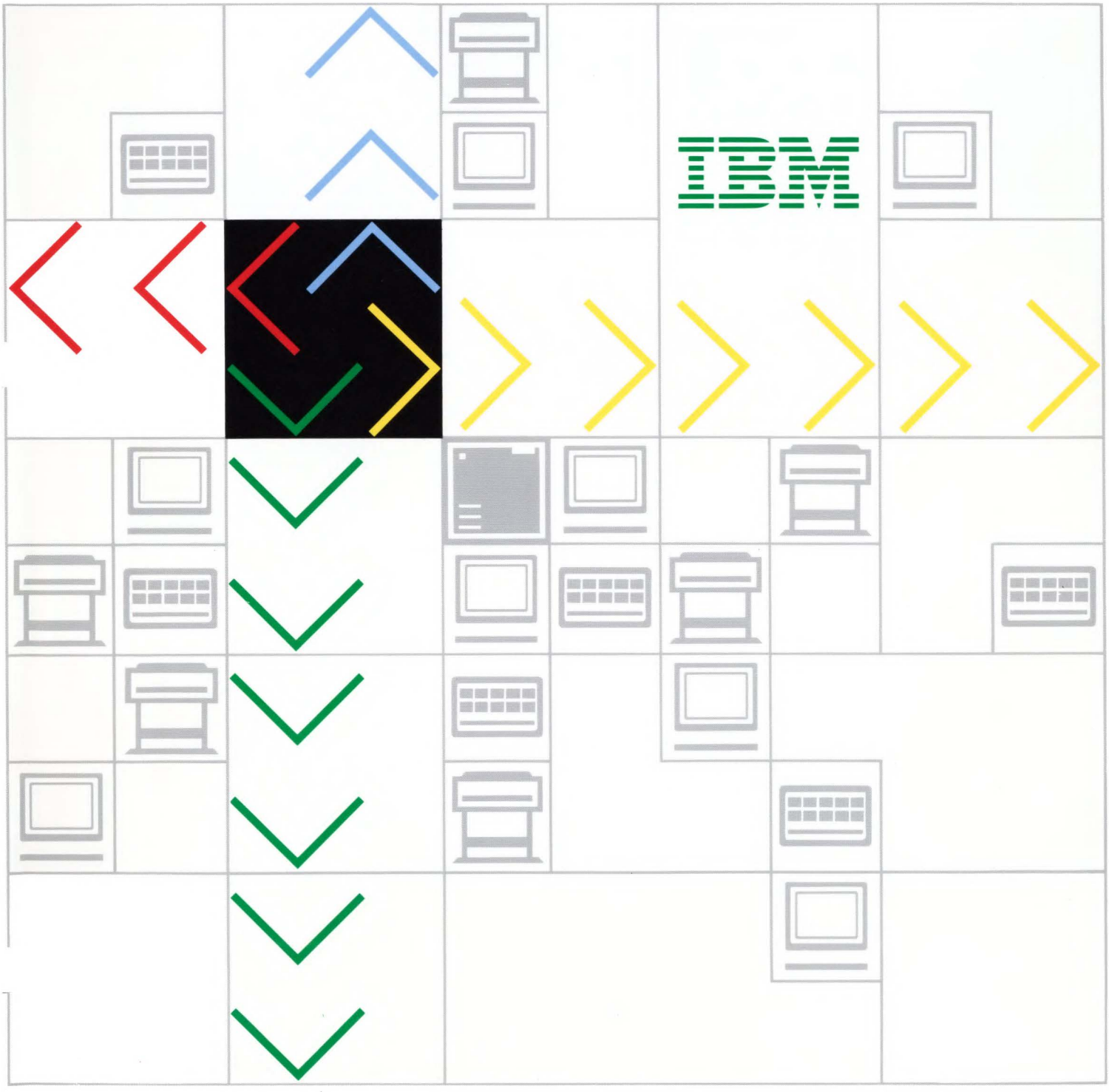
IBM 3270 Information Display System

Introduction



IBM 3270 Information Display System

Introduction

GA23-0318-0

Twentieth Edition (June 1986)

This major revision obsoletes GA27-2739-18. This edition adds information about the 3174 Subsystem Control Unit and terminals that were announced since the last revision of this manual.

Some illustrations in this publication represent design models and might not be exact replicas of production models.

Changes are made periodically to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest *IBM System/370 and 4300 Processors Bibliography*, GC20-0001, for the editions that are applicable and current.

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Preface

This publication is written for those who have a basic understanding of display systems and their relation to a host computer. Anyone reading the chapters related to programming should understand an operating system and applications-related programming support for display systems. Customer executives and data processing managers, system analysts, programmers, and IBM marketing representatives and systems engineers will find introductory information about these IBM 3270 Information Display System products:

- 3174 Subsystem Control Unit Model 1L (local attachment)
- 3174 Subsystem Control Unit Models 1R and 2R (remote attachment)
- 3174 Subsystem Control Unit Models 51R and 52R (remote attachment)
- 3274 Control Unit Models 21A, 21B, 21D, 31A, 31D, 41A, and 41D (local attachment)
- 3274 Control Unit Models 21C, 31C, 41C, 51C, and 61C (remote attachment, BSC or SDLC protocol)
- 3276 Control Unit Display Station Models 1, 2, 3, and 4 (remote attachment, BSC or SDLC protocol)
- 3276 Control Unit Display Station Models 11, 12, 13, and 14 (remote attachment, SDLC protocol)
- 3178 Display Station Models C1, C2, C3, and C4
- 3179 Color Display Station Model 1
- 3179 G Color Graphics Display Station Models G1 and G2
- 3180 Display Station Model 1
- 3262 Line Printer Models 3 and 13
- 3268 Printer Models 2 and 2C
- 3278 Display Station Models 2, 3, 4, and 5
- 3279 Color Display Station Models 2X, 3X, S2A, S2B, and S3G
- 3287 Printer Models 1, 1C, 2, and 2C
- 3290 Information Panel Models 220 and 230
- 3299 Terminal Multiplexer Model 2
- 3814 Switching Management System Models A1, A2, A3, and A4
- 4214 Printer Model 1
- 4234 Printer Model 1
- 4245 Printer Models D12 and D20
- 4250 Printer Model 1
- 5150 Personal Computer, all models
- 5160 Personal Computer Models 068, 078, 086, and 087; 3278/79 Emulation Adapter optional
- 5160 Personal Computer Model 589, with 3278/79 Emulation Adapter
- 5170 Personal Computer Models 068, 099, 239, and 495; 3278/79 Emulation Adapter optional
- 5170 Personal Computer Models 599 and 739 with 3278/79 Emulation Adapter
- 5210 Printer Models G1 and G2
- 5271 3270-PC, all models
- 5273 3270-PC AT, all models
- 5371 3270-PC/G, GX
- 5373 3270-PC AT/G, AT/GX

- 5540 Workstation (Japan only)
- 5550 Workstation (Japan only)
- 5560 Workstation (Japan only)
- 5578 Workstation (Japan only)
- 6150 RT Personal Computer Models 20, 25, and A25
- 6151 RT Personal Computer Model 10
- OEM Devices and Subsystems—Serial OEM Interface (SOEMI)

Not all terminals listed are available in every country. Consult your IBM marketing representative for details about hardware and programming support available for your configuration.

Contents

Figures

Summary of Changes

Twentieth Edition (June 1986)

Revision Highlights

This edition introduces the IBM 3174 Subsystem Control Units, a new generation of 3270 control units. The 3174, with improved technology and expanded storage, is the gateway of the 3270 Information Display System.

Performance of the 3174 Model 1L is significantly better than the 3274 models 41, in most cases, particularly with CUT-mode workstations.

Customization of the 3174 requires less time than customization of a 3274.

Attachment flexibility of the new subsystem control units is increased for terminal attachment. They can be configured to connect terminals directly , or via 3299 Terminal Multiplexers, or by a combination of these attachments. The base large-cluster control units have an integrated four-port terminal adapter for attaching Category A terminals either directly (four terminals) or via one to four optional Terminal Multiplexer Adapter features (a maximum of 32 terminals), or via a combination of 3299 Terminal Multiplexers and optional Terminal Multiplexer Adapter features (a maximum of 32 terminals).

The small-cluster subsystem control units have a similar attachment flexibility, but with a maximum of 16 terminals. A base unit has an integrated 9-port terminal adapter for attaching Category A terminals either directly (9 terminals), or via two 3299 Terminal Multiplexers (16 terminals), or a combination of one 3299 (8 terminals) and 8 terminals directly attached (16 terminals).

A second 5.25-inch diskette drive with 1.2M byte capacity is available as an optional feature. It is required for downloading operational microcode to some distributed function terminals like the IBM 3290 and IBM 3179 Model G. Also, the second diskette drive reduces the need for diskette swapping when customizing or running offline utility programs.

The use of model designations to define selected configurations of the new, 3174 control unit has reduced the number of special features required. All special features that are available are customer-installable.

A Serial OEM Interface (SOEMI), a basic function of the 3174 Subsystem Control Unit Model 1L, extends attachment capability to a variety of industry devices of independent manufacturers for engineering, scientific, and manufacturing environments. A protocol based on structured fields provides the user with programming flexibility.

Attachability of instrumentation, measurement and control, and other equipment can be provided via OEM adapters that provide appropriate conversion to industry standards bus interfaces such as IEEE 488, IEEE 696, and IEEE 796. Applications such as controlling measurement, robotics, process control, voice synthesis/recognition, medical applications, and many others can then be implemented when non-SNA protocol is used.

Response Time Monitor is a base function of the new control units. It provides for enhanced network management by permitting the accurate measurement and recording of the transaction times between the inbound host attention (AID) and a user-defined transaction end. It also allows thresholds to be established for certain subsystem errors that are reported via alerts.

New offline diskette utility programs are available for use with the new control units:

- Configure
- Modify Keyboards
- Copy Files
- Merge Downstream Load
- Identify the Customizing Keyboard
- Microcode Upgrade
- Diagnostics
- Encrypt/Decrypt
- Define PAM
- Merge RPQs.

Some of the more popular 3274 keyboard support microcode RPQs are incorporated into the base control microcode for the new 3174 Subsystem Control Units. **For X.25 Network Support** the 3174 may be customized to support a permanent virtual circuit or a switched virtual circuit. Labels are supplied for the operational keys of the assigned terminals.

The X.21 Support Short Hold mode is a standard feature of the 3174.

Other Additions

Information has been added for:

- 3179 G Color Graphics Display Station
- 3814 Switching Management System
- 4234 Printer
- 4245 Printer.

In a new chapter, "Chapter 4. IBM Personal Computers," information has been added for:

- 3270 Personal Computers AT/G and AT/GX
- 5560/50/40 Multiworkstations
- 6150 and 6152 RT Personal Computers.

Nineteenth Edition (November 1984)

- Information has been added for:
  - The 3270 Personal Computer/G and 3270 Personal Computer/GX
  - The 4214 Printer
- Technical and editorial changes are made throughout the publication.

Eighteenth Edition (March 1984)

- Information has been added for:
  - 3178 Display Station Model C4
  - 3179 Color Display Station
  - 3180 Display Station Model 1
  - Keyboard Definition Utility for the modifiable keyboard
- Technical and editorial changes are made throughout the publication.

Frontispiece. IBM 3174 Subsystem Control Unit: The Gateway of the IBM 3270 Information Display System

Chapter 1. Introduction

For developing, tracking, and sharing information, the IBM 3270 Information Display System is a business tool for the '80s. Its display terminals and keyboards can be used by people in many different roles — managerial, professional, secretarial, clerical, or data processing.

In the office, computer systems support administrative procedures. They offer word processing for correspondence, electronic message systems for person-to-person communication, teleconferencing services, online calendars, and links to corporate files and outside services.

In many businesses, customers call by telephone to check on the status of their accounts, or to check on the disposition of an order. The speed with which a display station can produce information means customer waiting time will be kept to a minimum. And for the display operator, obtaining that information from a computer file is a quick and simple job.

With a display system, people do not have to be near their files to use them. Miles away from the host computer, an operator can quickly and easily gain access to files to read or update them. Because the host computer system is capable of processing different jobs at the same time, people sitting at adjacent terminals can be doing completely different work.

Components

The IBM 3270 Information Display System is a family of display products that can be configured together in a subsystem: display stations with keyboards; printers; IBM personal computers; and control units (see Frontispiece). From a selection of components, you can tailor a computer system to fit your needs for the display of textual, numeric, and graphic material. The various models of each product have a full complement of standard features, so that configuring a system is a straightforward task. Special features for a particular model can be ordered easily. Figure 1-1 provides an overview of the components that can be attached in an IBM 3270 Information Display System.

Display stations give their operators quick access to data, stored in a computer, in a convenient form. The display image is clear, stable, and bright. To reduce glare, the display screens have either an etched surface or a filter bonded to their surface. Information or instructions are entered into the system at the **keyboard** connected to the display station. After being typed, each character immediately appears on the display screen. Using color, graphics, and special highlighting, the display station operator can create suitable formats for displaying data.

Printers are available in table-top models or as larger, floor-standing units. They are distinguished by their printout: dot matrix or letter quality type. Models vary according to print rate, and certain models print in four colors.

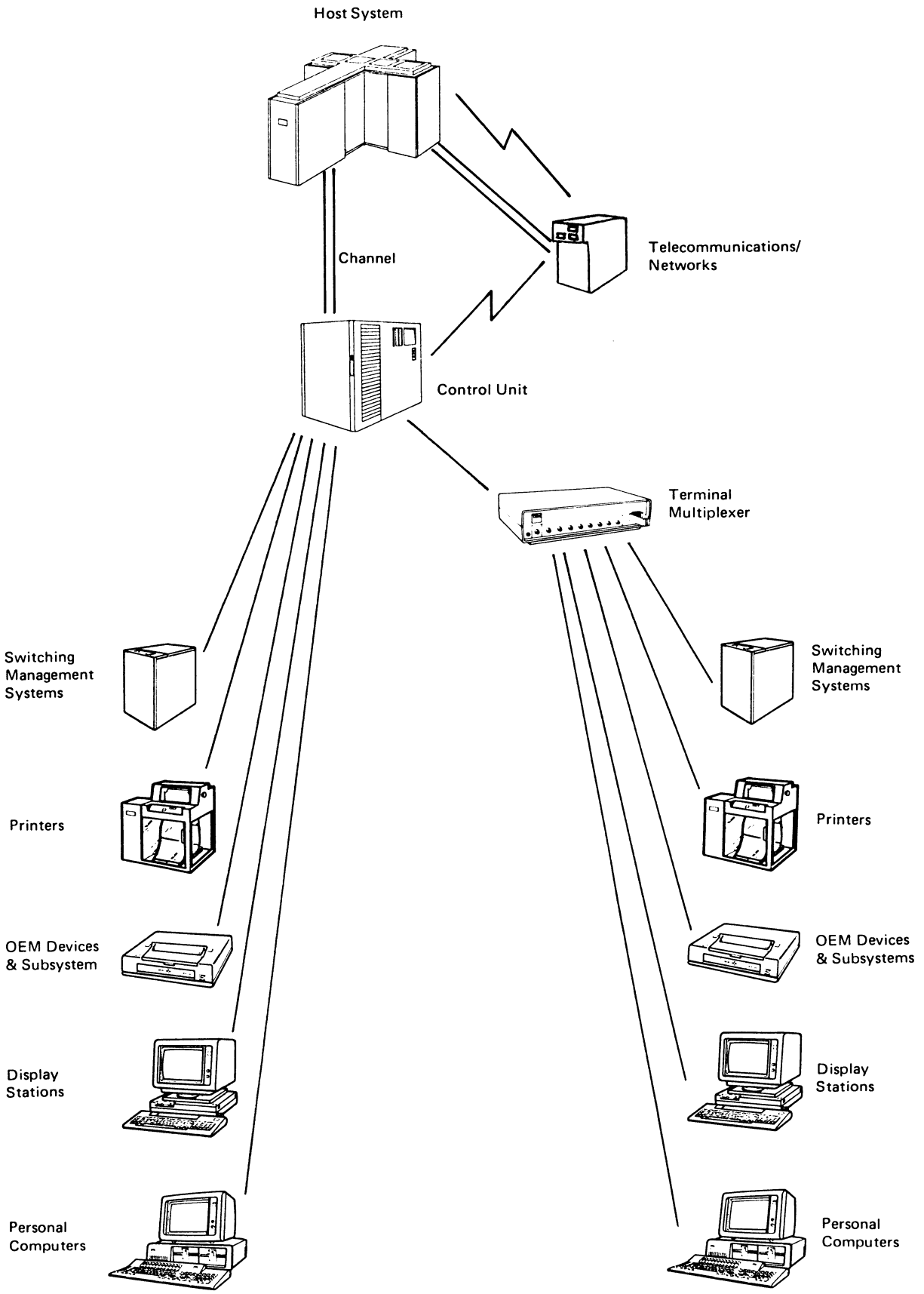

Figure 1-1. Composite Overview of the IBM 3270 Information Display System Attachment

The **control unit** links the display system to a central computer, or data processing system, called the *host*. The control unit controls the operations of the display stations and printers attached to it. The component configuration can be a cluster of 32 (or fewer) display stations and printers linked to a separate control unit, or as simple as the 3276, a single integrated control unit display station.

The 3270 system was announced in 1971, and the new components that IBM introduces are designed to be compatible with the earlier models.

Highlights of the 3270 System

The components in the 3270 Information Display System are an attractive addition to the office environment. They can be arranged to create individual work stations that make efficient use of available space.

Comfort is a key to productivity. The keyboards are angled for typing ease, and on some models the operator can adjust the angle. The display screens are designed to reduce glare, and on several models the screen can be tilted for more comfortable viewing.

The components in the 3270 system each have unique features. Some of the highlights are:

Keyboards

- A selection of typewriter, data entry, APL, text, attribute select, overlay, operator console, and modifiable keyboards

Display Stations

- Screen formatting and editing
- A choice of typing in only uppercase letters or in mixed uppercase and lowercase letters
- An operator information area at the bottom of the display screen (outside the data area) to communicate the status of the terminal, cluster, or system to the operator
- Color capabilities
- Graphics capabilities
- Display highlighting:
  - Reverse video, to reverse the color of a character or field with the color of the screen background
  - Blinking of a character or field
  - Underscore of a character or field
- Programmed Symbols, a feature that allows an organization to define as many as six character sets or fonts, to extend the range of special characters, symbols, or signs that can be displayed or printed
- Selector light pen and Cursor Select key to select certain fields of data on the display screen for the program to process
- The 3270 Personal Computer and the 3290 Information Panel, a new generation of display stations, which can display several screens simultaneously for viewing. The operator can move from one screen to another to work, and choose to make one or more of the viewing screens an area for copying from other screens.

Printers

- Dot matrix or letter quality printout
- Color printing capabilities
- Programmed Symbols, a feature that allows an organization to define as many as six character sets or fonts, to extend the range of special characters, symbols, or signs that can be printed
- Underscore on color and monochrome printers

Cabling

- The 3299 Terminal Multiplexer, which provides significant cable savings when used to attach terminals to a 3174 or 3274 control unit

Programming

- APL capabilities
- Personal Computer capabilities
- Graphics capabilities

Security

- A security keylock and an operator identification card
- A magnetic slot reader and magnetic hand scanner for entering magnetically encoded data
- Encryption/decryption capability so that data can be enciphered and deciphered between the host computer and the control unit

System Monitoring

- The Response Time Monitor, a means of accurately measuring, recording, and displaying end-user response time. The Response Time Monitor records the time lapse from when the operator presses the *Enter* key until the host handles the data and returns it to the display screen. Gathering such information over a period of time produces response time statistics that are useful for network management and evaluation.

Programming Support

IBM has developed an array of operating systems, telecommunication access methods, and licensed programs for the 3270 Information Display System. The programs, designed to meet clients' needs, cover such varied topics as financial management, personnel, trend analysis, document composition, graphic display, and airline control systems. Check with your IBM marketing representative for details on programming support available for the 3270 system.

Customer Setup

Certain components are designated as customer setup units, which offer advantages for the customer — early availability and greater flexibility in the installation and relocation of the components.

Problem Determination

The problem determination and recovery procedures designed for the operator to use with the 3270 units ensure that more computer time is available to the customer. The handy *Problem Determination Guide* included in most keyboards explains basic problems the user might encounter and suggests actions to take.

The Alert function assists the system operator with network problem determination. This function enables the 3174 or 3274 control unit to send error messages about problems in the system to the system operator. The operator can determine whether the alerts describe a particular type of error or errors on particular devices.

Chapter 2. Capabilities of the 3270 System

The 3270 Information Display System can be used with your application software for inquiries, for data or order entries, for personal computing, for document development, for program development, and for monitoring of system activities. Versatile features such as color and programmed symbols used in these applications help you produce information in an attractive and useful format.

Inquiries

In a simple inquiry, the operator types a small input message — a name or an account number — that elicits a short and quick output response, such as "yes" or "no." A credit house uses a simple inquiry application to determine whether a customer should be allowed to charge additional purchases.

In a complex inquiry, the operator types a small input message (up to 100 characters) that elicits a large output message (an entire screen or several screens of data). A credit house uses a complex inquiry application to get a complete credit history of a person who is trying to establish credit.

An inquiry can include a file update. The input message is again relatively small. The output message can be several screens of data, which the display operator modifies. A credit house uses this application when it records credit payments.

Data Entry

The 3270 Information Display System has a number of features that simplify data processing applications. The operator uses the keyboard, the magnetic slot reader, or the magnetic hand scanner, instead of conventional keypunch equipment, to enter data. When large amounts of data need to be entered, such as with payroll or inventory control, online key entry can be used to enter data that will be processed separately by an application program. The online key entry procedure is a highly productive and efficient method for copying large amounts of data. Editing tools help the operator verify that the data entered is correct. Formatted fields and protected data simplify and speed up the data entry.

With the magnetic hand scanner, the operator can read magnetic-stripe labels on shelves and cartons; with the magnetic slot reader, the operator can read magnetic-stripe tags on badges and credit cards.

The display operator can enter data as formatted or unformatted entries. In an unformatted entry, the operator types in a customer's name and account number, and then types in an order: part number, quantity, price, and special instructions. The sequence in which the items are entered is important, but the location of the items on the screen is not. The data could be entered in one or two lines of type, or each item could be entered on a separate line.

In a formatted entry, the application program divides the screen into fields of data and defines the type of information to be displayed in each location (see Figure 2-1 for an example). Using a formatted screen to type in a sell-stock order, the operator would type data opposite the displayed labels.

Displayed Labels Data Entered

Figure 2-1. An Example of a Formatted Entry

Depending on the application, the operator may take advantage of these capabilities to enter data:

Protected fields: In an application where certain information must be entered (such as renewal data for a driver's license, or a change of address), but where other information cannot be modified (driver's license number), the operator is prevented from entering data in the protected fields. A protected field is passed over by simply pressing the Tab key.

Special keys: The operator can change unprotected alphanumeric data. There are special keys to change numeric-only data, or to erase the screen, a field, or characters in a field. The two edit keys, Insert and Delete, are used to change what has been typed.

Nondisplayed fields: If there are security restrictions on some parts of a file, the display operator can enter data in those fields without its being displayed or printed. To do this, the operator must type in a special password or ID for access to the data. This ID can also be typed in a nondisplayed field.

Highlighting: To help focus the operator's attention, selected data can be underscored, made to blink, or be displayed at brighter intensity or in reverse video. Programmed Symbols with different character sizes and fonts can be used to distinguish different categories of information. On a color display screen, color can accent different and related categories of information.

Personal Computing

With an IBM 3270 Information Display System, executives and managers have all the advantages of immediate access to information and the means to manipulate it. The applications can be as simple as information retrieval, corporate communications, and financial records — or as complex as "what if" scenarios. Executives can generate their own reports, plan and track the development of different divisions, send mail electronically, gain access to public data bases, and use an automated calendar program to keep track of their schedules. Personal computing can be used for these tasks and more: planning, modeling, and simulation; financial and statistical analysis; mathematical, scientific, and engineering problem-solving; and econometrics.

Patterns of personal computing vary widely. One professional may use a single program package "as is," without any modifications. Others may write their own programs, using a programming language oriented for end users. Still others may have a data processing department to develop an interactive program for them.

Document Development

With the software you select, the 3270 display stations can be used to write memos, letters, and reports, and to maintain mail logs. The Entry Assist function enables a display station to operate much like a power typewriter. Entry Assist simplifies page formatting and enhances existing editing capabilities.

Program Development

For programmers, the 3270 Information Display System provides interactive facilities for creating, compiling, testing, and updating programs. Interactive subsystems that provide program development facilities include the conversational monitor system (CMS) under VM/370, System Productivity Facility (SPF) under the time-sharing option (TSO), and Virtual Storage Personal Computing (VSPC) under multiple virtual storage (MVS). With these facilities, programmers at 3270 terminals can create, compile, test, and update programs. The 3290 Information Panel offers large-screen and split-screen options that can improve programmer productivity.

Monitoring System Operation

A display screen can hold many system messages and display them faster than a keyboard printer. You can use the display station to control system operations by entering data into the system and receiving it from the system. If used only to monitor system operation, the screen displays the status or operator messages, but no data is entered into the system.

Color Applications

Because data presented in color is easier to separate visually, it is easier to understand. Base color —four colors—is provided on a field basis. Extended color—seven colors —is available on a field and character basis. Using a color display or printer, you can create distinctions that speed recognition of particular fields of data. Color facilitates these tasks:

Distinguishing data sources: Differentiating data that has been entered at the keyboard, data that has been program-generated, data that is held on file, messages from the host computer, and so on.

Distinguishing data types: Differentiating headings, field names, data as originally entered, data entered and since changed, and instructions from the program.

Handling data codes: If the information displayed is categorized by a numeric code, about seven coded categories are the most that an operator can handle readily. If an additional categorization coded in color is introduced, the operator can handle a number of categories in each color.

Graphics

Pictures are an almost universal language, quickly comprehended. They convey information more directly than words, by the use of patterns, shapes, and colors. Converting numeric data into graphic form gives the data more meaning. Graphics can be used for:

Scheduling: Through a computer network, several offices, in different locations, can have simultaneous access to a graphic presentation of a complex schedule. Color enhances scheduling.

Process Monitoring and Control: You can use graphics to create a flow diagram indicating the status of a process or operation, such as any of the operations in chemical processing plants and oil refineries. Use of color assists the critically important interpretation of the data in such diagrams.

Graphic Arts and Publishing: Graphics, especially when augmented by color, have considerable potential in the fields of graphic design, composition, and illustration.

Computer-Assisted Instruction: Particularly when combined with color, graphics will improve the quality and effectiveness of computer-assisted instruction and online tutorial material.

Technical Data Analysis: Researchers and development professionals can present numeric information in graphic form to improve comprehension and productivity.

Business: You can create your own forms for payroll, billing, reports, and orders.

Engineering: Graphics are used for representation of data reduction and analysis, and for modeling and simulation in engineering applications.

Programmed Symbols: Alphanumeric and Graphic Applications

The Programmed Symbols feature allows you to store, under program control, as many as six character sets or fonts defined by your organization. This extends the range of special characters, symbols, or signs that can be displayed or printed in the text. Programmed symbols are a standard function of some display stations; for other display stations and printers, they are available as a special-order feature. The Attribute Select Overlay keyboard has special narrow keytops (in the 48-key data section) over which templates with special font symbols can be laid whenever one of the programmed symbol sets is used. Programmed symbols can be defined as:

- Characters of different sizes
- Characters from foreign alphabets
- Mathematical signs and symbols
- Scientific signs and symbols
- Special type fonts, such as italic
- Shapes or picture components.

When programmed symbols are defined as shapes or picture components, you can use them in combinations to create pictures on the screen or printed page.

Vector Graphics

With vector graphics available on certain 3270 Personal Computer work stations, complex graphics can be created and manipulated to suit a variety of host-interactive and personal computer applications. Graphics are drawn by a comprehensive set of vector graphic instructions such as line, arc, and image, and attributes such as color and line width. Drawing controls such as scaling (reducing or enlarging all or part of a picture), rotation (changing the orientation of all or part of a picture), and projection (obtaining a selected two-dimensional view of a three-dimensional object) allow graphics to be manipulated once they are created.

Vector processing handled by the work station instead of the host and an economical data stream combine to improve host performance and reduce the demands on the network and control units.

Security Enhancements

Security Keylock: A key can be used to disable the display station or printer (where available) whenever it is to be left unattended. The equipment can be used only when the proper key is inserted in the lock and turned to the ON position.

Magnetic Slot Reader (3278 and 3279 display stations): This accessory attaches to the display station with a cable and is used to send coded messages to the host system. For personal identification, magnetic-stripe tags and badges can be passed through a slot in the reader, which has three indicators and a buzzer that provide information on the status of the read data.

Magnetic Hand Scanner (3278 and 3279 display stations): This accessory attaches to the display station with a cable and, like the magnetic slot reader, can be used to read magnetic-stripe tags for security purposes. The scanner can read magnetic-stripe labels on objects, and magnetic-stripe tags that are hand-held or placed on a flat surface. Three lights and a buzzer provide information on the status of the read data.

Nondisplay Keying Mode: A program can define fields that will accept data entered from the keyboard but not display the data on the screen.

Address Keylock (3276 Control Unit Display Station): A key can open the operator panel drawer to a position that exposes the address and transmit level switches (where installed). When the drawer is locked, these switches are inaccessible.

Encryption/Decryption: When used with other IBM Cryptographic Subsystem products and operating in a network governed by a Systems Network Architecture (SNA)/Synchronous Data Link Control (SDLC), this feature permits transmission of encrypted data between the host computer and control units:

- 3174 Models 1R, 2R, 51R, and 52R
- 3274 Models, 21C, 31C, 41C, 51C, and 61C
- 3276 Models 11, 12, 13, and 14.

The encrypted form of the transmitted data prevents unauthorized disclosure and modification of the data, whether accidental or intentional.

Chapter 3. Display Stations

A 3270 display station combines the functions of your pen and paper, typewriter, and files all into one machine. As you type words, information, and instructions at the display keyboard, they appear on the display screen. Correspondence, reports, records, and data bases can all be filed away, and then called back up to the screen and modified whenever necessary. Using interactive programs, you can also do planning, modeling, simulations, and statistical and financial analysis at a display station.

The 3270 display stations vary in their physical design, yet they follow the same architecture and share a common data stream format. Their screens differ in size, and the size of the characters and the space between the lines of type can vary with the display.

The color of the characters and of the background screen also depends on the display device:

- Green characters on a black background (3178, 3180, 3277, 3278)
- A choice of colored characters on a black background (3179, 3279)
- Orange characters on a black background (3290)
- A choice of eight colors for both characters and backgrounds (the color monitor of a 3270 Personal Computer, 3179 G).

The 3270 display station images are clear and stable. On some models, the brightness can be adjusted. To help reduce glare, the display screens have either an etched surface or a filter bonded to their surface.

Figure 3-1. IBM 3179 Color Display Station

3179 Color Display Station (Model 1)

The IBM 3179 Color Display Station (shown in Figure 3-1) is a compact, lightweight, seven-color display station emphasizing low price and ease of use. The Typewriter Keyboard layout has 122 keys, including 24 individual program function (PF) keys plus a numeric keypad in adding-machine layout. Data is displayed on a screen that holds 1920 characters (24 rows with 80 characters in each row).

The modifiable keyboard can be used when the 3179 is attached to selected models of the 3174 or 3274 control unit. By modifying the keyboard tables in the 3174 or 3274, the user can create uniquely defined keyboard layouts. Removable keycaps can then be moved about on the keyboard to reflect the changes made to the keyboard tables. See "Keyboard Definition Utility" on page 5-5.

Base color for the 3179 is four colors—red, blue, green, and white, provided on a field basis. Extended color is seven colors—red, blue, green, white, yellow, turquoise, and pink, available on a field and character basis.

An unmodified version of the keyboard can operate in emulation mode (similar to a 3178, 3278, or 3279 keyboard), to be compatible with application programs written for those display stations.

Three separate machine elements make up the 3179 Color Display Station: the video, logic, and keyboard elements. Designed for customer comfort, the 3179 has a movable keyboard with an adjustable inclination angle. Tilt and swivel are standard for the video pedestal. Automatic color convergence produces bright, crisp colors. Light reflections and smudges are reduced by an enhanced-contrast display screen, producing sharp, clear images. These replaceable work-station elements offer the operator easier problem analysis.

Additional 3179 features include:

- Plug compatibility with all IBM 3279 Model S2A and S2B displays, and with 3279 Model 2A, 2B, and 02X displays with comparable function
- Audible alarm and security keylock
- A monocase switch for switching to uppercase alphanumeric mode
- Support for ASCII requirements
- An optional (accessory) two-way switch that allows the user to switch from one control unit to another.

The 3179 Color Display Station is supported by existing 3270 programming systems and application programs, and no changes are required in the current programs written for the 3279 Models S2A and S2B with equivalent function. No programming changes are needed for 1920-character 3178s and 3278s with standard functions.

The 3179 attaches to a 3174 or 3274 control unit, to the 3276 Control Unit Display Station, or to a 4321 or 4331 Processor (via the Integrated Display Printer Adapter).

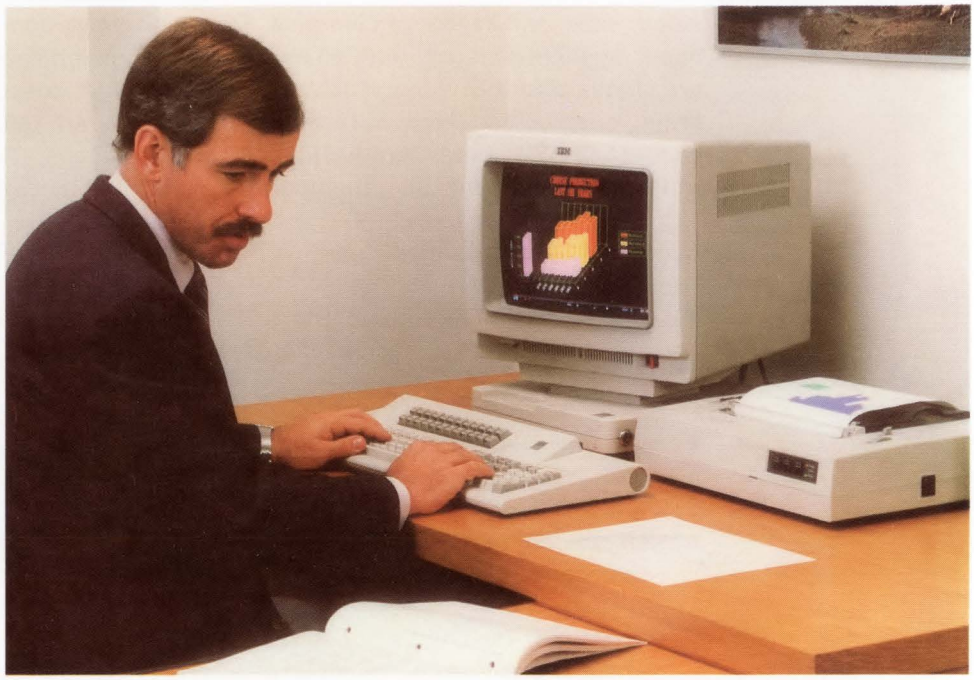

Figure 3-2. IBM 3179 G Color Graphics Display Station

3179 G Color Graphics Display Station (Models G1 and G2)

The IBM 3179 G Color Graphics Display Station (shown in Figure 3-2) is a compact, eight-color, low-priced graphic display station. The Typewriter Keyboard layout has 122 keys, including 24 individual PF keys plus a numeric keypad in adding-machine layout. Data is displayed on a screen that holds 1920 (80 columns × 24 rows) or 2560 (80 columns × 32 rows) characters.

The Keyboard Definition Utility is provided as standard. By modifying the keyboard tables in the 3274/ 3290/ 3179 G Load diskette, the user can define as many as three customer-designed keyboard layouts. Removable keycaps can then be moved about on the keyboard to reflect the changes made to the keyboard tables.

Base color of the 3179 G is eight colors—red, green, blue, white, yellow, turquoise, pink, and black.

Three separate machine elements make up the 3179 G Color Graphics Display Station: the video, logic, and keyboard elements. Designed for customer comfort, the 3179 G has a movable keyboard with an adjustable inclination angle. Tilt and swivel are standard for the video pedestal. Automatic color convergence produces bright, crisp colors. Light reflections and smudges are reduced by an enhanced-contrast display screen, producing sharp, clear images. These replaceable work-station elements offer the operator easier problem analysis. Through an IBM 3979 Expansion Unit, the 3179 G supports the IBM 5227 Mouse, the IBM 3852 Color Printer Model 2 (screen copier), and the IBM 7371 and 7372 Color Plotters.

Additional 3179 G features include:

- The ability to work with IBM 3279 application programs running under the Graphics Data Display Manager (GDDM), provided the application program does not make device-specific assumptions—the number of PS sets available, for instance
- Audible alarm and Security keylock
- Delete key (repeat action)
- Delete Word, Next Word, and Previous Word key
- Graphic cursor
- Two font sizes: a 9 × 16 font for the 1920-character screen, and a 9 × 12 font for the 2560-character screen.

Host support, including GDDM Release 4, is available. Screen management functions support the interaction of graphic and alphanumeric information.

Figure 3-3. IBM 3180 Display Station

3180 Display Station (Model 1)

The IBM 3180 Display Station (shown in Figure 3-3) emphasizes low price while providing multiple screen formats, advanced display functions (vertical scrolling, operator and program selectable screen formats, record/play function, modifiable keyboard), ease of use, and operator comfort. The adjustable display can be raised or lowered, tilted forward or backward, and turned to the right or left for viewing comfort. In addition, the standard 122-key, low-profile keyboard has adjustable height. The two types of keyboard layouts available for the Model 1 are Typewriter and Data Entry.

Four screen formats are available:

- A maximum of 1920 characters—24 rows of 80 characters each
- A maximum of 2560 characters—32 rows of 80 characters each
- A maximum of 3440 characters—43 rows of 80 characters each
- A maximum of 3564 characters—27 rows of 132 characters each

The modifiable keyboard can be used when the 3180 is attached to selected models of the 3174 or 3274 control unit. By modifying the keyboard tables in the 3174 or 3274, the user can create uniquely defined keyboard layouts. Removable keycaps can then be moved about on the keyboard to reflect the changes made to the keyboard tables.

The record/play function makes repetitive keying easier. A series of up to 97 keystrokes can be "saved" in the 3180 via a program function key. Upon command, the saved data can be recalled. The recorded data will be retained when power is turned off. Also, the automatic display dim function dims the screen if there is no keystroke activity for 10 minutes.

The 3180 consists of five work station elements:

- Display
- Logic
- Keyboard
- Cable attachment module
- Power cord.

Any one element can be individually replaced, making problem analysis easier.

Additional 3180 capabilities include:

- Extended highlighting
- Monocase switch for dual or monocase character selection.
- Local copy
- Keyboard numeric lock
- Cursor position indicator
- Adjustable audible alarm
- Security keylock
- An optional (accessory) two-way switch that allows the user to switch from one control unit to another.

The 3180 Display Station attaches to the 3174 or 3274 control unit, 3276 Control Unit Display Station, or the 4300 Processors.

Figure 3-4. IBM 3290 Information Panel

3290 Information Panel

The IBM 3290 Information Panel (shown in Figure 3-4) is a display station that features a large, flat plasma panel as its visual display medium. The smudge-resistant screen can display as many as 9920 characters (62 rows by 160 columns). The panel can be tilted forward or backward, and the slope of the keyboard and optional keypad can be adjusted.

Multiple-screen viewing capability means that the 3290 will operate as many as four display stations (logical terminals) simultaneously at the one physical terminal. All four screens can appear together, and each can interact independently with its own host program. The operator uses the keyboard to work with each of the displayed terminals, one at a time. The viewing area can display concurrently four 3278 Model 2 screens, or two 3278 Model 3 screens, or two 3278 Model 4 screens, or two 3278 Model 5 screens. The 3290 can also display a full page of 132-column computer printout or two pages of 80-column text.

The 3290 keyboard is available in a Typewriter or APL layout. Keyboard functions can be expanded by adding either a numeric keypad or a program function keypad.

- The operator selects the desired screen configuration for screen splits, and can set up one or more of the screens as a copy screen for the active screen. The copy screen can then be used as a reference when the operator modifies the data displayed on the active screen.
- The customer can develop as many as six sets of Programmed Symbols, for a variety of shapes, fonts, and symbols.

- Using the Keyboard Definition function, the customer can develop as many as three alternative keyboard layouts for particular applications, in addition to the standard keyboard layout.
- With Entry Assist, the 3290 can operate much like a power typewriter. Capabilities include setting left and right margins, tabbing, a bell to signal the end of the line, cursor movement by word, and the word-wrap mode, which automatically moves the last word on a line to the next line if it would overrun the right margin.
- The rule line, a viewing aid, moves up or down on the screen with the cursor. This horizontal line, a full screen in width, can be turned on or off.
- The image of one displayed screen, or of a partition, can be enlarged by changing the character size.
- Under program control, the screen can be divided into as many as 16 partitions.
- The 3290 attaches to any model of the 3174 Subsystem Control Unit and only to certain models of the 3274 Control Unit. (See Figures 7-2 and 7-5 in Chapter 7.)

The 3290 provides data stream compatibility with the 3278 and 3279 display stations. Existing alphanumeric applications run on the 3290 displayed in their current screen size. No programming changes are required for current alphanumeric applications unless the program is affected by 3174 or 3274 control unit configuration restrictions (no Category B terminals, 3279 extended color, etc.) or by required hardware functions not available with the 3290 (magnetic readers, ASCII, Encryption/Decryption, color, etc.). The 3290 interacts with structured-field data-stream functions.

The multiple-screen facilities of the 3290 can be used without modifications to system software, with the exception of TSO/VTAM.

Figure 3-5. IBM 3178 Display Station

3178 Display Station (Models C1, C2, C3, C4, and C5)

The IBM 3178 Display Station (shown in Figure 3-5) is a compact, lightweight display station, economically sized for the office environment. It can be flexibly situated in a work station because it has three separate and movable elements: the display unit, the logic unit, and the low-profile keyboard. Optional accessory extension cables for the keyboard and display unit allow the logic unit to be mounted as far as 7 feet away from keyboard and display. The mounting bracket, also an accessory, can be used to install the logic unit on the side of a desk or a file cabinet, or on the wall, producing a compact desk-top arrangement for the keyboard and display. Separate elements make it easier for the operator to isolate a problem while troubleshooting; any one element can be individually replaced.

The 3178 was designed with operator comfort in mind. The etched screen reduces light reflections and fingerprint smudges. The display terminal sits on a pedestal and can be tilted and swiveled. The keyboard can be adjusted to two different angles.

The display capacity is the same for each model; the screen displays 24 rows of 80 characters each. Each model has a different keyboard:

- Model C1 has a 75-key Data Entry keyboard.
- Model C2 has an 87-key Typewriter keyboard.
- Model C3 has an 87-key Typewriter keyboard with a numeric keypad, and is available in U.S. English only.
- Model C4 has an 87-key Typewriter keyboard with a numeric keypad in both uppercase and lowercase, and is available in U.S. English only.

The following characteristics apply to all models of the 3178:

- Audible alarm, keyboard numeric lock, and security keylock are standard functions.
- All models attach to all 3174 terminal adapters.
- All models attach to Type A terminal adapters on a 3274 Control Unit.
- All models attach to a 3276 Control Unit Display Station operating in SDLC protocol.
- All models attach to a 3276 Model 2, 3, or 4 operating in BSC protocol.
- All models, except Models C3 and C4, attach to a 4321 or 4331 Processor (via the Display Printer Adapter).
- All models attach to existing and new IBM Switch Control Units.

Figure 3-6. IBM 3279 Color Display Station

3279 Color Display Station (Models S2A, S2B, S3G, 02X, and 03X)

The IBM 3279 Color Display Station (shown in Figure 3-6) can be used in both text and graphic applications. The display unit can be tilted. The following keyboard features are available: Typewriter, Data Entry, Data Entry Keypunch, APL, Text, Overlay, Operator Console, and Attribute Select.

The Model S2A provides the base colors on a field basis: white, red, blue, and green. The screen displays a maximum of 24 lines of 80 characters each.

The Model S2B provides extended colors on both a character and a field basis: pink, yellow, and turquoise; white, red, blue, and green. Extended highlighting (underscore, blinking, and reverse video) and APL/Text character set are standard. The screen displays a maximum of 24 lines of 80 characters each.

The Model S3G provides programmed symbols as well as extended colors, extended highlighting, and APL/Text character set. Programmed symbols permit the user to define special characters, symbols, or shapes to suit particular applications. The Model S3G screen displays a maximum of 32 lines of 80 characters each.

The features available on Models 02X and 03X can be customized to meet your specifications. The models differ in the display capacity of their screens: Model 02X displays 24 lines of 80 characters each, and Model 03X displays 32 lines of 80 characters each.

The following characteristics apply to all models of the 3279:

- The base color switch on all models allows the operator to choose to display in base color or in monochrome. In the base color mode, the colors of the fields depend on their protection and intensity characteristics. In the monochrome mode, characters on the screen are green, except in intensified fields. There the characters are displayed as white. When extended color is used, the position of the base color switch does not affect the colors displayed.
- When the colored dots appear in their correct positions on the screen, the picture quality and color sharpness are good and the color is termed *converged*. Certain models have automatic color convergence. With the others, there is a simple procedure the operator can perform to set up and maintain color convergence.
- An audible alarm sounds whenever the operator enters a character in the next-to-last position on the screen. The alarm can also be activated under program control. The operator can modify the volume.
- All models attach to all 3174 models.
- All models attach to the 3274 via a Type A terminal adapter. For base color mode, Models S2A, S2B, and 02X attach to all models of the 3276 except Model 1, and Models S3G and 03X attach to all models of the 3276 except Models 1 and 2.

The IBM 3270 Personal Computer Attachment adds IBM Personal Computer capability to all 3279 display stations.

Figure 3-7. IBM 3278 Display Station

3278 Display Station (Models 2, 2A, 3, 4, and 5)

The models of the IBM 3278 Display Station (shown in Figure 3-7) vary according to the density and amount of data displayed on the screen. The Model 2 uses larger characters and more space between the lines to display 24 rows of 80 characters. Using smaller character sizes and less space between the lines, the Model 3 displays 32 rows, and the Model 4 displays 43 rows of 80 characters. The Model 5 screen displays either 24 rows of 80 characters or 27 rows of 132 characters. The Model 2A with its accompanying keyboard is used as the primary system console for 4300, 3081, 3083, and 3084 processors.

At the 3278 display station, the operator can use either a keyboard or a selector pen, or both, to display and manipulate data on the screen. The selector pen is a hand-held device used to select items from a list of data. The following keyboard features are available: Typewriter, Data Entry, Data Entry Keypunch, APL, Text, Overlay, and Attribute Select.

- A monocase switch makes it possible to change back and forth from dual-case display (mixed uppercase and lowercase) to monocase display (uppercase only).
- An application program can define fields of data on the screen as protected/unprotected, alphanumeric, normal/intensified, and displayed/nondisplayed.

- The Print key can be used to send a copy of what is currently displayed on the screen directly to an authorized printer.
- Audible alarm, keyboard numeric lock, and security keylock are standard.
- Several features significantly enhance the capabilities of a 3278:
  - The Programmed Symbols feature allows the customer to define as many as six 190-symbol sets for a variety of shapes, fonts, and symbols.
  - Extended highlighting for particular characters or a field provides blinking, reverse video, or underscore.
  - The Overlay and Attribute Select keyboards are equipped with keys that provide immediate access to the programmed symbol sets and desired highlights.
- The IBM 3270 Personal Computer Attachment adds IBM Personal Computer capability to the 3278 display stations.
- Models 2, 3, 4, and 5 can attach to all 3174 terminal adapters.
- Models 2, 3, and 4 can attach to Type A terminal adapters on a 3274. The Model 5 can attach to Type A terminal adapters on every 3274 model except Model 21B.
- Models 2, 3, and 4 can attach to a 3276 Control Unit Display Station, using SDLC protocol.
- Models 2, 3, and 4 can attach to a 3276, using BSC protocol. The Model 2 can attach only to a 3276 Model 2, 3, or 4. The Model 3 can attach only to a 3276 Model 3 or 4. The Model 4 can attach only to a 3276 Model 4.

Chapter 4. IBM Personal Computers

The IBM Personal Computers are a family of work stations designed for both professional and office use to meet the needs for interactive computing, when connected to a host computer, and for local personal computing. Described in this chapter are the IBM Personal Computers that attach to the 3270 Information Display System.

Figure 4-1. IBM 6150 RT Personal Computer Model 25

IBM 6150 RT Personal Computer Models 20, 25, and A25

The IBM 6150 RT Personal Computer is a powerful and extendable work-station-oriented system for the personal computer requirements of the technical professional. (Figure 4-1 shows the Model 25.) An addition to the computer-related products, the IBM 6150 RT Personal Computer features a 32-bit reduced instruction set microprocessor with virtual storage, as well as optional Personal Computer compatibility for both program and hardware attachment. The system is designed to satisfy the computing needs of academic, engineering and scientific, and Computer-Aided Design/ Computer-Aided Manufacturing (CAD/CAM) environments, with discipline-specific as well as personal productivity applications.

Highlights of the 6150 are:

- New high-performance 32-bit microprocessor
- Hardware-assisted virtual storage management addressing to 1 terabyte
- IBM Personal Computer family compatibility via optional IBM PC AT Coprocessor Card
- Open architecture, hardware and software
- System storage with error correction code, with 1M bytes standard on the Model 20 and 2M bytes on the Model 25.

IBM 6151 RT Personal Computer Model 10

The IBM 6151 RT Personal Computer is a powerful and extendable work-station-oriented system for the personal computer requirements of the technical professional. An addition to the computer-related products, the IBM 6151 RT Personal Computer features a 32-bit reduced instruction set microprocessor with virtual storage, as well as optional Personal Computer compatibility for both program and hardware attachment. The system is designed to satisfy the computing needs of academic, engineering and scientific, and CAD/CAM environments, with discipline-specific as well as personal productivity applications.

Highlights of the 6151 are:

- New high-performance 32-bit microprocessor
- Hardware-assisted virtual storage management addressing to 1 terabyte
- IBM Personal Computer family compatibility via optional IBM PC AT Coprocessor Card
- Open architecture, hardware and software
- System storage with error correction code, with 1M bytes standard on the Model 10.

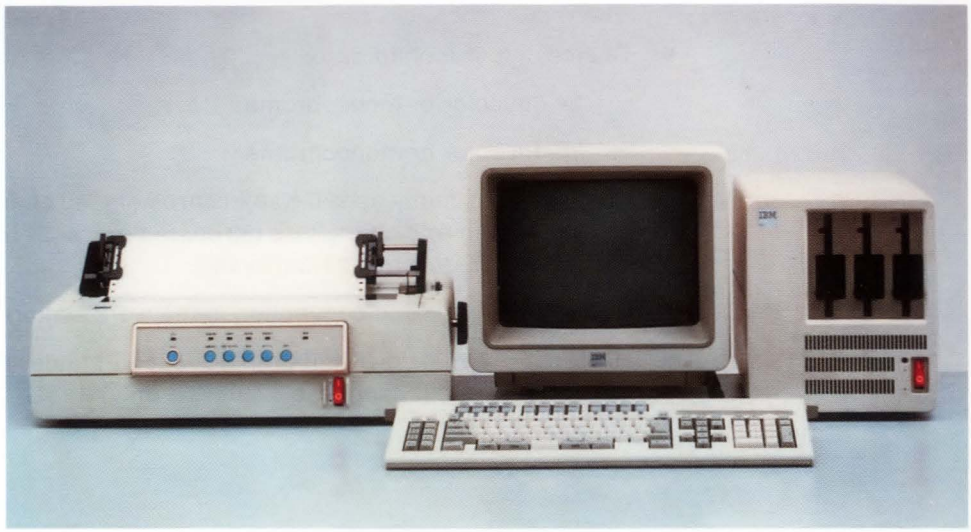

Figure 4-2. IBM 5560 Multiworkstation

IBM 5560/50/40 Multiworkstations

The IBM multistation family including the IBM 5560, 5550, and 5540 Multiworkstations combines three roles into one. (Figure 4-2 shows the 5560.) These work stations can all function as a Japanese-language personal computer for business applications, a Japanese-language word processor, and a Japanese-language online communication terminal. Japanese language including Kanji is a double-byte character set (DBCS), and these work stations also support other languages. Every program in the extensive multistation software library can be used on any of the work stations. This enables the user to share easily both data and programs. Each work station consists of a system unit, a display, a keyboard, and, optionally, a printer.

IBM 5560 Multiworkstation

- High-speed and high-capacity data processing
- Choice of two monitors: 24-dot color or monochrome
- Displays of as many as 960 Kanji characters (40 characters × 24 lines), or 1920 alphanumeric characters (80 characters × 24 lines), with a resolution of 1066 × 725 dots in a 24-dot system
- Kana/Roman-to-Kanji conversion in the work station
- Host-interactive color/Kanji graphics support under the Graphical Data Display Manager (GDDM) and vector-to-raster conversion (Japanese 3270PC/G only)

IBM 5550 Multiworkstation

- Choice of four monitors:
  - 24-dot color or monochrome
  - 16-dot color or monochrome
- Displays of as many as 960 Kanji characters (40 characters × 24 lines), or 1920 alphanumeric characters (80 characters × 24 lines), with a resolution of 1066 × 725 dots in a 24-dot system
- Kana/Roman-to-Kanji conversion in the work station
- Host-interactive color/Kanji graphics support under GDDM and vector-to-raster conversion (Japanese 3270PC/G only)

IBM 5540 Multiworkstation

- Low-profile compact design
- Choice of two monitors:
  - 24-dot monochrome
  - 16-dot color
- Displays of as many as 960 Kanji characters (40 characters × 24 lines), or 1920 alphanumeric characters (80 characters × 24 lines), with a resolution of 1066 × 725 dots in a 24-dot system
- Kana/Roman-to-Kanji conversion in the work station
- Host-interactive color/Kanji graphics support under GDDM and vector-to-raster conversion (Japanese 3270PC/G only)

Figure 4-3. IBM 3270 Personal Computer

IBM 3270 Personal Computer

With the IBM 3270 Personal Computer (3270-PC) (shown in Figure 4-3), the user can arrange the screen into as many as seven smaller windows of various sizes. One personal computer session, four host sessions, and two notepad sessions can be displayed at one time. A notepad session can be used for jotting down online notes while the user works in a host or personal computer session. The user operates in one session at a time, using the same keyboard for each one. Moving from one session to work in another simply requires pressing a key.

The number of sessions that can be displayed at one time and the user's ability to control the presentation of these sessions on the screen make the 3270 Personal Computer unique among 3270 display terminals. HELPER, the online tutorial program provided with the 3270 Personal Computer, explains its capabilities and functions, and introduces the novice to the use of the screen management functions.

The 3270 Personal Computer is available in several configurations of these elements:

- 5271 or 5273 System Unit with an adjustable keyboard attached with a flexible cord
- 5151 Monochrome Display or 5272 Color Display
- 3270-PC Control Program
- 3270-PC File Transfer Program
- IBM Disk Operating System (DOS)
- 5152 Graphics Printer.

The color and monochrome monitors display 24 lines of 80 characters during host sessions, and 25 lines of 80 characters during an IBM Personal Computer DOS session.

The keyboard has a typewriter character set. The 3270 host keytops are printed in black, and keytops unique to IBM Personal Computer operations are printed in blue. The two system units available (5271 and 5273) each allow storage and retrieval of information on flexible diskettes and hard disks. Two methods of printing are available: from a host printer attached to a control unit or from an attached personal computer printer.

During customizing, the 3270 Personal Computer is set in one of two host-interactive modes:

Distributed function terminal (DFT) mode runs from one to four 3270 sessions emulating a 3178, 3179, 3278 (except Model 1), or 3279.

Control unit terminal (CUT) mode runs only one session emulating a 3178, 3179, 3278 Model 2, or a 3279 Model S2A.

In these modes the user can:

- Copy information between 3270 sessions (DFT only)
- Record a series of keystrokes that can be played back (autokey recording)
- Change the colors of characters and the background on the screen (on a color display)
- Change the size, shape, and placement of the windows
- Create as many as 10 different screen profiles (arrangements of the windows on the screen)
- Save screen profiles, autokey recordings, and notepad information when turning off power, and restore them when turning on power
- Call up Help panels for guidance in working with various sessions and functions
- Transfer files from a host computer to a personal computer session.

The 3270 Personal Computer, operating in either CUT mode or DFT mode, attaches to all models of the 3174 Subsystem Control Unit.

In CUT mode, the 3270 Personal Computer attaches to any 3174 model or to any 3274 model via a Type A terminal adapter. In DFT mode, it attaches to certain models of the 3274 Control Unit (see Figure 7-5 on page 7-12). Attachment requires one physical Type A port and from one to four logical addresses. Category B terminals cannot be attached to a 3274 Control Unit that is customized to support 3270 Personal Computers operating in DFT mode.

The 3270 Personal Computer has data stream compatibility for alphanumeric applications with all 3178 models, all 3278 models except Model 1, and the 3279. It does not, however, support a multiple-partition data stream. No programming changes are needed for current alphanumeric applications if the hardware features used on the 3270 display are available on the 3270 Personal Computer. The 3270 Personal Computer supports the 3270 data stream in CUT mode, and the extended data stream in DFT mode. The IBM Personal Computer DOS session permits the operation of all-points-addressable (APA) graphics with the APA graphics card installed. The 5273 System Units use the Extended Graphics Adapter (XGA) to accomplish the same function.

In DFT mode, the 3270 Personal Computer supports programmed symbols with the installation of the Programmed Symbols (PS) adapter card.

Figure 4-4. IBM 3270 Personal Computer AT/G

IBM 3270 Personal Computer/G and /GX Ranges of Work Stations

The interactive graphics capabilities of the 3270 Personal Computer are greatly enhanced by the IBM 3270 Personal Computer/G and /GX ranges of work stations. (The 3270 Personal Computer AT/G is shown in Figure 4-4.) The all-points-addressable (APA) displays, with their associated display attachment units, system unit, and keyboard, provide comprehensive graphics facilities for both host-interactive and personal computer applications. Vector graphics are used to create and manipulate (reduce or enlarge, move, change the orientation of) complex pictures, charts, drawings, foils, and other graphics forms.

The IBM 3270-PC Graphics Control Program offers the same screen management functions as the 3270-PC Control Program, extending these functions for the manipulation of graphics as well as for alphanumeric data. One personal computer session, four host sessions, and two notepad sessions can be displayed at one time.

The work stations support 3270 alphanumeric and graphics application programs running in the host computer. By emulating the Color Graphics Adapter of the IBM Personal Computer, the work stations can run programs under PC DOS, taking advantage of a screen with up to 8 colors (on the IBM 5279 Display), and up to 16 colors (on the IBM 5379 Display Model C01).

The work stations are available in the following configurations:

- ***3270 Personal Computer/G***: 5279 Color Display with IBM 5278 Display Attachment Unit; IBM 5371 System Unit Model 12, 14, or 16; standard or APL 3270-PC keyboard; Graphics Control Program Version 1; and PC DOS.
- ***3270 Personal Computer/GX***: 5379 Color Display Model C01 with IBM 5378 Display Attachment Unit Model C01; IBM 5371 System Unit Model 12, 14, or 16; standard or APL 3270-PC keyboard; Graphics Control Program Version 1; and PC DOS.
- ***3270 Personal Computer/GX***: 5379 Monochrome Display Model M01 with 5378 Display Attachment Unit Model MO1; 5371 System Unit Model 12, 14, or 16; standard or APL 3270-PC keyboard; Graphics Control Program Version 1; and PC DOS.
- ***3270 Personal Computer AT/G***: 5279 Color Display with IBM 5278 Display Attachment Unit; IBM 5373 System Unit or a 5170 System Unit with the Personal Computer AT/G Option Kit; standard or APL 3270-PC keyboard; or standard PC-AT keyboard; Graphics Control Program Version 3; and PC DOS.
- ***3270 Personal Computer AT/GX***: 5379 Color Display Model C01 with IBM 5378 Display Attachment Unit Model C01; IBM 5373 System Unit or a 5170 System Unit with the Personal Computer AT/GX Option Kit; standard or APL 3270-PC keyboard; or standard PC-AT Graphics Control Program Version 3; and PC DOS.
- ***3270 Personal Computer AT/GX***: 5379 Monochrome Display Model M01 with 5378 Display Attachment Unit Model MO1; IBM 5373 System Unit or a 5170 System Unit with the Personal Computer AT/GX Option Kit; standard or APL 3270-PC keyboard; or standard PC-AT Graphics Control Program Version 3; and PC DOS.

A number of optional devices — graphics printers (color or monochrome), plotters (color), a tablet, a mouse, and a secondary monochrome display (for 5379 only) — can also be attached.

The work stations offer a choice of three displays:

- The 5279 is a medium-resolution, 355-millimeter (14-inch) color display offering 720 × 512 picture elements (PELs) for general graphics work. Simple pictures, pie charts, histograms, bar charts, and other graphics forms may be created and manipulated. For alphanumeric data, the 5279 can display either 2560 characters in 80 columns by 32 rows or 3920 characters in 80 columns by 49 rows. The display (with antiglare screen) can be tilted and swiveled for operator comfort.
- The 5379 Model CO1 is a high-resolution, 480-millimeter (19-inch) color display offering 960 × 1000 PELs for precision graphics work such as map drawing and electronic design, where color coding offers an advantage. When used without the Graphics Control Program, it can display a 1024 × 1024-dot matrix in a viewable area of 280 × 280 millimeters (11 × 11 inches). For alphanumeric applications, up to 4000 characters can be displayed as 80 columns by 50 rows. The display (with antiglare screen) can be tilted and swiveled for operator comfort.

- The 5379 Model MO1 is a high-resolution, 480-millimeter (19-inch) monochrome display offering 960 × 1000 PELs for precision graphics and text application work — engineering drawings and page composition. For alphanumeric applications, up to 4000 characters can be displayed as 80 columns by 50 rows. The display (with antiglare screen) can be tilted and swiveled for operator comfort.

Two modes are available for attaching the 3270 Personal Computer/G and /GX ranges of work stations to the 3174 or 3274 control unit:

- In distributed function terminal (DFT) mode — required for the graphics functions of the work stations — the work stations attach to certain models of the 3174 or 3274 (see Figures 7-2 and 7-5). Attachment requires one physical Type A port and from one to four logical addresses.
- In control unit terminal (CUT) mode, the work stations attach to any model of the 3174 or 3274. In this mode, only one host session can be run.

The 3270 Personal Computer/G and /GX ranges of work stations have data stream compatibility with 3270 displays for alphanumeric applications and, in DFT mode, support the 3270 extended data stream and extended highlighting. No programming changes are needed for current alphanumeric applications unless the program is affected by 3174 or 3274 control unit configuration restrictions and as long as the hardware features used on the 3270 display are available on the 3270 Personal Computer. Application programs written for the 3279 using the IBM Graphical Data Display Manager (GDDM) licensed program can migrate without change using GDDM Release 4.

Chapter 5. Keyboards

The keyboard is your tool for controlling the display station, signaling the application program, and entering information. A display keyboard looks similar to a typewriter keyboard, but the characters you type are printed on the screen instead of on paper. Using the keyboard, you can bring to the screen data that was previously entered at the keyboard and filed away.

For each 3270 display station there are several IBM keyboards, each with a key layout designed to suit a particular job —such as word processing, data entry, or programming. A modifiable keyboard is also available for some display models so that you can define your own keyboard layouts. All the keyboards have alphabetic keys, numeric keys, special symbol keys, and control keys for entering information. Whatever your choice of keyboards, you will find that they are designed to be comfortable, easy to use, and versatile.

All alphanumeric, special symbol, and cursor-positioning keys are typematic. When the key is held down, the character will be typed repetitively until the key is released.

The number of keys can range from 66 keys for the IBM 3277 Display Station to 122 keys on a 3270 Personal Computer keyboard (shown in Figure 5-1).

Keyboards are available in a number of national languages. Displays with typewriter, data entry, or data entry keypunch keyboards may be mixed when attached to a 3174 Subsystem Control Unit, a 3274 Control Unit, or the 3276 Control Unit Display Station, but the keyboard languages must be the same. Extended binary-coded decimal interchange code (EBCDIC), APL/Text, and American National Standard Code for Information Interchange (ASCII) character sets are available. Consult your IBM marketing representative for more information about national language keyboard versions and character sets.

Touch Typing Controls

These controls are located in the touch-typing area of the keyboard, where the alphanumeric and graphic characters are found:

- **Uppercase Shift**
- **Uppercase Shift Lock**
- **Alpha Shift** (Data Entry keyboards only): Overrides the numeric input field definition and the Keyboard Numeric Lock condition to allow input of alphanumeric data in a numeric field.
- **Numeric Shift** (Data Entry keyboards only): Overrides the numeric field definition and the Numeric Lock condition to allow entry of upshift characters.
- **Tabbing keys**
- **Backspace keys**
- **New Line key:** Moves the cursor to the beginning of a new line.

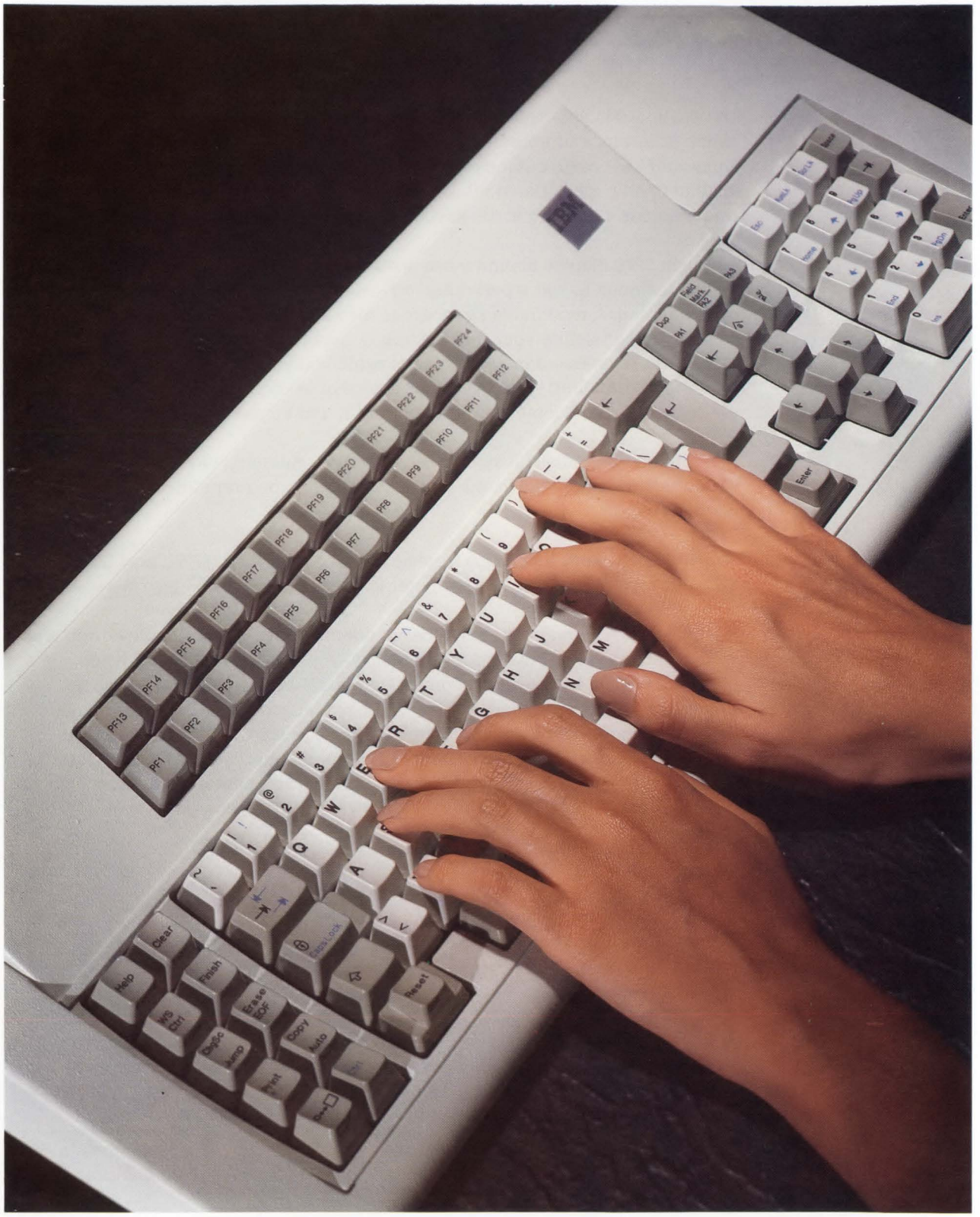

Figure 5-1. IBM 3270 Personal Computer Keyboard

- **Reset key:** Used to recover from Do Not Enter conditions. It can also be used to cancel certain operations. It causes user input such as a print request to be ignored and reverts to the program state prior to the input.
- **Device Cancel key** (3179, 3179 G, 3180, 3278, 3279, 3290): Cancels a pending print request to the printer.
- **Quit key** (3270-PC): Cancels the current action performed.
- **Enter key:** Tells the program that you have completed your message and are waiting for the information on your screen to be entered into the host system.

General Controls

Located on the left side of the keyboard, most of these controls can be used in many applications. Some of them are used only to place the keyboard in a different mode.

- **Attention key:** Provides a means of getting the program's attention. The program that is operating in the host system determines how the Attention key is used.
- **System Request key:** Can perform two different functions. It can be used to send a signal to the host system to tell the program that you have a test request message. Or it can be used to clear your display screen and switch the display station between the application and control programs.
- **Cursor Select key:** Duplicates the operation of the selector pen and is typically used to select items from a list, menu, or table.
- **Erasing controls** — Clear, Erase Input, and Erase to End of Field keys: The operator uses the Clear key to erase the entire display screen and the display format. The Erase to End of Field key is used when the operator has entered some data into part of a field and wants the rest of the field erased. The Erase Input key is used to erase all data input fields on the display screen.
- **Print key:** Requests a printed (hard) copy of the information on the screen from the printer assigned to that display station.
- **Copy key:** Copies data from one session to a copy area on the screen (3290) or to another session on the screen (3270-PC).
- **Record and Play keys** (3180, 3270-PC): The Record key records sequences of keystrokes for automatic playback using the Play key.
- **Rule key** (3290): Places a horizontal line under the row containing the cursor on the screen.
- **Setup Mode** (3180, 3290, 3270-PC): Allows you to change the layout of the screen and select other default options.
- **Extended Select Shift** (3178, 3179, 3179 G, 3180, 3278, 3279, 3290, 3270-PC): For the 3290 and 3179 G, this changes the function of certain program function keys. For the 3178, 3179, 3180, 3278, 3279, and 3270-PC, this extends the keyboard for such functions as remote communication and response time monitoring.
- **Work Station Control Mode** (3270-PC): Enables you to perform screen management functions.

- **Doc On Off**: Puts the display in document mode, enabling the entry assist functions.
- **Enlarge** (3270-PC): Changes the size of a window to fill the entire screen, without changing the character size.
- **Zoom** (3290): Causes the active screen to be displayed with the largest allowable character size, filling the entire screen.

Screen Management, Program Access, and Editing Controls

The cursor is a movable marker that looks like a short underscore line; it indicates where the next character you type will be displayed. A visual aid, the cursor helps you focus on the active area of the screen. It moves automatically across the screen as you type. You can also control the cursor, moving it to any position on the screen to indicate where to enter, replace, or delete characters.

To the right of the touch-typing area are the frequently used keys for screen management, cursor positioning, editing, and program access.

- **Up and Down Cursor keys**
- **Left and Right Cursor keys**
- **Double-Speed Cursor, Left and Right keys**
- **Backtab key**
- **Selectable Field Tab key** (3179 G)
- **Next Word key** (3179 G)
- **Previous Word key** (3179 G)
- **Delete Word key** (3179 G): Deletes the word when the cursor is positioned at the first character of a word and the trailing space or null in an unprotected field.
- **Backspace erase** (3179 G): In insert mode, deletes the character to the left of the cursor position, with the cursor moving to the left, one position at a time.
- **Cursor Home key**: Moves the cursor to the first nonprotected character position on the screen.
- **Change Screen key** (3290, 3270-PC): Displays the next screen or set of sessions after the one currently displayed.
- **Jump Screen** (3290, 3270-PC): Moves the cursor to the next viewport (called *window* on the 3270-PC) on the screen.
- **Jump Partition** (3290): Moves the cursor to the next partition on the screen.
- **Duplicate key:** Used during data entry to indicate that the field data from the previous record should be duplicated.
- **Field Mark key:** Used when operating with an unformatted display to indicate the end of a field to the program.
- **Insert and Delete keys:** Allow you either to add or to delete characters easily. In the document mode, a typematic delete and a word delete are both available.
- **Program Access keys** (PA1, PA2, PA3): Send a signal to a program that performs display operations; no input data from the screen is transmitted to the program.

Program Function and Attribute Selection Controls

- **Program Function keys**, PF1 through PF24: Pass input data from the screen and send a signal to a program to call for a particular display operation, such as splitting a line of text or moving from the middle of a file to its starting lines on the viewing screen. Application programs can define the action that occurs when any of the program function (PF) keys is pressed. The group of PF keys and their functions can also be programmed as an operator desires, with each key set to perform a particular function.
- **Attribute Select keys** (3179, 3179 G, 3180, 3278, 3279, 3290): When supported under program control, these keys select the extended highlighting, extended color, background transparency (3179 G unique), and programmed symbol attributes of the character that is being entered.
- **Cursor Appearance keys,** Alternate Cursor and Cursor Blink: Determine how the cursor looks on the screen. The standard cursor is a nonblinking marker that looks like an underscore. The other options are a reverse-image cursor (a small rectangle which, when positioned on a character, changes the color of the character to the color of the screen), a blinking reverse-image cursor, or a blinking cursor. The blinking cursor is useful for teaching new users, or for screens filled with data, because it makes the cursor immediately obvious.
- **Graphic Cursor (+Cr) keys** (3179 G): Used to specify alternately which of the two cursors, the alphanumeric or the graphic, is the active cursor. When the Graphic Cursor Mode indicator (+Cr) appears in the operator information area, the graphic cursor is the current active cursor. Absence of this indicator means that the alphanumeric cursor is currently active.

Keypad

A separately housed keypad (3179, 3180, 3290), an optional feature, is available for numeric data entry or program function applications. It can be located on either side of the keyboard to allow for left- or right-handed use.

Keyboard Definition Utility

This precustomizing procedure (3179, 3180) for the modifiable keyboard allows you to create your own uniquely defined keyboard layouts by modifying the keyboard tables in the 3174 or 3274 control unit. Certain keycaps are removable and can be interchanged with other keycaps on the keyboard. Square-shaped keycaps, like the alphanumeric and program function keycaps, are removable and interchangeable; the larger-shaped keycaps—Shift, Tab, Reset, Shift Lock, Carriage Return, Spacebar—and Alt keycaps are not.

By modifying the keyboard tables, and then moving keycaps about on the keyboard, the user can define keyboard layouts to meet specific application requirements.

A maximum of four keyboard layouts and their associated keyboard tables may be defined for each 3174 Subsystem Control Unit and each 3274 Control Unit. Each layout, either standard (unmodified) or modified, is assigned a keyboard ID.

Chapter 6. Printers

The 3270 family includes both dot-matrix and line printers. The models vary in size and in the print rate, vertical spacing, character pitch, and graphics capability that they offer. Though print rate is often an important consideration in selecting a printer, the actual rate of output for a particular installation is affected by the control unit configuration and line transmission speed, output format, colors printed per line, and the programming application processing. When output is printed in several colors, the print rate will be reduced in proportion to the number of color changes on a page. Using the Programmed Symbols feature for dense printing or for printing nonstandard character format also reduces the rate of printer output.

Figure 6-1. IBM 5210 Printer

5210 Printer Models G01 and G02

The IBM 5210 Printer (shown in Figure 6-1) is a desk-top impact printer that uses a bidirectional printwheel to produce letter-quality output. The printer can be fed cut-sheet paper, manually or automatically, or can be fed continuous forms. The 5210 employs a cartridge ribbon, and the Ribbon Saver allows two modes of ribbon feed for two different qualities of print.

- Model G01, maximum print rate: 40 characters per second (96 characters, 10-pitch).
- Model G02, maximum print rate: 60 characters per second (96 characters, 10-pitch).
- Print positions: 132 for 10-pitch, 158 for 12-pitch, and 198 for 15-pitch.
- Vertical spacing: 3, 4, 5.3, 6, 8, 9.6, 12, 24, and 48 lines per inch.
- Character pitch: 10, 12, and 15 characters per inch.
- Both models attach to any 3174 Subsystem Control Unit.
- Both models attach to the Type A terminal adapter of the 3274 Control Unit or to the 3276 Control Unit Display Station.

Figure 6-2. IBM 4214 Printer Model 1

4214 Printer Model 1

The IBM 4214 Printer Model 1 (shown in Figure 6-2) is a bidirectional, dot-matrix, desk-top printer for office or remote use. The printer can be loaded by tractor feed, document demand, or continuous forms, and produces near-letter-quality output. Using the operator panel, you can alter character and line spacing, margins, quality of print, and physical movement of forms. The ribbon cartridge uses a continuous loop to increase ribbon life.

- Maximum print rate: 200 characters per second (82 lines per minute).
- Attaches to any 3174 Subsystem Control Unit.
- Attaches to the 3274 Control Unit or to the 3276 Control Unit Display Station.

Figure 6-3. IBM 4234 Printer

4234 Printer Models 001 and 002

The IBM 4234 Printer (shown in Figure 6-3) is a heavy-duty, intermediate-speed, impact-matrix line printer using Dot Band technology. Models are available for attachment to a 3174, 3274,or 3276 control unit using either coaxial or twinaxial cable. The 4234s are designed for customer setup and customization.

- Three selectable print qualities and speed:
  - Draft (uppercase only), 410 lines per minute
  - Data processing, 300 lines per minute
  - Letter quality, 120 lines per minute
- 13.2-inch print line
- Vertical and horizontal fine adjustment
- Customer-changeable print band
- Clean hands, long-life ribbon — approximately 30 million characters
- Both models attach to any 3174 Subsystem Control Unit.
- Both models attach to the Type A terminal adapter of the 3274 Control Unit and to the 3276 Control Unit Display Station.

Figure 6-4. IBM 4245 Printer

4245 Printer Models D12 and D20

Models D12 and D20 of the IBM 4245 Printer (shown in Figure 6-4), with print rates of 1200 and 2000 lines per minute respectively, are significant additions to the IBM high-speed printer product line. These band printers provide improved print quality, performance reliability, and reduced power, and require less floor space.

Standard features of these printers include optical character recognition (OCR) printing support and field upgradability. They attach to 3174 or 3274 control units by coaxial cable.

- Both models attach to any 3174 Subsystem Control Unit.
- Both models attach to the Type A terminal adapters of the 3274 Control Unit or to the 3276 Control Unit Display Station.

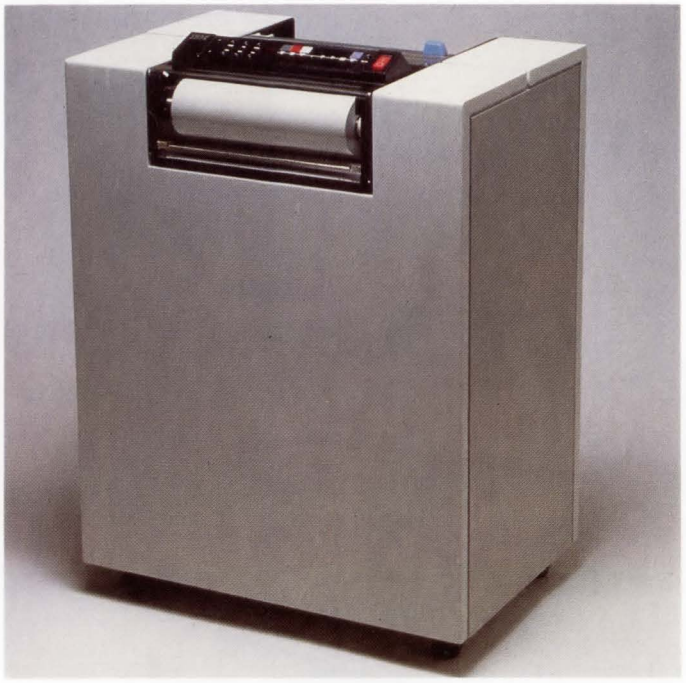

Figure 6-5. IBM 4250 Printer

4250 Printer

The IBM 4250 Printer (shown in Figure 6-5) is used for publishing applications. A standing unit, this high-resolution printer produces camera-ready print masters with text and line-art graphics intermixed. The 4250 uses a roll of aluminum-coated, electrosensitive paper.

- The print head speed is 1 meter per second (40 inches per second). All points on the printable area of the page are addressable.
- The printer attaches to any model of the 3174 Subsystem Control Unit.
- The printer attaches to the Type A terminal adapter of the 3274 Control Unit Models 31A, 31D, 41A, and 41D.

Figure 6-6. IBM 3262 Line Printer

3262 Line Printer Models 3 and 13

The IBM 3262 Line Printer (shown in Figure 6-6) is a high-speed line printer that produces character-engraved print on continuous forms. This floor-standing unit has an integral forms stand/stacker.

- Model 3, maximum print rate: 650 lines per minute.
- Model 13, maximum print rate: 325 lines per minute.
- Print positions: 132.
- Vertical spacing: program-controlled.
- Character pitch: 10 characters per inch.
- Duplicate forms: up to 4 parts.
- Models 3 and 13 attach to any 3174 Subsystem Control Unit.
- Model 3 attaches to the Type A terminal adapter of the 3274 Control Unit.
- Model 13 also attaches to the Type A terminal adapter of the 3274 Control Unit and to the 3276 Control Unit Display Station.

3287 Printer Models 1C and 2C

The 3287 Printer Models 1C and 2C (shown in Figure 6-8) can produce output in four colors: red, green, blue, and black. (Print positions 1 – 120 can print in four colors; print positions 121 – 132 print in black.) Programmed Symbols, a special feature the customer can order, allows the user to define and print symbols, characters, and shapes that combine to create a graphic representation.

- Model 1C, maximum print rate: 80 characters per second in one color.
- Model 2C, maximum print rate: 120 characters per second in one color.
- Print positions: 132.
- Vertical spacing: 3, 4, 6, and 8 lines per inch.
- Character pitch: 10 characters per inch.
- Duplicate forms: up to 6 parts; 5- and 6-part forms should be tested individually.
- Both models attach to the 3174 Subsystem Control Unit.
- Both models attach to the Type A terminal adapter of the 3274 Control Unit and to the 3276 Control Unit Display Station. Only base color on a field basis can be printed when the printer is attached to a 3276.

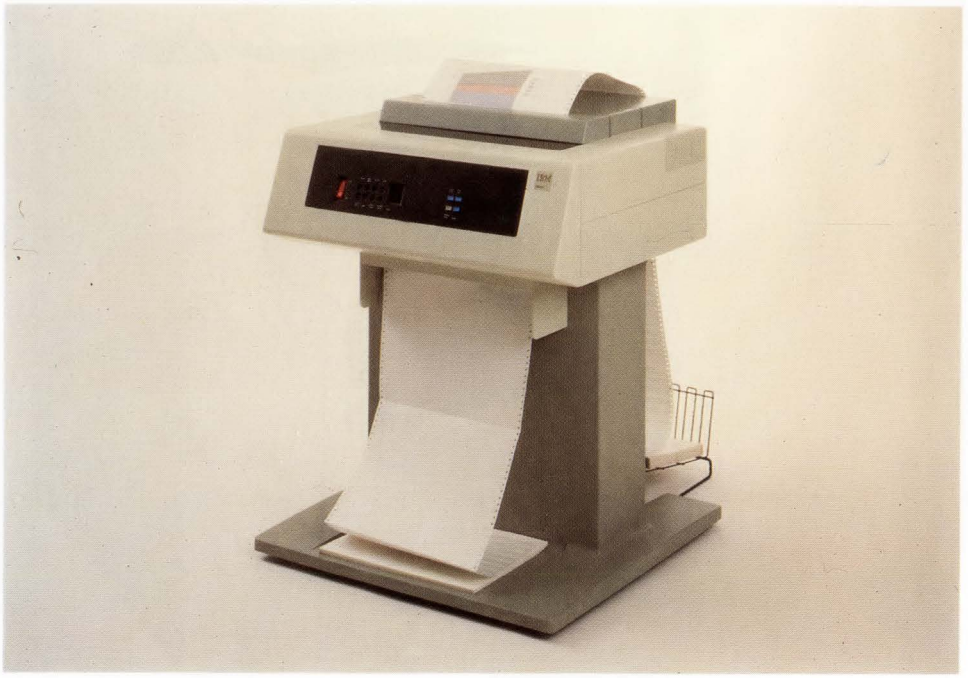

Figure 6-7. IBM 3268 Printer

3268 Printer Model 2

The IBM 3268 Printer (shown in Figure 6-7) is a high-speed dot-matrix printer with bidirectional printing capability. It uses continuous forms. The printer is a floor-standing unit with a pedestal base.

- Maximum print rate: 340 characters per second.
- Print positions: 132.
- Vertical spacing: 3, 4, 6, and 8 lines per inch.
- Character pitch: 10 and 16.7 characters per inch.
- Duplicate forms: up to 6 parts; 5- and 6-part forms should be tested individually.
- Attaches to any 3174 Subsystem Control Unit.
- Attaches to the Type A terminal adapter of the 3274 Control Unit or to the 3276 Control Unit Display Station.

3268 Printer Model 2C

The IBM 3268 Printer Model 2C can produce output in four colors: red, green, blue, and black. This dot-matrix printer has bidirectional printing capability, using continuous forms. The printer is a floor unit, with a pedestal base.

- Programmed-symbols capability provides as many as six symbol sets. Two types of symbol sets are available: those that print a single color within a character cell (all or a portion of an entire symbol), and those that print multiple colors within a character cell.
- Maximum print rate: 340 characters per second when printing alphanumeric characters; 147 characters per second when printing in all points addressable (APA) mode.
- Print positions: 132 at 10 characters per inch; 220 at 16.7 characters per inch (condensed).
- Vertical spacing: 3, 4, 6, and 8 lines per inch.
- Character pitch: 10 and 16.7 characters per inch.
- Duplicate forms: up to 6 parts; 5- and 6-part forms should be tested individually.
- Attaches to any 3174 Subsystem Control Unit.
- Attaches to the Type A terminal adapter of the 3274 Control Unit or to the 3276 Control Unit Display Station.

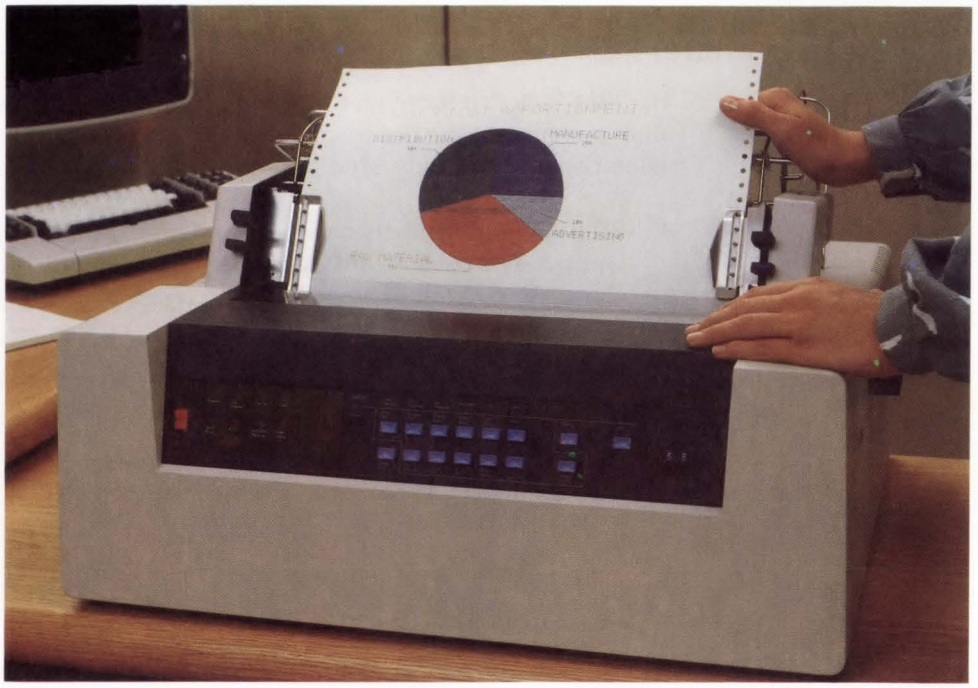

Figure 6-8. IBM 3287 Printer Model 2C

3287 Printer Models 1 and 2

The IBM 3287 Printer, a table-top printer, produces dot-matrix printout and has bidirectional printing capability. Programmed Symbols, a special feature the customer can order, allows the user to define and print symbols, characters, and shapes that combine to create a graphic representation.

- Model 1, maximum print rate: 80 characters per second.
- Model 2, maximum print rate: 120 characters per second.
- Print positions: 132.
- Vertical spacing: 3, 4, 6, and 8 lines per inch.
- Character pitch: 10 characters per inch.
- Duplicate forms: up to 6 parts; 5- and 6-part forms should be tested individually.
- Both models, with the 3274/3276 attachment and feature (8331), attach to the 3174 Subsystem Control Unit.
- Both models attach to either the Type A or Type B terminal adapter of the 3274 Control Unit or to the 3276 Control Unit Display Station.

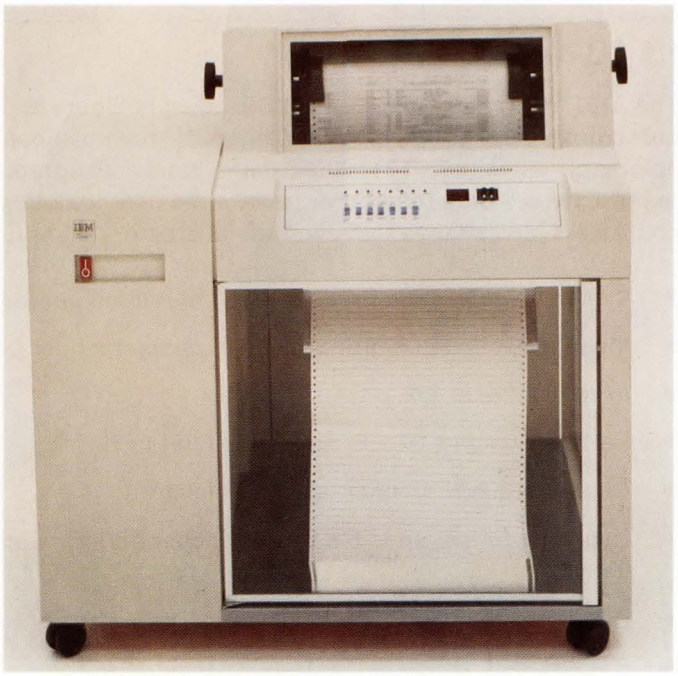

Figure 6-9. IBM 3289 Line Printer

3289 Line Printer Models 1 and 2

The IBM 3289 Line Printer (shown in Figure 6-9) is a medium-speed line printer that produces character-engraved quality print on continuous forms. This floor-standing unit has an integral forms stand/stacker.

- Model 1, maximum print rate: 155 lines per minute.
- Model 2, maximum print rate: 400 lines per minute.
- Print positions: 132.
- Vertical spacing: 6 and 8 lines per inch.
- Character pitch: 10 characters per inch.
- Duplicate forms: up to 6 parts.
- Both models attach to the Type A terminal adapter of the 3274 Control Unit or to the 3276 Control Unit Display Station.

Chapter 7. Control Units

The control unit is the vital link in the 3270 Information Display System, connecting the display stations and printers to the host data processing system. Display stations and printers attached to control units can be installed in many different configurations, depending on the demands of your business.

To select a control unit model that is suitable for your particular configuration, you need to know the method by which the control unit will be attached to the host computer (whether local or remote), the number and type of display stations and printers to be attached to the control unit, and their base function and features.

3174 Subsystem Control Unit

The models of the 3174 Subsystem Control Unit introduce a new generation of control units to the 3270 Information Display System. (A Model 1L is shown in Figure 7-1.) With improved technology and expanded storage, the 3174 is the gateway of the 3270 system, connecting the terminals (display stations and printers) to the host data processing system. Introductory highlights of the 3174 Subsystem Control Units are also found under "Revision Highlights" on page ix.

The 3174 Subsystem Control Unit can attach to a host data processing system in several ways:

- Local attachment directly to a host system channel.
- Remote attachment via binary synchronous communication (BSC) protocol or Synchronous Data Link Control (SDLC) protocol, either through communication facilities or through direct connection via an Electronic Industries Association (EIA) or International Telegraph and Telephone Consultative Committee (CCITT) interface. Remote models are capable of operating over X.21 and X.25 facilities.
- Direct connection to the IBM 8100 Information System or to IBM Communication Controllers.

Figure 7-1. IBM 3174 Subsystem Control Unit Model 1L

Attaching Terminals

When attached to a control unit, display stations and printers are referred to as *terminals*. The terminals that attach to the 3174 Subsystem Control Unit are listed in Figure 7-2 on page 7-4.

The attachment flexibility of the new subsystem control units allows more creative configuration of terminal attachment. The terminals can now be configured to connect directly to the 3174 Subsystem Control Unit, or through 3299 Terminal Multiplexers, or by a combination of these attachments. Combinations are unique to the 3174 models.

The large-cluster control unit Models 1L, 1R, and 2R have an integrated four-port terminal adapter for attaching Category A terminals either directly (four terminals) or via one to four optional Terminal Multiplexer Adapter features (up to 32 terminals), or via a combination of 3299 Terminal Multiplexers and optional Terminal Multiplexer Adapter features (up to 32 terminals).

The small-cluster control unit Models 51R and 52R have a similar attachment flexibility, but with a maximum of 16 terminals. A base unit has an integrated nine-port terminal adapter for attaching Category A terminals either directly (9 terminals), or via two 3299 Terminal Multiplexers (16 terminals), or a combination of one 3299 (8 terminals) and 8 terminals directly attached (16 terminals).

A multiplexer offers the advantage of connecting eight terminals to one 3174 port; also, less cable is needed when the multiplexer is located close to the cluster of 8 terminals.

The control units can be grouped conveniently according to their type of attachment and the size of the cluster of display stations and printers they can control:

- Locally attached model:
  - 3174 Model 1L can control a large cluster of as many as 32 display stations and printers.
- Remotely attached models:
  - 3174 Models 1R and 2R can control a large cluster of as many as 32 display stations and printers.
  - 3174 Models 51R and 52R control a maximum of 16 display stations and printers.

New terminals are continually being announced. The IBM salesperson will know of any terminals that are not yet represented in this book.

Storage

Displays and printers have a diversity of features. The models of the 3174 Subsystem Control Unit differ on the basis of the displays and printers that they support (see Figure 7-2 on page 7-4). All the 3174 models have a basic 1M byte (M equals 1 048 576) of storage:

- 3174 Model 1L has 1M byte of storage and one high-capacity 1.2M byte diskette drive, designed to support all basic functions; a second 1.2 drive is optional.
- 3174 Models 1R and 2R have 1M byte of storage and one 1.2M byte diskette drive, designed to support all basic functions; a second 1.2 drive is optional.
- 3174 Models 51R and 52R have 1M byte of storage and one high-capacity 1.2M byte diskette drive, designed to support all basic functions; a second 1.2 drive is optional.

The simplicity of the 3174 design makes it easy to use. New technology will allow the transparent flow of properly programmed instructions, from the system processor to terminals connected to the 3174. The 3174 models support multiple features, possess functions and features compatible with earlier control unit models, and are easily configured.

Customization

All 3174 models have a high-capacity 1.2M byte diskette drive and are capable of storing a greater amount of data than all previous control units. Microcode diskettes are shipped with each control unit. The diskettes are used to generate an initial microcode load (IML) diskette that supports the configuration of display stations and printers on your system. The IML diskette gives the 3174 all the information about the system that is necessary when power is turned on.

To customize a diskette, the operator follows a documented procedure for typing in the system configuration features at the keyboard of a control unit terminal attached to the control unit. (See Figure 7-2 on page 7-4.) A user-customized diskette can be recustomized as you add or remove features to meet your changing needs. Backup IML diskettes can be generated with a similar procedure.

Terminal	Channel-Attached		Remotely Attached		Type of Terminal
	SNA	Non-SNA	SDLC	BSC	
	1L	1L	1R, 2R, 51R, 52R	1R, 51R	
Displays					
3178					
Model C1	X	X	X	X	CUT
Model C2	X	X	X	X	CUT
Model C3	X	X	X	X	CUT
Model C4	X	X	X	X	CUT
3179					
Model 1	X	X	X	X	CUT
Model G1	X	X	X	X	DFT
Model G2	X	X	X	X	DFT
3180 Model 1	X	X	X	X	CUT
3278 Models 2, 3, 4, 5	X	X	X	X	CUT
3279					
Model S2A	X	X	X	X	CUT
Model S2B	X	X	X	X	CUT
Model S3G	X	X	X	X	CUT
Model 2X	X	X	X	X	CUT
Model 3X	X	X	X	X	CUT
3290					
Model 220	X	X	X	X	DFT
Model 230	X	X	X	X	DFT
5150, all models	X	X	X	X	DFT
5160					
Models 68, 78	X	X	X	X	DFT
Models 86, 87	X	X	X	X	DFT
Model 589	X	X	X	X	DFT
5170					
Models 68, 99	X	X	X	X	DFT
Models 239, 495	X	X	X	X	DFT
Models 739, 599	X	X	X	X	DFT
5210 Models G1, G2	X	X	X	X	CUT
5271, all models	X	X	X	X	DFT
5273, all models	X	X	X	X	DFT
5371, all models	X	X	X	X	DFT
5373, all models	X	X	X	X	DFT
5540	X	X	X	X	DFT
5550	X	X	X	X	DFT
5560	X	X	X	X	DFT
5578	X	X	X	X	DFT

Figure 7-2 (Part 1 of 2). Terminals Supported by 3174 Subsystem Control Units

Terminal	Channel-Attached SNA 1L	Channel-Attached Non-SNA 1L	Remotely Attached SDLC 1R, 2R, 51R, 52R	Remotely Attached BSC 1R, 51R	Type of Terminal
Displays (cont'd)					
6150					
Models 20, 25	X	X	X	X	DFT
Model A25	X	X	X	X	DFT
6151 Model 10	X	X	X	X	DFT
SOEMI (OEM Devices)		X			
Printers					
3262					
Model 3	X	X	X	X	
Model 13	X	X	X	X	
3268					
Model 2	X	X	X	X	
Model 2C	X	X	X	X	
3287					
Model 1	X	X	X	X	
Model 1C	X	X	X	X	
Model 2	X	X	X	X	
Model 2C	X	X	X	X	
4214 Model 1	X	X	X	X	
4234 Model 1	X	X	X	X	
4245					
Model D12	X	X	X	X	
Model D20	X	X	X	X	
4250 Model 1	X	X	X	X	
5210					
Model G1	X	X	X	X	
Model G2	X	X	X	X	
Switching Mgnt Sys					
3814					
Model A1	X	X	X	X	
Model A2	X	X	X	X	
Model A3	X	X	X	X	
Model A4	X	X	X	X	

Legend:

- DFT = distributed function terminal: A terminal that can interpret the data stream and execute functions without help from the control unit to which it is attached.
- CUT = control unit terminal: A terminal that *cannot* interpret the data stream and execute terminal functions without help from the control unit to which it is attached.

Figure 7-2 (Part 2 of 2). Terminals Supported by 3174 Subsystem Control Units

3174 Model 1L

The 3174 Model 1L is a large-cluster control unit. It is shipped with an S/370-type channel adapter for SNA and non-SNA for local attachment. The basic storage is 1M byte. One 5-1/4-inch, high-capacity 1.2M diskette drive is standard for all models. A second diskette drive must be installed if distributed function terminals are to be used for downstream load (DSL). A four-port terminal adapter with either IBM 3299 Multiplexer Adapters or Terminal Multiplexer Adapters (a special feature) supports a maximum of 32 Category A terminals.

Customization is performed with a control unit terminal attached to port 0 of the 3174. Any terminal may be attached to port 0 at other times. All 3174 control units support Full Keyboard Utilities.

Subsystem online tests and problem determination are performed through a control unit terminal attached to any port or multiplexer without interrupting other terminals attached to the 3174. Offline tests are performed through the 3174 control panel. You may wish to review the "Highlights" of the 3174 Subsystem Control Units on page ix.

Special features can be installed by the customer.

- 1.2M Diskette Drive
- Terminal Multiplexer Adapter.

3174 Model 1R

The 3174 Model 1R is a large-cluster control unit designed for remote operations. It contains EIA RS-232C/CCITT V.24 and CCITT V.35 interfaces for SNA/SDLC, BSC, or X.25 remote link attachment. The basic storage is 1M byte. One 5-1/4-inch, high-capacity 1.2 diskette drive is standard for all models. A second diskette drive must be installed if distributed function terminals are to be used for downstream load (DSL). A four-port terminal adapter with either IBM 3299 Terminal Adapters or Terminal Multiplexer Adapters (a special feature) supports a maximum of 32 Category A terminals.

Customization is performed with a control unit terminal attached to port 0 of the 3174. Any terminal may be attached to port 0 at other times. All 3174 control units support Full Keyboard Utilities.

Subsystem online tests and problem determination are performed through a control unit terminal attached to any port or multiplexer without interrupting other terminals attached to the 3174. Offline tests are performed through the 3174 control panel. You may wish to review the "Highlights" of the 3174 Subsystem Control Units on page ix.

Special features can be installed by the customer.

- 1.2M Diskette Drive
- Terminal Multiplexer Adapter
- Encrypt/Decrypt

3174 Model 2R

The 3174 Model 2R is a large-cluster control unit designed for remote operations. It contains X.21 interface (CCITT V.11) for SNA/SDLC or X.25 remote link attachment. The basic storage is 1M byte. One 5-1/4-inch high-capacity 1.2 diskette drive is standard for all models. A second diskette drive must be installed if distributed function terminals are to be used for downstream load (DSL). A four-port terminal adapter with either IBM 3299 Terminal Multiplexers or Terminal Multiplexer Adapters (a special feature) supports a maximum of 32 Category A terminals.

Customization is performed with a control unit terminal attached to port 0 of the 3174. Any terminal may be attached to port 0 at other times. All 3174 control units support Full Keyboard Utilities.

Subsystem online tests and problem determination are performed through a control unit terminal attached to any port or multiplexer without interrupting other terminals attached to the 3174. Offline tests are performed through the 3174 control panel. You may wish to review the "Highlights" of the 3174 Subsystem Control Units on page ix.

Special features can be installed by the customer.

- 1.2M Diskette Drive
- Terminal Multiplexer Adapter
- Encrypt/Decrypt

Figure 7-3. IBM 3174 Subsystem Control Unit Model 51R

3174 Model 51R

The 3174 Model 51R (shown in Figure 7-3) is a small-cluster control unit designed for remote operations. It contains EIA RS-232C/CCITT V.24 and CCITT V.35 interfaces for SNA/SDLC, BSC, or X.25 remote link attachment. Basic storage is 1M byte. One 5-1/4-inch high-capacity 1.2 diskette drive is basic for all models. A second diskette drive is required if distributed function terminals are to be used for downstream load (DSL). A nine-port terminal adapter supports 9 Category A terminals directly or 16 Category A terminals through IBM 3299 Terminal Multiplexers.

Customization is performed with a control unit terminal attached to port 0 of the 3174. Any terminal may be attached to port 0 at other times. All 3174 control units support Full Keyboard Utilities.

Subsystem online tests and problem determination are performed through a control unit terminal attached to any port or multiplexer without interrupting other terminals attached to the 3174. Offline tests are performed through the 3174 control panel. You may wish to review the "Highlights "of the 3174 Subsystem Control Units on page ix.

Special features can be installed by the customer.

- 1.2M Diskette Drive

3174 Model 52R

The 3174 Model 52R is a small-cluster control unit designed for remote operations. It contains X.21 interface (CCITT V.11) for SNA/SDLC or X.25 remote link attachment. The basic storage is 1M byte. One 5-1/4-inch high-capacity 1.2 diskette drive is standard for all models. A second diskette drive is required if distributed function terminals are to be used for downstream load (DSL). A nine-port terminal adapter supports 9 Category A terminals directly or 16 Category A terminals through IBM 3299 Terminal Multiplexers.

Customization is performed with a control unit terminal attached to port 0 of the 3174. Any terminal may be attached to port 0 at other times. All 3174 control units support Full Keyboard Utilities.

Subsystem online tests and problem determination are performed through a control unit terminal attached to any port or multiplexer without interrupting other terminals attached to the 3174. Offline tests are performed through the 3174 control panel. You may wish to review the "Highlights" of the 3174 Subsystem Control Units on page ix.

Special features can be installed by the customer.

- 1.2M Diskette Drive

3274 Control Unit and 3276 Control Unit Display Station

The 3274 and 3276 control units can attach to a host data processing system in several ways:

- Local attachment directly to a host system channel.
- Remote attachment via BSC protocol or SDLC protocol, either through communication facilities or through direct connection via an EIA or CCITT interface. Remote models of the 3274 are capable of operating over X.21 and X.25 facilities.
- Direct connection to the IBM 8100 Information System, or to the IBM 3704, 3705, and 3725 Communication Controllers.
- Loop attachment either to a data-link-attached or to a directly attached loop of the IBM 8100 Information System and the IBM 4300 Processor Complex.

The System/370 and the 4300 System can operate as a host computer to any 3270 display system that is remotely attached and using BSC protocol. The System/370, 4300 System, 8100 Information System, 303x Processor, and 3081 Processor can operate as a host computer to any 3270 display system that is remotely attached and using SDLC protocol.

Attaching Terminals

As mentioned previously, display stations and printers attached to a control unit are referred to as *terminals.* Those display stations and printers developed specifically to attach to the 3274 Control Unit are called *Category A* terminals. Category B terminals are designed to attach to earlier control unit models, the 3271 and 3272. (Any models that control large clusters of as many as 32 terminals, including Category B terminals, can attach a maximum of only 16 Category B terminals.) On a control unit, Type A adapters attach Category A terminals, and Type B adapters attach Category B terminals. A third adapter, the 3299 Terminal Multiplexer, attaches only Category A terminals to all models of the 3274 except Model 51C. Using the 3299 Terminal Multiplexer requires less cable.

The 3274 Control Units can be grouped conveniently according to their type of attachment and the size of the cluster of display stations and printers they can control.

- Locally attached Models 21A, 21B, 21D, 31A, 31D, 41A, and 41D (shown in Figure 7-4 on page 7-11) can control a large cluster of as many as 32 display stations and printers.
- Remotely attached Models 21C, 31C, and 41C can control a large cluster of as many as 32 terminals.
- Remotely attached Models 51C and 61C control mid-sized clusters. The Model 51C controls a maximum of 12 display stations and printers, and the Model 61C controls as many as 16.

Figure 7-4. IBM 3274 Control Unit Model 41D

Storage

Displays and printers have a diversity of features. The models of the 3274 Control Unit differ on the basis of the displays and printers that they support (see Figure 7-5). The greater the amount of storage a particular control unit model offers, the more functions and features it can support.

- Models 21A, 21B, 21C, and 21D have 64K bytes (K equals 1024) of storage. They deliver basic functions at an economical price.
- Model 51C also is designed to support basic functions at an economical price. Its 64K bytes of storage can be upgraded to 128K or 192K bytes to support added features, as your system is expanded.
- Models 41A, 41C, 41D, and 61C have 192K bytes of storage, which can be upgraded to 320K bytes. The simplicity of their design makes them easy to use. They support multiple features, possess functions and features compatible with earlier models of the 3274, and are easily configured.
- Models 31A, 31C, and 31D have 128K bytes of storage, which can be upgraded to 192K bytes. Models 31A, 31C, and 31D are recommended only for those installations where Category B terminal support is still required. Otherwise, a Model 41A, 41C, or 41D should be considered.

Customization

As part of the installation procedure for all 3274 models, from two to seven diskettes are used to generate a customized initial microcode load (IML) diskette that supports the configuration of display stations and printers that your business requires. The IML diskette gives the 3274 all the information about the system required for startup when power is turned on.

To customize a diskette, the operator follows a procedure for typing in the system configuration features at the keyboard of a control unit terminal attached to the 3274. (See Figure 7-2 on page 7-4.) A user-customized diskette can be recustomized as you add or remove features to meet your changing needs. Backup IML diskettes can be generated with a similar procedure.

	Channel-Attached											
	SNA			Non-SNA				Remotely Attached				
Terminal	21A	31A	41A	21B	21D	31D	41D	21C	31C	41C	51C	61C
Category A Displays												
3178												
Model C1	X	X	X	X	X	X	X	X	X	X	X	X
Model C2	X	X	X	X	X	X	X	X	X	X	X	X
Model C3	X	X	X	X	X	X	X	X	X	X	X	X
Model C4	X	X	X	X	X	X	X	X	X	X	X	X
3179 Model 1	4	X	X	4	4	X	X	4	X	X	X	X
3179 G		X	X			X	X		X	X	X	X
3180 Model 1	X	X	X	X	X	X	X	X	X	X	X	X
3270-PC,PC/G/GX	5	X	X	5	5	X	X	5	X	X	X	X
3278												
Models C2, C3	X	X	X	X	X	X	X	X	X	X	X	X
Model C4	X	X	X	X	X	X	X	X	X	X	X	X
Model C5		X	X			X	X		X	X	2	X
3279												
Model S2A	X	X	X	X	X	X	X	X	X	X	X	X
Model S2B	4	X	X	4	4	X	X	4	X	X	X	X
Model S3G	4	X	X	4	4	X	X	4	X	X	X	X
Model 2X	4	X	X	4	X	X	X	4	X	X	X	X
Model 3X	4	X	X	4	X	X	X	4	X	X	X	X
3290		X	X			X	X		X	X	X	X
5150, all models	X	X	X	X	X	X	X	X	X	X	X	X
5160												
Models 68, 78	X	X	X	X	X	X	X	X	X	X	X	X
Models 86, 87, 586	X	X	X	X	X	X	X	X	X	X	X	X
5170												
Models 68, 99X	X	X	X	X	X	X	X	X	X	X	X	
Models 239, 495	X	X	X	X	X	X	X	X	X	X	X	X
Models 739, 599	X	X	X	X	X	X	X	X	X	X	X	X
5540/50/60	X	X	X	X	X	X	X	X	X	X	X	X

Figure 7-5 (Part 1 of 2). Terminals Supported by 3274 Control Units

Terminal	Channel-Attached							Remotely Attached				
	SNA			Non-SNA								
	21A	31A	41A	21B	21D	31D	41D	21C	31C	41C	51C	61C
5578	X	X	X	X	X	X	X	X	X	X	X	X
6150												
Model 20	X	X	X	X	X	X	X	X	X	X	X	X
Model 25	X	X	X	X	X	X	X	X	X	X	X	X
Model A25	X	X	X	X	X	X	X	X	X	X	X	X
6151 Model 10	X	X	X	X	X	X	X	X	X	X	X	X
Category A Printers												
3262												
Model 3	X	X	X	X	X	X	X	X	X	X	X	X
Model 13	X	X	X	X	X	X	X	X	X	X	X	X
3268 Model 2	X	X	X	X	X	X	X	X	X	X	X	X
3268 Model 2C	4	X	X	4	X	X	X	4	X	X	X	X
3287												
Model 1	X	X	X	X	X	X	X	X	X	X	X	X
Model 1C	4	X	X	4	X	X	X	4	X	X	X	X
Model 2	X	X	X	X	X	X	X	X	X	X	X	X
Model 2C	4	X	X	4	X	X	X	4	X	X	X	X
3289												
Model 1	X	X	X	X	X	X	X	X	X	X	X	X
Model 2	X	X	X	X	X	X	X	X	X	X	X	X
4214												
4234 Model 1	X	X	X	X	X	X	X	X	X	X	X	X
4245 Models D12, D20												
4250		X	X			X	X					
5210												
Model G01	X	X	X	X	X	X	X	X	X	X	X	X
Model G02	X	X	X	X	X	X	X	X	X	X	X	X
Category B Displays												
3277 Model 2		X		X	X	X		1	X		3	
Category B Printers												
3278 Model 1		X		X	X	X		1	X		3	
Model 2		X		X	X	X		1	X		3	

Legend:

X Indicates that attachment is possible.

1 Binary synchronous communication operation only.

2 Requires additional storage.

3 SNA/Synchronous Data Link Control operation, requiring additional storage.

4 Base color operation only.

5 Control unit terminal mode only.

Figure 7-5 (Part 2 of 2). Terminals Supported by 3274 Control Units

3274 Models 41A, 41C, 41D, and 61C

The 3274 Models 41A, 41C, 41D, and 61C have the same functions and features as the Models 31A, 31C, 31D, and 51C, respectively, but they do not support any Category B terminals. These newer models all have 192K bytes of storage and a double-sided diskette drive. Additionally, 128K bytes of storage may be added (for a total of 320K) to support additional functions such as X.25 communications. A number of standard provisions make these models easy to install and configure:

- Models 41A, 41C, and 41D have 32 Category A terminal ports. Suited for a smaller system, the Model 61C has 16 such ports.
- Support for the 3290 Information Panel.
- Standard voltage options and communication cable.
- Category A adapters to support Category A terminals or the 3299 Terminal Multiplexer.

The models differ in their method of attachment to a host processing system:

- Model 41A: Local attachment (SNA). See the description of Model 31A for details.
- Model 41D: Local attachment (non-SNA). See the description of Model 31D for details.
- Models 41C and 61C: Communicate remotely using SDLC or BSC protocol. For details, see the descriptions of Models 31C and 51C, respectively.

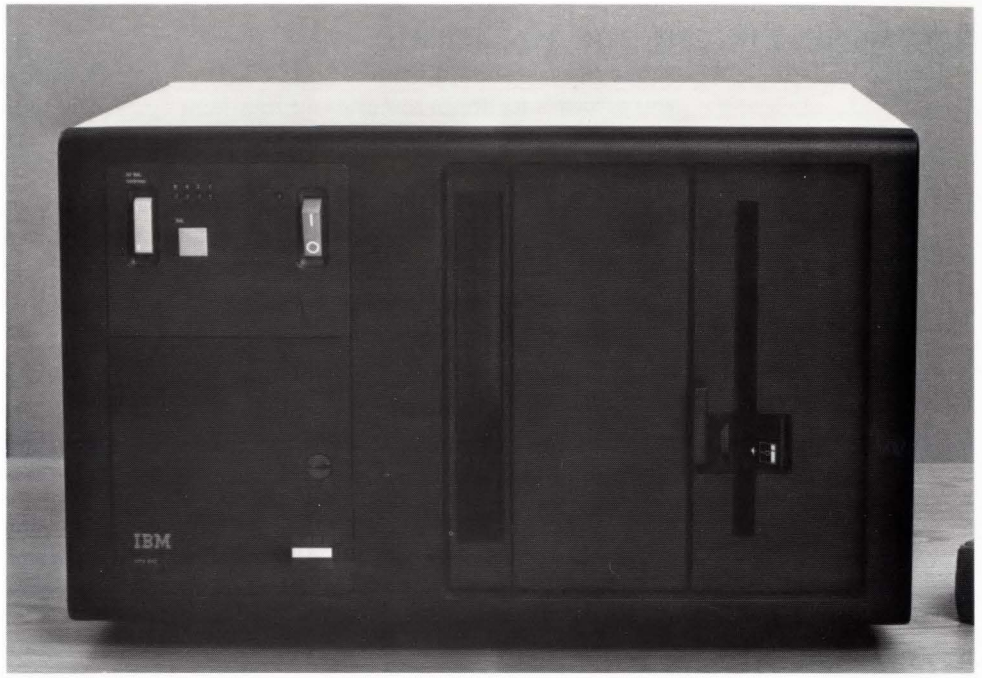

Figure 7-6. IBM 3274 Control Unit Model 51C

3274 Model 51C

A table-top model, the 3274 Model 51C (shown in Figure 7-6) can control a maximum of 12 display stations and printers for remote communication with the host system. The base Model 51C permits attachment of eight Category A terminals. Its base 64K bytes of storage can be increased to 128K, 192K, or 256K as the system is enhanced. The Model 51C communicates remotely in the same manner as Models 21C and 31C. With the appropriate configuration support, it provides all the functions supported by those models, but it does not support the 3299 Terminal Multiplexer. Additionally, Model 51C can:

- Communicate with a 4331 Processor or the 8100 Information System via a directly attached loop using SDLC and operate in half-duplex mode at 9600 or 38 400 bps over the loop.
- Communicate with a 4331 Processor or the 8100 Information System via a data-link-attached loop using SDLC and operate in half-duplex mode at 1200 or 2400 bps over the loop.
- Operate in half-duplex point-to-point mode using SDLC at transmission speeds of 1200, 2400, 4800, and 9600 bps on switched facilities.
- Communicate with the 8100 Information System via direct connection (without modems or communication facilities) at speeds up to 56 000 bps using SDLC protocol.

The Model 51C supports the same functions on the same terminals that the 3276 Control Unit Display Station supports, except for the 3276 printer default matrix. In addition, it can control more terminals.

3274 Models 21A, 21B, 21D, 31A, and 31D

These floor-standing control units can control a maximum of 32 display stations and printers for local attachment to a host system. Models 21A, 21B, and 21D have 64K bytes of storage; Models 31A and 31D have 128K bytes of storage.

- Models 21A and 31A: Local attachment (SNA version) to a System/370 processor is via a byte multiplexer, selector, or block multiplexer channel,[1] or to a 303x or 3081 via a byte multiplexer or block multiplexer channel. Attachment to a 4300 processor is via byte multiplexer or block multiplexer channel.
- Models 21B, 21D, and 31D: Local attachment (non-SNA) to a System/370 processor is via a byte multiplexer, selector, or block multiplexer channel,[1] or to any 303x, 3081, or 4300 processor via a byte multiplexer or block multiplexer channel.
- If there is a need to add functions to your system, these models can be enhanced. The Models 21A and 21D can be upgraded to Models 31A and 31D, and the storage on a Model 31A or 31D can be increased to 256K bytes.

3274 Models 21C and 31C

These floor-standing control units can control a maximum of 32 display stations and printers for remote attachment to a host system. Model 21C has 64K bytes of storage; Model 31C has 128K bytes and can be expanded to 192K or 256K for enhanced functions. Functionally compatible, both Models 21C and 31C:

- Communicate with a System/370 or 4300 processor using SDLC protocol via a 3704, 3705, or 3725 Communication Controller or via the Communications Adapter feature of the 4331 Processor.
- Communicate with a System/370 or 4300 processor using BSC protocol.
- Communicate with System/370 Models 115, 125, 135, and 138, using BSC, via an Integrated Communications Adapter.
- Operate in half-duplex point-to-point or multipoint mode on half-duplex or duplex facilities, using SDLC or BSC, at transmission speeds of 2000, 2400, 4800, 7200, and 9600 bps on nonswitched facilities. Point-to-point communication at speeds up to 56 000 bps are also possible where facilities are available. (All communication at speeds greater than 9600 bps must use SDLC protocol.) In addition, communication via a 3705 or 3725 Communication Controller, or the Communications Adapter feature of the 4331 processor, can be by means of direct connection (that is, without modems or communication facilities) at speeds up to 57 600 bps.

[1] Because of performance considerations, which may yield less than maximum output, attachment to a non-DCC subchannel of a block multiplexer channel or to a selector channel is not recommended.

Figure 7-7. IBM 3276 Control Unit Display Station with 3287 Printer

3276 Control Unit Display Station

The IBM 3276 Control Unit Display Station (shown in Figure 7-7) is a table-top control unit integrated into a display station module. It can control a cluster of up to eight display stations and printers, including its own display, and is designed for remote attachment to a host system. There are eight models of the 3276. Models 1, 2, 3, and 4 are used with BSC transmission control, and Models 11, 12, 13, and 14 are used with SNA/SDLC. Models 1, 2, 3, and 4 each have a different display screen size. Models 11, 12, 13, and 14 have the same display screen sizes as Models 1, 2, 3, and 4 respectively.

All models can operate in half-duplex mode on duplex or half-duplex communication facilities. They can communicate with a 3704, 3705, or 3725 Communication Controller or the Communications Adapter feature of the 4331 Processor at 1200 bps (SDLC or BSC) directly, without need for communication facilities or a modem.

- Models 1, 2, 3, and 4 communicate with a System 360/370, or any 4300 processor using BSC protocol over communication facilities via (where applicable) a 2701 Data Adapter Unit, a 2703 Transmission Control, a 3704, 3705, or 3725 Communication Controller, an Integrated Communications Adapter, or the Communications Adapter feature of the 4331.

  Models 1, 2, 3, and 4 operate using BSC protocol at 1200, 2000, 2400, 4800, and 7200 bps. When the models are directly connected to a 3704, 3705, or 3725 Communication Controller, communication speed is limited to 1200 bps.

- Models 1, 2, 3, and 4 communicate, when the SDLC/BSC switch is set to SDLC, with the 8100 system via a modem or direct connection on an SDLC data link.

- Models 11, 12, 13, and 14 communicate with the 8100 Information System via a modem or direct connection on an SDLC data link, a directly attached loop, or a data-link-attached loop.
- All models with the SDLC/BSC Switch feature communicate with a System/370 or any 4300 processor, using SDLC protocol over communication facilities, via a 3704, 3705, or 3725 Communication Controller, or via the Communications Adapter feature of the 4331 processor.
- Models 11, 12, 13, and 14 operate using SNA/SDLC protocol at 1200, 2400, 4800, 7200, and 9600 bps. When the models are directly connected to the 3704, 3705, or 3725 Communication Controller, communication speed is limited to 1200 bps.

  Models 1, 2, 3, and 4 with the optional SDLC/BSC Switch feature installed can operate via SDLC protocol at the same communication line speeds as Models 11, 12, 13, and 14. But, if the Switch feature is installed, a 3279 Color Display Station cannot be attached to the 3276.
- All models can communicate with a 3704 or 3705 Communications Controller or the Communications Adapter feature of the 4331 Processor at 1200 bps (SDLC or BSC) without need for communication facilities or a modem (direct connection).

At a 3276 display station, the operator can use either the keyboard or the selector pen (optional) to enter information. The keyboard provides all the standard editing functions. The models have varying screen capacities:

- Models 1 and 11 display a maximum of 12 lines of 80 characters each. When operating in 3277-compatible format, the Model 1 will display 40 characters per line.
- Models 2 and 12 display a maximum of 24 lines of 80 characters each.
- Models 3 and 13 display a maximum of 32 lines of 80 characters each.
- Models 4 and 14 display a maximum of 43 lines of 80 characters each.

A special nondisplayed input mode allows fields of data to be program-defined so that they will accept information entered at the keyboard without displaying it on the screen. The Security Keylock and the Audible Alarm are standard.

Figure 7-8 shows the Category A terminals supported by the various models of the 3276 Control Unit Display Station.

Terminal	1	11	2	12	3	13	4	14
Category A Displays								
3178								
Model C1		X	X	X	X	X	X	X
Model C2		X	X	X	X	X	X	X
Model C3		X	X	X	X	X	X	X
Model C4		X	X	X	X	X	X	X
3179 Color Display Station		1	1	1	1	1	1	1
3180 Model 1		X	X	X	X	X	X	X
3270-PC/G and /GX		2	2	2	2	2	2	2
3278								
Model 2		X	X	X	X	X	X	X
Model 3		X	X	X	X	X	X	X
Model 4		X		X	X	X		
3279								
Model S2A		X	X	X	X	X	X	X
Model S2B		1	1	1	1	1	1	1
Model S3G		1		1	1	1	1	1
Model 2X		1	1	1	1	1	1	1
Model 3X		1		1	1	1	1	1
3290								
Category A Printers								
3262								
Model 3								
Model 13	X	X	X	X	X	X	X	X
3268 Model 2	X	X	X	X	X	X	X	X
Model 2C	1	1	1	1	1	1	1	1
3287								
Model 1	X	X	X	X	X	X	X	X
Model 1C	1	1	1	1	1	1	1	1
Model 2	X	X	X	X	X	X	X	X
Model 2C	1	1	1	1	1	1	1	1
3289								
Model 1	X	X	X	X	X	X	X	X
Model 2	X	X	X	X	X	X	X	X
4250								
5210								
Model G01	X	X	X	X	X	X	X	X
Model G02	X	X	X	X	X	X	X	X

Legend:

X Indicates that attachment is possible.

1 Base color mode only.

2 Control unit mode only.

Figure 7-8. Category A Terminals Supported by 3276 Control Unit Display Stations

Chapter 8. Optional System Components

Figure 8-1. IBM 3270 Personal Computer Attachment

3270 Personal Computer Attachment

With the IBM 3270 Personal Computer Attachment (shown in Figure 8-1), an IBM Personal Computer System Unit can be connected to an IBM 3278 or 3279 display and keyboard. The Attachment gives you the choice of working with the 3278's or 3279's host computer or using Personal Computer capabilities to operate as a personal computer. With Personal Computer capability added to the 3278 or 3279, you can use the wealth of programs designed for the Personal Computer and create application programs tailored to your needs, using BASIC or other Personal Computer programming languages. Both mainframe work and individualized computing can be accomplished without the clutter of two separate terminals on the same desk.

When the system is operating in the host-computer mode, your input is processed by the control unit and sent to the host. The System Unit does not interfere with the processing. When the system is operating as a Personal Computer, most IBM Personal Computer application programs running under DOS can be used. Even though the results are displayed on the 3278 or 3279 screen, your input is processed by the Personal Computer System Unit. With this arrangement, both 3278 or 3279 host programs and personal computer programs can run concurrently.

Files from the host system and the System Unit can be transferred back and forth. Data transferred from a host application program can be formatted for use by IBM Personal Computer programs. Selected screens of information generated by the 3278's or 3279's host system can be transferred to the Personal Computer printer or to the System Unit diskette.

To attach to the 3278 or 3279 display, the IBM Personal Computer System Unit must have 64K bytes of storage; a 5-1/4-inch Diskette Drive Adapter and one Diskette Drive; and a Color/Graphics Monitor Adapter or Monochrome Display and Parallel Printer Adapter.

The **3278 or 3279 Personal Computer Adapter,** used for the 3278 or 3279, is installed by a service representative. This adapter provides:

- The capability of using either the 3278 (or 3279) or the Personal Computer screen image
- A path for transferring data between the host and the Personal Computer
- An input/output panel for a cable connection and test switch.

The **3270 Personal Computer Attachment Option** can be installed by the customer. The option provides:

- An adapter in the Personal Computer into which the 3278 or 3279 keyboard can be plugged
- Three cables to connect the Personal Computer to the 3278 or 3279 display and keyboard
- A cable distribution box
- A user's guide, including Personal Computer diskettes.

Figure 8-2. IBM 3299 Terminal Multiplexer

3299 Terminal Multiplexer Models 1 and 2

An intermediary between the 3174 or 3274 control unit and the terminals in large or dispersed computer installations, the 3299 Terminal Multiplexer (shown in Figure 8-2) allows the terminals to be located at a greater distance from the control unit. In addition, the 3299 eliminates the expense and planning involved in running individual coaxial cables from the control unit to each of the Category A terminals attached to it.

- Only one coaxial cable is required to connect a control unit and a 3299, which can be located as far as 1500 meters (4920 feet) from the control unit. Since each 3299 can attach a maximum of eight Category A terminals, four 3299s are required to attach 32 terminals to a control unit.
- Category A terminals can be attached to the 3299 by coaxial cable from a distance as far as 1500 meters (4920 feet) away. This means that the terminals can be 3000 meters (9840 feet) from a control unit, which is twice the distance allowed for directly cabled terminals.
- The 3299 can attach to all the control units except the 3274 Model 51C, which is equipped with 3299 Terminal Multiplexer support.
- The 3299 Model 2 contains a wrap feature that allows an Online Wrap Test (10) for problem determination. This test allows testing of a particular terminal or multiplexer without affecting other terminals operating at the same time.

Figure 8-3. IBM 3814 Switching Management System

3814 Switching Management System

The IBM 3814 Switching Management System (shown in Figure 8-3) is a device that switches processor channels among I/O control units in a data processing center. The modular design of the 3814 allows individual 3814 units to be distributed through a large processing center to put switching capability where it is needed.

The 3814 lets you switch resource pools among processors, back up failing processors and devices, and balance the workload among processors, making it easier for you to manage the resources in your data center. Using the 3814, you can:

- Rapidly reconfigure your resources among the channels of one or more IBM System/370, 30xx, or 43xx processors
- Provide alternative paths to critical devices
- Increase the number of possible control unit configurations on each channel.

Following are some of the characteristics of the 3814:

- Allows remote control of switching (you can locate the switching console up to 1000 feet away from the 3814).
- Uses operator control on a 3178 or 3278 display terminal or a 3270 PC, or, if the system attachment feature is installed, on a host-attached terminal
- Uses prestored configurations for rapid, error-free reconfigurations

- Switches synchronously with a lull in channel traffic, or immediately
- Has an online help facility (USERINFO) that can be tailored by the customer
- Generates a log record file
- Prints to a 3278 printer
- Allows password security
- Has self-diagnostics.

Chapter 9. Functional Control Capability

To use the functional control capability of the IBM 3270 Information Display System effectively, the system designer must consider the display image formats, transaction design, communication facilities, operator wait times, operator costs, channel loading, number of processor interruptions, number of telecommunication messages, and application program design. This is best done by selecting a typical transaction and evaluating the effect of functional control capability on system costs and performance. This evaluation, coupled with an assessment of operator control capabilities and considerations of system configuration, physical setup, and installation planning, will determine the best ratio between cost and performance for a display system.

Highlights of the functional control capabilities of the 3270 Information Display System include:

Format Control by Data Field: The 3270 system provides program control by data field. Each data field is established by a field-attribute character in the first position of the field. The field attribute character, written by the program, occupies a single nondisplayed character position at the beginning of a field and serves as a visual separation between successive fields. A field may be started at any character position on the display screen. The attribute character can define:

- Protected or nonprotected fields: A protected field is one that cannot be modified by the display operator. An unprotected field is one in which the operator can enter or modify data.
- Alphanumeric or numeric fields: An alphanumeric field is an input field in which an operator can enter alphabetic, numeric, or symbol characters. A numeric field has special meaning for protected fields, data entry keyboards, and the Numeric Lock special feature.
- Character display (nondisplay, display, intensified display).
- Detectability or nondetectability (by use of a selector pen).
- Tab stop positions (the first character position of unprotected fields).

Note: A secondary effect of the protection and intensity attributes is the control of field color on the 3179 Color Display Station, the 3279 Color Display Station (all models), and the 3287 Printer Models 1C and 2C when in base color mode. Fields can be displayed in any of the four colors: red, blue, green, and white. Fields can be printed in any of the four colors.

Format Control by Data Field and Character: Extended attribute codes control these additional characteristics:

- Extended highlighting (reverse video, blinking, and underscore)
- Extended color (seven colors)
- Programmed symbols

These attributes can be associated with fields or individual characters.

Alert: The Alert function makes it easier for the system operator to do problem determination and failure isolation. The 3174 and 3274 control units send unsolicited error messages to the host through the Network Communication Control Facility (NCCF) and the Network Problem Determination Application (NPDA) licensed programs. The messages appear on the system operator's screen. Alert capability can be set up to show all the errors in the network by type, or only errors in a certain device. Alert is an SNA-only function, supported by microcode in the 3174 and 3274.

Audible Alarm (display stations): An application program can activate the alarm. The User's Guide for a program tells whether the audible alarm sounds and, if so, the different reasons for sounding it. The audible alarm also sounds whenever the operator enters a character in the next-to-last character position on the screen.

Audible Alarm (3262): This audible alarm is activated by a code in the host program or by an error condition that occurs during printer operation. This alarm can be disabled by the operator.

Audible Alarm (3268, 3287 and 3289): This audible alarm alerts the operator to conditions requiring operator intervention. The operator can adjust the volume of the alarm.

BSC Copy Command (3174 Models 1R and 51R; 3274 Models 21C, 31C, 41C, 51C, and 61C): The host-initiated BSC Copy command may be used with these control units to direct data transfer from one terminal to another terminal attached to the same control unit. Upon accepting the command issued at the receiver (*to*) terminal, the control unit controls the data transfer from the sender (*from*) terminal. This eliminates the need to transfer the buffer data to and from the host.

BSC and SDLC Protocol: BSC protocol provides transmission reliability and comprehensive data checking. SDLC protocol, compared with BSC protocol, provides more extensive data-checking capability, results in greater transmission efficiency, and uses common-carrier facilities.

3174 Channel Interface Speeds: Data transfer rates to 1.25 million characters per second allow operation at the speed of the channel, which reduces response time.

3274 Channel Interface Speeds: Data transfer rates of 10 000 to 650 000 characters per second allow operation at the speed of the channel, which reduces response time.

Character Addressing: Addressing facilities permit starting a program write at any character position of the display screen. The write address can be set any number of times during an image write or update, or both. This allows selective writes to various noncontiguous areas of the display screen. This facility also allows the modification of single- or multiple-field attribute characters as well as data characters.

Communication Line Speeds: Depending on the unit and its features, transmission rates of up to 64 000 bps are possible.

Erase Unprotected: The Erase Unprotected operation capability erases all unprotected data fields to null codes, and it positions the cursor in the first unprotected field of the screen.

Host-Initiated Local Copy Function (SNA only: 3174; 3274; 3276 Models 11, 12, 13, and 14; and 3276 Models 1, 2, 3, and 4 with the SDLC/BSC Switch Feature): The host can initiate a local copy function by sending a write-type command with the print bit set. This function permits data transfer from a 3178, 3179, 3180, 3278, 3279, or 3290 display station to any printer(s) attached to the same control unit. Printer assignment is controlled by a print authorization matrix in the control unit. This matrix specifies, for example, which displays may use a given printer. The matrix is loaded in the 3174 and 3274 from the host by the user-written application program or from the customized system diskette. Category A display stations can transfer data only to Category A printers. In the 3276, the matrix is determined by the physical attachment of the printers to the 3276 at power-on time. In this matrix, each display station is associated with the powered-on printer that has the next higher terminal address. Printer assignment can be changed at the attached display station keyboard.

Null Suppression: To reduce message lengths while providing maximum length input fields, 3270 data fields can be erased to null codes under operator or program control. As an operator keys input data into a field, data codes replace null codes, leaving null codes in any unkeyed positions of the field. When a read modified message is sent to the host system, null codes are not transmitted as part of the message. This eliminates the transmission of unnecessary codes from unused positions of a field.

Operator-Initiated Local Copy Function (Non-SNA and SNA: 3174, 3274, and 3276): The operator initiates a local copy from a 3178, 3179, 3179 G, 3180, 3278, 3279, and 3290 display station to a printer(s) attached to the same control unit by pressing the Print key on the display station keyboard. As with the host-initiated local copy function (described above), printer selection is controlled by a print authorization matrix in the 3174, 3274, or 3276.

Program Tab: To decrease the length of a message transmitted to a display station, Program Tab permits writing data fields into successive unprotected data fields that were previously defined by a screen format. This eliminates the need to transmit control characters to specify the starting address of noncontiguous data, and so reduces the number of control characters required.

Protected Data Image Format: Protected data image format prevents the operator from entering data on specific areas of the screen. This allows field labels, instructions, and field control information to be written to a display station once and reused any number of times with variable input or output data. For example, in file inquiry, a protected data image format can be written to the

display station once, allowing later transmission of only the variable data records. Similarly, a protected data image format can be written to a display station once and can be used many times for repetitive key entry input transactions.

Read Modified Command: This command permits transfer of only operator-modified data fields with null codes suppressed. Because this operation reduces the message size by including essential data only, it also reduces traffic on the communication line and channel.

Remote General Poll: The control unit hardware has provisions to allow the program, with a general poll instruction, to interrogate all devices attached to the control unit with only one request. This reduces polling overhead and communication line traffic.

Repeat Characters: To decrease the number of data characters that must be transmitted to a display station, a single character, transmitted once, can be repeated from a starting address to an ending address.

Select: Display systems directly attached to a channel require a buffer load delay to prepare to execute a write or a read operation. A select operation allows a selector or block multiplexer channel to be released for other use during this delay time.

Short Read: Program access (PA) keys permit an operator to communicate with the program without transmitting unprotected data fields to the host system. Pressing one of these keys causes a short read operation that will transmit only the information necessary to identify which of the keys caused the attention. This eliminates the transmission of unnecessary data to the host system processor, thereby reducing traffic on the communication line and channel.

Write and Erase/Write Alternate Commands: These commands are used to load, format, and selectively erase device buffer data.

Write Structured Field Command: This command provides a general mechanism for conveying command-like functions, called *structured fields,* in the data stream to a terminal. These structured fields can be used by a program to perform various functions. For example, the program may interrogate a device to establish its characteristics, such as whether it supports color, or it may instruct the device on whether the attributes of color and highlighting should be included in data sent from the terminal to the host computer. It also establishes whether the operator can select these attributes from the display station keyboard.

Chapter 10. System Attachment

This chapter introduces the ways that 3270 control units can be attached to a host system.

Local Attachment

Locally, a control unit is attached to a System/370 type processor through a selector, multiplexer, or block multiplexer channel. The control unit is attached by cable to one of the eight control unit positions on the channel interface. From the host computer, the channel provides the control unit with both the data for display and printing, and the control information it needs to direct the operation of its attached display stations and printers. In their buffer storage, the display stations and printers store the data from the control unit for display or printing. The buffer permits simultaneous presentation of the display image and composition of a message from the keyboard at each display station.

Locally attached control units can be positioned as far as 61 meters (200 feet) from the system channel, depending upon the system and channel configuration. Locally attached control units are:

- 3174 Subsystem Control Unit Model 1L
- 3274 Control Unit Models 21A, 21B, 21D, 31A, 31D, 41A, and 41D.

Remote Attachment

Remotely, the control unit and the system channel can communicate (1) through a channel-connected communication controller or an integrated control unit using BSC protocol, or (2) through a communication controller using BSC or SDLC protocol. The control unit communicates with intermediary devices by means of communication facilities (data links):

- Modems
- Voice-grade channels
- Equivalent facilities: telephone lines, microwaves, or satellites.

These control units can be remotely attached using BSC protocol:

- 3174 Models 1R and 51R
- 3274 Models 21C, 31C, 41C, 51C, and 61C
- 3276 Models 1, 2, 3, and 4.

These control units can be remotely attached using SDLC protocol:

- 3174 Models 1R, 2R, 51R, and 52R
- 3274 Models 21C, 31C, 41C, 51C, and 61C
- 3276 Models 11, 12, 13, and 14
- 3276 Models 1, 2, 3, and 4 if equipped with the SDLC/BSC Switch feature.

The following system processors support 3274 and 3276 control units:

- System/370
- 4300
- 8100 (remote SDLC)
- 303X
- 308X
- 309X
- S/38 (remote SDLC)
- S/88 (remote BSC)

The following system processors support 3174 subsystem control units:

- 4361
- 4381
- 308X
- 309X
- 8100 (remote SDLC)
- S/38 (remote SDLC)

Loop Attachment Using SDLC Protocol

A loop attachment increases the number of terminals and control units that can be attached to a host system. A 3270 display system can be loop-attached to the:

- 8100 System
- 4300 System

through the following control units:

- 3274 Models 51C and 61C
- 3276 Models 11, 12, 13, and 14.

Directly attached loops operate at speeds up to 9600 bits per second (bps); data-link-attached loops operate at 1200 or 2400 bps.

Communication Networks and Modems

Remotely attached 3270 display systems that use BSC or SDLC protocol operate in data half-duplex transmission mode on half-duplex or duplex communication facilities.

When using BSC protocol, the following control units can attach to a multipoint nonswitched network:

- 3174 Models 1R and 51R
- 3274 Models 21C, 31C, 41C, 51C, and 61C
- 3276 Models 1, 2, 3, and 4.

When using SDLC protocol, the following control units can attach to a multipoint nonswitched line network:

- 3174 Models 1R, 2R, 51R, and 52R
- 3274 Models 21C, 31C, 41C, 51C, and 61C
- 3276 Models 11, 12, 13, and 14
- 3276 Models 1, 2, 3, and 4 with the SDLC/BSC Switch feature installed.

The following can also attach to switched lines:

- 3174 Models 1R, 2R, 51R, and 52R
- 3274 Models 51C and 61C
- 3276 Models 11, 12, 13, and 14
- 3276 Models 1, 2, 3, and 4 with the SDLC/BSC Switch feature installed.

When two or more SDLC devices are multidropped and attached to a communication controller, messages can be simultaneously transmitted and received by the communication controller on duplex facilities (multi-multipoint operation). The communication controller can operate in data duplex mode; the 3270 units, however, operate only in data half-duplex mode.

Some of the external IBM modems that can be used in remote systems are:

Nonswitched Network Modems

- 3833 2400 bps
- 3834 4800 bps
- 3863-1 2400 bps
- 3864-1 4800 bps
- 3865 9600 bps
- 3868-1 2400 bps
- 3868-2 4800 bps
- 3868-3 9600 bps
- 3868-4 9600 bps
- 5811 2400, 4800, 9600, 19 200 bps (Baseband)
- 5865 9600 bps
- 5866 14 400 bps
- 5868 9600 bps
- 5868 14 400 bps
- 5979-L41 2400, 4800, 9600, 19 200 bps (Baseband)

Switched Network Modems

- 3863-2 2400 bps
- 3864-2 4800 bps

Note: 14 400 bps – not with 3276; 19 200 bps – not with 3274, 3276.

Switched Network Backup (SNBU) Operation

Some of the external IBM modems that support SNBU operation are:

- 3863
- 3864
- 3865
- 3872 (except 3174)
- 3875 (except 3174)
- 5865
- 5866 (except 3276)

For 3174 or 3274 SNBU operation, a backup Control diskette containing SNBU support may be needed.

Switched-network backup operation is initiated by the terminal operator. When, for example, a problem is experienced with a nonswitched line, the terminal operator can invoke SNBU by calling the host system via the public switched telephone network to reestablish a connection and resume operation.

A Digital Data Service (DDS) adapter installed in the 3274 Models 21C, 31C, 41C, 51C, and 61C or in the 3276 interfaces with American Telephone and Telegraph's nonswitched Data-Phone[1] digital data service network.

In the 3274, the DDS adapter can operate in BSC or SDLC data transmission at speeds of 2400, 4800, and 9600 bps and, in SDLC, at 56 000 bps. In all models of the 3276, the DDS adapter can operate at speeds of 2400 and 4800 bps; and in Models 11, 12, 13, and 14, the DDS adapter can also operate at a speed of 9600 bps.

A CCITT V.35 Interface feature for attachment to an external modem or other data circuit-terminating equipment (DCE), provides for speeds up to 56 000 bps for SDLC or 9600 bps for BSC on the 3274 Models 21C, 31C, 41C, 51C, and 61C.

The X.21 interface features permit SDLC operation at speeds of 2400, 4800, 9600, or 48 000 bps through X.21 switched and nonswitched data communication equipment.

The X.25 adapter feature enables remote models to attach to host systems via an X.25 network, using SNA-defined protocols.

1 Trademark of American Telephone and Telegraph Company.

Chapter 11. Programming Support

Following is a list of some of the operating systems, access methods, and licensed programs that support the IBM 3270 Information Display System. For details about them, contact your IBM marketing representative.

Operating Systems

- Airlines Control Program (ACP)
- Disk Operating System/Virtual Storage Extended (DOS/VSE)
- Multiple Virtual Storage/Extended Architecture (MVS/XA)
- Multiple Virtual Storage/System Product (MVS/SP)
- Operating System/Virtual Storage 1 (OS/VS1)
- Small System Executive (SSX)
- Small System Executive/Virtual Storage Extended (VSE/SSE)
- Virtual Machine/System Product (VM/SP)

Telecommunication Access Methods

- Advanced Communications Function/Virtual Telecommunications Access Method (ACF/VTAM) under DOS/VS, DOS/VSE, and OS/VS
- Advanced Communications Function/Telecommunications Access Method (ACF/TCAM) under OS/VS
- Advanced Communications Function/Virtual Telecommunications Access Method Entry (ACF/VTAME) under DOS/VSE
- Basic Telecommunications Access Method (BTAM) under OS, DOS, OS/VS, and DOS/VS
- Basic Telecommunications Access Method — Extended Support (BTAM-ES) under DOS/VSE
- Extended Telecommunications Modules (EXTM) feature of CICS/DOS/VS
- Telecommunications Access Method (TCAM) under OS and OS/VS
- Virtual Telecommunications Access Method (VTAM) under DOS/VS and OS/VS

Network Control

- Advanced Communications Function/Network Control Program (ACF/NCP)
- Emulation Program (EP)
- Network Communications Control Facility (NCCF)
- Network Logical Data Manager (NLDM)

- Network Performance Analyzer (NPA)
- Network Performing Analysis Reporting System (NETPARS)
- Network Problem Determination Application (NPDA)
- Virtual Machine/VTAM Communications Network Application (VM/VCNA)
- VM/Pass-Through Facility

Cross-Industry Licensed Programs

- Financial Management System
- Instructional Systems (IIAS/IIPS)
- Interactive Financial System (IFS)
- Interactive Personnel System (INTERPERS)
- Planning, Control, and Decision Evaluation System (PLANCODE)
- Report Management and Distribution System (RMDS)
- Trend Analysis

Information Center

- A Departmental Reporting System II (ADRS II)
- APL Data Interface (APL/DI)
- APL Financial Planning System (APL/FPS)
- GRAPHPACK Full Screen Interface
- Query-by-Example (QBE)
- VS APL (A Programming Language)

Development Center

- Development Management System/CICS/VS (DMS/CICS/VS)
- Development Management System/Cross System Product (DMS/CSP)
- Entry Level Interactive Application System (ELIAS)
- IMS Application Development Facility II (IMSADF II)
- Screen Definition Facility/Customer Information Control System (SDF/CICS)

Office Systems

- Advanced Text Management System III (ATMS III)
- Document Composition Facility (DCF)
- Host Display View Facility (HDVF)
- Integrated Processing of Data and Text (IPDT)
- Professional Office System (PROFS)
- Storage Information Retrieval System (STAIRS)

Data Base Data Communication Systems

- CICS/DC Aids
  - CICS/VS Online Test/Debug II (OLTD II)
  - CICS Source Program Maintenance Online II (SPM II)
- Customer Information Control System/VS (CICS/VS)
- DB/DC Data Dictionary
- IMS/VS Aids
  - Batch Terminal Simulator
- Information Management System/VS Data Communications (IMS/VS-DC)

Interactive Programming Support

- Conversation Monitor System (CMS)
- Interactive System Productivity Facility (ISPF)
- Time Sharing Option (TSO)
- TSO Extensions (TSO/E)
- Virtual Storage Extended/Interactive Computing and Control Facility (VSE/ICCF)
- Virtual Storage Personal Computing (VSPC)

Other Licensed Programs

- Communication Oriented Production Information Control System (COPICS)
- Display console support for local 3270 displays and printers used as operator's consoles through Device-Independent Display Operator Console Support (DIDOCS) and Status Display Support OS and OS/VS
- Distributed Processing Control Executive (DPCX)
- Distributed Processing Programming Executive (DPPX)
- Downstream Load Utility (DSLU)
- Editor (XEDIT)
- Graphical Data Display Manager (GDDM)
- 3270-PC Graphics Applications System
- Time Sharing Option (TSO) of TCAM and VTAM
- 3-Dimensional Presentation Graphics Facility (3D-PGF)
- 3270 Personal Computer File Transfer Program

Chapter 12. Installation Planning and Customer Setup

The design and physical characteristics of the 3270 Information Display System make the components an attractive addition to an office or to a computer room. For details on work-space considerations, site preparation, cables and connectors, and machine specifications, refer to the section "Further Reading," on page X-7. When planning your installation, be sure to consider using the 3299 Terminal Multiplexer to decrease significantly the amount of cable required.

Certain units in the 3270 display system are designated for customer setup. These units can be set up as soon as they arrive, reducing the time spent waiting for the units to become operational. Because they are customer setup units, the components can be easily relocated.

The setup process consists of two steps: physical setup and checkout. The setup instructions are shipped with the units. Once the units are unpacked and placed in position, customer personnel capable of operating the units should be able to set them up and check them out. These are the customer setup units:

- 3174 Subsystem Control Unit Models 1R, 2R, 51R, and 52R
- 3274 Control Unit Models 21C, 31C, 41C, 51C, and 61C
- 3270 Personal Computer Attachment
- 3276 Control Unit Display Station
- 3178 Display Station
- 3179 Color Display Station
- 3179 G Color Graphics Display Station
- 3180 Display Station
- 3270 Personal Computer
- 3270 Personal Computer/G and /GX
- 3278 Display Station
- 3279 Color Display Station
- 3290 Information Panel
- 3262 Line Printer
- 3268 Printer
- 3287 Printer
- 3289 Printer
- 4214 Printer
- 4250 Printer
- 5210 Printer
- 3299 Terminal Multiplexer

For further information about customer setup, see your IBM marketing representative.

Chapter 13. Problem Determination

To ensure that more computer time is available to the customer, the problem determination procedures and recovery routines for the 3270 units are designed to be easy to use.

Problem determination procedures are provided for the 3174, 3274, and 3276 control units, as well as for the 3178, 3179, 3179 G, 3180, 3278, 3279, and 3290 display stations, and the 3262, 3268, 3287, 3289, 4214, 4250, and 5210 printers. Customer Problem Analysis and Recovery procedures for the operator are provided with each 3178, 3179, 3179 G, 3180, and 3290 display station. Each 3278 and 3279 keyboard includes a problem determination guide. For the IBM 3270 Personal Computer Attachment, diagnostic aids are available on a diskette. The *IBM 3270 Personal Computer Control Program User's Guide and Reference* and the *3270 Personal Computer Graphics Control Program User's Guide* contain two appendixes that describe how to isolate and solve software problems.

At the host level, the following IBM software products help provide effective problem determination:

Network Problem Determination Application (NPDA) 5735-XX8: Working with the Network Communications Control Facility (NCCF) 5735-XX6 (a program that provides communication and data base facilities for collecting, storing, and retrieving data on network errors), this program collects, organizes, and displays error statistics, as well as data about communication controllers, transmission lines, control units, and terminals. It also helps the NCCF operator locate a component causing problems. The supported SNA environments include VTAM, TCAM, ACF/VTAM, and ACF/TCAM with NCP under OS/VS, and ACF/VTAM and ACF/VTAME with NCP under DOS/VSE.

Display Exception Monitoring Facility (DEMF): This software tool for network problem determination and isolation enhances the availability of the 3174, 3274, and 3276 control units when operating in BSC mode.

Network Error Management Facility (NEMF) OS/DOS/CICS 5798-DAW: This program collects, organizes, and displays error statistics and data about communication controllers, transmission lines, control units, and terminals. It also helps locate a component causing problems. The supported communication environments include BTAM and TCAM operating under OS/VS, and BTAM under DOS/VS. When using SNA protocol, supported environments include EXTM and ACF/VTAM with NCP under DOS/VS. (All environments require CICS.)

Facility Error Recognition System (FERS): This facility permits logging of 3270 display system and transmission line statistics at the host. The data retrieved through FERS is used in problem determination for the suspected 3270 display system.

List of Abbreviations

ACF/TCAM. Advanced Communications Function/Telecommunications Access Method.

ACF/VTAM. Advanced Communications Function/Virtual Telecommunications Access Method.

ACF/VTAME. Advanced Communications Function/Virtual Telecommunications Access Method Extended.

APA. All points addressable.

APL. A programming language.

ASCII. American National Standard Code for Information Interchange.

bps. Bits per second.

BSC. Binary synchronous communication.

BTAM. Basic Telecommunications Access Method.

BTAM-ES. Basic Telecommunications Access Method — Extended Support.

CAD. Computer-Aided Design.

CAM. Computer-Aided Manufacturing.

CCITT. The International Telegraph and Telephone Consultative Committee.

CICS. Customer Information Control System.

CMS. Conversational Monitor System.

cps. Characters per second.

CUT. Control unit terminal.

DBCS. Double-byte character set.

DCE. Data circuit-terminating equipment.

DDS. Digital Data Service.

DEMF. Display Exception Monitoring Facility.

DFT. Distributed function terminal.

DOS. Disk Operating System.

DSL. Downstream load.

EBCDIC. Extended binary-coded decimal interchange code.

EIA. Electronic Industries Association.

FERS. Facility Error Recognition System.

GDDM. Graphical Data Display Manager.

ID. Identifier.

IML. Initial microcode load.

I/O. Input/output.

Kb. Kilobyte; 1024 bytes.

Mb. Megabyte; 1 048 576 bytes.

mm. Millimeter.

MVS. Multiple virtual storage.

NCCF. Network Communications Control Facility.

NCP. Network Control Program.

NEMF. Network Error Management Facility.

NPDA. Network Problem Determination Application.

OCR. Optical character recognition.

OEM. Original equipment manufacturer.

OS. Operating System.

PA. Program access.

PAM. Printer authorization matrix.

PC. Personal Computer.

PEL. Picture element.

PF. Program function.

PS. Programmed symbols.

RPQ. Request for price quotation.

SDLC. Synchronous Data Link Control.

SMS. Switching Management System.

SNA. Systems network architecture.

SNBU. Switched network backup.

SOEMI. Serial original equipment manufacturer interface.

SPF. System Productivity Facility.

TCAM. Telecommunications Access Method.

TCU. Transmission control unit.

TSO/VTAM. Time Sharing Option for the Virtual Telecommunications Access Method.

VS. Virtual storage.

VSE. Virtual Storage Extended.

VSPC. Virtual Storage Personal Computing.

VTAM. Virtual Telecommunications Access Method.

VTAME. Virtual Telecommunications Access Method Extended.

XGA. Extended Graphics Adapter.

Glossary

This glossary includes terms and definitions from the *IBM Vocabulary for Data Processing, Telecommunications, and Office Systems,* GC20-1699. If you do not find the term you are looking for, refer to the Index or to the *IBM Vocabulary for Data Processing, Telecommunications, and Office Systems,* GC20-1699.

A

access method. A technique for moving data between main storage and an input/output device.

adapter. In 3270, hardware that is generally required for transferring data and commands between the processor and an I/O device.

alphanumeric. Pertaining to a character set that contains letters, digits, and, usually, other characters such as punctuation marks.

American National Standard Code for Information Interchange (ASCII). A standard code consisting of control characters and graphic characters; used for information interchange between data processing and communication systems and associated equipment.

application mode. The operating mode of the 3270 Personal Computer keyboard when it is logically attached to one of the following: a host computer session, the personal computer session, or a notepad session.

autokeying. A function of the 3270 Personal Computer that records frequently used groups of keystrokes and plays them back at designated locations on the screen.

B

binary synchronous communication (BSC). Communication using binary synchronous transmission; that is, data transmission in which synchronization of characters is controlled by timing signals generated at the sending and receiving stations.

block-multiplexer channel. A multiplexer channel that interleaves bytes of data. Contrast with *selector channel.*

C

channel interface. The communication link between the channel unit and its attached control units, consisting of shared control and a data line.

character set. A defined collection of characters.

cluster control unit. A device, such as the 3274 Control Unit, that can control the input/ output operations of more than one terminal, such as a group (cluster) of 3278 Display Stations.

communication controller. A type of communication control unit whose operations are controlled by a program stored and executed in a unit. It manages the details of line control and the routing of data through a network. Examples are the IBM 3704, 3705, and 3725 Communication Controllers.

communication facility. Anything used or available for use in furnishing data communication service.

control unit terminal (CUT). A terminal that cannot interpret the data stream and execute terminal functions without help from the control unit to which it is attached.

customizing procedure. The multistep process, performed at the 3274 Control Unit, of constructing a configuration image of the 3270 subsystem.

D

data link. The physical connection and the connection protocols between units that exchange data over a telecommunication line.

data-link-attached loop. A data communication transmission loop used to attach I/O devices to the system by a data link facility rather than directly by cables. Contrast with *directly attached loop.*

data stream. All data transmitted through a channel in a single read or write operation to a display station or printer.

directly attached loop. A loop that connects to the loop adapter by cables, rather than through a data link facility, and allows attachment of a variety of I/O devices. Contrast with *data-link-attached loop.*

diskette. A thin, flexible magnetic disk and a semi-rigid protective jacket in which the disk is permanently enclosed.

distributed function terminal (DFT). A terminal that can interpret the data stream and execute terminal functions without help from the control unit to which it is attached.

distributed function terminal mode. An operational mode that allows multiple concurrent logical terminal sessions.

document mode. The mode in which a terminal supporting Entry Assist is said to be when the operator has activated the Entry Assist functions.

duplex. (1) (ISO) In data communication, pertaining to a simultaneous two-way independent transmission in both directions. Synonymous with *full duplex*. (2) Contrast with *half-duplex*.

E

entry assist. A function that allows the display station to operate much like a typewriter, providing facilities such as margins, tabbing, a bell to signal the end of the line, word deletion, and more.

F

full duplex. Synonym for *duplex*.

H

half-duplex. (1) In data communication, pertaining to an alternate, one-way-at-a-time, independent transmission. (2) Contrast with *duplex*.

hardware. (1) (ISO) Physical equipment used in data processing, as opposed to computer programs, procedures, rules, and associated documentation. (2) Contrast with *software*.

host computer. A large, central processor that provides services such as computation, data base access, or special programs or programming languages.

I

interface. A shared boundary. An interface might be a hardware component to link two devices, or it might be a portion of storage or registers to which two or more computer programs have access.

K

keypad. For the 3290 Information Panel, a separately housed group of keys available for either numeric data entry or program function applications.

L

leased line. Deprecated term for *nonswitched line*.

M

modem (modulator-demodulator). A device that modulates and demodulates signals transmitted over data communication facilities.

multiplexer channel. A channel designed to operate with a number of I/O devices simultaneously. Several I/O devices can transfer records at the same time by interleaving items of data.

N

nonswitched line. A connection between a remote terminal and a host system that does not have to be established by dialing. Synonymous with *leased line*.

notepad. For the 3270 Personal Computer, the session that contains notes the user makes.

P

program function key. A key that passes a signal to a program to call for a particular operation.

S

selector channel. An I/O channel designed to operate with only one I/O device at a time. Once the I/O device is selected, a complete record is transferred one byte at a time.

software. (1) (ISO) Computer programs, procedures, rules, and possibly associated documentation concerned with the operation of a data processing system. (2) Contrast with *hardware*.

switched line. A telecommunication line in which the connection between the computer and a remote station is established by dialing.

Synchronous Data Link Control (SDLC). A discipline for managing synchronous, code-transparent, serial-by-bit information transfer over a communication channel. Transmission exchanges may be duplex or half-duplex over switched or nonswitched data links. The communication channel configuration may be point-to-point, multipoint, or loop.

systems network architecture (SNA). The description of the logical structure, formats, protocols, and operational sequences for transmitting information units and controlling the configuration and operation of networks.

T

time-sharing. The interleaved use of a device's operating time that allows two or more concurrent uses of the device.

transmission control unit (TCU). A communication control unit whose operations are controlled only by programmed instructions from the computing system to which the unit is attached; no program is stored or executed in the unit. Contrast with *communication controller*.

W

window. On the IBM 3270 Personal Computer, the "openings" on the screen through which the application data is viewed. The window can be the size of the full screen or as small as one character.

work station control mode. The master control function of the 3270 Personal Computer from which the control program functions are initiated.

Further Reading: IBM Publications

A full range of publications is available to use with the 3270 Information Display System. These publications explain how to plan for, set up, install, program, and use the components. For a summary listing of 3270 publications, see *IBM 3270 Information Display System: Library User's Guide*, GA23-0058. These publications provide an in-depth discussion of specific aspects of the system mentioned in the product descriptions:

Color Applications

IBM 3270 Information Display System: Color and Programmed Symbols, GA33-3056. Details of base color, extended highlighting, extended color, and programmed symbols capacities, including programming support.

3179 Color Display Station Description, GA18-2177.

3179 Color Display Station Operator's Guide, GA18-2180.

3279 Color Display Station Operator's Guide, GA33-3057.

3179 G Color Graphics Display Station Description, GA18-2261.

3287 Printer Models 1C and 2C Component Description, GA27-3229.

Configurations and Features

3270 Information Display System: Feature Description, GA23-0113.

Installation Planning and Setup

IBM 3270 Information Display System: Installation Manual—Physical Planning, GA27-2787. Information on work-space considerations, site preparation, cables and connectors, and machine specifications.

IBM 3179 Color Display Station Description, GA18-2177.

IBM 3179 Color Display Station Operator Guide, GA18-2180.

IBM 3180 Model 1 Display Station Introduction and Preinstallation Planning Manual, GA21-9465.

IBM 3270 Information Display System: Library User's Guide, GA23-0058. Lists installation and planning manuals for specific models.

Keyboards

IBM 3270 Information Display System: Character Set Reference, GA27-2837. Complete description of the keyboards available for various national languages.

3178 Display Station Operator Reference Guide, GA18-2128.

3179 Color Display Station Operator Guide, GA18-2180.

3179 G Color Graphics Display Station Description, GA18-2261.

3180 Display Station Model 1 User's Guide, GA21-9468.

3180 Keyboard Template, GX21-9298.

3270 Personal Computer Control Program User's Guide and Reference, SC27-0103.

3270 Personal Computer Online Tutorial, SA23-0163.

3270 Information Display System: Keyboard Definition Utility User's Guide, GA23-0187. Introductory and procedural information for defining unique keyboard layouts for displays with modifiable keyboards.

3276 Control Unit Display Station Operator's Guide, GA18-2040.

3278 Display Station Operator's Guide, GA27-2890.

3279 Color Display Station Operator's Guide, GA33-3057.

3290 Information Panel Description and Reference, GA23-0021.

3290 Information Panel Operator's Guide, GA23-0143.

Operator Comfort

Human Factors of Workstations with Display Terminals, G320-6102.

Problem Determination

DOS/CICS User's Guide, G229-7030. FERS configuration, implementation, and operation information.

OS/CICS User's Guide, G229-7029. FERS configuration, implementation, and operation information.

OS/VS Display Exception Monitoring Facility (DEMF) User's Guide, GC34-2003. DEMF requirements for software configuration, communication facility, and operating procedures.

Network Communications Control Facility (NCCF) General Information, GC27-0429.

Network Problem Determination Application (NPDA) General Information, GC34-2010.

3270 Facility Error Recognition System (FERS) Service Aid Description, G229-7029. FERS configuration, implementation, and operation information.

Programming

3270 Data Stream Programmer's Reference, GA23-0059.

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

Programmed Symbols

IBM 3270 Information Display System: Color and Programmed Symbols, GA33-3056.

3287 Printer Models 1C and 2C Component Description, GA27-3229.

Index

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IBM 3270 Information Display System
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