

## Section 11: IBM Personal Computer



Announced August 12, 1981

## 11:05 IBM Personal Computer Configuration Overview

### Introduction

The IBM Personal Computer is a versatile, general-purpose system that supports a wide range of processing environments. It can be used in home, educational, or any size business environment. Thousands of application programs (IBM-Logo and vendor-Logo) are available for this configuration.

An IBM Personal Computer in the home can be a stand-alone system or can use telecommunications to communicate with another computer system. It can execute entertainment, educational, business, word processing, simple and advanced graphics, program development, personal productivity, telephone and voice communications, and remote inquiry application programs. Many of these programs are suitable for a business as well as a home environment.

An IBM Personal Computer in an educational or business environment can be a stand-alone system, cable-connected to other local computer systems, or configured to communicate with remote computer systems via telecommunications. A wide variety of educational, traditional general business (accounts payable, accounts receivable, payroll, inventory control, for example), advanced word processing, and business-specific application programs are provided for these environments.

In addition, the hardware and programming provided by the IBM Personal Computer Engineering/Scientific (PC/ES) Series and the graphics hardware and programs available support use of the IBM Personal Computer in business, engineering, and science applications, such as advanced text processing, presentation graphics, computer-aided design, computer-aided engineering, laboratory automation, and numerical analysis.

The IBM Personal Computer can also be included in an IBM PC Network or an IBM Token-Ring Network. The IBM PC Network is a low-cost local area network that supports the interconnection of only IBM personal computers via coaxial cable. Peer-to-peer communication among the personal computers and resource (file and printer) sharing are supported by the IBM PC Network Program. File transfer, print functions, and message transfer are provided.

The IBM Token-Ring Network is a high-speed local area network that supports the interconnection of IBM personal computers, departmental systems, and

host processors within an establishment using the IBM Cabling System, including Type 3 specified telephone media. This network supports facilities like those supported by the IBM PC Network. Communication between an IBM Token-Ring Network and an IBM PC Network is supported.

The IBM Personal Computer can communicate with remote IBM personal computer configurations directly via communications lines or via diskette interchange.

The IBM Personal Computer can also be connected to various local or remote processors (System/370, 30XX, 4300, 9370, Series/1, 8100, and System 34/36/38, for example) in order to be used as an intelligent workstation and as a personal computer. Using appropriate programming support, the IBM Personal Computer can emulate several different kinds of workstation. Access to remote information services, such as THE SOURCE (service mark of the Source Telecomputing Corporation, a subsidiary of the Reader's Digest Association, Inc.) and CompuServe®, is also supported and the IBM Personal Computer can be used as a videotex terminal.

Hardware features and programming support enable the IBM Personal Computer to be connected to and communicate with various IBM office systems. Multiple IBM Personal Computers can be cable-attached to a 5520 Administrative System to emulate 5253 Display Stations. The IBM Personal Computer can exchange documents with remote Displaywriter, 6670 Information Distributor, 5520 Administrative System, and Office System 6 configurations as well as with other IBM personal computers.

In addition, document exchange between a cable-connected Displaywriter and IBM Personal Computer configuration is supported and an IBM Personal Computer can communicate with DISOSS/370 in a host processor using Personal Services/PC. Direct document exchange between IBM personal computers is also supported using Personal Services/PC.

Support of word processing functions for an IBM Personal Computer connected to an 8100 Information System is provided, as is communication between an IBM Personal Computer and a host VM/370 PROFS system. The DisplayWrite Series provides document processing capabilities for a stand-alone IBM Personal Computer similar to facilities provided for a Displaywriter system, including support of Document Content Architecture format

for documents. Such documents can be exchanged with DisplayWrite/370 operating in a host processor.

A telephone can be connected to an IBM Personal Computer configuration via the Personal Telephone Manager Adapter to improve productivity in environments with high telephony activity using advanced telephone management functions.

The Voice Communications Option and its associated application programs integrate voice and asynchronous communications with user applications. Voice (audio) can be recorded and played back locally or remotely, programs can be controlled via voice commands, and text from a local or remote file can be converted to synthetic speech. Telephone management like that supported for the Personal Telephone Manager Adapter is also provided.

The IBM Personal Computer system unit can have 4700 Finance Communication System I/O devices connected to it and optionally can be attached to a 4701 Finance Communication Controller (see Section 11:20).

Using the Copier Management Information System (CMIS) program, the IBM Personal Computer can manage up to 20 IBM and/or selected Xerox copiers that are connected to the IBM Personal Computer. This system can be used to control access to the copiers managed by CMIS and to obtain copier usage statistics.

The majority of application programs that execute under the IBM Personal Computer Disk Operating System in the IBM Personal Computer can also execute in other IBM personal computers that have the required hardware resources.

The IBM Personal Computer configuration is designed for those who require more hardware features, online storage, and/or numbers and types of I/O devices than are available for a PCjr configuration but who do not anticipate the need for fixed disk storage or more than five expansion slots for standard and optional features in their initial configuration. If, however, fixed disk storage and more slots are required at a later time, they can be added to an IBM Personal Computer configuration by installing the 5161 Expansion Unit. A large number of optional features are available that permit this configuration to be expanded as processing needs increase.

## Physical Components

The IBM-logo personal computer units that can be included in an IBM Personal Computer configuration are the following:

- 5150 System Unit/Keyboard Models 104, 166, and 176 (currently available models)
- 5150 System Unit Models X66 and X76. These models have no keyboard and are designed to be used only with the IBM 3270 Personal Computer Attachment for the 3278 or 3279. These models and features are no longer marketed by IBM.
- 5161 Expansion Unit Model 1 (provides fixed disk storage and additional space for optional features)
  - 5151 Monochrome Display Model 1
  - 5153 Color Display Model 1
  - 5154 Enhanced Color Display Model 1
  - 5175 Professional Graphics Display Model 1 (5161 Expansion Unit required)
  - 3295 Plasma Monitor Model 1
  - 4055 InfoWindow Display
  - 4865 Personal Computer 3.5" External Diskette Drive Model 1
  - 4201 Proprietary Model 1
  - 4202 Proprietary XL Model 1
  - 5181 Compact Printer Model 1
  - 3852 Color Jetprinter Model 2
  - 5201 QUIETWRITER® Printer Models 1 and 2
  - 5216 Wheelprinter Model 2
  - 5223 Wheelprinter E Model 1
  - 3812 Pageprinter Model 1
  - 5152 Matrix Printer Model 1 (no longer marketed by IBM)
  - 5152 Graphics Printer Model 2 (no longer marketed by IBM)
  - 5182 Color Printer Model 1 (no longer marketed by IBM)
  - 6180 Color Plotter Models 1 and 2 and 6184 Color Plotter
  - 7371 (no longer marketed by IBM) and 7372 Color Plotters
  - 3117 and 3118 Scanners
  - 5083 Tablet Model 2
  - 5178 IBM PC Network Translator Unit
  - 8228 Multistation Access Unit
  - 5841 and 5842 Modems
  - 6157 Streaming Tape Drive

The IBM Personal Computer can also be connected to various processors and other I/O devices (both IBM- and vendor-logo).

## Minimum Configuration

Every stand-alone IBM Personal Computer configuration must include one 5150 System Unit/Keyboard and one display device. The minimum IBM Personal Computer configuration consists of the following:

- One 5150 System Unit/Keyboard Model 104, which has 64Kb of random access memory and no diskette drive
- One display, which can be any one of the following:
  - 5151 Monochrome Display (Monochrome Display and Printer Adapter or Enhanced Graphics Adapter required)
  - 5153 Color Display (Color/Graphics Monitor Adapter or Enhanced Graphics Adapter required)
  - Customer-supplied direct drive or composite video color or black and white video monitor (Color/Graphics Monitor Adapter required)
  - Customer-supplied color or black and white television set with an RF (radio frequency) modulator (Color/Graphics Monitor Adapter required)

This limited configuration supports stand-alone operations using only the BASIC Interpreter in read only memory of the 5150 System Unit. Input is supplied via the keyboard and output can be shown on the display. The IBM Personal Computer Disk Operating System (DOS) requires one 5.25" diskette drive and cannot be used in this limited stand-alone configuration. The price of a single minimum 5150 hardware configuration, 5150 Model 104 with a TV attached to the Color/Graphics Monitor Adapter, is \$1409.

The price for a single minimum stand-alone 5150 hardware configuration for use with DOS (includes one 5.25" double-sided diskette drive, the diskette adapter, and a TV attached to the Color/Graphics Monitor Adapter) is \$1784. If a 5151 Monochrome Display attached via the Monochrome Display and Printer Adapter is used as the required display device, the minimum single unit hardware price for use of a 5150 with DOS is \$2065.

## Configuration Features

The following highlights the features of 5150 configurations, including memory sizes, types and maximum number of attachable I/O devices, and processors/units to which a 5150 configuration can be connected.

- One 5150 System Unit/Keyboard with the Intel 8088 16-bit microprocessor
- Math Co-processor Option available to increase the speed and precision of arithmetic, logarithmic, and trigonometric functions
- Read only memory (ROM) of 40K (40,960) bytes
- BASIC-80 Interpreter in ROM (enhanced version of the widely used Microsoft BASIC – MBASIC – Interpreter)
- Random access memory (RAM) for program use (operating system and application) of 64Kb (65,536 bytes) to 640Kb (655,360 bytes) or of 16Kb (16,384 bytes) to 576Kb (589,824 bytes) for early 5150 models
- One or two IBM 5.25" diskette drives installed in the 5150 System Unit with a 160/180Kb capacity each for single-sided diskettes or a 320/360Kb capacity each for double-sided diskettes (providing 320Kb, 360Kb, 640Kb, or 720Kb maximum of online diskette capacity)
- One or two external 5.25" diskette drives (not supplied by IBM)
- One external 3.5" diskette drive (4865 Personal Computer 3.5" External Diskette Drive Model 1) with a capacity of 720Kb
- One or two fixed disk drives of 10Mb (10,618,880 bytes) capacity each (provided via the 5161 Expansion Unit Model 1) for a maximum capacity of 20Mb (21,237,760 bytes) of online fixed disk storage. Two 5.25" internal IBM diskette drives, one 3.5" or two 5.25" external diskette drives, and two fixed disk drives can be installed in the same 5150 configuration when the 5161 unit is present. IBM fixed disks cannot be installed in the 5150 unit.
- Two or four displays, depending on the display adapters installed
- One 5175 Professional Graphics Display via the Professional Graphics Controller to provide advanced graphics application support. A variety of programs (Graphics Development ToolKit, Graphical Kernel System, and Graphical File System, for example) are available to support basic and advanced graphics for IBM displays. In addition, the Graphics Terminal Emulator program allows a 5150 to emulate the Tektronix™ 4010 and 4100 protocols and the Lear Siegler ADM3A terminal using an IBM display and the Graphics Development ToolKit.

- One 4055 InfoWindow Display to form an IBM InfoWindow System
- One or two parallel printers via the Monochrome Display and Printer Adapter or the Emulex/Persyst BoB/MG – Monochrome Graphics Board and the Parallel Printer Adapter and one or two serial printers via the Asynchronous Communications Adapters. A single printer with a serial interface, such as the 4201 Proprietary, can be shared by up to seven IBM personal computers (IBM PCjr, IBM Personal Computers, IBM Personal Computer XT, and IBM Personal Computer ATs) using the Giltronix Peripheral Sharing Device Model 8007.
- Attachment of one customer-supplied cassette recorder
- Attachment of up to two customer-supplied joysticks or up to four customer-supplied game paddles for video game interaction via the Game Control Adapter
- Attachment of the 5083 Tablet Model 2 for use with applications such as those supported by the PC/Videotex-Graphic Artist Facility
- Programmable speaker for audio and musical applications
- Emulation of terminals, such as the IBM 3278, 3279, and 3101 and DEC VT100, VT101, VT102, and VT52
- Data security via the Keylock Feature
- Connection to the following:
  - System/370, 30XX, 4300, 9370, and Series/1 processors using the Asynchronous Communications Adapter, Binary Synchronous Communications (BSC) Adapter, or Synchronous Data Link Control (SDLC) Communications Adapter
  - 5520 Administrative System via cable attachment to the Display Station Emulation Adapter
  - System/34, System/36, System/36 PC, or System/38 via the Display Station Emulation Adapter or the Enhanced Display Station Emulation Adapter
  - System/36 (5360 or 5362 System Unit) to be used as the system console and system printer for the execution of System/36 diagnostics
  - 8100 Processor using the Asynchronous Communications Adapter, Synchronous Data Link Control Communications Adapter, or 8100 PC Adapter
  - A Series/1 processor with the Series/1 to Personal Computer Channel Attachment and Series/1 to Personal Computer Attachment Cable features. The Personal Computer Channel Extender Card provided with the channel attachment feature is installed in the 5150 configuration (see discussion under “IBM Series/1-Personal Computer Interconnect” in Section 11:10)
- A 4860 PCjr, a 5140 PC Convertible, another 5150 Personal Computer, a 5155 Portable Personal Computer, a 5160 or 5162 Personal Computer XT, a 5160 Personal Computer XT/370, a 5170 Personal Computer AT or AT/370, 3270 Personal Computer workstations, a 5531, 7531, 7532, or 7552 Industrial Computer, a paper tape reader, a communicating typewriter, a laboratory instrument, voice recognition devices, letter-quality printers, mouse devices, or other machines that use the RS-232C interface, via the Asynchronous Communications Adapter
- A System/88 via the Asynchronous Communications Adapter to use the 5150 as the system console or an ASCII terminal
- A videotex host via the Asynchronous Communications Adapter to use the 5150 as a videotex terminal
- A remote VM/370 PROFS system using the Asynchronous Communications Adapter or a 3278/79 emulation adapter
- DISOSS/370 in a host processor using the Asynchronous Communications Adapter
- 3708 Network Conversion Unit or 3710 Network Controller via the Asynchronous Communications Adapter. The PC/HOST File Transfer and Terminal Emulator Program supports this connection.
- A local Displaywriter via cable attachment to the Asynchronous Communications Adapter. The IBM Personal Computer can be a stand-alone system or part of a cluster of IBM personal computers.
- A remote Displaywriter, 6670 Information Distributor, 5520 Administrative System, or Office System 6 via the BSC adapter for document exchange
- A telephone via the Personal Telephone Manager Adapter
- A telephone, one or two telephone lines, a microphone, and a speaker via the Voice Communications Adapter
- 3278 Display Station using the IBM Personal Computer 3278 Attachment Option (which is the IBM Personal Computer portion of the 3270 Personal Computer Attachment for the 3278) – withdrawn from marketing
- 3279 Color Display Station using the IBM Personal Computer 3279 Attachment Option (which is the IBM Personal Computer portion of the 3270 Personal Computer Attachment for the 3279) – withdrawn from marketing

- 3274 Control Unit, Display/Printer Adapter in a 4321/4331/4361 Processor, Workstation Adapter in a 4361 Processor, or Device Cluster Adapter in a 4701 Finance Communication Controller via the 3278/79 Emulation Adapter
  - Up to 63 other local IBM personal computers (IBM PCjr's, IBM Personal Computers, IBM Portable Personal Computers, IBM Personal Computer XT's and XT/370's, IBM Personal Computer AT's and AT/370's, and IBM 5531, 7531, and 7532 Industrial Computers) using the Cluster Adapter and Cluster Cable Kit
  - Up to 71 (or up to 255 using non-IBM cabling) other local IBM personal computers (IBM Personal Computers, IBM Portable Personal Computers, IBM Personal Computer XT's and XT/370's, IBM Personal Computer AT's and AT/370's, and IBM 5531, 7531, 7532, and 7552 Industrial Computers) via the IBM PC Network Translator Unit, IBM PC Network Adapters, and IBM PC Network Cabling Components
  - Up to 259 other local IBM personal computers, System/36's, and System/36 PC's via the IBM Token-Ring Network PC Adapter or IBM Token-Ring Network PC Adapter II, IBM Token-Ring Network Multistation Access Unit, and IBM Cabling System.
  - IBM Electronic Typewriter 65, 85, or 95 via the Printer Adapter or the Monochrome Display and Printer Adapter
  - An IBM SELECTRIC® System/2000 Typewriter with the Printer Option installed via the Printer Adapter or the Monochrome Display and Printer Adapter
  - 5218 Printwheel Printer Model A03 or A04 via the 5218 Printer Attachment Cable attached to an Asynchronous Communications Adapter. Up to four IBM personal computers can share one 5218 printer using the 5218 Printer Sharing feature.
  - 4975 Printer Model 02R (with the 4975 Printer Attachment feature - RPQ 8V0262) attached to the Asynchronous Communications Adapter. This table-top, serial matrix printer can be used for draft, near-letter-quality, and label printing. The following can be printed on labels: universal product code (UPC) bar code (Versions A and E), 3-of-9 bar code, MSI Plessey bar code, European article numbering (EAN) bar code (Versions 8 and 13), UPC magazine/paperback title and issue coding bar code (2 and 5 digit), optical character recognition (OCR) A font (National Retail Merchants Association - NRMA - subset), and large characters (2, 4, or 8 times standard height). See GA34-0144 for a description of the 4975 Printer.
  - 6180, 7371, or 7372 Color Printer (desktop plotters) or 6184 Color Plotter (free-standing unit) via a cable connected to the Asynchronous Communications Adapter or General Purpose Interface Bus Adapter. The IBM Personal Computer can be a stand-alone system or connected to a host System/370, 30XX, or 4300 processor.
  - 7374 or 7375 Color Plotter when the 5150 configuration is connected to a host System/370, 30XX, or 4300 processor. Attachment of the plotter to the 5150 is via a cable connected to the Asynchronous Communications Adapter or General Purpose Interface Bus Adapter.
  - 3117 and 3118 Scanners (desktop scanners) via the High Speed Adapter or Asynchronous Communications Adapter
  - Analog and digital devices and instruments via the Data Acquisition and Control Adapter to control processes, monitor transducers, and automate electronic testing
  - Up to 48 devices that use the ANSI/IEEE-488 standard via the General Purpose Interface Bus Adapter
  - The 3680 Point of Sale System via the Asynchronous Communications Adapter, BSC adapter, or SDLC Communications Adapter (see *Connecting the IBM Personal Computer and the 3680 Point of Sale System: A Feasibility Study*, GG24-1598)
  - Up to 20 IBM and/or selected Xerox copiers using the Terminal Communications Adapter Kit
  - Custom attachments using the Prototype Card
  - 4700 Finance Communication System (FCS) I/O devices via 4700 FCS Options
  - Airline reservation systems using the Binary Synchronous Communications Adapter and the Airline Link Control Programming RPO (PX0001)
  - 7171 ASCII Device Attachment Control Unit via the Asynchronous Communications Adapter to emulate an ASCII device (such as the 3101 Display Terminal)
  - The ROLM Computerized Branch Exchange (CBX II and VSCBX). For information, see *IBM/ROLM Switched Data Products Installation Aid*, GA27-3709.
  - Other host processors using appropriate software
- Up to three communications adapters (of more than one type, if desired) can be installed in the same 5150 configuration. The limit for each type is two

for the Asynchronous Communications Adapter (one when the 1200 bps Modem or 2400 bps Modem is installed), one for the SDLC adapter, and two for the BSC adapter. However, when the SDLC adapter is installed, only one BSC adapter and one asynchronous adapter (or one 1200 bps Modem or 2400 bps Modem) can be installed as well. Alternatively, two BSC adapters and one asynchronous adapter (or one 1200 bps Modem or 2400 bps Modem) can be the three installed communications adapters. The stand-alone 5841 or 5842 Modem can be attached to these communications adapters to connect them to communications lines.

The IBM Personal Computer can be connected to the IBM Cabling System for attachment to the following:

- 3274 Control Unit
- Display/Printer Adapter of a 4321/4331/4361 Processor
- Workstation Adapter of a 4361 Processor
- System/36, System/38, or 5294 Remote Control Unit
- Loop Adapter of an 8100 Information System
- 5520 Administrative System
- Device Cluster Adapter of a 4701 Finance Communication Controller

The IBM Cable Data Management System licensed program can be executed in an IBM Personal Computer configuration to aid in the planning, installation, and records maintenance functions associated with the IBM Cabling System. This program is designed to be used by facilities engineers, planners, or managers.

## Operating Systems Supporting

The 5150 Personal Computer is supported by the following IBM-logo operating systems:

- IBM Personal Computer Disk Operating System (DOS) — all versions. Fixed disk drives (10Mb capacity) are supported as of Version 2.0. The external 3.5" diskette drive is supported as of Version 3.2. One 5.25" diskette drive is required to use DOS in a 5150 configuration.
- IBM Personal Computer/Interactive Executive (PC/IX). One 5.25" double-sided diskette drive and one 10Mb fixed disk drive are required.
- CP/M-86™. One 5.25" diskette drive is required. Fixed disks are not supported.

The UCSD p-System™, no longer marketed by IBM, also supports the 5150 Personal Computer (fixed disks are not supported).

## Compatibility

### Hardware

The 5150 Personal Computer is compatible with the 4860 PCjr, 5140 PC Convertible, 5155 Portable Personal Computer, 5160 Personal Computer XT, 5160 Personal Computer XT/370 in PC mode, 5170 Personal Computer AT in real address mode, 5170 Personal Computer AT/370 in PC mode, 3270-PC and 3270-PC/G and GX workstations, and 5531 Industrial Computer. Since the 8088 microprocessor is used in 4860, 5150, 5155, 5160, 5271, 5371, and 5531 system units (80C88 in the 5140), microprocessor instructions for personal computer mode are compatible among these system units. The 80286 microprocessor operating in real address mode in the 5162, 5170, 7531, 7532, 7552, 3270 Personal Computer AT, or 3270-PC AT/G or AT/GX is upward-compatible with the 8088.

Diskettes (5.25") with 160/180Kb or 320/360Kb capacities are interchangeable among 4860 PCjr, 5150 Personal Computer, 5155 Portable Personal Computer, 5160 Personal Computer XT and XT/370, 5170 Personal Computer AT and AT/370, 3270 Personal Computer workstation, and 5531, 7531, and 7532 Industrial Computer configurations.

The 3.5" (720Kb) diskette used in the 5140 PC Convertible and 7552 Industrial Computer can be read/written in a 5150 Personal Computer, 5155 Portable Personal Computer, 5160 or 5162 Personal Computer XT, or 5170 Personal Computer AT configuration that contains an external 3.5" diskette drive (the 4865 external 3.5" drive) or in the internal 3.5" drive in a 5160, 5162, or 5170 configuration.

Cassettes are interchangeable without restrictions between PCjr and 5150 Personal Computer configurations. Cartridges can be used only in a PCjr.

### Programming

The majority of programs that operate in an IBM Personal Computer configuration can also operate in an IBM Portable Personal Computer, IBM Personal Computer XT or XT/370 (in PC mode), IBM 3270 Personal Computer workstation, or IBM 5531 Industrial Computer as long as the configuration contains the required memory, features, and I/O devices. The majority can also operate in a PCjr configuration, an IBM Personal Computer AT or AT/370 (in PC mode), 7531, 7532, or 7552 Industrial Computer, 3270 Personal Computer AT, or

3270-PC AT/G or AT/GX with the required features.

Programs for the 5150 configuration that are available on 3.5" diskettes should also operate in a 5140 PC Convertible that has the required hardware features.

### Customer Responsibilities

The 5150 Personal Computer and its features are customer setup. Detailed setup instructions are included with each unit. The customer is responsible for unpacking the system components, attaching them correctly, and running the supplied diagnostic program. However, initial setup is available from the IBM National Service Division at the IBM hourly rate and minimum charge or for eligible customers without charge (see *Notice to Customers* dated August 20, 1985 for no-charge setup eligibility).

An individual power source is required for each IBM-Logo personal computer unit that can be included in a 5150 configuration (see "Physical Components" earlier in this subsection) except for the 5151 Monochrome Display, which receives power from the 5150 or 5161 unit.

### Data Security

The customer is responsible for providing any desired data security functions. Programs or hardware that perform data encryption and decryption can be installed in a 5150 configuration.

The optional Keylock Feature can be installed on the 5150 System Unit and/or 5161 Expansion Unit to prevent physical and programmed access to the physical and data contents of the 5150 and/or 5161 unit when the keylock is in the locked position. See description of this feature in Section 11:10 under "Keylock Feature."

Security for IBM personal computers is discussed in *Good Security Practices for Personal Computers*, G320-9280, and *Good Security Practices for Control of Off-Site Terminal and Software Usage*, G320-9295.

### Purchase Locations

All 5150 Personal Computer IBM-Logo units and features are purchase only. Models 104, 166, and 176 of the 5150 System Unit can be purchased at the following locations:

- IBM NCMD and SWMD branch offices. Orders for any quantity are accepted by branch office marketing representatives. IBM Credit Corporation term leases and installment payment plans are available for IBM Personal Computers purchased from an IBM branch office.
- Authorized IBM Personal Computer retail dealers

### Warranty Period

The warranty period for 5150 and 5161 units is three months and the warranty service is Customer Carry-in Repair.

See the table under "Single Unit Prices" in Section 11:10 for the warranty period and warranty service for all optional features of 5150 and 5161 units.

### IBM Service Offerings

The following IBM service offerings are available:

- IBM Maintenance Agreement:
  - Warranty Option. For 5150 and 5161 units IBM On-Site Repair is available.
  - Annual Maintenance. For 5150 and 5161 units, IBM On-Site Repair and Customer Carry-In Repair are available.
- For customers with a minimum of 150 IBM Personal Computer-based system units under the IBM Maintenance Agreement, the Volume Maintenance Amendment is available to provide volume maintenance discounts. The 5150 and other IBM personal computer system units, selected IBM displays and printers, and selected non-IBM-Logo hardware products are eligible for the volume maintenance discount.
- IBM Hourly Service:
  - Customer Carry-In Repair
  - IBM On-Site Repair
- Self-service using the Hardware Maintenance and Service package (a purchased item), which enables the customer to isolate the problem to an under-the-cover field-replaceable unit

See Appendix A for service offering descriptions.



## Publications

The following publications are provided with each 5150 Personal Computer configuration:

- *Guide to Operations* (6322510). This binder contains setup and starting instructions, keyboard information, instructions for installing each optional feature ordered for the configuration, and testing information. The diagnostics diskette and two diskettes (one for the monochrome display and one for the color display) that contain the system tutorial "Exploring the IBM Personal Computer" are also provided in this binder.
- *BASIC* (6280075). This binder describes the functions provided by the BASIC Interpreter that is included in ROM in a 5150 System Unit.

The following hardware- or software-oriented publications can be purchased:

- *IBM Personal Computer System Technical Reference* (6322507) – \$30. This reference describes the system board, Math Co-processor Option, power supply, keyboard, and communications functions and lists 8088 microprocessor and Basic Input/Output System (BIOS) instructions.
- *IBM Personal Computer Options and Adapters Technical Reference* (6322509) – \$125. This multivolume reference describes the 5161 Expansion Unit, displays, printers, diskette and disk drives, memory expansion, cables, and connectors. It contains information that is applicable to the IBM Personal Computer, IBM Portable Personal Computer, IBM Personal Computer XT and XT/370, and IBM Personal Computer AT and AT/370.
- *Hardware Maintenance Service* (6280087) – \$195 and *Hardware Maintenance Reference* – \$150. These manuals provide procedures and an advanced diagnostics diskette to isolate a problem to a field-replaceable unit. These manuals also provide service information for the 5155 Portable Personal Computer, 5160 Personal Computer XT, and 5170 Personal Computer AT.
- *The Directory* (6276670). These publications describe personally developed software packages that can be ordered by mail or telephone. The categories of programs offered include entertainment, education, productivity, programming, lifestyle, and business. These programs are listed in a table in Section 41:10.

Technical reference manuals, maintenance publications, and the BASIC manual that have a part number but no form number can be purchased from an IBM branch office, from an IBM Authorized Per-

sonal Computer Dealer, or by calling the *Technical Directory* (800-IBM-PCTB).

The following form-numbered items that contain hardware and programming information about the 5150 Personal Computer can be ordered from IBM branch offices:

- *IBM Personal Computers Hardware Facts* (pocket brochure), G520-3916
- *Introduction to Personal Computers for Business – An Executive Overview*, G520-2306
- *The Library of IBM Personal Computer Software Offerings*, G520-1107. This publication describes selected IBM-logo programs.
- *Personal Computer Software*, GB30-2037 and GN60-1257. These publications briefly describe IBM personal computer vendor-logo application programs that are available from IBM. The following is given for each program: feature highlights, description, purpose, application type, operating environment (hardware and software requirements), compatibility (interface to other application programs), and ordering information (including price).
- *Personal Computer Software Pocket Guide*, GB30-2479. This reference card lists the vendor-logo programs available from IBM, program part number, program feature code, program charge, and IBM personal computer configurations supported.
- *Software Directory*, GB21-9949
- *An IBM Guide to Choosing Business Software*, SB30-3224. This book is designed for non-technical business managers. It describes software features that support all the major areas of accounting, including general ledger, accounts payable, payroll, order entry and invoicing, inventory accounting, and accounts receivable.
- *Engineering and Scientific Programs for IBM Personal Computers Available from non-IBM Sources*, GC34-0588
- *Guide to Learning: Resources for Users of IBM Personal Computers*, G570-2091. This guide provides a brief description of manuals, programs, audiocassettes, and courses that are designed for those who want to learn about and/or teach courses on the IBM PCjr, IBM Personal Computer, or IBM Personal Computer XT. Hardware, operating systems, languages, and application programs are covered.

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- Engineering/Scientific Series brochures:
  - *Systems and Software for Integrated Workstations*, G520-5011 (pocket brochure) or G520-5010
  - *Professional Graphics Display and Controller*, G520-5013
  - *Data Acquisition and Control*, G520-5020
  - *General Purpose Interface Bus*, G520-5021
  - *Graphics Terminal Emulator*, G520-5016
  - *Graphical Kernel System*, G520-5015
  - *Virtual Device Interface (VDI) Specification Sheet*, G520-5018
  - *Graphical File System*, G520-5014
  - *Plotting System*, G520-5017
  - *Professional FORTRAN*, G520-5019
- More detailed information about Engineering/Scientific Series hardware and software is contained in *IBM Personal Computer Seminar Proceedings Volume 2, Number 10*, G320-9317.
- *IBM Assistant Series for PC End Users*, G520-6206. This brochure describes integrated assistant series programs.

The publication *The IBM Personal Computer Catalog*, G570-2064, describes certain IBM personal computer hardware units, supplies, accessories, software, and furniture that can be ordered from IBM. The items described can be purchased by mail, by telephone (via IBM Direct), and/or from an IBM marketing representative, depending on the item.

Additional publications regarding particular features are indicated in the feature descriptions in Section 11:10.

## Education

The following are some of the self-study courses that are available for IBM personal computers:

- Personal Computing Concepts (32273)
- Using the IBM Personal Computer and DOS (32271)
- The IBM Personal Computer Technical Coordinator Training Course – Guided Learning Center course (G4002)
- Using IBM DisplayWrite 2 (32284)
- Using IBM DisplayWrite 3 (32281)
- Document Exchange: DisplayWrite 3 and System/36 (32266)
- Using the WordStar Program (32274)
- Using the 1-2-3™ Program (32278)
- Using the VisiCalc™ Program (32272)
- Fundamentals of Programming the IBM Personal Computer (32275)
- Business Programming in BASIC (32279)
- Advanced BASIC Programming Techniques (32280)

Classroom courses are described in a pamphlet, GR20-4857, that is available from IBM DIRECT-Education (1-800-IBM-2468, operator 498).

## 11:10 IBM 5150 System Unit

The 5150 System Unit Model 176 for the IBM Personal Computer is shown in Figure 11-1.



Figure 11-1. 5150 System Unit Model 176

### Models Available

The available 5150 models provide different standard features. Otherwise, they are functionally and physically identical. The following 5150 models are available:

- Model 104:
  - System Unit/Keyboard (83 keys)
  - 64Kb random access memory
- Model 166:
  - System Unit/Keyboard (83 keys)
  - 256Kb random access memory
  - Diskette Drive Adapter
  - One 5.25" Double-Sided Diskette Drive

- Model 176:
  - System Unit/Keyboard (83 keys)
  - 256Kb random access memory
  - Diskette Drive Adapter
  - Two 5.25" Double-Sided Diskette Drives

The following 5150 models have been withdrawn from marketing by IBM:

- Model 114:
  - System Unit/Keyboard (83 keys)
  - 64Kb random access memory
  - Diskette Drive Adapter
  - One 5.25" Single-Sided Diskette Drive

## 11:10 IBM 5150 System Unit

- Model 164:
  - System Unit/Keyboard (83 keys)
  - 64Kb random access memory
  - Diskette Drive Adapter
  - One 5.25" Double-Sided Diskette Drive
- Model 174:
  - System Unit/Keyboard (83 keys)
  - 64Kb random access memory
  - Diskette Drive Adapter
  - Two 5.25" Double-Sided Diskette Drives
- Model X14:
  - System Unit
  - 64Kb random access memory
  - Diskette Drive Adapter
  - One 5.25" Single-Sided Diskette Drive
- Model X64:
  - System Unit
  - 64Kb random access memory
  - Diskette Drive Adapter
  - One 5.25" Double-Sided Diskette Drive
- Model X74:
  - System Unit
  - 64Kb random access memory
  - Diskette Drive Adapter
  - Two 5.25" Double-Sided Diskette Drives
- Model X66:
  - System Unit
  - 256Kb random access memory
  - Diskette Drive Adapter
  - One 5.25" Double-Sided Diskette Drive
- Model X76:
  - System Unit
  - 256Kb random access memory
  - Diskette Drive Adapter
  - Two 5.25" Double-Sided Diskette Drives

Models X14, X64, X66, X74, and X76 are used only with the IBM 3270 Personal Computer Attachment features, which have also been withdrawn.

Each current 5150 model (104, 166, and 176) can be field-upgraded to the maximum 5150 configuration by installing optional features.

Models 813, 824, 1, 14, 64, and 74 of the 5150 have also been withdrawn from marketing. Most of the optional features and I/O devices for the three currently available 5150 models can be installed in 5150 configurations that include the withdrawn 5150 models.

A 5150 System Unit cannot be converted to the system unit for any other IBM personal computer configuration.

## Physical Characteristics

### *Dimensions (approximate)*

- Height: 5.5 inches (142 mm)
- Width: 19.5 inches (500 mm)
- Depth: 16 inches (410 mm)

### *Weight (approximate)*

- Model 104: 21 lb
- Model 166: 25 lb
- Model 176: 28 lb

## Environment

- Air temperature:
  - 60 to 90 degrees F (15.6 to 32.2 degrees C) for system on
  - 50 to 110 degrees F (10 to 43 degrees C) for system off
- Cooling: Air-cooled via a fan inside the 5150 System Unit
- Humidity: 8% to 80% for system on or off
- Noise level:
  - 56 decibels (dB) without printer
  - 66 decibels with printer
- Electrical:
  - 104 to 127 volts AC, 60 Hz
  - 180 to 259 volts AC, 50 Hz (outside U.S.A.)

## Standard Features

The following are standard features of all 5150 models unless indicated otherwise. Each feature is discussed under "Standard Feature Descriptions" in this subsection.

- Microprocessor – Intel 8088 (4.77-megahertz clock speed)
- Eight interrupt levels
- Direct memory access (DMA) – three channels
- 40Kb of read only memory (ROM)
- BASIC-80 Interpreter in ROM
- Random access memory (RAM) of 16Kb for the 5150 Model 1, 48Kb for the 5150 Model 813, 256Kb for 5150 Models 166, 176, X66, and X76, and 64Kb for all other 5150 models
- Five system expansion slots for feature cards
- Adapter for a customer-supplied audiocassette recorder
- A programmable speaker and associated adapter
- One 5.25" Diskette Drive Adapter (all models except 1 and 104)

- 5.25" Diskette Drive (all models except 1 and 104) – one single-sided for Models 813, 14, 114 and X14; two single-sided for the Model 824; one double-sided for Models 64, 164, 166, X64, and X66; and two double-sided for Models 74, 174, 176, X74, and X76
- Keyboard adapter
- 83-key keyboard (all models except X14, X64, X66, X74, and X76)
- Automatic power-on self-test
- A 63.5-watt power supply with cooling fan
- Professional Graphics Controller (one maximum) – 5161 unit required
- Emulex/Persyst BoB/MG – Monochrome Graphics Board (non-IBM-logo) – one maximum
- Data Acquisition and Control Adapter (four maximum)
- Data Acquisition and Control Adapter Distribution Panel (four maximum)
- General Purpose Interface Bus Adapter (four maximum)
- Asynchronous Communications Adapter (two maximum unless the SDLC adapter or 1200 bps Modem or 2400 bps Modem is installed, then one maximum)
- Binary Synchronous Communications (BSC) Adapter (two maximum unless the SDLC adapter is installed, then one maximum)
- Synchronous Data Link Control (SDLC) Communications Adapter (one maximum)
- Communications Adapter Cable (one for each communications adapter installed)
- Giltronix Peripheral Sharing Device Model 8007 (one maximum)
- 1200 bps Modem (one maximum)
- 2400 bps Modem (one maximum)
- 5841 Modem (one for each communications adapter installed)
- 5842 Modem (one for each communications adapter installed)
- Display Station Emulation Adapter (one maximum)
- Enhanced Display Station Emulation Adapter (one maximum)
- Advanced 3278/79 Emulation Adapter (one maximum)
- 8100 PC Adapter (one maximum and mutually exclusive with the SDLC adapter)
- Cluster Adapter (one maximum)
- Cluster Cable Kit (one less than the number of systems in the cluster)
- IBM PC Network Translator Unit (one per network), IBM PC Network Adapters (one maximum per 5150 unit), and IBM PC Network Cabling Components to form an IBM PC Network
- IBM Token-Ring Network Multistation Access Unit (one per eight IBM personal computers), IBM Token-Ring Network PC Adapter or IBM Token-Ring Network PC Adapter II (one maximum per 5150 unit), and the IBM Cabling System to form an IBM Token-Ring Network
- Voice Communications Option or Voice Communications Adapter (one maximum)
- Personal Telephone Manager Adapter (one maximum)
- High Speed Adapter for 3117/3118 Scanner attachment (one maximum)
- PC Adapter for 3117 Scanner (one maximum)

## Optional Features

The following are optional features that are currently available for 5150 configurations. The 5.25" Single-Sided Diskette Drive, IBM Personal Computer 3278 Attachment Option, IBM Personal Computer 3279 Attachment Option, and 3278/79 Emulation Adapter features have been withdrawn from marketing. Available and withdrawn features are discussed under "Optional Feature Descriptions" in this subsection except the 4700 Finance Communication System Options, which are discussed in Section 11:20.

- Math Co-processor Option (one maximum)
- 16Kb Memory Module Kit (Models 1 and 813 only)
- 64Kb Memory Module Kit (three maximum on the Model 104, 114, 164, and 174 system board and three maximum on a 64/256Kb Memory Expansion Option card)
- 64/256Kb Memory Expansion Option (two maximum)
- 256Kb Memory Expansion Option (one or two maximum depending on the 5150 model)
- Game Control Adapter (one maximum)
- Prototype Card (one maximum)
- Diskette Drive Adapter (Models 1 and 104 only – one maximum)
- 5.25" Double-Sided Diskette Drive (two diskette drives maximum per 5150 configuration)
- 4865 Personal Computer 3.5" External Diskette Drive Model 1 (one maximum)
- Monochrome Display and Printer Adapter (one maximum)
- Color/Graphics Monitor Adapter (one maximum)
- 3295 Display Adapter (one maximum)
- Printer Adapter (one maximum)
- Enhanced Graphics Adapter (one maximum)
- Graphics Memory Expansion Card (one maximum)
- Graphics Memory Module Kit (one maximum)
- Enhanced Graphics Adapter Jumper Card (one maximum)

- Displaywriter/Personal Computer Attach Convenience Kit (two maximum)
- IBM 65/85/95-PC IPL/Diagnostic Diskette and Diagnostic Tool – MES 8569 (one maximum)
- 5218 Printer Attachment Cable (two maximum)
- 5218 Printer Sharing (one for each group of four IBM personal computers that are to share one 5218)
- Terminal Communications Adapter Kit (one maximum) – to connect copiers
- Keylock Feature (one for the 5150 and one for the 5161)
- BIOS Update Kit (one maximum) – required only for certain features for some early 5150 models
- 6157 Tape Attachment Feature (one maximum)
- 4700 Finance Communication System Input Option (one maximum)
- 4700 Finance Communication System Output Option (one maximum)
- 4700 Finance Communication System Security Option (one maximum)

The optional features listed are installed inside the 5150 System Unit or 5161 Expansion Unit except the Communications Adapter Cable, Cluster Cable Kit, MES 8569, 5218 Printer Attachment Cable, 5218 Printer Sharing, Displaywriter/Personal Computer Attach Convenience Kit, 5178 IBM PC Network Translator Unit and Cabling components, IBM Token-Ring Network Multistation Access Unit and IBM Cabling System, 5841 or 5842 Modem, Data Acquisition and Control Adapter Distribution Panel, Giltronix Peripheral Sharing Device, 4865 diskette drive, and Keylock Feature.

A variety of non-IBM-logo hardware features can be purchased from IBM for installation in a 5150 configuration to support facilities not provided by IBM-logo standard and optional features. See Appendix D for information about such non-IBM-logo features.

### Physical Components Included

Each 5150 System Unit contains the system board, the programmable speaker, and the power supply and fan. The one or two IBM 5.25" diskette drives that can be included in a 5150 configuration are also housed in the 5150 System Unit. Certain optional features for a 5150 configuration must be installed only in the 5150 unit or only in the optional 5161 Expansion Unit. Others can be installed in the 5150 or 5161 unit.

Each 5150 system board contains:

- The processor subsystem (includes the Intel 8088 microprocessor and associated functions)
- Read only memory (40Kb)
- Random access memory:
  - 256Kb for 5150 Models 166, 176, X66, and X76
  - 64K to 256Kb for 5150 Models 104, 114, 164, and 174
  - Up to 64Kb for 5150 Models 813, 824, 1, 14, 64, 74, X14, X64, and X74
- The keyboard adapter
- The cassette adapter
- The programmable speaker adapter
- Five system expansion slots that are used to hold feature cards
- Socket for the Math Co-processor Option module

The system board also contains two sets of eight switches that can be read under program control. These switches, called dual inline package (DIP) switches, provide configuration information for the operating system. They must be set to indicate whether the Math Co-processor Option is installed, the amount of memory installed, the types and number of displays installed, the operational mode (40- or 80-character lines) for the color display when power is turned on (when only a color display is installed), and the number of diskette drives attached.

The 5150 is delivered with the DIP switches set for the configuration ordered. If optional features are added to a 5150 configuration thereafter, the customer must set the appropriate switches, if required, as per the instructions in the *Guide to Operations*.

Standard and optional feature cards plug into expansion slots provided in the left rear corner of the system board inside the 5150 or 5161 unit. A feature card that provides for the attachment of an external unit has a connector (such as a 25-pin D-shell type) attached to one end. When the slot cover for the expansion slot to be used for a feature card is removed from the rear panel of the 5150 or 5161 unit and the card is installed, the connector on the end of the feature card is exposed so that a cable can be plugged into it to attach the appropriate unit (I/O device or modem, for example).

## Standard Feature Descriptions

### Microprocessor

The instruction execution function in the 5150 System Unit is the Intel 8088 16-bit microprocessor with a 4.77-megahertz (MHz) clock speed and 410-nanosecond cycle time. The microprocessor is implemented on one logic chip that is about the size of a penny. It can address 1024Kb of memory using a 20-bit address and up to 768 I/O addresses are supported.

For a description of the 8088 microprocessor, see Section 13:10 under "Microprocessor."

### Direct Memory Access

The direct memory access (DMA) facility is provided to enable I/O operations to be overlapped with instruction execution and each other. A DMA controller that provides four independent channels is included on the system board. This controller can operate simultaneously with the 8088 microprocessor to handle data transfer from one location to another in random access memory and between random access memory and I/O devices. Up to three DMA transfers can operate at a time. The fourth DMA channel is used to refresh the dynamic random access memory.

Data transfer occurs eight bits at a time to and from I/O and memory adapters. A data rate of up to 1.5Mb/sec can be handled by a DMA channel and up to 64Kb can be transferred in one I/O operation (read or write request). The DMA channels can be used, for example, by the diskette drive adapter, fixed disk adapter, SDL/C adapter, display adapters, Cluster Adapter, IBM PC Network Adapter, Data Acquisition and Control Adapter, and General Purpose Interface Bus Adapter.

### Read Only Memory

The 5150 contains 40Kb of read only memory (ROM). The contents of ROM remain when power to the 5150 System Unit is turned off and writing to this memory cannot be done. ROM is used for the permanent residence of certain programs.

The standard ROM is addressed using the highest 40K addresses in the 1024Kb address space that is accessible to the 8088 microprocessor. An additional 216Kb of address space is reserved for ROM expansion. Note that ROM is also present on

certain feature cards to provide device level control for the device attached to the adapter card.

ROM contains the following:

- Power-on self-test program. This program executes a series of diagnostic tests (including a random access memory test) each time power to the 5150 is turned on. The time required for the test is variable and depends on the amount of random access memory installed. If a failure is found, the appropriate error code is displayed.
- Diskette bootstrap loader to initial program load (IPL) from diskette drive A
- Basic Input/Output System (BIOS). This system provides basic input/output support (device level control) for the major I/O devices that attach to the 5150 (keyboard, display, printer, diskette, and fixed disk), full I/O support for a cassette recorder, and support of the Asynchronous Communications Adapter. BIOS provides an operational interface to the system and relieves the programmer of concern for device hardware characteristics. A graphics character generator and system services, such as time of day and configuration and memory size determination, are also provided by BIOS.

The programmer should access BIOS via the standard program interrupts (interrupt instruction specifying the BIOS interrupt type) rather than by actual address. There are over 40 defined interrupts that permit the user to IPL, perform I/O operations to supported devices, request timer functions, request installed memory size, print the contents of the display screen, and access ROM BASIC.

Parameters are passed to and received from BIOS using the registers in the 8088 microprocessor. BIOS uses a small portion of random access memory as a work area. A listing of the BIOS instructions is provided in the 5150 *Technical Reference* (6322507).

- Time-of-day clock support. A programmable interval timer on the system board that provides an interrupt 18.2 times per second is used to support a time-of-day clock. Timer routines in ROM permit a program to set the clock and obtain the current time of day. An indication of whether 24 hours have passed since the last clock read was issued is given with the time of day.
- Dot patterns for 128 characters in graphics mode for displays
- A code indicating this unit is a 5150. This code can be inspected by programming.
- BASIC-80 Interpreter (cassette level enhanced). Highlights of the supported functions are:

- Full-screen editor for easy program creation and modification
- 40- or 80-character display lines
- Up to 16 foreground and 8 background colors supported (requires a color display)
- Automatic line numbering
- 40-character variable names (all characters significant)
- Multiple statements per program line
- 250 characters per program line
- Comments on program line
- Up to 17-digit numeric precision
- Error trapping
- Addressable workspace up to 60Kb
- Integer/real/string variables
- Single- and double-precision floating-point numbers
- Support of medium- and high-resolution graphics modes for displays
- Support of sequential cassette files
- Support of the display, keyboard, and printer
- Support of the standard programmable speaker and optional light pen and joysticks

The BASIC Interpreter in ROM of the 5150 is functionally equivalent to the BASIC Interpreter in ROM of other IBM personal computers. The Disk BASIC and Advanced BASIC that are provided with DOS support additional functions.

Once the 5150 has been turned on and the self-test diagnostics have been executed successfully, an attempt is made to IPL an operating system from diskette drive A (leftmost drive) or from the first fixed disk (C) drive in the 5161 unit (if present). The BASIC Interpreter is made ready and identified on the screen if an operating system has not been loaded.

### Random Access Memory

Random access memory (RAM) is read/write program-addressable memory. In the 5150, RAM is dynamic memory (its contents must be refreshed periodically) and its contents are lost when power to the 5150 is removed. This memory is parity-checked for validity. The standard memory in a 5150 model has a 200-ns access time and a 345-ns cycle time (assuming 64K-bit memory modules).

The standard 64Kb in 5150 Models 104, 114, 164, and 174 and the standard 256Kb in 5150 Models 166, 176, X66, and X76 can be expanded to a maximum of 640Kb using the optional 64Kb Memory Module Kit, 64/256Kb Memory Expansion Option, and 256Kb Memory Expansion Option features, as described under "Optional Feature

Descriptions" in this subsection. For 5150 Models 813, 824, 1, 14, 64, 74, X14, X64, and X74 (which have a maximum of 64Kb on the system board), maximum memory size is 576Kb using two memory option cards.

A 5150 System Unit that can have a maximum of 256Kb on the system board has a "B" stamped on its rear panel and "64Kb-256Kb" printed on the system board. A 5150 System Unit that can have a maximum of 64Kb on the system board has no identification on its rear panel and "16Kb-64Kb" printed on the system board.

DOS Versions 1.0 and 1.1 require approximately 12Kb of memory for residence during system operation. Thus, for a 64Kb memory configuration, application programs that require up to 52Kb at a time can be used. DOS Versions 2.0 and 2.1 require a minimum of 24Kb of memory for their residence, while DOS Versions 3.0 and 3.1 require 36Kb minimum. For DOS Version 3.2, a minimum of 44Kb is required.

Note that locations in the 1024Kb address space that is accessible to the 8088 microprocessor are preassigned. The first 640Kb address range is allocated to address the 640Kb of random access memory that can be installed in a 5150 configuration. The remaining 384Kb of address space is allocated to address read only memory on the system board and memory on I/O adapters. Thus, the 640Kb to 1024Kb address range is allocated for system functions and cannot be used to address random access memory.

### System Expansion Slots

Five full-feature system expansion slots are standard on the system board to contain memory and adapter features. These slots accept full-feature and smaller special-feature cards. All slots in the 5150 support 8-bit transfer operations. One slot in all 5150 models must be used to hold a display adapter for the required display device. One additional slot is used for the standard Diskette Drive Adapter in all 5150 models except 1 and 104.

The following require one system expansion slot each unless otherwise indicated:

- 64/256Kb Memory Expansion Option
- 256Kb Memory Expansion Option
- Game Control Adapter\*
- Prototype Card\*
- Diskette Drive Adapter
- Monochrome Display and Printer Adapter\*
- Color/Graphics Monitor Adapter\*



- 3295 Display Adapter
  - Printer Adapter\*
  - Enhanced Graphics Adapter
  - Emulex/Persyst BoB/MG – Monochrome Graphics Board
  - Data Acquisition and Control Adapter\*
  - General Purpose Interface Bus Adapter\*
  - Asynchronous Communications Adapter\*
  - Binary Synchronous Communications Adapter\*
  - SDLC Communications Adapter\*
  - 1200 bps Modem
  - 2400 bps Modem
  - Voice Communications Adapter
  - Personal Telephone Manager Adapter
  - High Speed Adapter to attach a 3117/3118 Scanner
  - PC Adapter for 3117 Scanner
  - Display Station Emulation Adapter (installation in the 5161 permitted if the 5520/Personal Computer Attachment Program Version 2 or 3 is used)
  - Enhanced Display Station Emulation Adapter\*
  - Advanced 3278/79 Emulation Adapter
  - IBM Personal Computer 3278 Attachment Option (withdrawn from marketing)
  - IBM Personal Computer 3279 Attachment Option (withdrawn from marketing)
  - 3278/79 Emulation Adapter (withdrawn from marketing)
  - 8100 PC Adapter\*
  - Cluster Adapter\*
  - IBM PC Network Adapter
  - IBM Token-Ring Network PC Adapter
  - IBM Token-Ring Network PC Adapter II
  - Terminal Communications Adapter\*
  - 6157 Tape Attachment Feature
  - 4700 FCS Input Option financial input adapter
  - 4700 FCS Output Option financial output adapter
  - 4700 FCS Security Option financial security adapter
  - 5161 Expansion Unit Model 1 extender card (provided with the 5161 unit)
- \* This feature can be installed in the 5150 or 5161 Model 1 unit. Others must be installed in the 5150 unit.

The Monochrome Display and Printer Adapter or the Color/Graphics Monitor Adapter can be installed in the 5161 Model 1 only if it is the second display adapter in the configuration. One display adapter must be installed in the 5150 unit for the primary (or only) display.

If more than five expansion slots are needed, the 5175 Professional Graphics Display is to be installed, or fixed disk storage is required, the 5161 Expansion Unit Model 1 must be attached to the

5150 System Unit. The 5161 Model 1 provides eight additional expansion slots for a total of 13 slots in the configuration as well as 10Mb of fixed disk storage (see 5161 Model 1 description in Section 11:15 for details).

### ***Cassette Recorder Adapter***

This adapter provides for the attachment of one customer-supplied audiocassette recorder via a 5-pin connector at the rear of the 5150 unit via a customer-supplied cable. The earphone output and either the microphone or auxiliary input of the cassette recorder are used. The cassette can be used for loading and saving programs and data. The data transfer rate of the cassette interface varies from 1000 to 2000 bits per second (125 to 250 characters per second, or 150 on average), depending on the data content. The BASIC Interpreter in ROM supports input/output operations using a cassette recorder. DOS does not support the cassette recorder.

### ***Programmable Speaker***

A 2.25"-diameter, 8-ohm audio speaker is included in all 5150 units. It attaches to the speaker adapter on the system board. Tones of varying frequency (37 to 32,000 Hz per second) and duration can be generated for musical applications, which can be written using the BASIC provided with DOS.

### ***Diskette Drive Adapter***

One Diskette Drive Adapter is standard in all 5150 models except 1 and 104, for which the adapter is optional. This adapter requires an expansion slot in the 5150, and only one diskette drive adapter can be installed in a 5150 configuration. One or two IBM-supplied internal 5.25" diskette drives can be attached to this adapter. The two drives can be any combination of single-sided and double-sided drives. Two external 5.25" diskette drives (not supplied by IBM) or one 3.5" external diskette drive (4865 Model 1) can also be attached to this adapter via the adapter connector in the rear of the 5150 unit for a total of four or three diskette drives, respectively. The diskette drive adapter uses direct memory access for record data transfer.

### 5.25" Single-Sided Diskette Drive

One or two 5.25" Single-Sided Diskette Drives (withdrawn from marketing) can be present in a 5150 System Unit to provide a maximum online capacity of 320Kb (327,680 bytes) using DOS Version 1.0 or 1.1 or of 360Kb (368,640 bytes) using DOS Version 2.0 or later. The drives attach to the Diskette Drive Adapter. The leftmost (A) drive is always used for initial program loading (IPL) at power-on time or when IPL is done via the keyboard. The single-sided diskette can read from and write to one side of a soft-sectored, double-density 5.25" diskette (but not a double-sided diskette).

For a description of this drive, see Section 13:10 under "5.25" Single-Sided Diskette Drive."

### 5.25" Double-Sided Diskette Drive

One or two 5.25" Double-Sided Diskette Drives can be present in a 5150 System Unit to provide an online diskette capacity of 720Kb (737,280 bytes) using DOS Version 2.0 or later or 640Kb (655,360 bytes) maximum using DOS Version 1.1. The two drives attach to the Diskette Drive Adapter. The leftmost (A) drive is always used for initial program loading (IPL) at power-on time or when IPL is done via the keyboard.

For a description of this drive, see Section 13:10 under "5.25" Double-Sided Diskette Drive."

### Keyboard

One 83-key keyboard is standard for all 5150 models except X14, X64, X66, X74, and X76. It is the same physical keyboard that is provided for 5160 Personal Computer XT Model 68, 78, 87, and 86 and 5160 Personal Computer XT/370 configurations. The keyboard attaches to a 5-pin connector in the back of the 5150 unit via a 6-foot (1.8-m) coiled cable and can be positioned as desired for typing comfort. Its typing angle can be adjusted to 5 or 15 degrees. Commonly used data and word processing functions are provided. The 101-key keyboard available for certain models of other IBM personal computer configurations is not available for the 5150 unit.

Approximate dimensions and weight of the 83-key keyboard are:

- Height: 2.3 inches (57 mm)
- Width: 19.5 inches (500 mm)
- Depth: 7.8 inches (200 mm)
- Weight: 6.2 lb (2.8 kg)

Highlights of the 83-key keyboard, which also apply to the 83-key lightweight keyboard for the 5155 Portable Personal Computer, are as follows:

- The 83 keys are provided in three major groups. There are ten programmable function keys on the left, a special 15-key keypad for numeric entry and cursor control on the right, and a standard typewriter layout for alphabetic, numeric, and certain special character keys in the middle of the keyboard. The ten function keys can be programmed to handle any desired functions. The keypad key functions can also be programmed to provide the function specified on each key, if desired.
- The keyboard provides a scan code to the system unit when a key is pressed instead of an ASCII code. A unique scan code is assigned to each key. A BIOS keyboard routine in ROM (for the U.S. English keyboard only) translates the scan code to the standard or extended ASCII character and presents it to the executing program. This permits the character or function of each key to be defined by programming. The scan codes for the various keyboards provided for IBM personal computer configurations are compatible at the BIOS level. Note that the 4860 keyboard does not generate a scan code for certain key combinations (Alt and F7, Shift and F9, Ctrl and F8, and Ctrl and F9).
- 256 characters are supported, which include 128 standard ASCII and 128 extended ASCII characters. Characters not listed on the keyboard can be entered using the Alt and numeric keypad keys (the decimal code for the character must be entered).
- The ten function keys can be programmed to support up to 40 different functions using keyboard shift keys (shift, Ctrl, and Alt keys). A plastic template, GX20-2413, is available that fits around the program keys and provides space to note the use of each key, program name, program mode, and other details.
- Cursor control keys provide for moving the cursor up, down, right, and left.
- PgUp, PgDn, home, and end keys and keys to insert and delete characters at the cursor position are provided for word processing.
- The ability to print the current contents of the video display at any time is provided via the PrtSc key.
- All noncontrol keys are typamatic (character or function is repeated as long as the key is held down).
- Tactile feedback provides pressure buildup and release as a key is pressed to indicate the keystroke has registered and the character or command has been sent to the processor. Audio

feedback provides a soft click when a key is pressed. These features aid typing when information is entered from notes.

- A 16-character type-ahead buffer is provided to prevent keystrokes from failing to be registered if information or a command is entered before the system unit is ready to receive it.
- A ledge above the top row of keys provides a convenient rest for propping open a book or reference manual between the video display and keyboard.

The 83-key keyboard is available in six different language layouts: U.S. English, U.K. English, French, German, Italian, and Spanish. The U.S. English 83-key layout (the only layout available in the U.S.A.) is shown in Figure 11-2. The international-layout keyboards are supported by DOS.

### Power Supply

The power supply (63.5-watt) in the right rear corner of the 5150 unit provides power (required voltages) to the system unit, its options, and the keyboard. A 120 volt AC and a 220/240 volt AC supply are provided. The 5151 Monochrome Display has its own power supply and receives AC power from the power system in the 5150 or 5161 unit.

Overvoltage protection is provided for the outputs and overcurrent protection is provided via two fuses. If any voltage output exceeds 200% of its maximum rated voltage or if any current output exceeds 130% of its nominal value, power to the 5150 is automatically removed. A system shutdown also occurs if adequate power is not being received.

### Optional Feature Descriptions

#### *Math Co-processor Option*

This option increases the speed and precision of arithmetic, logarithmic, and trigonometric functions. It provides an Intel 8087 coprocessor that performs floating-point arithmetic and provides three to ten times better performance than the 8088 microprocessor executing floating-point subroutines, depending on the operation performed. Multiply and divide operations provide the lower performance improvements while logarithmic, trigonometric, and square root operations provide the higher performance improvements. See Section 13:10 under "Math Co-processor Option" for a description of this feature.



Figure 11-2. U.S. English 83-key keyboard for the IBM Personal Computer

### **64Kb Memory Module Kit**

This feature provides 64Kb of parity-checked random access memory via nine small plug-in modules. Each module contains 64K bits. This memory has a 200-ns access time and a 345-ns cycle time. Up to three of the module kits (192Kb) can be installed on a 5150 Model 104, 114, 164, or 174 system board to provide 256Kb on the board. Models 166, 176, X66, and X76 have 256Kb on the system board as a standard feature. Up to three 64Kb module kits can be added to the 64/256Kb Memory Expansion Option feature card.

Note that the 16Kb Memory Expansion Kit can be installed only in a 5150 Model 1 or 813 (which are no longer marketed) to expand the memory on the system board to a maximum of 64Kb in 16Kb increments.

### **64/256Kb Memory Expansion Option**

This option provides 64Kb of parity-checked random access memory on an 11" card that plugs into an expansion slot in the 5150 unit. This option cannot be installed in the 5161 unit. This memory has a 200-ns access time and a 345-ns cycle time.

Up to three 64Kb Memory Module Kits can be plugged into a 64/256Kb Memory Expansion Option card for a total of 256Kb on the card. The system board must have its maximum memory capacity (64Kb or 256Kb) installed before memory can be added via the 64/256Kb Memory Expansion Option. Switches on the option card must be set to indicate the amount of memory on the option card and in the system unit.

One or two 64/256Kb Memory Expansion Option features can be installed in a 5150 unit. For 5150 models with 256Kb on the system board, one memory expansion card contains 256Kb while the other card contains 64Kb or 128Kb to provide a total of 576Kb or 640Kb in the configuration. For models with 64Kb on the system board, each memory expansion card can contain 256Kb to provide a total of 576Kb in the 5150 configuration.

### **256Kb Memory Expansion Option**

This option provides 256Kb of parity-checked random access memory on a 5" card. It plugs into an expansion slot only in the 5150 unit (not in the 5161 unit). The system board must have its maximum memory capacity (64Kb or 256Kb) installed.

One or two 256Kb Memory Expansion Options can be installed in 5150 models with 64Kb maximum on the system board to provide up to 576Kb in the configuration. One 256Kb Memory Expansion Option and one 64/256Kb Memory Expansion Option with 64Kb or 128Kb can be installed in 5150 models with 256Kb on the system board to provide up to 576Kb or 640Kb, respectively, in the configuration.

The access time of the memory on the 256Kb Memory Expansion Option card is 290 ns and the cycle time is 840 ns.

### **4865 Personal Computer 3.5" External Diskette Drive Model 1**

One 4865 Personal Computer 3.5" External Diskette Drive Model 1 feature can be installed in a 5150 configuration (any model) to provide an additional diskette drive. The 5150 unit can have two internal 5.25" 360Kb diskette drives installed in addition to the 4865 external drive, which has a capacity of 720Kb. The 4865 provides the ability to interchange data using the 3.5" diskette between the 5150 and the 5140 PC Convertible or 7552 Industrial Computer and among 5150, 5155, 5160, 5162, and 5170 configurations with a 3.5" diskette drive.

This feature provides the following components:

- External diskette drive with permanently attached signal/power cable
- Power split cable
- Cover plate
- Update (6280784) to the 5150 *Guide to Operations* (includes one 5.25" diagnostic diskette)

The 4865 Model 1 external diskette drive attaches to the Diskette Drive Adapter (connector on the end of the adapter card) via the 3-foot (.9-meter) signal/power cable attached to the 4865 unit. The supplied power split cable provides power from the 5150 system to the external 4865 unit.

The 4865 Model 1 reads and writes the 3.5" double-sided, high capacity (2HC) diskette (not available from IBM). The 3.5" diskette is housed in a rigid plastic case that contains a built-in write protect switch. The plastic case has 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. See Section 12:10 for a photo of the 3.5" diskette.

Characteristics of the 4865 Model 1 diskette drive are:

- Number of rotations per minute: 300
- Track-to-track access time: 6 ms
- Data transfer rate: 250Kb bits per second
- Head settling time: 15 ms
- Height: 4.69 inches (119 mm)
- Width: 2.17 inches (55 mm)
- Depth: 8.27 inches (210 mm)
- Weight: 3.4 lb (1.54 kg)

Characteristics of the 3.5" diskette are:

- Track density: 135 tracks per inch
- Number of tracks: 80 per surface
- Number of surfaces: 2
- Number of bytes per sector: 512
- Number of sectors per track: 9
- Formatted capacity: 737,280 bytes

The 4865 Model 1 is supported by DOS as of Version 3.2. IPL (initial program load) from a 4865 attached to a 5150 is not supported and DOS Version 3.2 loaded from a 5.25" diskette or from a fixed disk is required to support operation of the 4865 unit. Therefore, the DOS Version 3.2 package that is supplied on 5.25" diskettes (6280057) must be purchased to support the 4865. The DOS Version 3.2 package supplied on 3.5" diskettes (6280058) cannot be used in a 5150 configuration.

Updates to the *Options and Adapters Technical Reference* (59X9945 for the Storage Devices section and 59X9946 for the Adapters section) can be purchased as can an update (6280111) to the 5150 *Hardware Maintenance and Service Manual* and an update (6280112) to the 5150 *Hardware Maintenance Reference Manual*. The 4865 unit is shown in Section 13:10 in Figure 13-2.

### **Game Control Adapter**

This feature permits up to two joysticks or up to four game paddles to be attached to a 5150 configuration. It can also be used as a general-purpose I/O card with four analog (resistive) inputs plus four digital input points.

A joystick allows the user to move an object shown on the video display in any direction for video game interaction. A game paddle supports simple vertical or horizontal movement of displayed objects. Joysticks and game paddles for the 5150 Personal Computer can be ordered from IBM. They are supported by BASIC but not by DOS. (The IBM-logo joystick for the IBM PCjr does not attach to the 5150 configuration.)

The Game Control Adapter (one maximum) can be installed in a special- or full-feature slot in the 5150/5161 unit. The adapter provides a 15-pin D-shell connector at the back of the 5150/5161 unit.

### **Prototype Card**

This feature (one maximum) is provided as a base for building and testing custom attachments for the 5150 configuration. The Prototype Card is a full-size circuit board 13.2 inches (335.3 mm) long and 4.2 inches (106.7 mm) high that plugs into a full-feature slot in the 5150 or 5161 unit. Circuitry and module holes are provided for interface with the IBM I/O bus. A bracket is included to secure the card in the 5150/5161, with a cutout provided for an external D-shell connector with 9 to 37 pins. Detailed instructions and component identifications for I/O attachment logic are provided with this feature.

### **Monochrome Display and Printer Adapter**

This adapter provides for attachment to the 5150 configuration of one 5151 Monochrome Display Model 1 and one printer, such as the 4201 Proprinter; 4202 Proprinter XL; 5152 Graphics Printer Model 2; 3852 Color Jetprinter Model 2; 5182 Color Printer; 5201 QUIETWRITER® Printer Models 1 and 2; 5216 Wheelprinter Model 2; 5223 Wheelprinter E Model 1; IBM SELECTRIC® System/2000 Typewriter; or IBM Electric Typewriter 65, 85, or 95; or a device with TTL (transistor to transistor logic) levels. The printer adapter provides a parallel interface to the attached printer/device (eight bits transferred at a time). See Section 31 for the cables required for printers that attach to this adapter.

One Monochrome Display and Printer Adapter can be installed in a 5150 configuration and requires one full-feature slot in the 5150 or 5161 unit. One other display adapter can be installed together with the Monochrome Display and Printer Adapter (Color/Graphics Monitor Adapter, Enhanced Graphics Adapter, or Professional Graphics Controller, for example).

When the Monochrome Display and Printer Adapter and the Color/Graphics Monitor Adapter are installed in the same 5150 configuration, at least one of the two adapters must be installed in the 5150 unit for the primary display.

This feature provides a 9-pin connector and a 25-pin connector at the rear of the 5150/5161 unit for attachment of a direct-drive display and a printer, respectively. A light pen cannot be attached to this adapter for use with the 5151 or another display.

The monochrome display adapter supports the following:

- Alphameric (text) mode with a 256-character set. All-points-addressable graphics mode is not supported.
- 25 lines of 80 characters
- Resolution of 720 pels horizontal, 350 pels vertical
- White characters on a dark background (normal display)
- Dark characters on a white background (reverse display)
- Blinking characters (on an individual character basis) for normal and reverse display
- White characters on a white background or dark characters on a dark background (for nondisplay of characters on an individual character basis)
- High intensity to highlight text via brightening

The Monochrome Display and Printer Adapter has 8Kb of ROM that contains a character generator and 256 character codes. The adapter also has 4Kb of read/write memory to hold the contents of one display screen of 25 80-character lines. The read/write memory is directly addressable by programming and can be read/written using direct memory access.

### ***Color/Graphics Monitor Adapter***

This adapter provides for the attachment of up to three color displays and one light pen to a 5150 configuration. Light pens are supported by BASIC but not by DOS. This adapter provides a 9-pin connector for a display that presents a direct-drive RGB (red, green, blue) signal, a connector (composite signal phone jack) for a display that presents a composite video signal, a four-pin Berg strip for connection of an RF modulator (P-1 connector), and a light pen (P-2) connector (six-pin Berg strip).

The following can be attached to this adapter:

- 5153 Color Display Model 1, which provides a direct-drive RGB signal, or another RGB direct-drive video monitor (the latter is not provided by IBM) — uses the direct-drive RGB connector (on the end of the adapter card)
- 5154 Enhanced Color Display Model 1, which provides a direct-drive RGB signal — uses the direct-drive RGB connector

- A black and white or color video monitor (not provided by IBM) — uses the composite video connector (on the end of the adapter card)
- A black and white or color television set with an RF modulator (not provided by IBM) — uses the four-pin Berg strip (on the side of the adapter card) or with the appropriate RF modulator cable plugs into the composite video connector (composite signal phone jack on the end of the adapter card). Only 40-column mode should be used for TV sets to improve character visibility.
- A light pen via the light pen connector (on the side of the adapter card)

Note that if a TV set or non-IBM display is used with the 5150, diskette drive errors may occur unless the display is located at least 12 inches (30 cm) away from the 5150 unit.

One Color/Graphics Monitor Adapter can be installed in a 5150 configuration and requires one full-feature slot in the 5150 or 5161 unit. One other display adapter can be installed together with the Color/Graphics Monitor Adapter (Monochrome Display and Printer Adapter, Enhanced Graphics Adapter, Professional Graphics Controller, or 3295 Display Adapter, for example).

When the Color/Graphics Monitor Adapter and the Monochrome Display and Printer Adapter are installed in the same 5150 configuration with a 5161 unit, at least one of them must be installed in the 5150 unit for the primary display.

See Section 13:10 under "Color/Graphics Monitor Adapter" for additional information about this display adapter.

### ***3295 Display Adapter***

The 3295 Display Adapter and 3295 Plasma Monitor constitute the IBM Personal Computer Information Panel. The 3295 adapter provides for the attachment of one 3295 Plasma Monitor to the 5150 System Unit via the standard 4.9-foot (1.5-meter) or optional 16.4-foot (5-meter) signal cable. One 3295 Display Adapter can be installed in a 5150 configuration. The 3295 display has a thin profile and requires a smaller amount of surface space than other IBM personal computer displays for the 5150. See Section 13:10 under "3295 Display Adapter" for a photo of the 3295 display.

The 3295 display can be the only display in the 5150 configuration or in one that also contains a Color/Graphics Monitor Adapter but not a Monochrome Display and Printer Adapter,

Enhanced Graphics Adapter, or Professional Graphics Controller. See Section 13:10 under "3295 Display Adapter" for a description of this feature.

### **Printer Adapter**

This adapter provides for attachment to the 5150 configuration of one printer, such as the 4201 Proprinter; 4202 Proprinter XL; 5152 Graphics Printer Model 2; 3852 Color Jetprinter Model 2; 5182 Color Printer; 5201 QUIETWRITER® Printer Models 1 and 2; 5216 Wheelprinter Model 2; 5223 Wheelprinter E Model 1; IBM SELECTRIC® System/2000 Typewriter; or IBM Electronic Typewriter 65, 85, or 95; or any device with TTL (transistor to transistor logic) levels. It provides a parallel interface to the printer/device (eight bits transferred at a time).

The Printer Adapter is used (1) to attach a parallel printer when a display adapter other than the Monochrome Display and Printer Adapter is installed or (2) when two parallel printers are to be installed and the Monochrome Display and Printer Adapter or Emulex/Persyst BoB/MG — Monochrome Graphics Board is already present.

One Printer Adapter can be installed in a 5150 configuration and requires one slot in the 5150 or 5161 unit (special- or full-feature). The adapter provides a 25-pin D-shell connector at the rear of the 5150/5161 unit for attachment of the printer cable. See Section 31 for the cables required for printers that attach to this adapter.

### **Enhanced Graphics Adapter, Graphics Memory Expansion Card, and Graphics Memory Module Kit**

The Enhanced Graphics Adapter provides one 9-pin connector on the end of the card for attaching a display that presents a direct-drive RGB (red, green, blue) signal. Composite video support for attaching analog monitors or TV sets is not provided. One light pen can be attached to this adapter in addition to one display via the P-2 connector (six-pin Berg strip on the side of the card).

This adapter provides for attachment to a 5150 configuration of one of the following: 5154 Enhanced Color Display (which offers a choice of more colors and a higher resolution than the 5153 Color Display), 5151 Monochrome Display, 5153 Color Display, or another direct-drive display. A light pen cannot be attached to this adapter for use with the 5151 display.

One Enhanced Graphics Adapter can be installed in a 5150 configuration and requires one slot in the 5150 unit. This adapter cannot be installed in the 5161 unit. One Graphics Memory Expansion Card can be installed in a socket on the side of the Enhanced Graphics Adapter, and the modules provided in one Graphics Memory Module Kit can be installed in the sockets provided on the Graphics Memory Expansion Card.

A 5150 Model 813, 824, 1, 14, 64, or 74 with serial number 0300960 or lower without a 5161 unit attached must have the BIOS Update Kit installed in order to use the Enhanced Graphics Adapter.

For a description of this adapter, see Section 13:10 under "Enhanced Graphics Adapter, Graphics Memory Expansion Card, and Graphics Memory Module Kit."

### **Enhanced Graphics Adapter Jumper Card**

One Enhanced Graphics Adapter Jumper Card must be installed in a 5150 configuration that is to be connected to a 4055 InfoWindow Display to form and IBM InfoWindow System. This jumper card is installed on the Enhanced Graphics Adapter card and connects to the General Purpose Interface Bus Adapter. It provides external synchronization from the 4055 display that allows text and graphics stored in the 5150 to overlay video stored in a videodisc player.

A Guide to Operations manual, GA27-3744, is supplied with this feature. A maintenance and service manual, SX27-3756, with a diagnostic diskette can be ordered. See Section 30:30 for a discussion of the 4055 InfoWindow Display.

### **Professional Graphics Controller**

The Professional Graphics Controller is required to attach the 5175 Professional Graphics Display to a 5150 configuration via the 5161 unit. The 5175 display together with the Professional Graphics Controller offers more colors and a higher resolution than the 5154 Enhanced Color Display and provides high-quality color graphics capabilities for a wide range of specialized applications.

The 5175 display (which has the same dimensions as the 5153 Color Display) can be used by engineers, scientists, technicians, and designers for computer-aided design, computer-aided manufacturing, image processing, and business presentation graphics. The 5175 display permits advanced graphics to be inte-

grated with other work performed by a 5150 Personal Computer.

One Professional Graphics Controller can be installed in a 5150 configuration. It requires two adjacent full-feature slots in the 5161 unit in a 5150 configuration. It cannot be installed in the 5150 unit. This controller can be present in a configuration that has one other display adapter installed (Monochrome Display and Printer Adapter, Color/Graphics Monitor Adapter, or Enhanced Graphics Adapter). Another display must be included in a 5150 configuration that contains a 5175 display in order to execute diagnostics.

For a description of this feature, see Section 13:10 under "Professional Graphics Controller."

### ***Emulex/Persyst BoB/MG – Monochrome Graphics Board***

This non-IBM-logo feature provides for attachment to the 5150 of one direct-drive monochrome display (such as the 5151 Monochrome Display) or color (RGB) display (such as the 5153 Color Display), one parallel printer (such as those that attach to the Monochrome Display and Printer Adapter), and one light pen. Graphics mode is supported for monochrome as well as color displays.

One of these features can be installed in a 5150 configuration. This feature can be used, for example, to provide low-cost graphics capabilities for a monochrome display. See Section 13:10 under "Emulex/Persyst BoB/MG – Monochrome Graphics Board" for additional information.

### ***Data Acquisition and Control Adapter and Data Acquisition and Control Adapter Distribution Panel***

The Data Acquisition and Control Adapter provides analog input and output channels and digital input and output ports to receive data from, and send data to, instruments and devices for the purpose of data acquisition, control, analysis, and quality control testing in laboratory, pilot plant, or full-scale production lines.

Up to four Data Acquisition and Control Adapters and panels can be installed in a 5150 configuration. When more than one such adapter is installed, all must be installed either in full-feature slots in the 5161 unit or in any available slots in the 5150 unit. A diagnostic program is provided with the adapter to test the hardware, and the Data Acquisition and

Control Adapter Program is available to support the operation of up to four of these adapters.

For more information, see Section 13:10 under "Data Acquisition and Control Adapter and Data Acquisition and Control Adapter Distribution Panel."

### ***General Purpose Interface Bus Adapter***

This adapter provides the means to attach devices and/or instruments that use the ANSI/IEEE-488 standard interface, including the 488A-1980 supplement, to a 5150 configuration. This adapter permits engineering and science professionals to access and control over 2000 different instruments that use the IEEE-488 standard.

Up to four General Purpose Interface Bus Adapters can be installed in a 5150 configuration. If multiple adapters use the same interrupt level, they must all be installed in the same unit (5150 or 5161). An adapter can have up to 14 devices or instruments attached with a maximum of 48 devices/instruments in one 5150 configuration.

The 7371, 7372, 7374, 7375 (Models 1 and 2), 6180 Model 2, and 6184 Color Plotters can be attached to this adapter. The IEEE488 Cable must be purchased for each device that is to be attached to this adapter.

This adapter can use the direct memory access capability and supports a memory access data rate of up to 300Kb per second. A programmed I/O data rate of up to 20Kb per second is also supported. User selection of the direct memory access channel and/or the interrupt level used by this adapter is provided. The adapter can send data as a talker, receive data as a listener, issue commands as a controller, or combine these functions as required.

The General Purpose Interface Bus Adapter Programming Support program supports up to four of these adapters controlling, monitoring, and accessing up to 48 devices.

For more information, see the brochure *General Purpose Interface Bus*, G520-5021.



### *Asynchronous Communications Adapter*

One or two Asynchronous Communications Adapters can be installed in a 5150 configuration. When the 1200 bps Modem or 2400 bps Modem is installed, only one asynchronous adapter can be present. When the SDLC adapter is installed, only one Asynchronous Communications Adapter, one 1200 bps Modem, or one 2400 bps Modem can be installed. The Asynchronous Communications Adapter requires one expansion slot in the 5150 or the 5161 Model 1 (special- or full-feature).

This adapter provides a path to a processor or an I/O device outside the 5150 or 5161 unit. A processor or I/O device can be connected to this adapter directly via cable (for local attachment). A remote processor can be attached to this adapter via a communication line using a plug-in modem. A customer-supplied cable (such as the Communications Adapter Cable) is required for attachment of an external modem (such as the 5841 or 5842 Modem) or other device to the asynchronous adapter.

The asynchronous adapter has one 25-pin D-shell connector to attach a device to the adapter. In addition, a current-loop interface is located in the same connector. A jumper block is provided to manually select the voltage or the current-loop interface. The latter is used, for example, to attach a 5218 Printwheel Printer to the 5150/5161. The recommended maximum cable length for attachment of a device to the current-loop interface is 50 feet (15.3 meters).

Two asynchronous adapters (or one asynchronous adapter and the 1200 bps Modem or 2400 bps Modem) in the same 5150 configuration can transmit/receive at the same time. However, because of contention for interrupt levels, concurrent operation of two asynchronous adapters is the only concurrent communications adapter operation possible.

Communication is performed using the EIA (Electronics Industry Association) RS-232C asynchronous interface. This is a serial (bit-by-bit transfer) interface. The adapter is fully programmable. Speed (50 to 9600 bps or 5 to 960 bytes per second), format (5-, 6-, 7-, or 8-bit characters), parity checking, and stop bits (1, 1.5, or 2) are selected as appropriate for the attached processor/device. A prioritized interrupt system controls transmit, receive, error, line status, and data set interrupts.

Line break, signal generation and detection, false-start bit detection, and internal diagnostics are also supported. The EIA-standard I/O signals transmit

data, receive data, clear to send, request to send, data set ready, data terminal ready, ring indicator, carrier detect, and received line signal detect are supported. Full double buffering eliminates the need for precise synchronization. The diagnostic capability provides the loop back functions of transmit/receive and input/output signals.

A 5150 configuration can be attached to the following using the Asynchronous Communications Adapter:

- System/370, 30XX, 9370, and 4300 processors
- 8100 Processors via the 7426 Terminal Interface Unit
- Series/1 processors
- 3708 Network Conversion Unit
- 3710 Network Controller
- 4860 PCjr
- 5140 PC Convertible
- 5150 Personal Computer
- 5155 Portable Personal Computer
- 5162 Personal Computer XT
- 5160 Personal Computer XT or XT/370
- 5170 Personal Computer AT or AT/370
- 3270 Personal Computer workstations
- 5531, 7531, 7532, and 7552 Industrial Computers
- 5181 Compact Printer
- Displaywriters
- 7371, 7372, 7374, 7375 (Models 1 and 2), and 6180 Model 1, and 6184 Color Plotters
- 3117 Scanner
- 3118 Scanner
- 3812 Pageprinter
- 5216 Wheelprinter Model 2
- 5218 Printwheel Printer Models A03 and A04 or other letter-quality serial printers
- 4975 Printer Model 02R
- 5083 Tablet Model 2
- 7171 ASCII Device Attachment Control Unit
- Paper tape readers
- Communicating typewriters
- Laboratory instruments
- Voice recognition devices and electronic keyboards
- Mouse devices (Microsoft<sup>™</sup> Mouse and Mouse Systems PC-PC XT Mouse, for example)
- Other devices and processors that use the RS-232C interface

The 5083 Tablet Model 2 attaches to the Asynchronous Communications Adapter via the 5083 Tablet Model 2 Personal Computer Attach Cable and Power Supply, an accessory for the 5083 Tablet Model 2 unit. The accessory provides a self-contained power supply that plugs into a standard grounded electrical outlet. A two-foot cable with a connector is attached to this power supply. The

5083 Model 2 plugs into this connector, which also has a six-foot cable attached. This six-foot cable has a connector at its other end to attach the cable to the Asynchronous Communications Adapter in the 5150 configuration.

The 5083 Model 2 attached to a 5150 configuration is supported by the PC/Videotex-Graphic Artist Facility (VTXGRAF). This program provides a facility to easily create and edit videotex frames of text and graphics in the North American Presentation Level Protocol Syntax (NAPLPS) environment. VTXGRAF can store frames in local libraries in the 5150 configuration for easy access and can manage local libraries. VTXGRAF provides a user-friendly interface to the corquisite product, IBM PC/Videotex, for frame transmission to, and capture from, an IBM host videotex delivery system.

For a description of the 5083 Tablet Model 2, see Section 15:40.

The SmarTerm™ 100 and VTERM™ II vendor-logo application programs support emulation of DEC VT100, VT101, VT102, and VT52 terminals using the asynchronous adapter for host processor communication (see descriptions in GB30-2037).

IBM-logo DOS application programs that support the Asynchronous Communications Adapter in a 5150 configuration for communications functions include the following:

- 3101 Emulation Program
- Asynchronous Communications Support Version 2
- Series/1 Intelligent Workstation Support PRPQ Version 2
- Personal Communications Manager
- PROFS Personal Computer Connection (PROFS/PC<sup>2</sup>)
- PC/Videotex
- PC/Colorview
- Personal Services/PC
- Data Edition IBM Personal Decision Series Productivity Product
- Mainframe Communication Assistant
- System/88 IBM Personal Computer Terminal Support

For descriptions of these programs, see Section 13:10 under "Asynchronous Communications Adapter."

### ***Binary Synchronous Communications (BSC) Adapter***

One or two BSC adapters can be installed in a 5150 configuration unless the SDLC adapter is present, in which case only one BSC adapter can be installed. The adapter requires a slot in the 5150 or 5161 Model 1 (full-feature). An external modem, such as the 5841 or 5842 Modem, must be cable-connected between the BSC adapter and a communication line using the Communications Adapter Cable feature.

The BSC adapter provides an EIA RS-232C interface. The adapter contains a universal synchronous/asynchronous receiver/transmitter, a programmable peripheral interface for an expanded modem interface, and a programmable interval timer. The adapter is programmed by IBM-logo communications software to operate in binary synchronous half-duplex mode.

The BSC adapter operates at up to 9600 bps with switched or nonswitched line support, provides modem control functions, supports program-controlled data transfer, supports electrical wrap and error status reporting, and has prioritized interrupt system controls.

The IBM-logo DOS application programs that support the BSC adapter in a 5150 configuration are:

- Binary Synchronous 3270 Emulation Program
- DisplayComm Binary Synchronous Communications Program
- Airline Link Control Programming RPO PX0001

For information about these programs, see Section 13:10 under "Binary Synchronous Communications (BSC) Adapter."

### ***Synchronous Data Link Control (SDLC) Communications Adapter***

One SDLC Communications Adapter can be installed in a 5150 configuration and only one asynchronous adapter (or one 1200 bps Modem or 2400 bps Modem) and one BSC adapter can be installed in the 5150 configuration when the SDLC adapter is present. One expansion slot in the 5150 or 5161 unit (full-feature) is required. An external modem, such as the 5841 or 5842 Modem, must be cable-connected between the SDLC adapter and a communication line using the Communications Adapter Cable feature.

The SDLC adapter provides an EIA RS-232C interface. The adapter contains an SDLC protocol controller, a programmable peripheral interface for an expanded modem interface, and a programmable interval timer. The adapter is programmed by IBM-Logo communications software to operate in synchronous half-duplex mode.

The SDLC adapter operates at up to 9600 bps with switched or nonswitched line support (including multipoint), provides modem control functions, supports program-controlled data transfer, supports electrical wrap and error status reporting, and provides prioritized interrupt system controls. The SDLC adapter can use direct memory access for data transfer.

IBM-Logo DOS application programs that support the SDLC adapter in a 5160 configuration for communications functions include the following:

- SNA 3270 Emulation and RJE Support Program
- PC 3270 Emulation Program Version 2.0, which replaces the IBM PC Network SNA 3270 Emulation Program (withdrawn from marketing), and Version 3.0
- Remote 5250 Emulation Program
- Batch Communications (program offering)
- Advanced Program-to-Program Communication for the IBM Personal Computer (APPC/PC)

For information about these programs, see Section 13:10 under "Synchronous Data Link Control (SDLC) Communications Adapter."

### **Communications Adapter Cable**

This cable supports the attachment of a modem to the Asynchronous Communications Adapter, BSC adapter, or SDLC adapter card connector at the rear of the 5150/5161. The cable is double-shielded and approximately 10 feet (3 meters) long. A wrap connector is provided to test the cable. This cable is used to connect a communications adapter to an external modem or other data communications equipment.

### **1200 bps Modem**

The 1200 bps Modem combines communications functions like those of the Asynchronous Communications Adapter and an asynchronous communications modem on one feature card using large scale integrated circuits. See Figure 13-4 in Section 13:10 for a photo of this feature card.

This 1200 bps Modem provides an interface between the 5150 and a voice grade or equivalent communication line (normally a telephone line) for asynchronous transmission of digital data. It is compatible with the stand-alone 5841 and 5842 Modems operating in asynchronous mode connected to an Asynchronous Communications Adapter or the serial port of a Serial/Parallel Adapter, and with the 2400 bps Modem.

One 1200 bps Modem can be installed in a 5150 System Unit in any slot. The modem card has a cover to protect against electrostatic discharge and provide ease of handling. The modem cannot be installed in the 5161 unit. When the 1200 bps Modem is present in the 5150 unit, only one Asynchronous Communications Adapter can be installed in the 5150 configuration as well.

See Section 13:10 under "1200 bps Modem" for a description of this feature.

### **5841 Modem**

The 5841 Modem (shown in Figure 13-5 in Section 13:10) is a microprocessor-based, general purpose, stand-alone modem that supports asynchronous or synchronous data transmissions at speeds up to 1200 bps across CCITT V.24/V.28 (EIA RS-232C/RS-334) interfaces. This modem provides an interface between DTE (data terminal equipment) and a voice grade or equivalent communication line (normally a telephone line) for transmission of digital data. Tests of the modem, communication line, and remote modem can be invoked via these interfaces.

The 5841 Modem can be attached to the Asynchronous Communications Adapter, BSC adapter, or SDLC adapter in a 5150 configuration via a customer-supplied EIA RS-232C cable. This modem operating in asynchronous mode attached to an Asynchronous Communications Adapter or the serial port of a Serial/Parallel Adapter is compatible with the 1200 bps Modem and 2400 bps Modem, which are internal modems combined with asynchronous communications functions, and with the 5842 Modem.

The 5841 supports point-to-point configurations in duplex mode and is compatible with Bell 212A and 103 practices and with CCITT V.22A and V.22B recommendations for transmitting data over the public switched telephone network. The 5150 can be connected to System/370, 30XX, 4300, 9370, Series/1, and 8100 processors and to IBM personal computers, for example, using this modem and a communications line.

For information about this modem, see Section 13:10 under "5841 Modem."

### **2400 bps Modem**

The 2400 bps Modem combines communications functions like those of the Asynchronous Communications Adapter and an asynchronous communications modem on one feature card using large scale integrated circuits. It is similar in appearance to the 1200 bps Modem (shown in Figure 13-4 in Section 13:10).

The 2400 bps Modem provides an interface between the 5150 and a voice grade or equivalent communication line (normally a telephone line) for asynchronous transmission of digital data. It is compatible with the stand-alone 5841 and 5842 Modems operating in asynchronous mode connected to an Asynchronous Communications Adapter or the serial port of a Serial/Parallel Adapter, and with the 1200 bps Modem.

One 2400 bps Modem can be installed in a 5150 System Unit. The modem card was a cover to protect against electrostatic discharge and provide ease of handling. The modem cannot be installed in the 5161 unit. When the 2400 bps Modem is present in the 5150 unit, only one Asynchronous Communications Adapter can be installed in the 5150 configuration as well.

For information about this feature, see Section 13:10 under "2400 bps Modem."

### **5842 Modem**

The 5842 Modem is a microprocessor-based, general purpose, stand-alone modem that supports asynchronous or synchronous data transmissions at speeds up to 2400 bps across CCITT V.24/V.28 (EIA RS-232C/RS-324) interfaces. It is similar in appearance to the 5841 Modem (shown in Figure 13-5 in Section 13:10).

The 5842 Modem provides an interface between DTE (data terminal equipment) and a voice grade or equivalent communication line (normally a telephone line) for transmission of digital data. Tests of the modem, communication line, and remote modem can be invoked via these interfaces.

The 5842 Modem can be attached to the Asynchronous Communications Adapter, BSC adapter, or SDLC adapter in a 5150 configuration via a customer-supplied EIA RS-232C cable. This modem operating in asynchronous mode attached to

an Asynchronous Communications Adapter or the serial port of a Serial/Parallel Adapter is compatible with the 1200 bps Modem and 2400 bps Modem, which are internal modems combined with asynchronous communications functions, and with the stand-alone 5841 Modem.

The 5842 supports point-to-point configurations in duplex mode. The 5150 can be connected to System/370, 30XX, 4300, 9370, Series/1, and 8100 processors and to IBM personal computers, for example, using this modem and a communications line. The 5842 is compatible with the following for transmitting data over the public switched telephone network:

- CCITT V.22bis recommendation at speeds of 2400 or 1200 bps
- Bell 212A practice at a speed of 1200 bps
- Bell 103 practice at speeds of 0 to 300 bps

For additional information about this modem, see Section 13:10 under "5842 Modem."

### **Display Station Emulation Adapter**

One Display Station Emulation Adapter can be installed in a 5150 configuration. It requires one slot in the 5150 System Unit. This adapter can be installed in the 5161 unit instead of in the 5150 unit unless Version 1 of the 5520/Personal Computer Attachment Program is used.

This adapter in a 5150 configuration is supported by the following IBM-Logo DOS application programs:

- 5520/Personal Computer Attachment Program (Versions 1, 2, and 3) to permit 5150 systems to communicate with a 5520 Administrative System (Versions 1 and 2 withdrawn from marketing)
- 5250 Emulation Program to permit a 5150 system to communicate with a System/34, System/36, System/36 PC, or System/38
- Attachment/36 Edition program executing with the 5250 Emulation Program to permit a 5150 system to communicate with a System/36 executing Attachment/36

The 5253 Emulation Installation Convenience Kit Version 3 can be purchased for the 5150 to provide the items necessary to permit attachment of the 5150 to the 5520 Administrative System and support 5253 emulation (Display Station Emulation Adapter, 5520/Personal Computer Attachment Program Version 3, T-connector, and Twinaxial Cable Assembly).

For a description of this feature and its programming support, see Section 13:10 under "Display Station Emulation Adapter."

### ***Enhanced Display Station Emulation Adapter***

This adapter permits a 5150 Personal Computer to be connected to a System/34, System/36, or System/38 directly; remotely via the 5251 Display Station Model 12; or remotely via the 5294 Remote Control Unit to emulate a 5250 workstation. This adapter is supported by the Enhanced 5250 Emulation Program (which replaces the withdrawn 5250 Emulation Program). Connection of a 5150 to a System/36 PC via this adapter as a locally attached display workstation is also supported (see Section 26).

As a 5250 workstation, the 5150 can emulate a 5291 or 5292 display and a 5256 or 5219 printer. The 5150 system can also operate as a stand-alone IBM Personal Computer. Access to 5150 fixed disk during execution of the Enhanced 5250 Emulation Program is supported. For a description of this feature, see Section 13:10 under "Enhanced Display Station Emulation Adapter."

### ***Personal Telephone Manager Adapter***

One Personal Telephone Manager Adapter can be installed in a 5150 configuration to permit one telephone (pulse or tone) to be attached to the 5150 or 5161 unit. The adapter card has a rear mounting bracket with two six-pin, six-contact connectors that accept modular plugs.

This adapter has rotary signal generation, dual tone multifrequency (DTMF) tone generation, a call progress processor, and programmable interval timers and can determine whether the handset is on or off the cradle of the attached telephone. The adapter also contains a loudspeaker for audio feedback of call progress tones, called party answering, incoming ringing with volume adjustment, and reminder expired alert with volume adjustment.

For a description of this feature, see "Personal Telephone Manager Adapter" in Section 13:10.

### ***Voice Communications Option***

The Voice Communications Option consists of the Voice Communications Adapter and the Voice Communications Operating Subsystem program, which enables the functions of the adapter. This option provides multiple functions: telephone management, telephone answering, speech recognition, voice synthesis, and data communications.

The Voice Communications Adapter can be installed in a slot in the 5150 (not the 5161). One telephone, one or two telephone lines, one microphone, and one 8-ohm speaker can be attached to the adapter via its five connectors. The adapter has subminiature audio-type connectors for attachment of a microphone and a speaker. Special telephone cables are provided with the adapter that use RJ11C connectors to connect to modular telephone wall outlets and telephones. The adapter also provides an internal modem that supports asynchronous communications. For a description of this feature, see "Voice Communications Option" in Section 13:10.

### ***High Speed Adapter***

One High Speed Adapter can be installed in a slot in a 5150 unit to attach one 3118 Scanner via the Communications Adapter Cable. The High Speed Adapter provides an RS-422 interface with a data rate of one million bits per second. This adapter can be installed instead of the Asynchronous Communications Adapter to maximize the performance of the 3118 Scanner.

The High Speed Adapter can also be used to connect one 3117 Scanner (with an attached Extension Unit) to the 5150 unit via the Serial Adapter Cable.

*A Guide to Operations* is supplied with the High Speed Adapter that contains a diagnostic diskette. A *Technical Reference*, SC18-2117, and *Hardware Maintenance and Service*, SY18-2167, can be purchased. See discussions of the 3117 and 3118 Scanners in Sections 32:20 and 32:25.

### ***PC Adapter for 3117 Scanner***

One PC Adapter for 3117 Scanner can be installed in a 5150 unit to connect one 3117 Scanner without an attached Extension Unit using the PC Cable for 3117 Scanner. A 5150 with a minimum of 256Kb of memory is required to support the 3117 diagnostics. See Section 32:20 for a discussion of the 3117 Scanner.

### **IBM Personal Computer 3278 Attachment Option**

The IBM Personal Computer 3278 Attachment Option for the 5150 Personal Computer (which has been withdrawn from marketing) and the IBM 3278 Personal Computer Adapter for the 3278 Display Station form the 3270 Personal Computer Attachment for the 3278, which allows a 5150 Personal Computer to be attached to a 3278 Display Station Model 1, 2, 3, 4, or 5 via 5-foot (1.5-meter) cables.

Models X14, X64, X66, X74, and X76 (withdrawn from marketing) of the 5150 (which do not have a keyboard), with a display adapter installed and without a display attached, are designed to be used with the IBM Personal Computer 3278 Attachment Option. The display and keyboard of the 3278 are used instead of those for the 5150 (shared between the 5150 and 3278). Alternatively, 5150 Models 114, 164, 174, 166, and 176 (which have a keyboard), with a display adapter installed and without a display attached, can be used with this 3278 attachment option.

A 3278 with an attached 5150 System Unit can be connected (via the 3274/3276 control unit) to any host system that supports 3278 attachment and can alternate between two modes of operation, host compute and personal compute.

For host compute mode, the 3278 operates the same way it did before the 3278 Personal Computer Adapter was installed and also supports data transfer between itself and the 5150 Personal Computer (using the 3274 only). Thus, the 3278 can be used for interaction with the host (via a 3274 or 3276) while the 5150 Personal Computer executes its own programs. The user switches between the two modes and determines whether the 3278 display and keyboard are associated with the 3278 host processor program or the 5150 Personal Computer program. Most IBM programs for the 5150 that can operate under DOS Version 1.1 and later can be executed in the 5150 in personal compute mode. Data obtained from the host system can also be processed in the 5150.

Sample programs for data transfer between the 3278 and the 5150 Personal Computer are provided with the IBM Personal Computer 3278 Attachment Option. These programs support screen capture (alphanumeric data shown on the 3278 display is sent to the 5150 for printing or writing to a diskette), transfer of files between VM/SP CMS in the host and the 5150, and transfer of files between MVS TSO in the host and the 5150. Other types of transfer between the host system and the 5150 can be user-written.

The IBM Personal Computer 3278 Attachment Option provides the following:

- An adapter for the 5150 System Unit that connects to the 3278 keyboard and display. It occupies slot 1 in the 5150.
- Additional 5-foot (1.5-meter) cables to connect the 5150 System Unit to the 3278 display and keyboard
- A cable distribution box
- A user's guide containing instructions and 5.25" diskettes. Updates to 3274 and 3278 publications also discuss the 3270 Personal Computer Attachment for the 3278.

Included on the supplied diskettes are:

- IBM Personal Computer 3278 Attachment Option Interrupt Handler
- IBM Personal Computer Data Transfer Sample Application Program
- VM/SP CMS File Transfer Sample Application Program (see GC23-0129 for a description of this program)
- TSO File Transfer Sample Application Program (see GC23-0128 for a description of this program)
- IBM 3270 Personal Computer Attachment Customization Program
- IBM Personal Computer 3278 Attachment Option Diagnostic Program

DOS Version 1.1 or later is required to use any of the supplied file transfer programs.

A 5150 System Unit attached to a 3278 can have a desktop 7371 or 7372 Color Plotter or a 7374 or 7375 Color Plotter attached.

The IBM 8100 DPPX/SP 3270 Personal Computer Attachment File Transfer PRPO (5799-WXT) operating in an 8100 with 8100 DPPX/SP supports program and data file transfer between the 8100 system and a 5150/3278 with the 3270 Personal Computer Attachment for the 3278. The 5150/3278 is connected to a 3274 Control Unit that is attached to an 8100 local loop, remote loop, or communications link.

The 5150 can transfer personal computer programs and data files to the 8100 for storage on disk. Files stored in the 8100 configuration can be shared among all 5150 users attached to the 8100 and among all 8100 users. These files can also be printed by the 8100. Files created or stored at the 8100 can be transferred to the 5150. The 5150 configuration can be attached to the 8100 via a leased or diald communications line.

One IBM Personal Computer 3278 Attachment Option can be present in a 5150 System Unit. This option is mutually exclusive with the IBM Personal Computer 3279 Attachment Option. The brochure *IBM 3270 Personal Computer Attachment for the IBM 3278 Display Station*, G520-0097, is available.

### **IBM Personal Computer 3279 Attachment Option**

The IBM Personal Computer 3279 Attachment Option for the 5150 Personal Computer (which has been withdrawn from marketing) and the IBM 3279 Personal Computer Adapter for the 3279 Color Display Station form the 3270 Personal Computer Attachment for the 3279, which allows a 5150 Personal Computer to be attached to a 3279 Color Display Station (all models except 2C) via 5-foot (1.5-meter) cables.

Models X14, X64, X66, X74, and X76 (withdrawn from marketing) of the 5150 (which do not have a keyboard), with the Color/Graphics Monitor Adapter installed and without a display attached, are designed to be used with the IBM Personal Computer 3279 Attachment Option. The display and keyboard of the 3279 are used instead of those for the 5150 (shared between the 5150 and 3279). Alternatively, 5150 Models 114, 164, 166, 174, and 176 (which have a keyboard), with the Color/Graphics Monitor Adapter installed and without a display attached, can be used with this 3279 attachment option.

A 3279 with an attached 5150 System Unit can be connected (via the 3274/3276 control unit) to any host system that supports 3279 attachment and can alternate between two modes of operation, host compute and personal compute.

For host compute mode, the 3279 operates the same way it did before the 3279 Personal Computer Adapter was installed and also supports data transfer between itself and the 5150 (using the 3274 only). Thus, the 3279 can be used for interaction with the host (via a 3274 or 3276) while the 5150 Personal Computer executes its own programs. The user switches between the two modes and determines whether the 3279 display and keyboard are associated with the 3279 host processor program or the 5150 program.

Most IBM programs for the 5150 that can operate under DOS Version 1.1 and later can be executed in the 5150 in personal compute mode. Data obtained from the host system can also be processed in the 5150.

Sample programs for data transfer between the 3279 and the 5150 Personal Computer are provided with the IBM Personal Computer 3279 Attachment Option. These programs support screen capture (alphanumeric data shown on the 3279 display is sent to the 5150 for printing or writing to a diskette), transfer of files between VM/SP CMS in the host and the 5150, and transfer of files between MVS TSO in the host and the 5150. Other types of transfer between the host system and the 5150 can be user-written.

The IBM Personal Computer 3279 Attachment Option provides the following:

- An adapter for the 5150 System Unit that connects to the 3279 keyboard and display. It occupies slot 1 in the 5150.
- Additional 5-foot (1.5-meter) cables to connect the 5150 System Unit to the 3279 display and keyboard
- A cable distribution box
- A user's guide containing instructions and 5.25" diskettes. Updates to 3274 and 3279 publications also discuss the 3270 Personal Computer Attachment for the 3279.

Included on the supplied diskettes are:

- IBM Personal Computer 3279 Attachment Option Interrupt Handler
- IBM Personal Computer Data Transfer Sample Application Program
- VM/SP CMS File Transfer Sample Application Program (see GC23-0129 for a description of this program)
- TSO File Transfer Sample Application Program (see GC23-0128 for a description of this program)
- IBM 3270 Personal Computer Attachment Customization Program
- IBM Personal Computer 3279 Attachment Option Diagnostic Program

DOS Version 1.1 or later is required to use any of the supplied file transfer programs.

A 5150 System Unit attached to a 3279 can have attached a desktop 7371 or 7372 Color Plotter or a 7374 or 7375 Color Plotter.

The IBM 8100 DPPX/SP 3270 Personal Computer Attachment File Transfer PRPQ (5799-WXT) operating in an 8100 with 8100 DPPX/SP supports program and data file transfer between the 8100 system and a 5150/3279 with the 3270 Personal Computer Attachment for the 3279. The 5150/3279 is connected to a 3274 Control Unit that

is attached to an 8100 local loop, remote loop, or communications link.

The 5150 can transfer personal computer programs and data files to the 8100 for storage on disk. Files stored in the 8100 configuration can be shared among all 5150 users attached to the 8100 and among all 8100 users. These files can also be printed by the 8100. Files created or stored at the 8100 can be transferred to the 5150. The 5150 configuration can be attached to the 8100 via a leased or dialed communications line.

One IBM Personal Computer 3279 Attachment Option can be present in a 5150 System Unit. This option is mutually exclusive with the IBM Personal Computer 3278 Attachment Option. The brochure *IBM 3270 Personal Computer Attachment for the IBM 3279 Color Display Station*, G520-0073, is available.

### **3278/79 Emulation Adapter**

This adapter has been withdrawn from marketing and replaced by the Advanced 3278/79 Emulation Adapter. The 3278/79 Emulation Adapter enables the 5150 System Unit to be attached via coaxial cable to one of the following:

- 3274 Control Unit attached to a local or remote System/370, 30XX, 4300, or 8100 processor (up to 31 personal computers per 3274 except for the Model 51C – 7 maximum – and the Model 61C – 15 maximum)
- 4321, 4331, or 4361 Processor via the Display/Printer Adapter (up to 15 personal computers per adapter)
- 4361 Processor via the Workstation Adapter (up to 32 personal computers per adapter)
- 4701 Finance Communication Controller with the Device Cluster Adapter

One 3278/79 Emulation Adapter can be installed in a 5150 configuration and it requires one slot in the 5150 (not 5161) unit.

Versions 1 and 2 of the 3278/79 Emulation Control Program are no longer available. The IBM PC 3270 Emulation Program, Entry Level and IBM PC 3270 Emulation Program Versions 2.0 and 3.0 support the 3278/79 Emulation Adapter.

For additional information about this adapter, see Section 13:10 under "3278/79 Emulation Adapter."

### **Advanced 3278/79 Emulation Adapter**

The Advanced 3278/79 Emulation Adapter replaces the 3278/79 Emulation Adapter and offers reduced cost and new function. The advanced adapter supports the hardware facilities of the 3278/79 adapter; it replaces and the following additional facilities:

- Distributed function terminal mode of operation. This mode allows distribution of 3270 data stream processing from the control unit to the personal computer and advanced capabilities, such as multiple concurrent 3270 sessions, when the advanced adapter is attached to a control unit with the same advanced capabilities (3274 Control Unit, for example)
- Hardware facilities (additional buffers on the adapter card and a 3270 buffer page change register) to improve performance when supported via software
- Connection to a 3274 via telephone twisted-pair media via the IBM/ROLM 3270 Coax-to-Twisted-Pair Adapter (in addition to via coaxial cable or the IBM Cabling System)
- Attachment to the 3274 Control Unit via the 3299 Terminal Multiplexer

The Advanced 3278/79 Emulation Adapter also uses less power than the 3278/79 Emulation Adapter and can be installed in a special-feature or a full-feature slot. Version 2 of the 3278/79 Control Program (withdrawn from marketing), IBM PC 3270 Emulation Program, Entry Level, and IBM PC 3270 Emulation Program Versions 2.0 and 3.0 support the advanced 3278/79 adapter.

For a description of the facilities supported by both the Advanced 3278/79 Emulation Adapter and the 3278/79 Emulation Adapter, see Section 13:10 under "3278/79 Emulation Adapter." For details about the new facilities of the advanced 3278/79 adapter, see the technical reference, GA23-0302. A maintenance and service manual, GA23-0269, is also available.

### **8100 PC Adapter**

One 8100 PC Adapter can be installed in a 5150 configuration to connect the 5150 to an available station address on a local or remote RLOOP in an 8100 Information System configuration. Remote attachment requires a 3843 Loop Control Unit.

A 5150 can be attached to a 9.6K-bps or a 38.4K-bps loop. Up to 26 5150 systems can be attached to a local 8100 loop, while up to ten can be attached to a remote 8100 loop. A 5150 can be defined as a single-session or a multiple-session



device. The 8100 system must use DPCX Release 4 and DOSF Release 4 (with PTFs UC02659, UC02660, and UC02661 installed), DPPX/SP, DPCX Release 5 with DSX, or DPCX Release 6 and DOSF Release 6.

The 8100 PC Adapter requires one slot in the 5150 or 5161 unit. It is mutually exclusive with the SDLC adapter and cannot operate concurrently with an Asynchronous Communications Adapter installed in the same 5150 configuration. For a description of this feature, see Section 13:10 under "8100 PC Adapter."

### ***Cluster Adapter and Cluster Cable Kit***

The Cluster Adapter installed in a 5150 Personal Computer permits it to be included in a cluster of interconnected IBM personal computers, which can include the IBM PCjr, IBM Personal Computer, IBM Portable Personal Computer, IBM Personal Computer XT and XT/370, IBM Personal Computer AT and AT/370, and IBM 5531, 7531, and 7532 Industrial Computers. Each PCjr in the clustered configuration must have the Cluster Attachment feature installed. Each 5150, 5155, 5160, 5170, 5531, 7531, and 7532 in the clustered configuration must have the Cluster Adapter feature installed.

One Cluster Adapter can be installed in the 5150 or 5161 unit. A 5150 Model 813, 824, 1, 14, 64, or 74 with a serial number lower than 0300961 and without a 5161 unit attached must have the BIOS Update Kit installed together with the Cluster Adapter. For a description of the cluster features and program support, see Section 13:10 under "Cluster Adapter and Cluster Cable Kit."

### ***IBM PC Network***

The 5178 IBM PC Network Translator Unit, IBM PC Network Adapters, and IBM PC Network Cabling Components features enable IBM Personal Computers, IBM Portable Personal Computers, IBM Personal Computer XTs and XT/370s, IBM Personal Computer ATs and AT/370s, and IBM 5531, 7531, 7532, and 7552 Industrial Computers to be connected to form an IBM PC Network. Up to 72 IBM personal computers using all IBM components, up to 256 using non-IBM cabling, or up to 1000 using a non-IBM translator unit and non-IBM cabling can be included in the network.

A 5150 in an IBM PC Network is supported by the following IBM-logo programs:

- IBM PC Local Area Network Program Version 1.1 (which replaces the IBM PC Network Program)
- IBM PC Local Area Network Program with the Local Area Network PrintManager Program
- PC 3270 Emulation Program Version 2.0, which replaces IBM PC Network SNA 3270 Emulation Program (withdrawn from marketing), and Version 3.0
- IBM Asynchronous Communications Server Program
- IBM Token-Ring Network/IBM PC Network Interconnect Program
- IBM PC Network Program with the IBM Series/1-PC Connect program

For a description of this network and its programming support, see Section 13:10 under "IBM PC Network."

### ***IBM Token-Ring Network***

The IBM Token-Ring Network is a general-purpose baseband token-ring local area network that is designed to interconnect IBM personal computers, departmental systems, and host processors within an establishment. It has a data transmission speed of four million bits per second that conforms to Institute of Electrical and Electronics Engineers (IEEE) 802.5 and IEEE 802.2 standards and European Computer Manufacturers Association (ECMA) 89 standards.

The IBM Token-Ring Network uses a structured wiring system (star-wired ring) and is designed to connect a variety of systems and devices, both IBM and non-IBM, in an establishment. Up to 260 coaxial, twinaxial, loop, and token-ring units can be connected in a network using data grade media (Type 1 or Type 2 cable). Type 9 specified media can be used as an alternative to Type 1 plenum cable. Up to 72 coaxial and token-ring units can be connected in a network using Type 3 specified telephone media (telephone twisted pair).

Non-IBM units can be connected to an IBM Token-Ring Network using components available from Texas Instruments, Inc.

The IBM Token-Ring Network Multistation Access Unit, IBM Token-Ring Network PC Adapter or IBM Token-Ring Network PC Adapter II, and IBM Cabling System enable IBM Personal Computers, IBM Portable Personal Computers, IBM Personal Computer XTs, IBM Personal Computer ATs and AT/370s, 3270 Personal Computers, 3270 Personal Computer ATs, 3270-PC AT/Gs, and AT/GXs, 5531, 7531, and 7532 Industrial Computers,

System/36s, and System/36 PCs, to be connected to form an IBM Token-Ring Network.

For a description of this network and its programming support, see Section 13:10 under "IBM Token-Ring Network."

The IBM Token-Ring Network Starter Kit is a package of hardware, software, and publications that provides everything required to convert four stand-alone IBM personal computers (5150, 5155, 5160, and 5170 units) into a four-workstation local area network. This kit is designed to help an installation quickly set up a small pilot network.

The kit consists of the following:

- One IBM 8228 Multistation Access Unit Model 001 (6091014)
- One IBM Cabling System Component Housing (6091078)
- Four each of the following:
  - IBM Token-Ring Network PC Adapter (6339100)
  - IBM Token-Ring Network PC Adapter Cable (6339098)
  - IBM Cable Assembly, 9.1 meters (30 feet) (8642552)
- Four each of the following:
  - IBM Token-Ring Network NETBIOS Program (6467037)
  - IBM PC Local Area Network Program (6280083)
- One IBM Token-Ring Network Starter Kit Guide (6466693)

A brochure, G520-6205, describes the starter kit.

### ***IBM Series/1-Personal Computer Interconnect***

The IBM Series/1 to Personal Computer Channel Attachment feature and the IBM Series/1-PC Connect program are jointly referred to as IBM Series/1-Personal Computer Interconnect. This facility provides a high-speed data path between a Series/1 processor and a 5150, 5160, or 5170 unit. Data transfer at up to 400 Kb/sec is supported. The 5150 user can access Series/1 resources and communicate with host systems and local area networks.

The Series/1 to Personal Computer Channel Attachment feature (a Series/1 feature) provides an intelligent Series/1 Channel Attachment Controller Card for the Series/1 processor (4954, 4955, 4956, 4959, or 4965) and a Personal Computer Channel Extender Card for the 5150 configuration. The Series/1 to Personal Computer Attachment Cable feature provides a 12-foot cable to connect a

Series/1 processor and a 5150 via the two provided cards. A 5150 can be connected to only one Series/1 processor using the Series/1 to Personal Computer Channel Attachment feature. For a description of this feature, see Section 13:10 under "IBM Series/1 – Personal Computer Interconnect."

### ***Displaywriter/Personal Computer Attach Convenience Kit***

This convenience kit permits a Displaywriter system (without any communications features installed in the diskette unit) to be cable-connected to a 5150 configuration via an Asynchronous Communications Adapter. The Compact Printer Connector Adapter (6450102) is also required. The 5150 can be a stand-alone system or part of an IBM personal computer cluster. When the 5150 is not being used as the interface to the cluster for the Displaywriter, it can be used as it would be if the Displaywriter were not attached. For a description of this feature, see Section 13:10 under "Displaywriter/Personal Computer Attach Convenience Kit."

### ***IBM 65/85/95-PC IPL/Diagnostic Diskette and Diagnostic Tool***

When the IBM 65/85/95-PC Attachment Device (MES 8566) is installed (by an IBM service representative) on an IBM Electronic Typewriter 65, 85, or 95 without the Modularity Option, the typewriter can be attached to a 5150 Personal Computer that has the IBM 65/85/95-PC IPL/Diagnostic Diskette and Diagnostic Tool (MES 8569) installed. Attachment is via a 6.5-foot (2-meter) cable to the Printer Adapter or the Monochrome Display and Printer Adapter in the 5150 configuration and permits the typewriter to be used as a letter-quality printer for the 5150 Personal Computer.

This attachment does not permit direct keyboarding from the typewriter to the 5150 Personal Computer. When not used as a printer, the typewriter can be used as an electronic typewriter with all its typewriter features and functions.

When used as a printer for the 5150 Personal Computer, the Model 65, 85, or 95 typewriter operates at 15.5 characters per second. The standard carriage in each model can handle paper as wide as 15.5 inches, while the wide carriage will handle paper up to 19.1 inches in width. A U.S. ASCII or U.S. Correspondence element is supported for the typewriter.

MES 8569 for the 5150 Personal Computer provides the IPL/Diagnostic Diskette and a diagnostic tool. The diskette contains the program that operates

in the 5150 System Unit when printing to the typewriter is desired and a diagnostic program. The printing program operates as an extension of DOS Version 1.0 or later. The diagnostic tool is an adapter plug that aids problem isolation when the diagnostic program is executed.

See *Hints for the IBM 65/85/95—Personal Computer Attachment Device*, G544-4132, for additional information.

### **5218 Printer Attachment Cable and 5218 Printer Sharing**

The 5218 Printer Attachment Cable is a 19.7-foot (6-meter) cable that permits a 5218 Printwheel Printer Model A03 or A04 (with specify code 9203) to be attached to a 5150 System Unit via an Asynchronous Communications Adapter configured for current-loop operations. The 5218 printer can be used as a letter-quality printer. Burst speed printing is 40 cps for the 5218 Model A03 and 60 cps for the Model A04.

The 5218 Printer Sharing feature permits up to four 5150 Personal Computer, 5155 Portable Personal Computer, 5160 Personal Computer XT, and 3270 Personal Computer (3270-PC) systems in any combination to be attached to one 5218 printer and to share the printer for letter-quality printing applications.

See Section 13:10 under "5218 Attachment Cable and 5218 Printer Sharing" for additional information.

### **Terminal Communications Adapter Kit**

One Terminal Communications Adapter can be installed in a 5150 configuration to permit it to manage up to 20 copiers (IBM Series III and Copier II, Kodak 100, and several Xerox models) using the Copier Management Information System (CMIS). Each copier is connected to the specific 6821 Copier Control Device (CCD) that supports its copier type (one of eight different CCDs available from IBM). The units in the CMIS configurations are interconnected via dedicated wiring installed by a contractor or by telephone wiring installed by the telephone company. Either 20 directly wired copiers or 19 directly wired copiers and one copier with a modem can be handled.

Communication between the 5150 configuration and each CCD is handled by the CMIS program executing under DOS Version 1.1 in the 5150. Each CCD accepts information entered by the copier user

and data from its attached copier, and transmits it to CMIS in the 5150. User identification data can be accepted from a magnetic strip card or from the CCD keypad. This information can be used to limit access to all or selected copiers to authorized users. The CCD also receives signals from the copier to indicate the number of copies made, number of originals copied, and features used.

The CMIS program processes the information it receives and can generate a usage report for each copier in the CMIS system, a change report that summarizes total cost by copier and account, and an exception report usage profile. CMIS is also used for configuring and changing the system and for system diagnostics.

The following CMIS publications are available:

- CMIS brochure, G552-2000
- Preinstallation Manual, G544-3078
- Physical Planning Manual, G544-3076
- User's Manual, S544-3079

### **Keylock Feature**

The Keylock Feature is a simple mechanical device that can be installed on a 5150 or 5161 unit in approximately 15 minutes using a screwdriver. The keylock unit is 5 inches square, 4 inches high, and weighs less than 2 lb.

The keylock unit is designed to be attached to the right rear corner of the 5160/5161 unit over the power switch. No alteration of the 5150/5161 unit or program support is required for this feature. Two keys are provided with the feature and duplicate keys can be obtained only from the lock manufacturer.

When the keylock is in the locked position, the cover removal screw of the 5150/5161 unit is protected to prevent physical access to the contents of the 5150/5161 unit. This protects against removal of the fixed disk drives in a 5161 unit as well as of the hardware installed in the 5150/5161 unit.

When the keylock is locked, power-on using the power-on switch on the 5150/5161 unit is not possible. In addition, if the display installed does not receive power from the 5150 unit (5153 or 5154 display, for example), the access port to the 5150 is blocked to prevent the 5150 from being powered on through the access port. Without power on, access to the 5150 configuration via a local program, by another computer via a communications link, or via another personal computer cabled to the 5150 in a

clustered configuration or local area network is not possible.

The cover of the keylock is also designed to permit installation of a cable or chain attachment to secure the 5150/5161 unit to the office furniture.

### ***BIOS Update Kit***

The BIOS Update Kit may be required for a 5150 Model 813, 824, 1, 14, 64, or 74 when the optional Enhanced Graphics Adapter, Cluster Adapter, or IBM PC Network Adapter is to be installed. If the serial number on the back of the 5150 System Unit is lower than 6300961 and the 5161 Expansion Unit is not attached, the kit is required to update BIOS in ROM. When the 5161 is included in the 5150 configuration, the appropriate ROM module has already been replaced.

The update kit provides a new BIOS module to replace an existing BIOS module, a module removal tool, and instructions for the module replacement.

### ***Giltronix Peripheral Sharing Device Model 8007***

The Giltronix Peripheral Sharing Device is a stand-alone unit that can have up to seven IBM personal computers (any combination of IBM PCjr's, 5150 Personal Computers, 5160 Personal Computer XT's, and 5170 Personal Computer AT's) connected to it to share the use of one printer with a serial interface, such as the 4201 Proprinter, that is also connected to the sharing device.

This non-IBM-logo unit can be used where a single printer is sufficient to support the printing requirements of multiple IBM personal computers (for example, in an educational environment that uses the Writing to Read program). For additional information, see description in Section 13:10 under "Giltronix Peripheral Sharing Device Model 8007."

### ***6157 Tape Attachment Feature***

One 6157 Tape Attachment Feature can be installed in a 5150 System Unit to permit the attachment of one 6157 Streaming Tape Drive to the 5150 via a 6-foot (1.8-meter cable) supplied with the tape drive. The SY-TOS<sub>TM</sub>/IBM 6157 Tape Utilities program supports the 6157 Streaming Tape Drive as a save/restore device for fixed disk storage in the 5150 configuration. For a description of the 6157 drive and its utility program support, see Section 13:10 under "6157 Tape Attachment Feature."

## Single Unit Prices as of December 31, 1986

Item	Part Number	Feature Code	Warranty Period (months) Warranty Service*	Single Unit Purchase Price (\$)
5150 System Unit/Keyboard				
Model 104 (83 keys)	5150104	—	3/CCR	1165
Model 166 (83 keys)	5150166	—	3/CCR	1445
Model 176 (83 keys)	5150176	—	3/CCR	1595
Advanced 3278/79 Emulation Adapter	8665789	5050	12/CCR	595
Asynchronous Communications Adapter	1502074	2074	3/CCR	100
Binary Synchronous Communications Adapter	1502075	2075	3/CCR	240
Binary Synchronous Communications Adapter (also for the 5170 Personal Computer AT)	1501204	1204	12/CCR	240
BIOS Update Kit (certain 5150 Models 813, 824, 824, 1, 14, 64, and 74 only)	1501005	1005	3/CCR	30
Cluster Adapter	1501206	1206	12/CCR	340
Cluster Cable Kit	1501207	1207	3/CCE	110
Color/Graphics Monitor Adapter	1504910	4910	3/IOR	244
Communications Adapter Cable	1502067	2067	3/CCE	65
Compact Printer Connector Adapter	6450102	0102	12/CCR	40
Data Acquisition and Control Adapter	6451502	1502	12/CCR	975
Data Acquisition and Control Adapter Distribution Panel	6451504	1504	3/CCE	190
Diskette Drive Adapter	1503780	3780	3/CCR	125
Display Station Emulation Adapter	6072534	2887	3/CCR	600
Displaywriter/Personal Computer Attach Convenience Kit	6403728	—	—	495
Emulex/Persyst BoB/MG — Monochrome Graphics Board	74X8477	7801	**	249
Enhanced Display Station Emulation Adapter	55X3365	2871	3/CCR	595
Enhanced Graphics Adapter	1501200	1200	12/CCR	524
Enhanced Graphics Adapter Jumper Card	8575146	6583	12/CCR	40
Enhanced 5250 Emulation Installation Convenience Kit Version 2.1	55X3364	2870	—	845
Game Control Adapter	1501300	1300	3/CCR	45
General Purpose Interface Bus Adapter	6451503	1503	12/CCR	295
Giltronix Peripheral Sharing Device Model 8007	1581/A01	—	***	695
Graphics Memory Expansion Card	1501201	1201	12/CCR	199
Graphics Memory Module Kit	1501203	1203	12/CCR	259
High Speed Adapter	6456730	4920	12/CCE	295
IBM PC Network: Adapter	6450213	0213	12/CCR	595
Base Expander	6450230	0230	3/CCE	59
Distance Kit: Short	6450231	0231	3/CCE	39
Medium	6450232	0232	3/CCE	79
Long	6450233	0233	3/CCE	89

\* Customer Carry-In Repair (CCR), Customer Carry-In Exchange (CCE), or IBM On-Site Repair (IOR)

\*\* Two-year warranty from manufacturer

\*\*\* 12-month warranty from Giltronix

## 11:10 IBM 5150 System Unit

Item	Part Number	Feature Code	Warranty Period	Single Unit Purchase Price (\$)
			(months) Warranty Service*	
IBM PC Network (continued):				
Cabling Segments:				
25-foot	6450234	0234	3/CCE	29
50-foot	6450235	0235	3/CCE	39
100-foot	6450236	0236	3/CCE	59
200-foot	6450237	0237	3/CCE	99
5178 PC Network Translator Unit	5178001	-	12/CCE	595
Transformer unit for PC Network	6450238	0238	12/CCE	NC
IBM Token-Ring Network:				
PC Adapter	6339100	3391	12/CCR	695
PC Adapter II	67X0438	5063	12/CCR	895
PC Adapter Cable	6339098	3390	-	35
Multistation Access Unit (8228 Model 1)	6091014	-	12/CCE	660
IBM Cabling System Component Housing	6091078	1078	-	99
Copper Repeater (8218 Model 1)	8218001	-	12/CCE	1095
Optical Fiber Repeater (8219 Model 1)	8219001	-	12/CCE	1650
Rack Mounting Assembly (for 8218 or 8219)	6339139	3001	-	300
Surface Mounting Brackets (for 8218 or 8219)	6339140	3002	-	20
Bridge Installation Kit	6476041	6041	-	3285
IBM Token-Ring Network Starter Kit	8228-KT1	-	**	4065
IBM 65/85/95-PC IPL/Diagnostic Diskette and Diagnostic Tool - MES 8569 (for the 5150)	-	8569	-	60
IBM 65/85/95-PC Attachment Device for IBM Typewriter (MES 8566)	-	8566	3/IOR	285
Convenience Kit for MES 8566 and MES 8569	-	8570	3/IOR	345
IEEEE488 Cable	5452378	5040	-	102
Keylock Feature	2683177	3177	12/CCR	50
Math Co-processor Option	1501002	1002	3/CCR	230
Monochrome Display and Printer Adapter	1504900	4900	3/CCR	250
PC Adapter for 3117 Scanner	6456805	4925	12/CCE	240
Personal Telephone Manager Adapter	6428982	8982	12/CCR	187
Printer Adapter	1505200	5200	3/CCR	75
Professional Graphics Controller	6451501	1501	12/CCR	1795
Prototype Card	1501400	1400	3/CCE	35
Synchronous Data Link Control Communications Adapter	1502090	2090	3/CCR	240
Synchronous Data Link Control Communications Adapter (also for the 5170 Personal Computer AT)	1501205	1205	12/CCR	240
Terminal Communications Adapter Kit	-	1614	60/CCE	860
Voice Communications Adapter	7684839	4839	12/CCR	950
Voice Communications Option	6294771	4771	12/CCR	995
1200 bps Modem	6164805	4805	12/CCR	499
16Kb Memory Expansion Kit (Models 1 and 813 only)	1501001	1001	3/CCR	30

\* Customer Carry-In Repair (CCR), Customer Carry-In Exchange (CCE), or IBM On-Site Repair (IOR)

\*\* Provisions of the individual components apply

Item	Part Number	Feature Code	Warranty Period	
			(months) Warranty Service*	Single Unit Purchase Price (\$)
2400 bps Modem	6164829	4829	12/CCR	569
256Kb Memory Expansion Option	1501209	1209	12/CCR	250
3295 Display Adapter	6487863	3025	12/CCR	1495
3295 Plasma Monitor	3295001	—	12/IOR	3695
Extended Signal Cable	2720066	3001	—	95
4700 FCS Input Option	6236049	6049	3/CCR	650
4700 FCS Output Option	6236052	6052	3/CCR	625
4700 FCS Security Option	6236054	6054	3/CCR	550
4865 Personal Computer 3.5" External Diskette Drive Model 1	4865001	—	12/CCE	395
5083 Tablet Model 2	5083002	—	3/IOE	650
Cursor	6248428	1511	3/IOR	175
Stylus	6248427	6351	3/IOR	100
Personal Computer Attach Cable and Power Supply	6248435	—	3/NA	150
5218 Printer Attachment Cable	6113647	—	—	45
5218 Printer Sharing	6113650	4471	3/CCE	625
5218 Convenience Pac	6113651	4470	—	220
5253 Emulation Installation Convenience Kit Version 3	6403724	2896	—	875
5841 Modem	6164800	5841	12/CCE	609
5842 Modem	6164807	5842	12/CCE	719
5.25" Double-Sided Diskette Drive	1503810	3810	3/CCR	250
6157 Streaming Tape Drive	6157001	—	12/CCE	1795
6157 Tape Attachment Feature	59X4156	4156	3/CCR	350
64Kb Memory Module Kit	1501003	1003	3/CCR	20
64/256Kb Memory Expansion Option	1501013	1013	3/CCR	190
8100 PC Adapter	6113477	7630	3/mail-in	1275

### Discounts Available

The 5150 and most of its hardware features are eligible for one of the following discounts:

- Volume Procurement Amendment
- Educational Allowance
- Special Bid

A customer who signs a VPA or special bid for IBM personal computers may establish a Technical Support Location (TSL) and assign one or more technical coordinators to be the primary interface to IBM for product usage and education. See the brochure *IBM Technical Coordinator Program, G520-4226*, and *Technical Support Location Customer Guide, G320-0728*, for a discussion of the technical coordinator program. The guide also discusses the responsibilities of a TSL-ECP coordinator, which can be designated if an IBM Employee

and Collegiate Program (ECP) amendment has been signed.

\* Customer Carry-In Repair (CCR), Customer Carry-In Exchange (CCE), or IBM On-Site Repair (IOR)

## 11:15 IBM 5161 Expansion Unit Model 1

### Introduction

The 5161 Expansion Unit with one 10Mb Fixed Disk Drive is shown in Figure 11-3.

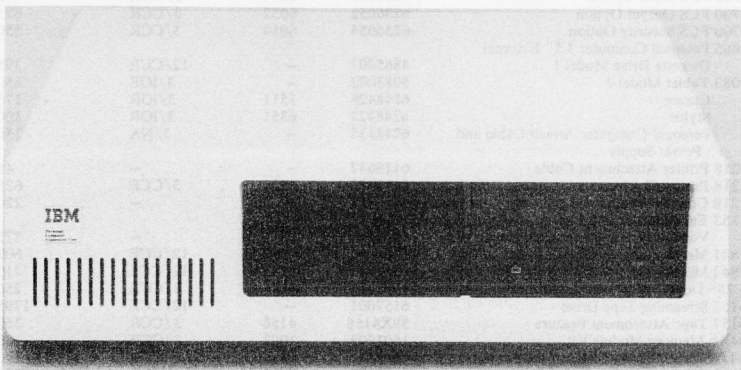


Figure 11-3. 5161 Expansion Unit

The 5161 Expansion Unit Model 1 provides fixed disk storage (10Mb or 20Mb) and additional expansion slots for the 5150 Personal Computer. The expansion slots allow for the installation of optional feature cards to extend the capabilities of the 5150 configuration.

One 5161 Model 1 can be attached to a 5150 System Unit. A ROM kit is provided with the 5161 Model 1. It contains one ROM module that must replace one of the ROM modules in a 5150 System Unit with serial number 6300960 or lower and a tool to use for the replacement.

The 5161 Model 1 can be field-installed and is a customer-setup unit. It can be placed beside the 5150 System Unit or stacked over or under the 5150 unit. When the 5161 is placed beside or on top of the 5150 unit, a printer or display can be placed on top of the 5161 unit. The 5161 unit requires its own power source.

The optional Keylock Feature can be installed on the 5161 unit. See description of this feature in Section 11:10 under "Keylock Feature."

### Physical Components

The 5161 Model 1 unit contains the following standard items:

- Eight expansion slots for optional feature cards (provided on an expansion board)
- One Fixed Disk Drive Adapter to attach one or two 10Mb Fixed Disk Drives (uses one slot)
- One 10Mb Fixed Disk Drive
- The receiver card required for connection to the 5150 System Unit (uses one slot in the 5161)
- A 130-watt power supply with cooling fan

A 39-inch (one-meter) signal cable to connect the 5161 and 5150 and an extender card that must be installed in a slot in the 5150 System Unit are also provided with the 5161 Expansion Unit. The extender card has DIP switches that must be set to indicate the amount of memory in the 5150 System



Unit. The 5161 unit weighs approximately 27 lb (12.2 kg) with one fixed disk installed.

Approximate dimensions of the 5161 are (same as for a 5150 unit):

- Height: 5.5 inches (142 mm)
- Width: 19.5 inches (500 mm)
- Depth: 16 inches (410 mm)

Environmental characteristics are (same as for a 5150 unit):

- Air temperature:
  - 60 to 90 degrees F (15.6 to 32.2 degrees C) for system on
  - 50 to 110 degrees F (10 to 43 degrees C) for system off
- Humidity:
  - 8% to 80% for system on
  - 20% to 80% for system off
- Electrical:
  - 90 to 137 volts AC, 60 Hz
  - 180 to 259 volts AC, 50 Hz

## Feature Descriptions

### Expansion Slots

Six of the eight expansion slots in a 5161 are full-feature slots and will accept full-feature or the smaller special-feature cards. The other two slots are special-feature slots. One full-feature slot contains the standard Fixed Disk Drive Adapter and another full-feature slot contains the 5161 receiver card.

The following optional features for 5150 Personal Computer configurations can be installed in the six available slots in the 5161 Model 1 unit:

- Game Control Adapter (special- or full-feature)
- Prototype Card (full-feature)
- Monochrome Display and Printer Adapter (full-feature slot) only if another display adapter is installed in the 5150 unit
- Color/Graphics Monitor Adapter (full-feature) only if another display adapter is installed in the 5150 unit
- Printer Adapter (special- or full-feature)
- Data Acquisition and Control Adapter (full-feature)
- General Purpose Interface Bus Adapter (special- or full-feature)
- Asynchronous Communications Adapter (special- or full-feature)
- Binary Synchronous Communications Adapter (full-feature)

- Synchronous Data Link Control Communications Adapter (full-feature)
- Display Station Emulation Adapter (full-feature) – not if Version 1 of the 5520/Personal Computer Attachment Program is used
- Enhanced Display Station Emulation Adapter (full-feature)
- Professional Graphics Controller (two adjacent full-feature) – must be in the 5161
- 8100 PC Adapter (full-feature)
- Cluster Adapter (full-feature)
- Personal Telephone Manager Adapter (full-feature)
- Terminal Communications Adapter (special- or full-feature)

As for a 5150 System Unit, expansion slots are located in the left rear area of the 5161 unit and feature cards plug into these slots. A feature card has a connector at one end into which a cable is plugged for attachment of an external unit (I/O device or modem, for example). All external units connect to the rear of the 5161 unit. One non-standard connector is provided on the back panel of the 5161 for connection of the 5151 Monochrome Display.

### Fixed Disk Drive Adapter

This standard adapter provides buffering, error detection, and data transfer between memory in the 5150 and a 10Mb Fixed Disk Drive in the 5161. Up to two 10Mb Fixed Disk Drives can be attached to this adapter and only one Fixed Disk Drive Adapter can be present in a 5161 Model 1. The adapter supports direct memory access transfer, automatic error detection and correction on 11-bit bursts using a 32-bit error checking and correction (ECC) code, automatic retries on disk access errors, and internal diagnostics.

### 10Mb Fixed Disk Drive

One 10Mb Fixed Disk Drive is standard in the 5161 Model 1 to provide 10,618,880 bytes of fixed disk storage, which is equivalent to about 28 double-sided diskettes at 360Kb each. One fixed disk can store over 5100 double-spaced 8.5 × 11 inch typewritten pages. One additional 10Mb Fixed Disk Drive can be installed in a 5161 Model 1 to provide a total of 21,237,760 bytes of fixed disk storage. The first fixed disk drive is addressed as C and the second is addressed as D.

The 10Mb Fixed Disk Drive is permanently sealed and contains two nonremovable 5.25" disks. The access mechanism contains one read/write head per

## 11:15 IBM 5161 Expansion Unit Model 1

disk surface (four heads), and the cylinder concept of accessing data is used (four tracks per cylinder and 306 cylinders).

The 10Mb Fixed Disk Drive has the following characteristics:

- 345 tracks per inch
- 512 bytes per sector (as formatted by DOS)
- 17 sectors per track
- 306 tracks per surface – 305 data and 1 diagnostic (1224 tracks)
- 4 surfaces
- Rotational speed: 3600 rotations per minute
- Average rotational delay: 8.33 ms
- Access time: 3 ms track-to-track
- Data transfer rate: 5M-bit per second
- Height: 3.25 inches (82.6 mm)
- Width: 5.75 inches (146 mm)
- Depth: 8 inches (203.2 mm)
- Weight: 4.6 lb (2.08 kg)

A disk-in-use indicator on the fixed disk drive is lit (red) whenever the drive is operating.

Fixed disk storage is supported by DOS as of Version 2.0. The minimum file size supported by DOS is 4096 bytes, which provides for a maximum of approximately 2592 files in one 10Mb fixed disk.

### Power Supply

The 5161 contains a 130-watt, four-voltage-level power supply in the right rear area of the unit. All power levels are regulated and an automatic shutdown of power to the 5161 occurs if an overvoltage or overcurrent condition is detected. A system shutdown also occurs if adequate power is not being received. The power cable is 6 feet (1.8 m) in length.

A self-test of the 5161 is performed automatically when power to the 5161 is turned on.

### Single Unit Prices

Item/Part Number/Feature Code	Single Unit Purchase Price (\$)
5161 Expansion Unit Model 1 (5161001)	2585
10Mb Fixed Disk Drive (1602500) (2500)	695
Keylock Feature (2683177) (3177)	50

### Discounts Available

The 5161 and its hardware features are eligible for one of the following discounts:

- Volume Procurement Amendment
- Educational Allowance
- Special Bid

## 11:20 4700 Finance Communication System Options

### Introduction

The following 4700 Finance Communication System (FCS) Options are available for the 5150 configuration:

- 4700 FCS Input Option, which permits attachment of 4700 input devices to the 5150 unit
- 4700 FCS Output Option, which permits one 4700 system printer to be attached to the 5150 unit
- 4700 FCS Security Option, which supports encryption and decryption by an application program for file data, programs, and communications data

One, two, or all three of the 4700 FCS Options can be installed in a 5150 System Unit that has a minimum of 256Kb of memory. These options cannot be installed in the 5161 Expansion Unit. The 5150 must have a display adapter installed (Monochrome Display and Printer Adapter, Color/Graphics Monitor Adapter, or Enhanced Graphics Adapter with or without its memory expansion options) with one display attached (5151 Monochrome Display, 5153 Color Display, or 5154 Enhanced Color Display). DOS Version 2.1 or later is also required to support 4700 device drivers and configuration customization.

The following optional features and printer for the 5150 System Unit can be installed in a 5150 configuration with one or more 4700 FCS Options (see feature descriptions in Section 11:10):

- Asynchronous Communications Adapter
- Display Station Emulation Adapter
- Printer Adapter
- Advanced 3278/79 Emulation Adapter or 3278/79 Emulation Adapter for attachment to a 4700 Finance Communication System
- 64/256Kb Memory Expansion Option and 64Kb Memory Module Kits to provide up to 640Kb of memory (576Kb if the 4700 FCS Output Option is installed)
- 4201 Preprinter Model 1
- 5152 Graphics Printer Model 2

Other 5150 features may also function with the 4700 FCS Options but have not been tested by IBM.

Publications are provided with each of the three options. They supplement the existing publications for the 5150 Personal Computer. The *4700 Per-*

*sonal Computer Hardware Maintenance and Service manual (6361605) can be purchased.*

A 5150 with 4700 FCS Options combines the financial orientation of 4700 system devices with the flexibility, computing power, and ease of use of the 5150 Personal Computer. A variety of traditional personal computer applications, such as word processing, spreadsheet, business communication and correspondence, office automation, and graphics can be performed. At the same time, information in financial data bases can be reviewed and changed, and the financial applications in a host system, a 4700 system, and the 5150 can be used.

### 4700 FCS Input Option

The 4700 FCS Input Option provides the following:

- Financial input adapter that requires one full-feature slot in the 5150 unit
- Financial input connector assembly
- Microcode diskette that provides program support for this option
- Diagnostic diskette for this option
- Guide to Operations (6361564) – provides installation instructions and problem determination procedures
- Microcode User's Guide (6361626 – SC31-3568)

The financial input connector assembly attaches to the financial input adapter. The connector assembly has connectors into which devices are plugged. A cable on the connector assembly plugs into the 5-pin personal computer keyboard connector on the back of the 5150 unit when a 4700 keyboard is used. When only the 5150 keyboard is used, it plugs into the 5-pin keyboard connector.

The following I/O devices (up to four) can be plugged into the connectors on the financial input connector assembly:

- One or two keyboards, as listed below
- One Magnetic Stripe Reader (6019489 or 6019474) or one Magnetic Stripe Reader Encoder (6019470)
- One Non-Encrypting PIN Keypad (5680905 or 5680908) or Encrypting PIN Keypad (5667650 or 5680917)

The keyboard combinations that can be attached to the connectors on the connector assembly are:

- One Administrative (107-key) Keyboard (4607) only
- One Expanded Alphanumeric (77-key) Keyboard (4677) only
- One 5150 keyboard with one Function (50-key) Keyboard (4650)
- One Alphanumeric (62-key) Keyboard (4662) with one Function (50-key) Keyboard (4650)
- One Expanded Alphanumeric (77-key) Keyboard (4677) with one Function (50-key) Keyboard (4650)

If a 3278/79 emulation adapter and the 4700 Personal Computer Application Services program are installed with the 4700 FCS Input Option, the 5150 can be attached to a 4701 Finance Communication Controller with disk storage (feature code 1055 or 1065). The remote IPL facility provided by the application services program can be used to start the 5150 from a diskette image file on a disk in the 4701, as described later in this subsection.

The magnetic readers and PIN keypad devices can be accessed by modified or new 5150 DOS application programs using the provided call level interface to the appropriate 4700 device driver. This interface can be used with the BASIC Interpreter, Assembler Language, and BASIC Compiler. Default translation tables define all allowable keyboard combinations and allow the finance keyboards to be transparent to 5150 applications. Thus, the 4700 keyboards can be used with existing, modified, and new 5150 DOS application programs.

A device attached to the 4700 FCS Input Option in a 5150 will have the same performance characteristics as when attached to the 4704 Display Unit.

#### 4700 FCS Output Option

The 4700 FCS Output Option provides the following:

- Financial output adapter that requires one full-feature slot in the 5150 unit
- Financial output cable to attach one printer to the financial output adapter in the 5150
- Microcode diskette that provides program support for this option
- Diagnostic diskette for this option
- Guide to Operations (6361600) – provides installation instructions and problem determination procedures
- Microcode User's Guide (6361624 – SC31-3568)

One of the following printers can be attached to the financial output adapter:

- 4710 Receipt/Validation Printer
- 4715 Continuous Forms Printer
- 4720 Forms/Passbook Printer

Printing to the 4700 printers can be done using modified or new 5150 DOS application programs that use the provided call level interface to the appropriate 4700 device driver. The interface can be accessed using the BASIC Interpreter, Assembler Language, or BASIC Compiler. Existing DOS applications that write to a parallel printer may use the Printer Redirect facility to route printer output to the 4715 or 4720 (which will operate at approximately half speed) with the restrictions indicated in the Microcode User's Guide.

A device attached to the 4700 FCS Output Option will have the same performance characteristics as when attached to the 4701 Finance Communication Controller.

#### 4700 FCS Security Option

The 4700 FCS Security Option provides the following:

- Financial security adapter that requires one full-feature slot in the 5150 unit
- Microcode diskette that provides program support for this option
- Diagnostic diskette for this option
- Guide to Operations (6024361) – provides installation instructions and problem determination procedures
- Microcode User's Guide (6024362)

The 4700 FCS Security Option provides the PC Encryption Interface Program, which allows a DOS application program to encrypt/decrypt file data, programs, and communications data using the ANSI (X3.92-1981) Data Encryption Algorithm (DEA). The SETKEY program is provided to modify master keys contained in random access memory on the financial security adapter. Master keys are retained when power to the 5150 unit is removed. However, the master keys are destroyed if the security adapter is removed.

## 4700 Personal Computer Application Services Program

The 4700 Personal Computer Application Services program operating under DOS Version 2.1 or later provides service routines that permit the 5150 to communicate and exchange data with the 4701 Finance Communication System Controller or 4702 Processor.

This program can be used in a 5150 configuration that is attached to the device cluster adapter in a 4701 Finance Communication Controller Model 2 via a 3278/79 emulation adapter in the 5150. The 4700 FCS Input Option is required in the 5150 only if the remote IPL facility of this program is to be used. The virtual volume support in this program requires a 4701 Model 2 or 3 with the Disk Expansion Unit.

The following functions are supported by the 4700 Personal Computer Application Services program executing in the 5150 configuration:

- Access to virtual volumes on the 4700 FCS Controller. The virtual volume function intercepts requests for access to a 5150 diskette drive that is not available and reroutes the request to a specially formatted area on the 4700 FCS Controller disk. The 5150 user also has access to public and private fixed disk volumes formatted and maintained as the virtual volume areas on the 4700 FCS Controller disk. This facility supports remote IPL of the 5150. For example, an operator could leave the 5150 diskette drive open and empty in order to IPL from the remote system file on the 4700 FCS Controller.
- File transfer. The file transfer facility (IPTXFER module operating in the 4700 FCS Controller) sends and receives entire files to and from the 4700 FCS Controller and, via the 4700 FCS Controller Resource Manager Release 3.0 program (5668-935), to and from a host processor. The user's existing 4700 financial application must be modified to recognize the file transfer commands and issue a call to the 4700 file transfer application program (IPTXFER).

A 4700 Finance Communication System with an attached 5150 that uses Release 3 of the 4700 FCS Controller Resource Manager must have the appropriate engineering change installed (325250 for the 4701 Model 1 or 2 or 325251 for the 4701 Model 3 or 4702). The 4702 can read 5.25" diskettes written by IBM personal computers (160Kb, 180Kb, 320Kb, 360Kb, and 1.2Mb capacities). However, the 4702 can write

only 1.2Mb-capacity diskettes, which are not supported by the 5150.

One of the following must be installed in the host processor for file transfer via the 4700 FCS Controller:

- 3270-PC File Transfer Program VM/SP 2.1 (5664-281)
- 3270-PC File Transfer Program MVS/TSO (5665-311)
- 3270-PC File Transfer Program CICS/VS (5798-DHQ)
- 4700 FCS Controller Resource Manager Release 3.0 (5668-935)
- Terminal emulation. This facility supports attachment of a 5150 to the device cluster adapter port of a 4700 FCS Controller via a 3278/79 emulation adapter and communication with the 5150 using the 4700 FCS instruction set. Existing application programs in the 4700 FCS Controller may use the 5150 as another device attached to the device cluster adapter without modification. As a 4704 Model 2 or 3 in controller tracking mode, the 5150 can have the following 4700 FCS I/O devices attached:
  - Administrative Keyboard (107 keys)
  - Expanded Alphanumeric Keyboard (77 keys)
  - Expanded Alphanumeric Keyboard (62 keys) with Function Keyboard (50 keys)
  - Personal computer keyboard
  - Non-encrypting PIN Keypads
  - Encrypting PIN Keypads
  - Magnetic Stripe Reader or Magnetic Stripe Reader/Encoder

Emulation of a 5250 Model 12 is supported when the 5150 is attached to a 4700 FCS Controller running the 5250 Emulation PRPQ.

- Programming interface. The programming interface supports communication from the 5150 to the 4700 FCS Controller. It enables a DOS program to initiate 4700 transactions, retrieve and modify host and controller files, and transfer blocks of data (records and messages) to and from 4700 FCS Controller resident programs.
- High level language application program interface. A high level language application program interface between the following is provided:
  - DOS application and a 4701 FCS Controller application
  - DOS application and the 4700 FCS Input Option
  - DOS application and the 4700 FCS Output Option

This interface is written in Assembler language and allows users of high level languages access to DOS interrupts from their high level language based applications. It is intended to be used by programmers who have little or no knowledge of

## 11:20 4700 Finance Communication System Options

5150 internal hardware. The languages supported are COBOL, BASIC, Compiled BASIC, Pascal, and Lattice™ C.

For personal computer application mode, attachment to the 5150 of the following 4700 FCS I/O devices is supported:

- Administrative Keyboard (107 keys)
  - Expanded Alphanumeric Keyboard (77 keys)
  - Expanded Alphanumeric Keyboard (77 keys) with Function Keyboard (50 keys)
  - Expanded Alphanumeric Keyboard (62 keys) with Function Keyboard (50 keys)
  - Personal computer keyboard
  - Personal computer keyboard with Function Keyboard (50 keys)
  - Non-encrypting PIN Keypads
  - Encrypting PIN Keypads
  - Magnetic Stripe Reader or Magnetic Stripe Reader/Encoder
- Customization of the operational diskette. Diskette customization is presented in a tutorial format. The user is led through a series of panels where choices are made concerning language selection for messages, modification of translate tables for ASCII to EBCDIC data string translation, and consolidation of the finance input and output option support on one operational diskette. Defaults are provided for all user selections.

The Branchbanker™ 4700 vendor-logo application program executing under the 4700 Personal Computer Application Services program in a 5150 supports control of the attached 4700 devices and communication with the 4700 FCS Controller. For information about this program, see Programming Announcement letters 285-161, 285-323, and 286-449.

The Safe Deposit™ 4700, Currency Control™ 4700, and Loan Loss Control™ 4700 vendor-logo programs are also available (see Programming Announcement letter 286-449 dated October 7, 1986).

### BANCStar 4700 Series Programs

The BANCStar™ 4700 Series of vendor-logo application programs support loan processing for a 5150 Personal Computer attached to a 4700 Finance Communication System. The programs are:

- BANCStar™ 4700 Account Opening Program
- BANCStar™ 4700 Mortgage Loan Program
- BANCStar™ 4700 Consumer and Commercial Loan Program

- BANCStar™ 4700 Mortgage, Consumer, and Commercial Loan Program
- BANCStar™ 4700 Generator

For information about these programs, see announcement letter 286-118 dated March 18, 1986.

### Office Systems Support

Office systems capabilities are provided for a 5150 with or without 4700 FCS Options installed that is connected to a 4700 Controller via a 3278/79 emulation adapter. The sending and receiving of messages, documents (in revisable form text document content architecture or final form text document content architecture format), and IBM personal computer files between the 5150 and a host processor via the 4700 Controller are supported.

Text documents created using Displaywrite 3 in a 5150 connected to a 4700 Controller can be sent to a host processor for processing or for further distribution using DISOSS/370 distribution facilities.

The 5150 must use Personal Services/PC Version 1 and 4700 Personal Computer Application Services or the 3278/79 Emulation Program with DOS Version 2.0 or later. The 4700 Controller must use the 4700 FCS Resource Manager Release 3, which provides passthrough support for transfer between the 5150 and a System/370-architecture processor.