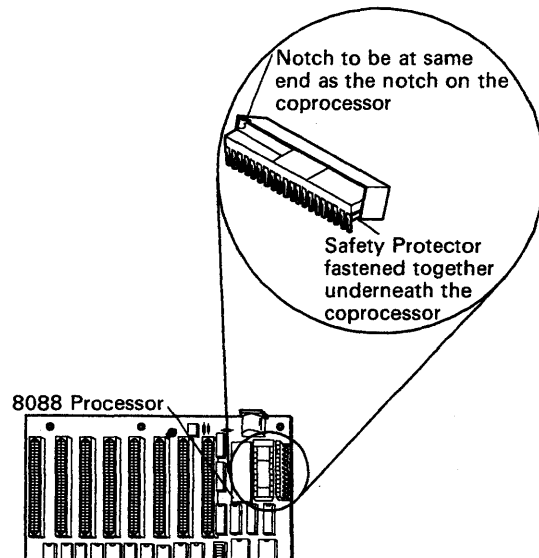
LEX40032

Figure 17-54. Math Coprocessor

The Math Coprocessor (8087) enables the IBM Personal Computer to perform high-speed arithmetic, logarithmic functions, and trigonometric operations with extreme accuracy.

Operation

The 8087 Coprocessor works in parallel with the 8088 Microprocessor. The parallel operation decreases operating time by allowing the coprocessor to do mathematical calculations while the microprocessor continues to do other functions.

Warning:

* The coprocessor is static sensitive.
* Incorrect placement of the coprocessor can result in damage to the system board or the coprocessor.
* The pins on the coprocessor are easily bent.

This 8087 Coprocessor can be used on the following systems:

* 5150
* 5160
* 5155
* 5271
* XT/370
* 5531
* Tempest PC/4950
* DunsPlus System.

5162/5170 Math Coprocessor, P/N8286127
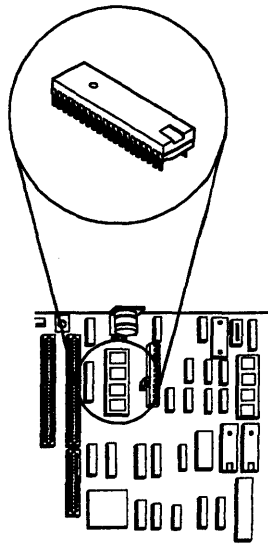
LEX40034

Figure 17-55. 5162/5170 Math Coprocessor

The IBM Personal Computer AT Math Coprocessor (80287) enables the IBM Personal Computer AT to perform high-speed arithmetic, logarithmic functions, and trigonometric operations with extreme accuracy.

Operation

The coprocessor works in parallel with the (80286) microprocessor. The parallel operation decreases operating time by allowing the coprocessor to do mathematical calculations while the microprocessor continues to do other functions.

Warning:

* The coprocessor is static sensitive.
* Incorrect placement of the coprocessor can result in damage to the system board or the coprocessor.
* The pins on the coprocessor are bent easily.

5162/5170 Serial/Parallel Adapter, P/N8286147

The IBM Personal Computer AT Serial/Parallel Adapter provides a parallel port and a serial port. It plugs into a system-board expansion slot. All system-control signals and voltage requirements are provided through a 2- × 31-position card edge connector.

Serial Portion

The serial portion of the adapter is fully programmable and supports asynchronous communications. It will add and remove start, stop, and parity bits. A programmable baud-rate generator allows operation from 50 baud to 9600 baud. Five-, six-, seven- and eight-bit characters with 1, 1.5, or 2 stop bits are supported. A prioritized interrupt system controls transmit, receive, error, and line status as well as data-set interrupts.

The rear of the adapter has a 9-pin D-shell connector that is classified as an RS232C port. When the optional IBM Communications Cable (9-Pin), which has a 9-pin D-shell connector on one end and a 25-pin D-shell connector on the other end, is connected to the adapter, the 25-pin end of the cable has all the signals of a standard EIA RS232C interface.

Communications Application
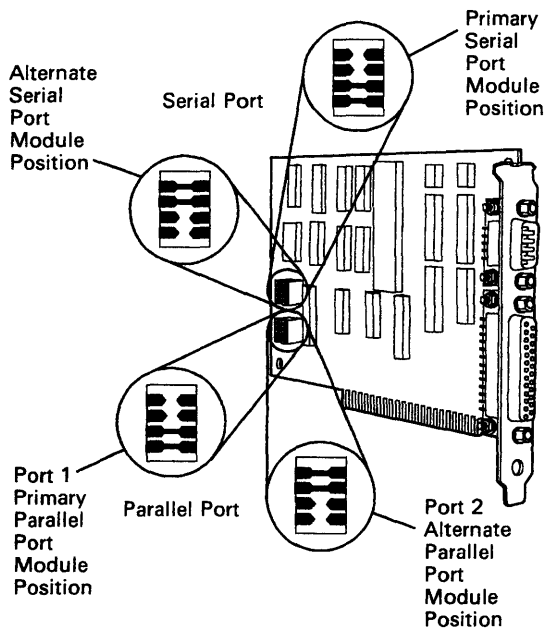
LEX41777

Figure 17-56. Serial/Parallel Adapter Jumper Positions

The serial output port can be addressed as either communications port 1 or communications port 2 as defined by jumper J1 in this section. Hex addresses begin with an X, which can be either a 3 for communications port 1 (interrupt level 4) or a 2 for communications port 2 (interrupt level 3).

Parallel Portion

The parallel portion of the adapter makes possible the attachment of various devices that accept 8 bits of parallel data at standard TTL levels. The rear of the adapter has a 25-pin D-shell connector. This port can be addressed as either parallel port 1 or 2. The port address is determined by the position of jumper J2.

To test the parallel portion of the Serial/Parallel Adapter with diagnostics, run option Run Test One Time, not option Run Test Multiple Times.

Asynchronous Communications Adapter, P/N8289150
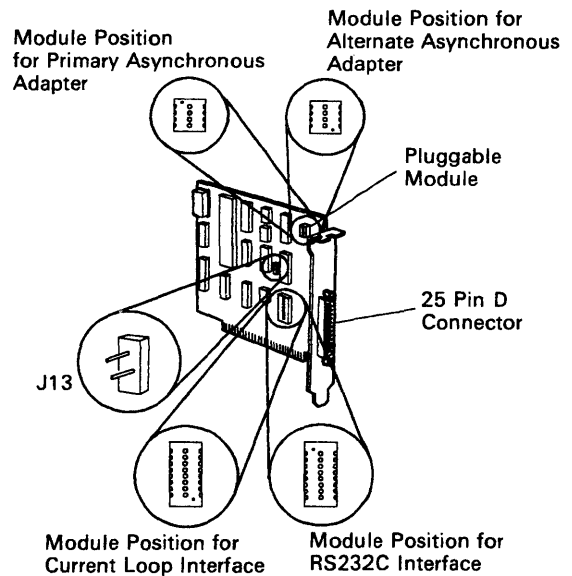
LEX40038

Figure 17-57. Asynchronous Communications Adapter and Adapter Address (Right View)

The Asynchronous Communications Adapter's system-control signals and voltage requirements are provided through a 2- × 31-position card-edge connector. One jumper module selects either RS232C or current-loop operation. The other jumper module selects one of two addresses for the adapter, so two adapters can be used in one system. An additional jumper is required on connector J13 if the adapter is to be installed in expansion slot 8 of an IBM Personal Computer XT or IBM Portable Personal Computer.

Operation

The adapter is fully programmable and supports asynchronous communications only. It will add and remove start bits, stop bits, and parity bits. A programmable baud-rate generator allows operation from 50 baud to 9600 baud. Five-, six-, seven-, or eight-bit characters with 1, 1.5, or 2 stop bits are supported. A fully prioritized interrupt system controls transmit, receive, error, line status, and data-set interrupts. Diagnostic capabilities provide loopback functions of transmit/receive and input/output signals.

Binary Synchronous Communications Adapter, P/N8286098
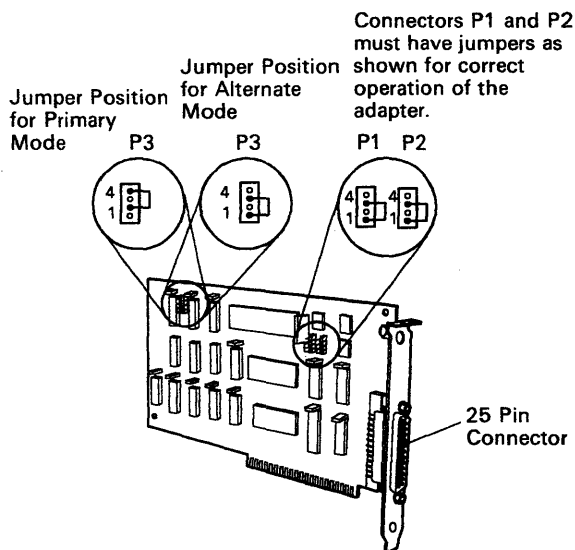
LEX40039

Figure 17-58. Binary Synchronous Communications Adapter

The IBM Binary Synchronous Communications (BSC) Adapter provides an RS232C-compatible communications interface for the IBM Personal Computer family of products. All systems control, voltage, and data signals are provided through a 2- by 31-position card-edge connector. External interface is in the form of Electronic Industries Association (EIA) drivers and receivers connected to an RS232C standard 25-pin, D-shell connector.

Operation

The adapter is programmed to operate in a binary synchronous mode. Maximum transmission rate is 9600 bits per second (bps). The main feature of the adapter is an Intel 8251A Universal Synchronous/Asynchronous Receiver/Transmitter (USART). An Intel 8255A-5 Programmable Peripheral Interface (PPI) also is used for expanded modem operation, and an Intel 8253-5 Programmable Interval Timer provides time-outs and generates interrupts.

Synchronous Data Link Control Communications Adapter, P/N8286099
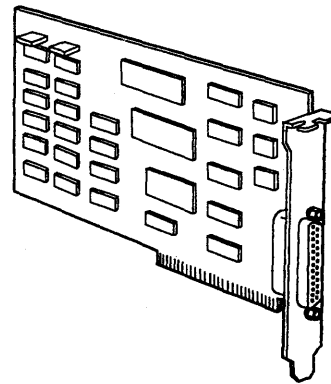
LEX40040

Figure 17-59. Synchronous Data Link Communications Adapter

The IBM Synchronous Data Link Control (SDLC) Communications Adapter provides communications support to the system in a half-duplex synchronous mode. The adapter receives address, data, and control signals from the system board through the internal bus. Electronic Industries Association (EIA) drivers and receivers connect to an RS232C standard 25-pin D-shell male connector.

Operation

The adapter is programmed by communications software to operate in a half-duplex mode. Maximum transmission rate is 9600 bps, as generated by the attached modem or other data communications equipment.

The SDLC Adapter uses an Intel 8273 SDLC Protocol Controller and an Intel 8255A-5 PPI for an expanded external modem interface. An Intel 8253 PIT generates timing and interrupt signals. Internal test-loop capability is provided for diagnostic purposes.

4700 Financial Communications System (FCS) Options

4700 FCS Input Adapter, P/N6236047
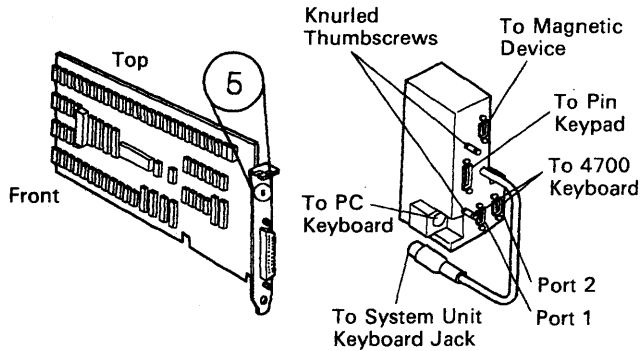
LEX41800

Figure 17-60. 4700 FCS Input Adapter

This option permits attachment of a 4700 FCS keyboard(s), a magnetic stripe reader or magnetic stripe reader/encoder, and an encrypting or non-encrypting PIN keypad via the financial input connector.

4700 FCS Output Adapter, P/N6236050
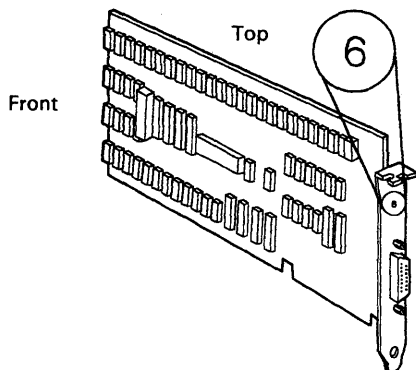
LEX41802

Figure 17-61. 4700 FCS Output Adapter

This option permits attachment of one finance printer; an IBM 4710 Receipt/Validation Printer, 4715 Continuous Forms Printer, or 4720 Forms/Passbook Printer.

4700 FCS Security Adapter, P/N6236053
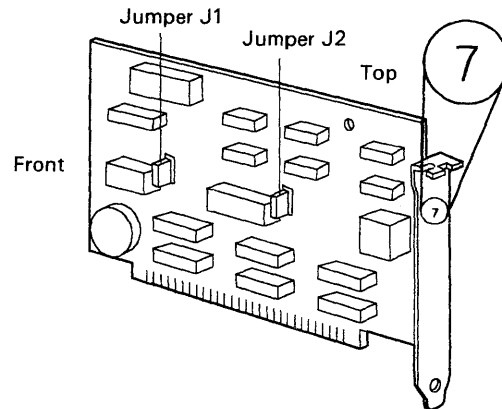
LEX41801

Figure 17-62. 4700 FCS Security Adapter

This option allows the user to encrypt or decrypt data in an application program for communications and files using the ANSI (X3.92 - 1981) Data Encryption Algorithm. The jumper J1 must be in place always, while jumper J2 must be in place only if this card occupies the slot 8 of a PC XT.

ARTIC (RIC) Switch Settings/Jumper Locations

The following jumper locations are for clarification only. The jumpers are the responsibility of the customer and should be coordinated with the programmer, as the hardware and software must match for proper operation. The customer and advanced diagnostics ask the customer to verify the address and other jumper positions. The customer is responsible for having a list of all jumper values (Appendix C in the *Guide To Operations* manual) to ensure correct setup and operation.
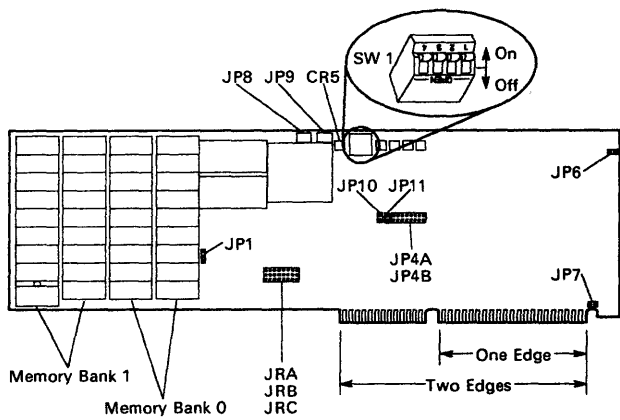
LEX41730

Figure 17-63. Jumper Locations

A new level A Real-Time Interface Coprocessor (ARTIC) card has been released which provides a jumper that must be plugged for AT-based systems. The new card can be identified by the presence of jumper pins above the edge connector or by assembly part numbers listed below.

	Old Asm P/N	New Asm P/N
128Kb Card	67X1245	00F5383
512Kb Card	76X1008	00F5384

The FRU numbers have not changed. Field stock has been purged and all orders will be filled with the new card.

| Switch Settings | | | | Base Address (Hex) | Physical Card Designation |
SW1	SW2	SW3	SW4		
On	On	On	On	02A0	0
Off	On	On	On	06A0	1
On	Off	On	On	0AA0	2
Off	Off	On	On	0EA0	3
On	On	Off	On	12A0	4
Off	On	Off	On	16A0	5
On	Off	Off	On	1AA0	6
Off	Off	Off	On	1EA0	7
On	On	On	Off	22A0	8
Off	On	On	Off	26A0	9
On	Off	On	Off	2AA0	10
Off	Off	On	Off	2EA0	11
On	On	Off	Off	32A0	12
Off	On	Off	Off	36A0	13
On	Off	Off	Off	3AA0	14
Off	Off	Off	Off	3EA0	15
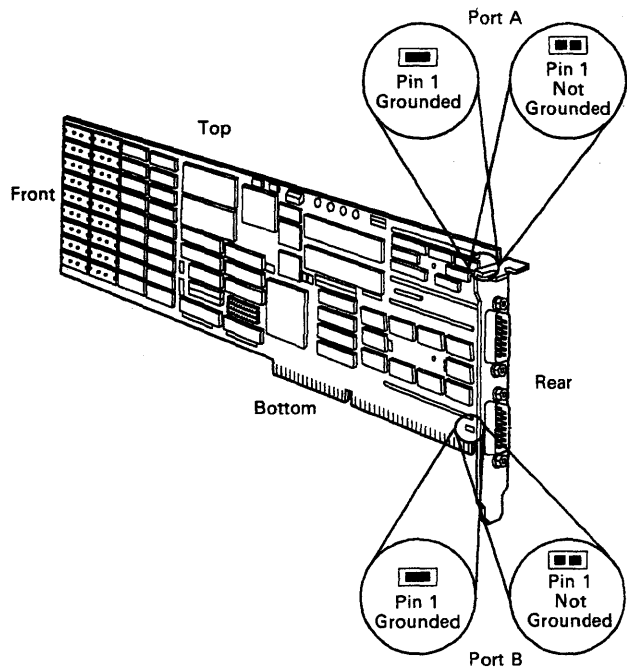
LEX41716

Figure 17-64. Ground Jumpers

ARTIC
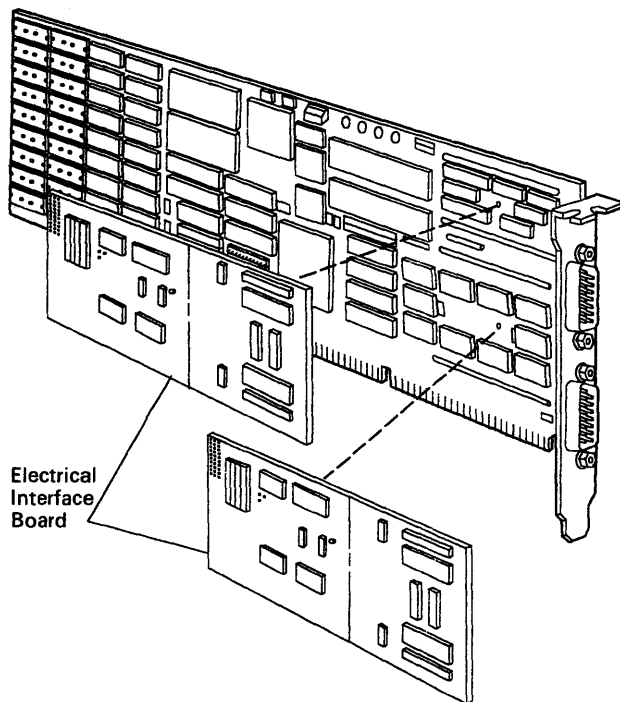
LEX41704

Figure 17-65. ARTIC

The ARTIC Adapter is a 3.5-inch × 13-inch native attachment adapter. ARTIC contains two serial ports which are programmable for asynchronous, BSC, SDLC, and HDLC communications protocols at data rates up to 64Kb/ps.

ARTIC provides the user with a programmable microprocessor (INTEL 80186) with ROM containing power-on self test (POST), subsystem loader, and I/O support microcode. ARTIC is available in two versions: P/N60X8192, 128Kb − 256Kb; and P/N76X1013, 512Kb − 1024Kb.

In order to accommodate the different possible physical interfaces encountered in the communications environment, ARTIC utilizes an interface board design.

Each interface board provides the physical interface for one serial port. ARTIC has the capacity to mount two interface boards. The interface boards and associated cable features will provide the following communication interfaces:

- 20 ma active and passive current loop
- EIA RS232C
- EIA RS422A
- CCITT V.35.

The customer has the ability to use vendor or IBM licensed programs to operate ARTIC.

Specifications

Only one ARTIC is supported in an IBM 5160 or 5531, and up to three are supported in the IBM 5170, 7531, and 7532. The ARTIC is not supported in the 5150 PC.

Applications

5531, 5160, 5170, 7531, and 7532.

Compatibility to Other Existing Options

The architecture of the IBM PC/ICs prohibits the use of 8-bit adapters, such as Enhanced Graphics Adapter (EGA), PC Network, and a 16-bit adapter like ARTIC in the system at the same time. This is due to the sharing of a common 128Kb I/O address space. If ARTIC is used in the 16-bit mode, one of the following conditions must exist:

- The 138Kb I/O region must be defined as 16-bit I/O address space. This means there are no 8-bit adapters which use this I/O address space.

- A separate 16-bit I/O address space is defined within user memory space below 640Kb.

Note: ARTIC can be installed in an AT edge connector slot (16-bit) and yet use only an 8-bit wide I/O channel bus.

Diagnostics Hints

Advanced diagnostics are on a separate diskette housed in the *ARTIC HMS* manual. These diagnostics *must* be loaded only by a system power on. If a Ctrl-Alt-Del is used, ARTIC will not be initialized or reset, giving false errors or conditions.

ARTIC Diagnostics Error Codes

Error Code Range	Replace
00-0F	Real-Time Interface Coprocessor (ARTIC)
10-1F	ARTIC
20-2F	RAM module identified by RAM module isolation procedure.
30-3F	ARTIC
40-4F	ARTIC
50-5F	ARTIC
60-6F	ARTIC
70-7F	Electrical interface board (If problem remains, replace the ARTIC.)
80	* (See note below.)
82-83	ARTIC
84-85	ARTIC
84-85	ARTIC
86	Cable being tested.
87	ARTIC
88	RAM module identified by RAM module isolation procedure.
89-8D	ARTIC
90-9F	ARTIC
A0	ARTIC

* Check the interrupt acknowledge and interrupt request level jumpers. If the jumpers are correct, replace the Real-Time Interface Coprocessor. If the jumpers are incorrect, correct them and repeat the diagnostics test.

Figure 17-66. FRU and Error Code Table

IBM Personal Computer 3278/79 Emulation Adapter, P/N8654378

Short Adapter, P/N8665792
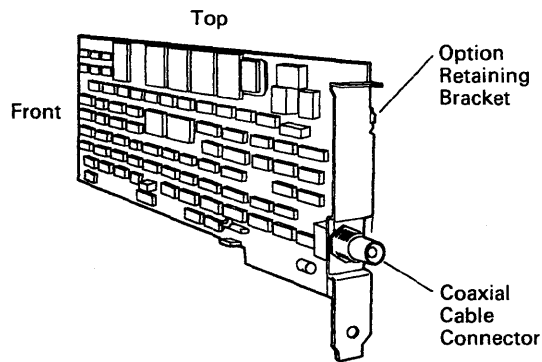
LEX40134

Figure 17-67. 3278/79 Emulation Adapter

The IBM 3278/79 Emulation Adapter expands the capabilities of the 5150, 5160, 5162, 8530, and 5170 by providing coaxial cable attachment to the 3274 Control Unit, the 4321, 4331, or 4361 Processor Display/Printer Adapter, or the 4701 Finance Communications Controller. When used with the Personal Computer 3278/79 Emulation Control Program (6024134), the system can emulate the functions of a 3278 Display Station Model 002 or a 3279 Color Display Station Model 2A or S2A, and can also support file transfer with the host. Both the host-controlled 3270 session and a local IBM Personal Computer DOS session can be active concurrently, and the user can interact with either session alternately.

Switch Settings

The switches on the 3278/79 Emulator Adapter card are normally preset.

Switch	Setting
1	On
2	On
3	On
4	Off
5	On
6	5271 - Off Slots 1-7, On Slot 8
7	On
8	On

Display Station Emulation Adapter (DSEA) Switch Settings, P/N6851206
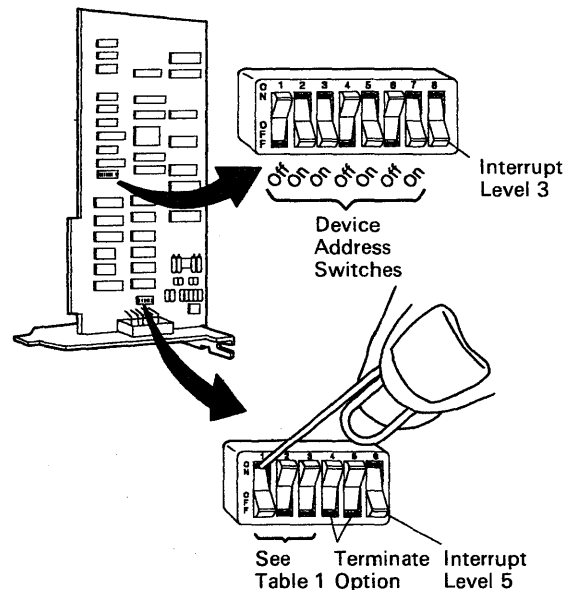
LEX40283

Figure 17-68. IBM Personal Computer/Display Station Emulation Adapter

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

The IBM PC/DSEA hardware consists of the adapter and a card support bracket. The DSEA plugs into a system expansion slot inside the IBM PC System Unit, the IBM PC XT System Unit, or the Expansion Unit. The T-connector and Twinaxial Cable Assembly accessories connect the system twinaxial cables to the 15-pin external connector on the DSEA.

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

Figure 17-69. Display Station Addresses/Switch Settings

Device Address Switch Assembly

The device address of the Display Station Emulation Adapter is selected by setting switches 1 through 7 of the 8-position switch assembly located on the adapter. Setting the switch on causes the corresponding I/O address bit to be off. The settings shown below indicate a device address of hexadecimal 250 to 257. The low order 3 bits of the I/O address are used to select the interface registers on the adapter.

Switch position 8 is used to select the IBM Personal Computer interrupt level 3. When the switch is on, interrupt level 3 is used. When the switch is off, interrupt level 3 is disabled. Either interrupt level 3 or interrupt level 5 must be selected, *never* both. The interrupt level selected must be compatible with the emulation software.

Switch Number	1	2	3	4	5	6	7	8
Switch Status	off	on	on	off	on	off	on	*
If the Switch is 'Off', the Bit is 'On'								
Bit Status	on	off	off	on	off	on	off	
Device Address Bit	9	8	7	6	5	4	3	
Bit Pattern	1	0	0	1	0	1	0	
Hex Equivalent	2			5			0	
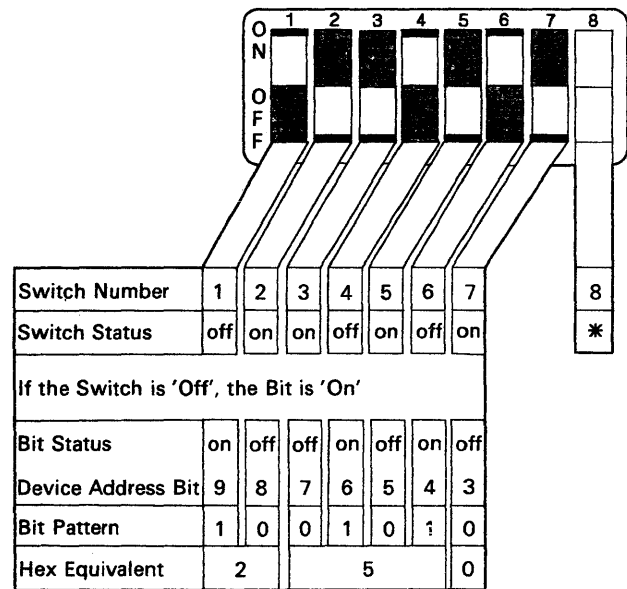
LEX40284

Figure 17-70. Device Address Switch Assembly

Display Station Address Switch Assembly

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

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

Switch position 6 is used to select the IBM Personal Computer interrupt level 5. When the switch is on, interrupt level 5 is used. When the switch is off, interrupt level 5 is disabled. The settings shown below indicate interrupt level 5. Either interrupt level 3 or interrupt level 5 must be selected, *never* both. The interrupt level selected must be compatible with the emulation software.
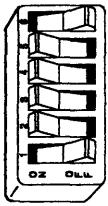
On - Interrupt Level 5
Off - Terminate Option
Off - Terminate Option
Off - Station Address Switch 1
Off - Station Address Switch 2
On - Station Address Switch 4

LEX40285

Figure 17-71. Display Station Address Switch
Assembly

Enhanced 5250 Display Station Emulation Adapter, P/N55X3367
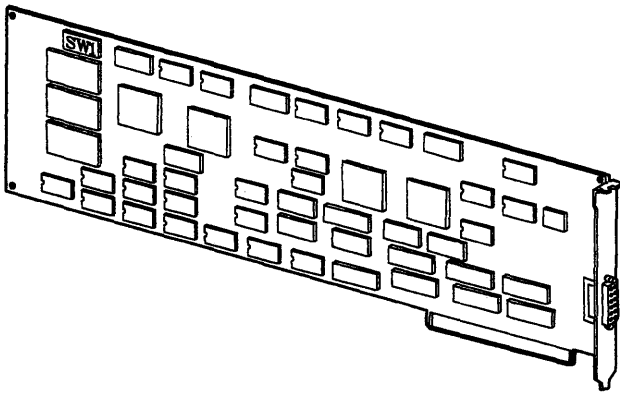
LEX41246

Figure 17-72. Enhanced 5250 Display Station Emulation Adapter

The Enhanced Display Station Emulation Adapter (EDSEA) feature consists of both hardware and microcode which enables the 5150, 5155, 5160, and 5170 to emulate a 5291, 5292-1, or 5292-2 display. An attached printer can emulate a 5256 or 5219 work station printer.

The EDSEA, when properly attached to a System/34, System/36, or System/38 host, allows the operator to establish a work station session with the host and hot key between the host work station session and the normal PC session.

Communications Adapter Cable, P/N8529274
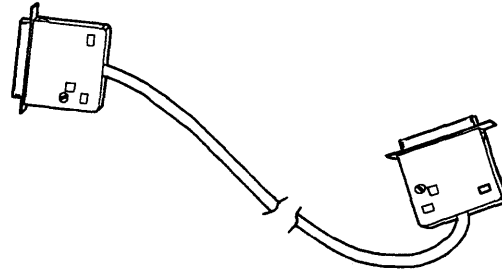
LEX40041

Figure 17-73. Communications Adapter Cable

The IBM Communications Adapter Cable is a 10-foot cable for connection of an IBM communications adapter to a modem or other RS232C Data Communications Adapter (DCE). It is fully shielded and provides a high-quality, low-noise channel for interface between the communications adapter and DCE.

The connector ends are 25-pin D-shell connectors. All pin connections conform with the EIA RS232C standard.

AT Serial Adapter Cable, P/N8286170

Modem Connector
or Other RS-232
Data Communications
Equipment

Communications
Adapter
Connector

1   14

1   6

13   25

5   9

25-Pin
D-Shell
Connector

9-Pin
D-Shell
Connector
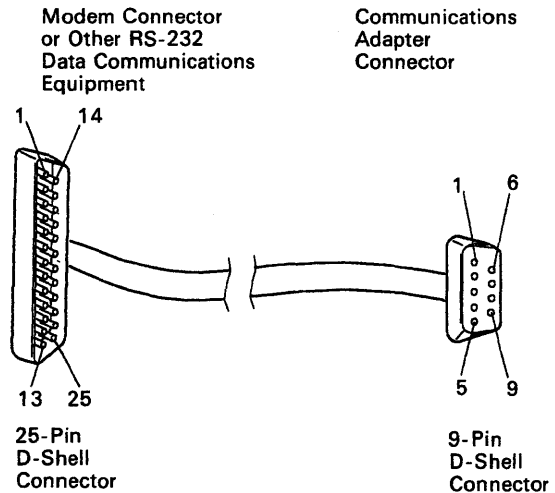
LEX40042

Figure 17-74. AT Serial Adapter Cable

The IBM Personal Computer AT Serial Adapter Cable is for connecting an IBM communications adapter with a 9-pin D-shell connector to a modem or other RS232C Data Communications Equipment (DCE). It is fully

shielded and provides a high-quality, low-noise channel for interface between the communications adapter and DCE.

One connector is a 9-pin D-shell connector and the other is a 25-pin D-shell connector. The pin numbering and connector specifications are in Figure 17-74 on page 17-32.

Personal Telephone Manager, P/N6428171
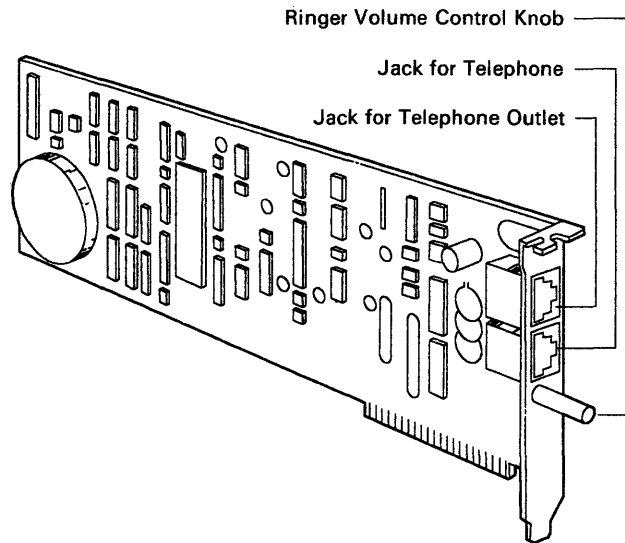
LEX41244

Figure 17-75. Personal Telephone Manager

The Personal Telephone Manager (PTM) is an application that allows the IBM Personal Computer to act as a telephone work station. The PTM can be used in 5150-, 5160-, and 5170-based systems. The PTM includes the following applications:

- Dial automatically from a user-created phone book.
- Create multiple phone books.
- Redial automatically from a list of the last eight numbers dialed by user.
- Search through phone books for a specific phone book entry.
- Set reminders for user.
- Assign advanced (PBX) telephone functions to a function key.
- Create keywords to use instead of frequently used dialing characters in user phone book.

IBM Personal Computer Internal Modem 1200 Jumper Positions, P/N6164804
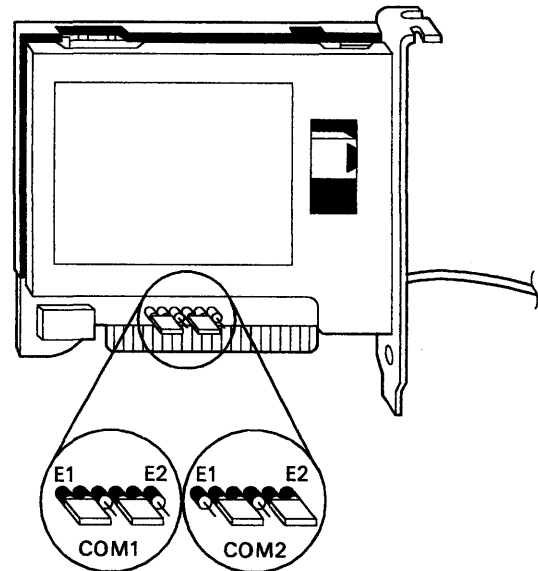
LEX41764

Figure 17-76. IBM Personal Computer Internal Modem 1200

Place the jumpers shown above in the COM1 position on the modem. If your IBM Personal Computer already has a serial device attached and is using COM1, place the modem jumpers in the COM2 position on the card.

This modem is designed for use with the 5150, 5155, 5160, and 5170. Its capabilities are as follows:

- Asynchronous data transmission in full-duplex mode at speeds up to 1200 bps.
- Automatic Adaptive Equalization, which dynamically adjusts modem to variances in quality of telephone line.
- Automatic generation of answer tone, 2100 Hertz in V.22 mode or 2225 Hertz in Bell 212 mode.
- Automatic or manual dial and answer.
- Control for A/A1 telephone leads in applications with key telephone systems.
- Two telephone jacks.
- Automatic Detection for transmission speed of 75, 100, 110, 134.5, 150, 200, 300, 600, or 1200 bps, and automatic compatibility adjustment.
- Telephone line surge protection.
- Automatic selection of tone/pulse dial.
- Automatic redial.
- Automatic detection of voice or failed call.

64Kb/256Kb Memory Expansion Option, P/N8286096

64Kb Memory Module Kit
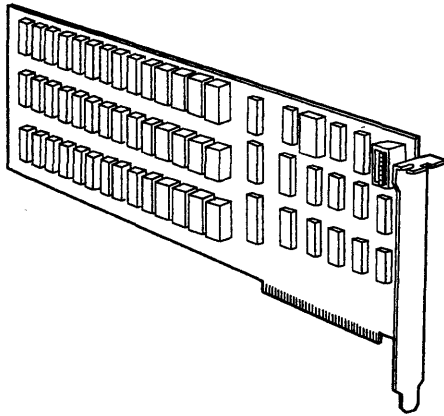
LEX40045

Figure 17-77. 64Kb/256Kb Memory Expansion Option (Right View)

The 64Kb Memory Module Kit and the 64Kb/256Kb Memory Expansion Option are available for the IBM Personal Computer family of products. Depending upon the amount of memory currently installed on the system board, memory module kits can be added to provide a maximum of 256Kb of RAM without using any of the system-unit expansion slots for a memory expansion option. The system board must be populated to the maximum amount of RAM before a 64Kb/256Kb Memory Expansion Option can be installed.

The IBM 64Kb/256Kb Memory Expansion Option has four banks of nine pluggable sockets. Each bank will accept a 64Kb Memory Module Kit, consisting of nine 64K × 1 modules with 16-pin industry-standard parts. The base 64Kb/256Kb expansion option comes with modules installed in bank 0, providing 64Kb of memory. The kits must be installed sequentially into banks 1, 2, and 3. The following chart shows how the 64Kb Memory Module Kit can be installed on the system board and the 64Kb/256Kb Memory Expansion Option.

	Minimum Memory	Maximum Memory	No. of 64Kb Memory Module Kits	Memory Module Type
64Kb/ 256Kb System Board	64Kb	256Kb	1, 2, or 3	64Kb × 1 bit, 16 pin
64Kb/ 256Kb Memory Option	64Kb	256Kb	1, 2, or 3	64Kb × 1 bit, 16 pin

Figure 17-78. 64Kb Memory Module Kit and 64Kb/256Kb Memory Expansion Option Usage

256Kb Memory Expansion Option, P/N6134136
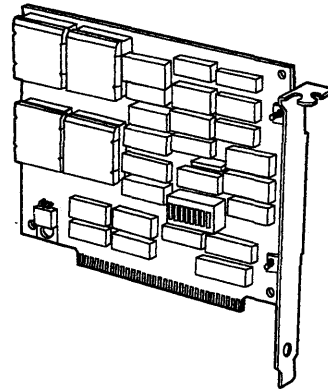
LEX40047

Figure 17-79. 256Kb Memory Expansion Adapter

The IBM 256Kb Memory Expansion Option is available for the IBM Personal Computer family of products. The system board must be populated to the maximum 256Kb of RAM before the IBM 256Kb Memory Expansion Option can be installed.

The IBM 256Kb Memory Expansion Option has four pluggable sockets. Each socket will accept a 64Kb Memory Module, consisting of one 64Kb × 9 32-pin, D RAM module. The 256Kb expansion option comes with all four modules installed, providing 256Kb of memory.

17-34

5170 128Kb Memory Expansion Option, P/N8286116
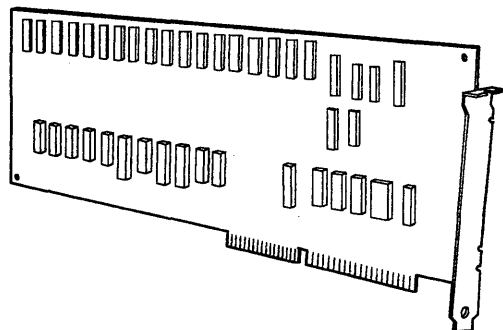
LEX40046

Figure 17-80. 128Kb Memory Expansion Adapter

The IBM Personal Computer AT 128Kb Memory Expansion Option has 18 RAM modules (64Kb × 1), for a total capacity of 128Kb.

5170 512Kb Memory Expansion Option, P/N8286115
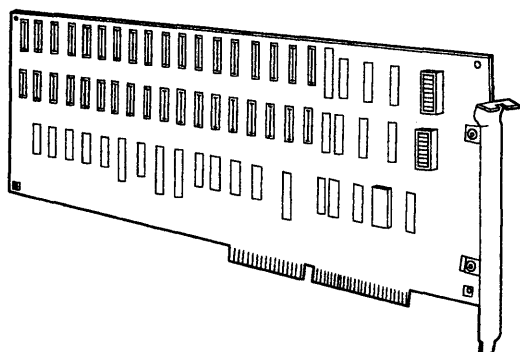
LEX40048

Figure 17-81. AT 512Kb Memory Expansion

The IBM Personal Computer AT 512Kb Memory Expansion Option has 26 RAM modules (128Kb × 1), for a total capacity of 512Kb. Refer to the 5170 Chapter for switch setting information.

Prototype Card, P/N8529213
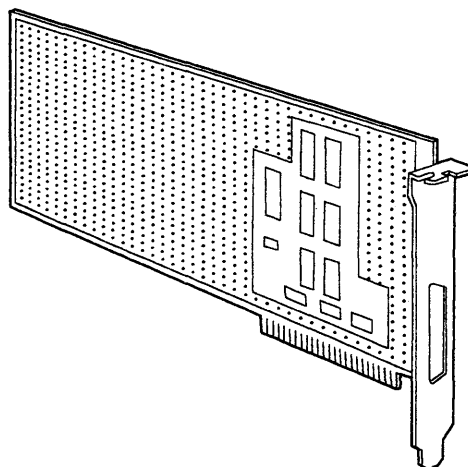
LEX40049

Figure 17-82. Prototype Card (Right View)

The Prototype card is 106.7 mm (4.2 in) high × 335.3 mm (13.2 in) long and plugs into an expansion unit or system-unit expansion slot. All system control signals and voltage requirements are provided through a 2- × 31-position card-edge tab.

The card contains a voltage bus (+5V DC) and a ground bus (0V DC). Each bus borders the card, with the voltage bus on the back (pin side) and the ground bus on the front (component side). A system interface design is also provided on the Prototype card.

The Prototype card can also accommodate a D-shell connector if it is needed. The connector size can range from a 9- to a 37-position connector.

Note: Install all components on the component side of the Prototype card. The total width of the card including components should not exceed 12.7 mm (0.5 inch). If these specifications are not met, components on the Prototype card might touch other cards plugged into adjacent slots.

IBM Token-Ring Network PC Adapter, P/N69X7856
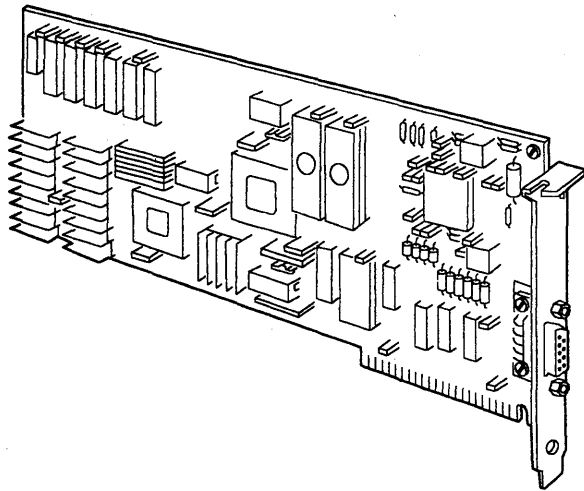
LEX41250

Figure 17-83. Token-Ring Network Adapter

The Token-Ring Network PC Adapter is an adapter card which requires a full-sized expansion slot in one of the following supported system units: 5150, 5155, 5160, 5162, 5170, and 8530. This adapter allows the listed system units to become IBM Token-Ring Network attaching devices. The feature includes a PC Adapter card, *PC Adapter Guide to Operations*, and a PC Adapter Diskette.

The *IBM Token-Ring Network GTO* contains installation instructions for the adapter, an adapter diskette, and operational instructions for the adapter diagnostics. The diskette contains programs that support the operation and testing of the adapter.

Remote Program Load (RPL) is an RPQ available for this adapter. The RPL function resides in a module (P/N67X0406) that is plugged onto the adapter card.

IBM Token-Ring Network PC Adapter II, P/N67X0395
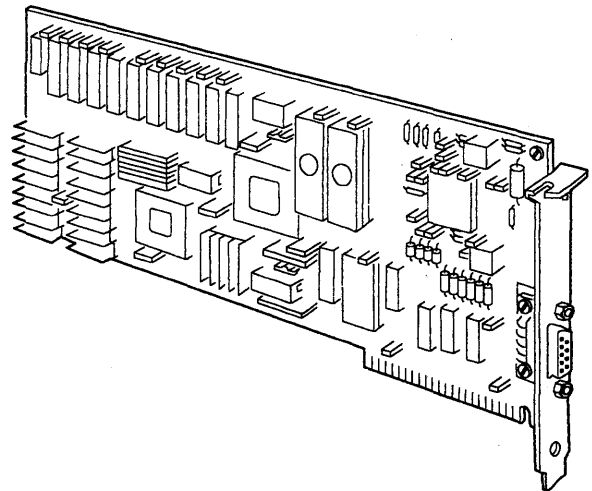
LEX42436

Figure 17-84. Token-Ring Network Adapter II

The Token-Ring Network Adapter II card requires a full-sized expansion slot in one of the following system units: 5150, 5155, 5160, 5162, 5170, 5531, 7531, 7532, and 8530. This adapter is functionally similar to the IBM Token-Ring Network PC Adapter in that it can be used in an attaching system to gain access to a token-ring network. However, the Adapter II has an additional 8Kb of RAM which allows it to be used as part of a bridge between two token-rings.

The *IBM Token-Ring Network GTO* contains installation instructions, an adapter diskette, and operational instructions for the adapter diagnostics. The diskette contains programs that support the operation and testing of the adapter.

Remote Program Load (RPL) is an RPQ available for this adapter. The RPL function resides in a module (P/N67X0406) that is plugged onto the adapter card.

Token-Ring Network PC Adapter and Token-Ring Network Adapter II

If you have an IBM Personal Computer, you should install the IBM Token-Ring Network PC Adapter in expansion slot 4. This position ensures that the adapter will get sufficient ventilation. If an adapter already occupies slot 4, check the documentation for that adapter to determine if the adapter requires slot 4. If it does not require slot 4, move the adapter to another slot. If the adapter does require slot 4, install

the IBM Token-Ring Network PC Adapter in the nearest available slot.

In the IBM Portable Personal Computer, the IBM Token-Ring Network Adapter will fit only in the long slot closet to the monitor. See the "Options Installation" section of the *IBM Portable PC Guide to Operations* for specific installation instructions.

If you have a IBM Personal Computer XT or AT, you can install the adapter in any of the slots.

The IBM Token-Ring Network PC Adapter should not be installed in an IBM Personal Computer Expansion Unit.

Setting the Switches on the Adapter

Before replacing an adapter or installing a new adapter, read this section to help you determine the correct switch settings on the adapter.

If you are replacing an adapter, check the switch settings on the adapter being removed. If the switches were not set correctly, the adapter being removed would not have worked correctly. If the switches were set correctly, set the switches on the replacement adapter in the same way.

On the component side of the adapter are two switch blocks (see below). These switches determine:

- Where the computer will address the read-only memory (ROM) of the adapter
- What interrupt level the computer will use to address the adapter
- Whether this adapter is the primary (first) or alternate (second) IBM Token-Ring Network PC Adapter in this computer.

Note: Set a rocker switch by pressing the rocker down to the desired position.
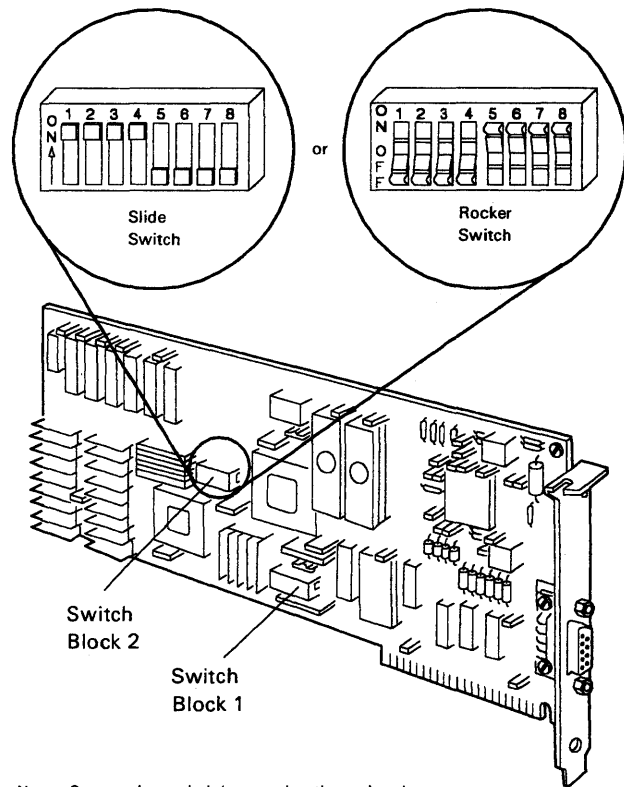
LEX42515

Figure 17-85. Token-Ring Switch Settings

Setting the Switches for ROM

Switches 1 through 6 on switch block 1 determine the address in the computer's memory where it will locate the adapter's read-only memory (ROM).

ROM requires 8Kb of storage. Use setting number 1 (816Kb) if you do not have an IBM PC Network Adapter installed. Use setting number 2 (880Kb) if you do have an IBM PC Network Adapter installed. If you install *two* IBM Token-Ring Network PC Adapters in the same computer, set the first one to setting number 1 and the second one to setting number 2. (You should install no more than two network adapters of either kind.)

If your computer has any other feature that uses the same areas of memory recommended here, the computer will not operate when it tries to access that part of memory.

Set switches 1 through 6 on switch block 1 as required. See "Personal Computer Memory" on page 17-38 to help you determine the correct ROM address.

Switch Block 1

Setting #1
ROM ADDRESS: CC000

Setting #2
ROM ADDRESS: DC000
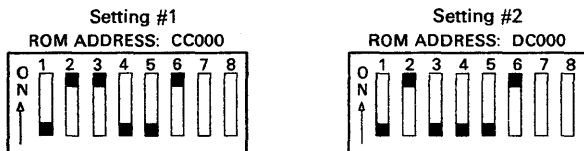
Record your switch settings for this adapter on the
following figure.
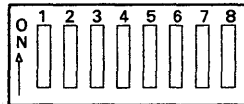
LEX42516

Personal Computer Memory

The switch positions 1 through 6 on switch 1 represent
bit positions 18 through 13 respectively of a 19-bit
address. The 19th bit is not settable since only the
upper half of computer memory is available for ROM.
When setting the bit positions, off is a logical 1 (one)
and on is a logical 0 (zero).

Memory Map

Listed below are:

* All 8Kb memory boundaries above address A0000
* The memory addresses used by some IBM Personal
  Computer products.

If you are not sure where 8Kb of unused addressable
space are located in your computer, see your
computer's *Technical Reference* or consult your sales
representative.

```
A0000—640Kb
A2000—648Kb
A4000—656Kb
A6000—664Kb
A8000—672Kb
AA000—680Kb
AC000—688Kb
AE000—796Kb
B0000—704Kb—Monochrome Display Adapter
B2000—712Kb—Monochrome Display Adapter
B4000—720Kb—Monochrome Display Adapter
B6000—728Kb—Monochrome Display Adapter
B8000—736Kb—Color Graphics Adapter
BA000—744Kb—Color Graphics Adapter
BC000—752Kb—Color Graphics Adapter
BE000—760Kb—Color Graphics Adapter
C0000—768Kb—3270 Personal Computer Adapter
C2000—776Kb
C4000—784Kb
C6000—792Kb
C8000—800Kb—Fixed Disk
CA000—808Kb—3270 Personal Computer Adapter
CC000—816Kb—PC Network Adapter (Primary)
CE000—824Kb—3278/3279 Emulator Adapter
D0000—832Kb—PC Cluster
D2000—840Kb—PC Cluster
D4000—848Kb—PC Cluster
D6000—856Kb—PC Cluster
D8000—864Kb
DA000—872Kb
DC000—880Kb—PC Network Adapter (Alternate),
                        5250 Emulator Adapter
DE000—888Kb
E0000—896Kb—Personal Computer AT ROM
E2000—904Kb—Personal Computer AT ROM
E4000—912Kb—Personal Computer AT ROM
E6000—920Kb—Personal Computer AT ROM
E8000—928Kb—Personal Computer AT ROM
EA000—936Kb—Personal Computer AT ROM
EC000—944Kb—Personal Computer AT ROM
EE000—952Kb—Personal Computer AT ROM
F0000—960Kb—Personal Computer AT ROM
F2000—968Kb—Personal Computer AT ROM
F4000—976Kb—PC, XT, and AT ROM
F6000—984Kb—PC, XT, and AT ROM
F8000—992Kb—PC, XT, and AT ROM
FA000—1000Kb—PC, XT, and AT ROM
FC000—1008Kb—PC, XT, and AT ROM
FE000—1016Kb—PC, XT, and AT ROM
```

Setting the Interrupt Level

Switches 7 and 8 on switch block 1 allow you to set the
interrupt level. The interrupt level allows an adapter
to request the attention of the computer's central proc-
essing unit. The adapter allows you the flexibility of
setting the interrupt level according to the features
you have installed. As with the ROM settings, if the
interrupt level that you select for the adapter conflicts
with another feature in your system unit, your com-
puter or one of the features will not operate correctly.

Switches 7 and 8 on switch block 1 are illustrated for
you to determine which interrupt level you can use.

Set the interrupt level 2, 3, or 7 as described below. Be sure you pick an interrupt level that does not conflict with the features in your computer.

Level 2

Use if you do not have a 3278-79 Emulator or an IBM PC Network Adapter.

Switch Block 1
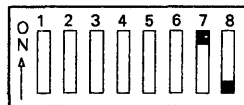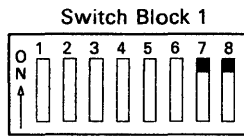
LEX42517

Level 3

Use if you cannot use level 2 and you do not have any of the following IBM Personal Computer adapters:

- IBM PC Network (secondary)
- Asynchronous Communications (secondary)
- SDLC Communications
- BSC (secondary).

Level 6

Do not use this interrupt. It is used by the diskette drive.
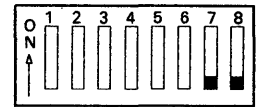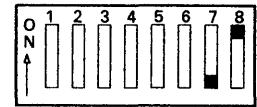
Record your switch settings for this adapter on the following figure.
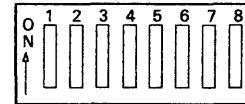
LEX42558

Level 7

Use if you cannot use level 2 or 3 and only if your printer does not use interrupt level 7.

Setting the Primary/Alternate Switch

Switch 2 on switch block 2 (see below) should be set to indicate that this is the primary or alternate adapter installed in this computer. Set switch 2 on switch block 2 as needed.

Switch Block 2

Primary   Alternate
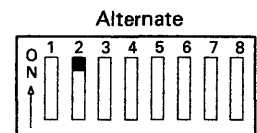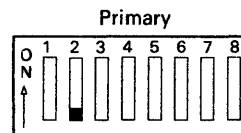
The remaining switches should be set as shown below.

Record your switch settings for this adapter on the following figure.
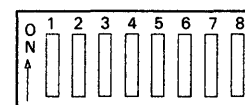
LEX42652

Cluster Adapter, P/N6323472
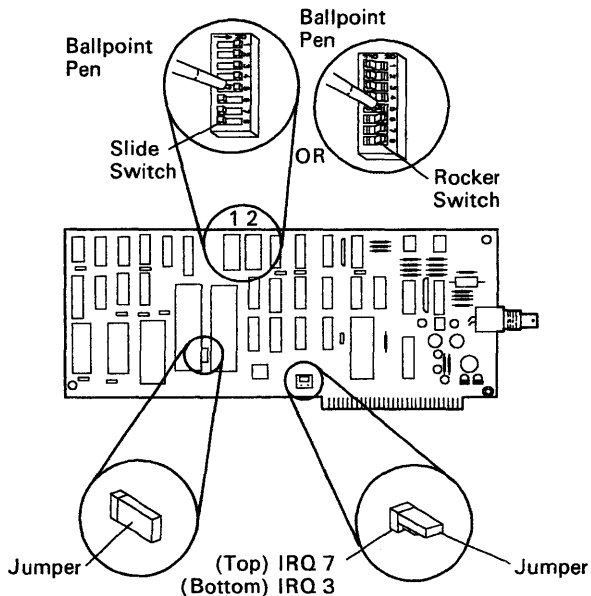
LEX40052

Figure 17-86. Cluster Adapter

The Cluster Adapter is a communication adapter used for linking up to 64 IBM Personal Computers (PCs). The transmission rate is 375,000 bits per second (bps). A multi-drop bus architecture passively links (cluster operation is unaffected if the power to any station is off) the PCs to a coaxial cable. The coaxial cable bus can be a maximum length of 1 kilometer (3280 feet) and requires a 75-ohm (Ω) terminating resistor at both ends to minimize signal reflection. The coaxial cable drop can be a maximum length of 5 meters (16.4 feet) and a minimum length of 1 meter (3.3-feet).
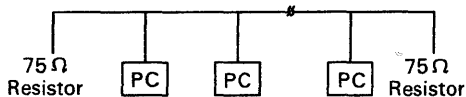
LEX40053

Figure 17-87. Cluster Example

The following figure shows the setting for switch 8 of switch block 1. When this switch is set to on, the Personal Computer will request an Initial Program Load (IPL) from another station in the cluster. This request delays the completion of POST by 30 seconds.
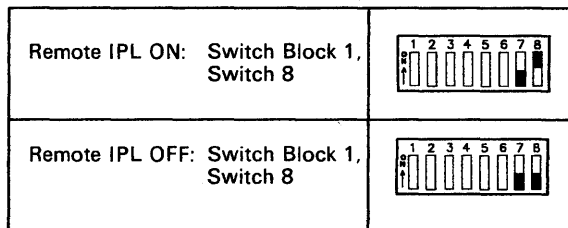
LEX40276

Figure 17-88. Switch 8, Switch Block 1

The following figure shows the settings for switches 1 through 4 of switch block 2 for adapters 1 through 4.

Switches 5 through 8 of switch block 2 are always set to off. If one Cluster Adapter is installed in an IBM Personal Computer, it must be set as adapter 1. Each additional adapter must have a different Cluster Adapter number.
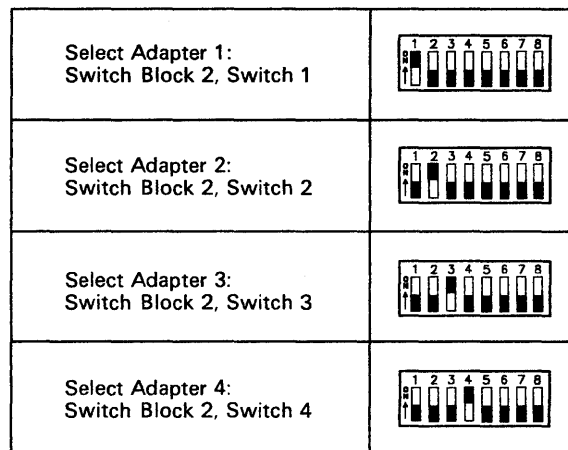
LEX40277

Figure 17-89. Cluster Switches 1 to 4, Switch Block 2,
Adapters 1 to 4

There has been one Engineering Change (EC) for the Cluster Network to correct the problem of Personal Computers dropping offline when there are more than 12 PCs attached to the network or the distance between PCs is greater than 100 feet. For more information on this EC, see ECA026 in Chapter 19, "Engineering Change Announcements (ECAs)" on page 19-1.

5170 Prototype Adapter, P/N8286138
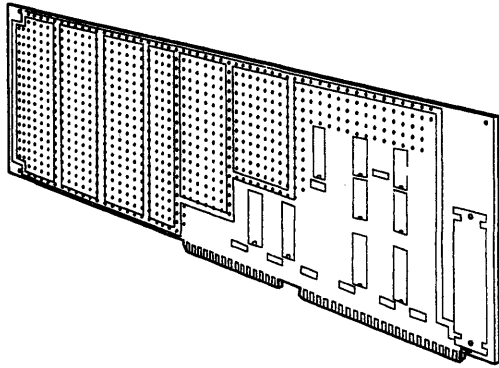
LEX40050

Figure 17-90. 5170 Prototype Adapter

The IBM Personal Computer AT Prototype Adapter is 121.9 mm (4.8 in) high × 333.25 mm (13.12 in) long and plugs into any system unit expansion slot except number 1 or 7. Two card-edge tabs, one 2- × 31-position and one 2- × 18-position, provide all system control signals and voltages.

The adapter has a voltage bus (+5V DC) and a ground bus (0V DC). Each bus borders the adapter with the ground bus on the component side and the voltage bus on the pin side. A system interface is also provided on the adapter with a jumper to specify whether the device has an 8- or a 16-bit data bus.

This adapter also accommodates a D-shell connector from 9 to 37 positions.

Note: All components must be installed on the component side of the adapter. The total width of the adapter, including components, should not exceed 12.7 mm (0.5 in). If these specifications are not met, components on the IBM Personal Computer AT Prototype Adapter might touch other adapters plugged into adjacent expansion slots.

Game Control Adapter, P/N8529151
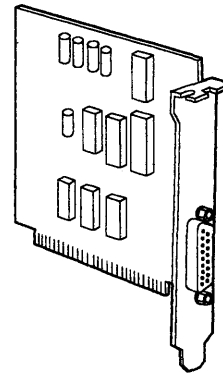
LEX40051

Figure 17-91. Game Control Adapter (Right View)

The Game Control Adapter allows up to four paddles or two joysticks to be attached to the system. This card fits into one of the slots of the system board or expansion board. The game control interface cable attaches to the rear of the adapter. In addition, four inputs for switches are provided. Paddle and joystick positions are determined by changing resistive values sent to the adapter. The adapter plus system software converts the present resistive value to a relative paddle or joystick position.

General Purpose Interface Bus Jumper Positions Adapter, P/N6181770

The GPIB Adapter (shown below) has four groups of jumper pins.
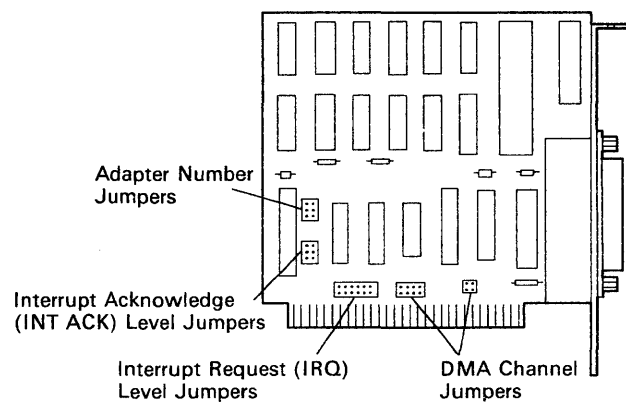
LEX40265

Figure 17-92. General Purpose Interface Bus Adapter

The IBM Personal Computer General Purpose Interface Bus (GPIB) provides an interface between the family of IBM Personal Computers and the IEEE-488 GPIB. This allows the PC to control and access multiple devices or instruments (plotters, disk drives, and multimeters) which are designed to the ANSI/IEEE-488 standard 1978, including the 488A-190 supplement. (GPIB cable P/N is 63X4882).

The adapter can perform as a talker and a listener, enabling the Personal Computer to send and receive commands or data to and from the devices on the GPIB.

Interrupt Request Level

The GPIB Adapter can share its interrupt request (IRQ) level with other adapters that can use shared interrupts. All adapters sharing an IRQ level must be installed in the same unit.

Interrupt Request Level	Jumper Positions
7	
6	
5	
4	
3	
2	

LEX40266

Figure 17-93. Interrupt Request Level Jumper Positions

Direct Memory Access (DMA) Channel

DMA Channel	Jumper Positions
1	
2	
3	

LEX40267

Figure 17-94. DMA Channel

Adapter Number

All GPIB adapters installed in the same system (system unit and expansion unit) must have different adapter numbers.

Adapter Number	Jumper Positions
0	
1	
2	
3	
4	
5	
6	
7	

LEX40268

Figure 17-95. GPIB Adapter Jumper Positions

17-42

Interrupt Acknowledge Level

The interrupt acknowledge (INT ACK) and interrupt request (IRQ) levels must be the same.

INT ACK Level	Jumper Positions
7	
6	
5	
4	
3	
2	

LEX40269

Figure 17-96. INT ACK Level Jumper Positions

Data Acquisition and Control Adapter Switch Settings

The Data Acquisition Adapter has five groups of slide-type dual in-line package (DIP) switches that control analog output range, analog input range, adapter number, and interrupt level. Each group of switches is labeled on the adapter, and each switch is numbered on the housing. The switch positions (on and off) also are labeled on the housing.

Switch Block 1

The following diagram shows the location and switch setting for switch block S1. Only the settings shown should be used for this switch block.
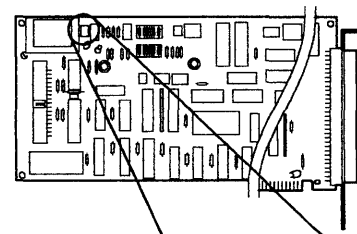
Output Range	Switch Settings
-5 to +5 Volts	
-10 to +10 Volts	
0 to +10 Volts	

LEX40279

Figure 17-97. Switch Block 1

The IBM Personal Computer Data Acquisition and Control Adapter (Data Acquisition Adapter) provides both analog and digital I/O capabilities. It is installed in any full-length expansion slot, and up to four may be installed in any system.

The adapter provides:

- Four analog input channels multiplexed into an analog-to-digital converter (ADC) with 12-bit resolution
- Two analog output channels, each having its own digital-to- analog converter (DAC), with 12-bit resolution
- A 16-bit digital input port
- A 16-bit digital output port
- A 32-bit timer
- A 16-bit, externally clocked, timer/counter
- An expansion bus.

Switch Block S2, Channel 1

Switch block S2 has two switches: S2-1 and S2-2. These switches determine the relationship between analog output values and the voltage output of the analog output device.

S2-1 controls voltage range:

- On: 10-volt range
- Off: 20-volt range.

S2-2 controls voltage polarity:

- On: Bipolar (±) voltage
- Off: Unipolar (+) voltage.

The following diagram shows the location and switch settings for switch block S2. Only the settings shown should be used for this switch block.

Output Range	Switch Settings
-5 to +5 Volts	
-10 to +10 Volts	
0 to +10 Volts	
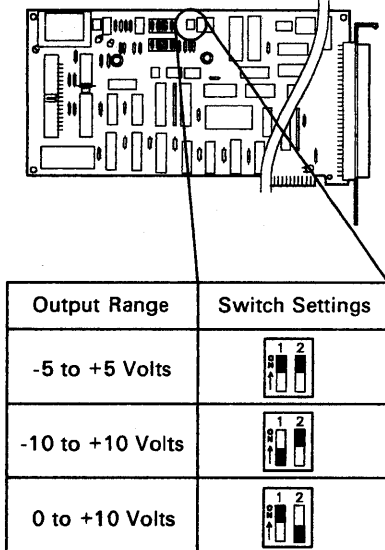
LEX40280

Figure 17-98. Switch Block 2

Switch Block S3, Analog Input Range

Switch block S3 has four switches: S3-1, S3-2, S3-3, and S3-4. The settings of these switches determine the relationship of analog input voltage to the values returned by the analog input device.

S3-1 is not used and is placed in the off position.

S3-2 controls the 20-volt input range:

- On: 20-volt range active
- Off: 20-volt range inactive.

S3-3 controls the 10-volt input range:

- On: 10-volt range active
- Off: 10-volt range inactive.

S3-4 controls voltage polarity:

- On: Bipolar (±) voltage
- Off: Unipolar (+) voltage.

The following diagram shows the location and switch settings for switch block S3. Only the settings shown should be used for this switch block.

Input Range	Switch Settings
-5 to +5 Volts	
-10 to +10 Volts	
0 to +10 Volts	
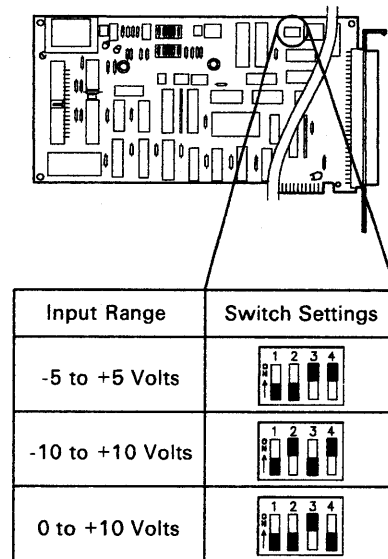
LEX40281

Figure 17-99. Switch Block 3

Switch Block S4, Adapter Number

Switch block S4 has two switches: S4-1 and S4-2. These switches specify the adapter number (0 through 3). Assign a number to each Data Acquisition Adapter before installation.

Note: Up to four Data Acquisition Adapters can be installed in your unit. Each adapter must be given a different adapter number.

Adapter Number	Switch Positions
0	
1	
2	
3	
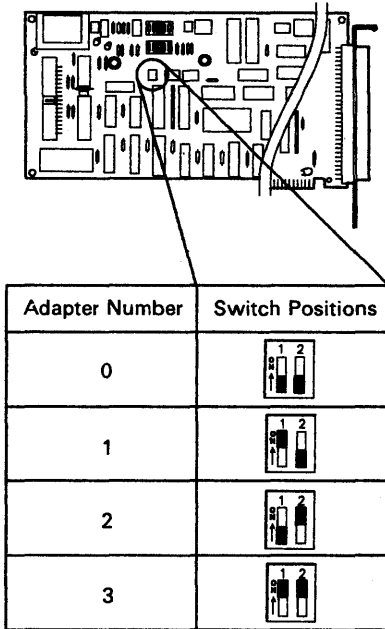
LEX40510

Figure 17-100. Switch Block 4

Switch Block S5, Interrupt Level

Switch block S5 has two 5-switch blocks rather than one 10-switch block. The switches of the right-hand, 5-switch block, although numbered 1 through 5, are functionally identical to switches 6 through 10.

These 10 switches determine the interrupt level of each Data Acquisition Adapter. Set the interrupt level for each adapter before installation. Data Acquisition Adapters installed in the same unit must be set to the same interrupt level. The settings for interrupt request level 7 (IRQ7) are recommended.

The following diagram shows the location and switch settings for switch block S5. Only the settings shown should be used for this switch block.

IRQ Level	Switch Settings
7 (Recommended)	
6	
5	
4	
3	
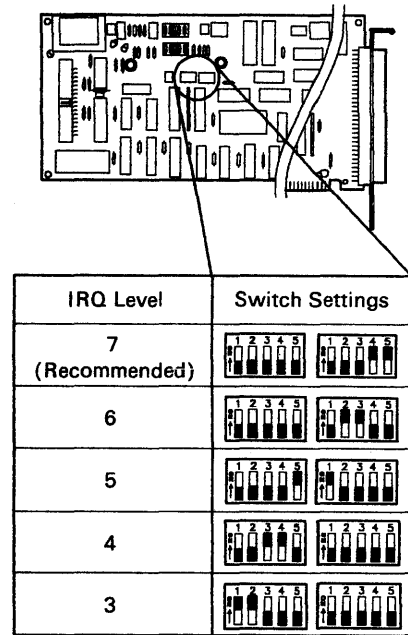
LEX40282

Figure 17-101. Switch Block 5

Data Acquisition and Control Adapter Distribution Panel, P/N6181769
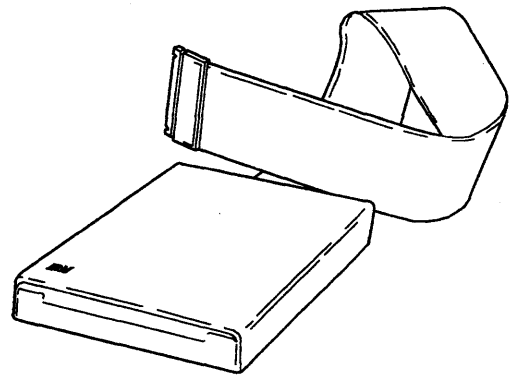
LEX40056

Figure 17-102. Data Acquisition and Control Adapter Distribution Panel

The IBM Personal Computer Data Acquisition and Control (Data Acquisition) Adapter Distribution Panel, with attached ribbon cable and 60-pin connector, is provided for external access to the Data Acquisition Adapter's analog I/O device, binary I/O device, and timer/counter device.

Four 22-screw terminal strips on the Distribution
Panel allow the user to connect external devices to the
Data Acquisition Adapter.

NMI Card, P/N6360609
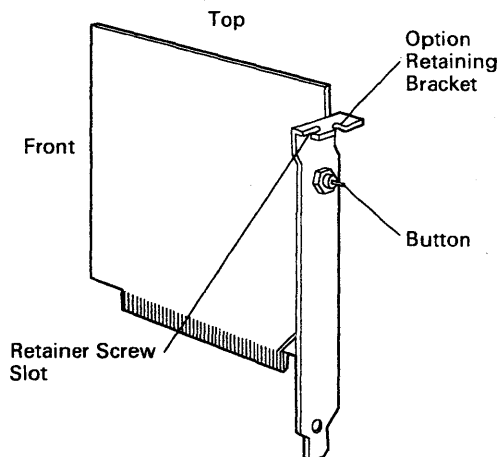
LEX40057

Figure 17-103. NMI Card

The Non-Maskable Interrupt (NMI) card is provided
with the Professional Debug Facility program, which is
a set of tools for experienced programmers.

The Resident Debug Tool program is part of the Profes-
sional Debug Facility. With the Resident Debug Tool
program in memory, pressing the button on the NMI
card should cause a non-maskable interrupt (interrupt
2) to occur. Pressing the button without the Resident
Debug Tool program in memory should cause a parity
check 2 error code.

Operation

To verify that the NMI card works properly, switch on
your computer and press the button on the NMI card.
You should receive a parity check 2 error code:

1. If you do not receive a parity check 2 error code,
   replace the card.
2. If you do receive a parity check 2 error code, your
   card is working properly. Switch off your com-
   puter, and then switch it back on. Everything
   should proceed normally.

Voice Communications Adapter, P/N2684438
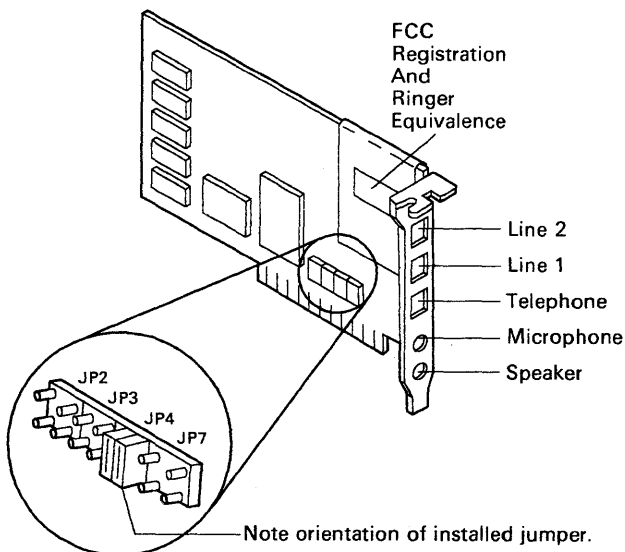
LEX41765

Figure 17-104. Voice Communications Adapter Jumper
Positions

Jumper block is usually set at JP4. It must be
installed at an interrupt level that does not conflict
with other positions.

At CSU and when replacing a defective adapter, it
must be determined if the default interrupt level (4) is
compatible with adapters in the system unit.
Instructions for selecting an interrupt level are in the
Voice Communications Installation and Setup Guide,
P/N6280713. Recent information indicates interrupt
level 7 is compatible with all other adapters. Interrupt
Levels 3 and 4 should not be used on systems running
programs written in BASIC or generated by the BASIC
compiler.

PC Music Feature, P/N81X8620
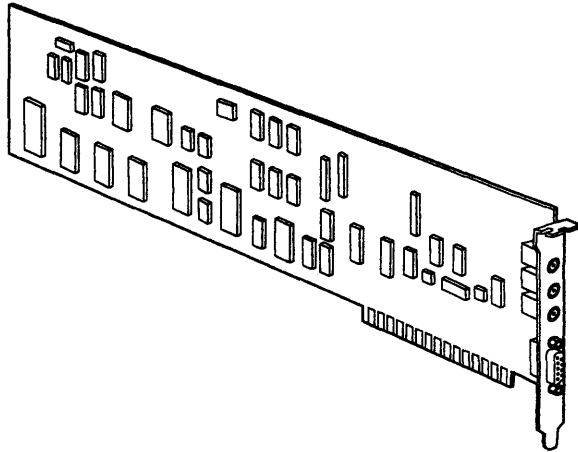
LEX42350

Figure 17-105. PC Music Feature

The PC Music Feature is compatible with 5150, 5160, 5162, 5170, and 8530. Special features include FM stereo sound output with 336 voices/instruments, 240 of which are preset and 96 of which are user programmable. Up to eight voices/instruments can be selected simultaneously, permitting an ensemble performance.

Limitations: A maximum of two PC Music Feature cards can be installed in a system unit. The PC Music Feature is not supported on the 4860, 5155, or 5140 machine types.

Prerequisites: The PC Music Feature can only be installed in an open full-length card slot in the system unit.

Enhanced Graphics Adapter Jumper Card, P/N8575146
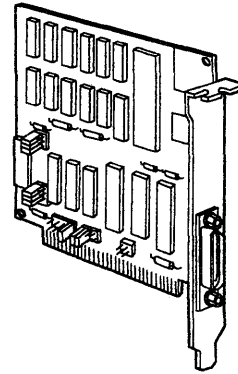
LEX42351

Figure 17-106. Enhanced Graphics Adapter Jumper Card

The Enhnaced Graphics Adapter (EGA) Jumper card provides an external synchronization from the IBM 4055 InfoWindow Display to allow text and graphics stored on the IBM Personal Computer or IBM Personal System/2 Model 30 (8530) to overlay motion or still frame video stored on a videodisc player and displayed on the 4055 InfoWindow.

Technical Information: The EGA Jumper card attaches to the feature connector of the IBM EGA or the InfoWindow EGA and to the IBM General Purpose Interface Bus (GPIB) Adapter (IRQ connector Row B, pins 2-6).

Maximum: One per system unit.

Prerequisites: IBM GPIB Adapter and the InfoWindow EGA.

For EGA Jumper card jumper settings, see the 4055 section of the Display Chapter.

2Mb Expanded Memory Adapter (XMA), P/N1497250
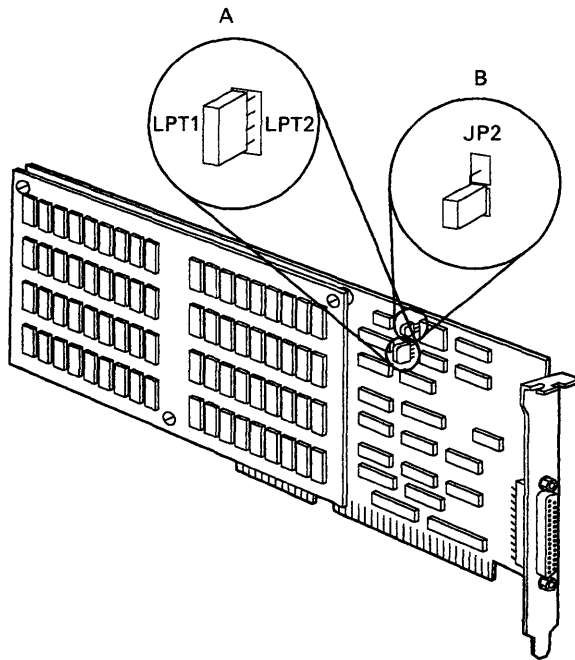
LEX42392

Figure 17-107. 2Mb Expanded Memory Adapter

The 2Mb Expanded Memory Adapter (XMA) provides 2Mb of expanded memory function and a standard parallel printer port for the 5160, 5170, 5271, 5371, and 8530. The 2Mb Expanded Memory Adapter supports the device drivers resident within the 3270 Workstation Program Versions 1.0 or 1.1 that provide application programs with expanded memory support, an Expanded Memory Specification (EMS) interface, and up to two PC DOS virtual disk interfaces. The EMS is issued by Lotus, Intel, and Microsoft.

The 2Mb XMA will backfill conventional memory from the 256Kb address to the 640Kb address. It is not necessary to use separate memory modules or cards for this purpose. The remainder to the adapter memory will be available for the EMS function. Up to two PC DOS virtual disk applications can run under EMS. The adapter can be apportioned to the virtual disk and other EMS application programs in 16Kb increments. The 3270 Workstation Program Versions 1.0 or 1.1 contain drivers. These EMS device driver programs provide a set of standard routines that allow applications to access memory on the adapter (up to 2Mb) through four 16Kb pages within the IBM Personal Computer address space.

Check the jumpers on the XMA card to make sure they are correct.

A   LPT1 (shown below) if only one printer port is available.

LPT2 if two printer ports are available and the printer attached to the XMA card is not the primary printer.

B   Must be plugged as shown.

Notes:

1. LPT2 is not supported on all 5271 PCs with a fixed disk. LPT1 is the only jumper that can be used for a 5271 with a fixed disk. If more than one printer card is installed, disable the XMA printer port by removing the 4-pin jumper.

2. When the XMA is installed in a 5273, the system board RAM jumper must be set for 256Kb of memory. When installed in the 5271, the system board must be set for 256Kb of memory and no other memory adapters can be installed.

0.5Mb to 6Mb Memory Expansion Adapter, P/N55X3619
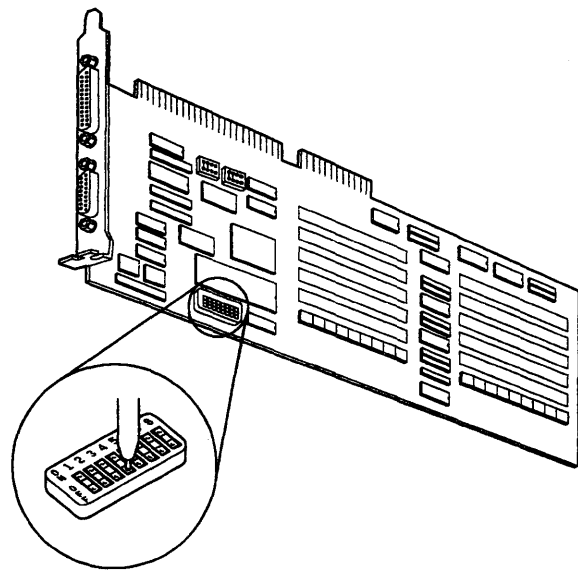
LEX42393

Figure 17-108. 0.5Mb to 6Mb Memory Expansion Adapter

The 0.5Mb to 6Mb Memory Expansion Adapter is a versatile multifunction adapter providing up to 6Mb of memory, split memory addressing, a parallel printer port, and an asynchronous serial communications port. Memory module kits can be added in increments up to 6Mb per adapter. Three adapters can be installed providing a maximum of 16Mb of additional memory. Split memory addressing allows the base memory to be filled to the 640Kb limit. Additional memory automatically becomes part of the expansion memory area.

The asynchronous serial communications port is an RS232C connector for interfacing to a modem, remote display terminal, serial printer, or other serial device. The parallel printer port provides a 25-pin connector to attach a parallel printer.

0.5Mb to 6Mb Adapter Switch Settings

Setting the Switches

To configure the 0.5Mb to 6Mb Memory Expansion Adapter to the correct position, reset the switches and/or jumpers.

Eight rocker switches, numbered 1 – 8, are located together in a block on the adapter.

Each switch can be set with a ballpoint pen or similar object. If a pen is used, make sure it does not leak. Use the pen to depress one end of the switch. To set a switch to the on position, depress the end of the switch across from the word on. To set a switch to the off position, depress the end of the switch across from the word off. In the following figure, switch number 4 is set to the off position.

If there is already expansion memory, the starting address of the memory being added must immediately follow the last address of the existing memory.

For example, a computer contains 640Kb of memory in its base memory area and 512Kb of expansion memory. Since the expansion memory has a starting address of 1Mb, the next available memory address is 1.5Mb. A 0.5Mb to 6Mb Memory Expansion Adapter added to this computer would require a starting address of 1.5Mb. The switch settings (SW1-SW5) for this starting address can be found in the following figure.

Base Memory Addressing

Switches 6 and 7 determine the starting address of memory that is added to the base memory area. If you have 256Kb or 512Kb of base memory currently installed in your computer, set switches 6 and 7 as shown below.
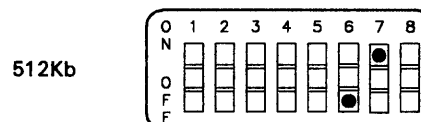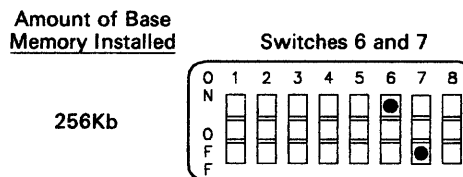
LEX42394

If you have 640Kb of base memory, the switch settings depend on the amount of expansion memory you have installed. If you have no expansion memory or your expansion memory is a multiple of 512Kb, set switches 6 and 7 as shown below.
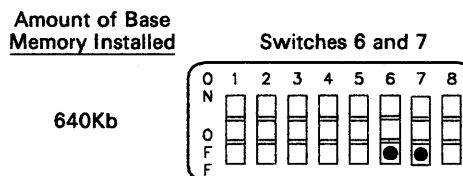
LEX42395

If the amount of expansion memory installed is *not* a multiple of 512Kb, refer to "Configuring Multiple Adapters" in this section.

Switch Definition Summary

The following table summarizes the memory of each of the eight switches:

Switch	Definition
1 – 5	Starting address in the expansion memory area
6 – 7	Starting address in the base memory area
8	I/O ports enable/disable

Configuring Multiple Adapters

Note: It is not necessary to reset the starting address on the adapter when memory modules are added to it. The starting address of memory on the adapter will stay the same. The adapter will automatically adjust for the increase in memory size.

Starting Address	Switches 1-5	Starting Address	Switches 1-5
1Mb (1024Kb)		1.5Mb (1536Kb)	
2Mb (2048Kb)		2.5Mb (2560Kb)	
3Mb (3072Kb)		3.5Mb (3584Kb)	
4Mb (4096Kb)		4.5Mb (4608Kb)	
5Mb (5120Kb)		5.5Mb (5632Kb)	
6Mb (6144Kb)		6.5Mb (6656Kb)	
7Mb (7168Kb)		7.5Mb (7680Kb)	
8Mb (8192Kb)		8.5Mb (8704Kb)	

LEX42396

Starting Address	Switches 1-5	Starting Address	Switches 1-5
9Mb (9216Kb)		9.5Mb (9728Kb)	
10Mb (10240Kb)		10.5Mb (10752Kb)	
11Mb (11264Kb)		11.5Mb (11776Kb)	
12Mb (12288Kb)		12.5Mb (12800Kb)	
13Mb (13312Kb)		13.5Mb (13824Kb)	
14Mb (14336Kb)		14.5Mb (14848Kb)	
15Mb (15360Kb)		15.5Mb (15872Kb)	

LEX42397

17-50

High Speed Adapter, P/N6456750

Jumper Pin Location
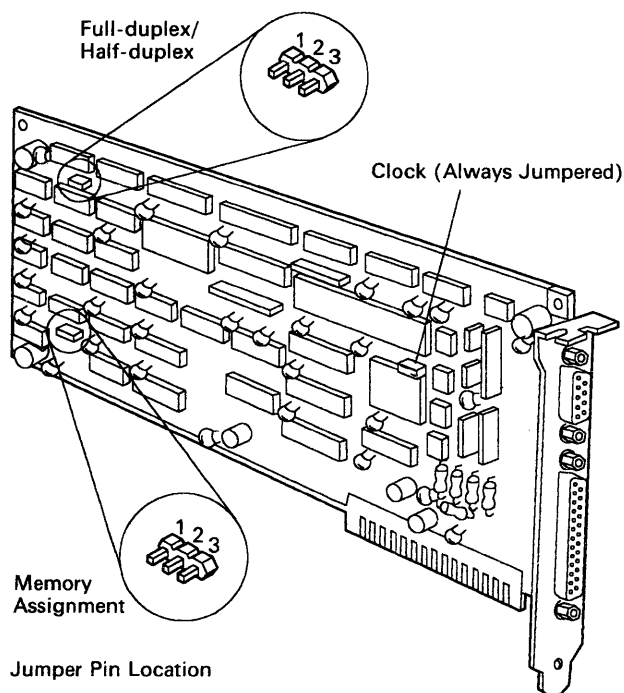
LEX42519

Figure 17-109. High Speed Adapter

The High Speed Adapter provides for the attachment of the 3117 Scanner with an extension unit or the 3118 Scanner to supported systems. This adapter requires a full-size expansion slot in the system unit. The adapter is fully programmable and supports asynchronous and synchronous communication protocols with a data rate of up to 1M BPS. The adapter contains a Serial Communication Controller, a Data Buffer, a Direct Data Transfer control logic, and RS422A driver and receiver. The adapter is designed to the EIA RS-422-A electrical interface and provides one 25-pin D-shell, male type connector. Only one adapter can be installed in a system unit.

Memory Assignment

The following pins show the jumpers for the selection of the memory address for the High Speed Adapter.

Primary Address (D8000 - D87FF)

No Jumper		X X
o o o	or	o o o
1 2 3		1 2 3

Secondary Address (DE000 - DE7FF)

X X
o o o
1 2 3

The High Speed Adapter is shipped with the jumper in the primary position. If your IBM Personal Computer already has a device that uses the primary address space, place the jumper in the secondary position on the adapter.

Clock

Always jumpered.

Full-Duplex or Half-Duplex

The following pins show the jumpers for the selection of the Channel-B communication method for the High Speed Adapter.

Full-Duplex

No Jumper		X X
o o o	or	o o o
1 2 3		1 2 3

Half-Duplex

X X
o o o
1 2 3

IBM PC Network Adapter II, P/N72X8105
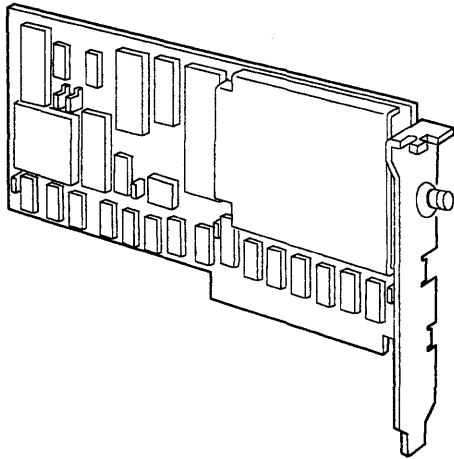
LEX42357

Figure 17-110. Adapter II

IBM PC Network Adapter II is a feature card that includes a modular broadband modem for connecting IBM Personal Computers to the IBM PC Network. It is compatible with the form factor and bus design of the original PC, yet takes advantage of greater Intel 80286 and 8086 processing speeds.

The card features a 2Mb/ps transmission speed with a CSMA/CD access protocol and supports both the previously available PC Network protocol.

IBM PC Network Baseband Adapter, P/N72X8101
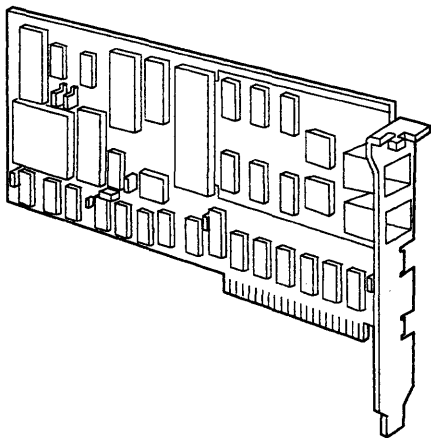
LEX42358

Figure 17-111. Baseband Adapter

The IBM PC Network Baseband Adapter is a feature card that includes a modular baseband transceiver for connecting IBM Personal Computers to the Baseband IBM PC Network. It is compatible with the form factor and bus design of the original PC, yet takes advantage of greater Intel 80286 and 8086 processing speeds. It is designed specifically for IBM Personal System/2 Model 030 (8530).

Optical Disk Adapter, P/N63X4157
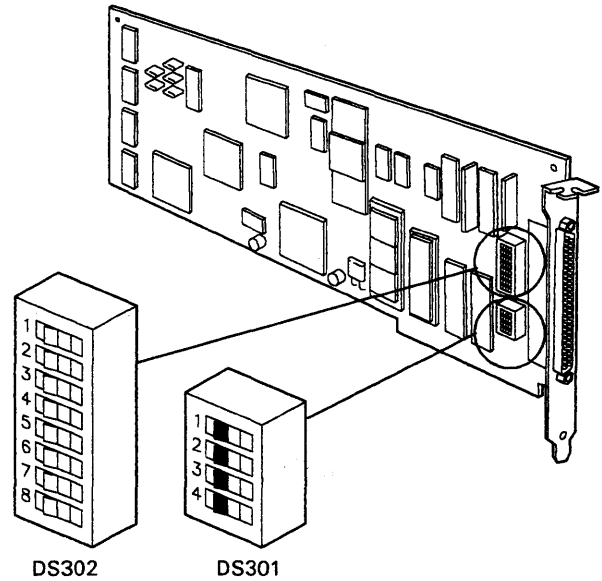
LEX42437

Figure 17-112. Optical Disk Adapter

Note: Refer to the *3363 GTO* or the *3663 HMS* manuals for the DS301 and DS302 switch settings.

The Optical Disk Adapter card supports IBM 3363 drive units only. The IBM 3363 Adapter card presents a high level command interface to software I/O drivers. Representative commands are READ, WRITE, SEEK, and SENSE.

The adapter card controls seek verification and fine seek adjustments. In addition, it allows sector demarking and detects and reports demarked sectors on a read operation.

The adapter card is buffered on the I/O bus and uses the system board direct memory access (DMA) or programmed I/O for data transfers. An interrupt level is also used to indicate operation complete and status conditions requiring system unit attention.

The system interface, controller, data buffer, error correction code (ECC), run length code (RLC) encoding

and decoding, and serializer/deserializer (SERDES) are all functions of the adapter card.

4250/PC Print Adapter Card, FRU P/N6193068
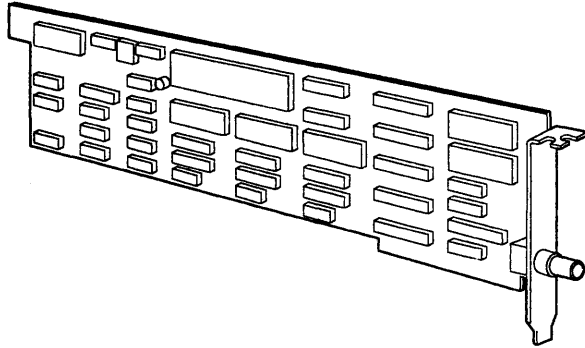
LEX42356

Figure 17-113. Print Adapter Card

The 4250/PC Print Adapter card will emulate the function of an IBM 3274D Cluster Controller in driving the 4250 Printer or the 4250/II ElectroCompositor.

The combination of the PC and the 4250 creates a stand-alone work station for high-quality printing or direct negative production.

This option requires one full-size expansion slot in the system unit and a communication (coaxial) cable.

3117 Scanner Adapter
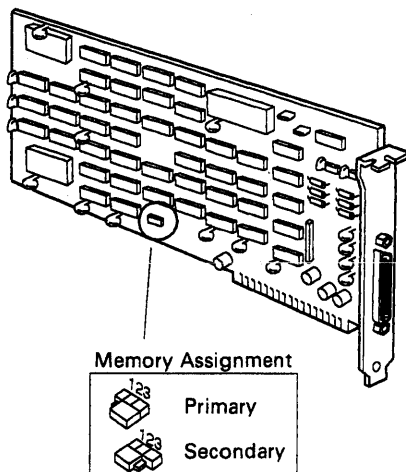
LEX42520

Figure 17-114. 3117 Scanner Adapter

The following pins show the jumpers for the selection of the memory address for the 3117 Scanner Adapter.

Primary Address (DE000 - DFFFF)

```
X X
o o o
1 2 3
```
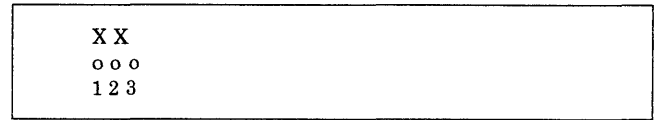
Secondary Address (D8000 - D9FFF)

```
X X
o o o
1 2 3
```

The 3117 Adapter is shipped with the jumper in the primary position. If your IBM Personal Computer already has a device that uses the primary address space, place the jumper in the secondary position on the adapter.

The 3117 Adapter allows connection of the 3117 Scanner to the supporting system. This adapter is installed into the full-size expansion slot of the system unit. The adapter provides a connector for attachment of the 3117 Personal Computer Cable. The adapter converts analog output from the 3117 Scanner device into digital image by the video circuit built in this adapter.

S/370 Channel Emulator, P/N70X5061
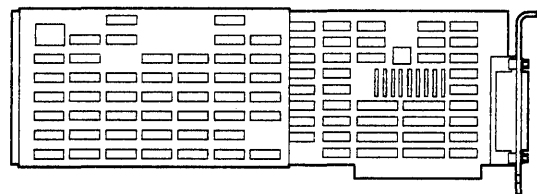
LEX42435

Figure 17-115. S/370 Channel Emulator

The S/370 Channel Emulator is an adapter card for the IBM 5170 PC AT System Unit, which emulates the operation of an IBM System/370 channel. The S/370 Channel Emulator feature consists of a piggyback card that occupies one full-size PC AT expansion slot and provides a 62-pin D-shell connector to an interface cable. The interface cable is 10 feet long and fitted with 370 bus and tag serpentine channel connectors for connection to supported 370 peripherals.

This feature allows attachment of a Channel 3820 Page Printer to a remote MVS host system. The remote host is attached, through a teleprocessing link, to the PC AT, which is attached to the 3820 through the S/370 Channel Emulator card and cable.

Installing the Card and Setting Switches

Before installing the S/370 Channel Emulator card, it must be configured to use available memory space in the Personal Computer. This section describes the step-by-step procedures to configure and install the card.

Locating a Memory Space

The S/370 Channel Emulator card requires a 64Kb memory space in the memory of the Personal Computer. For the card to use this space, you must:

1. Locate a space that is not currently being used.
2. Configure the card to use that space by setting the switches on the card.

The following table lists the five Personal Computer memory spaces that the card can use, together with the switch settings for each space.

Line No.	Address (Bytes)	Address (Hex)	Card Switch 1 2 3	Check One
1	524289	80000	On On On	
2	589825	90000	Off On On	
3	655361	A0000	On Off On	
4	786433	C0000	On On Off	
5	851969	D0000	Off On Off	

The following procedures help you to locate an available Personal Computer memory space for the card. You must select one of the five spaces listed in the table.

If your system has options or I/O adapters installed, they might be using one of the five memory spaces. See the appendix for a list of IBM Personal Computer products and the memory addresses they use. For additional information on Personal Computer memory spaces and addresses, see the *S/370 Channel Emulator Technical Reference*.

1. When the DOS prompt (C >) is displayed, type **chkdsk.**

   The DOS CHKDSK command displays disk drive information, followed by two lines of information about main memory. For example:

```
1.

xxxxxx bytes total disk space
xxxxxx bytes in xx user files
xxxxxx bytes available on disk

524288 BYTES TOTAL MEMORY
xxxxxx bytes free
```

2. **Is the number of bytes of total memory *less than* 524289?**

   YES The memory address on *line 1* can be used for the card.

   a. Make a check mark on *line 1* in the table in "Locating a Memory Space." *You will need to refer to the table later for information on this line.*

   b. Continue with "Removing the Cover of the System Unit."

   NO Continue with the next step.

3. **Is the number of bytes of total memory *less than* 589825?**

   YES The memory address on *line 2* can be used for the card.

   a. Make a check mark on *line 2* in the table in "Locating a Memory Space." *You will need to refer to the table later for information on this line.*

   b. Continue with "Removing the Cover of the System Unit."

   NO Continue with the next step.

4. **Does your Personal Computer have installed an Enhanced Graphics Adapter (EGA)?**

   YES You cannot use the address on *line 3* for the card. Continue with Step 5.

   NO The address on *line 3* can be used for the card.

   a. Make a check mark on *line 3* in the table in "Locating a Memory Space." *You will need to refer to the table later for information on this line.*

   b. Continue with "Removing the Cover of the System Unit."

   Note: You can use the Systems Diagnostics that came with the *IBM Personal Computer Guide to Operations* manual to determine which display features are installed in your machine.

5. If you have still not found an available space, refer to the manual for the I/O adapters that are installed in your system, or the list of some adapter cards and the memory spaces they use.

6. Using the manual, see if the memory address on *line 4* or the memory address on *line 5* is used by any of the other adapter cards in your system.

7. If the memory address is not used, select the appropriate line from the table. Then,

   a. Make a check mark on this line in the table in "Locating a Memory Space" on page 17-54. *You will need to refer to the table later for information on the line you selected.*

   b. Continue with "Removing the Cover of the System Unit."

8. If all five memory addresses are being used, you must decide which option or feature to remove so that the card can be installed. If you need help in deciding which option can be safely removed, see your local IBM representative.

Setting the Card Switches

You are now ready to configure the card by setting three switches on the card.

1. Lay the card on a flat surface and locate the switch block.
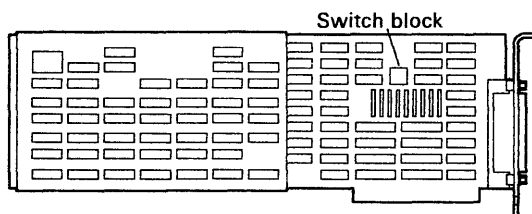
LEX42649

Figure 17-116. Switch Settings

The switches are labeled 1, 2, and 3. Each switch is set either on or off.
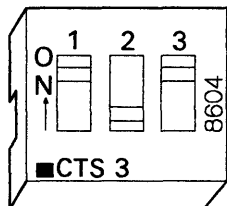
LEX42521

2. Refer to the table "Locating a Memory Space" on page 17-54 for the switch settings you must use. These settings are the ones for the memory space you selected.

Memory Map

The following list shows all 64Kb boundaries above 512Kb (x'80000') with the corresponding S/370 Channel Emulator switch settings. It also includes some of the IBM Personal Computer products that use those addresses.

If you are not sure where an available 64Kb addressable space is located in your Personal Computer, see the *IBM Personal Computer Technical Reference* manual or consult your IBM representative.

Additionally, the Token-Ring Network Adapter has switch-selectable memory that can be mapped into the following ranges:

Address	Origin	Switches 1 2 3	Personal Computer Product
80000	524289	On On On	System Board Memory Memory Expansion Card
90000	589825	Off On On	System Board Memory Memory Expansion Card
A0000	655361	On Off On	Enhanced Graphics Adapter Professional Graphics Adapter
B0000	720897	Off Off On	Enhanced Graphics Adapter Professional Graphics Adapter Monochrome Display Adapter Color Graphics Adapter
C0000	786433	On On Off	Enhanced Graphics Adapter Professional Graphics Adapter 3270 Personal Computer Adapter PC Network Adapter (primary) 3278/3279 Emulator Adapter
D0000	851969	Off On Off	PC Cluster PC Network Adapter (alternate) 5250 Emulator Adapter
E0000	917505	On Off Off	System Board ROM
F0000	983041	Off Off Off	System Board ROM

Setting the S/370 Channel Emulator Card's Memory

Switches 1 through 3 on the switch block represent address bits 16 through 18, respectively, of a 20-bit address (numbered as bits 0 through 19); the switch block is used for decoding the address of the S/370 Channel Emulator card.

When setting the switch positions, off is a logical 1 (one) and on is a logical zero (0).

Chapter 18. Personal Computer Parts Catalog

Assembly 1: 4860 PCjr System Unit

LEX40291

LEX40292

Asm – Index	Part Number	Units	Description
1 –		1	4860 PCjr System Unit
– 1	8286006	1	• System Unit Top Cover
– 2	8285995	1	• Diskette Drive Face Plate
– 3	8286007	1	• System Unit Base
– 4	8286004	1	• Keyboard
– 4	6135725	1	• Enhanced Keyboard
– 5	8285983	1	• Keyboard Cord
– 6	8285987	1	• Parallel Printer Attachment
– 6	6323471	1	• Cluster Attachment
– 6	6135678	1	• Speech Attachment
– 6	6135679	1	• 128Kb Memory Expansion Attachment
– 6	6135680	1	• Power Expansion Attachment
– 7	8285994	1	• Right Side Cover
– 8	8286010	1	• System Unit Footpad (Pack of 56)

Assembly 2: 4860 PCjr System Unit, Internal
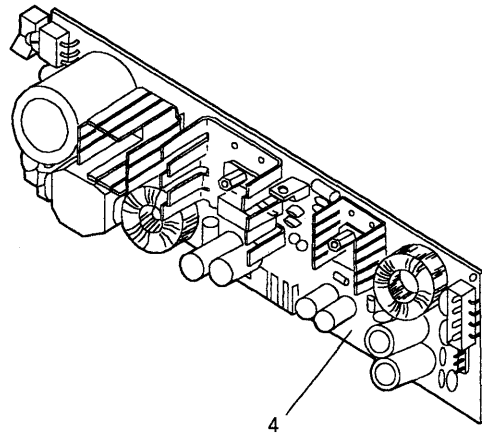
LEX40293
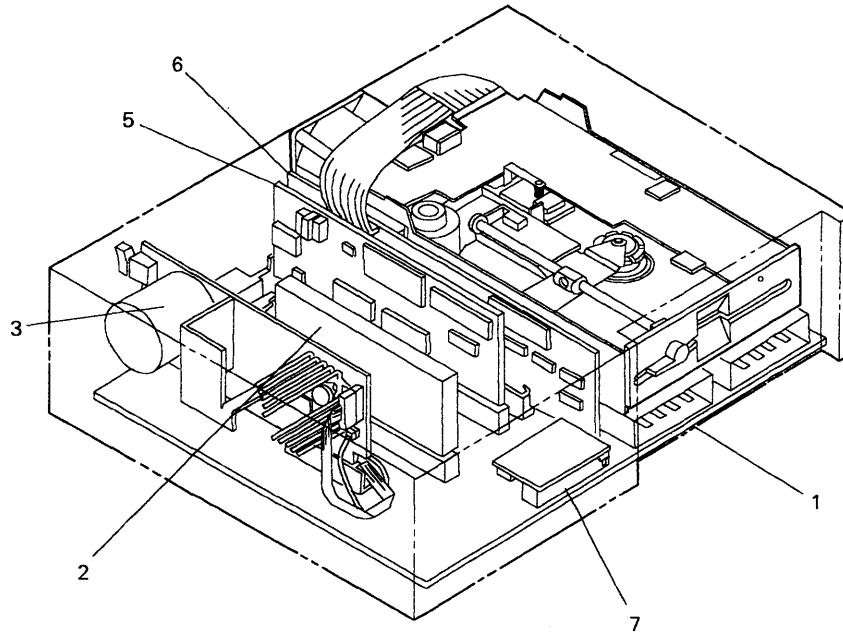
LEX40296

Asm—Index	Part Number	Units	Description
2—		1	4860 PCjr System Unit, Internal
—1	8654225	1	• System Board
—2	8654227	1	• 64Kb Memory and Display Expansion
—3	8654399	1	• Power Board 1 (Obsolete, use 6135986)
—4	6135986	1	• Power Board 2
—5	8654400	1	• Internal Modem
—6	8654228	1	• Diskette Drive Adapter
—7	8654226	1	• Infrared Receiver

Assembly 3: 4860 PCjr System Unit Options
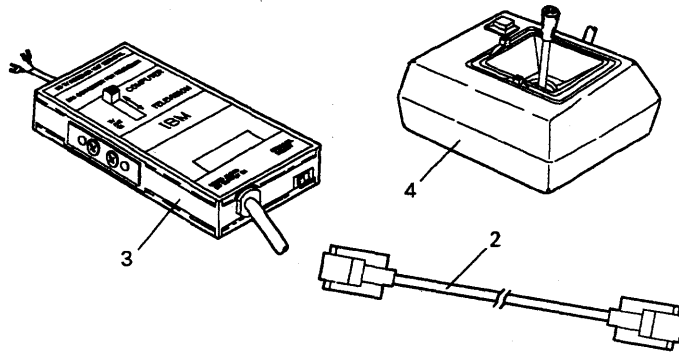
LEX40293
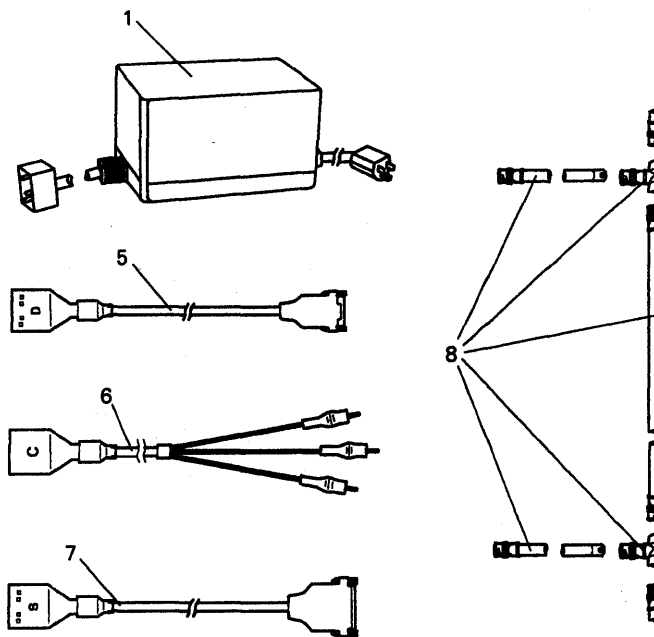
LEX40294

Asm–Index	Part Number	Units	Description
3–		1	4860 PCjr System Unit Options
–1	8286003	1	• Power Transformer
–2	8285985	1	• Modem Cable
–3	8285989	1	• Connector for Television
–4	8286002	1	• Attachable Joystick
–5	8285991	1	• Color Display Adapter Cable
–6	8285992	1	• Cassette Adapter Cable
–7	8285993	1	• Serial Devices Adapter Cable
–8	6323575	1	• Cluster Cable Kit
–	6447196	1	• • Service Plug
–	6447197	1	• • Post-Loop Plug
–	6447198	1	• • Serial Wrap Plug
–	8529228	1	• • Parallel Printer Attachment Wrap Plug
–	6320352	1	• • Cluster Attachment Terminating Plug

Assembly 4: 4860 PCjr Diskette Drive
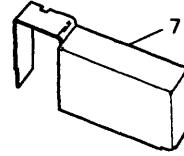
LEX40297
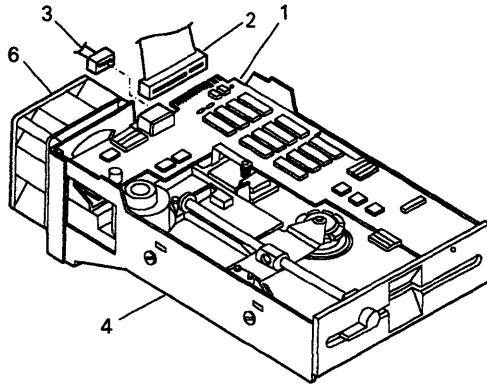
LEX40298
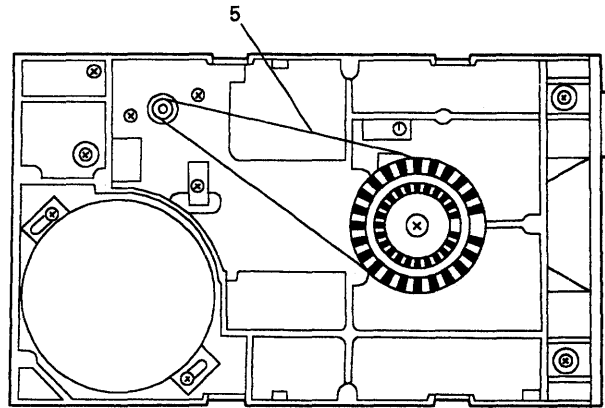
LEX40299

Asm – Index	Part Number	Units	Description
4 –		1	4860 PCjr Diskette Drive
– 1	8285997	1	• Diskette Drive
– 2	8285986	1	• Diskette Drive Signal Cable
– 3	8285984	1	• Diskette Drive Power Cable
– 4	8286005	1	• Diskette Drive Mounting Bracket
– 5	8285998	1	• Diskette Drive Drive Belt (Qume Drive)
– 5	6280537	1	• Diskette Drive Drive Belt (Alps Drive)
– 6	8285982	1	• Diskette Drive Fan Assembly
– 7	6135989	1	• Fan Plenum
–	8285988	1	• Keyboard Battery Cover
–	8654400	1	• Internal Modem (300 bps)
–	6447163	1	• J1/J2 Connector Guides
–	6448835	1	• CPU Hardware Kit
–	6448836	1	• Keyboard Hardware Kit
–	6448933	1	• Disk Drive Spacer

Assembly 5: 4865 3.5-Inch External Diskette Drive (5150, 5155, and 5160)
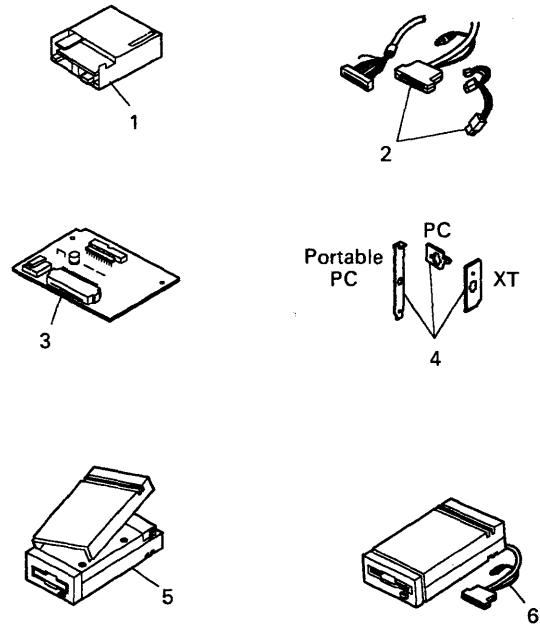
LEX41867

Asm – Index	Part Number	Units	Description
5 –			3.5-Inch Diskette Drive
– 1	6820821		• Diskette Drive
– 2	2683196		• Cable Group - PC, XT, Portable PC
–			• • Signal/Power Cable
–			• • Power-Split Cable
– 3	2683195		• Converter Card - CMOS/TTL
– 4	2683194		• Hardware Group
–			• • Plate - PC
–			• • Plate - XT
–			• • Plate - Portable PC
–			• • Screw - Bottom Shield
–			• • Screw - Card and Top Shield
–			• • Screw - Drive
–			• • Lockwasher
– 5	2683192		• Cover Group - PC, XT, Portable PC
–			• • Top Cover
–			• • Bezel/Bottom Cover
–			• • Top Shield/Foil
–			• • Bottom Shield
–			• • Lens
–			• • Logo
–			• • Label - Mfg.
– 6	2683199		• Element Exchange - PC, XT, Portable PC
–			• • Diskette Drive
–			• • Signal/Power Cable
–			• • Converter Card
–			• • Cover Group

Assembly 6: 4865 3.5-Inch External Diskette Drive (5162 and 5170)
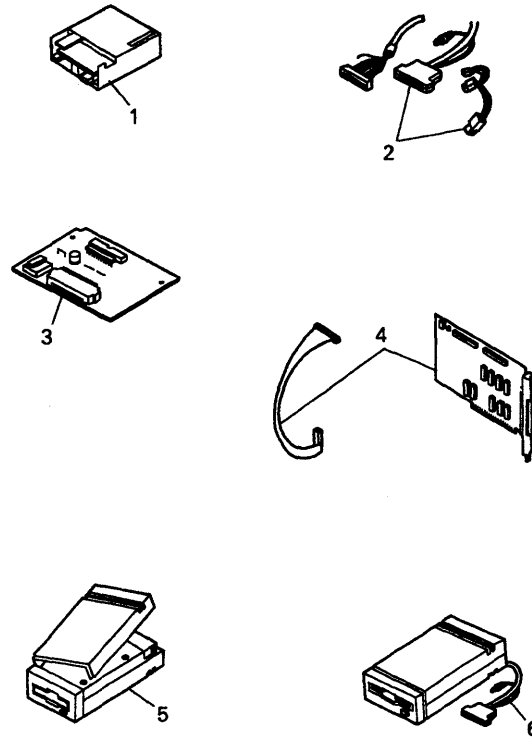
LEX41868

Asm – Index	Part Number	Units	Description
6 –			3.5-Inch Diskette Drive
– 1			• Diskette Drive
– 2	2683197		• Cable Group - AT
–			• • Signal/Power Cable
–			• • Power-Split Cable
– 3	2683195		• Converter Card - CMOS/TTL
– 4	2683198		• Adapter Group
–			• • External Diskette Drive Adapter
–			• • Internal Flat Cable
– 5	2683193		• Cover Group - AT
–			• • Top Cover
–			• • Bezel/Bottom Cover
–			• • Top Shield/Foil
–			• • Bottom Shield
–			• • Lens
–			• • Logo
–			• • Label - Mfg.
– 6	2683200		• Element Exchange - AT
–			• • Diskette Drive
–			• • Signal/Power Cable
–			• • Converter Card
–			• • Cover Group

5140 PC Convertible

Part No.	Part Name
2682760	Bracket, Left Rail Handle
2682761	Bracket, Right Rail Handle
2682762	Handle
2682765	Spring - Latch
2682766	Button - Latch
2682774	Button - On/Off
2682780	Bracket - Printer Attachment
2682901	PC Board Edge Connector
2684106	Logo - IBM
2684265	Roller - Diskette Assembly
2684266	Slide - LH
2684268	Slide - RH
2684277	Cover Assembly Rear
2684279	Cover Assembly Battery
2684281	Screw - Diskette Mounting
2684282	Screw - Back Cover
2684332	Battery Holder
2684333	Modem Hole Cover
2684335	Carriage - Diskette Cover
2684339	Pin - Diskette/LCD Hinge
2684340	Pin - Cam Follower
59X0196	Speaker Assembly
59X0233	LCD/Bezel Assembly
59X0266	Cap, LCD Connector
60X5435	Dealer Starter Kit
60X5478	Cable, Diskette Drive
60X5479	Cable, Serial Printer
60X5486	Yoke Assembly
81X8538	Cover - LCD
60X5537	Base Cover
60X5538	Insulator, Base Planar
60X5548	Glare Shield, Monochrome Monitor
6404095	3.5-inch Blank Diskette
6487125	Paper Holder
6487126	Screw, Planar Mounting
6487135	Cover Assembly, Diskette Drive
6820782	Foot - Base Unit
6820786	Acoustic Adapter
6820787	Async/Parallel Adapter
6820788	Automobile Power Adapter
6820790	Battery Pack
6820793	CRT Adapter
6820794	220 Volt Battery Charger
6820795	Planar
6820796	Portable Printer
6820797	128K Memory Card
6820798	Battery Charger
6820815	Keyboard - U.K.
6820816	Keyboard - France
6820817	Keyboard - Germany
6820818	Keyboard - Spain
6820819	Keyboard - Italy
6820821	Diskette Drive
6820822	AC Power Adapter (Universal)
6820824	240 Volt Battery Charger
6952301	Power Cable, AC Adapter (U.S.A.)
6952320	Power Cable, AC Adapter (France, Germany, Spain)
6952356	Power Cable, AC Adapter (U.K.)
6952374	Power Cable, AC Adapter (Italy)
7396929	Keyboard - U.S.A.
7396941	Power Supply
8285985	Cable, Television Extension
8285989	Cable, CRT/TV
8285991	Cable CRT/Color Monitor
8529228	Wrap Plug - RS232
8529280	Wrap Plug - Parallel
8529214	Cable - Parallel
8529274	Cable - Serial
59X0323	Enhanced LCD
60X5610	256K Memory Card
81X8480	Enhanced Modem
60X5599	Diskette Drive Insert
60X5600	Diskette Drive Insert
60X5627	16.5-watt Power Supply (used with Backlite LCD)
60X5629	Backlite LCD Assembly

18-8

Assembly 7: 5150 PC System Unit

3 (Option Cards)
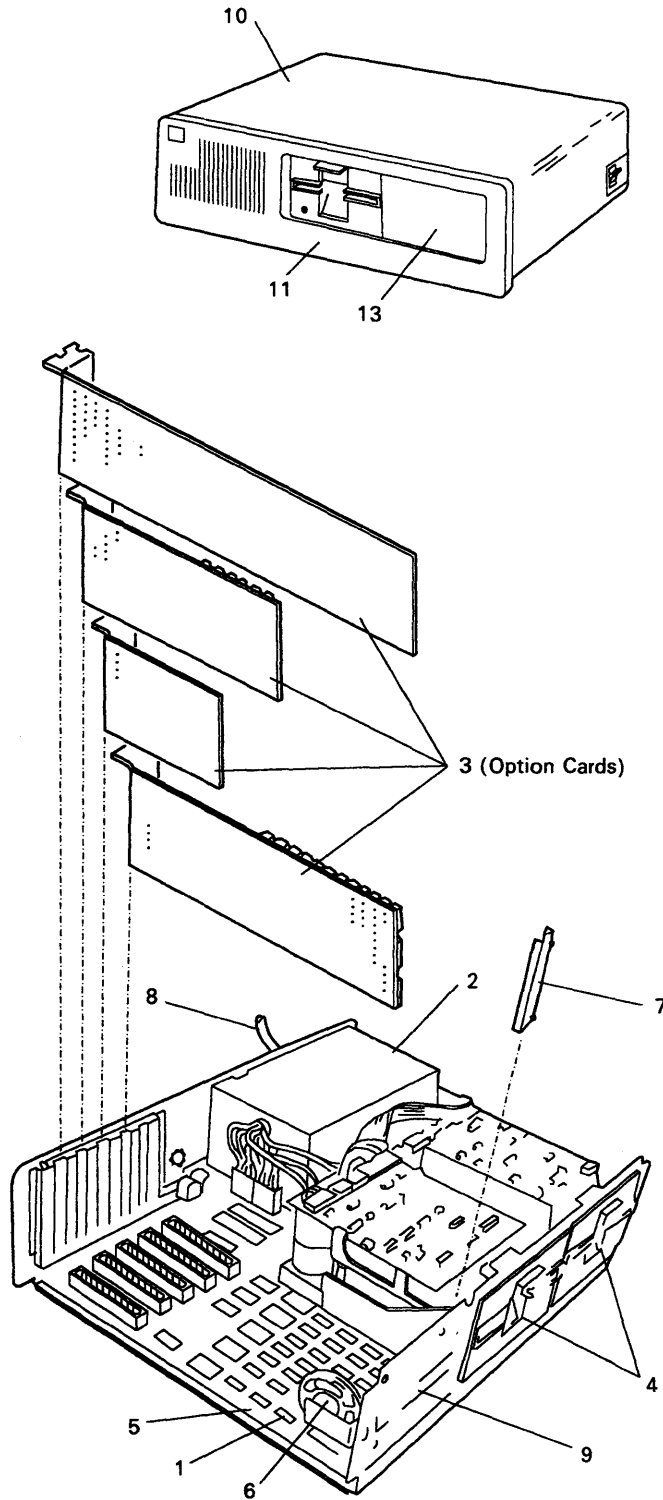
LEX41692

Asm-Index	Part Number	Units	Description
7-		1	5150 System Unit
-1	8529142	1	• 16Kb RAM Module
-1	8529211	1	• 64Kb RAM Module
-2	8529155	1	• Power Supply (63.5-Watt)
-3	8529152	1	• Diskette Drive Adapter
-4	8529153	1	• 160Kb/180Kb Diskette Drive Assembly
-4	8529206	1	• 320Kb/360Kb Diskette Drive Assembly
-5	8529238	1	• 16Kb/64Kb System Board
-5	8654213	1	• 64Kb/256Kb System Board
-6	8529143	1	• Speaker and Cable
-7	8529156	1	• Card Support Bracket
-8	8529158	1	• Power Cord
-9	8529161	1	• Base Assembly
-10	8529162	1	• Top Cover
-11	8529163	1	• Bezel Assembly
-13	8529204	1	• Disk Cover Plate
-	4584656	1	• Keypad (CSA)
-	8529297	1	• Complete Keyboard Assembly
-	8529159	1	• Data/Control Cable (Diskette Drive)
-	8529171	1	• Data/Control Cable (Fixed Disk)
-	8529165	1	• Miscellaneous Parts Kit
-	4584656	1	• Keybutton Group
-	8529157	1	• Adjustable Foot
-	8529168	1	• Keyboard Cable Assembly
-	8529169	1	• Keyboard Base Assembly
-	8529170	1	• Keyboard Cover Assembly
-3			• See "5150/5160 Options and Adapters" on page 18-18.

Assembly 8: 5155 Portable System Unit
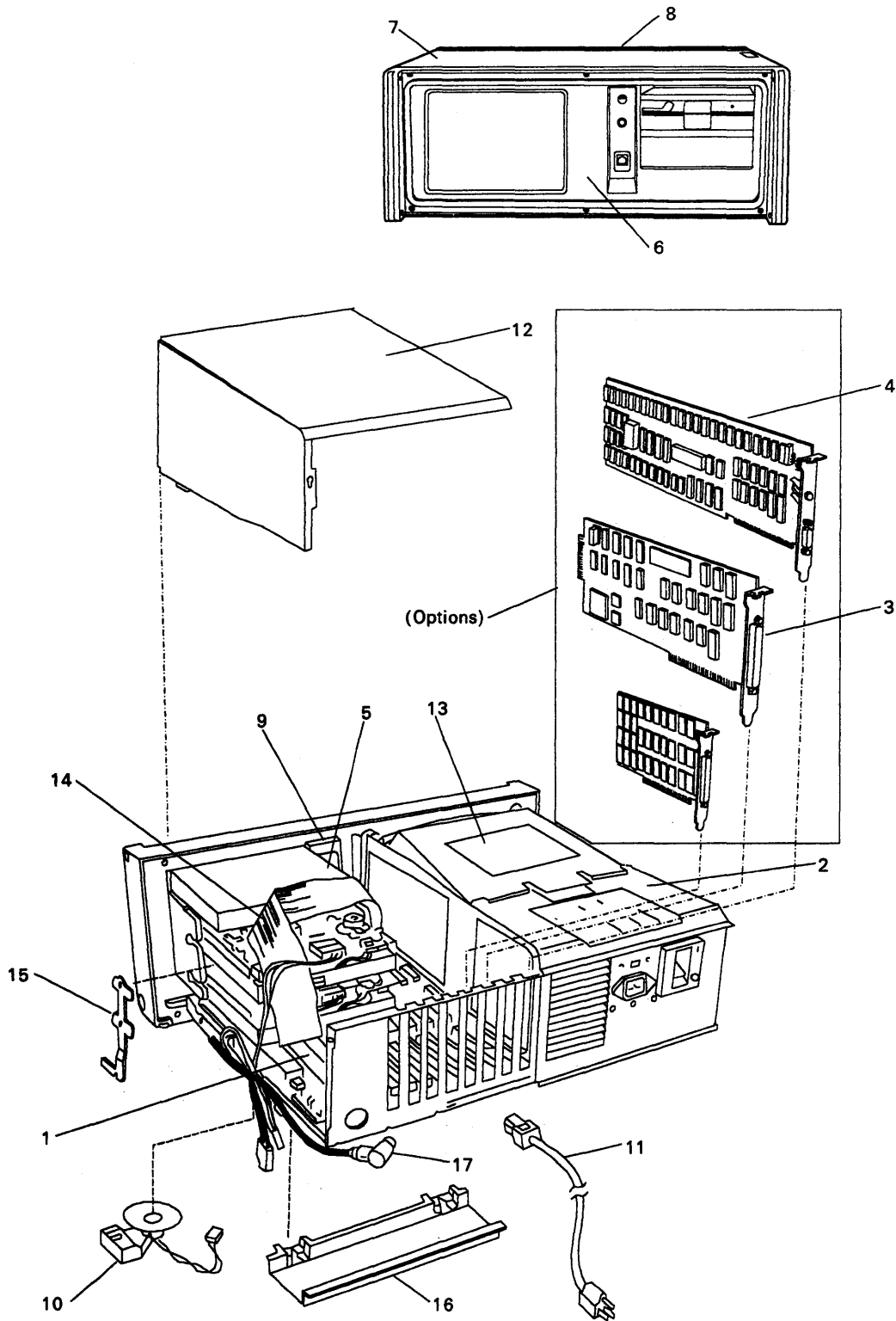
LEX40303

Asm – Index	Part Number	Units	Description
8 –		1	5155 Portable System Unit
– 1	8529254	1	• 64Kb/256Kb System Board
– 2	8654417	1	• Power Supply (114 Watt)
– 3	8529152	1	• Diskette Drive Adapter
– 4	8286097	1	• Color Card
– 5	8285978	1	• 360Kb Diskette Drive Assembly
–	8529211	1	• 64Kb RAM Module
–	4561616	1	• Keypad (CSA)
–	8654422	1	• Complete Keyboard Assembly
– 6	8654413	1	• Panel Assembly
– 7	8654414	1	• Cover Assembly
– 8	8654449	1	• Cover, Handle Assembly
–	8285972	1	• Terminator, Diskette Drive
–	8285975	1	• High Voltage Transformer, Display
–	8285976	1	• Yoke, Display
– 9	8285977	1	• Brightness/Contrast Assembly
–	8285979	1	• Belt, Diskette Drive
– 10	8529143	1	• Speaker and Cable
–	8529156	1	• Card Support Bracket
– 11	8529158	1	• Power Cord
– 12	8654415	1	• Shield
– 13	8654419	1	• Display Assembly
– 14	8654420	1	• Signal Cable, Diskette Drive
– 15	8654421	1	• Ground Bracket, Diskette Drive
–	8654438	1	• Front Panel Hardware Kit
–	8654439	1	• Cover and Handle Hardware Kit
–	8654440	1	• Panel Assembly Hardware Kit
–	8654441	1	• Display Hardware Kit
–	8654442	1	• System Hardware Kit
–	8654443	1	• Keyboard Hardware Kit
–	8654444	1	• Fan, 114 Watt Power Supply
–	8654445	1	• Label Kit
–	8654447	1	• Cover
–	8654451	1	• Shield, Keyboard (Internal System)
– 16	8654452	1	• Cable Raceway
–	4584657	1	• Keybutton Group
–	8654424	1	• Bottom Cover, Keyboard
–	8654425	1	• Top Cover, Keyboard
–	8654426	1	• Cable Assembly, Keyboard
– 17	8654427	1	• Cable, Keyboard (Internal)

Assembly 9: 5160 PC XT System Unit
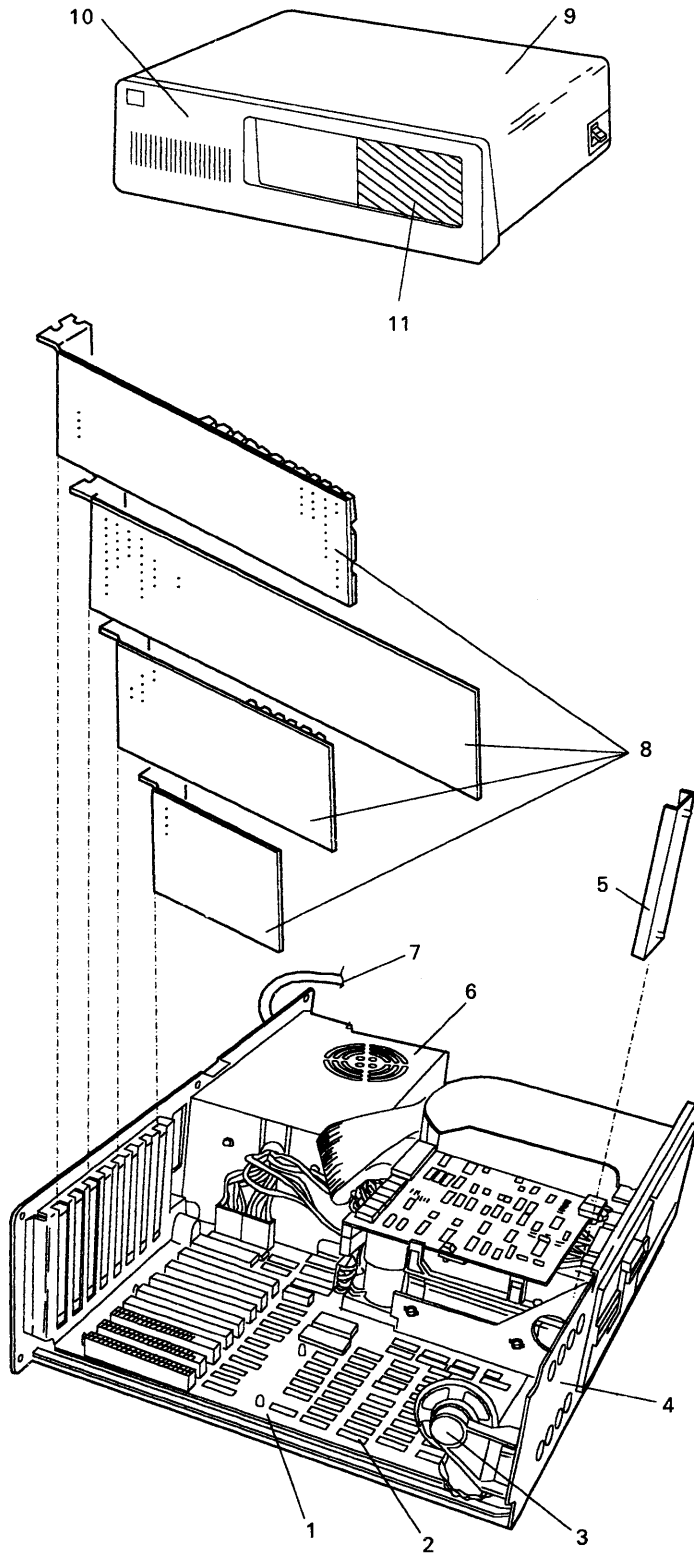
LEX41728

Asm– Index	Part Number	Units	Description
9–		1	5160 PC XT System Unit
–1	8529254		• System Board 64Kb – 256Kb (Populated to 128Kb)
–2	8529211		• 64Kb Memory Module
–1	83X1520		• System Board 256Kb – 640Kb
–2	6480008		• 256Kb Memory Module
–2	8529211		• 64Kb Memory Module
–3	8529143		• Speaker and Cable
–4	8529248		• Base Assembly (Frame)
–5	8529156		• Card Support Bracket
–6	8529247		• Power Supply, 120 Volt
–6	8654269		• Power Supply, 220/240 Volt
–7			• Power Cord (See Power Cord Parts List.)
–8			• See Internal Options and Adapters.
–NS	8529165		• Miscellaneous Parts Kit
–			• • Screw, System Cover (Qty 5)
–			• • Clip, Bezel (Qty 5)
–,			• • Clip, Blank Bezel (Qty 2)
–			• • Spring, Keyboard Foot (Qty 2)
–			• • Foot Pad, Keyboard (Qty 10)
–			• • Foot Pad, System Unit (Qty 5)
–			• • System Board Support (Qty 1)
–			• • Screw, Flange (Qty 10)
–	8285980		• Cover Assembly (5160)
–9	8529162		• Top Cover (No Bezel)
–10	8585163		• Bezel Assembly (5160)
–	68X3916		• • Front Logo
–	68X3917		• • Rear Logo
–	8529204		• • FCC Label
–11	8529204		• Disk Cover Plate
–NS	8529206		• 320Kb/360Kb Diskette Drive Assembly
–NS			• Power Cord (See Power Cord Parts List.)
–NS	6937077		• Shipping Carton, System Unit
–NS	6489910		• Diskette Drive Assembly, Double-Sided, Half-High
–NS	8529275		• Fixed Disk Drive, 10Mb
–NS	6489907		• Fixed Disk Drive, 20Mb
–NS	8529297		• Keyboard Assembly, (84-Key)
–NS	1390290		• Keyboard Assembly (w/o Cable), (101-Key)

Note: (NS) Denotes Not Shown.

Assembly 10: 5161 Expansion Unit

LEX42527

LEX40307
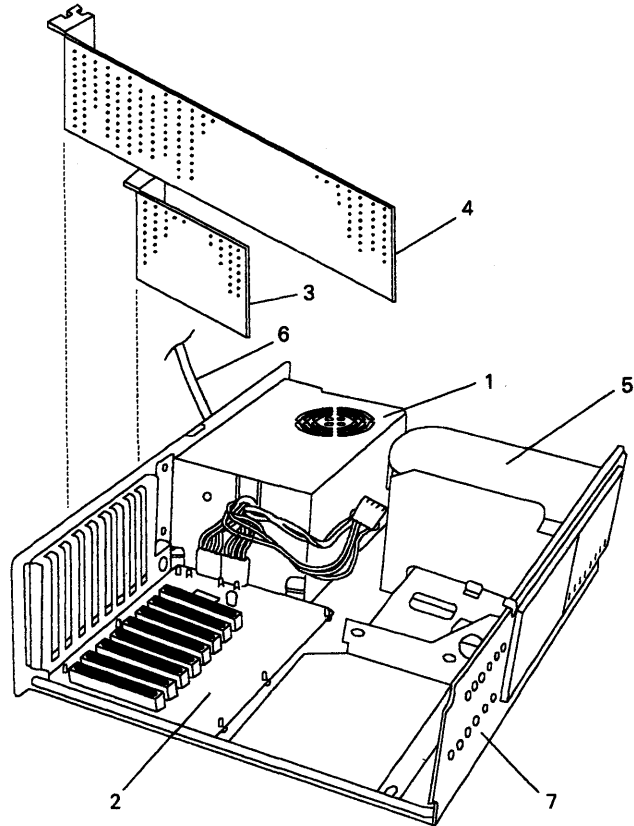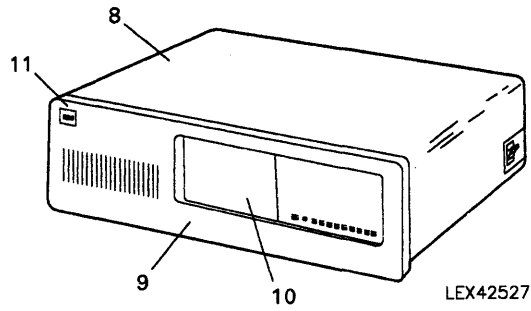
Asm–Index	Part Number	Units	Description
10–		1	5161 Expansion Unit
–1	8529247	1	• Power Supply (130 Watt)
–2	8529250	1	• Expansion Board
–3	8529251	1	• Receiver Card
–4	6489914	1	• Fixed Disk Adapter
–5	8529275	1	• 10Mb Fixed Disk
–6	8529158	1	• Power Cord
–7	8529248	1	• Base Assembly
–8	8529162	1	• Top Cover
–9	8529163	1	• Bezel Assembly
–10	8529204	1	• Disk Cover Plate
–	8529253	1	• Expansion Unit Cable
–	8529271	1	• Data/Control Cable (Fixed Disk Drive)
–11	68X3913	1	• Logo, Front
–	68X3914	1	• Logo, Back

5150/5160 Options and Adapters

Part No.	Part Name
8654401	64Kb/256Kb Memory Expansion Option (Does not include memory modules)
8286096	64/256Kb Memory Expansion (Populated to 64Kb)
8529211	64Kb Memory Module
6134136	256Kb Memory Expansion Option (Includes modules)
6134137	64Kb Memory Module (32-Pin) (Includes Module Puller)
8654378	3278/79 Emulation Adapter
8529150	Asynchronous Communications Adapter
8286098	Binary Synchronous Communications (BSC) Adapter
8529156	Card Support Bracket
6323472	Cluster Adapter
6323575	Cluster Cable Kit
8286097	Color/Graphics Monitor Adapter
8529274	Communications Adapter Cable
6181768	Data Acquisition Adapter
6181769	Data Acquisition Control Panel
8529152	Diskette Drive Adapter
6851206	Display Station Emulation Adapter (DSEA)
6100218	DSEA Cable Assembly
6851167	DSEA T Connector
7362188	DSEA Terminator
6403635	EDSEA Cable (Integrated)
55X3367	Enhanced Display Station Emulation Adapter (EDSEA)
8654215	Enhanced Graphics Adapter (Memory Expansion Card not included)
6323445	Extender Card
6489914	Fixed Disk Drive Adapter, 10Mb/20Mb
6480086	Data Control Cable (fixed disk drive) 20Mb only
8529271	Data Control Cable (fixed disk drive) 10Mb only
6236047	FCS Input Adapter
6236048	FCS Input Connector
6236050	FCS Output Adapter
6236051	FCS Output Adapter Cable
6236053	FCS Security Adapter
8529151	Game Control Adapter
6181770	GPIB Adapter
6323468	Graphics Memory Expansion Card (Memory modules not included)
8654219	Graphics Memory Module (Qty 1)
6937078	Keyboard Shipping Carton
2683189	Keylock Option
8529147	Math Coprocessor and 8088 Processor (Must be installed as a set)
8529148	Monochrome Display and Printer Adapter
6360609	Non-Maskable Interrupt (NMI)
2684462	Notched Black Telephone Cable, for Voice Communications Adapter
2684487	Notched White Telephone Cable, for Voice Communications Adapter
8286171	PC Network Adapter
8286172	PC Network Adapter Cable
6164804	Personal Computer Internal Modem 1200
6428171	Personal Telephone Manager Logic Card (PTM)
6428178	PTM Attachment Cable
8529149	Printer Adapter
8529214	Printer Cable
62X0912	Professional Graphics Controller
6181772	Professional Graphics Memory Module (Qty 1)
8529213	Prototype Card
6118772	RAM Module
8529251	Receiver Card (Expansion Unit)
6299634	Series/1 Channel Attachment Card
6927077	System Unit (CPU) Shipping Carton
8286099	Synchronous Data Link Control (SDLC) Communications Adapter
2684509	Tabbed Black Telephone Cable, for Voice Communications Adapter
2684514	Tabbed White Telephone Cable, for Voice Communications Adapter
69X7856	Token-Ring Network Adapter
2684438	Voice Communications Adapter
72X8105	PC Network Adapter II
72X8101	PC Network Baseband Adapter
6164828	2400 BPS Internal Modem
67X0395	Token-Ring Adapter II
2683119	3295 Display Adapter
6456750	High Speed Adapter
81X8620	Music Adapter
81X8624	Music Midi Adapter
85X2706	ARTIC
6456806	3117 Scanner Adapter
63X4157	Optical Disk Adapter
6323484	Compact Printer Adapter

5160 PC XT Diskette Drive Parts

Diskette Drive (Type 1)

Part No.	Part Name
8529153	Diskette Drive Assembly – 160Kb
8529206	Diskette Drive Assembly – 320Kb
8529154	Diskette Drive Belt
8529225	Write Protect Switch
8529260	Latch
8529261	R.H. Guide
8529262	L.H. Guide
8529293	Front Panel
8529294	Miscellaneous Parts

Diskette Drive (Type 2)

Part No.	Part Name
8529206	Diskette Drive Assembly
8654252	Latch
8654244	L.H. Guide
8654245	R.H. Guide
8654250	Write Protect Switch
8654251	Diskette Drive Belt
8654254	Front Panel

Diskette Drive (Type 3)

Part No.	Part Name
8529206	Diskette Drive Assembly
1696637	R.H. Guide
1696624	L.H. Guide
1696625	Diskette Drive Belt
1696621	Latch
1696627	Miscellaneous Parts

3.5-Inch Diskette Drive

Part No.	Part Name
6820821	Diskette Drive Assembly
6480081	Bezel Assembly
6489919	Cable Adapter Card
6489918	Terminating Resistor
6489911	Tray

XT/370 Parts

Part No.	Part Name
8654373	PC/3277EM Card
8654371	PC/370-M Card
8654372	PC/370-P Card
8654374	PC/370-P-M Cable
8654378	3278/79 Emulation Adapter

PC Network Parts

PC Network

Part No.	Part Name
8286171	Network Adapter
8286172	Adapter Cable
8286173	Translator Unit
8286174	Translator Unit Connection Hardware
8286175	Spare Parts Kit (Tool and Label)
8286176	Translator 120V AC Transformer
8286178	Base Expander
8286179	Short-Distance Kit
8286180	Medium-Distance Kit
8286181	Long-Distance Kit
8286182	Cable, 7.82 m (25 ft)
8286183	Cable, 15.24 m (50 ft)
8286184	Cable, 30.48 m (100 ft)
8286185	Cable, 60.96 m (200 ft)
8286177	Translator, 220V AC Transformer

PC Network Baseband

Part No.	Part Name
72X8100	PC Network Baseband Extender
72X8101	PC Network Baseband Adapter
72X8102	PC Network Baseband Adapter/A
72X8103	Spare Parts Kit (Wrap and Terminator Plugs)
72X8104	PC Network Baseband Adapter Cable, 7.82m (25 ft)
72X8107	IBM Cabling System PC Network Baseband Cable

Assembly 11: 5162 PC XT 286 System Unit

LEX42524

LEX42523

Asm-Index	Part Number	Units	Description
11-		1	5162 PC XT 286 System Unit, Interior
-1	62X1025	1	• System Board
-2	62X1035	1	• 256Kb Memory Module Package
-3	62X1026	1	• 64Kb × 4 Memory Module
-NS	6480008	1	• • Parity Module, System Board
-4	62X1030	1	• Battery Holder
-NS	72X8498	1	• • Battery
-5	62X1034	1	• Power Supply
-6	8529143	1	• Speaker Assembly
-7	62X1123	R	• Base Frame Assembly
-NS	62X1128	AR	• Plastic Parts Kit
-			• • Card Support Bracket (6)
-			• • Planar Board Support (5)
-			• • Screw, Shield Drives
-			• • Foot Pad, CPU (4)
-			• • Tape, Air Dam
-NS	62X1129	AR	• Miscellaneous Screw Kit
-			• • Screw, Flat Head, 100 degree (7)
-			• • Screw, Hex Head 3 mm × .5 inch (5)
-			• • Screw, Hex Head 8/32 × .5 inch (5)
-			• • Screw, 4 mm × 6 mm (4)
-			• • Bolt Flange (15)
-NS	62X1130	AR	• Miscellaneous Metal Parts Kit
-			• • Bracket, Blank
-			• • Mounting Bracket, Diskette Drive
-		1	• 5162 PC XT System Unit, Exterior
-8	8285980	1	• Top Cover (No Bezel)
-9	8529162	1	• Bezel Assembly

5162 PC XT 286 Internal Options and Adapters

Part No.	Part Name
8286127	80287 Math Coprocessor
59X7294	512Kb/2Mb Memory Expansion Adapter
6480008	256Kb RAM Module (Qty 1)
62X0641	256Kb RAM Module Kit (Qty 18)
8286098	Binary Synchronous Communications (BSC) Adapter
8529146	Color/Graphics Monitor Adapter
6181768	Data Acquisition Adapter
8654215	Enhanced Graphics Adapter (w/o Memory Expansion Card)
6323468	Graphics Memory Expansion Card (w/o Memory Modules)
8654219	Graphics Memory Module (Qty 1)
62X1032	Fixed Disk and Diskette Drive Adapter
6181770	GPIB Adapter
8529148	Monochrome Display and Printer Adapter
8586171	PC Network Adapter
8286172	PC Network Adapter Cable
8286147	Serial/Parallel Adapter
8286170	Serial Adapter Cable
8286194	Serial Adapter Connector
8286099	Synchronous Data Link Control (SDLC) Communications Adapter
2684438	Voice Communications Adapter (VCA)
2684462	Notched Black Telephone Cable for VCA
2684487	Notched White Telephone Cable for VCA
2684509	Tabbed Black Telephone Cable for VCA
2684514	Tabbed White Telephone Cable for VCA
6181769	Data Acquisition Control Panel
6851206	Display Station Emulation Adapter (DSEA)
6100218	DSEA Cable Assembly
6851167	DSEA T Connector
7362188	DSEA Terminator
6403635	EDSEA Cable (Integrated)
55X3367	Enhanced Display Station Emulation Adapter (EDSEA)
6323445	Extender Card
6236064	FCS Input Adapter
6236048	FCS Input Connector
6236050	FCS Output Adapter
6236051	FCS Output Adapter Cable
6236053	FCS Security Adapter
8529151	Game Control Adapter
6360609	Non-Maskable Interrupt Card (NMI)
2684462	Notched Black Telephone Cable for VCA
2684487	Notched White Telephone Cable for VCA
6164804	Personal Computer Internal Modem 1200
6428178	Personal Telephone Manager Attachment Cable
6428171	Personal Telephone Manager Logic Card
62X0912	Professional Graphics Controller
6181772	Professional Graphics Memory (Qty 1)
8286138	Prototype Adapter
6453610	Terminal/Host Adapter Card
69X7768	Token-Ring Network Adapter
55X3619	.5Mb – 6Mb Memory Expansion Adapter
62X1035	256Kb Memory Module Package
8286116	128Kb Memory Expansion Adapter
59X7317	64Kb Memory Module (Qty 1)
6279116	128Kb/640Kb Memory Expansion Adapter
59X7317	64Kb Memory Module (Qty 1)
6480008	256Kb RAM Module (Qty 1)
8286115	512Kb Memory Expansion Adapter
8286139	128Kb RAM Module (Qty 1)

Assembly 12: 5162 PC XT 286 System Unit Diskette Drive (5.25-Inch)

LEX42527

Asm–Index	Part Number	Units	Description
12–			5162 PC XT 286 System Unit Diskette Drive
–1	62X1028	1	• Diskette Drive, Half-High 1.2Mb
–NS	8285972	AR	• • Terminating Resistor
–1	62X1036	1	• Diskette Drive, Half-High 360Kb*
–2	62X1033	1	• Signal Cable, Fixed Disk and Diskette Drive
–NS	8285972	AR	• • Terminating Resistor
–3	6489901	AR	• Blank Bezel Assembly
–4	6489904	AR	• Mounting Plate, Left or Right
–5	6489912	AR	• Molding, Bezel
–6	6489905	AR	• Mounting Bracket
–NS	62X1129	AR	• Miscellaneous Screw Kit
–			• • Hex Head Screw 3 mm × 6 mm (Qty 5)
–			• • Flat Head Screw 3 mm × 6 mm (Qty 7)

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* Indicated by an * on the front of the diskette drive

Assembly 15: 5170 AT System Unit, Exterior

LEX41721

Asm – Index	Part Number	Units	Description
15 –		1	5170 AT System Unit, Exterior
–1	8286119	1	• Cover
–2	8286134	1	• Front Bezel
–3	8286114	AR	• Blank Bezel
–4	8286133	1	• Control Panel Assembly
–5	8286117	1	• Keylock Assembly
–NS	8286169	1	• Back Panel

Assembly 16: 5170 AT System Unit, Interior

LEX41866

The following chart is a cross-reference that will assist in identifying the correct replacement system board for the base models of the Personal Computer AT (5170). The base models are 068, 099, 239, 319, and 339.

Serial No. Range	FRU No.	Model	BIOS Part No.
0000001-5999999	8286112	068/099	6181028, 6181029, 1503107, 1503108, 1503109, 1503110, 6180957, 6180958, 6180959, 6180960, 6180124, 6180125, 6180126, 6101027,
6000000-6999999	6480170 6480072	239 239	6480090, 6480091, 6448894, 6448895 6480090, 6480091
7000000-7999999	6489922	319/339	61X9265, 61X9266, 61X0820, 61X0821

Any numbers other than the ones listed here on BIOS modules in a Personal Computer AT are for the Model 239.

The BIOS module sockets are located in positions U17, U27, U37, and U47 on the system board. If the system board has four BIOS module, all sockets will be filled, but if there are only two BIOS modules, they will be located in positions U27 and U47.

Asm − Index	Part Number	Units	Description
16−		1	5170 AT System Unit, Interior
−1	6480170	1	• System Board, Type 1, 256Kb−512Kb (Populated to 256Kb) - Model 239
−2	8286139	AR	• 128Kb RAM Module (Qty 1)
−1	6480072	1	• System Board, Type 2, 512Kb - Model 239
−2	6480008	18	• 256Kb RAM Module (Qty 1)
−1	6489922	1	• System Board, Type 3, 512Kb - Models 319/339
−1	61X6607	1	• • System Board AT Store Controller Models 899/839
−1	61X6605	1	• • System Board AT Store Controller Models 849, 819, and 820
−1	8286112	1	• System Board Models 068 and 099
−2	6480008	18	• 256Kb RAM Module (Qty 1)
−3	8286121	1	• Battery
−4	8286122	1	• Power Supply
−5	8286118	1	• Cable, Control Panel
−6	8529143	1	• Speaker Assembly
−7	6480007	R	• Base Frame Assembly
−NS	8286132	AR	• Miscellaneous Metal Parts Kit
−NS	8286135	AR	• Miscellaneous Plastic Parts Kit
−NS	8286136	AR	• Screw Hardware Kit

5170 AT Internal Options and Adapters

Part No.	Part Name
8286127	80287 Math Coprocessor
8286116	128Kb Memory Expansion Adapter
59X7317	64Kb Memory Module (Qty 1)
6279116	128Kb/640Kb Memory Expansion Adapter
59X7317	64Kb Memory Module (Qty 1)
6480008	256Kb RAM Module (Qty 1)
8286115	512Kb Memory Expansion Adapter
8286139	128Kb RAM Module (Qty 1)
59X7294	512Kb/2Mb Memory Expansion Adapter
6480008	256Kb RAM Module (Qty 1)
62X0641	256Kb RAM Module Kit (Qty 18)
1497250	2Mb Memory Expansion Adapter
55X3619	.5Mb − 6Mb Memory Expansion Adapter
62X1035	256Kb Memory Module
8286098	Binary Synchronous Communications (BSC) Adapter
6323472	Cluster Adapter
6323575	Cluster Cable Kit
8286097	Color/Graphics Monitor Adapter
6181768	Data Acquisition Adapter
8654215	Enhanced Graphics Adapter (w/o memory expansion card)
6323468	Graphics Memory Expansion Card (w/o memory modules)
8654219	Graphics Memory Module (Qty 1)
8286125	Fixed Disk and Diskette Drive Adapter
8529151	Game Control Adapter
6181770	GPIB Adapter
8529148	Monochrome Display and Printer Adapter
8286171	PC Network Adapter
8286172	PC Network Adapter Cable
62X0912	Professional Graphics Controller
6181772	Professional Graphics Memory Module (Qty 1)
6323412	Miscellaneous Hardware Kit
8286138	Prototype Adapter
8286147	Serial/Parallel Adapter
8286170	Serial Adapter Cable
8286194	Serial Adapter Connector
8286099	Synchronous Data Link Control (SDLC) Communications Adapter
2684438	Voice Communications Adapter (VCA)
2684462	Notched Black Telephone Cable for VCA
2684487	Notched White Telephone Cable for VCA
2684509	Tabbed Black Telephone Cable for VCA
2684514	Tabbed White Telephone Cable for VCA
70X5061	S/370 Channel Emulator Card
70X4865	S/370 Channel Emulator Cable
63X4157	Optical Disk Adapter
75X8247	Personal Pageprinter Adapter

Note: For additional options and adapters, refer to "5162 PC XT 286 Internal Options and Adapters" on page 18-22.

Assembly 17: 5170 AT System Unit Keyboard (84-Key)

LEX41724

Asm – Index	Part Number	Units	Description
17 –	8286165		Keyboard Assembly, U.S.A.
– 1	8286142	1	• Cover, Top
– 2	8286146	1	• Cable, External
– 3	8286143	1	• Base
– 4	8286141	1	• Foot, Adjustable
			(The Adjustable Foot Spring is
			included in the Miscellaneous
			Parts Kit for the System Unit.)
– 5	8286145	1	• Cable, Internal
– 6	8286144	1	• LED Card
– 7	8286140	1	• Keypad Assembly, U.S.A.
–	8286153	NS	• Keybutton Kit, U.S.A.

Assembly 18: 5162/5170 AT System Unit Keyboard (101/102 Key)

LEX41725

Asm–Index	Part Number	Units	Description
18–			5162/5170 AT System Unit Keyboard (101/102 Key)
–	6447033		• Keyboard Assembly, U.S.A.
–	6447035		• Keyboard Assembly, France
–	6447036		• Keyboard Assembly, Germany
–	6447037		• Keyboard Assembly, Italy
–	6447038		• Keyboard Assembly, Spain
–	6447034		• Keyboard Assembly, U.K.
–1	6447039	1	• Keypad Assembly, U.S.A.
–1	6447041	R	• Keypad Assembly, France
–1	6447042	R	• Keypad Assembly, Germany
–1	6447043	R	• Keypad Assembly, Italy
–1	6447044	R	• Keypad Assembly, Spain
–1	6447040	R	• Keypad Assembly, U.K.
–NS	6447052	R	• Circuit Board Assembly
–NS	6448803	R	• Cable, Internal
–NS	6447053	R	• LED Assembly
–NS	6447055	R	• Cover Assembly
–NS	6447054	R	• • Foot, Adjustable (Qty 2)
–NS	6447056	AR	• Miscellaneous Parts Kit
–			• • Screws (Qty 5)
–			• • Nut
–			• • Lock Washer
–2	6447051	1	• Cable Assembly, External
–NS	6110464		• Tool, Key Cap Removal
–	6447045	NS	• Keybutton Kit, U.S.A.

3.5-Inch Diskette Drive

Part No.	Part Name
6820821	Diskette Drive Assembly
6480081	Bezel Assembly
6489919	Cable Adapter Card
6489918	Terminating Resistor
6489911	Tray

XT/370 Parts

Part No.	Part Name
8654373	PC/3277EM Card
8654371	PC/370-M Card
8654372	PC/370-P Card
8654374	PC/370-P-M Cable
8654378	3278/79 Emulation Adapter

PC Network Parts

PC Network

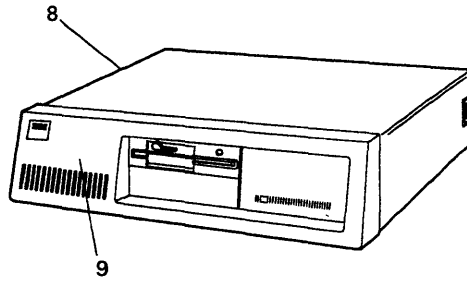| Part No.	Part Name
8286171	Network Adapter
8286172	Adapter Cable
8286173	Translator Unit
8286174	Translator Unit Connection Hardware
8286175	Spare Parts Kit (Tool and Label)
8286176	Translator 120V AC Transformer
8286178	Base Expander
8286179	Short-Distance Kit
8286180	Medium-Distance Kit
8286181	Long-Distance Kit
8286182	Cable, 7.82 m (25 ft)
8286183	Cable, 15.24 m (50 ft)
8286184	Cable, 30.48 m (100 ft)
8286185	Cable, 60.96 m (200 ft)
8286177	Translator, 220V AC Transformer

PC Network Baseband

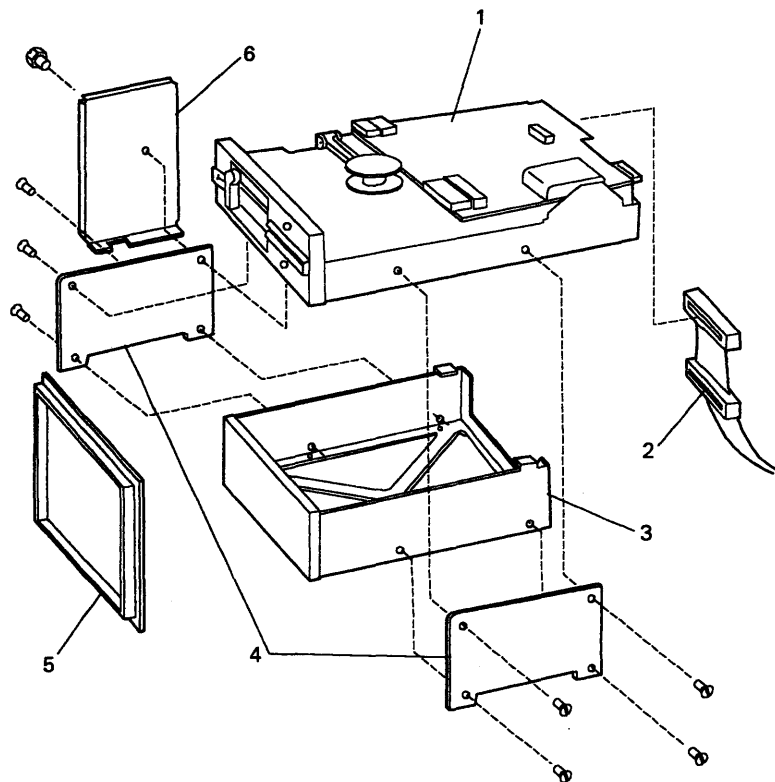| Part No.	Part Name
72X8100	PC Network Baseband Extender
72X8101	PC Network Baseband Adapter
72X8102	PC Network Baseband Adapter/A
72X8103	Spare Parts Kit (Wrap and Terminator Plugs)
72X8104	PC Network Baseband Adapter Cable, 7.82m (25 ft)
72X8107	IBM Cabling System PC Network Baseband Cable

Assembly 11: 5162 PC XT 286 System Unit

LEX42524

LEX42523

Asm – Index	Part Number	Units	Description
11 –		1	5162 PC XT 286 System Unit, Interior
–1	62X1025	1	• System Board
–2	62X1035	1	• 256Kb Memory Module Package
–3	62X1026	1	• 64Kb × 4 Memory Module
–NS	6480008	1	• • Parity Module, System Board
–4	62X1030	1	• Battery Holder
–NS	72X8498	1	• • Battery
–5	62X1034	1	• Power Supply
–6	8529143	1	• Speaker Assembly
–7	62X1123	R	• Base Frame Assembly
–NS	62X1128	AR	• Plastic Parts Kit
–			• • Card Support Bracket (6)
–			• • Planar Board Support (5)
–			• • Screw, Shield Drives
–			• • Foot Pad, CPU (4)
–			• • Tape, Air Dam
–NS	62X1129	AR	• Miscellaneous Screw Kit
–			• • Screw, Flat Head, 100 degree (7)
–			• • Screw, Hex Head 3 mm × .5 inch (5)
–			• • Screw, Hex Head 8/32 × .5 inch (5)
–			• • Screw, 4 mm × 6 mm (4)
–			• • Bolt Flange (15)
–NS	62X1130	AR	• Miscellaneous Metal Parts Kit
–			• • Bracket, Blank
–			• • Mounting Bracket, Diskette Drive
–		1	• 5162 PC XT System Unit, Exterior
–8	8285980	1	• Top Cover (No Bezel)
–9	8529162	1	• Bezel Assembly

5162 PC XT 286 Internal Options and Adapters

Part No.	Part Name
8286127	80287 Math Coprocessor
59X7294	512Kb/2Mb Memory Expansion Adapter
6480008	256Kb RAM Module (Qty 1)
62X0641	256Kb RAM Module Kit (Qty 18)
8286098	Binary Synchronous Communications (BSC) Adapter
8529146	Color/Graphics Monitor Adapter
6181768	Data Acquisition Adapter
8654215	Enhanced Graphics Adapter (w/o Memory Expansion Card)
6323468	Graphics Memory Expansion Card (w/o Memory Modules)
8654219	Graphics Memory Module (Qty 1)
62X1032	Fixed Disk and Diskette Drive Adapter
6181770	GPIB Adapter
8529148	Monochrome Display and Printer Adapter
8586171	PC Network Adapter
8286172	PC Network Adapter Cable
8286147	Serial/Parallel Adapter
8286170	Serial Adapter Cable
8286194	Serial Adapter Connector
8286099	Synchronous Data Link Control (SDLC) Communications Adapter
2684438	Voice Communications Adapter (VCA)
2684462	Notched Black Telephone Cable for VCA
2684487	Notched White Telephone Cable for VCA
2684509	Tabbed Black Telephone Cable for VCA
2684514	Tabbed White Telephone Cable for VCA
6181769	Data Acquisition Control Panel
6851206	Display Station Emulation Adapter (DSEA)
6100218	DSEA Cable Assembly
6851167	DSEA T Connector
7362188	DSEA Terminator
6403635	EDSEA Cable (Integrated)
55X3367	Enhanced Display Station Emulation Adapter (EDSEA)
6323445	Extender Card
6236064	FCS Input Adapter
6236048	FCS Input Connector
6236050	FCS Output Adapter
6236051	FCS Output Adapter Cable
6236053	FCS Security Adapter
8529151	Game Control Adapter
6360609	Non-Maskable Interrupt Card (NMI)
2684462	Notched Black Telephone Cable for VCA
2684487	Notched White Telephone Cable for VCA
6164804	Personal Computer Internal Modem 1200
6428178	Personal Telephone Manager Attachment Cable
6428171	Personal Telephone Manager Logic Card
62X0912	Professional Graphics Controller
6181772	Professional Graphics Memory (Qty 1)
8286138	Prototype Adapter
6453610	Terminal/Host Adapter Card
69X7768	Token-Ring Network Adapter
55X3619	.5Mb – 6Mb Memory Expansion Adapter
62X1035	256Kb Memory Module Package
8286116	128Kb Memory Expansion Adapter
59X7317	64Kb Memory Module (Qty 1)
6279116	128Kb/640Kb Memory Expansion Adapter
59X7317	64Kb Memory Module (Qty 1)
6480008	256Kb RAM Module (Qty 1)
8286115	512Kb Memory Expansion Adapter
8286139	128Kb RAM Module (Qty 1)

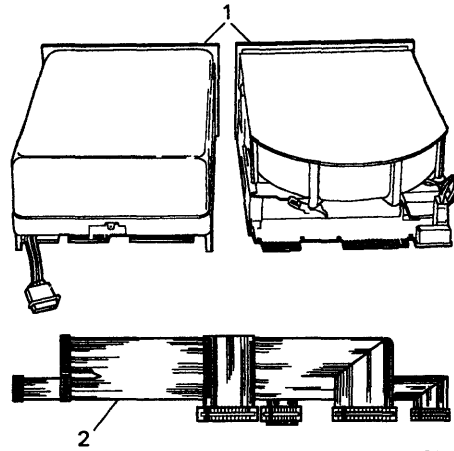# Assembly 12: 5162 PC XT 286 System Unit Diskette Drive (5.25-Inch)

LEX42527

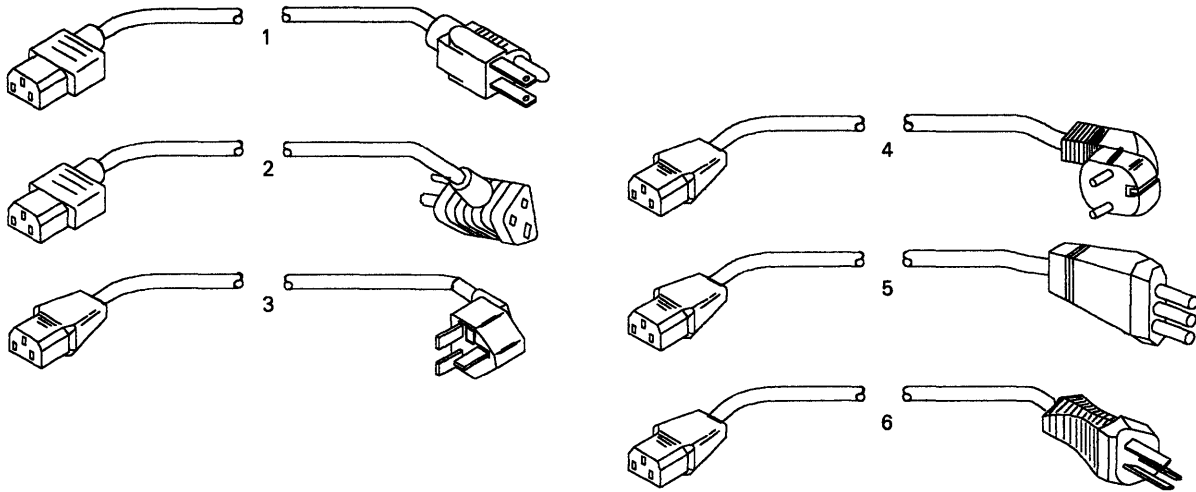| Asm – Index	Part Number	Units	Description
12 –			5162 PC XT 286 System Unit Diskette Drive
–1	62X1028	1	• Diskette Drive, Half-High 1.2Mb
–NS	8285972	AR	• • Terminating Resistor
–1	62X1036	1	• Diskette Drive, Half-High 360Kb*
–2	62X1033	1	• Signal Cable, Fixed Disk and Diskette Drive
–NS	8285972	AR	• • Terminating Resistor
–3	6489901	AR	• Blank Bezel Assembly
–4	6489904	AR	• Mounting Plate, Left or Right
–5	6489912	AR	• Molding, Bezel
–6	6489905	AR	• Mounting Bracket
–NS	62X1129	AR	• Miscellaneous Screw Kit
–			• • Hex Head Screw 3 mm × 6 mm (Qty 5)
–			• • Flat Head Screw 3 mm × 6 mm (Qty 7)

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* Indicated by an * on the front of the diskette drive

Assembly 13: 5162 PC XT 286 System Unit Fixed Disk Drive

LEX42529

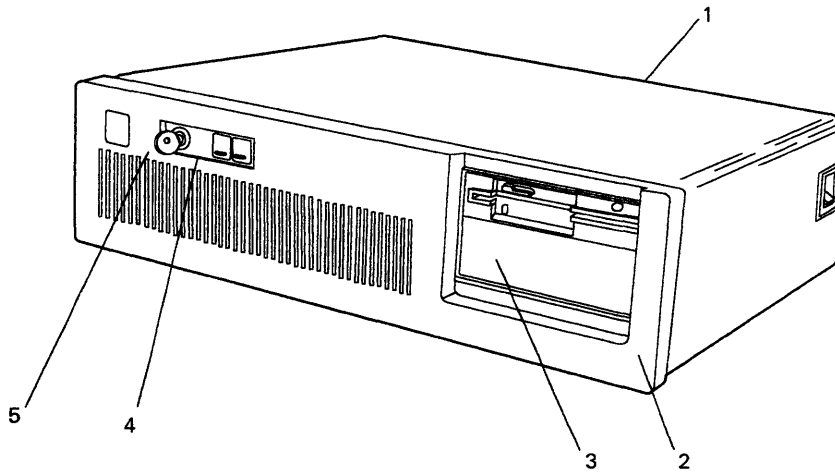| Asm – Index	Part Number	Units	Description
13 –			5162 PC XT 286 System Unit Fixed Disk Drive
–1	62X1031	AR	• Fixed Disk Drive, 20Mb
–2	62X1033	1	• Single Cable, Fixed Disk and Diskette Drive

Assembly 14: 5162/5170 System Unit Power Cords

LEX42530

Asm – Index	Part Number	Units	Description
14 –			5162/5170 System Unit Power Cords
– 1	8529158	1	• Power Cord, Options, U.S.A.
– 2	62X1045	1	• Power Cord, System Unit, U.S.A. (5162)
–			• Power Cord, Venezuela
–			• Power Cord, Columbia
– 2	8286120	1	• Power Cord, System Unit, U.S.A. (5170)
–			• Power Cord, Venezuela
–			• Power Cord, Columbia
– 3	8529341	1	• Power Cord, U.K.
–			• Power Cord, Hong Kong
–			• Power Cord, Singapore
– 4	8529281	1	• Power Cord, Germany
–			• Power Cord, France
–			• Power Cord, Spain
– 5	8529282	1	• Power Cord, Italy
– 6	8529284	1	• Power Cord, New Zealand
			Warning: Use only the proper power cord certified for your country.

Assembly 15: 5170 AT System Unit, Exterior

LEX41721

Asm – Index	Part Number	Units	Description
15 –		1	5170 AT System Unit, Exterior
– 1	8286119	1	• Cover
– 2	8286134	1	• Front Bezel
– 3	8286114	AR	• Blank Bezel
– 4	8286133	1	• Control Panel Assembly
– 5	8286117	1	• Keylock Assembly
– NS	8286169	1	• Back Panel

Assembly 16: 5170 AT System Unit, Interior

LEX41866

The following chart is a cross-reference that will assist in identifying the correct replacement system board for the base models of the Personal Computer AT (5170). The base models are 068, 099, 239, 319, and 339.

Serial No. Range	FRU No.	Model	BIOS Part No.
0000001-5999999	8286112	068/099	6181028, 6181029, 1503107, 1503108, 1503109, 1503110, 6180957, 6180958, 6180959, 6180960, 6180124, 6180125, 6180126, 6101027,
6000000-6999999	6480170 6480072	239 239	6480090, 6480091, 6448894, 6448895 6480090, 6480091
7000000-7999999	6489922	319/339	61X9265, 61X9266, 61X0820, 61X0821

Any numbers other than the ones listed here on BIOS modules in a Personal Computer AT are for the Model 239.

The BIOS module sockets are located in positions U17, U27, U37, and U47 on the system board. If the system board has four BIOS module, all sockets will be filled, but if there are only two BIOS modules, they will be located in positions U27 and U47.

Asm – Index	Part Number	Units	Description
16–		1	5170 AT System Unit, Interior
–1	6480170	1	• System Board, Type 1, 256Kb – 512Kb (Populated to 256Kb) - Model 239
–2	8286139	AR	• 128Kb RAM Module (Qty 1)
–1	6480072	1	• System Board, Type 2, 512Kb - Model 239
–2	6480008	18	• 256Kb RAM Module (Qty 1)
–1	6489922	1	• System Board, Type 3, 512Kb - Models 319/339
–1	61X6607	1	• • System Board AT Store Controller Models 899/839
–1	61X6605	1	• • System Board AT Store Controller Models 849, 819, and 820
–1	8286112	1	• System Board Models 068 and 099
–2	6480008	18	• 256Kb RAM Module (Qty 1)
–3	8286121	1	• Battery
–4	8286122	1	• Power Supply
–5	8286118	1	• Cable, Control Panel
–6	8529143	1	• Speaker Assembly
–7	6480007	R	• Base Frame Assembly
–NS	8286132	AR	• Miscellaneous Metal Parts Kit
–NS	8286135	AR	• Miscellaneous Plastic Parts Kit
–NS	8286136	AR	• Screw Hardware Kit

5170 AT Internal Options and Adapters

Part No.	Part Name
8286127	80287 Math Coprocessor
8286116	128Kb Memory Expansion Adapter
59X7317	64Kb Memory Module (Qty 1)
6279116	128Kb/640Kb Memory Expansion Adapter
59X7317	64Kb Memory Module (Qty 1)
6480008	256Kb RAM Module (Qty 1)
8286115	512Kb Memory Expansion Adapter
8286139	128Kb RAM Module (Qty 1)
59X7294	512Kb/2Mb Memory Expansion Adapter
6480008	256Kb RAM Module (Qty 1)
62X0641	256Kb RAM Module Kit (Qty 18)
1497250	2Mb Memory Expansion Adapter
55X3619	.5Mb – 6Mb Memory Expansion Adapter
62X1035	256Kb Memory Module
8286098	Binary Synchronous Communications (BSC) Adapter
6323472	Cluster Adapter
6323575	Cluster Cable Kit
8286097	Color/Graphics Monitor Adapter
6181768	Data Acquisition Adapter
8654215	Enhanced Graphics Adapter (w/o memory expansion card)
6323468	Graphics Memory Expansion Card (w/o memory modules)
8654219	Graphics Memory Module (Qty 1)
8286125	Fixed Disk and Diskette Drive Adapter
8529151	Game Control Adapter
6181770	GPIB Adapter
8529148	Monochrome Display and Printer Adapter
8286171	PC Network Adapter
8286172	PC Network Adapter Cable
62X0912	Professional Graphics Controller
6181772	Professional Graphics Memory Module (Qty 1)
6323412	Miscellaneous Hardware Kit
8286138	Prototype Adapter
8286147	Serial/Parallel Adapter
8286170	Serial Adapter Cable
8286194	Serial Adapter Connector
8286099	Synchronous Data Link Control (SDLC) Communications Adapter
2684438	Voice Communications Adapter (VCA)
2684462	Notched Black Telephone Cable for VCA
2684487	Notched White Telephone Cable for VCA
2684509	Tabbed Black Telephone Cable for VCA
2684514	Tabbed White Telephone Cable for VCA
70X5061	S/370 Channel Emulator Card
70X4865	S/370 Channel Emulator Cable
63X4157	Optical Disk Adapter
75X8247	Personal Pageprinter Adapter

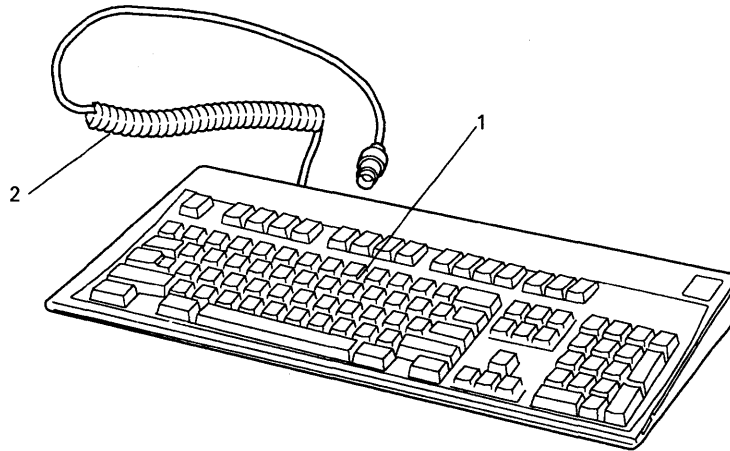**Note:** For additional options and adapters, refer to "5162 PC XT 286 Internal Options and Adapters" on page 18-22.

Assembly 17: 5170 AT System Unit Keyboard (84-Key)

LEX41724

Asm – Index	Part Number	Units	Description
17 –	8286165		Keyboard Assembly, U.S.A.
– 1	8286142	1	• Cover, Top
– 2	8286146	1	• Cable, External
– 3	8286143	1	• Base
– 4	8286141	1	• Foot, Adjustable (The Adjustable Foot Spring is included in the Miscellaneous Parts Kit for the System Unit.)
– 5	8286145	1	• Cable, Internal
– 6	8286144	1	• LED Card
– 7	8286140	1	• Keypad Assembly, U.S.A.
–	8286153	NS	• Keybutton Kit, U.S.A.

Assembly 18: 5162/5170 AT System Unit Keyboard (101/102 Key)

LEX41725

Asm–Index	Part Number	Units	Description
18–			5162/5170 AT System Unit Keyboard (101/102 Key)
–	6447033		• Keyboard Assembly, U.S.A.
–	6447035		• Keyboard Assembly, France
–	6447036		• Keyboard Assembly, Germany
–	6447037		• Keyboard Assembly, Italy
–	6447038		• Keyboard Assembly, Spain
–	6447034		• Keyboard Assembly, U.K.
–1	6447039	1	• Keypad Assembly, U.S.A.
–1	6447041	R	• Keypad Assembly, France
–1	6447042	R	• Keypad Assembly, Germany
–1	6447043	R	• Keypad Assembly, Italy
–1	6447044	R	• Keypad Assembly, Spain
–1	6447040	R	• Keypad Assembly, U.K.
–NS	6447052	R	• Circuit Board Assembly
–NS	6448803	R	• Cable, Internal
–NS	6447053	R	• LED Assembly
–NS	6447055	R	• Cover Assembly
–NS	6447054	R	• • Foot, Adjustable (Qty 2)
–NS	6447056	AR	• Miscellaneous Parts Kit
–			• • Screws (Qty 5)
–			• • Nut
–			• • Lock Washer
–2	6447051	1	• Cable Assembly, External
–NS	6110464		• Tool, Key Cap Removal
–	6447045	NS	• Keybutton Kit, U.S.A.

Assembly 19: 5170 AT System Unit Diskette Drives (5.25-Inch)
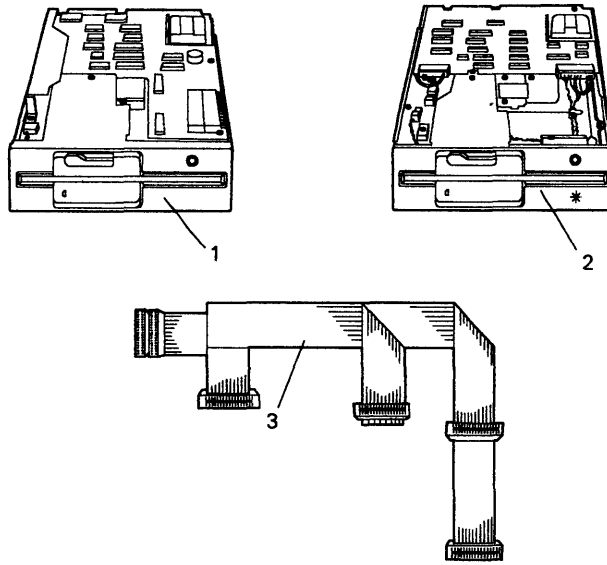
LEX41726

Asm – Index	Part Number	Units	Description
19 –			5170 AT System Unit Diskette Drives (5.25-inch)
– 1	8286130	AR	• Diskette Drive, High Capacity
– 2	8286131	AR	• Diskette Drive, Double-Sided*
– 3	8286124	1	• Signal Cable, Fixed Disk and Diskette Drive

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* Indicated by an * on the front of the diskette drive

Assembly 20: 5170 AT System Unit Fixed Disk Drives
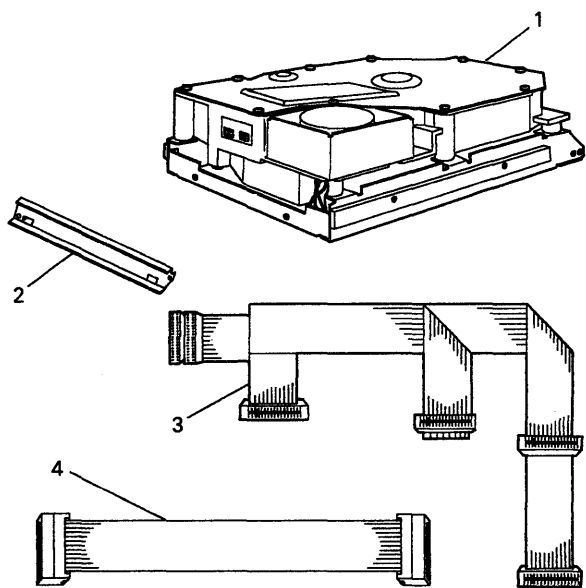
LEX41727

Asm – Index	Part Number	Units	Description
20 –			5170 AT System Unit Fixed Disk Drives
–	6278099	AR	• Fixed Disk Drive, 20Mb
– 1	8286216	AR	• Fixed Disk Drive, 30Mb
– 2	6489949	AR	• Keeper Bar, Fixed Disk
– 3	8286124	1	• Signal Cable, Fixed Disk and Diskette Drive
– 4	8286129	AR	• Data Cable, Fixed Disk Drive

5170 AT Store System Controller Parts

Common Parts for Models 8XX

Part No.	Part Name
6347798	Loop Adapter
6236178	MPCA Adapter
61X6605	System Board (All models)
6316839	Cable S10 to LAN
6316840	Cable Loop
63X4998	Cable Loop (Model 819)
6164855	Modem Loop Band

AT/370 Parts

Part No.	Part Name
2684070	PC/370-P2 Card
2684069	PC/370-M2 Card
8654374	PC/370-P-M Cable
8654378	3278/79 Emulation Adapter

ARTIC (RIC) Parts

Part No.	Part Name
60X8192	128K ARTIC Adapter
76X1013	512K ARTIC Adapter
58X7285	RS232C
58X7286	RS422A
58X7287	V.35
58X7288	20 mA
60X8200	64K Memory Module (128K Adapter)
76X1022	256K Memory Module (512K ARTIC Adapter)
67X1245	Direct Connect
67X1247	Modem Attach
67X1249	V.35
67X1609*	Spare Parts Kit

Note: ARTIC spare parts kit (67X1609) contains extra screws, nuts, and jumpers. The jumpers contained in this kit are unique to ARTIC because of the height restraints of the adapter to interface cards.

3270 PC Parts

The following are commonly used FRU part numbers for 3270 PC Products. For more information, refer to the maintenance documentation included with the ship group.

3270 PC (5271 FRU Numbers)

Part No.	Part Name
8654395	Printer Memory Adapter Card
8529149	Printer Adapter Card
2683116	256K Memory Expansion (Piggy-Back Card)
8654381	Program Symbols Adapter
8654390	All-Points-Addressable Adapter
8654386	Display Adapter
8665792	Distributed Function Communications Adapter (3278/79 Emulation Adapter)
8654385	Card, Top Card Connector
6453624	Keyboard Adapter

Part No.	Part Name
8654377	Keyboard Adapter Cable
6453624	NMI Keyboard Adapter
6217063	NMI Keyboard Adapter Wrap Plug
4466857	XMA Base Card
4466858	XMA Memory Card
4466859	XMA Memory Adapter

Keyboard Assembly Part Numbers (5271/5273)

Part No.	Part Name
1389098	Keyboard - Converged
1390290	Keyboard - Enhanced
8654377	Keyboard Adapter Cable
6453622	Enhanced Keyboard Cable Adapter

Display Part Numbers (5272)

Part No.	Part Name
6931932	Color Display
6871672	Swivel Assembly
8529158	Power Cord

(5371)

Part No.	Part Name
8654377	Keyboard Cable Adapter Cable
8654382	IEEE-488 Interface Adapter Cable
8654392	Display Adapter
8665792	DFCA Card
8654391	Keyboard/Tablet or Mouse Adapter
8654396	IEEE-488 Adapter
8654395	Printer/Memory Adapter
5371 Keyboard Assembly	(See 5271 Keyboard Part Numbers)

3270 Personal Computer AT (5273 FRU Numbers)

Part No.	Part Name
8286116	128Kb Memory Expansion Adapter Card
8665792	Distributed Functions Communications Adapter Card
8654386	Display Adapter Card (Domestic)
4466861	Keyboard/Timer Adapter Card
8654377	Keyboard Adapter Cable
2683118	Extended Graphics Adapter (XGA) Card
6347752	Programmed Symbols Adapter Card

Top Card Connectors

Part No.	Part Name
8654385	2-Card, 2-Wide
6453677	2-Card, 3-Wide
2683122	3-Card, 3-Wide

3270 PC AT/G & GX (5373 FRU Numbers)

Part No.	Part Name
8665792	DFCA Card
8286115	EMA Extended Memory Adapter*
2683554	Display/Mouse/Tablet Adapter
6347727	Internal Mouse/Tablet Cable
1887915	Keyboard Adapter Cable

* This is a standard 512Kb Memory Expansion Card with revised switch settings.

3270 PC/G Display Attachment Unit (5278)

Part No.	Part Name
1887693	Model 1 DAU (5371)
1887745	Model 2 DAU (5373)
1887792	Cable - DAU to System Unit

3270 PC/G Color Display (5279)

Part No.	Part Name
1887678	Color Display Element
5699346	Power Cable
1887778	Monitor to DAU Cable
1887676	Tilt/Swivel Assembly
1887675	Lift/Tilt/Swivel Assembly

3270 PC Tablet (5083)

Part No.	Part Name
6248433	Tablet
6248523	Four Button Cursor
8248522	Stylus

3270 PC Mouse (5277)

Part No.	Part Name
1887686	Mouse and Pad Assembly

Note: All base system parts for the 3270 XT products are the same as 5160 XT base system parts.

Note: All base systems for 3270 AT products are the same as 5170 AT base system parts.

Assembly 21: 3295 Plasma Monitor
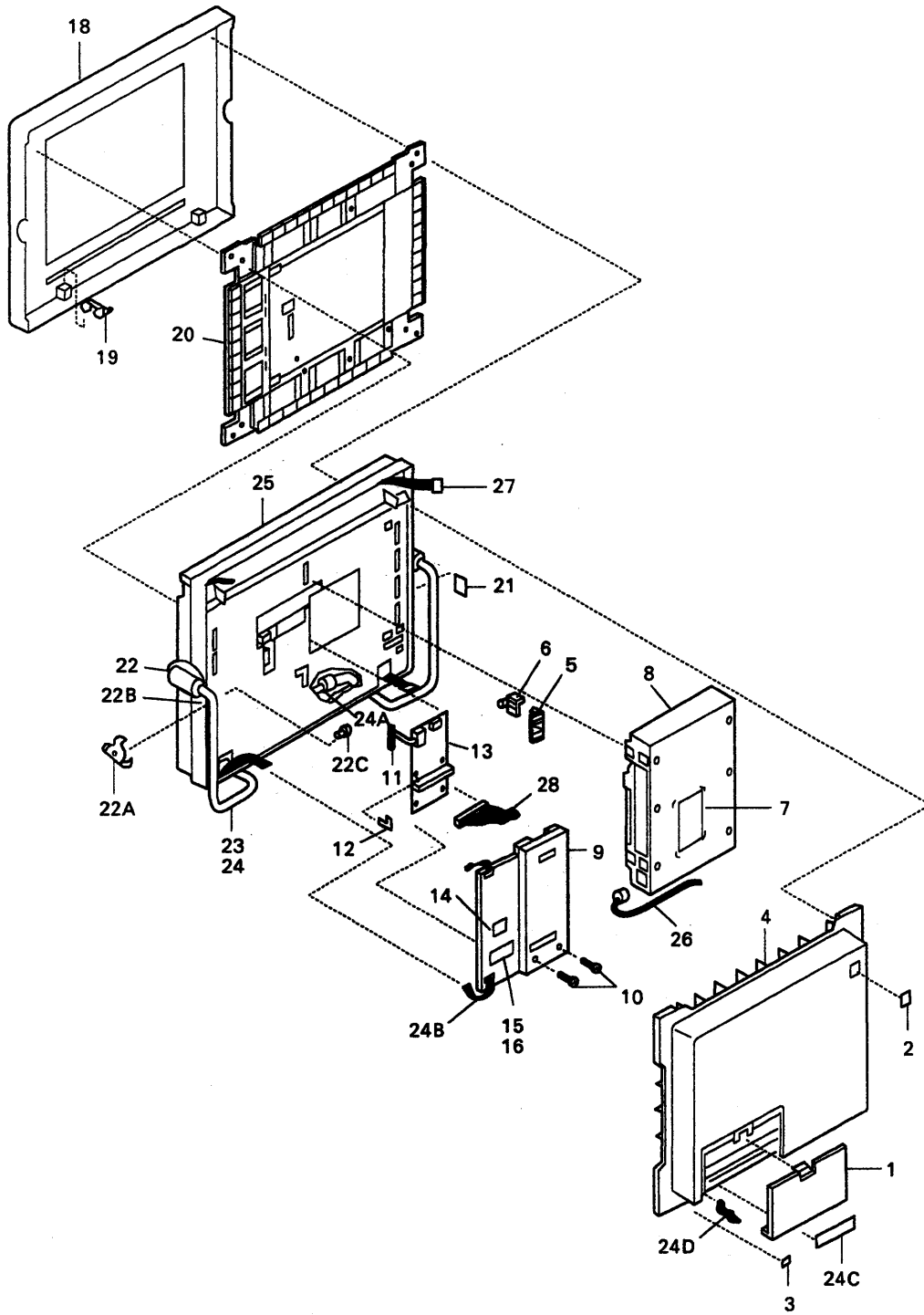
LEX41755

Asm – Index	Part Number	Units	Description
21 –			3295 Plasma Monitor
–1	2720054		• Cover I/O
–2	2720078		• Plate - Rear
–3	2720068		• Plug
–4	2720053		• Cover - Rear
–5	2720058		• Switch - Bezel
–6	2720057		• Switch - Lever
–			• Lever
–7	4804340		• Label 200V
–	4804341		• Label 100V
–8	6128690		• Display Power
–			• Unit, 100V
–8	6128691		• Display Power
–			• Unit, 200V
–	6128693		• Display Power
–			• Unit Fan
–			• Assembly
–9	2720076		• Cover
–10	1621508		• Screw
–11	2720075		• Cable Assembly
–12	2720056		• Latch
–13	2720070		• Card Assembly
–14	4804348		• RID Tag
–15	4804334		• ID Label
–16	5640748		• Clear Label
–18	2720052		• Cover - Bezel
–19	2720059		• Retainer, Spring
–20	8269140		• Panel Assembly (WT)
–	6128480		• Panel Assembly
–21	2720083		• Label, Domestic
–	2720083		• Label, Japan
–22	2720060		• Cover - Pivot
–22A	6217275		• Cap
–22B	6217158		• Stop
–22C	1622675		• Screw
–23	2720069		• Support
–24	1621816		• Screw
–24A	6217157		• Sleeve
–24B	2720081		• Jumper Assembly
–24C	2720079		• Voltage Rating
–			• Label - 100-127V
–	2720080		• Voltage Rating
–			• Label - 200-240V
–24D	2720067		• Link
–25	2720051		• Housing Assembly
–26			• Power Cord
–27	2720081		• Jumper Assembly
–28	1837487		• Cable 1.5 m
–	2720066		• Cable 5 m

Assembly 22: 5378 Display Attachment Unit Assembly (Color/Mono)
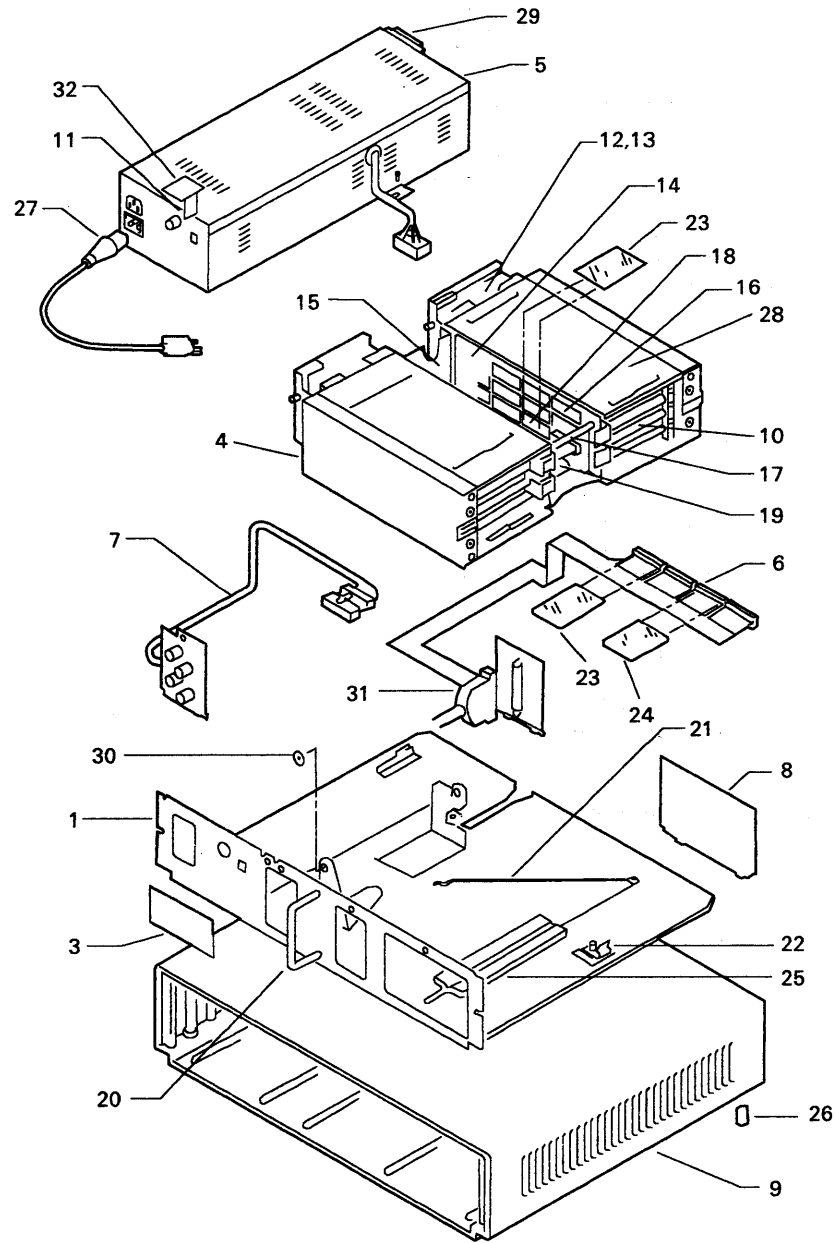
LEX41757

Asm – Index	Part Number	Units	Description
22 –		1	5378 Display Attachment Unit (Mono)
–		1	5378 Display Attachment Unit (Color)
– 1	4421590	1	• Plate Assembly
– 3	4421694	1	• Label, Use For Mono - Raleigh M/CS
– 3	4421638	1	• Label, Use For Color - Raleigh M/CS
– 3	4421635	1	• Label, Use For Mono - GNCK M/CS
– 3	4421637	1	• Label, Use For Color - GNCK M/CS
– 4	4421583	1	• Logic Gate
– 5	4421613	1	• Power Supply Assembly
– 6	8233832	1	• Cable Assembly, Signal Flexi
– 7	4421620	1	• Cable Assembly, Video
– 8	4421596	1	• Panel, Blank
– 9	4421580	1	• Cover Assembly
– 10			• Logic Cards (See Detail A)
– 11	5214456	1	• Fuse 6 Amp SB 250V
– 12	4421586	2	• Fan 12V
– 13	4421589	4	• Fan, Shockmount
– 14	8223695	1	• Logic Board A
– 15	8223696	1	• Logic Board B
– 16	4134800	1	• Logic Board, Support
– 17	4421691	1	• Spacer, Hexagonal
– 18	8233831	1	• Cable Assembly Flexi-Interconnect Overflow
– 19	8233876	1	• Interconnect Card
– 20	4421582	1	• Handle
– 21	4421649	1	• Stay, Support
– 22	4421610	1	• Latch
– 23	4421774	2	• Cable Retainer, Plastic
– 24	4421775	1	• Cable Retainer, Plastic
– 25	1735245	1	• Foam Strip
– 26	4421600	4	• Foot
– 27	8248354	1	• Cable, Mainline Power
– 28	4421584	1	• Logic Casing
– 29	4421599	1	• Molding Insert (Power Switch)
– 30	1887828	2	• Fastener, Push-On
– 31	8529253	1	• Cable, 5371 Attach
– 32	4421640	1	• Label, Hazard 800V
–	1743144	1	• Card Guide 4-wide

Assembly 23: 5379 Display Assembly (Color/Mono)
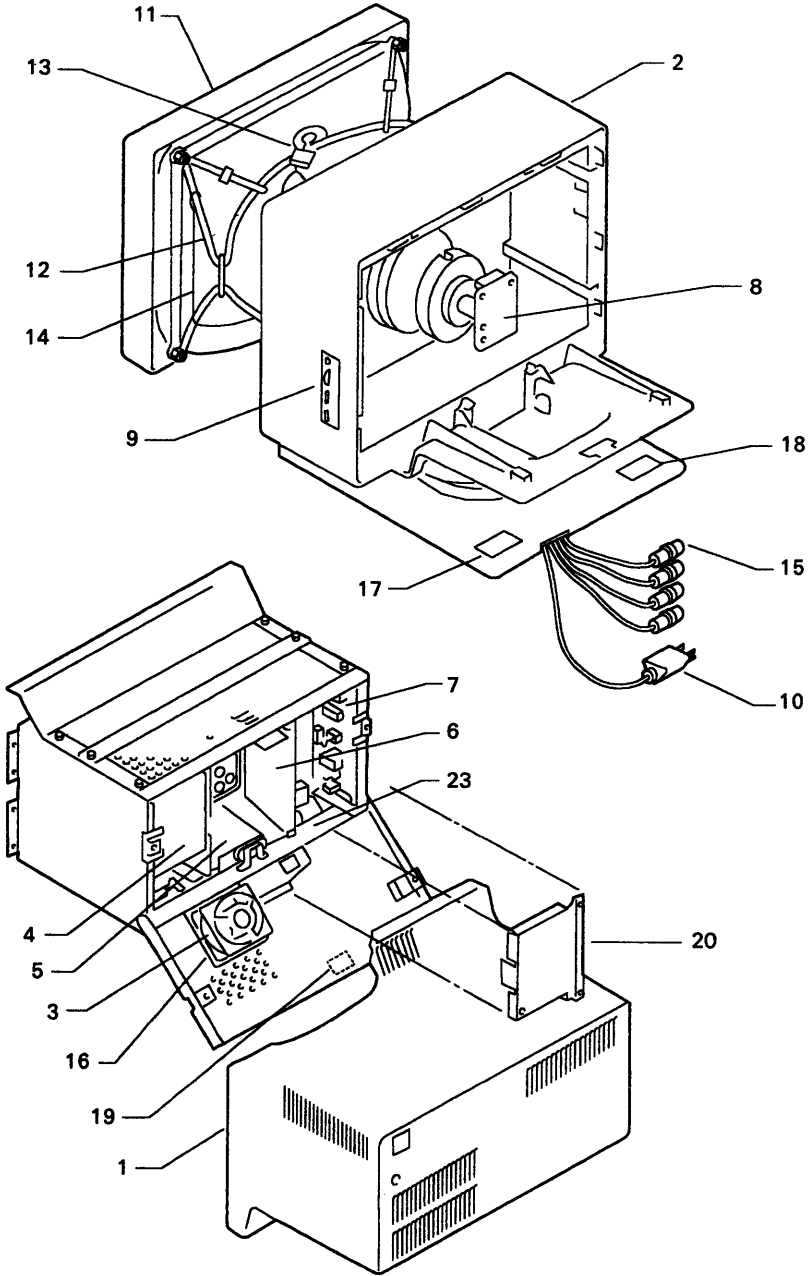
LEX41756

Asm – Index	Part Number	Units	Description
23 –		1	5379 Display Assembly (Mono) 19-inch
–		1	5379 Display Assembly (Color) 19-inch
– 1	4421771	1	• Cover Assembly, Rear - Mono
– 1	4421770	1	• Cover Assembly, Rear - Color
– 2	4421769	1	• Cover, Front with Tilt/Swivel
– 3	4421624	1	• Fan, Color Only
– 4	4421761	1	• Card, Power Supply - Mono
– 4	4421621	1	• Card, Power Supply - Color
– 5	4421765	1	• Power Supply Assembly, Primary - Mono
– 5	4421626	1	• Power Supply Assembly, Primary - Color
– 6	4421763	1	• Card, Video Amp - Mono
– 6	4421623	1	• Card, Video Amp - Color
– 7	4421762	1	• Card, Deflection Amp - Mono
– 7	4421622	1	• Card, Deflection Amp - Color
– 8	4421766	1	• Card, CRT Socket - Mono
– 8	4421707	1	• Card, CRT Socket - Color
– 9	4421764	1	• Card, Manual Controls - Mono
– 9	4421625	1	• Card, Manual Controls - Color
– 10	4421628	1	• Power Cable, Mainline
– 11	4421768	1	• CRT and Bezel Assembly - Mono
– 11	4421767	1	• CRT and Bezel Assembly - Color
– 12	4421631	1	• Degauss Coil Assembly - Color Only
– 13	4421632	1	• EHT Cable
– 14	4421917	1	• CRT Ground Wire
– 15	4421629	2	• Cable, Twin-Ax Assembly - Mono
– 15	4421629	4	• Cable, Twin-Ax Assembly - Color
– 16	4421630	1	• Fan, Rubber Mount
– 17	4421636	1	• Label, Color
– 17	4421634	1	• Label, Mono
– 18	4421641	1	• Label, FCC Notice
– 18	4421642	1	• Label, FCC Notice - German
– 19	4421680	1	• Label, Hazard 25000V
– 20	4421919	1	• Safety Shield, Rear - Mono
– 20	4421918	1	• Safety Shield, Rear - Color
– 21	4421627	1	• Spares Kit 1 - Mechanical
–			• • Screw, Taptite, M4, 8 mm Lg
–			• • Screw, Taptite, M4, 12 mm Lg
–			• • Screw, Self-Tap, 2.9 × 13 mm Lg
–			• • Screw, Self-Tap, 3.5 × 9.5 mm Lg
–			• • Screw, Bezel Mounting
–			• • Screw, Card Cage Mounting
–			• • Lckw, Star
–			• • Cable Tie
–			• • Cable Tie
–			• • Trimmer Knob
–			• • Clamping Ring, EHT Collet
–			• • Foot, Rubber
–			• • Locknut, Ground Wire
–			• • Ground Wire (Rear Door)
–			• • Bush, Insulated
–			• • Bush, Insulated
–			• • Logo Plate, Mono
–			• • Logo Plate, Color
– 22	4421772	1	• Spares Kit 2 - Card Guides
–			• • Card Guide - Upper
–			• • Card Guide - Lower
–			• • Card Guide - Rear
– 23	4421773	1	• • Spares Kit 3 - Cables
–			• • Cable, XO-XN
–			• • Cable, XG-XH
–			• • Cable, XA-XB
–			• • Cable, XD-XB
–			• • Cable, XI-XH

Industrial PC Products

5531 Industrial PC

Part No.	Part Name
6421781	10Mb Fixed Disk Assembly
6421658	Cover Assembly
6421659	Top Cover (No Bezel)
6421663	Fan Filter Frame Kit (Includes Frame and Handle)
6421765	Fan Filter Kit (Two Filters)
6421662	Bezel Assembly (w/ Filter Assembly and Door Assembly)
6421661	Door Assembly
6421660	RFI Kit (Gasket, Clips and Screws)
6421664	Card Retainer
6421667	Miscellaneous Hardware Kit (Screws, Foot Pads, Standoffs)
6421606	Power Adapter Card
6421665	Fan Assembly
6421666	Thermal Assembly
6426080	Combination Adapter
8286097	Color Monitor Adapter
8529254	System Board
6421668	Keyboard Assembly
8529168	Keyboard Cable
6421670	Bottom Cover (Keyboard)
6421669	Top Cover (Keyboard)
85X2697	RTI Adapter
85X2682	RTI and Keyboard Cable
6421671	Hardware Kit (Foot Pads, Feet, Screws, Springs) for Keyboard
6421654	Combination Adapter Cable (Serial Port)
8529158	Power Cord

5532 Industrial Color Display

Part No.	Part Name
6421672	5532 Display Assembly
8529158	Power Cord
6421682	Power Cord Retainer
6421678	Power Cover (Gray)
6421679	Screen Cover Screw Kit
6421763	Air Filter Cover (Two Covers)
6421764	Air Filter Kit (Four Filters)
6421790	Shipping Material

7531 Industrial AT (Floor Standing)

Part No.	Part Name
61X6605	System Board (Model 111)
8286112	System Board (Model 41)
70X8870	System Cover
70X8871	Rear Bezel
70X8872	Front Bezel
70X8874	Filter Assembly
70X8875	Diskette Bezel Assembly
70X8877	Filter Hood
67X1489	Power Supply
70X8879	Power Cable
6347786	Power Adapter Card
70X8876	Diskette Door Assembly
8529143	Speaker Assembly
6523463	Filter Material Kit
70X8895	Card Retainer
8529156	Card Support Bracket

70X8878	System Unit Fan Assembly
70X8898	5.25-Inch 20Mb Fixed Disk Drive (Model 041)
6523489	Miscellaneous Hardware Kit
70X8873	Base
70X8876	Diskette Door Assembly
70X8891	1.2Mb Diskette Drive
70X8892	320Kb/360Kb Diskette Drive
70X8893	Diskette Drive Blank
70X8894	Diskette Shield
8286121	Battery
6219901	Rail Kit
1388032	Keyboard without Cable (Model 041)
6447051	Keyboard Signal Cable
58X8156	Combination Adapter II
58X8157	128Kb Memory Expansion Card
58X8056	Thermal Assembly
6421654	Combination Adapter Cable (Serial Port)
85X2697	RTI Adapter
85X2682	RTI and Keyboard Cable
1390652	Keyboard (Model 111)
00F5484	3.5-Inch 720Kb Diskette Drive (Model 111)
05F6241	3.5 – 20Mb Disk Drive (Model 111)

7532 Industrial AT (Rack Mount)

Part No.	Part Name
61X6605	System Board (Model 111)
8286112	System Board
70X8882	System Cover
70X8883	Side Panel (Left)
70X8884	Side Panel (Right)
70X8885	Filter Assembly
6523463	Filter Material Kit
70X8887	Bezel, System Unit
70X8888	Diskette Bezel Assembly
70X8889	Diskette Door Assembly
6421654	Combination Adapter Cable (Serial Port)
70X8890	Handle, System Unit
70X8891	1.2Mb Diskette Drive
70X8892	320/360 Diskette Drive
70X8893	Diskette Drive Blank
70X8894	Diskette Shield
70X8895	Card Retainer
8529156	Card Support Bracket
8286121	Battery
70X8896	Internal Keyboard Cable
6219901	Rail Kit
8286124	Fixed Disk/Diskette Drive Signal Cable
6523455	Miscellaneous Hardware Kit
70X8897	Fan Assembly
70X8898	5.25-Inch 20Mb Fixed Disk Drive (Model 041)
70X8901	Bracket, Disk Mounting
6347786	Power Adapter Card
70X8900	Bracket Disk Mounting (Upper)
8286129	Data Cable, Fixed Disk
67X1489	Power Supply
70X8879	Power Cord
1388032	Keyboard without Cable (Model 041)
6447051	Keyboard Signal Cable
58X8156	Combination Adapter II
58X8157	128Kb Memory Expansion Card
58X8056	Thermal Assembly
85X2697	RTI Adapter
85X2682	RTI and Keyboard Cable
1390652	Keyboard (Model 111)

00F5484	3.5-Inch 720Kb Diskette Drive (Model 111)
05F6241	3.5-Inch 20Mb Disk Drive (Model 111)

7552 Industrial Computer

Part No.	Part Name
85X1931	System Resource Card
85X2694	Power Supply
85X1933	Processor Card
85X1938	512Kb/3Mb Memory Card
85X1929	Diskette Drive 720Kb
85X1928	Hard File 10Mb (Model 140)
85X1930	Disk/Diskette Adapter (Model 140)
85X2693	Backplane
85X2841	5.25-inch Diagnostic Diskette
85X2840	3.50-inch Diagnostic Diskette
85X2697	RTI Adapter
85X2682	RTI and Keyboard Cable
00F5545	Hard File 20Mb (Model 540)
16F2222	Disk/Diskette Adapter (Model 540)
00F5546	Diskette Drive 1.44Mb (Model 540)
85X1936	PC Adapter Card
85X2683	Power Supply Fan
85X2053	Hard File Signal Cable 10Mb
09F1719	Hard File Signal Cable 20Mb
85X2052	Hard File Data Cable
85X2051	Diskette Cable
85X2699	AC Power Card
85X2698	Keyboard
85X2682	Keyboard Cable
85X2884	Math Coprocessor
85X2700	Memory Module

7534 Industrial Enhanced Color Display

Part No.	Part Name
6523586	Display Assembly 110V
6421764	Filter Kit
6425349	Bezel Assembly
6425336	Screen Cover (Clear)
6523587	Display Assembly 220V
8529158	Power Cord
6421679	Screen Cover Hardware Kit
6421763	Air Filter Bracket Kit

7544 Industrial Graphics Display

Part No.	Part Name
16F2230	Display Assembly 100V - 127V
16F2231	Display Assembly 200V - 240V
8529158	Power Cord (U.S.) 110V
16F2258	Power Cord (U.S.) 220V
6421763	Air Filter Bracket Kit
6421764	Air Filter
6523585	Packing Material
6425349	Bezel and Gasket Assembly with Logo
6421679	Screen Cover Hardware Kit

7494 ELF

Part No.	Part Name
76X0851	7494 ELF Model 12
76X0852	7494 ELF Model 13
76X0853	7494 ELF Model 14
15F8116	7494 ELF Model 50
15F8117	7494 ELF Model 51
15F8118	7494 ELF Model 52
15F8119	7494 ELF Model 53

Service is not provide for 7494 ELF accessories. Customers are to be directed to the point of sale for replacement procedures. Accessories include:

High Resolution Bar Code Wand
Low Resolution Bar Code Wand
Wall Mount with Power Supply
Desk Mount with Power Supply.

Tempest PC Products

4451/4455/4456 Tempest PC and XT

Part No.	Part Name
7943411	Duct Transition
7943412	Duct Sleeve
7943414	Captive Screw Assembly
7943422	Top Cover Assembly
7943520	Keyboard Assembly
101A313	Speaker Assembly
101A577	Connector PNL
101A624	Power Supply (UPS)
102A196	Video Cable (Tempest Aux Col)
102A217	Video Cable (Tempest Color)
102A241	Slot Saver Cable (Tempest)
102A245	Slot Saver Keyboard Filter
102A248	Slot Saver Printer Filter
102A252	Slot Saver Async Filter
103A418	3-Card Adapter (T)
103A493	Dual Voltage Tempest (Color)
107A867	Slot Saver (Keyboard Adapter/128Kb)
107A868	Slot Saver Card (Keyboard Adapter/ 384Kb)
8529152	Diskette Adapter
8529206	Diskette Drive
8529254	System Board
8286127	Math Processor
8654378	Distributed Function Com.
100A008	Enclosure Disk Top Cover
100A009	Distributed Function Com.
100A028	Plug Bottom
100A037	Rem. Hard Disk Cable (Fro.)
100A038	Rem. Hard Disk Cable (Fro.)
100A039	Rem. Hard Disk Cable (Fro.)
100A077	TCA Filter, PCB Assembly
100A167	Connector Plt.
100A189	Communications Adapter
100A469	Gasket
100A495	Removable Hard Disk Drive
100A496	5Mb Cartridge (Becomes SU)
100A497	Kit-Mounting, Cartridge D
100A498	Removable Hard Disk Control
100A520	Keyboard, Tempest
100A539	Power Supply Filter (5A)
100A557	Connector Panel
100A565	Front Name Plate
101A283	Bezel Assembly
102A210	Display Monochrome Tempest
8654386	Monochrome Display Adapter
100A086	Filter Assembly Monochrome
100A534	Video Cable (Monochrome Tempest)
102A207	Slot Saver Cable, Non-Tempest
8529158	Power Cord System Unit, Non-Tempest

1385103	Keyboard, Non-Tempest
6128849	Display Power Cord
6871672	Pedestal for Color Display, Non-Tempest
6931932	Non-Tempest Color Display
1650667	Blue Jumper

4459 Tempest PC-AT

Part No.	Part Name
102A701	System Unit Enclosure
102A702	Top Cover Assembly
102A724	Top Cover Gasket
102A732	Transition Duct
102A768	Transition Duct Sleeve
1504091	Transition Duct Screw
5498118	Mounting Screw
2129550	Flat Washer
108A534	Powerline Filter Assembly
102A747	PLF Remote Cable
8286122	Power Supply
112A601	Powerline Filter Fuse TO.5
112A602	Powerline Filter Fuse T4
112A603	Powerline Filter Fuse T7
112A594	Safety Cap
7943434	Mounting Screw, Flat Head
1501676	Ground Strap
110A306	Nut
102A704	Diskette/Disk Drive Enclosure Cover
102A703	Diskette/Disk Drive Enclosure
112A587	System Board
1504091	Mounting Screws
8286116	128Kb Memory Expansion Adapter
8286115	512Kb Memory Expansion Adapter
100A306	Communications Adapter (Frontier Card)
104A631	Mono Display and Printer Adapter (Hercules Card)
8654215	Display Adapter (EGA)
102A784	Removable Cartridge Disk Drive Adapter
8529148	Mono Display and Printer Adapter
8286097	Color/Graphics Monitor Adapter
8286147	Serial/Parallel Adapter
102A202	Wrap Plug (Frontier)
100A470	I/O Panel Gasket
100A237	Panel
100A166	Cover, 9 Pin
100A168	Connector Plate, 25 Pin
100A169	Connector Plate, 50 Pin
257985	Flat Washer
257984	Lock Washer
37913	Hex Nut
100A149	Connector Cover
100A157	Special Washer for Cover
102A792	Keyboard Filter Assembly
102A791	Serial Filter Assembly
101A619	Parallel Printer Filter Assembly
110A267	Display Filter Assembly
101A961	Color Adapter Filter
110A522	EGA Filter
102A782	Cartridge Drive, 10Mb
102A783	Cartridge, 10Mb

5126 Technician Terminal Parts

Part No.	Part Name
8654411	Printer
8654215	Enhanced Graphics Adapter (EGA)
8286165	Keyboard

8286147	Serial/Parallel Adapter
8286139	128Kb RAM Module (For use on P/N6480170)
6447490	Diskette Drive
8286125	Disk/Diskette Adapter
8286121	Battery
8286116	128Kb Memory Adapter
6480170	System Board
6373523	Fixed Disk (Hard File)
6447482	ALDL/Touch Adapter
6447506	Probe Adapter
6447445	Power Supply
6447511	5126 MIM
6447437	Cable Assembly (Fixed Disk and Diskette)
6447422	Actuator (Micro Switch)
6447419	Micro Switch
6447413	Key, Keyboard Drawer
6447399	Thermal Switch
6447321	Filter
6447296	Phone Cable
6447288	Post (for Cables)
6447230	Power Control Device (Wake-Up Box)
6447220	Touch Sensor
8529143	Speaker
6278698	Knob On/Off
6278697	Knob Brightness
6278696	Knob Contrast
6219895	Power Cord
6164875	2400 Baud Modem (Internal)
6134262	Monitor
4796537	Fan
59X7317	64Kb RAM Module (Used on P/N8286116)

To obtain a *5126 Maintenance Information Manual* (MIM), order P/N 6447511.

Personal Computer/Series 1

4950

Part No.	Part Name
6323421	TCA Card
6323422	Processor Card
8529254	System Board

All parts not listed above are the same as 5160 XT base parts. See 5161 XT parts section for part numbers.

5170 Model 495

Part No.	Part Name
6487848	S/1 Processor Card
6453610	Terminal/Host Adapter Card
8286112	System Board
6278099	20Mb Fixed Disk Drive

5170 Model 496

Part No.	Part Name
67X1683	S/1 Processor Card
6453610	Terminal/Host Adapter Card
6489922	System Board
8286216	30Mb Fixed Disk Drive

5170 Model 497

Part No.	Part Name
6487848	S/1 Processor Card
6453610	Terminal/Host Adapter Card
6480072	System Board
8286216	30Mb Fixed Disk Drive

Series/1 5170 Documentation (All Models)

SX34-0184	HMS for S/1 feature Includes advanced diagnostics, Reference card, Problem Isolation Guide, and wrap connector

All parts not listed above are the same as 5170 AT based parts. See 5170 AT parts section for part numbers.

Displays

Monochrome Display (5151)

Part No.	Part Name
6937097	Display (Monochrome) Shipping Carton
8529171	Monochrome Display
8529177	Brightness Knob
8529178	Contrast Knob

Color Display (5153)

Part No.	Part Name
6937192	Color Display Shipping Carton
8529227	Color Display
8529158	Power Cord
8529287	Brightness Knob
8529288	Contrast Knob
8529289	Power On/Off Knob

IBM PCjr Color Display (4863)

Part No.	Part Name
6133803	Color Display
6133804	Foot Pads (4)
6133805	Tilt Stand

Enhanced Color Display (5154)

Part No.	Part Name
6182313	ECD Shipping Carton
6182056	Shipping Cushion Front
6182057	Shipping Cushion Rear
6182319	Shipping Bag
6321035	Enhanced Color Display
6321056	Knob Cover Cap Kit
6323319	Feet Kit
8529158	Power Cord

Professional Graphics Display (5175)

Part No.	Part Name
6182313	PGD Shipping Carton
6182056	Shipping Cushion Front
6182057	Shipping Cushion Rear
6182319	Shipping Bag
6181764	Professional Graphics Display
6133993	Knob Kit
6323319	Feet Kit
6323468	Graphics Memory Expansion Card
8529158	Power Cord

The following displays are listed on another page.

Display	Location
5272 Color Display	15-4
Assembly 21: 3295 Plasma Monitor	18-36
Assembly 23: 5379 Display Assembly (Color/Mono)	18-40
5532 Color Display	12-3
7534 Industrial Enhanced Color Display	12-8
7544 Industrial Enhanced Color Display	12-9

Assembly 24: Streaming Tape Drive
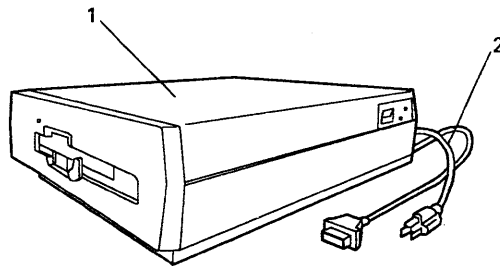
LEX42531

Asm – Index	Part Number	Units	Description
24 –			IBM 6157 Streaming Tape Drive
– 1	08F3391	1	• IBM 6157 Tape Drive, U.S.A., Canada, Low Voltage
– 1	6298375	1	• IBM 6157 Tape Drive, U.S.A., Canada, High Voltage
– 1	08F3675	1	• IBM 6157-002 Tape Drive, U.S.A., Canada, Low Voltage
– 1	08F3682	1	• IBM 6157-002 Tape Drive, U.S.A., Canada, High Voltage
– 2	61X6438		• Power Cable, U.S.A. (Filtered)
– 2	6952300	1	• Power Cable, U.S.A. (Standard)
– 2	6952301	1	• Power Cable, Cook County, IL (6 ft)
–	6453929	1	• Tape Lock Lever Kit

Tools and Test Equipment

The following items may be necessary to properly perform PC service calls.

Voltmeter (Analog)

A meter similar to the Triplett Model 310.
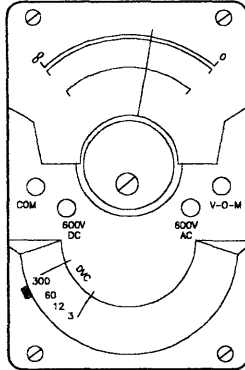
LEX40058

Figure 18-1. Voltmeter

Module Puller

A module puller should be similar to the one shown below. It is used to remove 64Kb Memory Modules 32-pin.
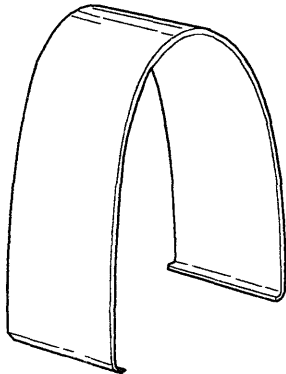
LEX40059

Figure 18-2. 64Kb Module Puller (supplied with module kit)

Tweezer Module Puller, P/N9900764

A tweezer-like module puller should be similar to the one shown below. It is used to remove the memory modules.
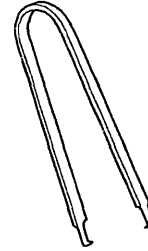
LEX40060

Figure 18-3. Tweezer-like Module Puller

Printer Adapter Wrap Plug, P/N8529228
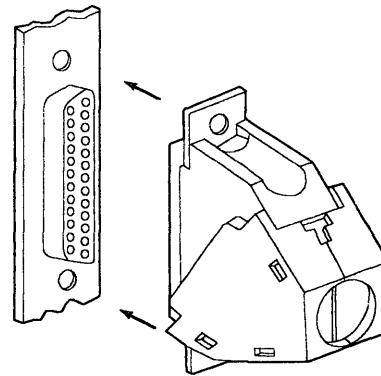
LEX40061

Figure 18-4. Printer Adapter Wrap Plug

Serial Port Wrap Plug, P/N8286126
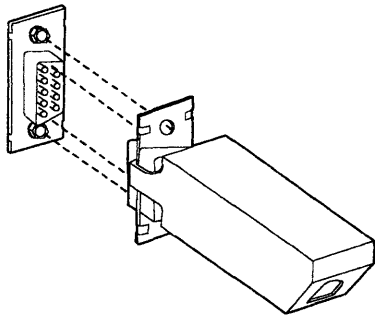
LEX40062

Figure 18-5. Serial Port Wrap Plug, 5170 Only

Communications Adapter Wrap Plug, P/N8529280
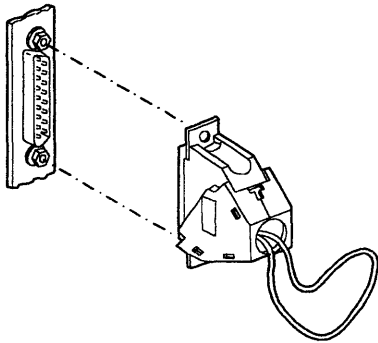
LEX40063

Figure 18-6. IBM Communications Adapter Wrap Plug

Wrap Plug, P/N72X8546

The Tri-Connector wrap plug is for use with the advanced diagnostics tests.

The Tri-Connector wrap plug replaces the following:

- Printer Adapter wrap plug, P/N8529228
- Serial Port wrap plug, P/N8286126
- Communications Adapter wrap plug, P/N8529280
- Communications wrap plug 25-pin, P/N62X1083
- Communications wrap plug 9-pin, P/N62X1084.
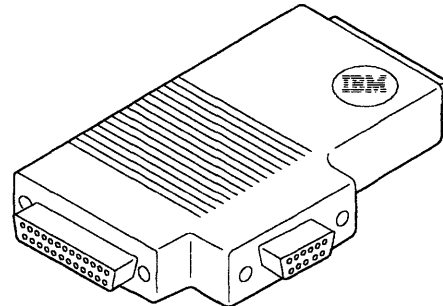
LEX42360

Figure 18-7. Tri-Connector Wrap Plug

Wrap Plugs

Part No.	Description
6323481	Cluster Wrap Plug
6323712	Data Aquisition and Control Wrap Plug
62X1083	2.04 Communications Wrap Plug

Figure 18-8. Wrap Plugs

Various Other Tools

Part No.	Description
0453473	Pin Aligner
1785931	Cable Screwlock Assembly
6447190	Diskette Drive Insert
6023451	5.25-inch SSDD Scratch Diskette
6023450	5.25-inch DSDD Scratch Diskette
6109660	5.25-inch DSHD Scratch Diskette
6404095	3.5-inch DSDD Scratch Diskette
6404078	3.5-inch DSHD Scratch Diskette

Figure 18-9. Other Tools

Cluster Terminating Plug, P/N6320352
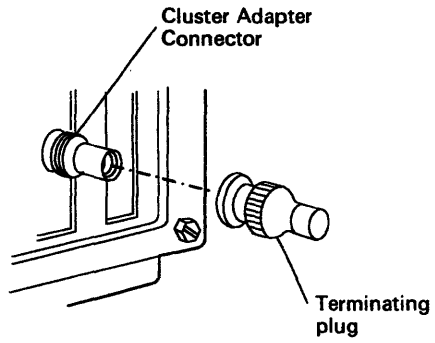
LEX40064

Figure 18-10. Terminating Plug

Industrial Computer Wrap Plugs

Part No.	Description
6421776	Communications Adapter Wrap Plug (25-Pin)
6426129	RS232 Wrap Plug (9-Pin)
6421655	Current Loop Wrap Plug (9-Pin)

Figure 18-11. 5531 Wrap Plugs

Chapter 19. Engineering Change Announcements (ECAs)

This chapter addresses Engineering Change Announcements (ECAs) available for IBM Personal Computer system units and associated I/O devices. ECAs are used to communicate field programs and include error symptoms and corrective action. All PC ECAs are Service Code 33 and should be made available to the customer at no charge.

To qualify for an ECA, the following conditions must be met:

* The machine type and model must match that in the ECA.
* The machine must fall within the affected serial number range, if applicable.
* The conditions in the Detail section of the ECA must agree with the machine configuration; for example, a 20Mb fixed disk drive, manufactured by XXX at level 00X, installed in a 51XX machine type with a serial number of 1234567.

All Personal Computer ECAs are released under the 5150 machine type. The specific machines affected are noted in the ECA.

Note: IBM reserves the right to cancel or change the conditions of an ECA without notice. The ECAs listed in this chapter were current at the publication date of this document. To ensure that you have the most current information, refer to the IBM Hardware Support Facility data base, accessible via RETAIN. To get printed or microfiche copies of ECAs, subscribe to Service Memorandum, Group 819 (S230-9053 for a printed copy, or S200-9053 for a microfiche copy). Orders should be placed through the branch office SLSS coordinator.

Index

ECA001

AS REQUIRED
AVAILABLE
ORDER FROM
PLANT OF CONTROL

85-02-27|REV. 86-12-03
SERVICE CODE 33
82-01-13
LOCAL
BOCA RATON

Purpose

Color Monitor will not Display Color

Early level 5150 machines may not work properly with
the color graphics adapter installed. The color monitor
will not display color but will display black and white.
This problem may occur with system boards
P/N8529205 or P/N8529299.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150		Color Graphics Adapter	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	0.5	0.5

Detail

If color cannot be achieved by adjusting the color
potentiometer on the system board per the Hardware
Maintenance and Service Manual, clip off capacitor C1
on the system board and readjust the color
potentiometer. C1 is located between the system board
power connectors and the color potentiometer and is
labeled C1 on the system board (see the LOCATIONS
section of the Hardware Maintenance and Service
Manual for system board power connectors and color
potentiometer locations).

Dispose of capacitor C1 locally. Record all time to
Service Code 33, ECA001, other branch office 990.

ECA002

AS REQUIRED
AVAILABLE
ORDER FROM
PLANT OF CONTROL

85-02-27|REV. 86-11-05
SERVICE CODE 33
83-02-01
LOCAL
BOCA RATON

Purpose

Replace 16/64K system board having a buffer overrun
problem with a current level 16/64Kb system board.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150		16/64K System Boards Only	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	01.0	01.0

Prerequisites

None

Companion

None

Concurrent

None

Detail

When entering information from the keyboard and the
keyboard buffer is exceeded, there is a chance that a
character may be lost, substituted, or the application may
lockup. If this happens, perform the following: Run the
diagnostics to be sure it is not a keyboard or some other
failure. If it determined that there is no other failure,
replace the system board with a current level board.

Notes

Record time and material using Service Code 33,
ECA002, other office worked 990.

ECA003

AS REQUIRED
AVAILABLE
ORDER FROM
PLANT OF CONTROL

85-02-27|REV. 86-11-05
SERVICE CODE 33
83-09-16
LOCAL
BOCA RATON

Purpose

Replace 32K, 64K, or 64/256K memory expansion cards having intermittent parity 2 check errors that cannot be found with diagnostics and fails only under customer application software.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150 5160		IBM Memory Expansion IBM Memory Expansion	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Prerequisites

None

Companion

None

Concurrent

None

Detail

For machines experiencing false parity check 2 errors, install the current version of the 64/256K card. Expansion cards sold after July 15, 1983, will not exhibit this problem. Order parts through normal distribution.

Notes

Record time and material using Service Code 33, ECA003, other office worked 990.

ECA004

	85-02-27|REV. 86-12-03
AS REQUIRED	SERVICE CODE 33
AVAILABLE	83-09-16
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Installation of the Personal Computer Math Coprocessor feature requires the replacement of the 8088 processor module on the system board and the addition of an 8087 Math Coprocessor.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150		Math Coprocessor	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Prerequisites

None

Companion

None

Concurrent

None

Detail

If the 8088 processor is soldered to a 16/64K system board (P/N8529205 or P/N8529238), preventing installation of a new 8088, the board must be replaced with a new 16/64K system board from stock. Record the action as Service Code 33, ECA004, and other office worked 990.

ECA005

	86-10-08|REV. 86-12-03
AS REQUIRED	SERVICE CODE 33
AVAILABLE	85-02
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Correct communication-related problems, when using DSEA, that are not able to be determined using advanced diagnostics.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150 5160		Display Station Emulation Adapter (DSEA)/System Board	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	01.0	01.0
	01.0	01.0

Physical Check

AMD-manufactured processor without module 74LS32 located in position U101 (5150), U90 (5160), or spare.

Prerequisites

None

Companion

None

Concurrent

None

Detail

Some PC and PC XT™ communication-related problems cannot be resolved with normal diagnostics when the display station emulation adapter (DSEA) is installed. Symptoms include, but are not limited to: No communication at all; one or more units dropping offline at any time; seemingly unrelated error codes (301, 516, 508, 548, and others) at various times or simultaneously on a single unit. If all async, bisync, SDLC and/or DSEA parameters are correct, look at the system board to identify the processor module located in position U35 (5150) or U28 (5160). If the module is an AMD 8237 or 9517, look for the presence of 74LS32 module in one of the following locations on the system board. On the 5150 system board, the 74LS32 module will be located in position U101 or the "spare" position. On the 5160 system board, the 74LS32 module will be located in position U90 or the "spare" position. System boards without the 74LS32 module in one of the above locations, that are experiencing problems with DSEA, should be replaced.

Notes

Order parts through normal distribution. All down level parts have been purged.

Record all time and material to Service Code 33, ECA005, or other office worked 990.

ECA006	SAFETY
AS REQUIRED AVAILABLE ORDER FROM PLANT OF CONTROL	85-02-27|REV. 86-11-05 SERVICE CODE 33 84-10 LOCAL BOCA RATON

Purpose

Replaces possible defective ASTEC power supplies in 5160.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5160		All with ASTEC P Supply	
5271		Same as above	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	1.0	1.0
	1.0	1.0

Prerequisites

None

Companion

None

Concurrent

None

Detail

A potential defect exists in 5160 ASTEC power supplies using Sanyo fans. These power supplies can be identified by checking for silver rivets on the plug receptacles at the rear of the power supply. (Zenith power supplies will have black rivets). If the supply has silver rivets, remove the cover and look through the fan grill. Sanyo fans will have their label visible through this opening. These power supplies must be replaced. Be sure the new supply does not have a Sanyo fan.

Refer to the Hardware Maintenance and Service Manual, Personal Computer XT™ section for power supply removal/replacement procedures.

The inspection and repair is to be accomplished at the customer location.

Record all time and parts using Service Code 33, ECA006, other branch office 990. All power supplies removed must be returned to Greencastle with the machine type and serial number of the customer's machine attached. This may be done with a piece of tape, but do not mark the power supply itself. The affected machines were manufactured between November 9, 1983 and November 23, 1983 and will be identified to NSD by the marketing branch office. If the machine cannot be located, NSD will notify marketing and complete the service data using Code 33 Complete and Activity Code 07.

ECA007

	85-02-27|REV.86-04-23
AS REQUIRED	SERVICE CODE 33
AVAILABLE	N/A
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

This ECA is reserved for future use.

ECA008

	85-02-27
AS REQUIRED	SERVICE CODE 33
AVAILABLE	84-04-04
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Speaker Noise

Eliminate speaker noise 5150 Personal Computers caused by noisy power supplies.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150	All		

B/M Installed	Service Hours	System Hours
	0.5	0.0

Detail

5150 Personal Computers experiencing speaker noise due to noisy power supplies can be fixed by installing a new level system board. New level system boards contain additional filtering to eliminate speaker noise. The new system boards can be identified by a three digit number (740, 752, 750, 751, or 747) stamped on the top side of the board. Order parts through normal distribution, all down level parts have been purged from stock. Charge all time and materials to Service Code 33, ECA008, other branch office 990.

ECA009

	85-02-27|REV. 86-12-03
AS REQUIRED	SERVICE CODE 33
AVAILABLE	85-02
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Printer adapter cards not supporting interrupt software.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150 5160 5161		Monochrome Printer Adapter and Parallel Printer Adapter	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	0.5	0.5
	0.5	0.5
	0.5	0.5

IBM ECA
Engineering Change Announcement

Prerequisites

None

Companion

None

Concurrent

None

Detail

Early level monochrome display printer adapter and parallel printer adapter cards did not support interrupt driven print software. New level cards that support printer interrupts were released in January, 1983. If you have a customer with an 8100 PC adapter who is experiencing a problem and all diagnostics have run correctly, suspect that you have an early level card and replace it. Most early level cards can be identified by the black mounting bracket. Current level cards have a silver bracket. Record all time and material to ECA009, Service Code 33, other branch office 990.

Notes

Order parts through normal distribution. Down level parts have been purged.

ECA010

	85-10-23|REV. 86-11-05
AS REQUIRED	SERVICE CODE 33
AVAILABLE	84-10-04
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Eliminate keyboard lockup when using a 370 or 3270 option with a Binary Synchronous Communications Adapter (BISYNC) installed.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150 5160 5271		3270 PC Emulation; PC XT/370; 5271; with BISYNC Adapter	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5
	00.5	00.5
	00.5	00.5

Physical Check

B4 land shorted to B3.

Prerequisites

None

Companion

None

Concurrent

None

Detail

A limited number of BISYNC adapters reached the field with the B4 edge connector land shorted to the B3 land. This will cause a malfunction when interrupt 2 is used in conjunction with the BISYNC adapter. The only products currently using interrupt 2 are PC XT 370, 3270 PC Emulation, and 5271.

If keyboard lockup occurs after configuring a machine with a 370 or 3270 option and a BISYNC adapter, the problem is most likely the BISYNC adapter. Bad adapter cards can be identified as follows:

1. Look at the solder side of the card.
2. Locate the card edge connector (connector that plugs into the system board).
3. Hold the card so that the gold lands of the edge connector are to the right of the RS232 connector.
4. Count the gold lands from left to right to the fourth (B4) land.
5. If the fourth land connects to the third land (B3), the card is defective.

If the BISYNC adapter card is defective, replace it with the new level card, P/N8286098. Field stock has been purged of down level cards, P/N8529296, and orders for this card will be subbed to the new P/N.

Notes

Record all time and materials to Service Code 33, ECA010, other branch office 990.

ECA011

	85-10-23|REV.86-11-05
AS REQUIRED	SERVICE CODE 33
AVAILABLE	84-01
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Replace down level extender card with up level card when false 1813 error codes occur while running customer problem determination or advanced diagnostics.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150 5160 5271		3270 PC* PC XT™/370* All*	

* When Attached to a 5161 Expansion Unit

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Prerequisites

None

Companion

None

Concurrent

None

Detail

When the 370 PC "XT" or the 3270 option has been installed in a PC or PC "XT" which has an expansion unit, an 1813 error indication will be generated while running CPAR or advanced diagnostics. The 1813 error indication will only be generated when running CPAR or advanced diagnostics. This error does not ordinarily occur in base PC or PC "XT" with expansion units. If this 1813 error occurs, it is probably due to a down level extender card P/N8529252. All stock in Greencastle has been purged and replaced with the up level card P/N6323445.

If the 1813 error occurs on machines with expansion units and the 3270 or the 370 PC "XT" option installed, replace the extender card with the up level card. Charge to ECA011, branch office 990, Service Code 33.

ECA012

	85-10-23|REV. 86-12-03
AS REQUIRED	SERVICE CODE 33
AVAILABLE	85-05
ORDER FROM	LOCAL
PLANT OF CONTROL	PRINCETON

Purpose

Potential compatibility problem between enhanced 5250 display station emulation adapter (EDSEA) and the basic color graphics adapter (BCGA) (P/N8529146) resulting in graphics distortion.

Prerequisites

None

Companion

None

Concurrent

None

Detail

BCGA users with a medium resolution color monitor (IBM 5153 or equivalent) may notice distortion along the borders between colors when operating in graphics mode with an EDSEA card installed. The level of distortion will vary depending upon a number of factors (all of which are beyond the service representative's control).

The problem can be diagnosed by running advanced diagnostics - color/graphics monitor test - 320 x 200 graphics. If the problem is present, distortion is apparent on the first screen along the vertical line where the green and red or red and yellow blocks meet. At its worst, distortion is only two columns wide.

The fix is to replace the BCGA card (P/N8529146). Do not replace the EDSEA card.

All time and parts required to resolve this problem should be written as ECA012, Service Code 33, other branch office 990, against the appropriate Personal Computer (PC) machine type. Parts replaced as a result of this ECA should be returned via RMER to:

IBM ECA
Engineering Change Announcement

IBM Corporation
107 College Rd.
Princeton, NJ 08540
ATTN: Mark Raines
17-616-04-E5

ECA013

	85-10-23|REV. 86-11-05
AS REQUIRED	SERVICE CODE 33
AVAILABLE	85-06
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Early level professional graphics controllers (PGC), FRU P/N6181765, may be subject to communication difficulties when installed in a system with communication adapters. Affected PGCs may limit transmission speed to 300 baud. Text received at higher speeds may be garbled. The current level of PGC allows transmission speeds up to 9600 baud.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5160 5161 5170		System Units with Communication Adapters and PGC Installed	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Physical Check

Early level cards have the "ASSY" number 6323697 printed on the left edge of the component side of the memory card (the only card whose component side is completely visible). Later level cards have the 6323697 covered and the "ASSY" numbers 6448811 or 62X0914 printed under the J2 connector. J2 is located in the upper left component side of the same card.

Prerequisites

None

Companion

None

Concurrent

None

Detail

The current level card corrects these communication performance problems by allowing line speeds up to 9600 baud. Early level cards ("ASSY" number 6323697) that exhibit these communication limitations should be replaced with the new FRU P/N62X0912. Order part number 62X0912 through normal parts distribution. Record all time and materials using Service Code 33, ECA013, other office worked 990.

Notes

PGCs with the "ASSY" number 62X0914 are the only level PGC that will operate in the PC AT® Model 339. The Model 339 uses a 8 mhz system clock and requires the 62X0914 ASSY to operate.

ECA014

	85-11-20|REV. 86-11-05
AS REQUIRED	SERVICE CODE 33
AVAILABLE	85-07
AUTOSHIPPED FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

A faulty component on the Fixed Disk/Diskette Drive (FD/DD) Adapter Card (P/N8286125) may cause difficulties with storing or retrieving information from the fixed disk.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5170		5170 Fixed Disk/ Diskette Drive Adapter Card P/N8286125	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Prerequisites

None

Companion

None

Concurrent

None

Detail

The customer support program for the fixed disk/diskette drive adapter card has expired and has been replaced by 5170 ECA014. A faulty component on less than 10% of fixed disk/diskette drive (FD/DD) adapter cards for the 5170 Personal Computer (P/N8286125) may cause difficulties with storing or retrieving information from the fixed disk drive.

Machines affected are in the following serial number ranges:
Within S/N range 5019001 to 5141250 (Model 068)
         or   0054001 to 0146900 (Model 099).

In addition to machines within the listed serial number ranges, any 5170 that has had a FD/DD card replaced before 07-19-85 may also have the problem.

Be sure to "Prepare the Fixed Disk Drive for Relocation" using the advanced diagnostics diskette option if the machine must be moved for service.

Fau!··· components can be identified as follows: Look at the component side of the FD/DD adapter card and locate the module in position U-19 (See diagrams contained in this TIP.) This module may be seen without removing the FD/DD card from the machine. If it is necessary for you to remove the FD/DD card from the machine in order to seee the module, caution is necessary when removing or inserting the card. The card guide located on the front frame may damage components on the card (replacement cards come with a redesigned card guide). If the module in position U-19 has a Texas Instruments logo, look at the bottom row of numbers printed on the module. If the bottom row of numbers ends with a "-10" suffix, the FD/DD card P/N8286125 must be replaced.

See diagrams below.
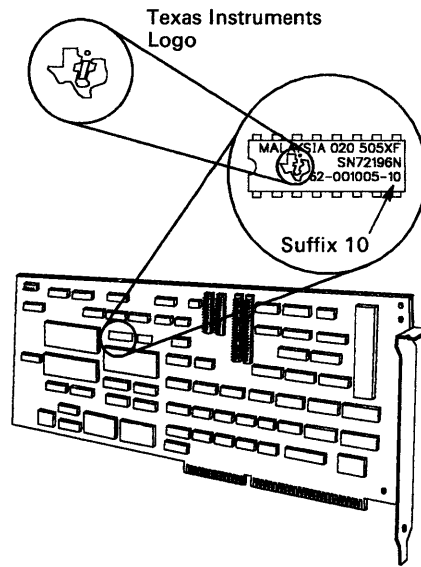
LEX40863

Return defective cards utilizing existing local procedures.

Record time and parts using Machine Type 5170, Service Code 33, ECA014, other branch office 990.

ECA015

	85-11-20|REV. 86-11-05
AS REQUIRED	SERVICE CODE 33
AVAILABLE	85-09-25
AUTOSHIPPED FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Provide a replacement diskette drive (360Kb) for DOS disk copy problem on unformatted target diskettes.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150 5160		All Machines with Type 3 Diskette Drive	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5
	00.5	00.5

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Physical Check

Refer to System Hardware Maintenance and Service (HMS) manual for drive identification.

Prerequisites

None

Companion

None

Concurrent

None

Detail

DOS disk copy may not function correctly under certain unique circumstances when using the same diskette drive for both source and target diskettes on the PC (5150) and PC XT™ (5160). The DOS disk copy procedure may not function correctly on a Personal Computer or Personal Computer "XT" which has a Type 3 diskette drive(s), less than 416Kb of memory and is using an unformatted target diskette.

To prevent this problem, use formatted target diskettes when running disk copy.

After using disk copy, a directory should be run to ensure all files were copied.

If using formatted diskettes is not an acceptable solution, exchange the diskette drive. Order parts through normal distribution. Record all time and material to Service Code 33, ECA015, other office 990.

ECA016

	85-11-20|REV. 86-11-05
AS REQUIRED	SERVICE CODE 33
AVAILABLE	85-10
AUTOSHIPPED FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Correct a potential problem on Personal Computer AT® (5170) with two diskette drives installed. See Detail for problem definition.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5170		5170 with 1.2Mb Installed, P/N8286130	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Prerequisites

None

Companion

None

Concurrent

None

Detail

A 5170, with two diskette drives installed, may experience diskette problems on the 1.2Mb drives.

A combination of changing diskettes and accessing the drives may cause the diskette drive change latch to be erroneously reset.

This could happen only if the user:

* Has diskettes in drives A and B
* Performs an operation on the diskette in drive A
* Changes diskettes in drive A (diskette change latch set)
* Performs an operation on diskette in drive B (accessing drive B which will cause the diskette change latch for drive A to be reset).

The next operation performed on the diskette presently in drive A could use the file allocation table and directory of the diskette that was previously in drive A. This could result in the file allocation table, directory, or data to be overwritten.

If the above symptoms occur, inspect the manufacturer's label on the rear of the drive. If numbers printed below the bar code are 345XXXXXX or 346XXXXXX (Xs may be any number) and there is not a second label on back of the drive with P/N59X7184, replace the drive(s). The

360Kb drive is software controlled and is not affected. Record all time and material to Service Code 33, ECA016, other office 990.

ECA017

	86-06-04|REV. 86-11-05
AS REQUIRED	SERVICE CODE 33
AVAILABLE	86-04
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Provide a replacement Enhanced Graphics Memory Expansion Card.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150 5160 5170		All Machines Containing an EGA Memory Expansion Card	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5
	00.5	00.5
	00.5	00.5

Physical Check

Early level cards are identified by P/N1501531 etched on the back (or solder side) of the card. Current levels of the card have various other numbers etched on the back of the card.

Prerequisites

None

Companion

None

Concurrent

None

Detail

Early level EGA Memory Expansion Card may cause the display to change colors unexpectedly. This primarily occurs when using certain graphics applications such as "PC Paintbrush" and "Drawing Assistant." This condition can be corrected by replacing the Memory Expansion Card (P/N6323468). Early level cards are identified by P/N1501531 being etched on the back (or solder side) of the card. Record all time and materials using Service Code 33 and ECA017. Other office worked - 990.

ECA018

	86-06-04|REV. 86-11-05
AS REQUIRED	SERVICE CODE 33
AVAILABLE	86-04
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Provide a replacement 5154 Enhanced Color Display for a failing unit.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5154		All Machines with Enhanced Color Displays Falling Within Certain Serial Ranges	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Physical Check

Affected displays are within serial number ranges 0001000 - 0091000 and 1010000 - 1012280 and do not have the characters "A1" following the "Country of Origin" on the rating label.

Prerequisites

None

Companion

None

Concurrent

None

Detail

Some early level 5154 Displays may fail to power up after being installed for a period of time. Displays that exhibit this symptom and fall within the affected serial number ranges may be exchanged with P/N6321035.

Notes

Record all time and materials using Service Code 33, ECA018, other office worked 990. Expiration date is 03-01-87.

ECA019

	86-06-04|REV. 86-12-03
AS REQUIRED	SERVICE CODE 33
AVAILABLE	86-04
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Eliminate high-pitched noise caused by the "IBM-manufactured" 10 megabyte fixed disk.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
4455		10 Megabyte Fixed Disk Drive	
5160			
5161			
5271			
5371			
5531			

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.0	00.5
	00.0	00.5
	00.0	00.5
	00.0	00.5
	00.0	00.5
	00.0	00.5

Physical Check

| The system has an "IBM-manufactured" fixed disk drive with serial number F274092 or lower installed in it.

1. Black cover over disk media.
2. Serial number F274092 or lower on fixed disk.
3. Label on side of drive which reads "WD12."

Prerequisites

None

Companion

None

Concurrent

None

Detail

"IBM-manufactured" 10 megabyte fixed disks with a serial number of F274092 or lower could produce a high-pitched noise from the static eliminator during normal customer operation. This will not cause any operational problems. If your system is exhibiting this noise problem, ensure that all data/programs on the fixed disk are backed up. Replace the fixed disk. The IBM-manufactured fixed disk can be identified by a black cover over the disk area and a label at the rear of the drive which reads "Manufactured by IBM," and a label on the side of the drive which reads "WD12."

Notes

Record all time and material to Service Code 33, ECA019, other office worked 990. The expiration of this ECA is 10/01/87.

ECA020

	86-07-30|REV. 86-11-05
AS REQUIRED	SERVICE CODE 33
AVAILABLE	86-06
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Replace potentially defective 128K Memory Modules (P/N8286139) used on Type 1 system boards (large version) and 512K adapter cards (P/N8286115) when diagnostics indicate a memory module failure.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5170 5273 5373 7531 7532		Type 1 System Boards (Large Version) and 512K Adapter Cards	

Estimated Installation Time

B/M Installed	Service Hours 01.0	System Hours 01.0

Prerequisites

To Install B/M	ECA Required	EC Required	Physical Checks for Prerequisites
			128K Memory Modules with Texas logo numbered 8535 through 8544 labeled with a plant of G.

Companion

To Install B/M	ECA Required	Machine Type	Comments
	ECA021		

Concurrent

None

Detail

Replace Memory Modules (P/N8286139) numbered 8535 through 8544 labeled plant code G that are found on the system board and 512K adapter card using the following information.

```
 ZA1250NL
 **** Gxxx
 singapore
```
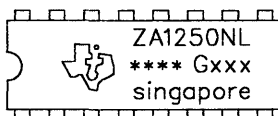
**** = 8535 Through 8544 Numbering

G = Plant Affected

Top Marking Only

The 128K modules (P/N8286139) are located on the system board and the 512K memory adapter card in the areas marked Bank 0 and Bank 1. Refer to the Hardware Maintenance and Service manual PICs or MAPs for bank and module locations. The affected modules do not affect data.

Notes

Order parts locally. Record all time and material to Service Code 33, ECA020, other office worked 990.

All parts replaced must be returned to local parts coordinator for disposition. Please advise them to return green tag parts in bulk to department 5K7 Boca Raton, internal zip 5012.

This ECA will expire on 06/30/88.

ECA021

AS REQUIRED	86-07-30|REV. 86-12-03
AVAILABLE	SERVICE CODE 33
ORDER FROM	86-06-27
PLANT OF CONTROL	LOCAL
	BOCA RATON

Purpose

Replace adapter cards containing potentially defective soldered memory modules and pluggable memory modules on the EGA expansion card when diagnostics indicate an adapter or memory module failure.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
4450 4455 5160 5160 5161 5170 5271 5273 5373 5531 7531 7532		EGA Expansion Card EGA Card PS AT Card PS XT Card XGA Card APA Card Note: Adapters and Modules Apply to All Machine Types.	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	01.0	01.0
	00.5	00.5
	00.5	00.5
	00.5	00.5
	00.5	00.5
	00.5	00.5
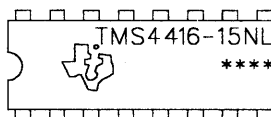
Prerequisites

To Install B/M	ECA Required	EC Required	Physical Checks for Prerequisites
			64K Memory Module with Texas logo numbered 8535 through 8544 labeled with plant code G.

Companion

To Install B/M	ECA Required	Machine Type	Comments
	ECA020		

Concurrent

None

Detail

Replace memory modules numbered 8535 through 8544 that are labeled plant code G when diagnostics indicate a memory module or adapter failure. When the memory modules are soldered, refer only to the number code 8535 through 8544 on the top of the memory module and replace the adapter card if applicable. When the memory modules are pluggable, refer to both top and bottom view and replace all of the affected modules during a repair action. The affected modules do not affect data.

64K Modules Affected

**** = 8535 Through 8544 Numbering

Top View

G = Plant Affected

Bottom View

LEX41852

64K memory module locations are designated by location numbers on the adapter card. Refer to the Hardware Maintenance and Service Manual PICs or MAPs for bank and module locations.

• EGA Memory Expansion Card

  (P/N6323468) has pluggable memory modules. (P/N8654219) located in Bank 01, 02, and 03.

The following adapters have soldered modules:

	Module Positions
EGA Card (P/N8654215)	U1, 2, 10, 11, 40, 41, 50 and 51
APA Card (P/N8654390)	U65, 78, 91 and 103
PS XT Card (P/N8654381)	U10, 23, 36, 49, 62, and 75
PS AT Card (P/N6347752)	U10, 23, 36, 49, 62, and 75
XGA AT Card (P/N2683118)	U11, 12, 24, 25, 38, 39, and 52.

Notes

Order parts locally. Record all time and material to Service Code 33, ECA021, other office worked 990.

All parts replaced must be returned to the local parts coordinator for disposition. Please advise them to return all parts in bulk to Department 5K7, Boca Raton, Internal Zip 5012.

This ECA will expire on 06/30/88.

- Cannot access hard file.
- Invalid data on network/hard file.

If any of the above conditions are present, do the following:

1. Load the 2.20 level of the advanced diagnostic diskette. When the main menu appears, refer to line five of the menu for the ROS date. If the date is 01/10/86, continue with step 2. If the date is not 01/10/86, use the diagnostics to isolate the failure.

2. Power down the system, remove the covers and the network card. Check the network card for the presence of a "4" in the third digit of the bar code label. The label is located at the lower center of the component side of the adapter. If the third digit is a four, replace the system board. Order P/N83X1520 from Greencastle. Record all time and materials using Service Code 33, ECA022, other office 990.

As with all ECAs coded 33, a maintenance agreement is **not** required. This ECA can be applied on-site until 01/31/87, after which the delivery will depend upon the customer's service offering.

Note: Future network adapter options will contain a test diskette to check the BIOS level on the system board. If the test calls for system board replacement, replacement should be performed using this ECA.

ECA022

	86-07-02	REV. 87-01-28
AS REQUIRED	SERVICE CODE 33
AVAILABLE	86-08
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Correct System Board Basic Input/Output storage (BIOS) Module to avert hard file error messages when some IBM PC network cards are installed.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5160		All 5160 Systems which are Installed in a Network, with a System Board BIOS Dated 01/10/86	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.8	00.8

Physical Check

None

Prerequisites

None

Companion

None

Concurrent

None

Detail

Errors may occur when a network adapter which has a bar code label that begins with 064 or 074 is installed in a 5160 with a system board BIOS dated 01/10/86. The error conditions that may occur follow:

- Hard file light stays on.
- Message "Not Ready Reading Drive C."

ECA023

	86-11-05
AS REQUIRED	SERVICE CODE 33
AVAILABLE	86-11
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Inspect power cords for certain data codes shipped with systems purchased between September 1, 1985, and September 23, 1986, to identify cords which may have a cold solder connection on the ground pin.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5170		All Models; Includes 5273 and 5373	

Prerequisites

None

Companion

None

Detail

Some power cords shipped with systems purchased between September 1, 1985, and September 23, 1986, may have a cold solder connection on the ground pin.

Material has been sent to customers providing information on how to identify the suspect power cords. The customer should mail the cord replacement request form as per instructions in order to receive a replacement power cord.

The following procedure should be followed to ensure that service personnel examine 5170 power cords prior to performing any type of service to the machine, as well as inspections for customers who request IBM's assistance.

1. Power off the system and any attached equipment.
2. Remove the AC power cord.
3. Power Cord Identification: Only power cords having a stackable right angle plug with the following characters stamped on the plastic exterior surface along the cord length every twelve inches should be inspected.

   1501677 18-3 TYPE SJT E-3462-C LL-30830 SHIELDED

   This power cord could be used for displays, printers, or other computers. You should therefore check all your power cords with a stackable right angle plug. (see Figure 1.)

   The prongs on the stackable right angle plug end of the cord have a code stamped in the metal at the base of the prong on the inside face. Only cords having one of the prongs stamped with a J7 and the other prong stamped with DN, AO, BO, CO, DO, EO, AP, BP, or CP should be replaced.
   - If the metal prongs have a different code, the cord should not be replaced.
   - If the cord has the above characters on the plastic exterior surface but you cannot read the code on the metal prongs, replace the cord.
   - Suspect power cords should be destroyed.
   - Order parts through normal distribution. Record all time and material to Service Code 33, ECA023, and other office 990.

One Prong	Other Prong
Code	**Code**
DN	J7
AO	
BO	
CO	
DO	
EO	
AP	
BP	
CP	

Plug Prong Coding System
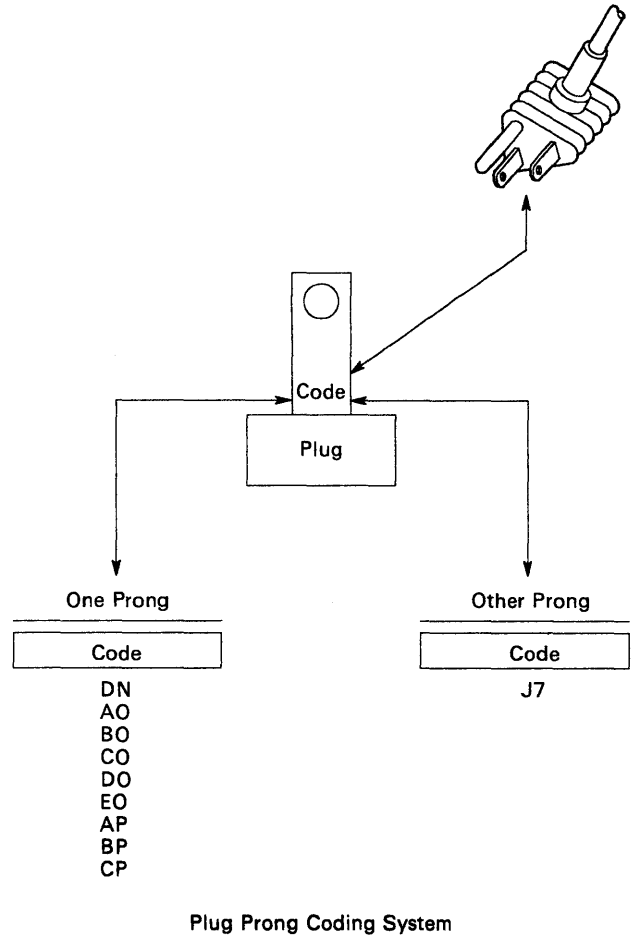
LEX42029

Figure 1.

ECA O24

87-02-11
AS REQUIRED   SERVICE CODE 33
AVAILABLE   86-12
AUTOSHIPPED FROM   LOCAL
PLANT OF CONTROL   BOCA RATON

Purpose

Correct a "parity check 2 ?????" error message which occurs on 5170 Models 068 and 099 containing certain options.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5170		Models 068 or 099 Sys. Board P/N8286112, Enhanced Graphics Adpt 512Kb to 2Mb Memory Expansion Adapter	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	01.0	01.0

Prerequisites

None

Companion

None

Concurrent

None

Detail

The IBM Personal Computer AT® (5170) Models 068 and 099 (serial number range 0000001-5999999) may experience a Parity Check 2 error if it has the following configuration:

1. A system board P/N8286112 containing a BIOS ROS Module date prior to 6-10-85
2. An Enhanced Graphics Adapter
3. And a 512Kb to 2Mb Memory Expansion Adapter.

The "parity check 2 ?????" error message occurs after a soft boot (CTRL, ALT, DEL) is performed. If a machine has the above configuration and error message, replace the system board with P/N6480170. The BIOS ROS module date is displayed in the menu screen of the Personal Computer "AT" (5170) Advanced Diagnostics Diskette, Version 2.04 or later. The ROS date can also be obtained by running the following basic program:

```
10        DEF SEG=&HF000
20        FOR X=&HFFF5 TO &HFFFC
30        PRINT CHR$(PEEK(X));
40          NEXT
RUN
```

Charge time and material to Service Code 33, ECA024, other branch office 990.

Notes

When future service activity requires planar board replacement and ECA024 is installed, P/N6480170 must be used. Therefore, it is recommended that a note to this effect be recorded on the repair history sticker (ZR28-0380)

ECA025

	87-04-08
MANDATORY	SERVICE CODE 33
AVAILABLE	87-03
AUTOSHIPPED FROM	RALEIGH
PLANT OF CONTROL	RALEIGH

Purpose

Replace 4800 Modem RPQ Cable P/N6164957 containing defective shielding. Cable being twisted can cause cable leads to ground to the shield and render the modem inoperable. This cable is only installed in one unique customer set using the RPQ4800 Modem. Any cable without a February 10, 1987 or later sticker on the cable at either connector end should be replaced.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5170		Model 849 Feature 8030	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Physical Check

If 4800 Baud Feature Modem B/M6164855 is on your 5170 Model 849 Store System Controller, cable P/N6164957 will be going to the multi-protocol adapter card (MPCA). The MPCA connector is a 25-pin EIA connector and the modem end has a 15-pin EIA connector. All cables without a quality sticker dated 2/10/87 or later should be replaced.

Prerequisites

RPQ FC 8030 installed on a Model 849 Store System Controller.

Companion

None

Concurrent

None

Detail

If cable sticker indicates date earlier than 2/10/87, run customer diagnostics for 4800 Modem using GTO and diagonal disk at site. Then power off 5170 and detach EIA cable from MPCA card and also from 4800 card at rear of 5170. Place new cable in position and connect one end to MPCA card and other end to 4800 card. Power on 5170 and verify BAT run is OK. Run 4800 diagnostic again and have your site polled by Central Site CPU to verify host site communications are good.

Notes

NSD Central Site in Columbus, Ohio will be shipping replacement cables to your branch office. If, by 3/16/87, cables are not received for your store site, you should call the Customer Help Desk and talk to the NSD installation team. The phone number is (800)848-2247. Record time to Service Code 33, ECA025, other office worked D6D. All removed cables must be returned to P.O. Box 12195, R.T.P., NC 27709. Attention: John Todd — use Internal Mail.

ECA026

	87-05-06|REV 87-07-29
AS REQUIRED	SERVICE CODE 33
AVAILABLE	87-04
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Correct the problem of Personal Computers dropping offline on a cluster network. This problem is prevalent when more than 12 PCs are attached or the distance between PCs is greater that 100 feet.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5150		Cluster Network	
5155		Cluster Network	
5160		Cluster Network	
5170		Cluster Network	
4860		Cluster Network	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5
	00.5	00.5
	00.5	00.5
	00.5	00.5
	00.3	00.0

Physical Check

See Detail.

Prerequisites

None

Companion

None

Concurrent

None

Detail

If the customer is experiencing problems as described in purpose section, then remove the cluster card from the system unit and check for the following:

* For Machine Types 5150, 5155, 5160, and 5170, remove the card from the system unit and locate the Modules U15 and U16. The number printed on U15 should S/N74S08 and the number on U16 should be S/N743S2. If the numbers are different, then order P/N6323472 and replace the card.

Ballpoint Pen

Ballpoint Pen

Slide Switch

OR

Rocker Switch

1 2

U15 U16

SN 74S08

SN 74S2

LEX42306

- The cluster card for the 4860 is not affected by this EC.

- If the coax cables were purchased from IBM, the customer should check all cables for the word "Phalo or Belden." If either of these words is printed on each cable, the cable is good. If neither of these words is printed on each cable, order the necessary quantities of cables. It is the customer's responsibility to install or have the cable installed.

  The P/N for the cable kit is P/N6323575, and consists of two coax cables: one 9.1 meters and one 3 meters in length.

Notes

Order parts through normal distribution.

Record all time and material to Service Code 33, ECA026, other office worked 990.

Return cables to branch office to be disposed of locally, and return cards through the normal channels.

Expiration date for this ECA is May 1, 1988.

SAS keywords: PCOMECBM 5150SYSECBM 5155SYSECBM 5160SYSECBM 5170SYSECBM

ECA027

EC A72641A   87-06-03
MANDATORY   SERVICE CODE 33
AVAILABLE   87-04
AUTOSHIPPED FROM
PLANT OF CONTROL   BOCA RATON

Purpose

Replace existing telephone cable in the 5126 which may contribute to failures during communication sessions.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5126 001		Internal Modem	B/M6447486
5126 002		Internal Modem	B/M6447485

Estimated Installation Time

B/M Installed	Service Hours	System Hours
B/M6447486	00.6	00.6
B/M6447485	00.6	00.6

Prerequisites

None

Companion

None

Concurrent

None

Detail

The telephone cable or cables being replaced connect to the Internal Modem Adapter, normally installed in I/O slot no. 1. This is a mandatory EC which will be autoshipped to all systems affected. In some cases, it will be shipped with the model upgrade MES K21987 (EC KH1200A, EC KH1202A) which converts a 5126 Model 001 to a 5126 Model 002.

Notes

Machines affected: All 5126s below S/N13001. Record all time to Service Code 33, ECA027, EC A72641A.

ECA028

	87-06-03
AS REQUIRED	SERVICE CODE 33
AVAILABLE	87-04
ORDER FROM	LOCAL
PLANT OF CONTROL	BOCA RATON

Purpose

Replace some PCjr™ color monitors (4863) that may be subject to arcing from the picture tube connector to the printed circuit board ground plane attached to the picture tube.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
4863		"PCjr" color displays	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Physical Check

4863 Color Monitors in the serial number range 140001-201102, which exhibit picture flicker and sounds of crackling (arcing).

Prerequisites

None

Companion

None

Concurrent

None

Detail

Arcing may occur in rare environmental conditions with symptoms of crackling sound and picture flicker. Any display with the stated characteristics should be replaced and the failing monitor returned to the parts distribution system for repair. This is not a safety problem, as the grounding path is confined to the internal machine ground.

Notes

Record all time and material using Service Code 33, ECA028, and other office worked 990. Return all defective displays to the parts distribution system for repair.

ECA029

EC A589130	88-03-23
MANDATORY	SERVICE CODE 33
AVAILABLE	87-06
AUTOSHIPPED FROM	RALEIGH
PLANT OF CONTROL	BOCA RATON

Purpose

5170 Store Controllers, Models 839, 849, and 899, are affected. This EC is part of a field upgrade of both the 5170 Store Controller and the 4683 terminals. The 4683 ECs are EC A58903 (printer) and EC A58977 (keyboard). The 5170 EC consists of installing a new EPROM on the loop adapter. The old EPROM is to be returned via a mailer that is included with the EC.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5170	B/M6347798	Models 839, 849, 899	B/M67X0895

Estimated Installation Time

B/M Installed	Service Hours	System Hours
B/M67X0895	00.3	00.3

Physical Check

An online procedure is given in the FB/M instructions to determine the EC level of the EPROM that is installed on the loop adapter.

Note: This procedure only applies to the first loop adapter. If there are two loop adapters installed in the controller, a visual inspection may be required.

Prerequisites

None

Companion

*   EC A58903, 4683 ECA001, Printer Change,
    B/M83X8273
*   EC A58977, 4683 ECA002, Keyboard Change,
    B/M83X8256.

It is considered appropriate to arrange to install the 4683
ECAs and the 5170 ECA, if required, at the same time.
Refer to 4683 ECA001 and ECA002 for information on
the printer and keyboard changes.

Concurrent

None

Detail

The new EPROM contains a change which will improve
loop response timings.

The FB/M provides instructions to remove the EPROM
using a blade screwdriver. Module puller, P/N9900764,
may also be used.

Notes

Reporting Instructions

Record this ECA using the following:

*   Service Code: 33
*   ECA029
*   Other office worked: EBR.

Refer to the memo, General Accounting Instruction NSD
8 for additional NSD branch office accounting informa-
tion this and associated ECAs will be shipped to the
NSD SE branch offices. This TDR will be updated to
reflect which FB/Ms can be obtained from
Mechanicsburg.

ECA030

	88-03-23
AS REQUIRED	SERVICE CODE 33
AVAILABLE	87-07
ORDER FROM	
PLANT OF CONTROL	BOCA RATON

Purpose

Correct the problem in which the 1.2Mb diskette drive
will not read or write diskettes in 1.2Mb mode when
there are two diskette drives installed in the system unit
and drive B is a 3.5-inch, 720Kb drive. This problem only
occurs if the 1.2Mb drive installed in position A is manu-
factured by ALPS for IBM.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5170 319 339		Personal Computer	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.8	00.8

Physical Check

Check the 3.5-inch diskette drive for the manufacture
name Toshiba. If the drive is manufactured by Toshiba
the name can be located on the circuit card on the
bottom of the drive or in some cases on the aluminum
casting. Check the circuit card located on top of the drive
for land patterns going to card connectors 2 and 4. (See
Figure 1 located in the Prerequisite section.) Also there is
a label on the rear of the drive (not on the tray). The
information on the label is as follows: Made in Japan
FDD XXXXXXXXX F0X No. XXXXXXXXXX Fuji Toshiba
Corporation.

Note: The Xs could be any number or combination of
numbers or letters. If the F0X located on the second line
is F02, F03, or F04, the drive should be replaced if the
system demonstrates the problem as described in the
Purpose section. With the drive installed in the tray, the
label is difficult to see, so you may have to reference
Figure 1.

Prerequisites

None

```
Land Pattern to Card Edge Connector -2-
|
|   (This card located on top side of 3.5"
|     diskette drive)
|
|   O---
|       |  <--- Land Pattern to Card Edge
|   O   |         Connector -4-
|   |   |
|-->|   |
|   |   |
___|   |
   |_   U U U U U U U U U U U U U U U  _|
       2 4                             40
```
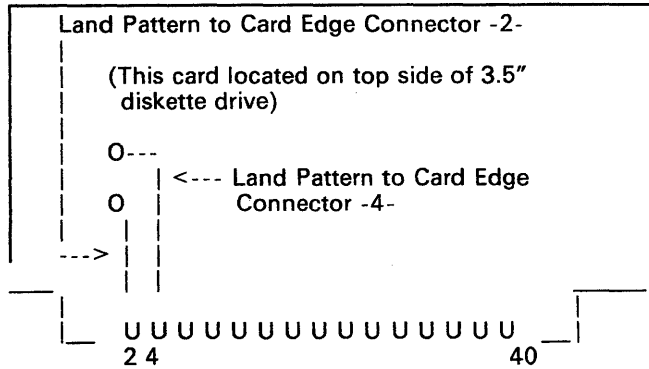
Figure 1.

Companion

None

Concurrent

None

Detail

If the drive is as described in the Physical Check section, replace the 3.5-inch diskette drive with P/N6820821.

Notes

Order parts through normal distribution. Record all time and material to Service Code 33, ECA030. Other office worked 990.

Return diskette drive as per normal branch office procedures.

ECA031

88-03-23

Purpose

This ECA is released for sequence purposes only.

ECA032

EC A72644A   88-03-23
MANDATORY   SERVICE CODE 33
AVAILABLE   87-11
AUTOSHIPPED FROM
PLANT OF CONTROL   BOCA RATON

Purpose

Revise the 5126-2 Maintenance Information Manual Parts Catalog. Insert the read error log utility documentation into the MIM. Provide a scratch diskette when running diagnostics. Provide a printer test kit to be used to test the print quality of the printer.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5126		MIM Update	B/M6447514

Estimated Installation Time

B/M Installed	Service Hours	System Hours
B/M6447514	00.3	00.3

Physical Check

Verify that the 5126-2 Maintenance Information Manual is the correct level. The top of the first white page should read "IBM 5126-2 Technician Terminal" and the back of that page should read "First Edition (December 1986)".

Prerequisites

None

Companion

None

Concurrent

None

Detail

Replace/insert pages in the Maintenance Information Manual. Replace the diskette holder in the MIM. Add a scratch diskette to the MIM. Add a printer test kit to the ship-group. This is a mandatory EC that will be autoshipped to all systems affected.

Notes

Record all time to Service Code 33, ECA032.

ECA033

88-03-23

Purpose

This ECA is released for sequence purposes only.

ECA034

EC101034	88-03-23
MANDATORY	SERVICE CODE 33
AVAILABLE	88-03
AUTOSHIPPED FROM	FSD
PLANT OF CONTROL	GAITHERSBURG

Purpose

Improve memory retention by installing the latest level CLC/PC Communications Adapter Card, P/N113A943, used by the IRS/IDRS Program.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5160 5170 8530			

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	01.0	01.0
	01.0	01.0
	01.0	01.0

Physical Check

Verify the level of the CLC/PC Communications Adapter Card. Using Figure 1, inspect the pinside of the adapter for the presence of a capacitor. If the capacitor is present, do not replace the CLC/PC card. If the capacitor is not present, use Figure 2 to determine if the adapter is a down-level card by inspecting the numbering on the three PALs (CHIPs). Down-level cards will have an A at the end of the number, for example: 9113-A. New level cards will have a B at the end of the number. Replace.

Prerequisites

To Install B/M	ECA Required	EC Required	Physical Checks for Prerequisites
		EC101034	

Companion

None

Concurrent

None

Detail

Record the card serial number of the old CLC/PC card. The card number will be used to update the cluster configuration.

Notes

Order CLC/PC Communications Adapter Card, P/N113A943, through normal distribution. Record all time and material to Service Code 33, ECA034, and other office T46.

ECA035

EC843548	88-03-23
AS REQUIRED	SERVICE CODE 33
AVAILABLE	88-02
ORDER FROM	ROCHESTER
PLANT OF CONTROL	ROCHESTER

Purpose

Correct a timing problem between the Personal Computer D/T5162 and the adapter card, P/N69X6905, for D/T6157.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5162		Tape Adapter D/T6157	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Physical Check

On Personal Computer D/T5162, verify that P/N92X6063 is installed, if D/T6157 is attached to the system unit.

Prerequisites

None

Companion

None

Concurrent

None

Detail

If the customer is experiencing invalid errors during read/write operations, remove the tape adapter card from the system unit. If the tape adapter card is not P/N92X6063, order this part number and replace the original card with P/N92X6063.

Notes:

1. Order parts through normal distribution.
2. Record all time and material to Service Code 33, ECA035, and other office worked 990.
3. Return cards through the normal channels. Expiration date for this ECA is December 31, 1988.

ECA036

	88-03-23
AS REQUIRED	SERVICE CODE 33
AVAILABLE	88-02
ORDER FROM	
PLANT OF CONTROL	55

Purpose

Install an arc shield on the CRT base card to prevent or eliminate arcing between components on the card.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5373		Model C01 Color Display	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Prerequisites

None

Companion

None

Concurrent

None

Detail

To install the mylar shield, P/N1887965 first locate and remove the CRT base card. Reference the 3270 Personal Computer AT/GX or GX Maintenance Information manuals for removal and replacement instructions. Now locate the focus potentiometer secured to the card by two clips attached to its base (see diagram). Remove the focus potentiometer by carefully unclipping it from beneath the base and insert the shield between the potentiometer and the base card. Take care to ensure its correct orientation so the clips and the contact pin pass through the holes provided in the shield. The long edge of the shield will align with the edge of the CRT base card. The rest of the shield can be curved up behind the potentiometer and the XH connector.

Base Card with Arc Shield
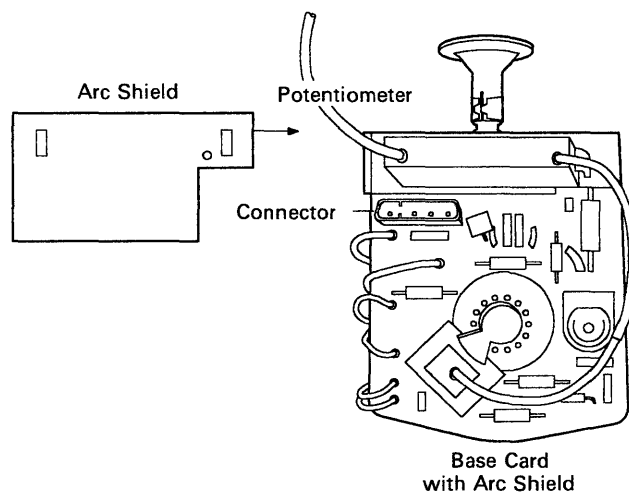
LEX42763

Figure 2.

Notes

Order parts locally. Record all time and material to
Service Code 33, ECA036, other office worked 990.

ECA037

	88-11-01
AS REQUIRED	SERVICE CODE 33
AVAILABLE	88-02
ORDER FROM	LOC
PLANT OF CONTROL	55

Purpose

Provide a plug adapter kit that will correct possible con-
nector incompatibility when installing replacement
CRT/yoke assemblies and amplifier cards.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5379		Model C01 Display	

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	00.5	00.5

Prerequisites

None

Companion

None

Concurrent

None

Detail

Adapter kit, P/N59X6942, should be used when the
replacement CRT/yoke assembly or the replacement
deflection amplifier card does not match the corre-
sponding socket on the old deflection amplifier card.
When these do not match, select the correct adapter from
the kit and cut off the mismatching plug from the
CRT/yoke assembly within 50 millimeters (2 inches) of
the point where the green and yellow wires enter the
back of the plug housing, and discard the green. Strip
back the insulation from both the green and yellow wires

to leave 6 millimeters (0.25 inch) of conductor exposed
on the existing and the replacement adapter wires. Insert
the plug wires and yoke wires, green to green and yellow
to yellow, into the in-line crimps until there is no bare
conductor showing and compress the crimp using tool
P/N450898. Plug the XY connector into the XY socket
on the deflection amplifier card.

Ensure that the following is true before testing: if the XY
(male) plug is being used, the upper wire is yellow and
the lower wire is green. If the XY (female) plug is being
used the upper wire is green and the lower wire is
yellow.

Notes

Order all parts locally. Record time and material to
Service Code 33, ECA037, other office worked 990.

ECA038

88-11-01

Purpose

This ECA is released for sequence purposes only.

ECA039

EC C00688	88-11-01
AS REQUIRED	SERVICE CODE 33
AVAILABLE	88-07
ORDER FROM	
PLANT OF CONTROL	BOCA RATON

Purpose

Correct I/O channel checks on the 7552 when using
ARTIC or ARTIC multiport communication coprocessors.

Machines, Features or Devices Affected

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
7552			

Estimated Installation Time

B/M Installed	Service Hours	System Hours
	01.0	00.0

Prerequisites

None

IBM ECA
Engineering Change Announcement

| *Companion*

| None

| *Concurrent*

| None

| *Detail*

| When the 7552 industrial computer is used with the
| ARTIC or ARTIC multiport communications cards, the
| 7552 will fail with the following symptoms:

| • I/O channel check errors on the system unit
| • Highly intermittent "hang" conditions.

| The frequency of the errors will vary depending on a
| number of factors (all of which are beyond the control of
| the service representative). An adapter card has been
| redesigned to eliminate the failures. The PC adapter card
| is identified on page 6-11 (Ref 2) of the 7552 Mainte-
| nance Information Manual. The part number in the
| manual is incorrect. The correct part number is
| P/N85X1936.

| The new level cards are identified by a large "10" in the
| corner of the card. Any PC adapter cards without the
| "10" are old cards and will cause the failure. Any ARTIC
| card that is used in an old level PC adapter card will fail.
| All old level PC adapter cards used with an ARTIC card
| should be replaced with the redesigned cards. To prevent
| old PC adapter cards from being moved from another
| card to an ARTIC card, all PC adapters in the system
| should be changed at the same time.

| Obtain parts locally. All time and parts required to solve
| this problem should be written as ECA039, Service Code
| 33, other branch office 990, against the Machine Type
| 7552. Parts replaced as a result of this ECA should be
| returned to:

| IBM MSP Parts Distribution
| 1347 Clint Moore Road
| Boca Raton, FL 33487
| ATTN: Will Hamel

ECA040

| 88-11-01

| *Purpose*

| This ECA is released for sequence purposes only.

ECA041

| MANDATORY
| AVAILABLE
| ORDER FROM
| PLANT OF CONTROL

SAFETY

88-11-01
SERVICE CODE 33
88-09
AUSTIN
AUSTIN

| *Purpose*

| Provide rework instructions for clipping the system cover
| tab and applying protective tape on the enhanced power
| supply card.

| *Note:* This ECA is a copy of 5140 ECA001. This ECA
| has been created for visibility purposes only! Please refer
| to notes at the end of this ECA for recording instructions.

| *Machines, Features or Devices Affected*

Type, Model, Stage	With B/M	Machines Affected and/or Feat/Device Description	B/M to be Installed
5140		Backlit Display	B/M8509171
5140		Enhanced Power Supply	B/M8509171

| *Estimated Installation Time*

B/M Installed	Service Hours	System Hours
B/M8509171	00.5	00.5
B/M8509171	00.5	00.5

| *Physical Check*

| Check the part number on the back side edge of the
| power supply card. If P/N0648713 is printed on the
| card, protective tape is not needed. If the card part
| number is P/N60X5617, apply the two strips of tape
| provided in the bill of material following the instructions
| provided.

| *Note:* This B/M contains materials (tape) to rework 10
| systems.

| *Prerequisites*

| Backlit display or enhanced power supply card.

| *Companion*

| None

| *Concurrent*

| None.

Detail

The printed circuit wiring on the backlit display power
supply card could be exposed to wear by the back cover
stabilizer bracket. This wear could cause the power
supply to have an electrical short to the back cover. The
short could cause machine damage. This short does not
present a shock hazard.

Notes

This B/M contains instructions and power supply rework
tape. Sufficient tape is included to service 10 supply
cards.

Note: After the cover tab has been clipped, the surface
must be free of burrs or sharp edges. Use a file or stone
to remove any material not removed by the cutting oper-
ation.

Record all time and material against Machine Type 5140,
Service Code 33, ECA001. 5150 ECA041 was created for
visibility purposes only. Do not record time against 5150
ECA041. (Refer to 5140 ECA001 for original EC infor-
mation.)

Chapter 20. Advanced Diagnostic Diskettes

The following advanced diagnostic diskettes are included in this chapter:

- IBM Advanced Diagnostics for the 5150, 5155, and 5160, Version 2.25.
- IBM Advanced Diagnostics for the 5162 and 5170, Version 2.07.

Making a Backup Copy

You should make a copy of these diskettes and put the originals in a safe place.

Power-On Self Test (POST)

Each time you power on the system, the POST is initiated. A comparison is made between the information entered in the setup program and what the POST finds. The POST takes 13 to 90 seconds to finish, depending on the options installed.

The POST checks the following:

- System board
- Memory
- Drive adapter
- Primary display adapter
- Keyboard
- Diskette drives
- Fixed disk drives.

To start the POST:

1. Power on the system.
2. Turn the brightness and contrast knobs fully clockwise (on IBM displays).

   The following will happen:
   - The keyboard status lights blink on, then off (5162, 5170).
   - While the memory is being tested, the memory size appears in the top corner of the screen and increases in 64Kb increments until the total system memory is tested.
   - One short beep is heard when the POST is successfully completed.
   - The IBM Personal Computer BASIC screen appears (if an operating system is not automatically loaded from diskette or fixed disk drive).

If the POST cannot be completed, an error message appears on the display with the following message:

(RESUME = "F1" KEY)

Note: The F1 function is not supported on the 5150.

Press the F1 key; the system unit bypasses the error and attempts to complete the POST. The POST might or might not finish, depending on the error.

Installed Devices Menu

This menu displays the options and devices installed in the system. Select Y to continue with system diagnostics. By selecting N, you can add or delete items from the Installed Devices menu.

Note: If you enter N, the screen displays the installed devices list error, 199. Disregard this error and continue to add or delete the options. After correcting the list, answer Y to continue. If you are unable to correct the list, you must still answer Y to continue.

System Checkout Menu

This menu allows you to choose the number of times a test is run, as well as the use of the error log or end system checkout.

The following is available on this menu:

0   RUN TESTS ONE TIME: Runs the diagnostic tests once.

1   RUN TESTS MULTIPLE TIMES: Runs the diagnostic tests as many times as you choose.

2   LOG UTILITIES: Allows you to use the error log and time of day functions.

9   END SYSTEM CHECKOUT: Returns to Select an Option menu.

Formatting a Fixed Disk Drive

A fixed disk drive must be formatted before use. The diagnostic tests will not run on an unformatted fixed disk drive.

Fixed disk drives normally contain tracks in excess of their stated capacity to allow for defective tracks. The user is notified by a diagnostic message when the defect limit has been reached and service is recommended.

Important: The advanced diagnostics format
program is different from the operating system format
program. Before you transfer information from backup
diskettes to the fixed disk drive, format the fixed disk
drive using the operating system diskette; refer to the
Operating System manual for a description of the
format commands.

Before the servicer replaces a fixed disk drive, a
format routine should be tried.

Chapter 21. Service Summary Cards

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Personal Computer Family
Service Information Manual
SB0F-2481

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