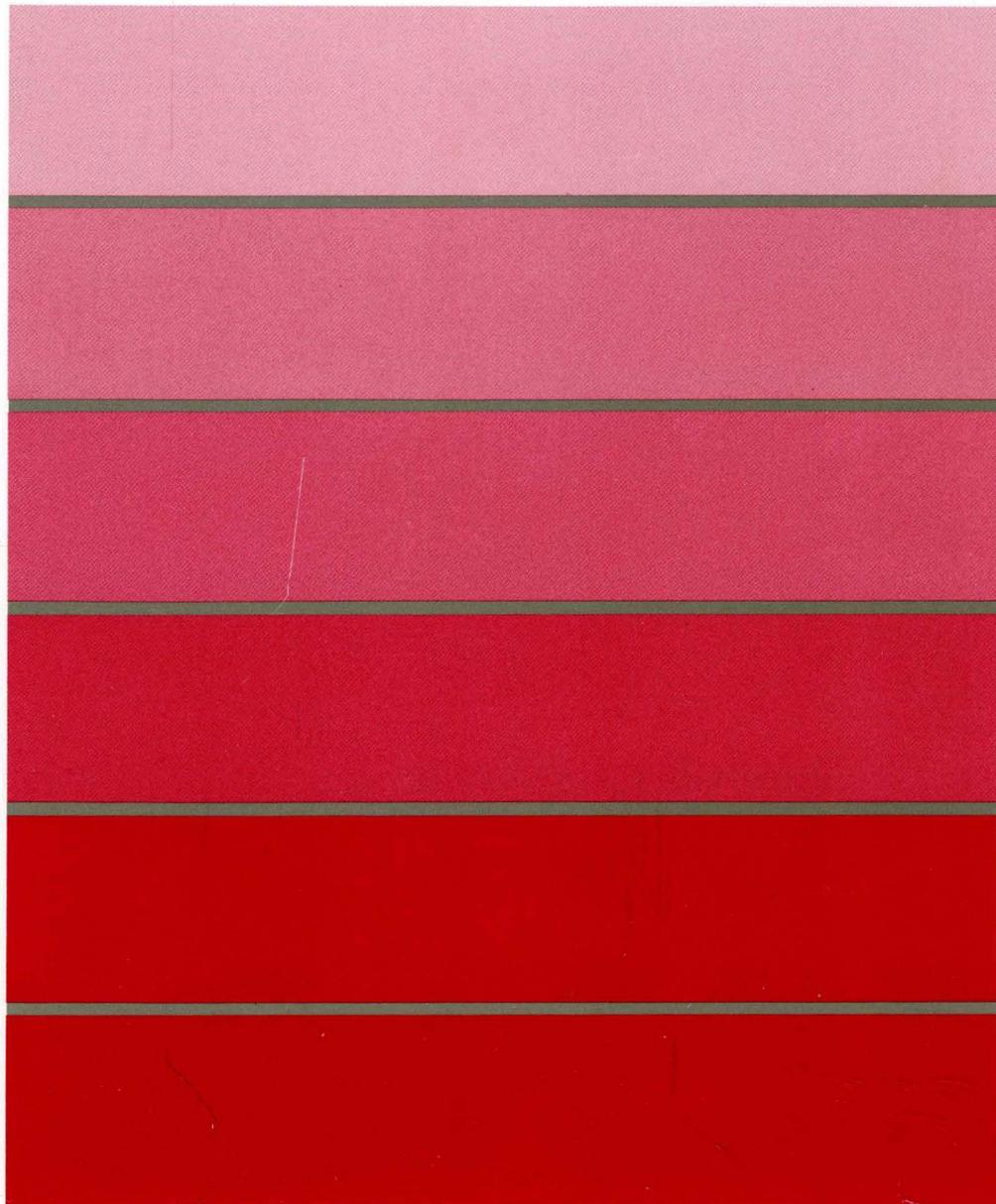




3270 Information  
Display System

## Introduction





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3270 Information  
Display System

## **Introduction**

**Twenty-Third Edition (October 1988)**

This major revision obsoletes and replaces GA27-2739-21. This edition adds information about the 3174 Subsystem Control Unit models, features, 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, 30xx, and 4300 Processors Bibliography*, GC20-0001, for the editions that are applicable and current.

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## Preface

This publication provides information about the IBM 3270 Information Display System and presents 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 Model 3R (Token-Ring attachment)
- 3174 Subsystem Control Unit Models 51R and 52R (remote attachment)
- 3174 Subsystem Control Unit Model 53R (Token-Ring attachment)
- 3174 Subsystem Control Unit Models 81R and 82R (remote attachment)
- 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)
- 3191 Display Station Models A, B, D, E and L
- 3192 Display Station Models C, D, F, G, L and W
- 3193 Display Station (scanner attachment)
- 3194 Display Station Models C, D and H
- 3262 Line Printer Models 3 and 13
- 3290 Information Panel Models 220, 230, and T30
- 3299 Terminal Multiplexer Models 2 and 3
- 3812 Pageprinter Model 2 with 3270 Information Display System Attachment Feature
- 3814 Switching Management System Models A1, A2, A3, and A4
- 4224 Printer (IPDS) Models 201, 202, 2E2, and 2C2
- 4234 Printer Model 1
- 4245 Printer Models D12 and D20
- 4250 Printer Model 1 and 2
- 5209 Link Protocol Converter
- 5210 Printer Models G1 and G2
- 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 all models with 3278/3279 Emulation Adapter
- 6151 RT Personal Computer all models with 3278/3279 Emulation Adapter
- 6262 Printer Models D12 and D14
- 8525 Personal System/2 with 3278/3279 Emulation Adapter
- 8530 Personal System/2 with 3278/3279 Emulation Adapter
- 8550 Personal System/2 with 3270 Connection
- 8560 Personal System/2 with 3270 Connection
- 8570 Personal System/2 with 3270 Connection
- 8580 Personal System/2 with 3270 Connection
- 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.

## **3270 Publications**

A full range of publications is available for 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.

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# Summary of Changes

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## Twenty-Third Edition (October 1988)

This edition adds information on the following products and features supported by the IBM 3174 Subsystem Control Unit:

- 3174 Storage Expansion
- Central Site Change Management
- 20 Megabyte Fixed Disk Drive
- IBM Token-Ring Network 3270 Gateway for Remote 3174 Models
- Network Asset Management
- Multiple Logical Terminals
- Country Extended Code Page
- Type 1 and Type 2 Communication Adapters for Models 1L and 3R
- IBM PC/Host File Transfer and Terminal Emulator Program (FTTERM)
- 3191 Display Station
- 3192 Display Station
- 3194 Display Station
- 3812 Pageprinter
- 6262 Printer Models D12 and D14
- IBM 8525 Personal System/2
- IBM 8530 Personal System/2
- IBM 8550 Personal System/2
- IBM 8560 Personal System/2
- IBM 8570 Personal System/2
- IBM 8580 Personal System/2.



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## Chapter 1. Introduction

For developing, tracking, and sharing information, the IBM 3270 Information Display System is a business tool for today and the future. 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 a link 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 products that can be configured together in a subsystem: display stations with keyboards; printers; IBM personal computers; and control units. 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. One way of entering information into the system is with 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 tabletop 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 or seven colors.

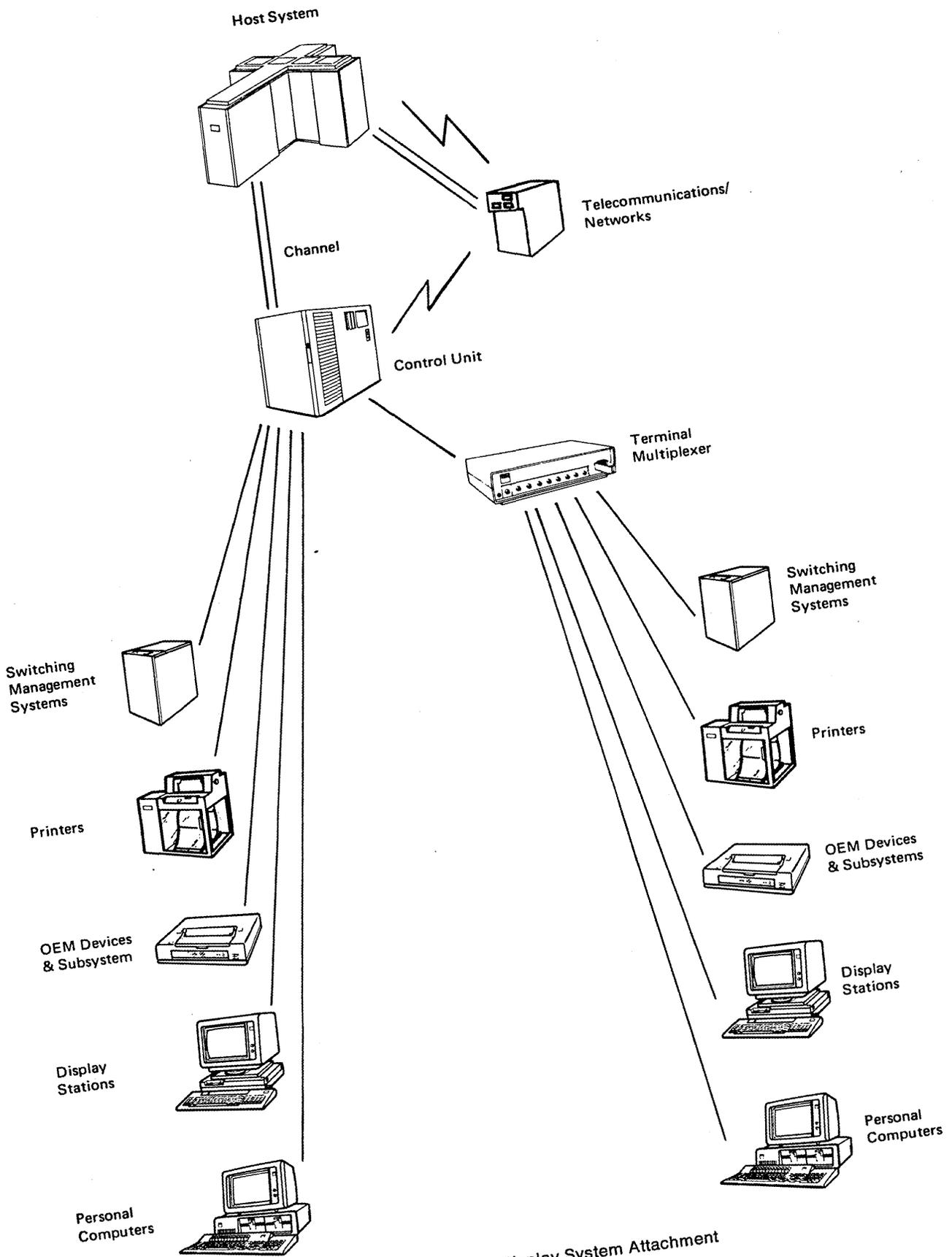


Figure 1-1. Overview of the IBM 3270 Information Display System Attachment

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 24 (or fewer) ASCII devices linked to a separate control unit.

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## Highlights

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, APL2, Text, modifiable, and IBM Enhanced keyboards are available.
  - **IBM Modifiable Keyboard Layout:**
    - Typewriter
    - Data Entry
    - APL2
    - Text.
  - **IBM Enhanced Keyboard Layout:**
    - Typewriter.

### 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
- Image – A rectangular, two-dimensional array of *picture elements (PELs)* (see “Image” on page 2-5).
- 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 3290 information Panel and the 3194 Display Station can display several screens simultaneously for viewing. The operator can move from one screen to another and choose to make one or more of the viewing screens an area for copying from other screens.

#### **Printers**

- Multifunction nonimpact page printer
- 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.

#### **IPDS Support**

- Text
- Image
- Graphics
- Overlays
- Bar Codes
- Load Fonts
- Page Segments

#### **Cabling**

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

#### **Programming**

- APL2 capabilities
- Personal Computer capabilities
- Graphics capabilities
- Image capabilities

#### **Security**

- A security keylock and an operator identification card
- A magnetic slot reader and magnetic hand scanner for reading magnetically encoded data
- Encryption/decryption capability; allows transmitted data to be scrambled or unscrambled for security purposes between a host computer and a 3174 control unit.

#### **Network Management**

- **Response Time Monitor (RTM)**

A means of accurately measuring, recording, and displaying end-user response time. The Response Time Monitor records the time between the operator's pressing the *Enter* key and the host's handling the data and returning 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.

- **Network Asset Management**

Network Asset Management supports host requests, through the Systems Network Architecture (SNA) network, for Vital Product Data information from the SNA 3174 and attached supported devices. The host can dynamically request the collection of product identification information (such as Machine Type, Serial Number, Model Number, Plant of Manufacture, Product Class (IBM/non-IBM), Power on information) from supported network components. This information will be available from the host upon request.

- **Central Site Change Management (CSCM)**

Central Site Change Management allows the user to distribute electronically customization parameters or microcode to Systems Network Architecture (SNA) 3174 Subsystem Control Units that are serviced from a central site. CSCM requires the Central Site Customization Utility to establish and maintain the central site library on a 3174 (except Model 81R or 82R) that has been designated as the central site control unit.

- **Central Site Customizing Utility (CSCU)**

Central site customization provides the ability to create and maintain, at a central site, a library that contains control unit parameters for all the IBM 3174 Subsystem Control Units in a network. CSCU also makes it possible to generate customized diskettes for the network 3174s.

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## Programming Support

IBM has developed an array of operating systems, telecommunication access methods, and licensed programs for the 3270 Information Display System. The programs cover defined areas in 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.

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## 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.

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## 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 control unit to send error messages about problems in the system to the system operator. The operator can use the Alert function to analyze the error.



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## Chapter 2. Capabilities of the 3270 System

The 3270 Information Display System consists of terminals directly attached to a control unit. Personal computers can operate as independent terminals or communicate with each other on a common IBM Token-Ring. A problem determination procedure is built into the system to expedite analysis and correction. The system is used for inquiries to hosts, IBM Token-Rings, or other terminals on the system, data entry, personal computing, interpersonal computer communication, document development, program development, and 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.

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### Inquiries

In a simple inquiry, an operator may type 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 might use the inquiry to determine a customer’s credit status before allowing 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.

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### Data Entry

The 3270 Information Display System has a number of features that simplify data processing applications. The operator uses a keyboard, a light pen a magnetic slot reader, or a magnetic hand scanner or a mouse. When large amounts of data are entered, such as with payroll or inventory control, **keyboard** entry can be used to enter data that will be processed separately by an application program. The keyboard entry procedure is a highly productive and efficient method for copying large amounts of data. Editing tools assist the operator to 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 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.



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 their 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. Symbols of 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.

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## 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: file transfer, planning, modeling, and simulation; financial and statistical analysis; mathematical, scientific, and engineering problem-solving.

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.

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## 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.

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## 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 makes these tasks easier:

**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 color graphics, 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.

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## 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. An Attribute Select Overlay keyboard (used with programmed symbols) has a special narrow keytop for templates with special font symbols. The template is placed over the keyboard for reference when symbol sets are 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 3192-G and certain 3270 Display Cards of Personal Computer and Personal System/2 workstations, 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.

To improve host performance and reduce the demands on the network and control units, vector processing:

- Is handled by the workstation instead of the host
- Provides an economical data stream.

---

## Image

Image is a rectangular, two-dimensional array of *picture elements (PELs)*.

An image is characterized by its size and resolution. The size of an image is represented by its width and height in PELs, and the resolution by the number of PELs per inch. (The physical size of an image can be obtained by dividing the size in PELs by the resolution.)

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## 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:** 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.

**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 the control units 3174 Models 1R, 2R, and 3R.

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

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## 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 be 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: 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.

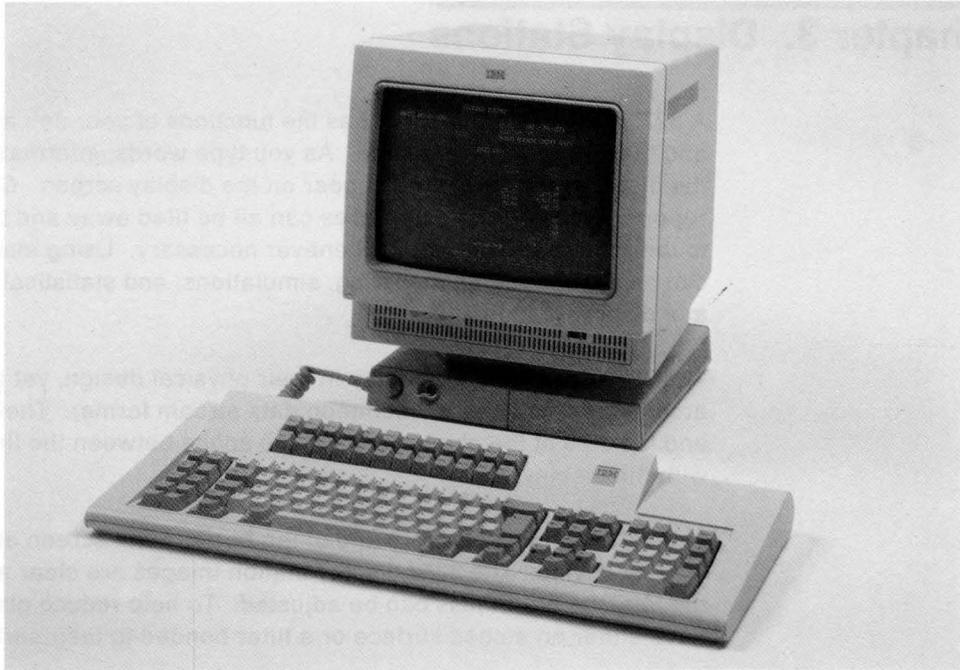


Figure 3-1. IBM 3191 Display Station

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## 3191 Display Station

The IBM 3191 Display Station (shown in Figure 3-1) is an economical monochrome CRT. Models A and B are 1920 character 12-inch CRTs. Models D,E, and L are 1920 or 2560 character 14- inch CRTs.

Highlights of the 3191 are:

- Improvement/performance
  - Economical
  - New extended warranty
  - Alert functions for maintenance
  - Selector Light Pen (Model L only) —a hand-held device that permits the operator to select fields of data from a display for input to the host system
  - Printer port for local screen copy (Model D, E, and L only)
  - Compatibility
  - IBM 3270-compatible.
  - Vital Product Data Support (except Models A and B)
- Screen characteristics
  - All models have a smudge-resistant screen
  - 80 columns by 24 rows plus the operator information area (Models A and B only)
  - 80 columns by 32 rows plus the operator information area (Models D,E, and L)
  - Large characters
  - Nonglare steady image
  - Auto-dim feature
- Keyboards
  - 102-key Enhanced keyboard
  - 104-key typewriter keyboard
  - 122-key typewriter keyboard
  - Keystroke record/play (Models D,E, and L)
  - Coiled keyboard cable
  - Home-row indicator keys
- Ergonomics
  - Smaller, lighter-weight video unit
  - Tilt/swivel pedestal
  - Small footprint
  - Low-profile keyboard with two angles of inclination.

---

## 3192 Display Station

The IBM 3192 Display Stations are high quality, 14-inch color or 15 inch monochrome CRT Display Stations with smudge resistant screens.

Highlights of the 3192 are:

- Improvement/performance
  - Vital Product Data Support (except Model G)
  - Cursor speeds selectable (except Model G)
  - Volume control for keyboard click
  - IBM 3270-compatible
  - Printer port for local screen copy
  - Host addressable print support for printers attached to displays (Model G only)
  - Print buffer for graphic screen print (Model G only)
  - Screen margin option
  - Record/play/pause; rule; vertical scroll (except Model G)
  - Selector Light Pen (Model L only) —a hand-held device that permits the operator to select fields of data from a display for input to the host system.

- Monitor
  - Model C provides 7-color 14-inch CRT with 80 x 24 or 80 x 32 characters
  - Model D provides a green monochrome 15-inch CRT with 80 x 24, 80 x 32, 80 x 44, or 132 x 27 characters
  - Model F provides 7 color high-resolution 14-inch CRT with 80 x 24, 80 x 32, 80 x 44, or 132 x 27 characters
  - Model G provides 7 color 14-inch CRT with 80 x 24 or 80 x 32 characters
  - Model L provides a green monochrome 15-inch CRT with 80 x 24, 80 x 32, 80 x 44, or 132 x 27 characters with a selector light pen capability
  - Model W provides a black on white 15-inch CRT with 80 x 24, 80 x 32, 80 x 44, or 132 x 27 characters
  - Etched, enhanced contrast CRT screen designed to reduce light reflections and fingerprint smudges to produce high-quality, high-resolution output
  - A video pedestal is provided as standard equipment.
- Keyboards
  - 102-key IBM Enhanced Keyboard (except Model G)
  - 104-key typewriter keyboard
  - 122-key typewriter keyboard
  - 104-key typewriter/APL2 keyboard (Model G only)
  - 122-key typewriter/APL2 keyboard (Model G only)
  - Keystroke record/play (except Model G)
  - Customer modifiable keyboard.
- Ergonomics
  - Tilt/swivel pedestal
  - Low-profile keyboard with two angles of inclination. (Model G has three angles of inclination).

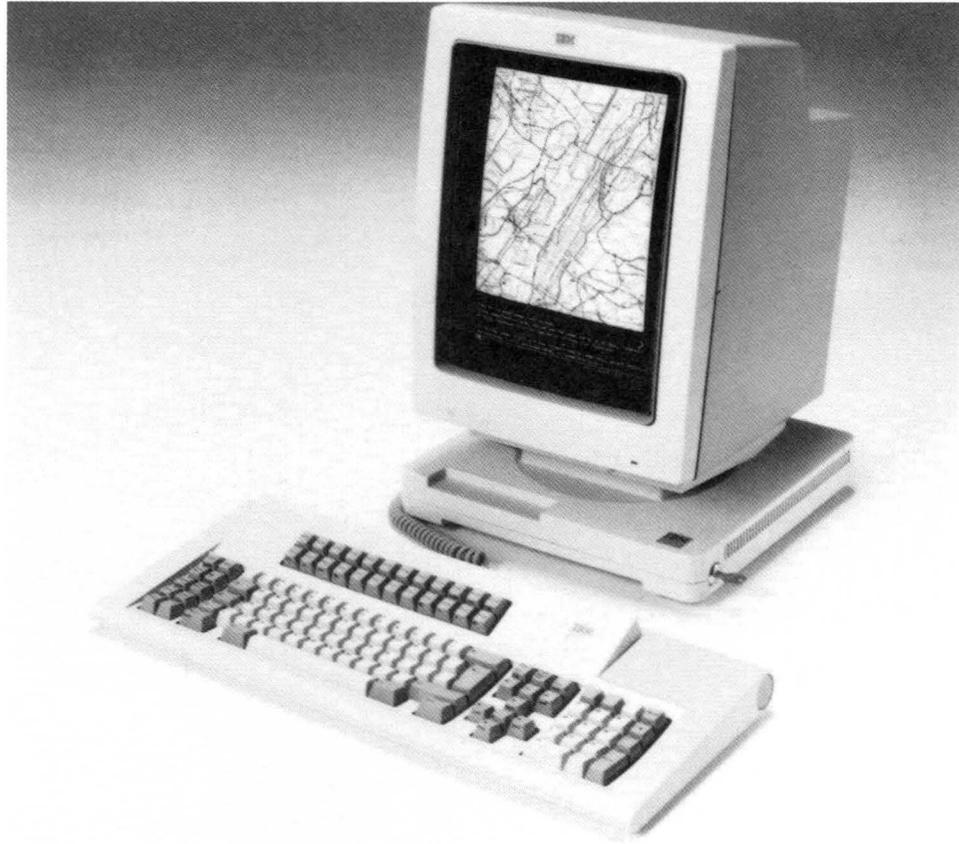


Figure 3-2. IBM 3193 Display Station

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### **3193 Display Station (Models 1 and 2)**

The IBM 3193 Display Station (shown in Figure 3-2) is a high-resolution, portrait-type, monochrome, 380-mm (15-inch) CRT image display providing up to letter or A4 size document display capability in addition to alphanumeric data. Compressed images can be sent to the 3193 from a scanner, and decompression is performed in the 3193. Image data compression is a technique to save transmission time and reduce storage requirements.

The 3193 is designed for operator comfort. The anti-reflection treatment minimizes glare. Two new cursors are provided in the image partition in addition to the alphanumeric cursor. These are a cross and a rectangular cursor. Each image cursor informs the host program of a point on the screen. An adjustable volume alarm is provided for operator alert. The video element can be tilted and swiveled to change the operator's viewing angle.

- Model 1 has a 122-key typewriter keyboard.
- Model 2 has a 102-key IBM Enhanced keyboard.

Characteristics that apply to both models are:

- High-resolution screen with 880 × 1152 dots
- 3278 Model 2, 3, and 4 screen support
- Display of 80 characters × 48 line screen support
- Three workstation elements (video, logic, and keyboard)
- Image data stream support
- Up to two logical terminal capability
- Up to eight partitions
- Enlarge partition
- Entry assist function
- Alert and response time monitor
- DFT attachment to IBM 3174s except Models 81R and 82R
- DFT attachment to IBM 3274
- Non-SNA and SNA channel and BSC/SNA remote attachments
- Tilt and swivel video base
- Security keylock
- Scanner attachment. (See the *IBM 3193 Display Station Description*, GA18-2364, for scanner attachments.)



Figure 3-3. IBM 3194 Display Station

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## 3194 Display Station

The IBM 3194 Displays (shown in Figure 3-3) are advanced-function, easy-to-read, 12 or 14-inch color or 15-inch monochrome display stations.

Highlights of the 3194 are:

- Logic element
  - Small footprint (14.5 inches x 13.4 inches x 3.2 inches, 14.3 pounds)
  - 3270 communication adapter
  - Integrated 1.44MB diskette drive
  - Security keylock
  - Personal Printer interface
  - File transfer
  - Two feature card positions
  - Communications support for one session of the 3194 as an ASCII session
  - Vital product data support.
- Monitors
  - Model C provides a 12-inch color monitor in 80 x 24 or 80 x 32 characters
  - Model H provides a 14-inch color monitor in 80 x 24, 80 x 31, 80 x 44, or 132 x 27 characters
  - Model D provides a 15-inch monochrome monitor in 80 x 24, 80 x 31, 80 x 44, or 132 x 27 characters
  - Easy-to-read font
  - High-resolution monitors
  - Advanced screen management with windowing
  - Multiple screen formats
  - Device Function Interface (Customer program execution interface)
- Keyboards
  - 102-key IBM Enhanced Keyboard
  - 104-key typewriter keyboard
  - 122-key typewriter keyboard
  - Flexible coiled cables for easy movement
  - Adjustable keyboard angle for maximum comfort
  - Keystroke record/play
  - Customer modifiable keyboard
- Ergonomics
  - Tilt/swivel pedestal
  - Low-profile keyboard with two angles of inclination



Figure 3-4. IBM 3290 Information Panel

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## 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 one 3278 Model 5 screen. 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.

- 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 is a viewing aid that can be set to move up or down on the screen with the cursor; otherwise, it is stationary. This horizontal line is a full screen in width and can be turned on or off.
- The image of one displayed screen, or of a partition, can be enlarged by pressing a designated key.
- 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, except Models 81R and 82R, and certain models of the 3274 Control Unit.

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.



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## Chapter 4. IBM Personal Computers

The IBM Personal Computers are a family of workstations 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:

- 5560/50/40 Multiworkstations
- 6150 RT Personal Computer all Models with 3278/3279 Emulation Adapter
- 6151 RT Personal Computer all Models with 3278/3279 Emulation Adapter
- 8525 Personal System/2 Model 25 with 3278/3279 Emulation Adapter
- 8530 Personal System/2 Model 30 with 3278/3279 Emulation Adapter
- 8550 Personal System/2 Model 50 with 3270 connection
- 8560 Personal System/2 Model 60 with 3270 connection
- 8570 Personal System/2 Model 70 with 3270 connection
- 8580 Personal System/2 Model 80 with 3270 connection.

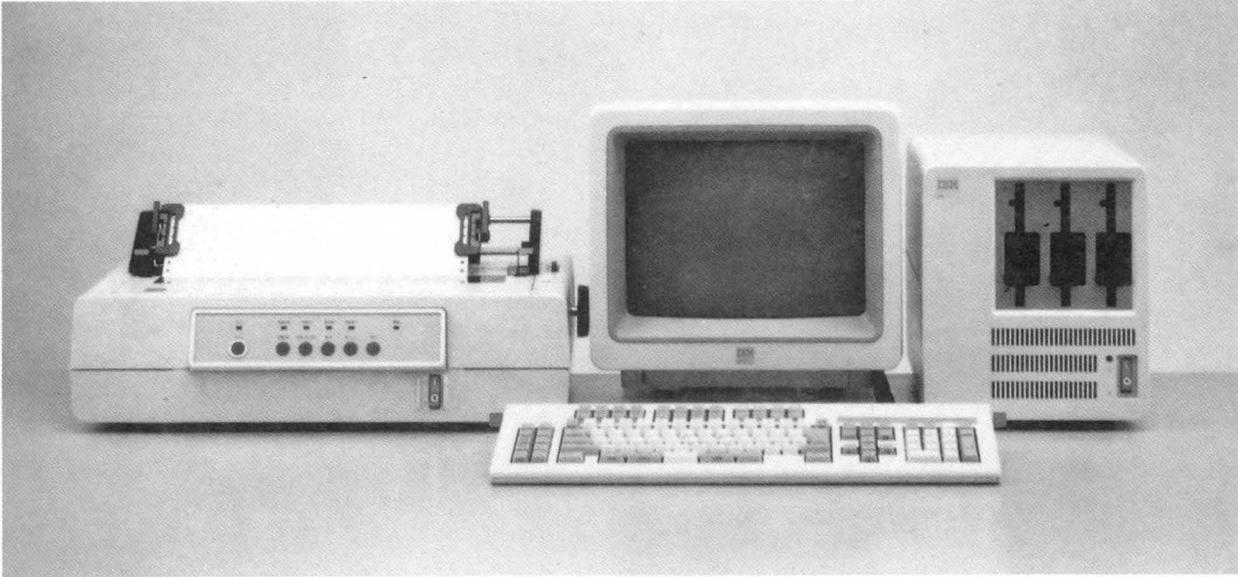


Figure 4-1. IBM 5560 Multiworkstation

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## IBM 5560/50/40 Multiworkstations

The IBM multistation family including the IBM 5560, 5550, and 5540 Multiworkstations combines three roles into one. (Figure 4-1 shows the 5560.) These workstations 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 workstations also support other languages. Every program in the extensive multistation software library can be used on any of the workstations. This enables the user to share easily both data and programs. Each workstation 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 workstation
- Host-interactive color/Kanji graphics support under the Graphic 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 workstation
- 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 workstation
- Host-interactive color/Kanji graphics support under GDDM and vector-to-raster conversion (Japanese 3270PC/G only)



Figure 4-2. IBM 6150 RT Personal Computer Model 25

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## IBM 6150 RT Personal Computer

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 4-2 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.

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## IBM 6151 RT Personal Computer

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.

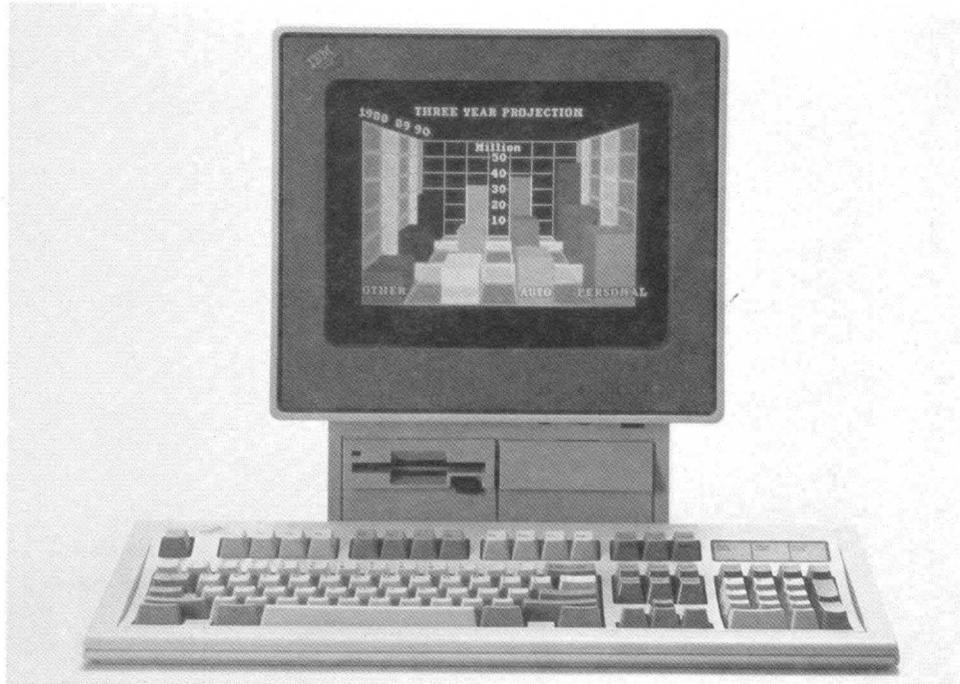


Figure 4-3. IBM 8525 Personal System/2

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## IBM 8525 Personal System/2

The IBM 8525 Personal System/2 is a general-purpose computer system that accepts most current adapters and offers approximately two times the processor performance of the current 8088-based IBM Personal Computers. The 8525 uses the 8086 processor and operates at 8MHz with no wait states to system memory.

Four models of the 8525 are available as workstations in a 3270 Information Display System. The 8525 is offered in the following combinations:

- Model 001 — IBM Space Savings keyboard, 12-inch monochrome monitor
- Model G01 — IBM Enhanced keyboard, 12-inch monochrome monitor
- Model 004 — IBM Space Savings keyboard, 12-inch color monitor
- Model G04 — IBM Enhanced keyboard, 12-inch color monitor.

Highlights of the IBM 8525 are:

- Approximately two times the processor speed of 8088-based IBM Personal Computers
- Graphics adapter displays up to 256 colors or 64 shades of gray (Multi-Color Graphics Array)
- Graphics adapter, diskette drive adapter, serial and parallel ports included
- New design, smaller size with reduced power requirements
- 12-inch color or monochrome graphics analog displays
- Advanced technology eliminating customer setup switches

All models of the IBM 8525 have the following standard features:

- 512KB random access memory (RAM) expandable to 640KB on the system board
- Diskette adapter supporting up to two 3.5-inch 720KB drives
- Multi-Color Graphics Array (MCGA) (R) with 64KB display buffer
- Serial port
- Parallel port
- Pointing device port
- Keyboard port
- IBM Space Saving Keyboard or IBM Personal System/2 Enhanced keyboard
- Audio earphone connector
- Socket for a Math Co-Processor
- One full-size and one 8-inch general-purpose slot to accommodate IBM 5150 Personal Computer, Personal Computer XT, and some non-IBM personal computer option cards that do not exceed 20 millimeters (0.8-inch) thickness.

The integrated Multi-Color Graphics Array automatically uses up to 64 shades of gray in converting color modes of operations for display on the IBM 8525-001 and 8525-G01 (monochrome model). This allows users who prefer a monochrome display to execute color graphics applications.



Figure 4-4. IBM 8530 Personal System/2

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## IBM 8530 Personal System/2

The IBM 8530 Personal System/2 is a general-purpose computer that can be used as a workstation in a networking environment. The 8530 provides increased base function by combining existing personal computer functions with an integrated graphics adapter and a parallel port. The system is based on an 8086 microprocessor running at 8MHz with no wait states and a 16-bit-wide data path to system memory.

Two models of the 8530 are available as workstations in a 3270 Information Display System:

- 8530 Model 002  
Central processing unit with a keyboard and two 720KB diskette drives.
- 8530 Model 021  
Central processing unit with a keyboard, one 20MB fixed disk with integrated controller, and a single 720KB diskette drive.

Highlights of the IBM 8530 are:

- Integrated function including graphics and a parallel port
- Displays up to 256 colors or 64 shades of gray
- New design, smaller size with reduced power requirements
- Compatible with IBM Personal Computer and Personal Computer XT
- World-wide power supply
- system setup switches eliminated.

All models of the IBM 8530 have the following features:

- 640KB random access memory (RAM), 16-bit-wide data path to processor
- Integrated diskette adapter supporting up to two 720KB drives
- Multi-Color Graphics Array (MCGA)
- Serial port
- Parallel port
- Pointing device port
- Keyboard port
- Enhanced personal computer keyboard
- Time-of-day clock with extended-life battery
- Socket for a Math Co-Processor
- Three general-purpose slots to accommodate IBM Personal Computer and IBM Personal Computer XT feature cards.

The integrated Multi-Color Graphics Array automatically uses up to 64 shades of gray in converting color modes of operations for display on the IBM 8503 Monochrome Display.



Figure 4-5. IBM 8550 Personal System/2

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## IBM 8550 Personal System/2

The IBM 8550 Personal System/2 is a desktop personal computer system with Micro Channel™ architecture. The system unit features a 10MHz 80286 microprocessor, ROM BASIC and 1MB of memory on the system board, expandable to 7MB with memory options.

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™ Micro Channel is a trademark of the International Business Machines Corporation

Highlights of the IBM 8550 are:

- Micro Channel architecture with a 16-bit bus
- 10MHz processing speed
- Multitasking and communications capabilities
- A 20MB fixed disk and 1.44MB, 3.5-inch diskette drive
- Feature integration on the system board which reduces the requirements for optional adapters
- Ease of installation and configuration
- Universal, automatic voltage-sensing power supply.

Standard features on the IBM 8550 are:

- 1.44MB, 3.5-inch diskette drive
- 20MB fixed disk drive
- Disk controller
- Keyboard port
- Serial/asynchronous port
- Parallel port
- Pointing device port
- Video Graphics Array (VGA) port.

The IBM 8550 supports IBM 8503, 8512, 8513, and 8514 analog displays that together with the VGA built-in function provide significant graphics and text capabilities. The VGA port supports graphics and text modes (including 640 x 480 graphics, 320 x 200 graphics in 256 colors, and 720 x 400 text).

Additional features of the IBM 8550 System Unit include: four 16-bit input/output (I/O) slots (with one slot occupied by the disk controller adapter), a time and date clock with battery backup, an additional position for a second 3.5-inch diskette drive, and the IBM Enhanced Personal Computer Keyboard.

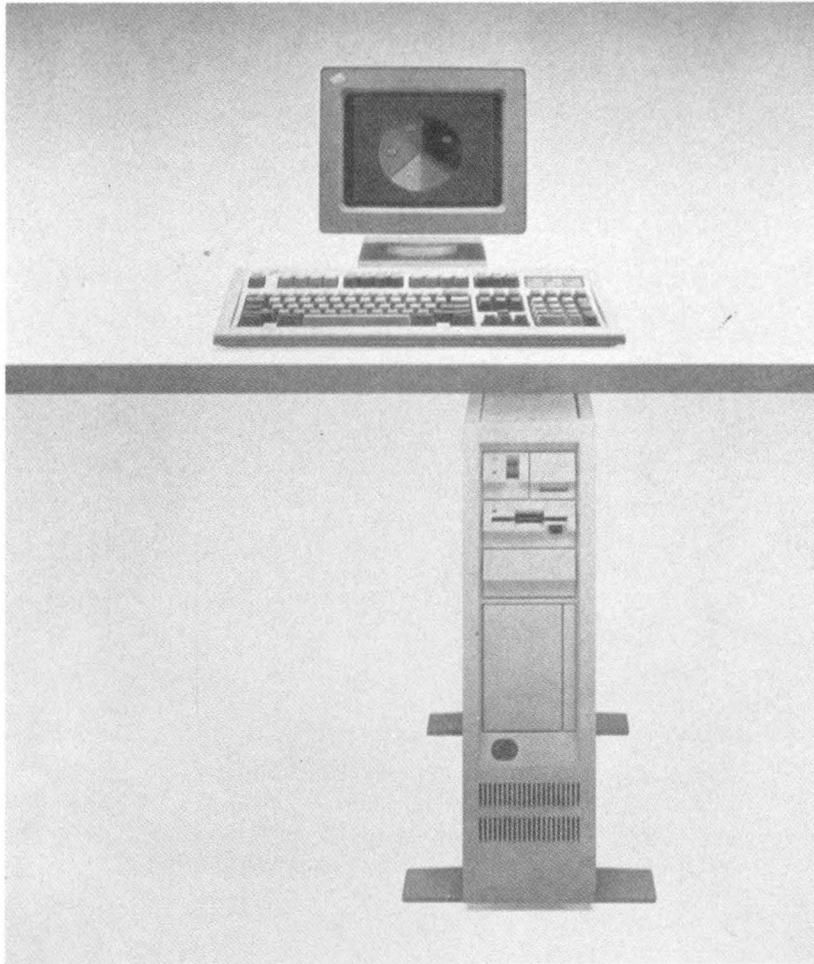


Figure 4-6. IBM 8560 Personal System/2

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## IBM 8560 Personal System/2

The IBM 8560 Personal System/2 is a floor-standing member of IBM's System/2 family with Micro Channel architecture. The IBM 8560 features a 10MHz 80286 microprocessor, ROM BASIC, and 1MB of memory on the system board, expandable to 15MB with memory options.

Highlights of the IBM 8560 are:

- Micro Channel architecture with a 16-bit bus
- 10MHz processing speed
- Multitasking and communications capabilities
- Significant graphics and text quality
- 44MB or 70MB fixed disk and 1.44MB, 3.5-inch diskette drive
- Feature integration on the system board which reduces the requirements for optional adapters
- Ease of installation and configuration
- Universal, automatic voltage-sensing power supply.

Standard features on the IBM 8560 are:

- 1.44MB, 3.5-inch diskette drive
- Either a 44MB or 70MB fixed disk drive
- Disk controller
- Keyboard port
- Serial/asynchronous port
- Parallel port
- Pointing device port
- Video Graphics Array (VGA) port.

The VGA port supports graphics and text modes (including 640 x 480 graphics, 320 x 200 graphics in 256 colors, and 720 x 400 text).

Additional features of the system unit include: eight 16-bit input/output (I/O) slots (with one slot occupied by the disk controller adapter), a time and date clock with battery backup, additional positions for a second 5.25-inch disk drive and for a second 3.5-inch diskette drive, and the IBM Enhanced Personal Computer Keyboard.



Figure 4-7. IBM 8570 Personal System/2

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## IBM 8570 Personal System/2

The IBM 8570 Personal System/2 is a desktop personal computer that enhances the PS/2 family of systems by offering a new level of performance in a desktop unit. The system is highlighted by the Micro Channel architecture with a 16 or 20 MHz 80386 32-bit microprocessor, high-density memory technology, and a wide range of integrated features. With the capability of supporting up to 16MB of high-speed real memory, 60MB or 120MB of disk storage, advanced graphics, and an optional 80387 Math Co-Processor, this system provides significant performance enhancements for desktop computer operations. The PS/2 Model 70 is compatible with most existing software products for IBM personal computer systems.

Highlights of the IBM 8570 are:

- 16 or 20 MHz 80386 32-bit microprocessor
- Up to 6MB of high-speed memory on the system board
- Large capacity 60MB or 120MB fixed disk with integrated controller
- Micro Channel architecture with a 16-bit and 32-bit bus
- Optional 16 or 20 MHz 80387 Co-Processor
- Ergonomic desktop design
- High level of feature integration on the system board
- Ease of installation and configuration.

Standard features on the IBM 8570 are:

- 1.44MB, 3.5-inch diskette drive
- Keyboard port
- Pointing device port
- Serial/asynchronous port
- Parallel port
- Video Graphics Array (VGA) port.

The VGA port supports graphics modes including 640 x 480 graphics in 16 colors and 320 x 200 graphics in 256 colors, and text modes including 720 x 400 graphics in 16 colors (9 x 16 character box). The VGA port maintains compatibility with Color Graphics Adapter (CGA) and Enhanced Graphics Adapter (EGA) modes.

The fixed disk drives have a capacity of 60MB or 120MB. The controller is integrated with the drive. The 60MB drive has an average access time of 27 milliseconds, and the 120MB drive has an average access time of 23 milliseconds.

The system has two levels of BIOS that total 128KB. The compatibility BIOS (CBIOS) with memory addressability of up to 1 megabyte provides compatible support for current application programs. An additional version of BIOS, Advanced BIOS (ABIOS), provides support for multitasking operating systems and has extended memory addressability up to 16MB.

The high level of feature integration on the system board reduces the requirement for optional adapters. Memory on the system board can be expanded to 6MB. The optional 80387 Math Co-Processor provides enhanced performance in arithmetic calculations. In addition, the system is designed for tool-free installation and includes security features in BIOS/CMOS and an external keylock.

Additional features on the IBM 8570 are:

- Three I/O slots (two 32-bit bus slots and one 16-bit bus slot with video extension)
- 132-watt automatic voltage-sensing power supply
- Time and date clock with battery backup
- Additional position for a second 3.5-inch diskette drive.

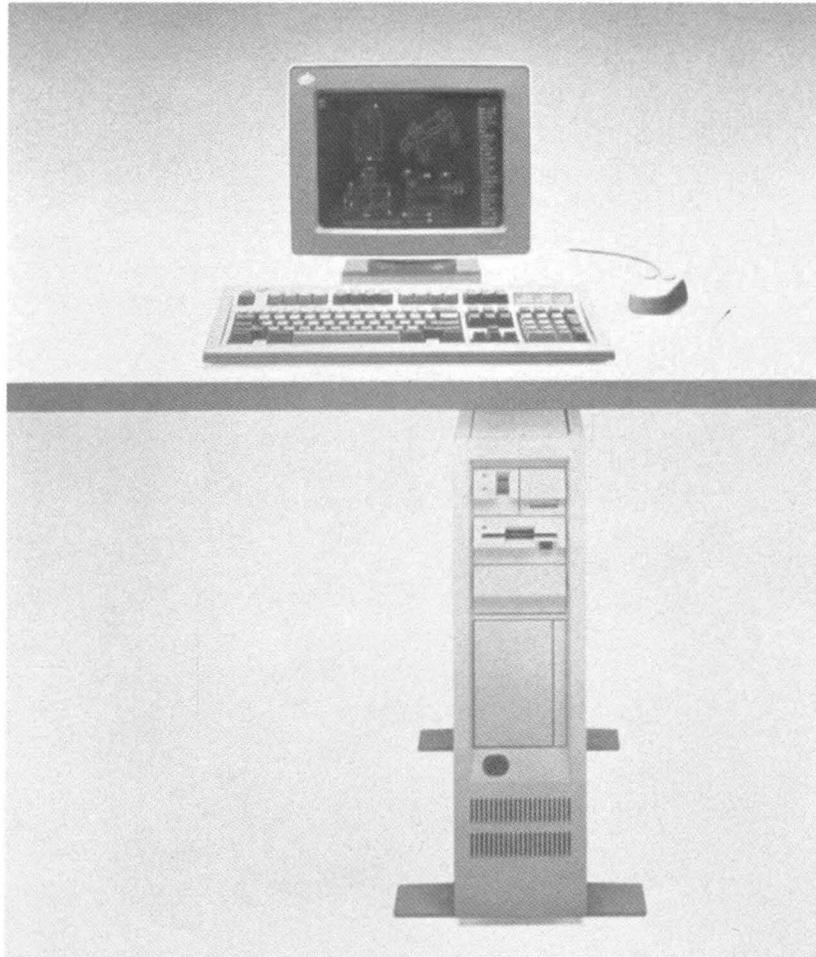


Figure 4-8. IBM 8580 Personal System/2

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## IBM 8580 Personal System/2

The IBM 8580 Personal System/2 is a floor-standing personal computer designed to meet the requirements of the multitasking environment. The IBM 8580 provides 32-bit large system architecture and function within an individual workstation. The 8580 system unit features Micro Channel architecture and a 20 MHz 80386 microprocessor partitioned into six functional units that process multiple instructions simultaneously. The Micro Channel architecture supports both 16-bit and 32-bit I/O and memory adapter cards.

Highlights of the IBM 8580 are:

- Micro Channel architecture with a 16-bit and 32-bit bus
- 20 MHz processing speed
- 80-nanosecond memory, 1-megabit chips, up to 16MB
- Multitasking and communications capability
- Excellent graphics and text quality
- Large-capacity 115MB fixed disk, 1.44MB, 3.5-inch diskette drive
- Feature integration on the system board which reduces the requirements for optional adapters
- Ease of installation and configuration
- Auto-restart power supply.

Standard features on the IBM 8580 are:

- 2MB of system board memory
  - Note:** 128K bytes are reserved for high-performance BIOS.
- 1.44MB, 3.5-inch diskette drive
- Fixed disk drive
- Disk controller adapter
- Integrated diskette controller
- Keyboard port
- Serial port
- Parallel port
- Pointing device port
- Video Graphics Array (VGA) port.

The VGA port supports 640 X 480 graphics, 720 x 400 text, 320 x 200 graphics in 256 colors, and is compatible with the Color Graphics Adapter (CGA) and the Enhanced Graphics Adapter (EGA).

Additional features of the IBM 8580 System Unit include:

- Eight I/O bus slots with five 16-bit and three 16/32-bit (one 16-bit slot is occupied by the disk controller adapter)
- A 225-watt universal power supply
- A time/date clock with a long-life lithium battery
- Additional positions for a second fixed disk drive and for a second 3.5-inch diskette drive.



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## Chapter 5. Keyboards

The keyboard is a 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. For some display models, 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 75 keys for the IBM 3278 Display Station to 122 keys on a 3270 Personal Computer keyboard (shown in Figure 5-1), except for the 124-Key Japanese Katakana.

Keyboards are available in a number of national languages. Displays with typewriter, data entry, data entry keypunch, or APL2, Text keyboards may be mixed when attached to a 3174 Subsystem Control Unit, but the keyboard languages must be the same. Consult your IBM marketing representative for more information about national-language keyboard versions and character sets.

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### Touch-Typing Controls

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

**Note:** The following functions are not available on all keyboards.

- **Alpha Shift:** Overrides the numeric input field definition and the Keyboard Numeric Lock condition to allow input of alphanumeric data in a numeric field.
- **Backspace keys:** Press this key to move the cursor to the left, one character position at a time.
- **Caps Lock:** Locks the keyboard in uppercase shift.
- **Device Cancel key:** Cancels a pending print request to the printer.
- **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.
- **New Line key:** Moves the cursor to the beginning of a new line.
- **Numeric Shift:** Overrides the numeric field definition and the Numeric Lock condition to allow entry of upshift characters.
- **Reset key:** Used to recover from certain conditions and to cancel certain operations.



Figure 5-1. IBM 3270 Personal Computer Keyboard

- **Quit key:** Cancels the current action performed.
- **Tab keys:** Moves the cursor to the first character position of the next unprotected field.
- **Uppercase Shift:** Places the keyboard in uppercase.
- **Uppercase Shift Lock:** Locks the keyboard in uppercase shift.

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## 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.

**Note:** The following functions are not available on all keyboards.

- **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.
- **Copy key:** Copies data from one session to a copy area on the screen or to another session on the screen.
- **Cursor Select key:** Duplicates the operation of the selector pen and is typically used to select items from a list, menu, or table.
- **Doc On/Off:** Puts the display in document mode, enabling the entry assist functions.
- **Enlarge:** Changes the size of a window to fill the entire screen, without changing the character size.
- **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.
- **Extended Select Shift:** Changes the function of certain program function keys or extends the keyboard for such functions as remote communication and response time monitoring.
- **Print key:** Requests a printed (hard) copy of the information on the screen from the printer assigned to that display station.
- **Record and Play keys:** The Record key records sequences of keystrokes for automatic playback using the Play key.
- **Rule key:** Places a horizontal line under the row containing the cursor on the screen.
- **Setup Mode:** Allows you to change the layout of the screen and select other default options.
- **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.
- **Work Station Control Mode:** Enables you to perform screen management functions.
- **Zoom:** Causes the active screen to be displayed with the largest allowable character size, filling the entire screen.

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## 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.

**Note:** The following functions are not available on all keyboards.

- **Backspace erase:** 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.
- **Change Screen key:** Displays the next screen or set of sessions after the one currently displayed.
- **Cursor Home key:** Moves the cursor to the first nonprotected character position on the screen.
- **Delete Word key:** 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.
- **Double-Speed Cursor, Left and Right keys**
- **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.
- **Jump Partition (3290):** Moves the cursor to the next partition on the screen.
- **Jump Screen:** Moves the cursor to the next viewport or window on the screen.
- **Left and Right Cursor keys:** Moves the cursor in the direction of the arrows.
- **Next Word key:** Moves the cursor to the first character of the next word.
- **Previous Word key:** Moves the cursor to the first character of the previous word.
- **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.
- **Selectable Field Tab key:** Moves the cursor to the first character position of the next unprotected field.
- **Up and Down Cursor keys:** Moves the cursor in the direction of the arrows.
- **3174 Entry Assist:** Sends the information on the screen to the program.

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## Program Function and Attribute Selection Controls

**Note:** The following functions are not available on all keyboards.

- **Attribute Select keys:** 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:** 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.
- **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.

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## Keypad

A separately housed keypad (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.

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## Keyboard Definition Utility

This precustomizing procedure (3179, 3180, 3191, and 3192) for the keyboards that are modifiable 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.



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## 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.

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## 3812 Page Printer Model 2

The IBM 3812 Page Printer Model 2, a multifunction nonimpact page printer of tabletop design provides cut-sheet, letter-quality text, all-points-addressable graphics and prints at 12 pages per minute maximum. Basic paper handling functions include dual input cassettes for legal and letter size paper and gummed labels.

The 3812 Model 2 also includes one megabyte of memory usable for printer operations and resident font storage.

New optional features for the 3812 Model 2 permit attachment to the IBM 3270 Information Display System and provide advance print functions for VM, MVS, and System 36/38 environments.

Highlights of the 3812 Model 2 are:

- One megabyte of printer working storage
- Dynamic index of fonts on operational diskette
- Image decompression support
- Attaches to IBM 3270 Information Display Systems, 43XX Processors, and 9370 Information Systems
- Support for composite page (text, image, graphics) on System/36
- Support for text and graphics for the 370 environment
- Support for advanced print functions in System/36 and System/38 environments.

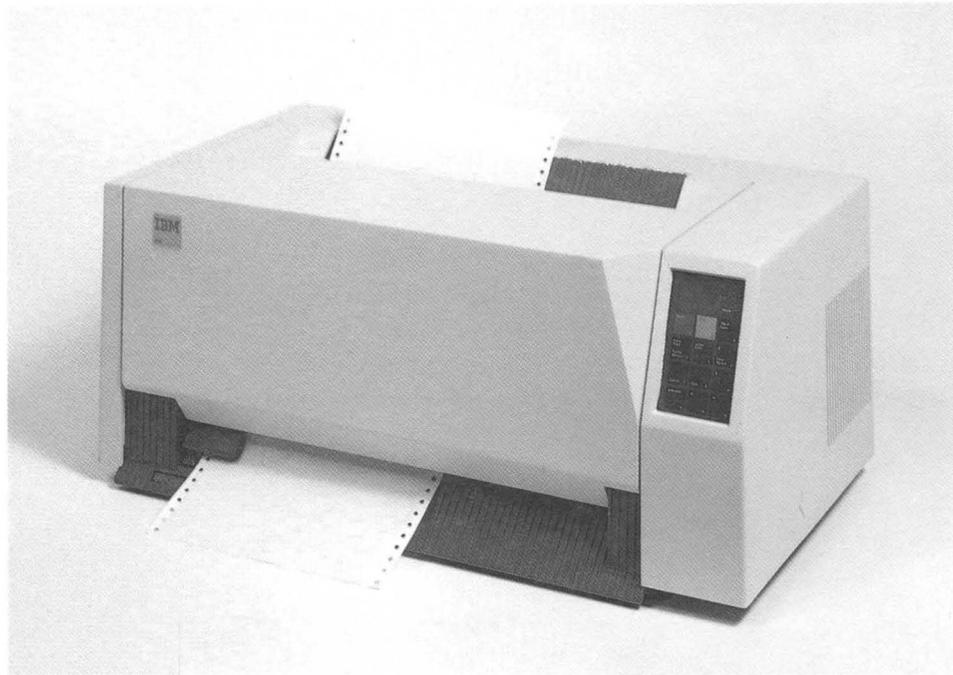


Figure 6-1. IBM 4224 Printer

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## 4224 Printer

The IBM 4224 Printer attaches to the 3270 Information Display System through the 3174 Subsystem Control Unit or the 3274 and 3276 control units. The 4224 is a serial dot-matrix impact printer with graphic capability and four or seven color, depending on the model.

- Model 201 – 200 characters per second (cps)
- Model 202 – 400 cps
- Model 2E2 – 400 cps (expanded storage)
- Model 2C2 – 400 cps (expanded storage and color).

Advance-print functions are implemented through the Intelligent Printer Data Stream (IPDS) and supported by the Graphic Data Display Manager (GDDM).

Highlights of the 4224 Printer:

- Text
- Image
- Graphics
- Overlays
- Loaded Fonts
- Page Segments



Figure 6-2. IBM 4234 Printer

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## 4234 Printer

The IBM 4234 Printer (shown in Figure 6-2) is a heavy-duty, intermediate-speed, impact-matrix line printer using Dot Band technology. The 4234 is designed for customer setup.

- 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.



Figure 6-3. IBM 4245 Printer

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## 4245 Printer Models D12 and D20

Models D12 and D20 of the IBM 4245 Printer (shown in Figure 6-3), with print rates of 1200 and 2000 lines per minute respectively, are significant additions to the IBM high-speed printer product line.

Standard features of these printers include optical character recognition (OCR) printing support and field upgradability.

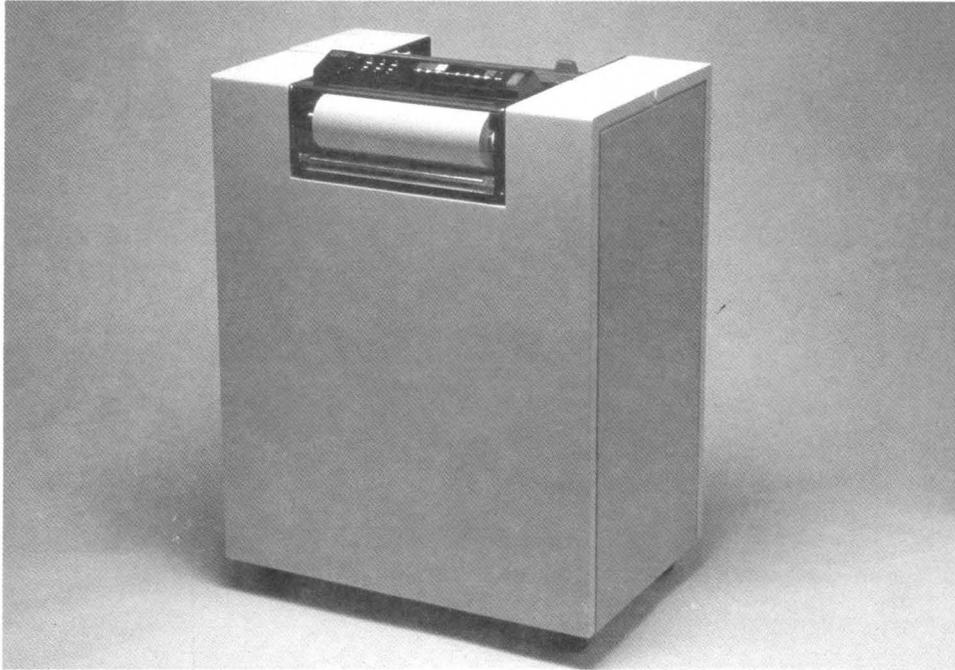


Figure 6-4. IBM 4250 Printer

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## 4250 Printer

The IBM 4250 Printer (shown in Figure 6-4) 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.

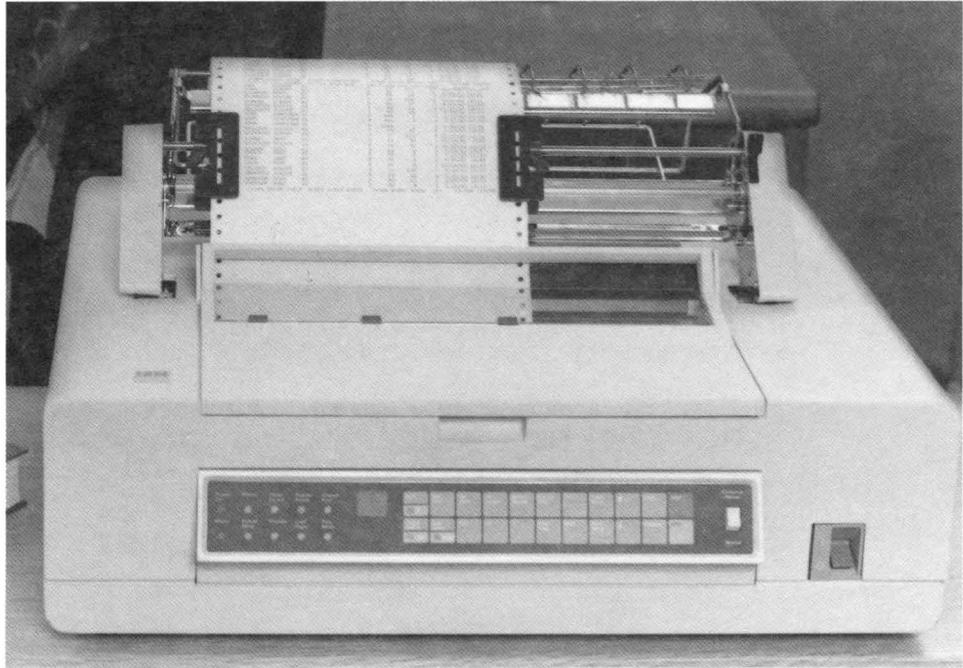


Figure 6-5. IBM 5210 Printer

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## 5210 Printer Models G01 and G02

The IBM 5210 Printer (shown in Figure 6-5) is a desktop 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.

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## 6262 Printer Models D12 and D14

Models D12 and D14 of the IBM 6262 Printer (shown in -- Fig '6262P' unknown --) are impact printers that use a fully formed character printband. They print at 1200 lines per minute. Both models are suitable for either computer center or workstation environments and can be attached to the 3174 and 3274 Models 41 and 61 controllers, the 9370 Workstation Controller, and 4361 Processor Workstation Adapter.

- Simplified forms setup procedures
- Smaller footprint: 64% of IBM 4245 Model 12 or 20
- Convenient power requirement: 120V, single phase
- Six-part forms capability
- Four tractors.

Additional benefits of the 6262 Models D12 and D14 printers include standard OCR alphanumeric printing and an 80-character Liquid Crystal Display panel display for operator messages.

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## Chapter 7. Control Units

The control unit is the vital link in the 3270 Information Display System, connecting the display stations, printers, and personal computers to the host data processing system. Display stations, printers, and personal computers 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.

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### 3174 Subsystem Control Unit

The IBM 3174 Subsystem Control Unit is one of the basic components of the IBM 3270 Information Display System. The 3174 connects 3270 system terminals (display stations and printers) to the host data processing system.

The following features/functions are available with the 3174:

- Central Site Customizing
- Central Site Change Management
- Storage Expansion
- 20MB Fixed Disk Drive
- Multiple Logical Terminals
- Country Extended Code Page
- Intelligent Printer Data Stream
- Asynchronous Emulation Adapter
- Token-Ring Network 3270 Gateway
- Response Time Monitor (RTM)
- Token-Ring Attachment
- Serial Original Equipment Manufacturer's Interface (SOEMI)
- Type 1 and Type 2 Communication Adapters for 3174 Models 1L and 3R
- Network Asset Management.

The 3174 Subsystem Control Unit can be locally attached (channel-attached) or remotely attached (telecommunications-attached) to a host system. IBM 3174 control units employ binary synchronous communication (BSC) or synchronous data link control (SDLC), X.25 transmission disciplines in remote operations, and Systems Network Architecture (SNA) protocols or the host processor channel program (non-SNA) in local operations.

## Models

Model 1L, 1R, 2R, and 3R control units are available with a maximum of 32-ports; Model 51R, 52R, and 53R control units are available with a maximum of 16-ports; Model 81R and 82R are available with a maximum of eight ports.

- Model 1L provides an S/370-architecture channel interface for SNA and non-SNA attachment to a host processor.
- Models 1R, 51R, and 81R provide EIA 232D/CCITT V.24 and CCITT V.35 interfaces for SNA/SDLC, BSC, or X.25 remote (telecommunications) attachment.
- Models 2R, 52R, and 82R provide an X.21 interface (CCITT V.11) for SNA/SDLC or X.25 remote (telecommunications) attachment.
- Models 3R and 53R attach to an IBM Token-Ring Network. Communication to the host is through a gateway that can be either an IBM 372X or 3745 Communication Controller with the Network Control Program Token-Ring Interface (NTRI) feature or a 3174 Model 1L, 1R, 2R, 51R, or 52R with the Token-Ring Network 3270 Gateway feature.

When a 3174 Model 1L control unit with the 3270 Gateway feature is providing the gateway to the host, VTAM views the Model 3R or 53R as channel-attached; when the 372X, or 3745 Communication Controller is providing the gateway to the host, VTAM views the Model 3R or 53R as a control unit on a switched point-to-point line.

## Asynchronous Emulation Adapter

The Asynchronous Emulation Adapter (AEA) consists of both hardware and microcode and requires a second 1.2MB diskette drive or one fixed disk drive in the 3174 Subsystem Control Unit. This adapter expands the connection capability for 3270-type display stations and printers, allowing them to connect to American National Standard Code for Information Interchange (ASCII) hosts and public data networks, as well as allowing ASCII display stations and printers to connect to IBM hosts, ASCII hosts, and public data networks. Figure 7-1 shows an overview of 3270 and ASCII terminal emulation.

- Three AEAs can be installed in Models 1L, 1R, 2R, and 3R of the 3174, for a total of 24 AEA ports.

These device attachments are in addition to the maximum of 32 terminals. However, the number of device addresses supported by non-SNA 3174 control units is 32.

- One AEA can be installed in Models 51R and 52R of the 3174, for a total of eight AEA ports.

These device attachments are in addition to the maximum of sixteen 3270-type terminals.

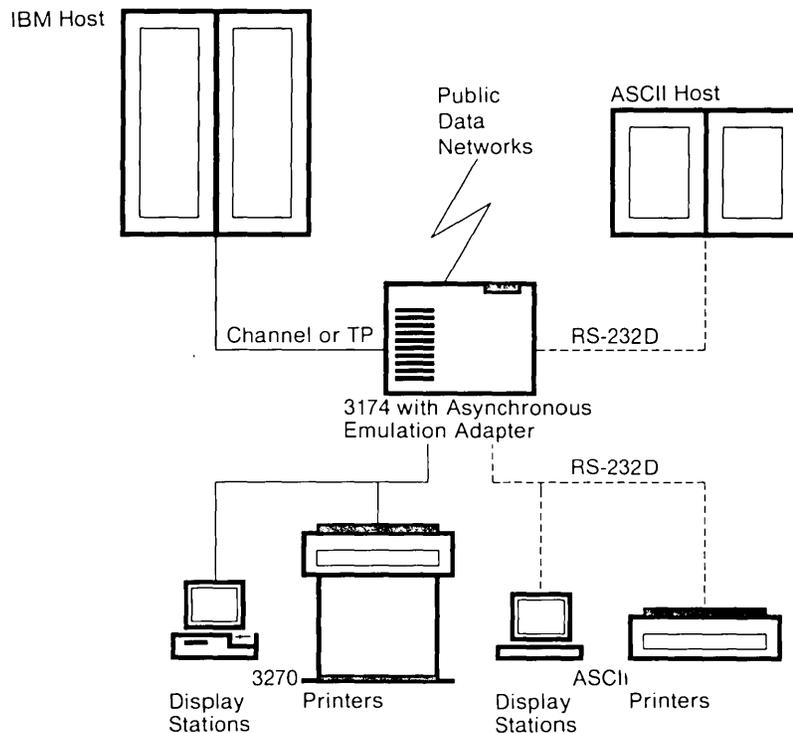


Figure 7-1. Overview of 3270 and ASCII Terminal Emulation

## Functional Description

The Asynchronous Emulation Adapter provides three major functions:

- **ASCII terminal emulation** (IBM 3270 terminals emulating an IBM 3101 Display Station, a DEC VT-100<sup>1</sup>, or an ASCII printer for connection to ASCII hosts or public data networks)
- **3270 terminal emulation** (ASCII terminals emulating an IBM 3178 Display Station Model C2, 3279 Color Display Station Model 2A, or 3287 Printer Model 2 for connection to an IBM host)
- **ASCII passthrough** (ASCII terminals connecting to ASCII hosts or to public data networks).

The Asynchronous Emulation Adapter supports duplex, character-mode, asynchronous transmission of 7-bit ASCII (ANSI 3.4,1977) data with parity. Odd, even, mark, space, and no-parity coding are supported. Ports can be configured in combinations of ASCII terminal emulation, 3270 terminal emulation, or ASCII passthrough. Each port provides an EIA 232D electrical interface and supports transmission speeds of 300, 1200, 2400, 4800, 9600, and 19 200 bits per second (bps) through modems over switched or nonswitched communication facilities or through direct connection (without modems).

## ASCII Emulation

**Terminal:** The following display stations are supported for ASCII terminal emulation: IBM 3178, 3179 (Model 1 only), 3180, 3191, 3192, 3194 operating in control unit terminal (CUT) mode, 3278, 3279 (operating in four-color mode), and 3270 Personal Computers operating in CUT mode.

**Keyboard:** The IBM typewriter, APL, and text keyboard types are supported through special keyboard maps for the IBM 3101 and DEC VT-100 display stations.

**Printer:** The IBM 3230 Model 2, 3262 Model 3 or 13, 3268 Model 2, and 3287 Model 1 or 2 are supported for ASCII printer emulation. ASCII control sequences for the following functions are supported: line feed, form feed, carriage return, bell, and tab-skip to the next multiple of 8 characters. The 3270 printer in this mode is used only as a host printer.

**Host Attachment:** ASCII host attachment is through any of the adapter ports, as specified on the destination menu.

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<sup>1</sup> VT-100 is a trademark of the Digital Equipment Corporation.

## 3270 Emulation

**Terminal:** The following ASCII display stations are supported for 3270 terminal emulation: IBM 3101, IBM 3151, IBM 3161, IBM 3162, IBM 3163 (supported as a 3161), DEC VT-52, VT-100, VT-220 (emulating a VT-100), TeleVideo<sup>2</sup> 912 and 970, Lear Siegler ADM<sup>3</sup> 3A/5, 11/12, 11/78, ADDS Viewpoint<sup>4</sup> A-2, Viewpoint 78, Esprit 78<sup>5</sup>, Hazeltine<sup>6</sup> 1500, and Hewlett Packard<sup>7</sup> 2621 terminals. ASCII display stations supported for 3279 2A emulation are the IBM 3164 and the DEC VT-241.

Compatible terminals that meet the requirements for attachment may connect to the emulation adapter under the provisions of the IBM Multiple Supplier Systems Bulletin.

Personal computers operating in emulation mode as one of the above display stations can also attach to the 3174, provided that an emulation program is available and that it is compatible with one of the emulation adapter's keyboard maps.

**ASCII Display Host Addressable Printer (HAP):** ASCII Display Host Addressable Printer refers to the ability of the 3174/AEA to support a display and a printer, attached to the display's auxiliary port, over a single communication link. The display and its attached printer appear as distinct addresses to the 3270 host. Host applications can communicate to both the display and the printer at the same time over the same link. ASCII Host Display Addressable Printer (HAP) support requires an ASCII display, operating in 3270 Terminal Emulation mode, capable of supporting an ASCII printer on an auxiliary port.

**Keyboard:** The user can choose between a generic keyboard map and a specific map designed for each ASCII terminal supported.

**Printer:** The general requirements for ASCII printers to be supported for 3270 printer emulation (LU1 SNA character string [SCS] mode and/or LU3 3270 Information Display System data-stream compatibility [DSC] mode) are as follows:

- Serial transmission
- Equal transmit and receive speeds, which must be in the range of speeds supported on the emulation adapter
- Duplex character mode
- 7-bit code defined by ASCII (ANSI 3.4, 1977)
- EIA 232D electrical interface
- A maximum of 132 print positions
- ASCII commands supported:
  - Carriage Return (Control M; hex OD)
  - Line Feed (Control H; hex OA)
  - Bell (Control G; hex O7)

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<sup>2</sup> TeleVideo is a trademark of TeleVideo Systems, Inc.

<sup>3</sup> ADM is a trademark of Lear Siegler, Inc.

<sup>4</sup> Viewpoint is a trademark of Applied Digital Data Systems, Inc.

<sup>5</sup> ESPRIT 78 is a trademark of Esprit Systems, Inc.

<sup>6</sup> Hazeltine is a trademark of Hazeltine Systems Inc.,

<sup>7</sup> Hewlett Packard is a trademark of Hewlett Packard.

- Carriage return must not generate a line feed, nor can a line feed generate a carriage return.
- The printer must not be dependent on any delay characters to allow mechanical motion.

Printers connected in this mode can be used as host printers, shared printers, and local copy printers.

**Host Attachment:** IBM host attachment is through the host attachment interface of the 3174 in which the adapter is installed.

**Operator Indicator Line:** Operator indicator status is provided upon request on the 24th or 25th line of the ASCII display station.

**RTM and Alert:** Network statistics for ASCII terminals are gathered in the same manner as 3270 terminals connected to the 3174.

**Typeahead:** ASCII display station keyboards are not locked during a screen write. This enables keystrokes to be entered while the screen is being updated, for greater efficiency.

## ASCII Passthrough

The emulation adapter can provide the connection between an ASCII terminal and an ASCII host, using any ASCII host-configured port. Flow controls supported by the adapter will prevent potential data overruns if supported by the host connection. If an overrun does occur, a message is sent to the display station operator. Error checking is the responsibility of the ASCII host.

## General Items Common to ASCII and 3270

**Destination Menu:** Prompts help the user determine how to connect with the desired host application.

**Modems:** Supported are all nonswitched, limited-distance, and switched-line modems that provide duplex asynchronous operation, support equal transmit and receive speeds, and conform to EIA 232D specifications on pins 1 to 8, 20, and 22. Connections can be made through "smart" modems, such as the IBM 5841.

Transmission on/transmission off (XON/XOFF), data terminal ready (DTR), and clear to send (CTS) asynchronous flow controls are supported.

**Security:** Password access to the adapter is provided, and session security is supported. When an ASCII device is in session with an IBM host and either disconnects or exceeds the configurable inactivity timer, the 3174 terminates the session. Security cannot be provided for host subsystems or applications (such as the Information Management System [IMS]) that retain data between sessions in the expectation that the same logical unit will come into session again.

If sensitive data is sent over external communication facilities, an encryption scheme outside the capabilities of this feature should be used.

## Central Site Customization Utility (CSCU)

Central site customization provides the ability to create and maintain, at a central site, a library that contains control unit parameters for all the IBM 3174 Subsystem Control Units in a network. CSCU also makes it possible to generate customized diskettes for the network 3174s.

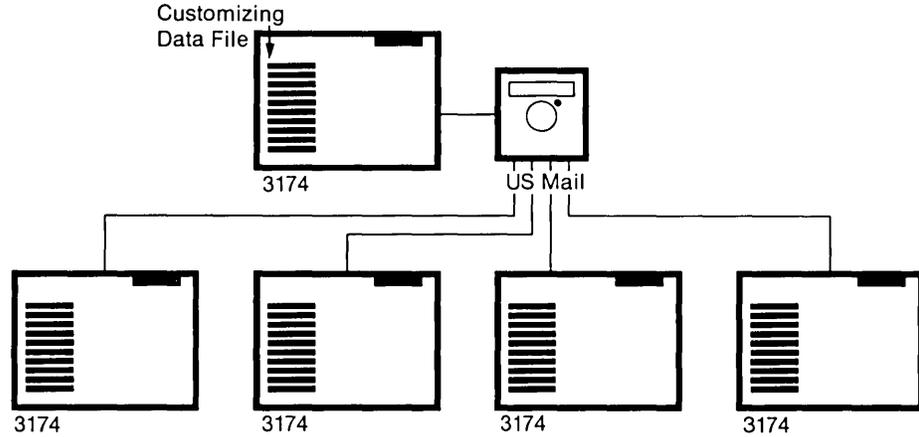


Figure 7-2. Central Site Customization

## File Maintenance

File maintenance for central site customization includes the ability to:

- Create and maintain customizing records for all 3174 subsystem control units on a control unit – by – control unit basis
- Select customizing data records for generating diskettes on a control unit – by – control unit basis.

## Hardware

Central site customization is done from any 3174 Model 1L, 1R, 2R, 3R, 51R, 52R, or 53R. The central site customization utility requires that the control unit:

- Be offline
- Have a 3278 control unit terminal (CUT) or similar terminal attached to port 0
- Have two diskette drives or one diskette drive and one fixed disk drive.

## Host Support

No host support is required for central site customization. All network 3174 subsystem control units are supported, regardless of host protocols.

## Central Site Change Management (CSCM)

CSCM allows the user to distribute electronically customization parameters or microcode to Systems Network Architecture (SNA) 3174 Subsystem Control Units that are serviced from a central site. CSCM requires the Central Site Customization Utility to establish and maintain the central site library on a 3174 (except Model 81R or 82R) that has been designated as the central site control unit.

The customization parameters or data are electronically distributed by Version 1, Release 2, of NetView Distribution Manager (DM) installed in the central site MVS/370 or MVS/XA host. NetView DM uses LU 6.2 support provided in ACF/VTAM, Version 3, Release 2, and defined protocols for managing changes and data distribution using an enhanced Systems Network Architecture Distribution Services (SNADS) format.

Customization parameters (the parameters contained in the central site library) are distributed electronically to an SNA 3174 without disrupting normal workstation operations. Electronic distribution of other data such as patches, new microcode engineering change release levels, Request for Price Quotations (RPQs), or downstream load (DSL) device code may require network site intervention, depending on the 3174 model or the choice of hardware features in the remote 3174.

CSCM also makes it possible to perform an initial microcode load (IML) of the remote 3174 from the central site. Using the proper microcode will significantly reduce the need for manual intervention at the remote site.

Although not required, the 20MB Fixed Disk Drive feature is desirable for the 3174 Subsystem Control Units that will participate in central site change management. At central site control units, the 20MB Fixed Disk Drive improves usability by eliminating diskette swapping when libraries for large networks are being maintained. For remote control units, it allows a backup copy of the current IML Control disk microcode to be retained, when migrating to a new microcode release.

## 20MB Fixed Disk Drive

The 20MB Fixed Disk Drive feature can be installed in all models of the 3174 except models 81R and 82R. This feature is functionally equivalent to the diskette drives available for the 3174. The advantage of this feature is the increased direct access storage device (DASD) storage, which also increases usability by reducing diskette swapping.

Two fixed disk drives can be installed on 3174 Models 1L, 1R, 2R, and 3R, and one can be installed on models 51R, 52R, and 53R. The 20MB Fixed Disk Drive can be installed in the field by the customer.

## Intelligent Printer Data Stream

The Intelligent Printer Data Stream (IPDS) is a structured field data stream designed to manage and control printer processes. (See Figure 7-3.) It is easily distinguished from previous printer data streams in that it supports all points addressability (APA). The APA printing concept allows users to position text, images, vector graphics, bar codes, and previously stored overlays at any point on a page.

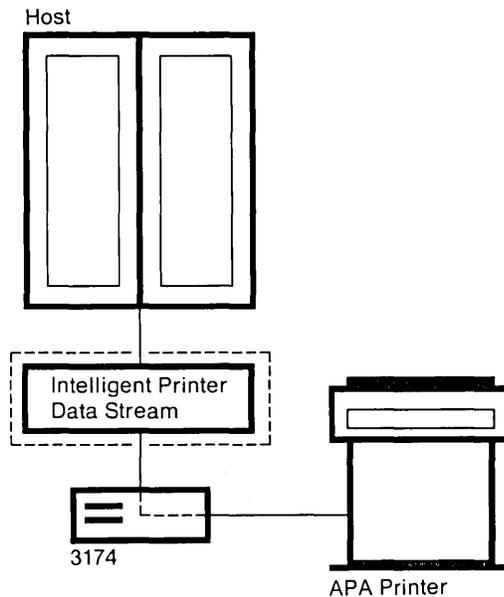


Figure 7-3. Intelligent Printer Data Stream

### Functional Description

The IPDS is transmitted from an application to the printer within structured fields that have been specifically designed for this purpose. The IPDS commands within the data stream enable the host to control:

- Media handling
- Downloading and managing of symbol sets (fonts) and printer-stored objects, such as overlays and page segments.

The printer can later use the stored objects to construct a printed page. The IPDS can significantly reduce the load on the host processor and the number of characters transmitted to the printer in many advanced printing applications.

## System Attachment

The IPDS is supported by:

- IBM 3274 Control Unit (Configuration Support-D, Release 65)
- IBM 3174 Subsystem Control Unit (Configuration Support A or S, (Release 2 or higher).

Printers capable of IPDS will be supported by both SNA and non-SNA control units. Attachment protocols are as follows.

- SNA
  - Channel-attached
  - SDLC-attached.

**Note:** Under SNA, support is limited to LU 1 only.

- Non-SNA
  - Channel-attached
  - BSC-attached.

**Note:** Under non-SNA, IPDS is only carried encapsulated in the 3270 data stream.

## Programming Dependencies

The IPDS depends on programming support outside the 3274 and 3174 control units.

The IPDS is dependent on the VTAM/NCP transmission subsystem to support printer operations to a BSC-attached control unit. In a way that does not depend on the presence of a write control character (WCC) to indicate “start print” in the data stream.

## Error Reporting and Recovery

The IPDS exception conditions are detected by the attached printer and are reported (at the data stream level) to the application that generated the IPDS data. The exception conditions are reported in an IPDS structured field called *Acknowledge (ACK) Reply*.

The control unit has no knowledge of printer-detected IPDS exceptions and does not take part in recovery except as directed by the application.

## IBM Token-Ring Network 3270 Gateway Feature

The 3174 Subsystem Control Unit Models 1L, 1R, 2R, 51R, and 52R with the IBM Token-Ring Network 3270 Gateway feature provide for IBM Token-Ring Network attachment to an SNA/SDLC host. Models 3R and 53R provide for attachment of a 3270 Information Display System to the Token-Ring Network.

The 3270 Gateway feature on Model 1L, 1R, 2R, 51R, or 52R provides for data passage between a host processor and workstations and the subsystem control units attached to the IBM Token-Ring Network. 3174 Models 3R and 53R provide connection to the network for their attached terminals via Models 1L, 1R, 2R, 51R, or 52R gateway or a 372X or 3745 Communication Controller communicating with the host processor.

The gateway feature does not interfere with the ability of ring-attached devices to communicate with each other on the ring; nor does it affect terminals directly attached to the 3174.

As many as 140 token-ring attached devices can be defined to VTAM in the host. The addresses are mapped to unique host subchannel or SDLC addresses. One subchannel or SDLC address is also required for the 3174 Control Unit in which the gateway feature is installed.

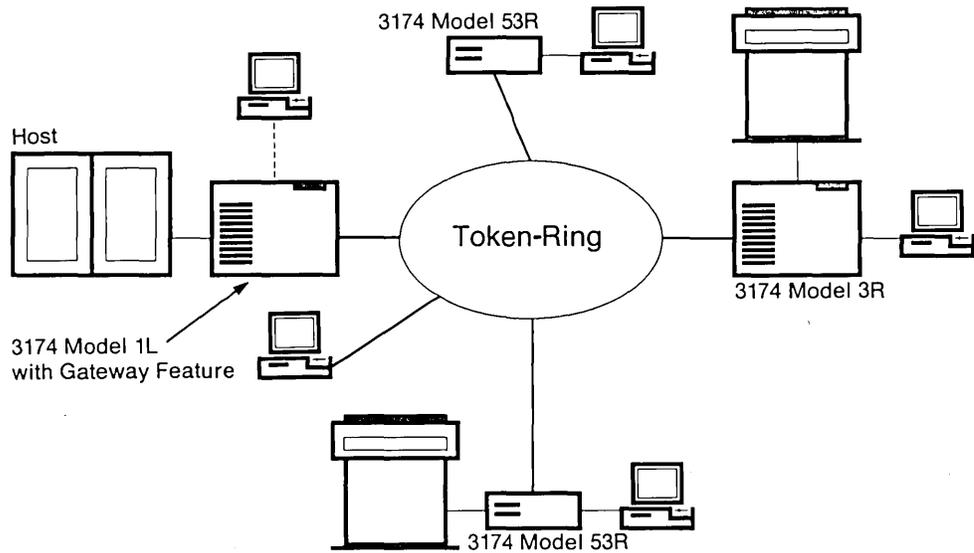


Figure 7-4. IBM Token-Ring Network

## Gateway Feature Components

The gateway feature comprises:

- A Token-Ring adapter in the 3174
- Utility and Control diskettes (Configuration Support S)
- Cable.

Additional storage is needed with this feature. The IBM Token-Ring Network 3270 Gateway feature can be ordered with the 3174 or installed by the customer.

## Token-Ring Adapter

The Token-Ring adapter serves as the attachment between the 3174 and the Token-Ring Network and provides for:

- Transfer of data
- Detection of ring and protocol errors.

## Microcode

Configuration Support-S Control diskettes are provided with the Token-Ring Network 3270 Gateway feature. All configuration support for 3174 functions applicable to the SNA 3174 is included.

The Utility diskette provides the ability to:

- Customize the 3174 Subsystem Control Unit
- Assign a ring address for the control unit containing the gateway feature
- Map the addresses of workstations or control units attached to the Token-Ring Network to specific subchannel addresses.

The Control diskette contains the microcode needed to connect and manage a Token-Ring Network downstream from the control unit.

The screen images used for customizing the gateway feature have the same format and interface used for customizing the 3174.

## 3174 Relationship

The Token-Ring Network 3270 Gateway feature does not affect normal 3174 functions for the terminals attached to the control unit terminal and distributed function terminal (CUT-DFT) interface. No changes are required in the host application program for the gateway feature.

## **Program Support**

The Token-Ring Network 3270 Gateway feature is supported by the following host-related programs:

- NetView
- Virtual Telecommunications Access Method (VTAM).

NetView and VTAM run under the following operating systems:

- Multiple Virtual Storage (MVS)
- Virtual Machine (VM)
- Virtual Storage Extended (VSE).

## **Problem Determination**

The Token-Ring Network 3270 Gateway feature provides ring-related error processing for the Token-Ring Network, as well as extensions of the following 3174 problem determination functions:

- Alerts
- Online tests
- Offline tests
- Error logging
- Trace.

In addition, host notification is provided for Token-Ring error-threshold conditions.

## **Network Asset Management**

Network Asset Management supports host requests, through the Systems Network Architecture (SNA) network, for Vital Product Data information from the SNA 3174 and attached supported devices. The host can dynamically request the collection of product identification information (such as machine type, serial number, model number, plant of manufacture, product class [IBM/non-IBM], power on information) from supported network components. This information will be available from the host upon request.

## **Multiple Logical Terminals (MLT)**

Multiple Logical Terminal support in Configuration Support A or S, Release 3.0 (or higher), enables IBM 3270 fixed-function displays attached to any model IBM 3174, regardless of host connection protocol, to interact with up to five host sessions. The host sessions can be directly connected to a single IBM host and one or more ASCII hosts. Each session can be connected to only one host at a time.

The MLT feature replaces the previously announced 3174 Multiple Logical Units (MLU) RPQ.

## Country Extended Code Page (CECP)

The Country Extended Code Page feature is an extension of the support for each Latin-based national language code page, to a 191 code point language code page for the countries listed below. When used in conjunction with CECP-capable displays and printers, CECP allows you to use symbols from languages other than the one for which the 3174 Subsystem Control Unit is customized. The national languages supported by CECP are:

Austrian/German (EBCDIC 76)	Netherlands
New Belgian (International)	Norwegian
Canadian Bilingual	Portuguese
Danish	Spanish
English (UK)	Spanish-Speaking
English (US)	Swedish
Finnish	New Swiss/French (International)
French AZERTY (105)	New Swiss/German (International)
Italian	

The Country Extended Code Page feature is supported with Configuration Support A or S, Release 4.0.

The CECP feature replaces the previously announced 3174 Country Extended Code Page (CECP) RPQ.

## Type 1 and Type 2 Communication Adapter for Models 1L and 3R

The Type 1 and Type 2 Teleprocessing Communication Adapters that provide the host attachment interfaces for 3174 Models 1R and 2R, respectively, are now available as optional features for the 3174 Models 1L and 3R. With either the Type 1 Communication Adapter or Type 2 Communication Adapter installed, and the appropriately configured microcode loaded, these 3174 models can operate on teleprocessing facilities as either 3174 Models 1R or 2R.

## 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 7-5 on page 7-16.

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 internal/external terminal multiplexers, or by a combination of these attachments. Combinations are unique to the 3174 models.

The large-cluster control unit Models 1L, 1R, 2R, and 3R 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). Category A terminals can also be attached via a combination of 3299 Terminal Multiplexers and optional Terminal Multiplexer Adapter features (up to 32 terminals).

The small-cluster control unit Models 51R, 52R, and 53R 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 (nine terminals), or via two 3299 Terminal Multiplexers (16 terminals), or a combination of one 3299 (eight terminals) and eight terminals directly attached (for a total of 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 eight 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, 2R, and 3R can control a large cluster of as many as 32 display stations and printers.
  - 3174 Models 51R, 52R, and 53R control a maximum of 16 display stations and printers.
  - 3174 Models 81R and 82R control a maximum of eight display stations and printers.

Your IBM Marketing representative will know of any terminals that are not yet represented or have been deleted in this book.

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## Microcode Support

IBM 3174 Configuration Support A and IBM 3174 Configuration Support S provide support for 3174 features and enhancements.

### IBM 3174 Configuration Support A

Configuration Support A, Release 4.0 provides microcode support for the 20MB fixed disk, Central Site Change Management (CSCM), Network Asset Management, APL2, Country Extended Code Page (CECP), Multiple Logical Terminals (MLT) Levels 4 and 5, and ASCII Display Host Addressable Printer (HAP).

### IBM 3174 Configuration Support S

Configuration Support S, Release 4.0, provides support for the IBM Token-Ring Network 3270 Gateway feature, as well as Network Asset Management, 20MB fixed disk, and Central Site Change Management (CSCM), CECP, APL2, and MLT Levels 4 and 5.

Figure 7-5 (Page 1 of 2). Terminals Supported by 3174 Subsystem Control Units

Terminal	Channel-Attached	Remotely Attached		Type of Terminal
	1L	1R, 2R, 3R 51R, 52R, 53R	81R, 82R	
<b>Displays</b>				
3178 all models	X	X	X	CUT
3179				
Model 1	X	X	X	CUT
Models G1, G2	X	X		DFT
3180 Model 1	X	X	X	CUT
3191 all models	X	X	X	CUT
3192				
Models C, D, F, L, W	X	X	X	CUT
Model G	X	X		DFT
3193 all models	X	X		DFT
3194 all models	X	X	X	DFT
3278 all models	X	X	X	CUT
3279 all models	X	X	X	CUT
3290 all models	X	X		DFT
5150, all models	X	X	X	CUT
5160 all models	X	X	X	CUT
5162, Model 286	X	X	X	CUT
5170, all models	X	X	X	CUT
5271, all models	X	X	X	DFT
5273, all models	X	X	X	DFT
5371, all models	X	X	X	DFT
5373, all models	X	X	X	DFT
5540/50/60	X	X	X	DFT
5578	X	X	X	DFT
6150 all models	X	X	X	CUT
6151, all models	X	X	X	CUT
SOEMI (OEM Devices)		X		
<b>Printers</b>				
3262				
Model 3	X	X	X	
Model 13	X	X	X	
3268				
Model 2	X	X	X	
Model 2C	X	X	X	

Figure 7-5 (Page 2 of 2). Terminals Supported by 3174 Subsystem Control Units				
Terminal	Channel-Attached	Remotely Attached		Type of Terminal
	1L	1R, 2R, 3R 51R, 52R, 53R	81R, 82R	
<b>3287</b>				
Models 1, 1C	X	X	X	
Models 2, 2C	X	X	X	
3812 Model 2	X	X	X	
4214 Model 1	X	X	X	
<b>4224</b>				
Models 201, 202	X	X	X	
Models 2E2, 2C2	X	X	X	
4234 Model 1	X	X	X	
<b>4245</b>				
Model D12	X	X	X	
Model D20	X	X	X	
4250 Model 1	X	X	X	
5210 Models G1, G2	X	X	X	
5227 Model 11	X	X	X	
6262 Models D12, D14	X	X	X	
<b>Switching Management System</b>				
<b>3814</b>				
Model A1	X	X	X	
Model A2	X	X	X	
Model A3	X	X	X	
Model A4	X	X	X	
<b>Legend:</b>				
<ul style="list-style-type: none"> <li>• 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.</li> <li>• DFT = distributed function terminal: A terminal that <i>can</i> interpret the data stream and execute functions without help from the control unit to which it is attached.</li> </ul>				

## 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. All the 3174 models (except Model 52R) have a basic 1MB (MB equals 1 048 576 bytes) of storage. Model 52R has 512KB (524 288 bytes) of basic storage.

- 3174 Models 1L, 1R, 2R, and 3R have 1MB of storage and one high-capacity 1.2MB diskette drive, designed to support all basic functions; one or two 20MB fixed disk drives and a second 1.2MB diskette drive are optional.
- 3174 Models 51R and 53R have 1MB of storage and one high-capacity 1.2MB diskette drive, designed to support all basic functions; a 20MB fixed disk drive or a second 1.2MB diskette drive are optional.
- 3174 Model 52R has 512KB of storage and one high-capacity 1.2MB diskette drive, designed to support all basic functions; a 20MB fixed disk drive or a second 1.2MB diskette drive are 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.

### 3174 Storage Expansion

Several combinations of 3174 features use more storage capacity than the base storage in the 3174. To allow functional growth and flexibility Models 1L, 1R, 2R and 3R have two card slots reserved for storage expansion; Models 51R, 52R and 53R have one card slot reserved for storage expansion. Storage expansion is not available on Models 81R and 82R. The 3174 Storage Expansion Feature card is available in three storage sizes, 512KB, 1.0MB and 2.0MB. The cards, in combination with 3174 base storage, can provide up to 3.0MB of total storage (except Model 52R which has total storage capacity of 1.5MB).

### Local Customization

All 3174 models have a high-capacity 1.2MB 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. These diskettes are used to generate an initial microcode load (IML) disk (either a diskette or a fixed disk) supports the configuration of display stations and printers on your system. The IML disk gives the 3174 all the information about the system that is necessary when power is turned on. To customize a disk, 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. A user-customized disk can be recustomized as you add or remove features to meet your changing needs. Backup IML diskettes can be generated with a similar procedure.



Figure 7-6. IBM 3174 Subsystem Control Unit Model 1L

## 3174 Model 1L

The 3174 Model 1L (shown in Figure 7-6) 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 1MB. One 5-1/4-inch, high-capacity, 1.2MB diskette drive is standard for all models. A second diskette drive or a fixed disk drive must be installed if distributed function terminals are to be used for downstream load (DSL). A four-port terminal adapter that attaches IBM 3299 Terminal Multiplexers and Terminal Multiplexer Adapters (a special feature) supports a maximum of 32 Category A terminals.

Customization is performed with a Control Unit Terminal (CUT) attached to port 0 of the 3174. 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 or through a control unit terminal attached to port 0 only.

Customer-installable special features are:

- 1.2MB Diskette Drive
- Terminal Multiplexer Adapter
- Token-Ring Adapter
- Asynchronous Emulation Adapter
- 20MB Fixed Disk
- Token-Ring 3270 Gateway
- Storage Expansion
- Type 1 Communication Adapter
- Type 2 Communication Adapter.

## 3174 Model 1R

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

Customization is performed with a Control Unit Terminal (CUT) attached to port 0 of the 3174. 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 or through a control unit terminal attached to port 0 only.

A Model 1R can be converted to a Model 3R, by the customer, for attachment to the IBM Token-Ring Network.

Customer-installable special features are:

- 1.2MB Diskette Drive
- Terminal Multiplexer Adapter
- Encrypt/Decrypt
- Asynchronous Emulation Adapter
- Storage Expansion
- 20MB Fixed Disk
- Token-Ring 3270 Gateway.

## 3174 Model 2R

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

Customization is performed with a Control Unit Terminal (CUT) attached to port 0 of the 3174. 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 or through a control unit terminal attached to port 0 only.

A Model 2R can be converted to a Model 3R, by the customer, for attachment to the IBM Token Ring Network.

Customer-installable special features are:

- 1.2MB Diskette Drive
- Terminal Multiplexer Adapter
- Encrypt/Decrypt
- Asynchronous Emulation Adapter
- Storage Expansion
- 20MB Fixed Disk
- Token-Ring 3270 Gateway.

## 3174 Model 3R

The 3174 Model 3R is designed to connect to an IBM Token-Ring Network. When connected to a Model 3R, the terminals can be located almost anywhere within an establishment and still operate at near channel response time.

The basic storage is 1MB. One 5-1/4-inch, high-capacity, 1.2MB diskette drive is standard for all models. A second diskette drive or a fixed disk drive must be installed if distributed function terminals are to be used for downstream load (DSL). A four-port terminal adapter that attaches IBM 3299 Terminal Multiplexers and Terminal Multiplexer Adapters (a special feature) supports a maximum of 32 Category A terminals.

Customization is performed with a Control Unit Terminal (CUT) attached to port 0 of the 3174. 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 or through a control unit terminal attached to port 0 only.

The Model 3R can be converted, by the customer, to a Model 1R or 2R.

Customer-installable special features are:

- 1.2MB Diskette Drive
- Terminal Multiplexer Adapter
- Encrypt/Decrypt
- Asynchronous Emulation Adapter
- Storage Expansion
- 20MB Fixed Disk
- Type 1 Communication Adapter
- Type 2 Communication Adapter.

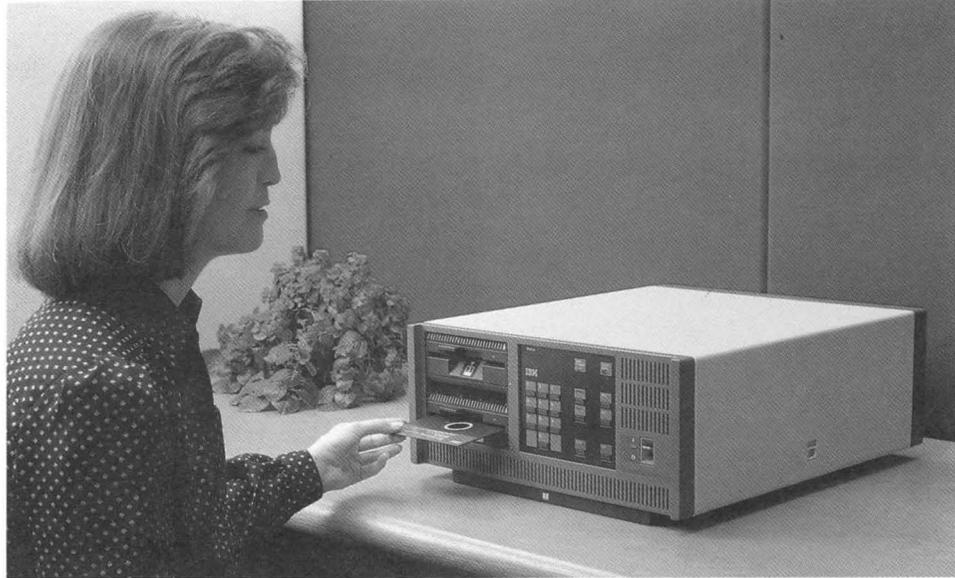


Figure 7-7. IBM 3174 Subsystem Control Unit Model 51R

## 3174 Model 51R

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

Customization is performed with a Control Unit Terminal (CUT) attached to port 0 of the 3174. 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 or through a control unit terminal attached to port 0 only.

Customer-installable features are:

- 1.2MB Diskette Drive
- Storage Expansion
- 20MB Fixed Disk
- Token-Ring 3270 Gateway
- Asynchronous Emulation Adapter.

## 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 512KB. One 5-1/4-inch high-capacity 1.2MB 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 nine Category A terminals directly or 16 Category A terminals through one or two IBM 3299 Terminal Multiplexers.

Customization is performed with a Control Unit Terminal (CUT) attached to port 0 of the 3174. 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 or through a control unit terminal attached to port 0 only.

Customer-installable features are:

- 1.2MB Diskette Drive
- Storage Expansion
- 20MB Fixed Disk
- Token-Ring 3270 Gateway
- Asynchronous Emulation Adapter.

## 3174 Model 53R

The 3174 Model 53R connects to the IBM Token-Ring Network. When connected to a Model 53R, terminals can be located almost anywhere within an establishment and still operate at near channel response time.

The basic storage is 1MB. One 5-1/4-inch, high-capacity, 1.2MB 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 nine Category A terminals directly or 16 Category A terminals through one or two IBM 3299 Terminal Multiplexers.

Customization is performed with a Control Unit Terminal (CUT) attached to port 0 of the 3174. 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 or through a control unit terminal attached to port 0 only.

Customer-installable features are:

- 1.2MB Diskette Drive
- Storage Expansion
- 20MB Fixed Disk.

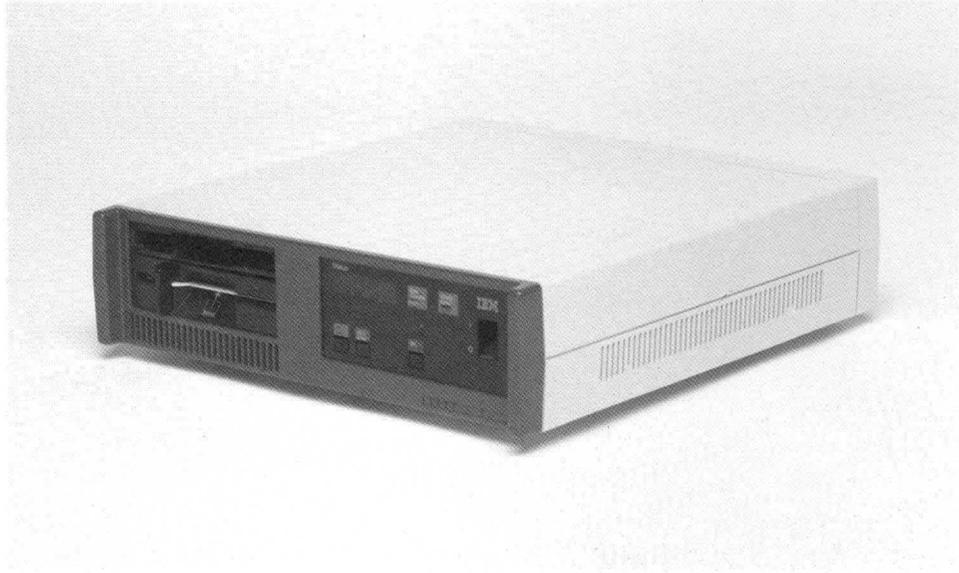


Figure 7-8. IBM 3174 Subsystem Control Unit Model 81R

### **3174 Model 81R**

The 3174 Model 81R (shown in Figure 7-8) is a very-small-cluster control unit designed for remote operations. It contains EIA 232D/CCITT V.24 and CCITT V.35 interfaces for SNA/SDLC, BSC, or X.25 remote link attachment. Basic storage is 1MB. One 5-1/4-inch, high-capacity, 1.2MB diskette drive is basic for all models. A four-port terminal adapter supports four Category A terminals directly or eight Category A terminals through an IBM 3299 Terminal Multiplexer.

Customization is performed with a Control Unit Terminal (CUT) attached to port 0 of the 3174. 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 or through a control unit terminal attached to port 0 only.

### **3174 Model 82R**

The 3174 Model 82R is a small-cluster control unit designed for remote operations. It contains an X.21 interface (CCITT V.11) for SNA/SDLC or X.25 remote link attachment. The basic storage is 1MB. One 5-1/4-inch, high-capacity, 1.2MB diskette drive is standard for all models. A four-port terminal adapter supports four Category A terminals directly or eight Category A terminals through IBM 3299 Terminal Multiplexers.

Customization is performed with a Control Unit Terminal (CUT) attached to port 0 of the 3174. 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 or through a control unit terminal attached to port 0 only.



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## Chapter 8. Optional System Components

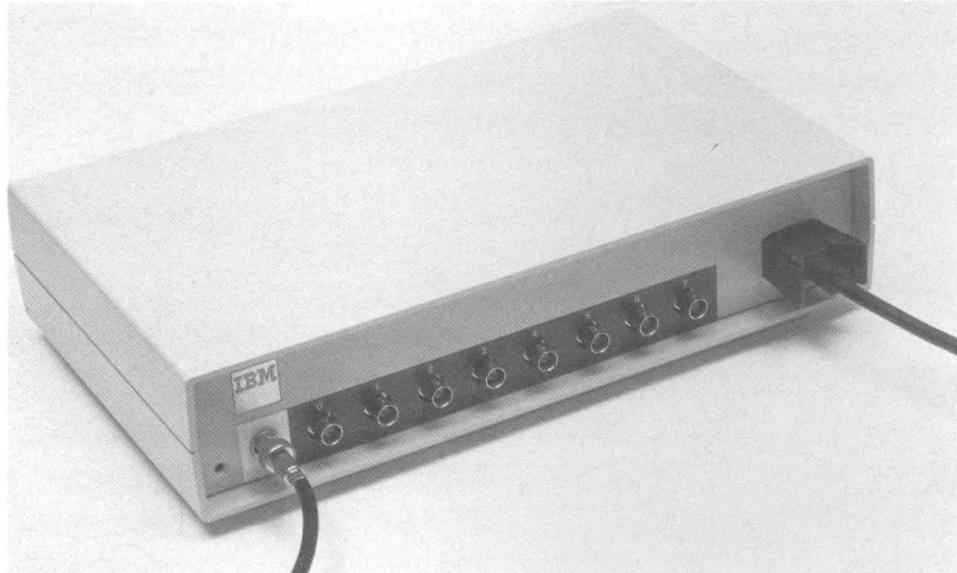


Figure 8-1. IBM 3299 Terminal Multiplexer

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### 3299 Terminal Multiplexer Models 2 and 3

An intermediary between the IBM 3174 or 3274 control unit and the terminals in large or dispersed computer installations, the IBM 3299 Terminal Multiplexer (shown in Figure 8-1) 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 terminals attached to it.

- Only one 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 terminals, four 3299s are required to attach 32 terminals to a control unit.
- Terminals can be attached to the 3299 by 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.
- The 3299 Model 2 is a replacement for the Model 1 in installations using coaxial cable. In addition, the Model 2 attaches directly to the IBM Cabling System, eliminating the need for baluns at the 3299 ends of the cables.

- The 3299 Models 2 and 3 are attached to a control unit using the IBM Cabling System without requiring a balun at the 3299 end of the cable. Baluns are not required at the 3174 end of the cable.

Specified twisted-pair wire is used to attach the terminals to the Model 3. The terminals will usually require a coax-to-twisted-pair adapter for attachment to twisted-pair wire. This adapter is not required at the Model 3 end of the wire.



Figure 8-2. IBM 3814 Switching Management System

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## 3814 Switching Management System

The IBM 3814 Switching Management System (shown in Figure 8-2) 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 305 meters (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 3287 printer
- Allows password security
- Has self-diagnostics.

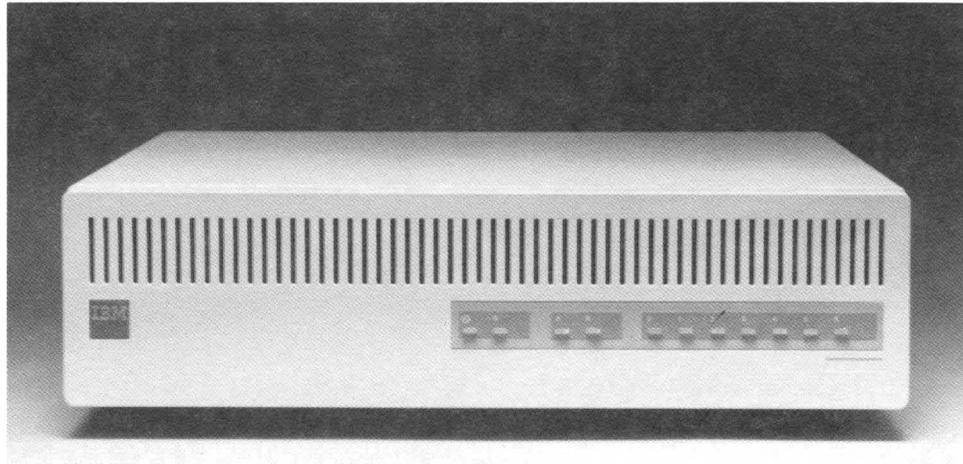


Figure 8-3. IBM 5209 Link Protocol Converter

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## 5209 Link Protocol Converter

The IBM 5209 Link Protocol Converter (shown in Figure 8-3) enables many 3270 display stations and printers to communicate with a 5250 host or control unit in addition to a 3174 or 3274 control unit.

The 5209 attaches to the 3274 or 3174 control unit by the 3299 Terminal Multiplexer. This permits the 5209 to be located up to 1500 meters (5000 feet) from the 3x74 control unit and 1500 meters (5000 feet) from the 5250 host or control unit. The terminals and printers can be located another 1500 meters (5000 feet) from the 5209.

The 5209 can connect up to seven terminals and printers. The terminals can switch between host sessions on the S/36 or 38 and the 370 host by use of a hot-key sequence. Printers can be assigned to either host via configuration.

The 5209 provides the customer a means of utilizing S/3x systems as a department computer while maintaining host applications on the 370. This eliminates dual terminals and printers and reduces the cabling impact.

The following display stations and printers are supported:

- 3178 Display Station Models C1, C2, and C3
- 3179 Color Display Station Model 1
- 3180 Display Station Model 1
- 3191 Display Station
- 3192 Display Station
- 3194 Display Station (CUT mode)
- 3278 Display Station Models 2, 3, 4, and 5
- 3279 Color Display Station Models S2A, 2A, 3A, 2X, 3X, S2B, S3G, 2B, and 3B
- 3270 Personal Computer (CUT mode)
- IBM Personal Computer with 3278/79 Emulation Adapter
- 3262 Line Printer Models 3 and 13
- 3268 Printer Models 2 and 2C
- 3287 Printer Models 1, 1C, 2, and 2C
- 3812 Pageprinter
- 4214 Printer Model 1
- 4224 Printer
- 4234 Printer Model 1
- 4245 Printer
- 5210 Printer Models G01 and G02.
- 6262 Line Printer.



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## 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 3270 color display stations and printers when in base color mode. Fields can be displayed and printed in any of the four colors red, blue, green, and white.

**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 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.

When the IBM Token-Ring 3270 Gateway feature is installed in a 3174 Model 1L, alerts are sent to the NCCF that reflect the status of the Token-Ring network attached to the control unit. 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.

**Audible Alarm** (printers): This audible alarm is activated by a code in the host program or by an error condition that occurs during printer operation. This audible alarm alerts the operator to conditions requiring operator intervention.

**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 3270 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: The operator initiates a local copy from a 3270 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.

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## Chapter 10. System Attachment

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

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### 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.

The 3174 Model 1L also attaches to the IBM 3044 Fiber Optic Channel Extender Link, permitting the control unit to be placed up to 2 kilometers (6600 feet) from the channel.

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### 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, 51R, and 81R
- 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, 52R, 81R, and 82R
- 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.

These control units can be remotely attached using X.25 protocol:

- 3174 Models 1R, 2R, 51R, 52R, 81R, and 82R
- 3274 Models 21C, 31C, 41C, 51C, and 61C.

The following system processors support 3274 and 3276 control units:

- System/370
- 4300
- 8100 (remote SDLC)
- 303x
- 308x
- 309x
- Series/1
- 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/3X (remote SDLC)
- Series/1
- Series Remote SDLC or BSC
- 9370 Remote SDLC or BSC.

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## Token-Ring Network Attachment

The control units attached to an IBM Token-Ring Network can communicate with the system channel by means of a gateway feature that attaches the Token-Ring Network to the channel. For the following control units, this gateway may be an IBM Token-Ring Network 3270 Gateway feature installed in a 3174 Model 1L, 1R, 2R, 51R, 52R, or a 3720 or 37X5 Communications Controller with the NCP/Token-Ring Interface (NTRI) facility.

Terminals attach to the IBM Token-Ring Network through:

- 3174 Models 3R and 53R.

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## 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.

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## 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, 51R, and 81R
- 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, 52R, 81R, and 82R
- 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, 52R, 81R, and 82R
- 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 Model 1 2400 bps
- 3864 Model 1 4800 bps
- 3865 9600 bps
- 3868 Model 1 2400 bps
- 3868 Model 2 4800 bps
- 3868 Model 3 9600 bps
- 3868 Model 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 Model L41 2400, 4800, 9600, 19 200 bps (baseband)

#### **Switched Network Modems**

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

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

Some of the external IBM modems that support Switched Network Backup (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, an interface with American Telephone and Telegraph's nonswitched Data-Phone<sup>1</sup> digital data service network.

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<sup>1</sup> Trademark of American Telephone and Telegraph Company.

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.



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## 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.

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### 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)

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### 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

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### Network Control

- Advanced Communications Function/Network Control Program (ACF/NCP)
- Emulation Program (EP)
- NetView
- Network Performance Analyzer (NPA)
- Network Performing Analysis Reporting System (NETPARS)
- Virtual Machine/VTAM Communications Network Application (VM/VCNA)
- VM/Pass-Through Facility
- Network Design and Analysis (NETDA)
- Netview Distribution Manager (NETVIEW DM)

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## 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

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## 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)

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## 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)

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## 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)

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## 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)

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## 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)

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## 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 (DSLUI)
- 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
- IBM PC/HOST File Transfer and Terminal Emulator Program (FTTERM)



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## 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 information on work-space considerations, site preparation, cables and connectors, and machine specifications, refer to *3270 Information Display System Library User's Guide*, GA23-0058. 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.

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



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## 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, 3270 display stations and printers, and the 3299 Terminal Multiplexers. Customer Problem Analysis and Recovery procedures for the operator are provided with each display station and 3299 Terminal Multiplexer. 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:

**NetView:** 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. 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.



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# List of Abbreviations

## A

**ac.** Alternating current.

**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.

**ACK.** Positive acknowledge.

**ACTLU.** Activate Logical Unit.

**ACTPU.** Activate Physical Unit.

**AID.** Attention identification.

**Alt.** Alternate.

**A/N.** Alphanumeric.

**APA.** All points addressable.

**APL.** A programming language.

**ARC.** Adapter return code.

**ASCII.** American National Standard Code for Information Interchange.

**Atb.** Attribute.

**ATTN.** Attention.

**avg.** Average.

**AWG.** American wire gauge.

## B

**B.** Busy.

**BB.** Begin bracket.

**BCC.** Block check character.

**BETB.** Between-bracket state.

**BIU.** Basic information unit.

**BOC.** Bus-out check.

**bps.** Bits per second.

**BSC.** Binary synchronous communication.

**BTAM.** Basic Telecommunications Access Method.

**BTAM-ES.** Basic Telecommunications Access Method – Extended Support.

**BTU.** British thermal unit.

## C

**C.** Celsius, column.

**C&D.** Cause and diagnostic (codes).

**CAC.** Common adapter code.

**CAD.** Computer-Aided Design.

**CAM.** Computer-Aided Manufacturing.

**CAW.** Channel address word.

**CC.** Control check, Chain Command (flag).

**CCC.** Copy control character.

**CCITT.** International Telegraph and Telephone Consultative Committee.

**CCW.** Channel control word.

**CD.** Change direction.

**CE.** Channel End.

**CECP.** Country Extended Code Page

**cfm.** Cubic feet per minute.

**Char.** Character.

**CICS.** Customer Information Control System.

**CID.** Connection identifier.

**cm.** Centimeter.

**cmd.** Command.

**CMS.** Conversational Monitor System.

**CNCL.** Cancel.

**CNM.** Communication network management.

**coax.** Coaxial (cable).

**comm.** Communication.

**cont.** Continuous.

**cps.** Characters per second.

**CR.** Command Reject.

**CRC.** Cyclic redundancy check.

**CRT.** Cathode-ray tube.

**CRV.** Cryptographic Session Verification.

**CSU.** Customer setup.

**CSW.** Channel status word.

**ctl.** Control.

**ctr.** Counter.

**CTS.** Clear to Send.

**CU.** Control unit.

**CUE.** Control Unit End.

**CUG.** Closed user group.

**CUT.** Control unit terminal.

## **D**

**D.** Display.

**DAA.** Data-access arrangement.

**DAF'.** Destination address field prime (local address of SLU).

**dB.** Decibel.

**DB.** Device Busy.

**DBCS.** Double-byte character set.

**dBm.** Decibels above one milliwatt.

**DC.** Data Check.

**DCE.** Data-circuit terminating equipment.

**DDS.** Digital Data Service.

**DE.** Device End.

**deact.** Deactivate.

**dec.** Decimal.

**DEL.** Delete.

**DEMF.** Display Exception Monitoring Facility.

**DEV.** Device.

**DFT.** Distributed function terminal.

**DGM.** Data Grade Media.

**DISC.** Disconnect.

**DLE.** Data link escape.

**DM.** Disconnect mode.

**DOS.** Disk Operating System.

**DP.** Distribution panel.

**DPC.** Dual-purpose connector.

**DPKT.** Default packet (size).

**DR.** Definite response.

**DSC.** Data stream compatibility.

**DSL.** Downstream load.

**DSR.** Data set ready.

**DTE.** Data terminal equipment.

**DUP.** Duplicate.

**DWND.** Default window (size).

## **E**

**EAS.** Extended Area Service.

**EAU.** Erase All Unprotected.

**EB.** End brackets.

**EBCDIC.** Extended binary-coded decimal interchange code.

**EC.** Equipment Check, engineering change.

**ECMA.** European Computer Manufacturer's Association.

**ECSA.** Extended Character Set Adapter.

**EFI.** Expedited flow indicator.

**EIA.** Electronic Industries Association.  
**EM.** End of message.  
**ENP.** Enable Presentation.  
**ENQ.** Enquiry.  
**EOF.** End of Field.  
**EOI.** End of Inquiry.  
**EOR.** End of Record.  
**EOT.** End of Transmission.  
**EPO.** Emergency Power Off.  
**EPSN.** Extended packet sequence numbering.  
**ERI.** Exception response indicator.  
**ERP.** Error recovery procedure(s).  
**ESC.** Escape.  
**ETB.** End of Transmission Block.  
**ETX.** End of Text.  
**EUA.** Erase Unprotected to Address.  
**E/W.** Erase/Write.  
**EX.** Exception (response).

## **F**

**F.** Fahrenheit.  
**FCS.** Frame checking sequence.  
**FERS.** Facility Error Recognition System.  
**FF.** Forms feed.  
**FID.** Format identifier.  
**FIE.** Function interpret error.  
**FM.** Field mark, function management.  
**FMD.** Function management data.  
**FMH.** Function management header.  
**FRMR.** Frame reject response.  
**ft.** Foot (or feet).

## **G**

**GDDM.** Graphic Data Display Manager.  
**GFI.** General format identifier.  
**GP.** General Poll.

## **H**

**h.** Coaxial cable type for indoor installation.  
**H.** Height.  
**HDLC.** High-Level Data Link Control.  
**Hex.** Hexadecimal.  
**HNAD.** Host network (DTE) address.  
**HT.** Horizontal Tab.  
**Hz.** Hertz.

## **I**

**I.** Information (format).  
**IC.** Insert Cursor.  
**ID.** Identification, identifier.  
**ident.** Identification.  
**IML.** Initial machine load, initial microcode load, initial microprogram load.  
**IMS.** Information Management System.  
**in.** Inch.  
**Ind.** Indicator.  
**INS.** Insert.  
**I/O.** Input/output.  
**IOPT.** Incoming call option.  
**IOS.** Input/Output Supervisor.  
**IPDS.** Intelligent Printer Data Stream.  
**IR.** Intervention Required.  
**IRS.** Interrecord separator.  
**ITB.** End of intermediate transmission block.

## K

**KANA.** Katakana.

**KB.** Kilobyte; 1024 bytes.

**kbd.** Keyboard.

**kcal/hr.** Kilocalories per hour.

**kg.** Kilogram.

**kVA.** Kilovolt ampere.

## L

**L.** Coaxial cable type for indoor or outdoor installation.

**L.** Left.

**LAPB.** Link access procedure balanced.

**lb.** Pound.

**LC.** Logical channel.

**LCID.** Logical channel identifier.

**LED.** Light-emitting diode.

**LF.** Line feed.

**LIC.** Last in chain.

**LLC.** Logical link control.

**LNA.** Logical network address.

**LRC.** Longitudinal redundancy check.

**LU.** Logical unit.

**lumens/m.** Lumens per square meter.

**LU/SSCP.** Logical unit/system services control point.

## M

**m.** Meter.

**MAP.** Maintenance analysis procedure.

**max.** Maximum.

**MB.** Megabyte; 1 048 576 bytes.

**MDT.** Modified data tag.

**MES.** Miscellaneous Equipment Specification.

**MGN.** Multiground neutral.

**MHS.** Magnetic hand scanner.

**min.** Minimum, minute.

**MIS.** Multiple interactive sessions.

**mm.** Millimeter.

**modem.** Modulator-demodulator.

**MPF.** Mapping field.

**MPP.** Maximum presentation position.

**MSR.** Magnetic slot reader.

**MVS.** Multiple virtual storage.

## N

**NA.** Not applicable.

**NAK.** Negative acknowledge.

**NAUN.** Nearest active upstream neighbor.

**NCCF.** Network Communications Control Facility.

**NCP.** Network Control Program.

**NEC.** National Electrical Code.  
**NEMA.** National Electrical Manufacturers Association.  
**NEMF.** Network Error Management Facility.  
**NETBIOS.** Network Basic Input/Output System.  
**NIA.** Network Interface Adapter.  
**NL.** New Line.  
**NMVT.** Network Management Vector Transport.  
**No.** Number.  
**NOLLC.** No logical link control.  
**NOP.** No operation.  
**NPDA.** Network Problem Determination Application.  
**NPKT.** Negotiated packet (size).  
**NRZ.** Non-return-to-zero (recording).  
**NS.** Nonsequenced (format).  
**NTT.** Nippon Telephone and Telegraph.  
**NUL.** Null.  
**NUM.** Numeric.  
**NWND.** Negotiated window (size).

## **O**

**OAF'.** Origin address field prime.  
**OC.** Operation Check.  
**OCIR.** Operator Identification Card Reader.  
**OCR.** Optical character recognition.  
**OD.** Outside diameter.  
**OEM.** Original equipment manufacturer.  
**o'flo.** Overflow.  
**OFFP.** Optical fiber patch cable.  
**OFRPTR.** IBM 8219 Optical Fiber Repeater.  
**OOPT.** Outgoing call option.

**OS.** Operating System.

## **P**

**P.** Printer, protected.  
**PA.** Program access.  
**PAC.** Program authorized credentials.  
**PAM.** Printer authorization matrix.  
**PBX.** Private branch exchange.  
**PC.** Personal Computer.  
**PCKT.** Packet.  
**PEL.** Picture element.  
**pF.** Picofarad.  
**PF.** Program function.  
**PI.** Pacing indicator.  
**PIC.** Problem isolation chart.  
**PID.** Product-set ID.  
**PIU.** Path information unit.  
**PLU.** Primary logical unit.  
**POST.** Power-On Self Test.  
**PRID.** Procedure-related identifier.  
**PS.** Programmed Symbols, physical services.  
**PSDN.** Packet switched data network.  
**PSH.** Physical services header.  
**PSI.** Primary to secondary indicator.  
**PSWD.** Password.  
**PT.** Program Tab.  
**PTT.** Postal Telephone and Telegraph.  
**PU.** Physical unit.  
**PVC.** Permanent virtual circuit, polyvinyl chloride.

## Q

**QFRMR.** Qualified frame reject response.

**QLLC.** Qualified logical link control.

**QRI.** Queued response indicator.

**QSM.** Qualified set mode.

## R

**R.** Rear, row.

**RA.** Repeat to Address.

**RB.** Read Buffer.

**RBM.** Read Buffer Modified.

**Rd Mod.** Read Modified.

**RDL.** Remote Data Link.

**REA.** Rural Electrification Administration.

**RECFMS.** Record Formatted Maintenance Statistics.

**rel.** Relative.

**Req.** Request.

**REQMS.** Request Maintenance Statistics.

**resp.** Response.

**RFI.** Radio-frequency interference.

**RH.** Request/response header.

**RM.** Read Modified.

**rms.** Root-mean-square.

**RNR.** Request not ready, receive not ready.

**RPOA.** Recognized private operating agency.

**RPQ.** Request for price quotation.

**R/R.** Request/response.

**RR.** Request ready, receive ready.

**RSP.** Response.

**Rt.** Right.

**RTM.** Response Time Monitor.

**RTS.** Request to send.

**RU.** Request/response unit.

**RVI.** Reverse interrupt.

## S

**S.** Sequenced (format), side.

**SA.** Selection addressing.

**SABM.** Set Asynchronous Balance Mode (command).

**SARM.** Set Asynchronous Response Mode.

**SBA.** Set Buffer Address.

**SCR.** Silicone-controlled rectifier.

**SCS.** SNA character string.

**SDLC.** Synchronous Data Link Control.

**sec.** Second.

**SF.** Special feature, specify feature, start field.

**SHF.** Set Horizontal Format.

**SI.** Suppress Index.

**SIOF.** Start I/O Fast Release.

**SLU.** Secondary logical unit.

**SM.** Status modifier.

**SMS.** Switching Management System.

**SNA.** Systems network architecture.

**SNBU.** Switched network backup.

**SNF.** Sequence number field.

**SNRM.** Set Normal Response Mode.

**SOEMI.** Serial Original Equipment Manufacturer Interface.

**SOH.** Start of heading.

**sol.** Solicited.

**SOR.** Start of record.

**SP.** Space, Specific Poll.

**SPD.** Selector pen detect.

**SPF.** System Productivity Facility.  
**SRM.** Set Reply Mode.  
**SS.** Surge suppressor.  
**S/S.** Status and sense.  
**SSCP.** System services control point.  
**SSR.** Secure string record.  
**STX.** Start of text.  
**SUB.** Substitute.  
**SVC.** Switched virtual circuit.  
**SVF.** Set Vertical Format.  
**sw.** Switch.  
**SYN.** Synchronous idle.  
**SYSREQ.** System request.

## **T**

**TA.** Terminal adapter.  
**TAF.** Target address field.  
**TC.** Transmission check.  
**TCAM.** Telecommunications Access Method.  
**TCLS.** Throughput class.  
**TCU.** Transmission control unit.  
**TH.** Transmission header.  
**TMA.** Terminal multiplexer adapter.  
**TP.** Teleprocessing.  
**TS.** Transmission services.  
**TSO.** Time Sharing Option.  
**TTD.** Temporary text delay.

## **U**

**U.** Unprotected.  
**UA.** Unnumbered acknowledgment.  
**UC.** Unit check.  
**UE.** Unit exception.  
**UKPSS.** United Kingdom Packet Switching Service.  
**UL.** Underwriters Laboratory.  
**unsol.** Unsolicited.  
**US.** Unit Specify.  
**U.S.** United States.

## **V**

**V.** Volts.  
**vect.** Vector.  
**VFC.** Vertical forms control.  
**VPD.** Vital product data  
**VS.** Virtual storage.  
**VSE.** Virtual Storage Extended.  
**VSPC.** Virtual Storage Personal Computing.  
**VTAM.** Virtual Telecommunications Access Method.  
**VTAME.** Virtual Telecommunications Access Method Extended.

## **W**

**WACK.** Wait before transmit positive acknowledge.  
**WCC.** Write control character.  
**WE.** Western Electric.  
**WNDO.** Window.

**WSF.** Write Structured Field.

**WT.** World Trade.

**X**

**XGA.** Extended Graphics Adapter.

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# Glossary

This glossary includes terms and definitions from the *IBM Dictionary of Computing: Information Processing, Personal Computing, Telecommunications, Office Systems, IBM-specific Terms*, SC20-1699.

The terms in this glossary are defined here as they apply to the 3270 Information Display System.

## A

**access control byte.** The byte following the start delimiter in a token or frame. It is used to control access to the ring.

**access method.** A technique for moving data between main storage and input/output devices.

**access priority.** The maximum priority that a token can have for the adapter to use it for transmission.

**access procedure.** The procedure or protocol used to gain access to a shared resource. In a Token-Ring network the shared resource is the medium. The medium access procedures specified by the IEEE 802 standard are CSMA/CD token, bus, and ring.

**access unit.** See *multistation access unit*.

**active.** Able to communicate on a network. An adapter is active if it is able to pass tokens on the network.

**active monitor.** A function in a single adapter on a ring network that initiates the transmission of tokens and provides token error recovery facilities. Any active adapter on the ring has the ability to provide the active monitor function if the current active monitor fails.

**adapter.** In the IBM Token-Ring Network, the circuit card within a communicating device, and its associated software, that enables the device to communicate over the network.

**Adapter Support Interface.** The software used to operate IBM Token-Ring Network Adapters in an IBM Personal Computer and to provide a common interface to application programs.

**adjusted ring length.** In a multiple-wiring-closet ring, the adjusted ring length is the sum of all wiring closet-to-wiring closet cables in the main ring path less the length of the shortest of those cables.

**alert.** In the IBM Token-Ring Network Manager, a notification appearing on the bottom line of any panel to indicate an interruption or a potential interruption in the flow of data around the ring.

**alphanumeric field.** A field that may contain any alphabetic, numeric, or special characters.

**alternate character set.** A character set, located in the terminal, from which characters are obtained for display and printing by using the graphic escape character in the data stream.

**alternate cursor.** An image reversal of each dot in the character cell at the cursor position.

**ambient.** Environment.

**appendage.** An application program routine provided to assist in handling a specific occurrence.

**application program.** A program written for or by a user that applies to the user's work. Some application programs run on a special kind of application program called a *network application program*. See *network application program*.

**attach.** To connect a device logically to a ring network, so that it can communicate over the network.

**attaching device.** Any device that is physically connected to a network and can communicate over the network.

**attention.** An I/O interruption generated asynchronously by a display station, usually as a result of an action taken by the operator of the device.

**attention identification (AID).** A code that the terminal sends in the inbound data stream to identify the operator action or structured field function that caused the data stream to be sent to the application program. An AID is always sent as the first byte of the inbound data stream. Structured fields in the data stream may also contain an AID over the network.

**attenuation.** A decrease in power from one point to another. In optical fibers, the optical power loss per unit of length is expressed in decibels per kilometer (dB/km) at a specific wavelength.

**attribute.** A characteristic.

**attribute select keyboard.** A keyboard that enables the operator, when permitted by the program, to change the character attributes of the keyed-in character.

**attribute type.** A code that identifies the characteristics from which the associated set of attribute values can be selected. See also *extended color*, *extended highlighting*, and *character set*.

**attribute value.** A code immediately following the attribute type in the data stream that specifies a particular characteristic from the set defined by the attribute type.

**audible alarm.** A special feature that sounds a short, audible tone automatically when a character is entered from the keyboard into the next-to-last character position on the screen. The tone can also be sounded under program control.

**auto removal.** Removing a device from the data passing activity without human intervention. This action is accomplished by the adapter.

**auto-skip.** Same as *automatic skip*.

**automatic polling.** (1) A hardware feature of a telecommunication unit that processes a polling list, polling the terminals in order and handling negative responses to polling without interrupting the processing unit. At the end of the list, polling is automatically begun again at the beginning of the list. Synonymous with *autopoll*. (2) See also *polling*.

**automatic skip.** After entry of a character into the last character position of an unprotected display field, automatic repositioning of the cursor from a protected and numeric field to the first character position of the next unprotected display field.

**autopoll.** Same as *automatic polling*.

## B

**backbone.** A transmission facility that interconnects bridges in hierarchical networks.

**backbone ring.** A ring that interconnects ring networks.

**backup path.** An alternative path for signal flow through access units and their main ring path cabling. The backup path allows recovery of the operational portion of the network while problem determination procedures are being performed.

**balun.** A transformer for connecting balanced (for instance, twisted-pair) cables to unbalanced (for

instance, coaxial) cable by matching the electrical characteristics of the cables.

**bandwidth.** The difference, expressed in Hertz, between the highest and the lowest frequencies of a range of frequencies.

**baseband Token-Ring network.** A Token-Ring network in which information is encoded, multiplexed, and transmitted without modulation of a carrier.

**base color.** The capability to display or print all characters in a field, in one of four colors, on a color terminal by using combinations of the field protection and the field intensify bits of the field attribute.

**beacon.** A frame sent by an adapter indicating a serious ring problem, such as a broken cable. An adapter is said to be *beaconing* if it is sending such a frame.

**binary synchronous communication (BSC).** Data transmission in which character synchronism is controlled by timing signals generated at the sending and receiving stations.

**blink.** An extended highlighting attribute value (for emphasis) of a field or character.

**block matrix.** The total array of dots that can be used to describe a graphic character for a 3270 display or printer.

**bracket.** In VTAM, an exchange of data between an application program and a logical unit that accomplishes some task.

**bridge.** An attaching device connected to two rings simultaneously to allow the transfer of information from one ring to the other. Rings joined together by bridges form multiple-ring networks.

**bridge number.** The identifier that distinguishes parallel bridges (that is, bridges spanning the same two rings).

**broadband Token-Ring network.** A Token-Ring network in which information is encoded, multiplexed, and transmitted with modulation of carriers.

**broadcast topology.** A network topology in which all attaching devices are capable of simultaneously receiving a signal transmitted by any other attaching device on the network.

**buffer.** A storage area reserved for use in performing input/output operations.

**buffer address.** The address of a location in the buffer at which one character can be stored.

**bus.** A type of network topology where the network consists of a bidirectional communication path with defined end points.

**bypass.** To eliminate an attaching device or an access unit from a ring network by allowing the data to flow in a path around it.

## C

**category A terminals.** Terminals that can be attached to the 3174 and to type A adapters in the 3274; for example, the 3278 and 3279 display stations, the 3287 Models 1, 1C, 2, and 2C, the 3262 Models 3 and 13, and the 3289 Models 1 and 2.

**category B terminals.** Terminals that can be attached to type B adapters in the 3274; for example, the 3277 display station, 3284, 3286, 3287 Models 1 and 2, and 3288 Printers.

**channel-attached.** Pertaining to the direct attachment of devices by channels to a host processor. Contrast with *telecommunication-attached*.

**character attribute.** The properties of a character with respect to its color, highlighting, and character set. See also *extended field attribute*.

**character buffer.** The read/write storage used by a partition for storing character or graphic data for display or printing on a terminal.

**character position.** A location on the screen at which one character can be displayed; also, an addressed location in the buffer at which one character can be stored.

**character set.** (1) A defined collection of characters in a loadable or nonloadable set selected by means of a local character set identifier. (2) An attribute type in the extended field and character attributes. (3) An attribute passed between session partners in the Start Field Extended, Modify Field, and Set Attribute orders.

**cladding.** Glass of a low refractive index that surrounds the core of an optical fiber.

**clear indicator.** In VTAM, a SESSIONC indicator sent by one node to another that prevents the exchange of messages and responses.

**closed path (or network).** A network in which all the cable paths and wiring closets are directly or indirectly connected.

**cluster control unit.** (1) A device that can control the input/output operations of more than one device. A remote cluster control unit can be attached to a host processor only via a communication controller. A cluster control unit may be controlled by a program

stored and executed in the unit, or it may be controlled entirely by hardware. (2) See also *communication controller*.

**coaxial cable.** A cable consisting of one inner conductor within, and insulated from, an external shield.

**code violation.** In differential Manchester code encoding, a bit that does not have a state transition at the mid-bit point. See *differential Manchester code*.

**command.** An instruction that directs a control unit or device to perform an operation or a set of operations.

**communication controller.** (1) A type of communication control unit whose operations are controlled by a program stored and executed in the unit. Examples are the IBM 3704 and 3705 Communications Controllers. (2) See also *cluster control unit*.

**completion code.** The final return code provided by the adapter as a result of an issued command.

**component.** Any part of a network other than an attaching device, such as an access unit.

**connecting blocks.** Fixtures used to terminate telephone wires in a wiring closet.

**control block.** In the IBM Token-Ring Network, a specifically formatted block of information provided from the application program to the Adapter Support Interface to request an operation.

**control character.** A character used in conjunction with a Write command to specify that a control unit is to perform a particular operation.

**control codes.** The hexadecimal values hex 00 through hex 3F, and hex FF in the 3270 data stream.

**control disk.** A customized diskette or disk containing the microcode that describes a particular control unit's attached terminals, and its method of attachment to the host.

**controller.** A unit that controls input/output operations for one or more devices.

**conventional 3270.** A locally attached 3270 terminal or a remotely attached 3270 terminal that uses the BSC line discipline.

**copy control character (CCC).** A character used in conjunction with the Copy command to specify the type of data to be copied.

**copy operation.** An operation that copies the contents of the buffer from one display station or printer to

another display station or printer attached to the same control unit.

**core.** The light-transmitting center of an optical fiber.

**cursor.** A unique symbol that identifies a character position in a screen display, usually the character position at which the next character to be entered from the keyboard will be displayed.

**cyclic redundancy check.** A system of error checking performed at both the sending and receiving station after a block check character sequence has been accumulated.

## D

**data circuit-terminating equipment (DCE).** The equipment installed at the user's premises that provides all the functions required to establish, maintain, and terminate a connection, and the signal conversion and coding between the data terminal equipment (DTE) and the line.

**data frame.** See *frame*.

**data link.** Any physical link, such as a wire or a telephone circuit, that connects one or more devices or communication controllers.

**data link layer (or level).** In open systems architecture, the layer that provides the functions and procedures used to establish, maintain, and release data link connections between elements of the network.

**data station.** See *station*.

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

**data terminal equipment (DTE).** Equipment that sends or receives data, or both.

**data transfer.** In telecommunication, the sending of data from one node to another.

**data transfer mode.** A set of facilities (including the macro instructions needed to use them) that enable the application program to communicate with terminals.

**datagram.** A particular type of information encapsulation at the network layer of the adapter protocol for the Network Basic Input/Output System (NETBIOS). No explicit acknowledgment for the information is sent by the receiver. Instead, transmission relies on the "best effort" of the link layer.

**decibels above one milliwatt.** A unit of absolute power measurement that is scaled such that zero dBm equals one milliwatt.

**definite response 1.** In VTAM, a response that indicates whether its associated message was successfully forwarded to its final destination (such as the display screen of an output device).

**definite response 2.** In VTAM, a response that indicates that the node sending the response has accepted recovery responsibility for the associated message.

**delimiter.** A bit pattern that defines the limits of a frame on a Token Ring network.

**designator character.** A character that immediately follows the attribute character in a selector-pen-detectable field. The designator character controls whether a detect on the field will or will not cause an attention. For a nonattention-producing field, the designator character also determines whether the modified data tag for the field is to be set or reset as a result of a selector-pen detect.

**detectable.** An attribute of a display field; determines whether the field can be sensed by the selector pen.

**device.** An input/output unit such as a terminal, display station, or printer. See *attaching device*.

**diagnostics diskette.** A diskette used by computer users and service personnel to diagnose hardware problems.

**dielectric.** Nonconductor of direct electric current.

**differential Manchester code.** A data-encoding method used by the IBM Token-Ring Network. In this method, a bit has the value of binary 0 if there is a state transition (polarity change) at the beginning of the bit boundary. The bit has the value of binary 1 if there is no transition. In a properly encoded bit, there must always be a transition at every *midpoint* position. If the transition is absent, a code violation results. Since only the presence or absence of the state transition (and not the actual polarity) determines a bit's value, this method of coding is polarity-independent.

**display field.** A group of consecutive characters (in the buffer) that starts with an attribute character (defining the characteristics of the field) and contains one or more alphanumeric characters. The field continues to, but does not include, the next attribute character.

**distribution panel.** A wiring board that provides a patch panel function and mounts in a rack.

**dot.** One point in a printer or display block matrix.

**downstream.** On a ring network, the direction of data flow. Contrast with *upstream*.

**drop.** A cable that leads from a faceplate to the distribution panel in a wiring closet. When the IBM Cabling System is used with the IBM Token-Ring Network, a drop may form part of a lobe. See *lobe*.

## E

**equipment rack.** A metal stand for mounting network components, such as distribution panels and IBM 8228 Multistation Access Units.

**equipotential bonding.** A means of limiting ground potential differences within a building.

**Erase All Unprotected (EAU) command.** A command that clears all unprotected fields to nulls, resets modified data tags in all unprotected fields, unlocks the keyboard, resets the attention identifier, and repositions the cursor to the first character of the first unprotected field.

**Erase Unprotected to Address (EUA) order.** An order that erases all unprotected positions (inserts nulls) from the current buffer address up to, but not including, the specified stop address.

**Extended Attribute Buffer (EAB).** A buffer for storing extended field attributes and character attributes.

**extended color.** (1) A capability that allows color terminals to display or print fields or characters in colors using extended field and character attributes. (2) An attribute type in the extended field attribute and character attribute.

**extended field attribute.** Additional field definition to the field attribute that controls defining additional properties such as color, highlighting, character set, and field validation. The extended field attribute is altered by information passed in the Start Field Extended and Modify Field orders.

**extended highlighting.** (1) A function that provides blink, reverse video, and underscore for emphasizing fields or characters on devices supporting extended field attributes and character attributes. (2) An attribute type in the extended field attribute and character attribute. (3) An attribute passed between session partners in the Start Field Extended, Modify Field, and Set Attribute orders.

## F

**faceplate.** A plate for connecting data and voice connectors to a cabling system. It may be wall-mounted or surface-mounted.

**fault domain.** In IBM Token-Ring Network problem determination, the portion of a ring that is involved with an indicated error.

**field.** See *display field*.

**field attribute.** A control character stored in the character buffer in the first character position of a field. For those devices supporting the 3270 data stream, a field attribute defines protected/unprotected, alphanumeric/numeric, detectable/nondetectable, display/nondisplay, intensity, and modified data tag.

**field inherit.** A bit setting in the character attribute that defaults the character properties to the extended field attributes or device default if the buffer is unformatted.

**FME response.** See *definite response 1*.

**formatted diskette.** A diskette that can be used by the computer to store data.

**formatted display.** A screen display in which a display field, or fields, has been defined as a result of storing at least one attribute character in the display buffer.

**frame.** The unit of transmission in the IBM Token-Ring Network. It includes delimiters, control characters, information, and checking characters.

## G

**gateway.** A device and its associated software that interconnect Token-Ring networks that use different logical link protocols.

**general polling.** (1) An input technique for remote 3270 devices in which special invitation characters are sent to a device control unit instructing that control unit to begin transmission from all devices ready to enter data. (2) See also *polling* and *specific polling*.

## H

**hard error.** A error condition on a Token-Ring network that requires that the ring be reconfigured or that the source of the error be removed before the ring can resume reliable operation.

**hertz (Hz).** A unit of frequency equal to one cycle per second.

**hierarchical network.** A multiple-ring network configuration providing only one path through intermediate rings between source rings and destination rings. Contrast with *mesh network*.

**hop count.** The number of bridges through which a frame has passed on the way to its destination.

**hop count limit.** The maximum number of bridges through which a frame may pass on the way to its destination.

## I

**idles.** Signals sent along a ring network when neither frames nor tokens are being transmitted.

**input device.** A device in a data processing system by which data may be entered into the system.

**Insert Cursor (IC) order.** An order that displays the cursor at the current buffer address.

**intensified display.** An attribute of a display field; causes data in that field to be displayed at a brighter level than other data displayed on the screen.

**intermediate telephone closet.** A room containing connection points for telephone wiring, located between the main telephone closet and work areas.

## J

**jack.** A connecting device to which a wire or wires of a circuit may be attached and that is arranged for insertion of a plug.

## L

**layer.** One of the seven layers of the Open Systems Interconnection reference model.

**leased line.** See *nonswitched line*.

**Library disk.** A diskette or fixed disk that contains customizing data for some or all of the control units in a network.

**limited broadcast.** The forwarding of specially designated broadcast frames only by bridges that are enabled to forward them.

**line control characters.** Characters that regulate the transmission of data over a line; for example, delimiting messages, checking for transmission errors, and indicating whether a station has data to send or is ready to receive data.

**link.** The logical connection between nodes including the end-to-end link control procedures.

**link connection.** All physical components and protocol machines that lie between the communicating link stations of a link. The link connection may include a switched or leased physical data circuit, a Token-Ring network, or an X.25 virtual circuit.

**link station.** (1) A specific place in a service access point that enables an adapter to communicate with another adapter. (2) A protocol machine in a node that manages the elements of procedure required for the exchange of data traffic with another communicating link station.

**lobe.** In the IBM Token-Ring Network, the section of cable (which may consist of several segments) that connects a device to an access unit.

**lobe logic.** The portion of the circuitry within an access unit that is associated with a single lobe receptacle on the access unit.

**lobe receptacle.** An outlet on an access unit for connecting a lobe.

**local area network.** A network in which communications are limited to a moderate-sized geographic area such as a single office building, warehouse, or campus and which do not generally extend across public rights-of way.

**logical link control procedure.** In a Token-Ring network, the part of the protocol that governs the assembling of transmission frames and their exchange between data stations independently of how the transmission medium is shared.

**logical unit.** The combination of programming and hardware of a teleprocessing subsystem that comprises a terminal for a SNA access method.

**loop.** A closed unidirectional signal path connecting input/output devices to a network.

## M

**MAC frame.** Frames that control the operation of the IBM Token-Ring Network and any ring station operations that affect the ring.

**main ring path.** The part of the ring made up of access units and the cables connecting them.

**main telephone closet.** A room where telephone cables enter a building and are connected to building telephone wiring.

**maintenance analysis procedure (MAP).** A document that gives the customer or service representative a step-by-step procedure for tracing a symptom to the cause of failure.

**medium.** A physical carrier of electrical energy.

**medium access control (MAC) procedure.** In a Token-Ring network, the part of the protocol that governs access to the transmission medium independently of the physical characteristics of the medium, but taking into account the topological aspects of the network, in order to enable the exchange of data between data stations.

**mesh network.** A multiple-ring network configuration providing more than one path through intermediate rings between source rings and destination rings. Contrast with *hierarchical network*.

**modified data tag (MDT).** A bit in the attribute character of a display field, which, when set, causes that field to be transferred to the channel during a read-modified operation. The modified data tag may be set by a keyboard input to the field, a selector-pen detection in the field, a card read-in operation, or program control. The modified data tag may be reset

by a selector-pen detection in the field, program control, or the ERASE INPUT key.

**Modify Field (MF).** An order that allows specified field attributes to be modified.

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

**multistation access unit.** In the IBM Token-Ring Network, a wiring concentrator that can connect up to eight lobes to the network.

## N

**nearest active upstream neighbor (NAUN).** Nearest active upstream neighbor. For any given attaching device on a ring network, the attaching device that is sending data directly to it.

**Netview.** 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 terminal.

**network.** (1) An interconnected group of nodes. (2) The assembly of equipment through which connections are made between data stations. See *token ring*.

**network administrator.** A person who manages the use and maintenance of a network.

**network application program.** A program used to connect and communicate with adapters on a network, enabling users to perform application-oriented activities and to run other application programs.

**node.** An endpoint of a link or a junction common to two or more links in a network.

**nonswitched line.** A connection between a remote 3270 unit and a computer that does not have to be established by dialing.

## O

**observer terminal.** In problem determination for the IBM Token-Ring Network, the device used to run the Ring Diagnostic or a network application program that is capable of providing ring status information.

**office.** See *work area*.

**ohm.** The practical meter-kilogram-second unit of electric resistance equal to the resistance of a circuit in which a potential difference of 1 volt produces a current of 1 ampere.

**open.** (1) To make an adapter ready for use. (2) A break in an electrical circuit.

**operational diskette.** See *working diskette*.

**optical fiber.** A single, separate optical transmission element comprising a core and a cladding.

**optical fiber cable.** One or more optical fibers with strengthening material and a protective cover.

**optical fiber connector.** Hardware installed on optical fiber cable ends to provide physical and optical cable attachment to a transmitter, a receiver, or a communication patch panel.

**order code.** A code that may be included in the write data stream transmitted for a display station or printer; provides additional formatting or definition of the write data.

**order sequence.** A sequence in the data stream that starts with an order code and includes a character address and/or data characters related to the order code.

**outgoing group.** In systems with TCAM, that section of a message handler that manipulates outgoing messages after they have been removed from their destination queues.

**output device.** A device in a data processing system by which data may be received from the system.

## P

**passive wiring concentrator.** A wiring concentrator that does not require a power source. See *wiring concentrator*.

**patch cable.** In the IBM Cabling System and the IBM Token-Ring Network, a length of type 6 cable with data connectors on both ends.

**path.** In a network, a route between any two nodes.

**path trace.** A function that may be requested of a bridge by a received frame. The request is for a record of the bridges through which the frame has passed.

**plenum cable.** A cable that is UL-listed as having adequate fire resistance and low smoke-producing characteristics for installation without conduit in ducts, plenums, and other spaces used for environmental air, as permitted by NEC Articles 725-2(b) and 800-3(d).

**polling.** A technique by which each of the terminals sharing a communication line is periodically interrogated to determine whether it requires servicing.

**Power-On Self Test (POST).** A series of diagnostic tests that are run each time the computer's power is turned on.

**Prepare to Read (PTR).** A command for a local 3274 Model 1D that allows the terminal to know the next program action.

**private branch exchange (PBX).** A private telephone exchange, automatic or manual, that provides for the transmission of calls to and from the public telephone network.

**problem isolation chart (PIC).** A diagnostic procedure for finding problems with a personal computer or its options.

**program attention key.** Any key on the keyboard that solicits program action by generating an I/O interruption. The keys are the CLEAR key, ENTER key, CNCL key, program function keys, and program access keys. Each program attention key is associated with a unique attention identification (AID) character.

**program function (PF) key.** A program attention key that may be defined to solicit program action that usually requires data to be read from the buffer of the display station. If a Read Modified command is issued in response to the program function key interruption, the attention identifier (AID) and all display fields in which the modified data tags are set are transferred to the program.

**Program Tab (PT) order.** An order that advances the current buffer address to the address of the first character location of the next unprotected field.

**Programmable Symbols (PS).** Customer-defined symbols, a maximum of 190 symbols to a programmed symbol set.

**protected field.** A display field for which the display operator cannot use the keyboard or operator identification card reader to enter, modify, or erase data.

**protocol.** (1) The set of rules governing the operation of functional units of a communication system that must be followed if communication is to be achieved. (2) A procedure for ordering the exchange of formatted information packets between correspondents. Protocols are interpreted by hardware and software within the adapter.

**protocol handler.** Programming in an adapter that encodes and decodes the protocol used to format signals sent along a network.

## R

**rack inventory chart.** A chart indicating the location of the components installed in the rack.

**read-only memory (ROM).** A computer's storage area whose contents cannot be modified.

**Receive receptacle.** On the IBM 8219 Optical Fiber Repeater, the receptacle that receives the signal in the main ring.

**receptacle.** See *lobe receptacle*.

**register.** A storage area in a computer where specific data is stored.

**remove.** To take an attaching device off the ring.

**Repeat to Address (RA) order.** An order that stores a specified alphanumeric or null character in up to 480 buffer locations, starting at the current buffer address and ending at, but not including, the specified stop address.

**repeater.** In a ring network, a device that amplifies or regenerates data signals in order to extend the distance between attaching devices.

**return code.** A hexadecimal value provided by the adapter to indicate the result of an action.

**ring (network).** A network configuration where a series of attaching devices are connected by unidirectional transmission links to form a closed path.

**Ring Diagnostic.** In the IBM Token-Ring Network, a program to be run in an IBM Personal Computer that provides the user information regarding the performance of the ring.

**ring error limit.** In the Ring Diagnostic, the point at which the number of soft errors can make ring operation unreliable.

**ring in (RI).** On an access unit, the receive or input receptacle.

**ring out (RO).** On an access unit, the transmit or output receptacle.

**ring sequence.** The order in which devices are attached on a ring network.

**ring status.** The condition of the ring.

**ring topology.** A logically circular, unidirectional transmission path without defined ends. Control can be distributed or centralized.

**routing.** The assignment of the path by which a message will reach its destination.

**RRN response.** See *definition response 2*.

## S

**segment.** A section of cable between components or devices on the network. A segment may consist of a single patch cable, multiple patch cables connected together, or a combination of building cable and patch cables connected together.

**selector pen.** A pen-like instrument that may be attached to the display station as a special feature. When pointed at a detectable portion of an image and then activated, the selector pen senses the presence of light at a display field and produces a selector-pen detect.

**selector-pen detect.** The sensing by the selector pen of the presence of light from data in a display field that has the detectable attribute. Depending on the designator character of that display field, the detection and location information is identified on the screen (and stored in the buffer) or may produce an interrupt that is transmitted to the CPU. units that can be activated, tailored to provide various protocols, and deactivated as requested.

**server.** A device on a network dedicated to specific functions.

**service access point.** A logical point made available by an adapter where information can be received and transmitted. A single SAP can have many links terminating in it.

**service clearance.** Minimum space required to allow working room for the machine operator and/or the customer engineer for servicing the unit.

**session.** (1) A connection between two application programs that allows them to communicate. (2) In SNA, a logical connection between two network addressable units that can be activated, tailored to provide various protocols, and deactivated as requested.

**SESSIONC indicators.** In VTAM, indicators that can be sent from one node to another without using SEND or RECEIVE macro instructions. SDT, clear, and STSN are SESSIONC indicators. All SESSIONC indicators are sent with a SESSIONC macro instruction.

**Set Attribute (SA) order.** An order that associates attributes in the EAB with individual characters.

**Set Buffer Address (SBA) order.** An order that sets the buffer address to a specified location.

**shared RAM.** Random access storage on the adapter that is shared by the IBM PC.

**soft error.** An intermittent error on a network that causes data to have to be transmitted more than once to be received. A soft error does not, by itself, affect the network's overall reliability. If the number of soft errors reaches the ring error limit, reliability is affected.

**specific polling.** (1) A polling technique that sends invitation characters to a device to find out whether the device is ready to enter data. (2) See also *general polling* and *polling*.

**star.** A wiring arrangement in which an individual cable runs from each work area to a concentration point.

**start delimiter.** The first byte of a token or frame. It consists of a special recognizable bit arrangement.

**Start Field (SF) order.** An order that indicates a specified location which contains an attribute byte and not a text character.

**Start Field Extended (SFE) order.** An order that generates an extended field attribute in the EAB and at the current buffer location.

**station.** (1) A work station. (2) A communication device attached to a network. The term used most often in the IBM Token-Ring Network.

**structured field.** A data stream format that permits variable-length data and controls to be parsed into its components without having to scan every byte.

**Suppress Index (SI) order.** An order that generates the suppress index character, valid only for the 3288-2 printer. This character inhibits a line index to allow overprinting.

**switched line.** A communication line in which the connection between the computer and a remote terminal is established by dialing.

## T

**telecommunication-attached.** Pertaining to the attachment of devices to a central computer through a communication control unit. Contrast with *channel-attached*.

**telecommunication network.** In a telecommunication system, the combination of all terminals and other telecommunication devices and the lines that connect them.

**terminal.** (1) A point in a system or communication network at which data can either enter or leave. (2) Any device capable of sending and receiving information over a communication channel.

**terminal-initiated logon.** A logon request that originates from the terminal.

**terminal multiplexer.** A device, such as the 3299 Terminal Multiplexer, for interleaving the signals for many devices onto a single coaxial cable.

**terminating room.** See *wiring closet*.

**token.** A sequence of bits passed from one device to another along the network. When the token has data appended to it, it becomes a *frame*.

**token monitor.** Synonym for *active monitor*.

**token ring.** A network with a ring topology that passes tokens from one attaching device to another.

**transmission medium.** A physical carrier of electrical energy or electromagnetic radiation.

**Transmit receptacle.** On the IBM 8219 Optical Fiber Repeater, the receptacle that transmits the signal in the main ring.

**twinaxial cable.** A shielded cable with two conductors inside a larger conductor. The conductors are insulated from the larger conductor and from each other.

## U

**unformatted display.** A screen display in which no attribute character (and, therefore, no display field) has been defined.

**unprotected field.** A display field for which the display station operator can manually enter, modify, or erase data.

**upstream.** On a ring network, the direction opposite that of data flow. Contrast downstream.

**Utility disk.** A diskette or fixed disk that contains the microcode necessary to run various customizing utilities, for example, to copy portions of a diskette for a backup diskette.

## V

**vertical drop distance.** The vertical distance from the faceplate to the raceway, which is in either the ceiling or the floor.

## W

**wide area network.** A network that provides data communication capability in geographic areas larger than those serviced by local networks.

**wire fault.** An error condition caused by a break in the wires or a short between the wires (or shield) in a segment of cable.

**wiring closet.** A room that contains one or more equipment racks and distribution panels that are used to connect cables together to form physical networks.

**wiring concentrator.** A lobe concentrator that allows multiple attaching devices access to the ring at a central point such as a wiring closet or in an open work area.

**work area.** An area in which terminal devices (such as displays, keyboards, and printers) are located. Access units may also be located in work areas.

**work station.** An input/output device that allows transmission of data or reception of data as needed to perform a job.

**working diskette.** A computer diskette to which files are copied from an original diskette for use in everyday operation.

**wraparound.** The continuation of an operation (for example, a read operation or a cursor movement operation) from the last character position in a buffer to the first character position in the buffer.

**write control character (WCC).** A character used in conjunction with a Write command to specify that a particular operation, or combination of operations, is to be performed at a display station or printer.

**Write Structured Field (WSF) command.** A command used for processing structured fields.

## 3

**3270 data stream.** A coded character data stream.



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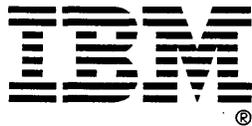
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