IBM

8100 Information System

An Introduction to the IBM 8100 Information System

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An Introduction to the IBM 8100 Information System

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Preface

This manual contains introductory information about the IBM 8100 Information System. Its objective is to assist the reader in understanding the 8100 Information System, the interrelationships of its components, and its approach to distributed data processing. Briefly discussed are system concepts, programming support, hardware components and features, and input/output devices that can be attached to the system.

Audience

Any user or potential user of the 8100 Information System, including managers, programmers, and installation planners, should be familiar with the contents of this manual. A general knowledge of data processing concepts, data communication concepts, and event-driven systems is assumed.

Organization

The information in this manual is divided into two parts of five chapters each. Part 1 is an "Executive Overview" that is for customer executives who will evaluate the use of distributed data processing in resolving their enterprises' needs. Part 2 is a "Technical Overview" that is for managerial and technical people who will evaluate the feasibility of using the 8100 Information System to realize a tailored distributed data processing system.

Part 1. Executive Overview

Chapter 1. Introduction
This chapter presents distributed systems concepts as compared to decentralized and centralized systems. It also introduces the 8100 Information System and explains how it covers the spectrum of decentralized-distributed-centralized processing.

Chapter 2. Relationship to Other Systems
This chapter presents the 8100 Information System building block approach to growth, either upward (to a centralized system) or downward (from a centralized system).

Chapter 3. Highlights–Hardware
This chapter introduces all the hardware components of the 8100 Information System.

Chapter 4. Highlights–Programming
This chapter introduces the two families of IBM programming support for the 8100 Information System, DPPX and DPCX.

Chapter 5. Reliability, Availability, and Serviceability
This chapter presents the tools and levels of support that are available for the 8100 Information System to allow for reliability, availability, and serviceability.

Part 2. Technical Overview

Chapter 6. Unit Configurations
This chapter presents the details about the functions and features of the 8130, 8140, and 8101.

Chapter 7. Processor Characteristics
This chapter describes the functions of the 8130 and 8140 processors.

Chapter 8. Input/Output Functions and Features
This chapter describes the functions and features of disk storage, communication facilities, loops, and operator panels, as they pertain to the 8130, 8140, and the 8101.

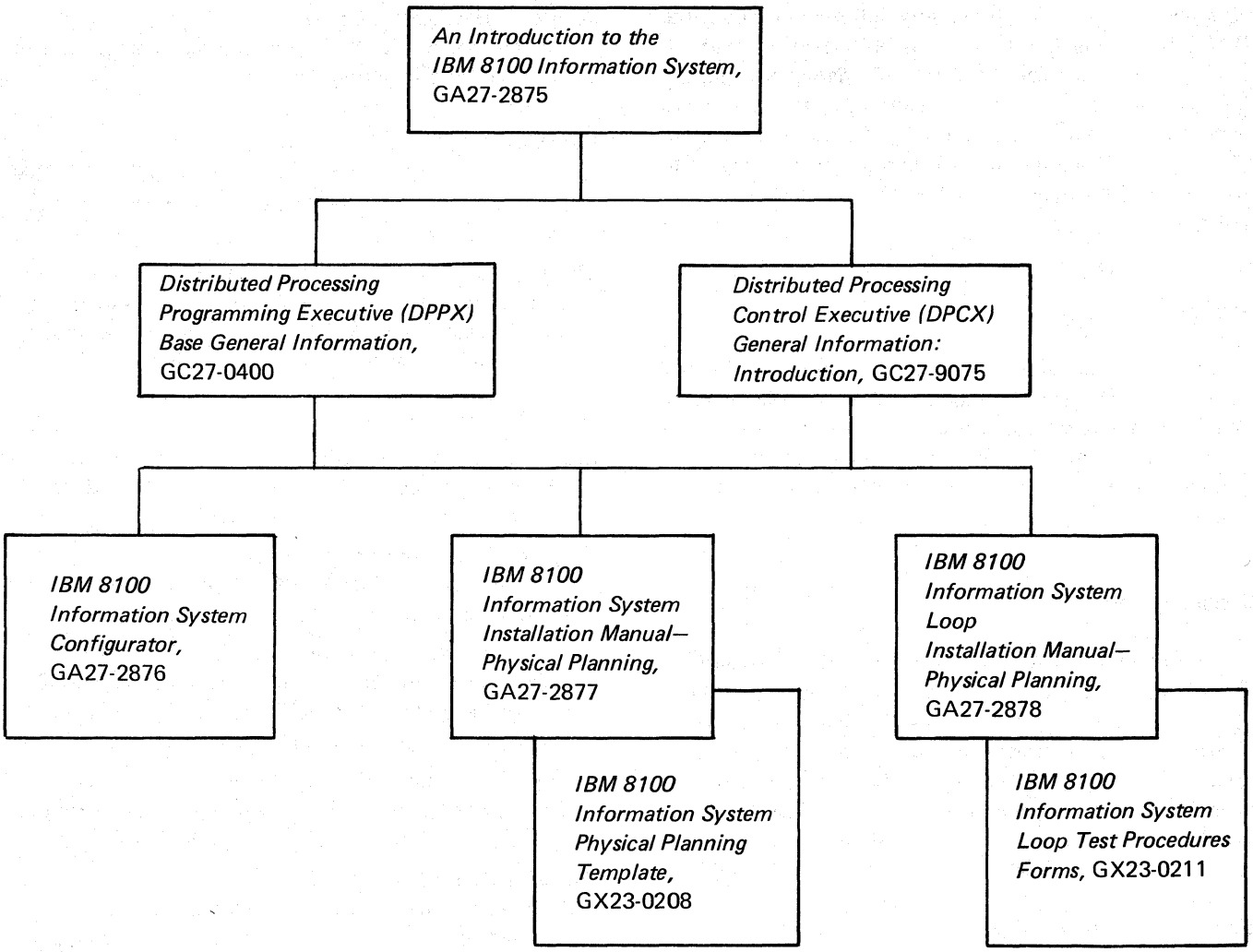
Chapter 9. Communication Capabilities
This chapter presents the communication facilities that may be used with the 8100 Information System.

Chapter 10. Attachable IBM Devices
This chapter presents all the IBM devices that can be attached to and are supported by the 8100 Information System.

Scope

This document discusses all of the 8100 Information System hardware components, features, and capabilities. The DPPX and DPCX licensed programs support different subsets of these. For details of what each licensed program does support, refer to the general information manual for that program.

Related Publications



Contents

Figures

Part 1. Executive Overview

This executive overview is for customer executives who will evaluate the use of distributed data processing in resolving the needs of their enterprise. At the end of this overview, the reader may:

- Continue with Part 2, "Technical Overview."
- Continue with *Distributed Processing Programming Executive (DPPX) Base General Information,* GC27-0400.
- Continue with *Distributed Processing Control Executive (DPCX) General Information: Introduction,* GC27-9075.

IBM 8100 Information System (Design Models)

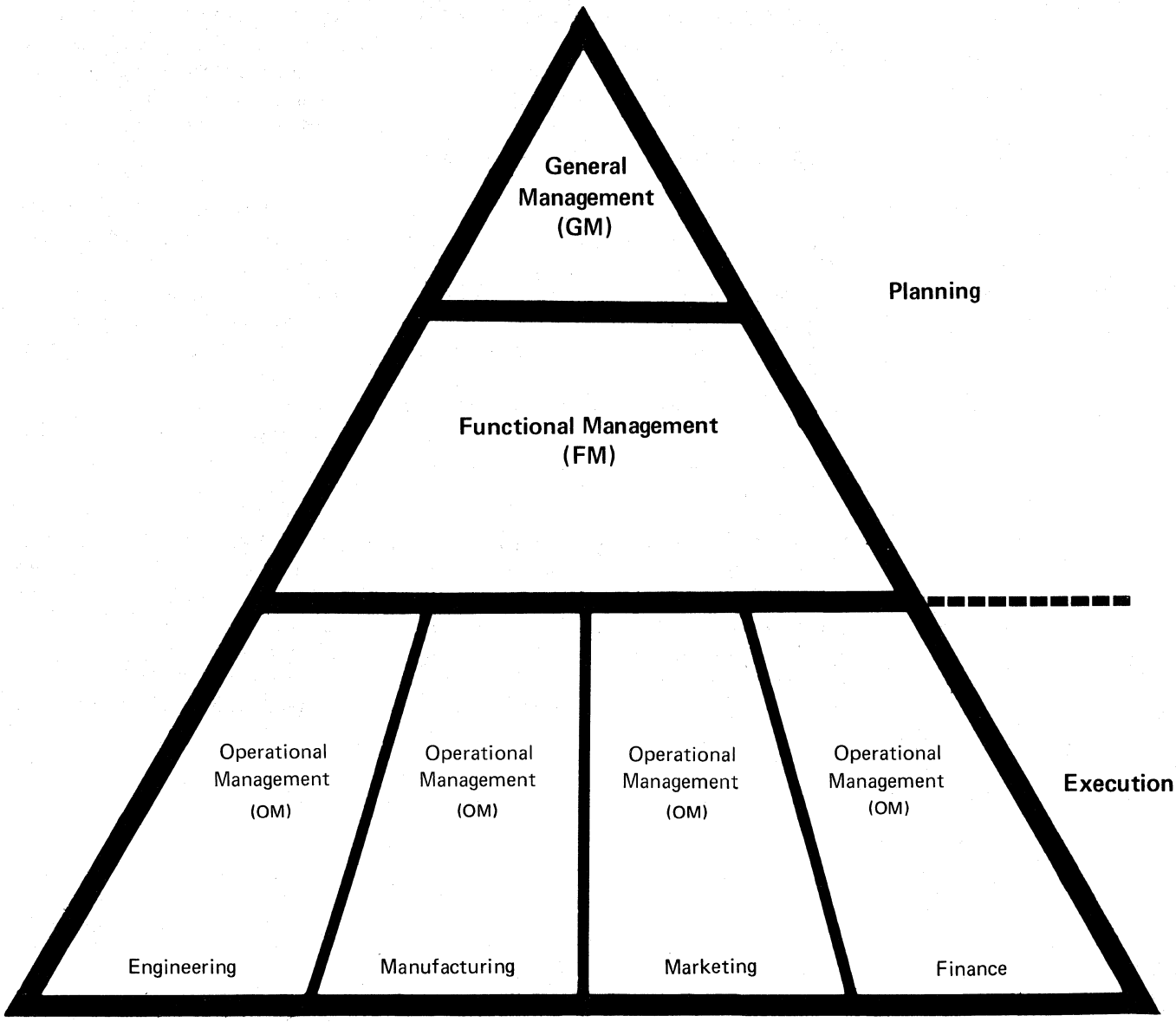
Chapter 1. Introduction

The IBM 8100 Information System shown in the frontispiece is a new addition to IBM's distributed systems products. It offers alternatives of price and function to the distributed data processing customer. The 8100 Information System also offers alternatives for implementing applications through a systems approach to the distribution of processing capabilities. It can be tailored to a wide variety of installations and can be used in many business and industrial applications.

The 8100 Information System is a multipurpose data processing system that can operate stand-alone or as part of a hierarchy of interconnected processors, which can be other 8100s, System/370s, or systems supplied by other manufacturers. Two kinds of programming support are offered for the 8100 hardware: Distributed Processing Programming Executive (DPPX), a group of licensed programs, and Distributed Processing Control Executive (DPCX), a licensed program that provides programming function compatible with the 3790 Communication System. Numerous I/O devices can be connected to the 8100 Information System either directly or through a common carrier communication line (hereafter referred to as a data link). Many of these devices can also be connected to communication loops, which are attached to the 8100 Information System directly or by data link.

Systems Network Architecture (SNA) is the basis for the 8100 Information System communication support; it offers an orderly, structured approach to distributed processing. Although Synchronous Data Link Control (SDLC) is the SNA communication discipline, the 8100 Information System allows for migration by supporting the Binary Synchronous Communication (BSC) and Start-Stop (S/S) disciplines. The 8100 Information System can be integrated into an existing communication network, which can gradually become an SNA network as newer communication devices and additional 8100 systems are added.

Data Processing and the Management of an Enterprise



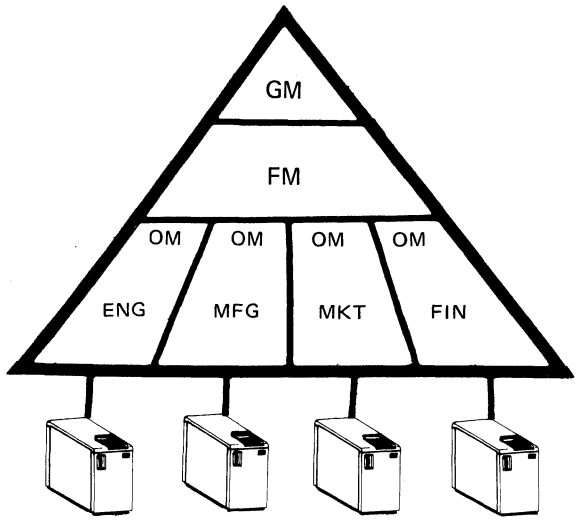
The management of an enterprise can organize its data processing in a variety of ways, ranging from totally decentralized to totally centralized.

Centralized | Decentralized

The organization is based on the present and future data processing needs as the management of an enterprise perceives them and on the data processing equipment and programming support available.

At one end of the data processing spectrum, an enterprise can take the decentralized approach. Each operational department sets up its own stand-alone data processing system. Operational management finds this approach very attractive, for a decentralized system allows:

- End users to participate in the scheduling and development of applications programs
- Administrative or production personnel to use the system easily
- Operational departments to ensure that their own data processing requirements, both future and present, are met
- Straight-forward cost justification
- High availability
- Fast application implementation without complicated systems and highly trained application programmers

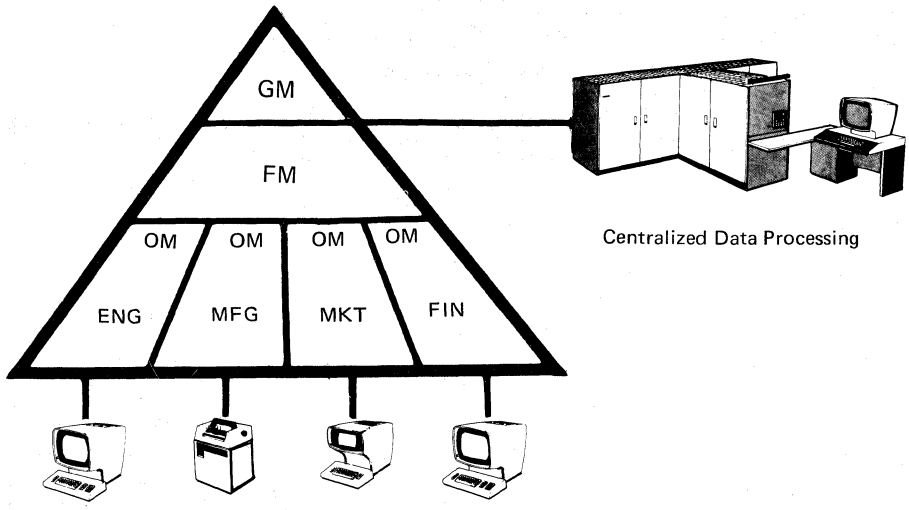


Stand-Alone Decentralized Data Processing

However, a series of these stand-alone systems can lead to duplication of effort and resources within the enterprise. Since these systems are controlled by discrete operational departments, there may not be uniform standards and controls from department to department, thus making the exchange of programs and data within the enterprise difficult or impossible.

Data is a valuable corporate resource. Much of the data created, used, and modified at the operational level is of significant value at the functional and general management levels. It can be used at these levels for the overall control and measurement of the enterprise. A decentralized system could result in the fragmentation of the enterprise's information system making it difficult for an enterprise to gather this information and control its flow throughout the enterprise. Management could therefore lose control of this valuable resource.

At the other end of the data processing spectrum is the centralized approach. With this approach, the general management of the enterprise consolidates the data processing function. Data base capabilities provide the means not only to eliminate redundancy, but also to bring together all the pieces of information into a valuable reservoir of corporate information. Controls are easier to implement and manage, and integrated applications are developed across the enterprise.

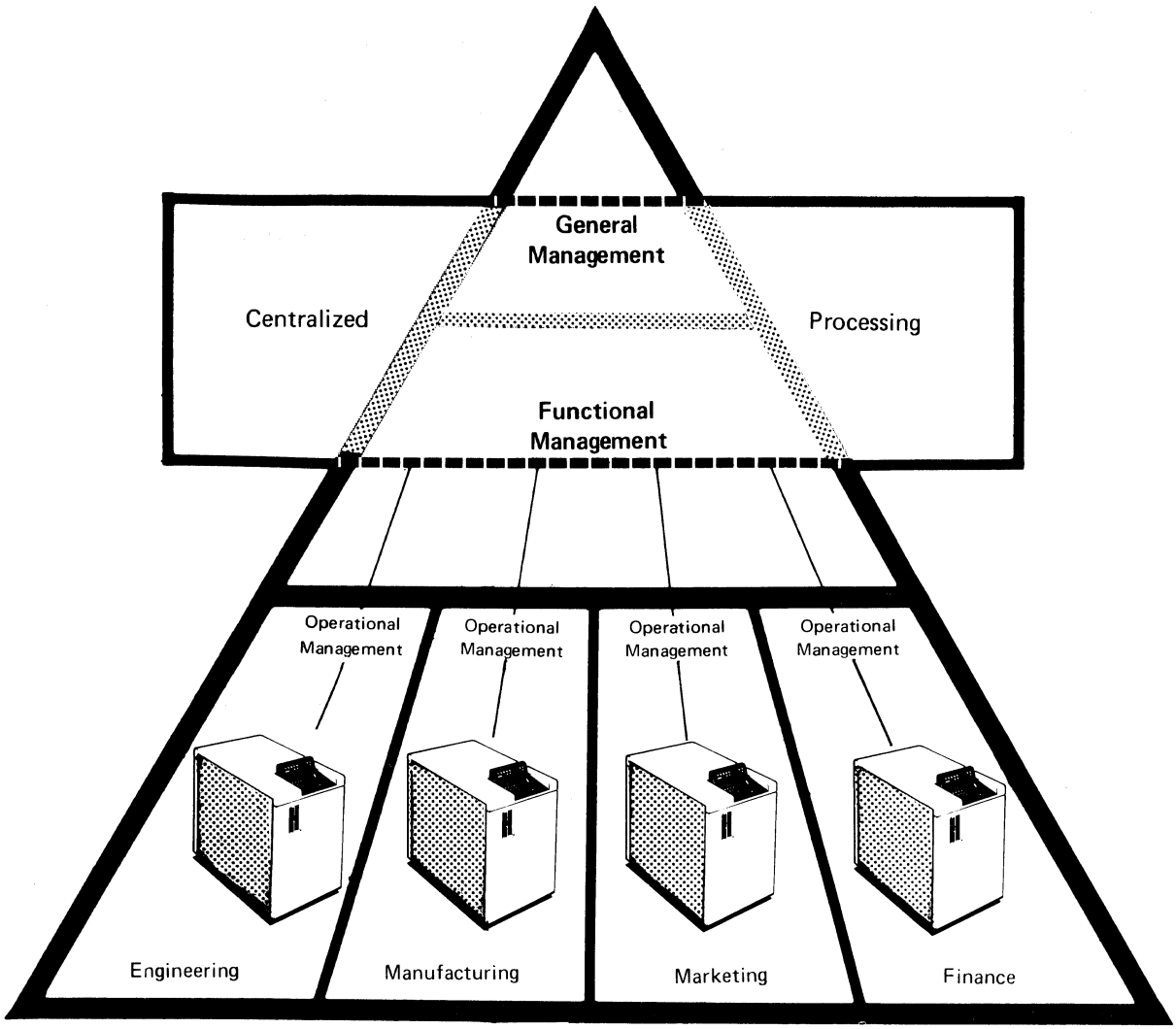


Centralized Data Processing

With centralized data processing, the end users at the operational level of the enterprise have their processing and data access needs satisfied through terminals, which allow them to interact with the processors and data base that serve the entire enterprise.

These centralized data processing departments direct resources to developing and implementing applications that serve non-operational areas. When they devote resources to operational applications, they must consider the needs of all operational departments. Individual operational departments can have difficulty getting their unique and changing data processing requirements satisfied. For this reason, and with the improvements in cost and performance in decentralized data processing technology, operational departments often find the decentralized approach very attractive.

To satisfy the ever-changing needs of the operational, functional, and general management levels, a data processing system must be flexible. It must satisfy the end user's data processing needs while maintaining the overall structure of the enterprise's information system. Standards must be set to control the structure and maintenance of the data base. Within this framework, end users must be able to use applications suitable for their unique operations. The systems must be able to grow and change as the data processing needs of the enterprise change.



Distributed Processing

Distributed Data Processing

Centralized | Distributed | Decentralized

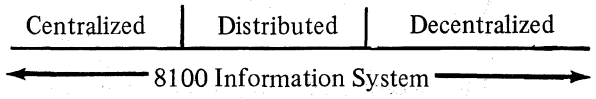
Distributed data processing satisfies this demand for a unified information system for the enterprise and the needs of end users at the operational level. Processing is performed at many locations in a wide variety of ways, each tailored to the application requirements of the end user. Programmable devices with data storage are connected to host or interconnected processors through communication links. Thus a distributed system can satisfy both the demand for a unified information system for the enterprise and the needs of end users at the operational level. Functions and data can be distributed within a network of processors to provide each level with both data and processing resources for increased productivity and management control of those resources. Distributed processing retains advantages of both centralized and decentralized processing and adds the flexibility to meet end-user requirements at all levels. It offers economies of scale, because data, programs, procedures, skills, and control can be shared. Programming, standards and procedures, security and integrity, and sensitive data can also be controlled and managed. At the same time, the end user can control application programs and make them meet the specific requirements of the operational department.

The IBM 8100 Information System: A Flexible Distributed Processing System

The 8100 Information System covers the entire data processing spectrum. It may be installed "bottom-up," that is, as decentralized systems at the operational level, and later connected to a distributed network.

It may be installed "top-down," as primary data processing nodes to larger centralized systems such as System/370.

It may even be installed as the primary system to other interconnected 8100 Information Systems.



The 8100 Information System has the configuration flexibility and programming support that enables data processing systems to grow and change as the needs of your enterprise grow and change.

It offers high function at low cost, a choice of primary licensed programs, and a wide selection of storage and I/O options, including direct access storage devices, a magnetic tape unit, communication facilities, printers, and printer/display terminals. The 8100 Information System accommodates multiple user environments by allowing the most appropriate of a variety of configurations to be selected, in order to fit the distributed system to the desired application.

With the 8100 Information System, your data processing system can evolve into a distributed processing system that provides:

Management control

Distributed functions

Distributed data

Communication alternatives

Implementation alternatives

System management

Management Control

With the 8100 Information System, management control of data processing can be maintained at the general and functional management levels, while distributing the processing of many applications.

At the central processor location, general and functional management retains the advantages of centralized data processing:

- Economies of scale in the use of hardware and the application of data processing skills
- Minimum redundancy in the development of applications throughout an enterprise
- The development and control of data processing standards
- The ability to manage applications both vertically and horizontally within the business

At the distributed processor locations, operational management gains the support of other systems in the network while retaining the advantages of decentralized processing:

- The ability to implement low-risk applications quickly
- High system availability for end-user applications
- Control of those applications that are unique to a particular operational function
- The ability to cost justify the distributed system in relation to the job at hand

Distributed Functions

The 8100 Information System has the ability to distribute processing functions throughout the enterprise, depending on where they can be most effective.

Applications can be moved from the central processor location to locations where they more logically or economically belong. New applications that are unique to the end user can be executed in the distributed processor. The ability to distribute processing functions permits a balanced approach: necessary control at the central location; sufficient flexibility for the end user.

Distributed Data

The 8100 Information System has the ability to distribute data, depending on where it is created, used, and stored.

Distributed processing can be a logical extension of present data base concepts. The central data base often contains information frequently accessed by remote users via terminals. Yet there may be no real requirement to keep that information on the central data base. In a simplified corporate structure, central control is at the top level, delegation of responsibility and assignment of work flow down through the organization, and information needs to be fed back to the top level. Typically, the amount of information processing that takes place is greatest at the operational level, and only summary data needs to be sent upward. In a data communication environment, as applications to support user departments are developed, requirements for information flow can increase, with corresponding increases in communication line costs and corresponding losses in response time.

With the 8100 Information System, the data processing needs of the organization can be closely matched by designing a system that:

- Stores strategic data at the corporate level
- Stores tactical information at the operational level
- Stores uniquely required information only where that requirement exists
- Stores commonly used information centrally, making it accessible to remote users for inquiry, processing, or update

Communication Alternatives

The 8100 Information System is a communication-based system. Its communication support is based on Systems Network Architecture (SNA) and Synchronous Data Link Control (SDLC), the SNA communication discipline. The older line disciplines, Binary Synchronous Communication (BSC) and Start-Stop (S/S), are also supported. Therefore, the 8100 Information System can be integrated into an existing communication network, with gradual migration to a SNA network, as newer communication devices and additional 8100 systems are added.

Because of its integrated hardware and programming capabilities, the IBM 8100 Information System, can be connected to a System/370 host or to other 8100 system processors. The System/370 host connection can range from the total dependence of a full-time linkage to the casual connection of manual dial-up with data store and forward. User applications determine the particular interprocessor relationship required.

Implementation Alternatives

The 8100 Information System offers the option of designing, developing, and testing applications either centrally or remotely, or in a combination of locations. Remote locations can develop stand-alone applications to support unique end-user needs, while systems to be used across operational areas can be developed centrally or jointly. The result can be greater responsiveness to end-user requests, and improved end-user involvement in system design and implementation. Regardless of where applications are developed, central control can be maintained.

Though the 8100 Information System is a major adjunct to System/370 host processing and is usually related to a centralized implementation, it can be installed as stand-alone systems in user departments remote from a central processor site. Applications development can be managed and implemented centrally or by the remote user department. Host connection and involvement in the distributed application can be present from the beginning of distributed systems development or can be added later. The relationship between the central system and the distributed systems is a factor in selecting which 8100 Information System licensed program is best suited to the total distributed systems plan.

System Management

The 8100 Information System provides the ability to manage a distributed processing network from a central location. Network problem determination can occur from the central site. Programs can be generated from a central location for all processors in the network, and those programs can also be updated from a central location.

Systems Network Architecture (SNA) Advantages

As stated earlier, the 8100 Information System's communication architecture is based upon IBM Systems Network Architecture. SNA defines a systematic approach to implementing communication-based applications. It provides communication systems of today with benefits similar to those that System/360 architecture provided for batch processing a decade ago.

SNA removes the need to provide logical and physical network and terminal control functions from customer application programs and puts those functions into IBM program offerings. This allows application programmers to concentrate on application requirements, which should reduce the time and effort required to implement and maintain user applications.

This architecture can provide device independence between the application program and the terminal. Because SNA terminals operate with a single line protocol (synchronous data link control), they can communicate with application programs through a common set of IBM programs. Terminals can be installed with the function and speed needed today and upgraded later to terminals with increased function or without the massive application reprogramming that was sometimes required in a pre-SNA environment.

Because all SNA devices use a standard line protocol, different SNA terminal types can share a single communication line. This resource sharing can reduce or even eliminate costs of redundant lines and networks previously required to support various terminal types. SNA offers greater potential use of data communication resources across all applications in the system. An objective of SNA is to permit any terminal to connect with any application and thus eliminate redundant terminals and lines. In many cases, new applications can be added using existing lines and terminals, providing another potential cost saving and making feasible many applications that could not be cost justified in the past.

Possibly the most important potential benefit offered by SNA is a systems approach to distributed processing. A distributed processing system developed under SNA can be flexible enough to meet both current and future requirements. As business grows or requirements change, SNA and distributed processing provide a logical framework for expanding a network with host or peer systems, while preserving the value of the investment already made.

General, functional, and operational management recognize that orderly growth is an essential requirement of an information system. SNA and the 8100 Information System distributed processing provide the architecture and the systems approach needed to meet the challenge of orderly growth in a logical manner.

System Reliability, Availability, and Serviceability (RAS)

Critical to the successful operation of any distributed system are the reliability, availability and serviceability (RAS) of the individual processors and of the total network. The 8100 Information System RAS facilities are enhanced by the Distributed System Network Management tools available for installation at the System/370 host location.

Licensed Programs

The 8100 Information System offers two alternatives in programming support, Distributed Processing Programming Executive (DPPX) and Distributed Processing Control Executive (DPCX).

DPPX is a communication-based operating system designed for 8100 Information System processors and for distributed applications. With DPPX, remote sites can develop, compile, and execute application programs either independently or with other 8100 Information Systems. Application program development can, of course, also be centralized in a single 8100 Information System.

DPCX continues the system philosophy of the IBM 3790 Communication System but uses the processing capabilities of the 8100 Information System hardware. DPCX allows current 3790 users to make compatible use of the newest IBM distributed system hardware, while retaining the advantages of host control of application development.

Chapter 2. Relationship to Other Systems

Because of the diversity of user requirements, the IBM 8100 Information System has been designed for use in systems with three different kinds of relationships:

Stand-alone

Interconnected processors

Host-connected processors

The degree to which the 8100 Information System supports the relationship depends on the programming support, which is discussed in Chapter 4.

Stand-Alone System

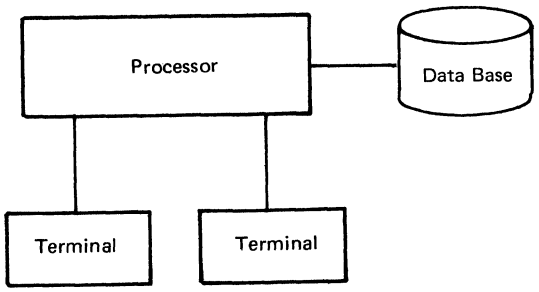


Figure 2-1. Stand-Alone System

The stand-alone system (Figure 2-1) performs an application or group of applications without depending on another processor. Data or program information may be transferred to other systems by store-and-forward transmission or by exchange of physical media. The stand-alone system may or may not (1) be located in a data processing center, (2) be part of any multiple system application, or (3) have any interactive connection to another system. If several locations require the same application, each location probably has its own independent system performing that application. Stand-alone systems may grow from stand-alone configurations to distributed configurations by subsequent connections to hosts and peers.

Interconnected Processors

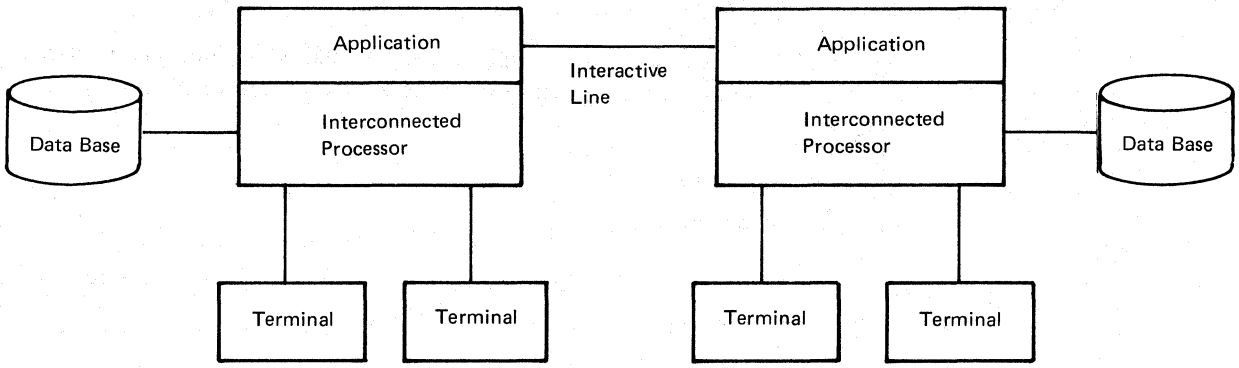


Figure 2-2. Interconnected Processors

Interconnected processors are two or more 8100 Information System processors directly linked together in a distributed system.

Interconnected processors (Figure 2-2) are supported by DPPX and operate jointly on one application or a group of closely related applications, in which a program on one processor:

- Activates application tasks resident on a interconnected processor
- Reads from or writes to an online data file or data base on a interconnected processor with the aid of user programming

Other characteristics of a interconnected processor include:

- Interactive use of interprocessor applications
- No subordination of one system to another with regard to communication or applications
- Optional communication link to a host processor for batch data or batch submission

Host-Connected Processors

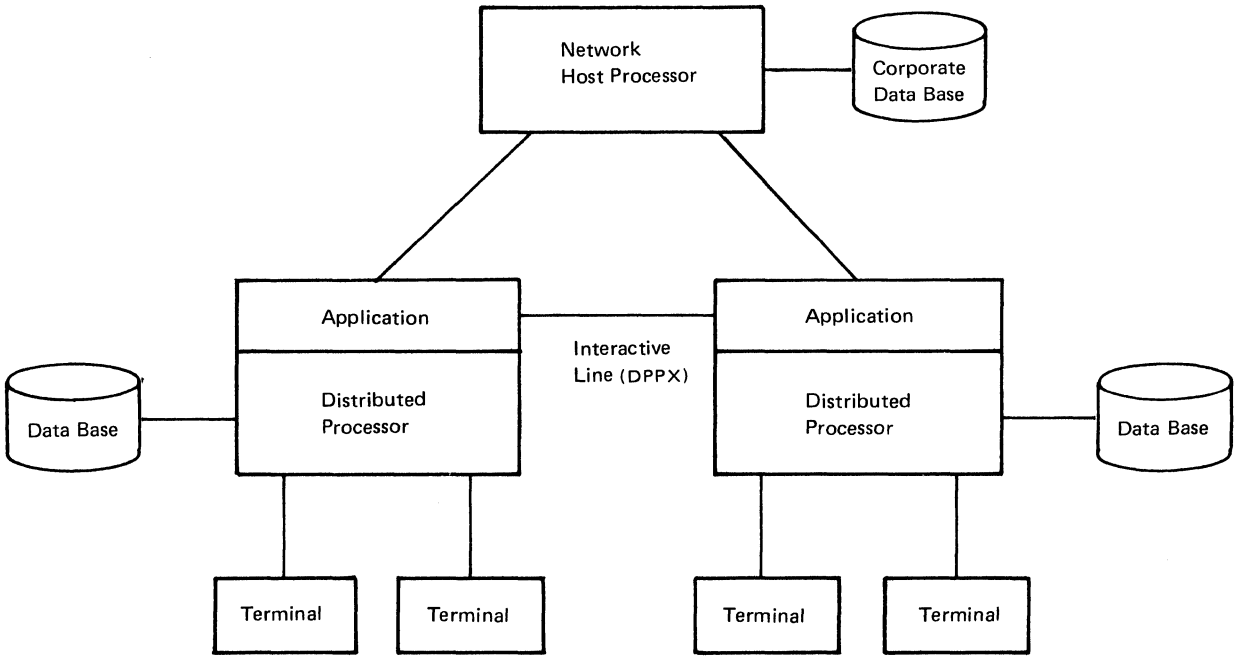


Figure 2-3. Host-Connected Processors

The host is the top system element in a host-connected system. Depending upon application requirements, the IBM System/370 can support a host-connected environment with 8100 Information Systems as satellites to the host site.

A host-connected system (Figure 2-3) consists of a host processor and one or more distributed processors operating jointly on an application or a group of closely related applications, in which a program on one processor:

- Activates application tasks resident on another system
- Reads from or writes to an online data file or data base on another system (with the aid of user programming)
- Transmits programs to another system for execution

The distributed processors may or may not depend on the host for support. A interconnected processor system may be configured within a host-connected system.

Chapter 3. Highlights–Hardware

Units of the IBM 8100 Information System can be selected and configured to meet a variety of application requirements. The most basic system includes the 8130 or 8140 Processor, with a disk, a removable diskette, and communication and I/O facilities. The system can be expanded by adding 8101 Storage and Input/Output Units that provide disk storage, an 8809 Magnetic Tape Unit adapter, and communication and I/O facilities. The communication and I/O adapters attach, either directly or by data link, multiple hard-copy or display terminals, a card reader and punch, and printers. These devices can also be attached to loops that are connected either directly or by data link to the 8100 Information System processor.

Figure 3-1 depicts a small system with display and printer functions. Figure 3-2 depicts a much larger system, that may be used for customer order servicing. Both of these systems may be expanded as shown by Figure 3-3, which depicts a system with one of each hardware product illustrated (this is not a maximum system). Only I/O devices supported by DPPX or DPCX are shown. Other communication devices may be attached with user-provided support programs.

Processors

The 8100 Information System offers two multilevel, interrupt-driven processors, the 8130 and 8140. The 8130 can have 256K, 384K, or 512K bytes of processor storage. The 8140 can have 256K to 384K, 320K, or 512K bytes of processor storage depending on the model.

The 8130 is available in four models. The 8140 is available in three model groups with four models in each group.

Processor	Models
8130	A21, A22, A23, A24
8140	A31, A32, A33, A34 A41, A42, A43, A44 A51, A52, A53, A54

8130 Processor

The IBM 8130 Processor is available in four models. Each provides controls, storage, processing capability, disk storage, diskette storage, and communication and I/O capabilities for the 8100 Information System.

The processor storage in Models A21 through A24 is 256K bytes; it can be increased by adding an increment of 128K bytes or an increment of 256K bytes for a maximum of 512K bytes of storage.

8140 Processor

The IBM 8140 Processor is available in twelve models. Each provides controls, storage, disk storage and diskette storage for the 8100 Information System. Additionally, Models A31 through A34 and A41 through A44 provide for communication and I/O capabilities. Processor storage in Models A31 through A34 is 256K bytes, which can be increased to 384K bytes. Storage in Models A41 through A44 is 320K bytes and in Models A51 through A54 is 512K bytes.

Floating-Point Arithmetic is only available on, and is a standard part of, Models A41 through A44. The Expanded Function Operator Panel is available on Models A31 through A34 and A41 through A44; however, if it is selected on Models A41 through A44, communication capabilities can be selected only via the 8101.

	Disk Storage				
	29 Million	23 Million	64 Million	58 Million	
Processor	Bytes*	Bytes**	Bytes*	Bytes**	Processor Storage
8130	A21	A22	A23	A24	256K to 512K bytes
8140	A31	A32	A33	A34	256K to 384K bytes
	A41	A42	A43	A44	320K bytes
	A51	A52	A53	A54	512K bytes

*Movable heads
**Movable and fixed heads

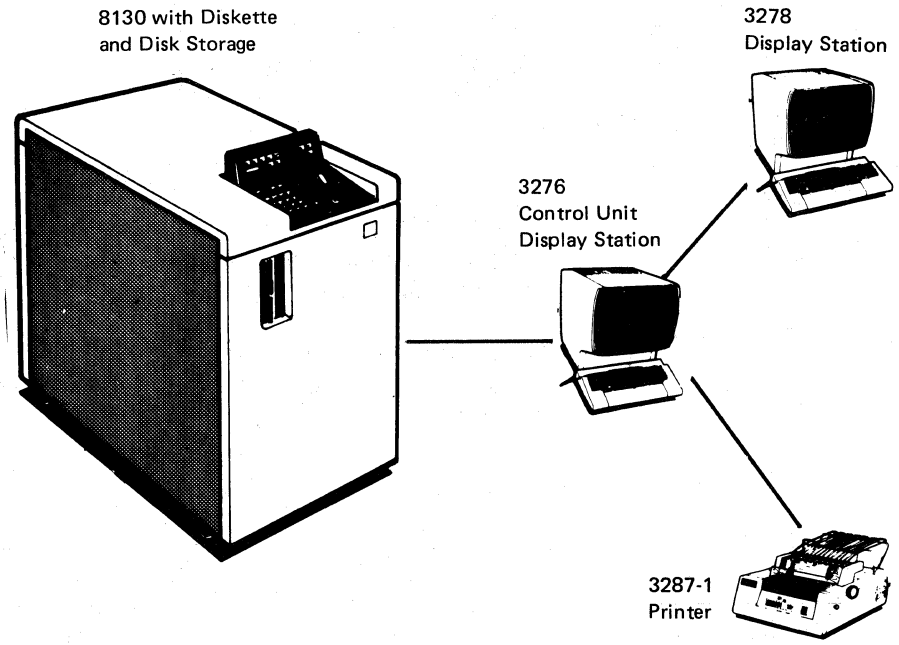


Figure 3-1. A Small IBM 8100 Information System

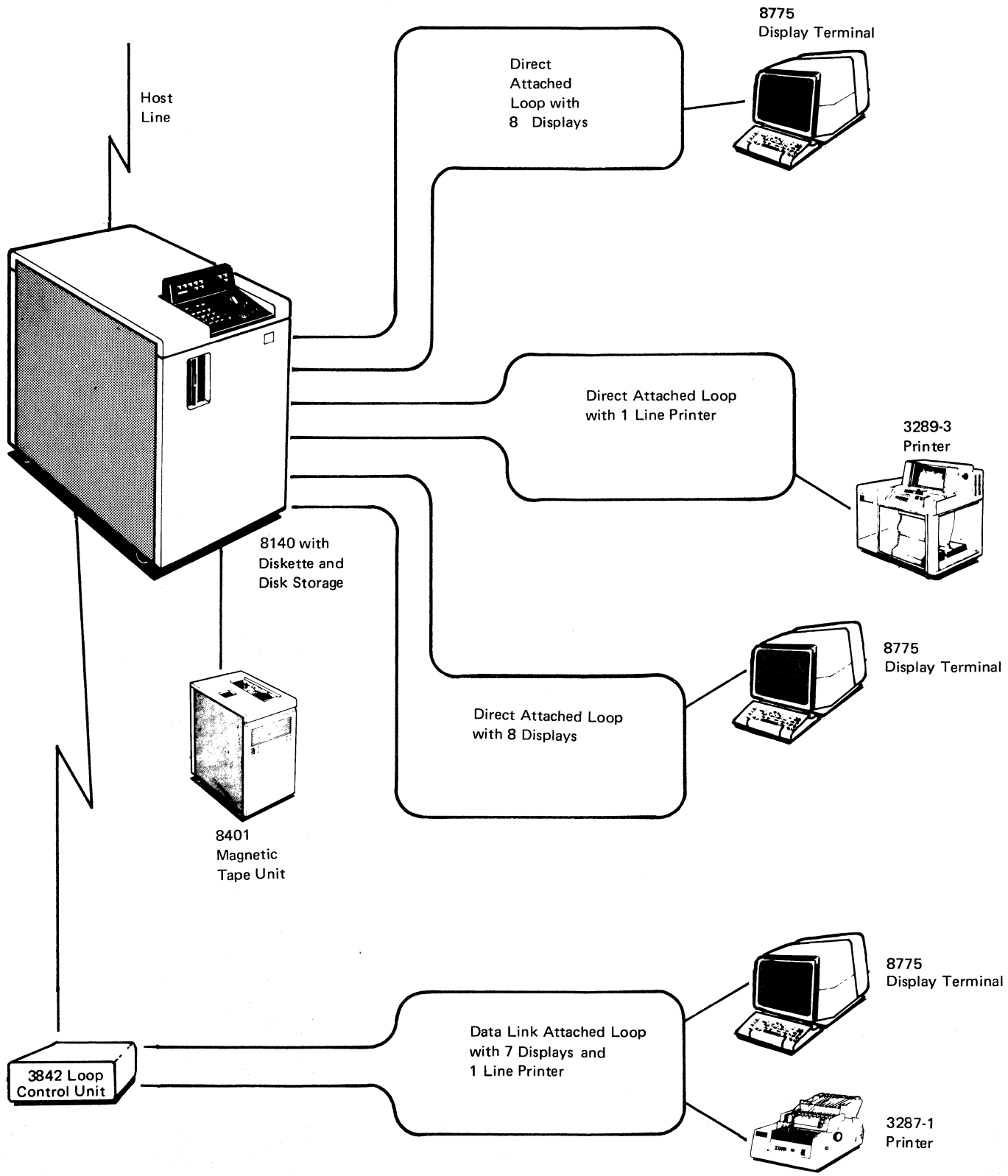
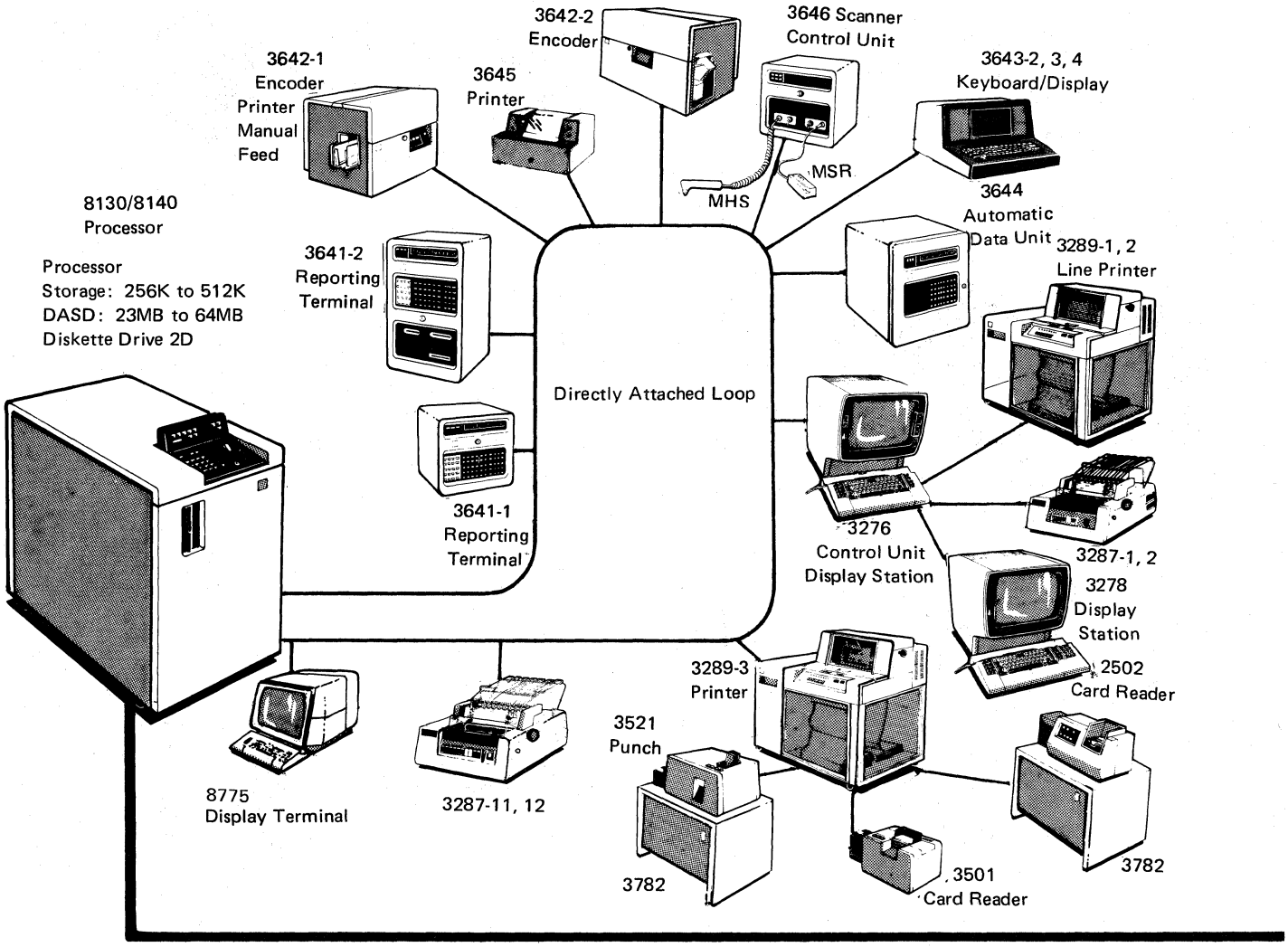


Figure 3-2. A Larger IBM 8100 Information System



COMMUNICATION PROTOCOLS

Analog Networks

- Protocols:
  - –SDLC, BSC (to 9600 bps)
  - –S/S (300 bps 8130; 600 bps 8140)
- Electrical Connections:
  - –EIA RS-232C
  - –CCITT V.24/V.28
  - –Integrated Modems (600, 1200 bps)

Digital Networks

- Protocols:
  - –SDLC, BSC (to 9600 bps)
- Electrical Connections:
  - –EIA RS-232C
  - –CCITT V.24/V.28
  - –CCITT X.21 bis/V.28
  - –Dataphone* Digital Service Adapter (DDSA)

Direct Connect

- Protocols:
  SDLC, BSC (to 9600 bps)
  - –S/S (300 bps 8130; 600 bps 8140)
- Electrical Connections:
  - –EIA RS-232C to EIA RS-232C (40 ft)
  - –CCITT V.35 to CCITT V.35 (1000 ft)

S/370 Data Link Connection

- Via Integrated Communication Adapter
  - –BSC
- Via 3704/3705 Communication Controller
  - –SDLC
  - –BSC
    3270 Line Protocol
    Mod 25 RJE Multileaving

DATA LINK ATTACHABLE DEVICES

- SDLC
  - –IBM 8100 Information System
  - –3767-1, 2, 3
  - –3276-11, 12, 13, 14
    3278
    3287-1, 2
    3289-1, 2
  - –3631/32 Models 1A, 1B
  - –3842/43 Loop Control Unit
- BSC
  - –3750 Switching System
  - –Devices conforming to 2780/3780 Line Protocol
- S/S
  - –2741
  - –Devices Conforming to TTY 33/35 Line Protocol

* AT&T Trademark

Figure 3-3 (Part 1 of 2). IBM 8100 Information System Hardware Products

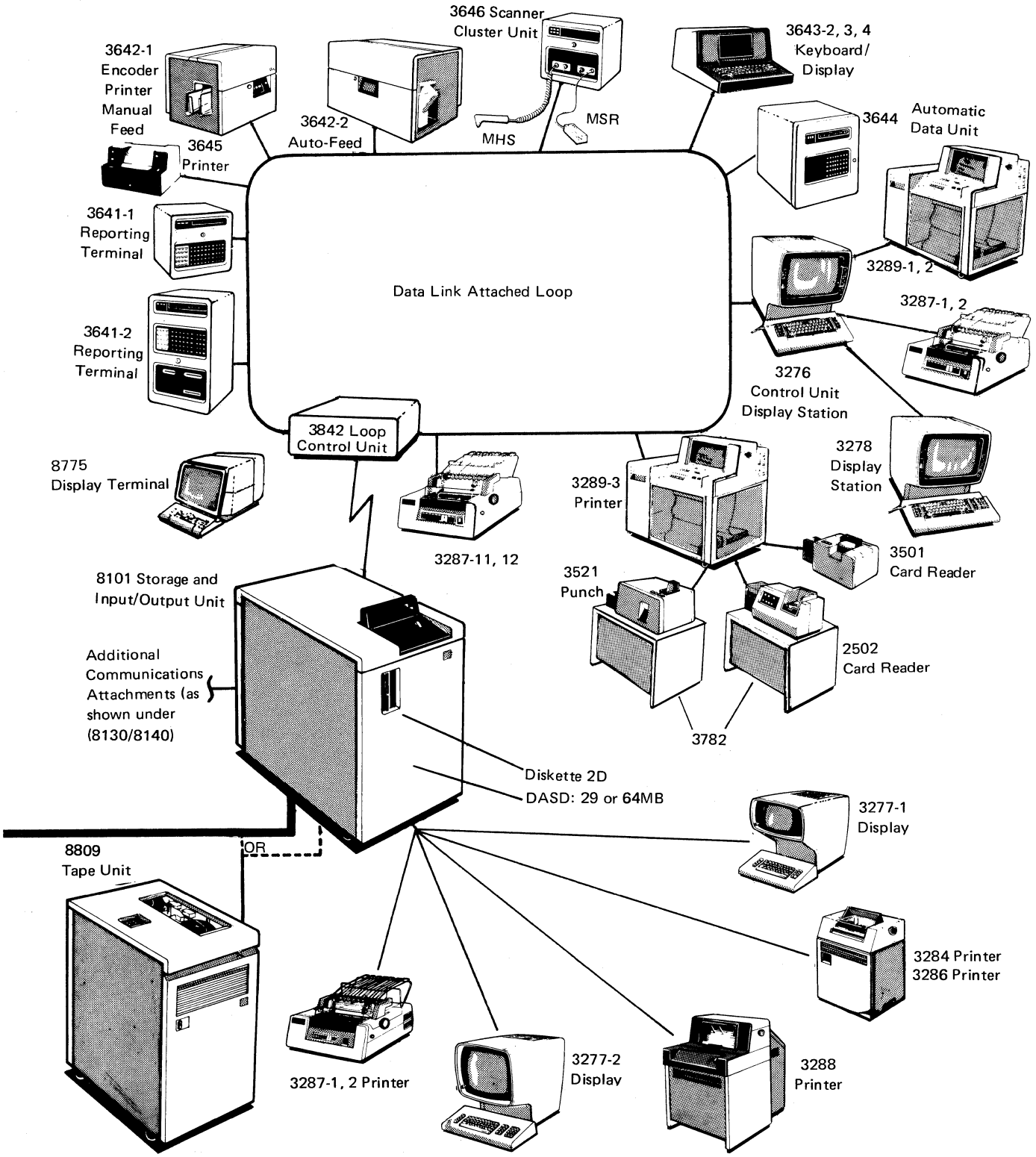


Figure 3-3 (Part 2 of 2). IBM 8100 Information System Hardware Products

Processor Functions

The 8130 and 8140 processors also provide the following:

- Dynamic address relocation and translation of logical addresses within a 4M-byte processor address space
- Storage protection and isolation of logical address spaces
- High-speed register storage separate from main storage
- Eight priority levels of program execution
- Capability to define supervisor and application programs on the same priority level
- Sixteen general registers per program
- Priority level assignment of I/O devices through programming (available on 8130 only when the System Expansion feature is installed)
- Sixteen sublevels per priority level for I/O interrupt identification (available on 8130 only when the System Expansion feature is installed)
- Basic instruction set containing 112 instructions
- Floating-point arithmetic with 30 floating-point instructions (8140 only)
- I/O bus with a capacity of up to 930K bytes per second for the 8130 and 125 million bytes per second for the 8140
- Flexible system configuration with the attachment of 8101 Storage and I/O Units
- Remote attachment to System/370 over communication facilities ranging from 600 to 9,600 bits per second with BSC, and up to 56,000 bits per second with SDLC
- Wide variety of I/O device attachment features including:

  Directly attached loops

  Loops attached by data link

  SDLC communication attachments

  BSC and S/S communication attachments

8101 Storage and Input/Output Unit

The 8130 base system can be expanded to include up to two IBM 8101 Storage and Input/Output Units. The 8140 base system can be expanded to include up to four 8101s. The 8101 Storage and I/O Unit allows expansion of communication and I/O capabilities, as well as additions to disk storage. The 8101 is available in three models dependent upon disk storage.

	8101 Models		
Feature	A10	A11	A13
Device Attachment Capability (I/O and Communication)	X	X	X
29 Million Byte Disk Storage		X	
64 Million Byte Disk Storage			X

The 8101 Storage and I/O Unit has the following features:

- An 8809 Magnetic Tape Unit adapter is available for all three 8101 models; however, only one 8809 adapter is allowed on each 8100 Information System.
- Diskette 2D drive
- Attachment of the IBM 3277 Display Station
- Attachment of the IBM 3284, 3286, 3287 Printers and IBM 3288 Line Printer

Attachment to the 8130, 8140, and 8101

The communication and I/O attachment features allow the attachment of:

- Data-link attachment to System/370 processors
- 8100-to-8100 communication
- Loops attached either directly or by data link
- Start-stop devices, IBM 2741 Communications Terminal and TTY* 33/35 Protocol devices
- Direct attachment of the IBM 3277 Display Station and the IBM 3284, 3286, 3287 and 3288 Printers to the 8101 Storage and I/O Unit.

Communication for the 8130, 8140, and 8101

Both DPPX and DPCX support the synchronous data link control (SDLC) line protocol. DPPX also supports the binary synchronous communication (BSC) and start/stop (S/S) line protocols. SDLC and BSC line speeds can be up to 9,600 bits per second.

Flexibility of device attachment is provided by directly attached or data link attached loops. The IBM 3631 and 3632 Plant Communication Controllers may be attached by data link and control their own loop transmission facility.

Directly connected facilities for S/S, BSC, and SDLC are available.

The line types supported by the 8100 are:

- Switched (host only)
- Switched with auto-answer from System/370 host (SDLC only)
- Nonswitched (leased line)
- Full and half duplex communication facilities operating in half duplex data mode

Loops for the 8130, 8140, and 8101

Loops can be attached to the 8100 Information System in two ways; directly and through a data link. Directly attached loops operate at 9600 or 38.4K bps. Data link attached loops operate at 1200 or 2400 bps. Reference *DPPX Base General Information* and *DPCX General Information: Introduction* for specific device and programming support.

Both directly attached and data link attached loops can be used with both processors and the 8101 Storage and I/O Unit.

*Trademark of Teletype Corp.

Both directly attached and data link attached loops support the following devices:

- IBM 3276 Control Unit/Display Station Models 11, 12, 13, 14
  - IBM 3278 Display Station Models 1, 2, 3, 4
  - IBM 3287 Printer Models 1, 2
  - IBM 3289 Line Printer Models 1, 2
- 3289 Line Printer Model 3
  - IBM 3782 Card Attachment Unit Model 1, which attaches the 3521 Card Punch
  - IBM 3782 Card Attachment Unit Model 2, which attaches the 2502 Card Reader
  - IBM 3501 Card Reader
- Plant Communication Devices
  - IBM 3641 Reporting Terminal
  - IBM 3642 Encoder Printer
  - IBM 3643 Keyboard Display
  - IBM 3644 Automatic Data Unit (ADU)
  - IBM 3645 Printer
  - IBM 3646 Scanner Control Unit
- 8775 Display Terminal
- IBM 3287 Printer Models 11, 12

A directly attached or data link attached loop may also be attached to the IBM 3631 and 3632 Plant Communication Controllers. Only the plant communication devices may be attached to loops controlled by the 3631 or 3632.

The Loop Adapter Second Lobe feature allows the directly attached loop to divide the attached devices between two different cables (through a second lobe) for improved device placement, simpler installation planning and control, and greater total loop cable length.

IBM Diskette 2D Drive

The 8100 Information System has a diskette feature which may be used for:

Logging

Dumping

Data exchange

Initial program load

The Diskette 2D Drive provides 1 million bytes of removable diskette storage and operates at a data rate of 62K bytes per second.

Only one diskette feature can be installed in a single processor. A maximum of two diskette features can be attached to a single 8100 system, the second being attached to the 8101 Storage and I/O Unit.

8775 Display Terminal

The IBM 8775 Display Terminal is a multi-function, cathode ray tube display that can be connected to the 8100 Information System by a directly attached loop at 9600 or 38.4K bps or a data link attached loop at 1200 or 2400 bps. Highlighting, multiple partitions, and extended data entry capabilities are available. A keyboard or a selector light pen permit an operator to display and manipulate data on the screen. Other functions include audible alarm, security keylock, or magnetic slot reader. The 8775 Display Terminal meets both general and unique display requirements with its set of basic and optional features.

The 8775 Display Terminal communicates with a 8100 system using synchronous data link control (SDLC) over either a directly attached or a data link attached loop.

The 8775 Model 1 displays up to 2560 characters in a 9x16 character matrix. The Model 2 displays up to 2560 characters in a 9x16 matrix or 3440 characters in a 9x12 character matrix.

The number of characters displayed is determined under operator control. All configurations include 62 alphanumeric and 32 special characters, the Space and Null characters. The 8775 uses 3270 field formatting capability, which permits individual fields of data on the screen to be program defined with various attributes, such as protected/unprotected, alphanumeric/numeric, normal/highlighted intensity, displayable/nondisplayable, and selector light pen detection allowed/disallowed.

Enhanced function consisting of highlighting, multiple partitions, and field validation is offered.

8809 Magnetic Tape Unit

The IBM 8809 Magnetic Tape Unit is a 9-track, reel-to-reel magnetic tape unit, which records at a phase encoded (PE) density of 1600 bytes per inch. It accepts half-inch tape with reel sizes of 6.25, 7.0, 8.5, and 10.5 inches. The 8809 Magnetic Tape Unit can operate at the following two speeds, the selection of which a program can control:

- .3175 meters/second (12.5 inches/second), which allows low-speed processing in a start/stop mode
- 2.54 meters/second (100 inches/second), which allows high-speed load/dump in a streaming mode

Mode changes are accomplished by a command issued from the 8100 and can be made at any point on the tape.

In start/stop mode, the 8809 operates the same as current tape products, for example, starting and stopping within the inter-block gap (IBG).

In streaming mode, the 8809 takes advantage of the fact that large amounts of data are generally transmitted in load/dump applications. Therefore, the 8809 maintains tape velocity through the gap, anticipating the next command. If the next command occurs during the gap crossing and is functionally consistent with the current tape direction and mode setting, the operation continues without loss of time because of start/stop or repositioning. If commands from the 8100 system are discontinued or arrive after the gap crossing (command overrun), the 8809 automatically repositions the tape for the next command.

The 8809 Magnetic Tape Unit is available in three models, and up to four 8809 units can be attached to the 8130 Processor, the 8140 Processor, or the 8101 Storage and I/O Unit.

Chapter 4. Highlights–Programming

This chapter briefly describes the two primary IBM licensed program packages available to support the IBM 8100 Information System hardware:

Distributed Processing Programming Executive (DPPX)–an operating system and associated licensed programs that work as a stand-alone system or as part of a distributed processing system

Distributed Processing Control Executive (DPCX)–a programming system that, in conjunction with the 8100 Information System, provides a range of systems compatible with 3790

Brief descriptions of DPPX and DPCX follow. For detailed descriptions, see *Distributed Processing Programming Executive (DPPX) Base General Information*, GC27-0400, and *Distributed Processing Control Executive (DPCX) General Information: Introduction*, GC27-9075.

Distributed Processing Programming Executive (DPPX)

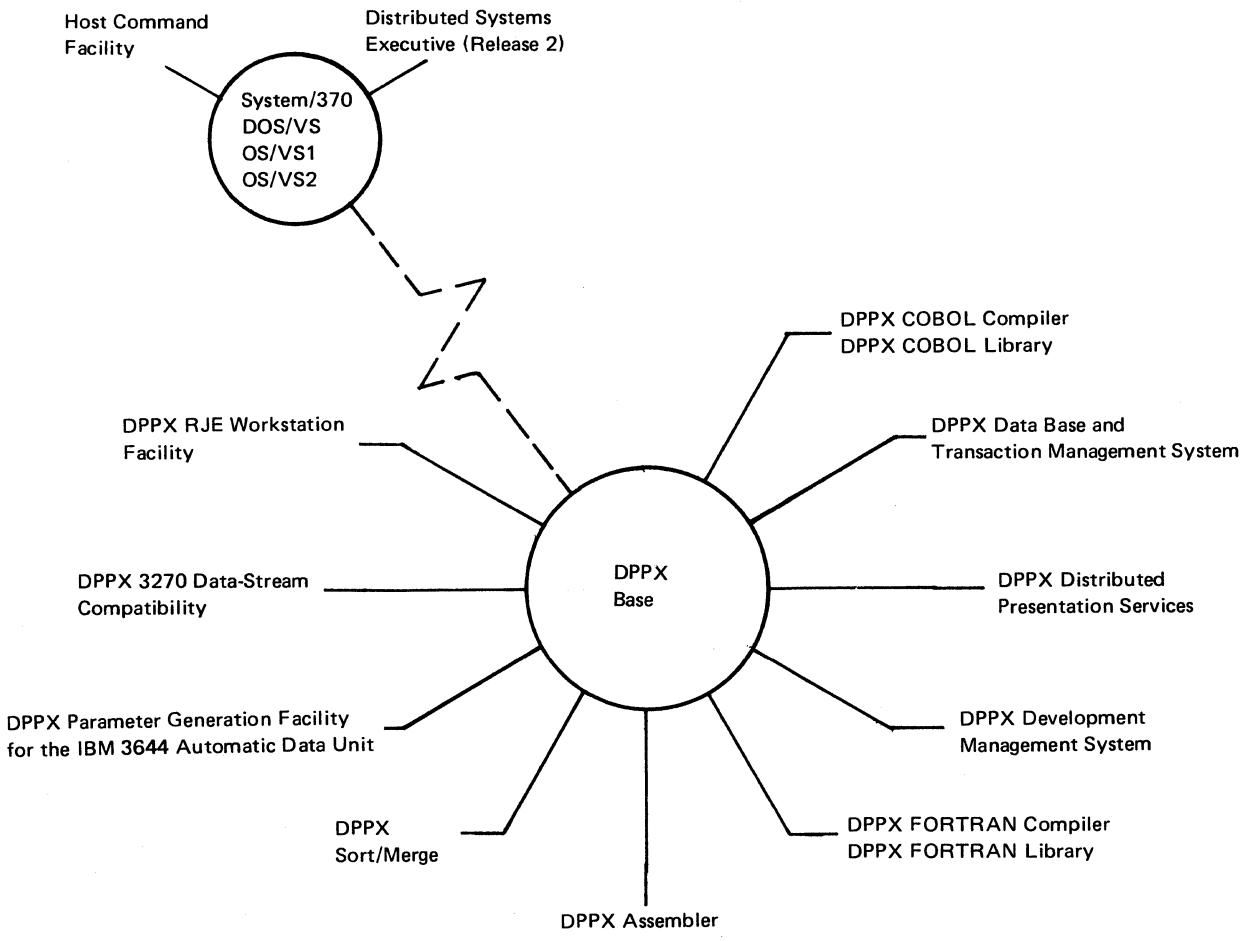


Figure 4-1. The DPPX Base Family of Licensed Programs

DPPX is a versatile, general-usage operating system made up of the DPPX Base licensed program and its family of licensed programs. DPPX supports 8100 Information System processors (including diskettes and disks for storage), the 8101 Storage and I/O Unit, and the 8401 Tape Unit. DPPX supports a wide variety of attachments for terminals, unit record devices, and system-to-system communication.

In the following description, the term "DPPX" means an operating system formed by the DPPX Base with the possible addition of one or more related licensed programs. When individual licensed programs such as the DPPX Base or the DPPX COBOL Compiler are described, they are referred to by name. The complete set of licensed programs that comprise the DPPX family is shown in Figure 4-1. This set includes two System/370 licensed programs which may be used in System/370 networks that include 8100 Information System processors.

DPPX is designed for distributed-processing configurations. With the range of programming and device support provided by DPPX, an 8100 Information System processor can communicate with other 8100 processors, and with System/370 processors, and can function as a stand-alone system. (8100 processors can also communicate with processors compatible with the System/370, including 3031, 3032, and 3033 processors. Throughout this section, the term "System/370" indicates any processor compatible with the System/370 family.)

In a DPPX distributed system, an enterprise can place data processing resources where they afford the best availability to users. Applications can be off-loaded from a central System/370 processor to remote locations and modified to execute in distributed processors, and new applications that are unique to the remote location can execute in the distributed processors. The ability to distribute processing functions permits a balanced approach: necessary control at the central location and sufficient flexibility for the remote location.

DPPX provides support services for application development, including high-level languages and interactive application-development tools. It can be programmed to handle many applications, including business, scientific, and manufacturing control.

DPPX has a comprehensive set of facilities that enable effective management of data-processing operations including system installation and customization, system operation, and system growth.

This section briefly describes the functions provided by DPPX, including the DPPX Base and the licensed programs named below. For more information, see *DPPX Base General Information,* and the general information manuals and program summaries for licensed programs related to DPPX.

Licensed Programs for DPPX

The programs that can be used with the DPPX Base fall into the categories listed below. Further information about each of the licensed programs is in individual general information manuals.

- Languages for application development:

  DPPX COBOL Compiler

  DPPX COBOL Library

  DPPX FORTRAN Compiler

  DPPX FORTRAN Library

Programmers who know these languages from use on other systems can easily familiarize themselves with DPPX FORTRAN and DPPX COBOL.

- Application support programs

  DPPX Distributed Presentation Services

  DPPX Data Base and Transaction Management System

  DPPX Development Management System

  These programs are particularly useful for programmers coding in DPPX COBOL.

  COBOL programs that involve communication with keyboard-display operators have two aspects: the program's logic and the full-screen presentation of data. The DPPX Distributed Presentation Services licensed program simplifies the creation of screen layouts.

  The DPPX Data Base and Transaction Management System licensed program supplements DPPX Base services by (1) managing concurrent processing of user-written transaction programs and (2) controlling access to and protecting the integrity of shared data.

  The DPPX Development Management System (DMS/DPPX) licensed program provides a simplified interface for coding DPPX COBOL programs. From a limited amount of user information, DMS/DPPX produces DPPX COBOL programs that can handle transactions or run as batch jobs. The DPPX COBOL program can involve the creation of screen layouts by DPPX Distributed Presentation Services.

- Programs for enhanced network access:

  DPPX Remote Job Entry Workstation Facility

  DPPX 3270 Data-Stream Compatibility

  Both of these programs are useful in System/370-to-8100 connections. The Workstation Facility communicates with a System/370 remote job entry subsystem (JES2, for example) and directs user-defined jobs to the host operating system's job queue to await execution. 3270 Data-Stream Compatibility allows users at some terminals attached to DPPX to communicate with selected 3270 applications in a System/370 host processor.

- System/370 programs for network management:

  Host Command Facility (HCF)

  Distributed Systems Executive (DSX)

  Both HCF and DSX extend to remote DPPX locations the expertise of centrally located personnel. HCF provides access to DPPX from a terminal connected to a System/370 host processor, permitting control of DPPX from a System/370 host. DSX ensures orderly sessions between a System/370 host processor and 8100 Information Systems and manages the batched transfer of data between 8100 and the host.

- Programs for specialized applications:

  DPPX Sort/Merge

  DPPX Parameter Table Generation Facility for the IBM 3644 Automatic Data Unit

  DPPX Assembler

Configuration Options

DPPX supports three basic types of network configurations, allowing the user to select a configuration to meet data processing requirements. In a distributed system, different combinations of the following three types of configurations are possible.

- Stand-alone 8100 Information System processors, where each processor can operate without communicating with other processors
- Interconnected 8100 Information System processors, where each processor can communicate with any other processor to which it is attached by a data link
- 8100 Information System processors connected to System/370 host processors

The relative merits of each of these configurations are described earlier. Chapter 2 includes examples of each of the above configurations.

Host Support

DPPX is supported by the VTAM, ACF/VTAM, BTAM, TCAM, and ACF/TCAM host access methods. DPPX supports 8100 Information Systems attached to a System/370 host via a 3704 or 3705 communications controller. Host operating system support is via DOS/VS, OS/VS1, OS/VS2 (SVS), and OS/VS2 (MVS). In addition, DPPX supports a number of program products such as IMS/VS, CICS/VS, and TSO.

User Interface to the DPPX Base

DPPX Base commands serve as the primary user interface to the system. A command name is one or two words that, in an abbreviated manner, describe a request. The names given to commands provide, in a sense, a language with which users request system services. This "language" can be translated; DPPX Base commands can be given new names in other languages.

When entering a command from a terminal, a user can choose to have the command processed immediately or to schedule it for delayed (batch) execution. Programmers coding an application can insert into their programs many of the commands that can be entered at a terminal. These commands execute by means of a call to the command-processing program. Commands are used for DPPX installation, operation, administration, and program development, and to describe user work and system resources. DPPX Base commands provide users with a single, clear interface, whether entered for interactive or batch execution or called from a program.

Each user shares the interface to the system provided by the DPPX command set. As the means of access for all users, the command set is powerful, capable of handling diverse requirements. A look at typical data processing activity at an 8100 Information System location shows the scope of the DPPX command set.

DPPX Base commands are used during the installation procedure to add licensed programs to the system and to customize the system. On a day-to-day basis, the administrative concern of managing user work and system resources is also handled by using commands. Special data areas called profiles contain information used by DPPX to control user work and system resources. An authorized user at a terminal uses commands, including those for editing data sets, to create, change, and delete profiles.

Other commands related to profiles aid in system operation. An authorized terminal user can be designated as the person to handle the system operator's role of directing system activity. Typical commands start and stop applications and activate and deactivate terminals, printers, and other network resources. The DPPX Base command facility provides an interface that allows an assembler program to be used for system operation.

The interactive nature of DPPX extends to the people who develop application programs and to the people who log on to use the applications. In fact, application-program developers can increase the system's interactivity—they can use the DPPX Base command facility to define their own commands or command lists, and tailor commands or command lists to their own needs.

Application Program Design and Development

Many services available with the DPPX Base simplify the development of DPPX COBOL and DPPX FORTRAN application programs. An application programmer using DPPX COBOL or DPPX FORTRAN need only learn a basic set of IBM-defined commands for requesting system services.

The following topics describe some of the system services available at an 8100 Information System location through DPPX for developing applications. An enterprise can centralize or disperse this development as desired. Development can take place at one or more IBM 8100 Information System locations, and the results of the development effort can be sent to other 8100 Information System locations. The distribution of application program development resources can be managed from a central System/370 processor using the Distributed Systems Executive licensed program, or from an 8100 Information System, using portable media.

Application Services

The DPPX Base and associated licensed programs simplify application design by providing a full complement of general-usage application support services. In general, application designers and developers can concentrate on the logic associated with their data processing task, and not be concerned with hardware characteristics or complex structuring of their program to fit into an execution environment. Many of these services are provided completely transparent to the application, or mapped to normal DPPX COBOL or DPPX FORTRAN language. Others are available through command or call interfaces. Some highlights of this support are:

- DPPX provides for a simple application structure. Even though an application program may be intended for simultaneous use by several terminals, it can be written as a single-user program. The DPPX Base command facility or the DPPX Data Base and Transaction Management System licensed program handle the scheduling of instances of the application as necessary for multiple requests, and route input/output to the appropriate terminal or other invoking source. The DPPX Base and the language processors support reentrancy, so only one physical copy of the program is needed in main storage for many users. Because the application-to-system interface is held constant, the same program can be used variously in interactive or batch modes. Applications can also be defined to the system as commands, to take advantage of the human-factored end user interface and the various tools for management and tailoring of the external appearance.
- For sequential input/output, applications can take advantage of the resource-independent interface (standard READ/WRITE in the higher level languages) that allows the program to be nonsensitive to the resource types it communicates with. Disks, diskettes, tapes, printers, card equipment, and terminals (SDLC, BSC, and start/stop) are all supported through this interface. While this capability allows the target of I/O to be varied at application invocation, it also frees the application designer from concerns about particular resource characteristics or transmission protocols.
- The DPPX Base authority mechanisms controlling access to programs, system services, and data are handled outside the application by manipulation of user and object profiles. A system administrator or security officer, who need not be a programmer, can set up and enforce these controls.

- With the DPPX Distributed Presentation Services licensed program, maps controlling the appearance of full-screen terminal displays used by an application are defined and maintained outside the application program itself. They can be modified, for instance to support a new terminal type or screen size, without change to the underlying applications.
- The DPPX Data Base and Transaction Management System (DPPX/DTMS) licensed program provides a set of services for data base usage: sharing and locking of data, deadlock detection and handling, and backout of changes in the event of application failure. This support simplifies application references to data bases, and is available to programs running in batch or interactive mode as well as under DPPX/DTMS.

Compilers

Two compilers are available as DPPX-related licensed programs: COBOL and FORTRAN. People already familiar with these languages from use on other systems can easily acquaint themselves with DPPX COBOL or DPPX FORTRAN. For further information about COBOL or FORTRAN, refer to the appropriate general information manual.

Source-Program Entry

Source programs are entered by logging on at a terminal to the DPPX Base command facility, defining a data set, using the interactive editor to enter and change the program's source statements, and filing the data set for subsequent compilation and link-editing.

Developers entering their source programs can do so from either keyboard-displays or keyboard-printers. From a keyboard-printer, the developer interacts with the line editor to enter and change a program's source statements. When the DPPX Distributed Presentation Services licensed program is installed, a full-screen editor is available for use by developers logged on at a keyboard-display. With or without full-screen capability, subcommands make it easy to add, change, locate, move, copy, and number the lines of a source-program data set.

DPPX Development Management Services (DMS/DPPX), another licensed program, presents a simplified procedure for the interactive development of a transaction or batch DPPX COBOL program. Following a series of prompts at a terminal, DMS/DPPX takes information supplied by a user with limited data processing experience and generates a complete application.

While working at certain keyboard-displays, a developer can request a printed copy of the screen image. This could provide a record of the terminal session, and may be convenient for noting changes to be made during subsequent sessions.

Program Execution

From a terminal, an application programmer can request that a program execute immediately or schedule it for delayed execution as a batch job. Application programmers can tailor the method for requesting program execution by using the DPPX Base command facility to define a command or a command list for that purpose.

Commands issued before an application program executes determine the source and destination of the program's data. Source and destination possibilities are: disks, diskettes, tapes, cards, terminals, or other application programs. An application program can remain independent of the type of resource that supplies or accepts the program's input and output data. Using appropriate DPPX Base commands, programmers can reassign, for example, the device to receive a program's output data from a disk to a diskette. Thus, the change is external to the program.

Certain application programs, most notably programs supporting commercial transactions, have unique requirements for specialized handling of data for the duration of their execution, particularly for recovery purposes. To help meet these requirements, the DPPX Data Base and Transaction Management System licensed program manages resources in a way that provides the ability to back out all data changes made during the execution of a program.

Debug Facilities

From a terminal, a programmer can use the DPPX Base interactive debug facility to diagnose problems in a program during execution. Program execution can be monitored by defining breakpoints and displaying and modifying the contents of storage, registers, or system status areas. If necessary, a dump of a user's address space can be taken.

Also available for diagnosing COBOL- and FORTRAN-compiled programs are diagnostic statements that can be included within programs before compilation. These statements are part of the individual compiler licensed programs.

Technical Support Personnel

As the number of separate locations in a network increases, so does the potential for increased support at these locations. DPPX provides a comprehensive set of facilities to allow effective management for:

System installation and customization

System operation

System growth and service

The facilities described below help minimize the level of expertise required in these areas. Options available through the DPPX Base and associated licensed programs extend the expertise of centrally located support personnel to remote 8100 locations.

System Installation and Customization

DPPX installation is a clear, step-by-step process. It begins after the hardware is installed, when the diskettes containing what will become the programming for the hardware arrive from an IBM Program Distribution Center. The process itself involves (1) data being copied from the diskettes to the system residence volume and (2) an initial program load (IPL) that initializes an operational system, including an operator's console.

The procedures that follow installation, to define and activate a system tailored to meet specific requirements, are collectively known as customization. These procedures largely involve matching hardware and programming. For example, if the system includes a 3277 keyboard-display, data about the 3277 must be available to DPPX.

Included with each DPPX Base are preconfigured definitions, which define different arrangements of hardware and programming. Each preconfigured definition has corresponding command lists, which define and activate the system's devices. In addition, IBM defines various values for system parameters, which determine the system's processing characteristics. Customizing DPPX immediately after installation involves determining which of the preconfigured definitions results in the system's most nearly resembling the desired system, choosing that definition during a subsequent IPL of DPPX, and optionally making any necessary changes to the system. One or more of the resulting systems can nearly satisfy the data processing needs of most users.

If an enterprise wants later to customize a resulting system to satisfy requirements to add or delete terminals, disks, or diskettes, or to add licensed programs, the required changes can be made by commands issued from a terminal. Any such changes can be made

whenever necessary during subsequent data processing operations. Commands can be issued to effect configuration changes such as the addition and deletion of network devices, without requiring a redefinition of the entire network.

The DPPX Base licensed program contains programming that permits the choice of any one of the preconfigured definitions. Changing to a new definition is a simple process that can be done using facilities in the DPPX Base.

An organization that has several 8100 Information Systems and has customized some systems at one location can transfer customization information to other 8100 locations.

System Operation

DPPX offers a wide variety of options for operator support in a distributed system. A person doing other work (developing application programs, for example) can also operate DPPX. Typically, the time spent operating the system is limited to starting the system, scheduling applications, following directions from or replying to occasional operator messages (primarily the messages for handling diskettes, tapes, and printers), and stopping the system.

In many 8100 locations, a program can be written to handle this routine work. The program, written in DPPX assembler language, can analyze operator messages and, as appropriate, send messages in response or pass messages to a terminal user.

There is no requirement that the program acting as the operator be an application executing in the system it is operating. An operator application program in an 8100 Information System can control its DPPX and DPPX in any other 8100 Information System that is attached by a data link.

The Host Command Facility licensed program allows a person connected with this program at a System/370 to log on to DPPX applications and act as the system operator for one of the 8100 Information System processors attached to the System/370 processor by a data link.

Regardless of the method of system operation selected when operations begin, the DPPX SWITCH command can be used to pass system control:

From a terminal user to a program

From a program to a terminal user

From one terminal user to another

From one program to another

any time during system operation.

System Growth and Service

DPPX, like any system, requires technical support for system growth and service. Typical requirements include more disk storage, a loop of terminals and a printer for a new department, new user IDs with varying levels of authorization, and, in some cases, specialized programming help for application requirements. DPPX design and structure make it unnecessary to know internal system details to satisfy these requirements. In particular, DPPX has data areas called profiles that make most required changes an administrative, rather than a system programming, function.

DPPX users, data sets, programs, devices, and commands–all subject to changes that the system administrator plans–are described by profiles. By adding or modifying profiles, an

authorized user can add to or change the characteristics of the system. Some profiles can be changed directly with the interactive editor, others have specific commands to manipulate them.

For example, to add a terminal to a network, DPPX Base commands are issued to create a new profile for the terminal. This allows the definition of its location in the network, its capabilities, and its relationship, if any, to other network resources (such as a control unit). As soon as the command has been processed, the terminal can be activated, and a user can log on to the system from that terminal.

Programmers can insert most DPPX Base commands into a DPPX COBOL or DPPX FORTRAN program. When the program executes, the included commands process by means of calls to command-processing programs. Thus, programmers coding in these languages can access system services not available through the DPPX COBOL or DPPX FORTRAN languages, often without recourse to a system programmer for assembler-program aid.

While it is not required for system installation, production, or service, the DPPX Assembler licensed program can be used to develop programs for specialized applications. The DPPX Base has, for example, an exit for a user-written assembler-language program to replace the IBM-defined password checking program.

As with system installation and operation, administrative and service personnel can stay at a central location and still handle changes to be made at remote locations. Existing profiles can be changed and new profiles added using the System/370 licensed programs Host Command Facility or Distributed Systems Executive.

DPPX Support and Structure

Users can benefit from DPPX and its services without learning details about internal system structure. When coding a DPPX COBOL program to service a commercial transaction or a DPPX FORTRAN program that provides a solution for a complex mathematical problem, an application programmer may assume, for example, that the data set holding an application program is unavailable for use by others, that a certain amount of main storage has been set aside, that the system will take a course of action in the event of an error, and, in general, that the system is doing work on the programmer's behalf, even if the work is not specifically requested. Application programmers need only know about "higher-level" commands that support application-program development; "lower-level" services are triggered as necessary by these commands. Whenever a user issues a command, programs and services that are in the user's response set do the work required to process the command.

Authorization and Security

A large part of a user's programming support is established when the user contacts the system by logging on. An authorization scheme involving user IDs and, optionally, passwords can be used to prevent unauthorized system access. Once a user successfully logs on, some of the resources (data sets, main storage, commands, and system services are examples) that the user can access are established when the user's profile is checked. Users can be protected from one another; resources can be assigned for exclusive or shared usage.

Publications

For more information, refer to *Distributed Processing Programming Executive (DPPX) Base General Information,* GC27-0400, and the general information manuals and program summaries for licensed programs related to DPPX.

Distributed Processing Control Executive (DPCX)

Distributed Processing Control Executive (DPCX), a licensed program designed to control the 8100 Information System, is a programmable, multi-application, display-oriented system, which can execute up to 31 user programs concurrently. DPCX can be used to perform functions as diverse as remote job entry (RJE), credit checking with reference to a host-managed master file, and batch printing. DPCX higher execution priority to interactive, terminal-oriented tasks.

Application programs written for the 3790 Communication System will run without change or re-compilation under DPCX when the same or compatible devices are used. User applications transferred from the 3790 will benefit from the increased performance of the DPCX/8100 Information System. User data sets can be transferred via diskettes from 3790 disk storage to 8100 disk storage. The data sets as transferred to diskette using a 3790 function and transferred from diskette to the 8100 disk using a DPCX service.

Distributed Processing

DPCX and its host support allow users to distribute data and processing functions and integrity while retaining control at the central host computer. These host-controlled functions include: program development, distribution and updating, systems design integrity; and network management. Applications, however, may run independently of the host, accessing local DPCX data bases and doing all processing locally. Conversely, applications may establish SNA (Systems Network Architecture) sessions with host applications, thus distributing processing and data between DPCX and host applications.

DPCX SNA Host Support

DPCX is supported by the ACF/VTAM, ACF/TCAM and EXTM host SNA access methods. DPCX/8100 is connected to the host via an SDLC (synchronous data link control) line. SCP (System Control Program) support is via DOS/VS, OS/VS1, OS/VS2 (SVS), and OS/VS2 (MVS). In addition, DPCX is supported by a number of program products such as IMS/VS, CICS/VS, VSPC and TSO, DSX, RES/JES1, JES2, JES3, and POWER/VS.

The DPCX application programmer can allow DPCX to manage all SNA protocols or can manage many of these protocols in the DPCX application program.

DPCX Application Programs

DPCX application programs are coded using the 3790 programming statements. Thus, programs written for the 3790 Communication System can run unchanged on the DPCX system, although applications must be modified if they are coded for hardware not supported by DPCX.

A DPCX application program can invoke a number of DPCX application services, such as transaction support, queued printing support, system-to-program support, program-to-program support, display panel support, and interface to system services.

Using DPCX statements the application programmer can write programs to be run in a variety of modes, batch, interactive, conversational, with inquiry and data set update.

In addition to programming the DPCX/8100 system using the 3790 programming statements, Development Management Service (DMS), a program product, can be used. DMS is a high productivity, form-driven, prompt response, interactive component for generating display panels, display printer formats and data definition sections of the application program.

Once a DPCX application program has been coded, it is tested and prepared by the 3790 host support program. Thus, all DPCX application programs are written and tested at the host location under control of the host data processing personnel. Only after these programs are completed at the host are copies transferred through the network to the various System 8100/DPCX installations.

At the 8100 system, each DPCX application program executes on a symbolic machine, and that symbolic machine consists of real storage resources (a set of buffers, registers, and condition indicators). Each symbolic machine is protected from access by other programs at the same 8100 system.

DPCX Access to Host Applications

DPCX provides support that allows its users access to certain host applications. These functions are listed below.

- 3270 Data Stream Compatibility, which allows local or remote displays and display printers to be supported by existing 3270-based host applications.
- On-line printing to local or remote display printers supported by 3270-based host applications.
- An RJE package that includes: on-line work station program support for host-based RJE applications and off-line functions, such as spooled printing and input editing with user exits.

In addition, many 3790 field developed programs (FDPs) and Installed User Programs (IUPs) are compatible with DCPX. There are also aids for monitoring program exception and timing performance.

DPCX Installation

A DPCX system is distributed, in its entirety, via diskettes from the IBM Programming Installation Department (PID) to all customer sites. Subsequent to installing the DPCX system, the user customizes it to his configuration of the 8100 Information System, using a DPCX interactive display service. In addition, DPCX may be re-configured by the customer, if new devices or functions are required, without impact to existing customer data bases or programs.

Summary

DPCX provides the user with a multi-application, interactive system for the distributed processing environment. It features: central host control with the ability to distribute data and processing; various combinations of interactive and batch communication with locally or remotely attached terminals and a host processor; many system-provided functions and services; a smooth transition to the 8100 Information System for 3790 users; and customer-configured installation.

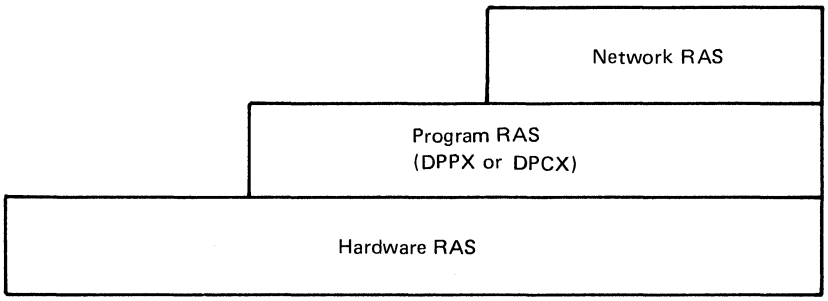
Publications

For more information, refer to *Distributed Processing Control Executive (DPCX) General Information: Introduction,* GC27-9075.

Chapter 5. Reliability, Availability, and Serviceability

With the growth and development of distributed systems, the availability of the host processor, the distributed processor, the data links, and the attached devices becomes essential for data processing operations. Therefore, a network control point for monitoring network status and for managing network problems and changes is required. This network control point can be located at any network node but is usually located at a System/370, which allows administration and management tools to be designed for operation with the System/370 host system.

The IBM 8100 Information System supports reliability, availability and serviceability (RAS) in three major areas: hardware, programming and network. The hardware support is supplemented by the programming support, which in turn is supplemented by the network support.



Hardware RAS

The 8100 Information System provides the hardware level of RAS, which is the base on which the other more complex levels are built. The following hardware RAS facilities, when used with an 8130 or 8140 processor, are available:

- Power-on and IPL tests
- Hardware error detection circuitry
- Field Engineering support
- Offline diagnostics
- Maintenance analysis procedures (MAPs), supported by a maintenance device
- Program Error Check
- I/O Error Handler
- Exception Error Handler

Programming RAS

The programming level of RAS combines the hardware RAS facilities with those of the associated licensed programs. This combination can be used:

As a stand-alone system

As part of a interconnected system (DPPX)

As part of a host-connected system

At this level, the RAS tools can be divided into those that are offered by both the hardware and the licensed programs and those that are offered only by the licensed programs.

Hardware/Licensed Program Tools:

- Error logging and display
- System message numbers
- Trace
- Online diagnostics
- Online softcopy MAPs (DPPX)

Program Product Tools:

- Online system or application dumps
- Stand-alone dumps
- Service level update management
- Programmed assistance in application of PTFs
- Application program debugging facilities
- Copy
- Entries or exits for user management or recovery procedures
- Vary I/O
- APAR create (DPPX)
- Error log formatter
- User exits

Network RAS

The network level includes the widest range of RAS support. It helps manage the network from a central control point where the major data processing resources are usually concentrated. It allows end users within the distributed system network to have only minimum data processing experience.

The network RAS facilities can be used by the network manager or control operator to:

- Monitor the status of a network and identify existing or developing network problems
- Access current information about a problem
- Test the nature and extent of an existing problem and verify when it has been resolved
- Report problems requiring further diagnosis to the proper support personnel

Network RAS Facilities:

- A network problem data display facility that selects, retrieves, and displays formatted error log data from a remote network node. This facility supports the network problem determination activity that defines the failing subsystem or node.
- A link testing facility that allows the user to detect and report network integrity problems. This facility verifies that a program in an initiating processor can communicate with a program in another processor within the network.
- A data set transmission capability that supports central program maintenance. This facility allows data from the host to be transmitted to a network node. It also assists in transmitting operating and error data sets from the node to the host.

RAS Summary

To meet the requirements of network management, the 8100 Information System offers RAS facilities with supporting documentation at the network, programming, and hardware levels. These RAS facilities take a network approach in their concept, requirements, staging, and implementation. They are a flexible means of responding to the RAS requirements of individual distributed system networks.

This is the end of the executive overview. You may:

- Continue with Part 2, "Technical Overview."
- Continue with *Distributed Processing Programming Executive (DPPX) Base General Information,* GC27-0400.
- Continue with *Distributed Processing Control Executive (DPCX) General Information: Introduction,* GC27-9075.

Part 2. Technical Overview

This technical overview is for managerial and technical people who will evaluate the feasibility of using the IBM 8100 Information System to realize a tailored distributed data processing system. At the end of this overview, the reader may:

- Continue with the *Distributed Processing Programming Executive (DPPX) Base General Information,* GC27-0400
- Continue with the *Distributed Processing Control Executive (DPCX) General Information: Introduction,* GC27-9075.
- Continue with the *IBM 8100 Information System Configurator*, GA27-2876.

Organization

The IBM 8100 Information System consists of two processor units, the IBM 8130 Processor and the IBM 8140 Processor, and, optionally, one or more IBM 8101 Storage and Input/Output Units. Each is offered in a variety of models. The features, characteristics, and models of each unit are described in Chapter 6, "Unit Configurations." Characteristics and features that are common to both processors are described in Chapter 7, "Processor Characteristics."

The processor units and the 8101 Storage and Input/Output Unit offer a variety of I/O device attachment features in addition to the selection of disk storage capacity identified by the model number of each unit. These features and disk storage capacities are described in Chapter 8, "Input/Output Functions and Features".

I/O devices that can be included in a system configuration are described in Chapter 10, "Attachable IBM Devices."

This part does not define restrictions or limitations placed on the system by DPPX or DPCX. These restrictions or limitations are defined in the documentation provided with the licensed programs.

Also, this part is not intended to be used to configure an 8100 Information System; however, it may be an aid in selecting features and devices when used in conjunction with the *IBM 8100 Information System Configurator,* GA27-2876.

Chapter 6. Unit Configurations

The IBM 8100 Information System is a communication-oriented stand-alone system with the capability of attaching to a host System/370. The 8100 processors and operating systems provide a flexible base for a wide variety of products. The 8100 processor and I/O structure provides:

- Processor storage capacities up to 512K bytes
- Dynamic address relocation and translation of logical addresses within a 4M-byte processor address space
- Storage protection and isolation of logical address spaces
- High-speed register storage separate from main storage
- Eight priority levels of program execution
- Definition of four modes of program execution
- Capability to define supervisor and application programs on the same priority level
- Sixteen fullword general registers per program
- Priority level assignment of I/O devices through programming (available on the 8130 Processor only when the System Expansion feature is installed)
- Sixteen sublevels per priority level for I/O interrupt identification (available on the 8130 Processor only when the System Expansion feature is installed)
- Basic instruction set containing 112 instructions
- Floating-point arithmetic with 30 floating-point instructions (8140 only)
- High-speed disk storage
- Tape subsystem compatible with System/370
- Wide variety of I/O device attachment features including:

  Directly attached display stations and printers

  Directly attached loops

  Data link attached loops

  SDLC communication attachments

  BSC and S/S communication attachments

The hardware units of the 8100 Information System are:

IBM 8130 Processor (Figure 6-1)

IBM 8140 Processor (Figure 6-2)

IBM 8101 Storage and Input/Output Unit (Figure 6-3)

Figure 6-1. IBM 8130 Processor (Design Model)

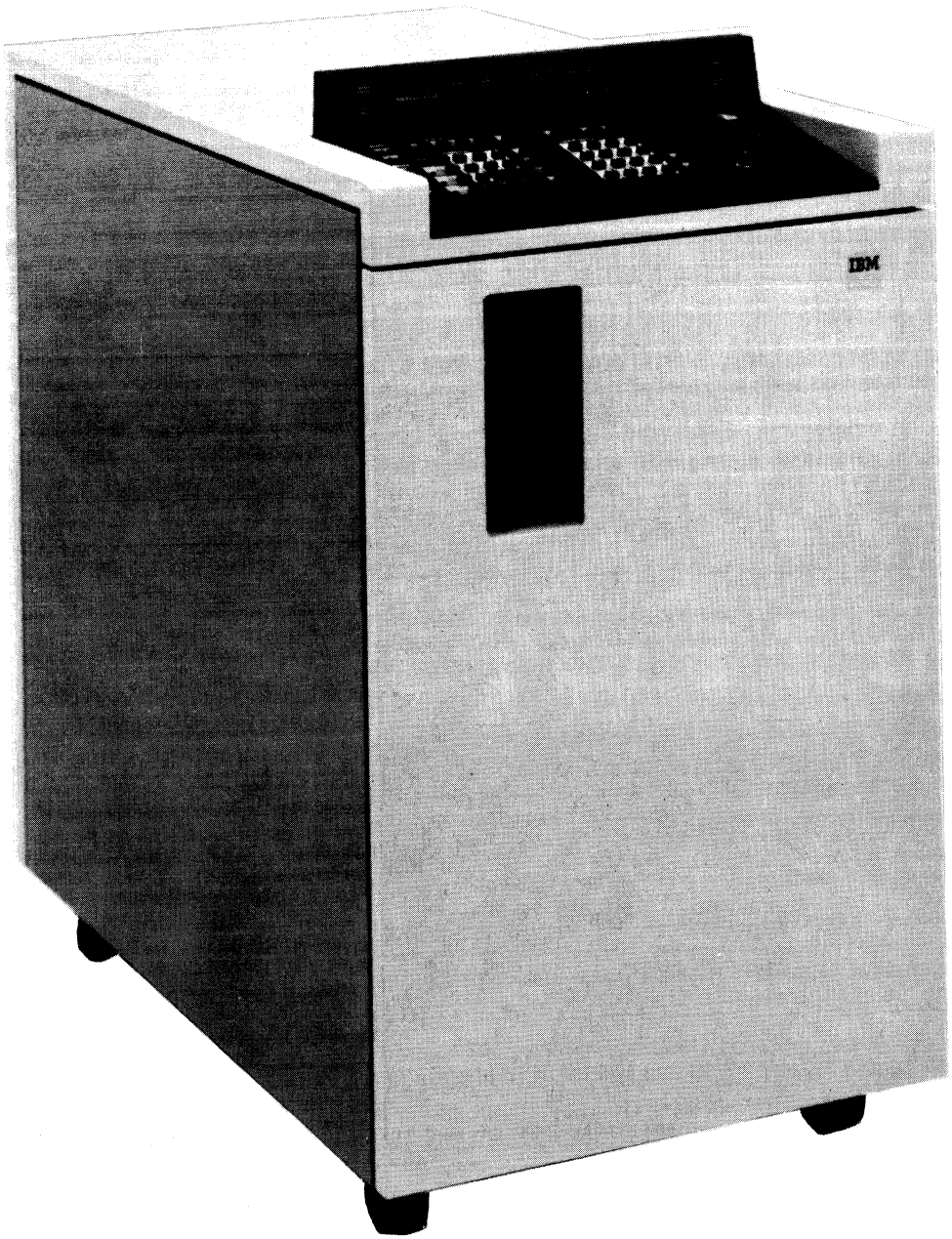


Figure 6-2. IBM 8140 Processor (Design Model)

Figure 6-3. IBM 8101 Storage and Input/Output Unit (Design Model)

Processors

The 8100 Information System offers two processor units. The 8130 is available in four models, and the 8140 is available in twelve models. This flexibility enables the user to configure a system to cover initial requirements and modify the system configuration to meet future needs.

8130 Models	Processor Storage	Disk Storage
A21	256K to 512K bytes	29 million bytes–movable heads
A22	256K to 512K bytes	23 million bytes–movable and fixed heads
A23	256K to 512K bytes	64 million bytes–movable heads
A24	256K to 512K bytes	58 million bytes–movable and fixed heads

8140 Models	Processor Storage	Disk Storage
A31	256K to 384K bytes	29 million bytes–movable heads
A32	256K to 384K bytes	23 million bytes–movable and fixed heads
A33	256K to 384K bytes	64 million bytes–movable heads
A34	256K to 384K bytes	58 million bytes–movable and fixed heads
A41	320K bytes	29 million bytes–movable heads
A42	320K bytes	23 million bytes–movable and fixed heads
A43	320K bytes	64 million bytes–movable heads
A44	320K bytes	58 million bytes–movable and fixed heads
A51	512K bytes	29 million bytes–movable heads
A52	512K bytes	23 million bytes–movable and fixed heads
A53	512K bytes	64 million bytes–movable heads
A54	512K bytes	58 million bytes–movable and fixed heads

Note: *Floating-Point Arithmetic is standard and available only on 8140 Models A41, A42, A43, and A44.*

The 8100 Information System includes an 8130 or 8140 Processor. Additionally, the 8130 with the System Expansion feature allows attachment of up to two 8101 Storage and I/O Units. The 8140 can have up to four 8101 Storage and I/O Units. A maximum of four 8809 Magnetic Tape Units can be attached either directly to an 8130 or 8140 or to an 8101.

The major difference between the 8130 and the 8140 Processors is the operating speed. Under DPPX, the 8140 executes instructions approximately 60% faster than the 8130. (The instruction execution speed should not be directly equated to overall system performance, which depends on a number of factors such as: hardware configuration, the choice of I/O communication facilities, and application characteristics.)

IBM 8130 Processor

The 8130 Processor is a low-cost, general-purpose processor with a wide range of applications. The 8130 is an interrupt-driven processor with eight hardware interrupt levels. A maximum of six communication facilities can be attached to the 8130. The devices that can be attached to the loop facilities are described in this chapter and also in Chapter 10.

The storage cycle time of the 8130 Processor is 1200 nanoseconds. The 8130 via the 8100 I/O bus has the capability of transferring data at 930,000 bytes per second.

All of the 8130 Processor models include the following standard items:

- Basic Operator Panel
- Processor storage of 256K bytes up to 384K or 512K bytes depending on feature selection
- 4K bytes of read-only storage in addition to the processor storage
- IBM diskette 2D drive with up to 1 million bytes of removable diskette storage. The 2D drive can utilize either the type 1 or 2D diskettes.
- Nonremovable disk storage with 23 to 64 million bytes of storage depending on model selection, plus 128K bytes accessed by fixed heads for models utilizing fixed heads
- Dynamic addressing and storage protection that allows addressing of up to 4 million bytes of logical storage
- Eight priority levels
- Maintenance device port

The floating-point arithmetic feature is not available for the 8130 Processor. Floating-point arithmetic may be performed by programs, such as the DPPX FORTRAN floating-point subroutines (an IBM licensed program).

Features

The following optional features may be specified for the 8130 (the feature codes are in parentheses):

- Keylock (4655)

  This three-position key-operated switch provides security for the 8100 system. The three switch positions are:

  SECURE: The power on and operator panel function switches are disabled.

  POWER ONLY: The power on switch is operable, but the operator panel function switches are disabled.

  ENABLE: The power on and operator panel function switches are operable.

- Security Cover Locks (6555)

  Provides locks for the front and rear covers.

- Security Lock, Diskette (6566)

  Provides a lock for the diskette cover.

- Processor Storage (1710)

  Provides 131,072 bytes of additional processor storage for Models A21 through A24. Maximum, one per 8130. Not available if feature 1720 is selected.

- Processor Storage (1720)

  Provides 262,144 bytes of additional processor storage for Models A21 through A24. Maximum, one per 8130. Not available if feature 1710 is selected.

- Feature Expansion (1520)

  Provides the capability to attach (in any combination) four of the following features:

  Directly attached loops (4830)

  Communication Adapters

  This feature is required to attach the Loop Adapter Second Lobe feature (4835) or the Multi-Speed Clock Feature (5200). Maximum, one per 8130.

- System Expansion (1530)

  Provides programmable hardware interrupt levels and I/O interrupt ID determination. Required for attachment of up to two 8101 Storage and I/O Units or one 8101 and one 8401 Magnetic Tape Unit directly to the 8130. Maximum, one per 8130.

- Loop Adapter (4830)

  Provides attachment of a directly attached loop at 9600 or 38.4K bps. Maximum, two on base 8130. Maximum, six if Feature Expansion Type I feature (1520) is installed.

- Loop Adapter Second Lobe (4835)

  Provides attachment of a second loop to a directly attached loop. Maximum, three per 8130. Prerequisite, Feature Expansion Type I (1520) and a Loop Adapter feature (4830) for each Loop Adapter Second Lobe feature.

The following communication features are available for the 8130 Processor. They are described in detail in the *IBM 8100 Information System Configurator,* GA27-2876.

- SDLC Communications with Business Machine Clock (1601)
- SDLC Communications without Business Machine Clock (1602)
- BSC/SS Communications with Business Machine Clock (1603)
- BSC Communications without Business Machine Clock (1604)
- Modem, Integrated, Nonswitched (5500)
- Modem, Integrated, Switched (5501)
- Data-phone* Digital Service Adapter (DDSA) (5660)
- EIA RS-232-C/CCITT V.24 Interface (3701)
- CCITT V.35 Interface (1550)
- Multi-Speed Clock (5200)
- Public Switched Network Adapter (PSNA) Manual (2947)

*Trademark of American Telephone and Telegraph

IBM 8140 Processor

The IBM 8140 Processor is a multilevel, interrupt-driven processor designed for the 8100 Information System. It offers greater performance than the 8130 and is available in twelve models, four of which offer floating-point arithmetic.

The storage cycle time for the 8140 Processor is 800 nanoseconds. The 8140 via the 8100 I/O bus has the capability of transferring data at 1.25 million bytes per second. The I/O bus allows four 8101 Storage and I/O Units to be attached. Up to four 8401 Magnetic Tape Units can be attached via a single 8101 in the 8100 Information System.

Processor storage for the 8140 can be 256K to 384K, 320K, or 512K bytes depending on the model.

All the 8140 Processor models include the following standard items:

- Basic Operator Panel
- 4K bytes of read-only storage is included in the processor storage
- IBM Diskette 2D drive with up to 1 million bytes of removable diskette storage. The 2D drive can utilize either the type 1 or 2D diskettes.
- Nonremovable disk storage with from 23 to 64 million bytes of storage available, depending on model selection
- Dynamic addressing and storage protection allowing addressing up to 4 million bytes of logical storage
- Eight priority levels
- Maintenance device port

Floating-point arithmetic is standard on the 8140 Models A41, A42, A43, and A44.

Features

Feature codes are in parentheses.

- Storage Increment 128K (1490)

  Provides 128K bytes of additional storage. Processor storage in Models A31, A32, A33, A34 can be increased from 256K to 384K bytes.

- Expanded Function Operator Panel (4545)

  Provides programmer and operator access to storage, program stop and restart capability and current operating indicators. Communication capabilities are not allowed on floating-point processors when this expanded function operator panel is selected. This feature is also not available on Models A51 through A54.

- Keylock (4655)

  Provides a three-position key-operated switch. The three switch positions are:

  SECURE: Disables power on and operator panel functions.

  POWER ONLY: Enables power on but disable operator panel function.

  ENABLE: Enables power and operator panel functions.

- Security Cover Locks (6555)

  Provides locks for the front and rear covers.

- Security Lock, Diskette (6566)

  Provides a lock for the diskette cover.

- Loop Adapter (4830)

  Provides for direct attachment of a single lobe loop at 9600 or 38.4K bps. A maximum of three loops and two second lobes can be attached to Models A31 through A34. A maximum of two loops and one second lobe can be attached to Models A41 through A44.

- Loop Adapter Second Lobe (4835)

  Provides for the attachment of a second lobe to a directly attached loop at 9600 or 38.4K bps. Prerequisite, 4830. Maximum, two per 8140.

The following communication features are available for the 8140 Processor. They are described in detail in the *IBM 8100 Information System Configurator*, GA27-2876.

- SDLC Communications with Business Machine Clock (1601)
- SDLC Communications without Business Machine Clock (1602)
- BSC/SS Communications with Business Machine Clock (1603)
- BSC Communications without Business Machine Clock (1603)
- Modem, Integrated, Non-switched (5500)
- Modem, Integrated, Switched (5501)
- Data-phone* Digital Service Adapter (DDSA), (5660)
- EIA RS-232-C/CCITT V.24 Interface (3701)
- CCITT V.35 Interface (1550)
- Multi-Speed Clock (5200)
- Public Switched Network Adapter (PSNA) Manual (2947)

IBM 8101 Storage and Input/Output Unit

The IBM 8101 Storage and Input/Output Unit provides disk storage, diskette storage, communication, and device attachment capabilities for the 8100 Information System. The 8130 Processor with the System Expansion feature or 8140 Processor allows 8101 Storage and I/O Units to be attached to a system. Furthermore, four 8809 Magnetic Tape Units may be attached to one of the 8101s in the system.

The 8101 is available in three models, which differ in the amount of disk storage size and I/O capability available.

Model	Optional Device Attachment	8809 Adapter (One per system)	Optional Type 2D Diskette Storage	Disk Storage
A10	Yes	Yes	Yes	None
A11	Yes	Yes	Yes	29 million bytes—movable heads
A13	Yes	Yes	Yes	64 million bytes—movable heads

*Trademark of American Telephone and Telegraph

The 8101 Storage and I/O Unit extends the data collection capability of the 8100 Information System by providing for the attachment of a wide variety of input/output devices. These devices consist of displays, printers, controllers, and data collection units. The devices may be attached to the 8101 directly, or through 8101 attached loops, data link attached loops, and communication facilities. The 8101 can attach communication facilities up to a maximum of eight. The devices that may be attached to the loop facilities are described in this chapter and also in Chapter 10.

Features

Feature codes are in parentheses.

- Display and Printer Attachment Type I (1501) or Type II (1502)

  Provides for the attachment of feature codes 1505 and 1506. Maximum, one per 8101; one per system.

- Display and Printer Adapter (1505)

  Provides attachment capability in any combination up to a maximum of four of the following devices:

  3277 Display Models 1, 2

  3287 Printer Models 1, 2

  3284 Printer

  3286 Printer

  3288 Printer

  Maximum, one 1505 per 8101; one per system. Prerequisite, 1501 or 1502.

- Display and Printer, Additional (1506)

  Up to five features of this type can be installed in addition to the Display and Printer Adapter (1505). This feature allows the attachment up to a maximum of four of the following devices in any combination:

  3277 Display Models 1, 2

  3287 Printer Models 1, 2

  3284 Printer

  3286 Printer

  3288 Printer

  Prerequisite, 1501 or 1502 and 1505.

  Maximum, five per 8101; however, note the following limitations on devices.

  The following system limits apply to devices attached by features 1505 and 1506:

3277-1, 2	up to	24
3287-1, 2	up to	4
3284	up to	4
3286	up to	4
3288	up to	4
Combined	maximum	24

  Prerequisite, 1501 and 1507.

- Communications Attachment Type I (1503) or Type II (1504)

  Provides for the attachment of loops and communication facilities up to a maximum of four. Maximum, one each per 8101; one each per 8130 system; two each per 8140 system.

- Diskette Drive and Magnetic Tape Attachment (1507)

  Provides the capability to attach feature codes 4520 and 4521. Only required for 8101 Model A10. Maximum, one per system.

- Diskette 2D Drive (4520)

  This feature provides 1 million bytes of removable diskette storage.

- Magnetic Tape Attachment (4521)

  Provides for the attachment of up to four 8809 Magnetic Tape Units. Maximum, one per system.

- Loop Adapter (4830)

  Provides for direct attachment of a single lobe loop at 9600 or 38.4K bps. Maximum, one per each feature code 1602; up to 14 per 8130 system, 19 per 8140 (Models A31-A34) system, or 18 per 8140 (Models A41-A44) system. These maximums are reduced by one for each communication facility attached to the 8101.

- Loop Adapter Second Lobe (4835)

  Provides for the attachment of a second lobe to a directly attached loop at 9600 or 38.4K bps. Prerequisite, 4830. Maximum of two per 8101; five per 8130 system, and six per 8140 system.

- Security Cover Locks (6555)

  Provides locks for the front and rear covers.

- Security Lock, Diskette (6566)

  Provides a lock for the diskette cover.

The following communication features are available for the 8101. They are described in detail in the *IBM 8100 Information System Configurator*, GA27-2876.

- SDLC Communications with Business Machine Clock (1601)
- SDLC Communications without Business Machine Clock (1602)
- BSC/SS Communications with Business Machine Clock (1603)
- BSC Communications without Business Machine Clock (1604)
- Modem, Integrated, Non-switched (5500)
- Modem, Integrated, Switched (5501)
- Data-phone* Digital Service Adapter (DDSA) (5660)
- EIA RS-232-C/CCITT V.24/V.28 Interface (3701)
- CCITT V.35 Interface (1550)
- Multi-Speed Clock (5200)
- Public Switched Network Adapter (PSNA) Manual (2947)

*Trademark of American Telephone and Telegraph

Chapter 7. Processor Characteristics

An IBM 8100 Information System includes an IBM 8130 Processor or an IBM 8140 Processor. The characteristics of these processors are described in this chapter.

Data Units

The basic unit of information is the 8-bit byte with parity. Bytes may be handled separately or grouped into fields. A halfword is two consecutive bytes; a word is four consecutive bytes; a doubleword is eight consecutive bytes. Register operands may be a byte, a halfword, or a word in length. Variable-length operands up to 256 bytes or halfwords may be located in main storage. Floating-point operands are a word or a doubleword in length and may be located in a floating-point register or in main storage.

Data Types

General instructions are provided for working with three types of data: signed and unsigned fixed-point numbers and unstructured logical quantities. Additional general instructions are provided to control instruction sequencing. Floating-point instructions provide for operations on floating-point data. Processor control information is manipulated with a set of processor control instructions.

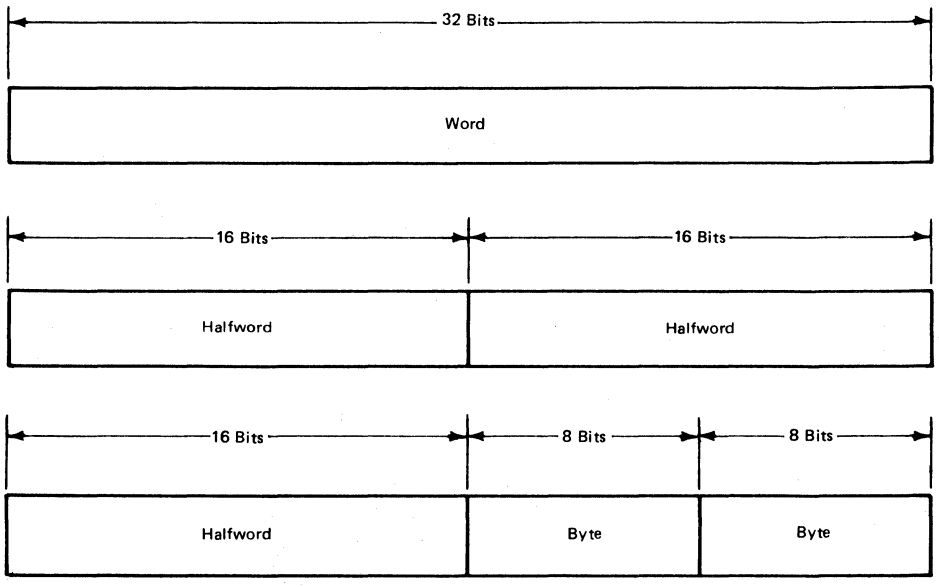
Processor Resources

This section describes the processor resources that are available to a program.

General Registers

General registers are organized in register sets. A register set consists of eight registers. General registers are 32 bits in length. Each program is assigned two sets of general registers, the primary register set and the secondary register set. These registers can be used for addressing, indexing, accumulating, and temporary operand storage.

Operands in general registers may be a byte, a halfword, or a word in length. One general register may hold multiple operands, each of which may be processed independently. The three possible allocations of operands in a general register are as follows:



Floating-Point Registers (8140 Only)

Eight sets of floating-point registers are provided for floating-pointoperations. A floating-point register is 64 bits in length, with four floating-point registers in each set. One set of floating-point registers can be assigned to a program. Floating-point operands may be either short format (32 bits) or long format (64 bits). When floating-point operands are 32 bits in length, the rightmost 32 bits in a floating-point register are unused.

Processor Storage

Processor storage provides the 8100 Information System processors with high-speed, directly accessible data storage. Data and programs must be loaded into main storage from input devices before they can be processed. Main storage is available in a variety of amounts, ranging from a minimum of 128K bytes to a maximum of 512K bytes. Processor storage availability for the individual processor models is described in Chapter 6, "Unit Configurations."

Byte locations in storage are consecutively numbered, left to right, starting with 0; each number is considered to be the address of the corresponding byte. A group of bytes in storage is addressed by the leftmost byte of the group. The number of bytes in the group is either implied or explicitly stated for the operation being performed.

Integral Boundaries

Certain units of data must be located in main storage on an integral boundary. An integral boundary means that a unit of data is located on a storage address that is a multiple of its size. For example, a halfword is on an integral boundary when it is located on a storage address that is a multiple of 2, and a word of data is on an integral boundary when it is located on a storage address that is a multiple of 4.

Floating point storage operands may be a word, or a double word in length. Both operand lengths are required to be on a word boundary.

Instructions must appear on halfword integral boundaries. Halfword and word storage operands must appear on integral boundaries. The low-order bits of addresses designating instructions or data operands that are required to be on integral boundaries are ignored and are assumed to be zero.

Addressing Main Storage

Storage addresses are linear from address 0 to the maximum byte address of the installed storage. If the maximum byte address of the installed storage is exceeded while referencing main storage, a program exception condition is detected by the processor, and the operation is suppressed.

The processor accesses main storage using real addresses. A real address is considered to be the byte address of a physical main storage location. A real address is only associated with one main storage location.

An address used by a program or during a channel I/O operation is a logical address. Logical addresses are not used to access main storage directly; a logical address identifies a byte location within a logical address space. Storage addressing is not permitted to wrap from the maximum address to address 0. Programs and channel I/O operations are assigned a logical address space by the supervisor program according to their size. The processor automatically relocates the logical addresses issued by a program or during a channel I/O operation into the processor address space. Logical addresses are relocated by the dynamic address relocation mechanism. The relocated address may be used to access main storage, or it may require translation by the dynamic address translation mechanism before main storage can be accessed by the processor. Dynamic address relocation and dynamic address translation are described later in this chapter under "Storage Control."

Instruction Set

An instruction is one or two halfwords in length. Each instruction is in one of seven basic formats. The halfword instruction formats are: register-register (RR), register-immediate (RI), register-storage (RS), and floating-point register-register (FF). The word instruction formats are: register-register long (RR-Long), register-storage long (RS-Long), and floating-point register-storage (FS). The format names express, in general terms, the specification of operands.

Operands

Operands can be grouped into three classes: operands located in registers, immediate operands, and operands in main storage. Operands may be either explicitly or implicitly designated.

Register operands may be located in either general registers or floating-point registers, with the type of register identified by the operation code of the instruction that processes the operand. The register containing the operand is specified in a four-bit field in the instruction, called the R field in the general instruction set and a two-bit field, called the F field in the floating-point instruction set. Some general instructions specify the register implicitly: the location of the register operand is implied by the operation code.

Immediate operands are contained within the instruction; the field containing the immediate operand is called the I field.

Operands in main storage may have either an implied length or a length that is specified by the contents of a general register. The addresses of operands in main storage are specified using the contents of a general register as part of the address. The address used to refer to main storage is contained in a general register designated by the R field in the instruction or is calculated from a base and displacement, designated by the B field and the D field, respectively, in the instruction. This addressing format permits the following flexibility in program design:

- Complete address specification using an abbreviated notation
- Address manipulation using instructions that employ general registers for operands
- Modification of addresses through programming without altering the instruction stream
- Operation independent of the location of data areas by directly using addresses received from other programs

For purposes of describing the execution of instructions, operands are designated as first and second operands and, in some cases, as third operands. Usually, two operands participate in instruction execution, and the result replaces the first operand. An exception is found in store-type instructions, where the result replaces the second operand. Except for storing the final result, and for instructions that include address modification as part of the operation, the contents of all registers and storage locations participating in the addressing or execution part of an operation are normally unchanged.

Instruction Summary

This section provides an overview of the capabilities of the 8100 Information System instruction set. These descriptions are grouped by the types of operations performed by the processor when the instructions are executed.

Arithmetic Operations: Arithmetic operands are provided for addition, subtraction, multiplication, division, and comparison of fixed-point binary numbers. Positive numbers are represented in true binary notation. Negative numbers are represented in twos-complement notation. Byte and halfword formats are provided for fixed-point numbers. Addition, subtraction, and comparison can also be performed on numbers that are represented in multiple bytes or halfwords.

Arithmetic operations are provided in the register-register instruction format. Addition and subtraction are also provided in the register-immediate format. For operands located in the high-order halfword of any general register, addition, subtraction, and comparison are also provided.

Logical Operations: Instructions are provided for AND, OR, and exclusive OR operations on byte and halfword operands. These operations are provided in the register-register instruction format. Logical operations on byte operands are also provided in the register-immediate instruction format. Included in this last group is a logical test operation that employs the immediate field as a mask. The mask is used to select one or more bits of a byte operand for testing.

Shift and Rotate Operations: Instructions are provided that shift (left) or rotate (left) the bits within a byte or halfword operand. An immediate field specifies a maximum shift or rotate of seven bit positions for a byte operand and fifteen bit positions for a halfword operand. All bits of the operand participate in the operation. The byte operand may be located in either register set.

Variable-Length Field Operations: Move and logical comparison operations are provided that operate on variable-length fields in main storage. The operand fields may contain a maximum of 256 bytes or halfwords. The instructions require the specification of three registers. Two of the registers contain the storage addresses of the operand fields; the third provides an eight-bit count.

Load and Store Operations: Load and store operations are provided for the transfer of data between main storage and general registers. For the register-register format instructions, the storage address is specified by the contents of a general register. The register-storage format instructions permit the specification of the storage-operand address with a base address and a displacement. The base address can be designated as the contents of a general register or as the value of the instruction address. For both instruction formats, the operand size may be a byte or halfword; word operands may also be designated with the register-storage format.

The capability is provided to load or store a group of eight halfword operands, collectively called a quadrant. Either general register set may be specified, and the operands may be designated as either the high-order or low-order halfword of the eight registers.

Certain operations in the register-register instruction format provide additional function to post-increment or pre-decrement the storage address. For the transfer of a quadrant, the storage address is incremented by 16.

Load Register Operations: Operations are provided in the register-register instruction format that transfer a byte or halfword from one general register location to another. The byte or halfword may be located in any operand position of any general register. In addition, an operation is provided in the register-immediate instruction format that allows a byte of immediate data to be loaded into a register.

An operation is provided to load a storage address. This operation adds the displacement field to a base address and places the result in a general register.

Branching Operations: The normal sequential execution of instructions may be changed by the use of branching operations to perform subroutine linkage and decision making. These operations permit the introduction of a new instruction address. The new address either is contained in a general register or is calculated from a base address and a displacement. The contents of a general register or the value of the instruction address may be used as the base address.

Subroutine linkage is provided by instructions that introduce a new instruction address and preserve the next-sequential-instructionaddress. Decision making is provided with conditional branching operations. These operations inspect condition indicators that reflect the results of arithmetic, logical, and I/O operations.

Other specialized branching operations are provided for counting and testing, bit testing, and n-way branching, where n is a value up to 256.

Input/Output Operations: Three I/O instructions are provided that transfer a byte or a halfword of data between the processor and an I/O device. The I/O Byte and the I/O Byte (Immediate) instructions transfer one byte of data during their execution. The I/O Halfword instruction transfers two bytes during its execution. These I/O instructions transfer data to or from a general register in the processor; they do not transfer data to or from main storage.

Channel I/O operations transfer data between main storage and a device. I/O instructions are used to prepare the device for the channel I/O sequence and to initiate the operation.

I/O instructions can only be executed by programs executing in the I/O, supervisor, and master modes. A program exception is detected by the processor when a program executing in application mode attempts to execute an I/O instruction.

I/O instructions and channel I/O operations are described later in this chapter under "I/O Operations."

Processor Control Operations: Processor control instructions permit a program to inspect and modify processor control information that reflects the operational status of the processor. The execution of processor control instructions is limited to programs executing in supervisor or master mode. A program exception is detected by the processor when programs executing in application or I/O mode attempt to execute processor control instructions.

Data Integrity and Security

Data integrity and security is maintained through the following processor facilities:

- Parity checking is done on data and control paths to and from register storage, main storage, and I/O devices.
- Execution of processor control instructions is limited to programs executing in supervisor or master mode.
- Logical address space isolation and protection is provided by the dynamic address relocation mechanism.
- Access protection is provided for each 2K block of processor address space by the dynamic address translation mechanism.
- Execution of I/O instructions is limited to programs executing in I/O, supervisor, or master mode.

Program Definition

A program is defined to the processor in terms of its logical address space and its operational status. A pair of control vectors is associated with the definition of each program. The address control vector (ACV) describes the size, location, and attributes of the program's logical address space. The program status vector (PSV) records the status of the program's execution and provides information with which the processor controls the execution of the program. Two PSV/ACV pairs are provided for each priority level; a primary PSV/ACV pair and a secondary PSV/ACV pair. Supervisor programs are usually

associated with the primary pair, and application programs are usually associated with the secondary pair. The processor uses control information called the program activation vector to determine which PSV/ACV pair should be given control on each priority level.

PSV/ACV pairs are stored in fixed locations in register storage. Each priority level is assigned a unique location for its primary and secondary PSV/ACV pair. The register storage location of the PSV/ACV pair that describes a program determines the priority level of that program's execution.

Processors that implement floating point operations provide an additional control vector for program control on each priority level. This control information is called the floating-point status vector (FSV). The FSV contains control information relative to the execution of floating-point instructions. The FSV for a specific prioirty level is activated by the processor when a program is dispatched on that level. One FSV is provided for each priority level; it is shared by the programs defined by the primary and secondary PSV/ACV pairs for that priority level.

A program is dispatched when its PSV/ACV pair is activated by the processor. The priority level to be given control and the determination of which PSV/ACV pair is to be activated, determines the fixed register storage location from which the PSV/ACV pair is activated. Program execution does not modify the active ACV. The PSV, however, provides the instruction address and condition indicators that record the execution of the program. When control is given to a new priority level or to the opposite PSV/ACV pair on the current level, the processor stores the current PSV in its fixed location in register storage before activating the new PSV/ACV pair. Saving the PSV information permits the interrupted program's execution to be resumed at a later time. Since the ACV is not modified during program execution, it is not stored when control is exchanged with a new PSV/ACV pair.

Address Control Vector

The address control vector (ACV) describes a logical address space assigned to a program or channel I/O operation. An ACV is paired with each PSV and channel pointer to define their logical address spaces when they are activated. ACVs are stored in fixed locations in register storage.

The ACV also defines what type of addresses are used by the program or channel I/O operation to access main storage. The addresses used by the program or channel I/O operation are called logical addresses. All logical addresses are relocated into the processor address space by the dynamic address relocation mechanism. The ACV defines whether the relocated addresses are to be used to access main storage or whether the relocated addresses must be translated by the dynamic address translation mechanism in order to access main storage. The dynamic address relocation mechanism and the dynamic address translation mechanism are described later in this chapter under "Storage Control." Channel I/O operations and channel pointers are described later in this chapter under "I/O Operations."

Program Status Vector

The program status vector (PSV) contains the information required for proper program execution. The PSV includes the instruction address, the program mode, condition indicators, register set numbers, and other control fields.

The instruction address contains the logical address of the next instruction to be executed. The instruction address controls instruction sequencing in the execution of the program.

The program mode defines the instruction execution privilege assigned for the program. Four program modes are defined: master mode, supervisor mode, I/O mode, and application mode. The program modes can be summarized as follows:

- Master Mode: All instructions are valid. In addition, all store and execute references to main storage are allowed, because the access codes in the translation table entries are ignored (with the exception of block-invalid bit). An access exception is recognized, regardless of the program mode, when an attempt is made to use an invalid table entry for translation. Access codes are described in this chapter under "Storage Access Protection".
- Supervisor Mode: All instructions are valid.
- I/O Mode: Only those instructions are valid that cannot be used to affect system integrity. Supervisor-privileged instructions are not valid in I/O mode; they include those instructions that modify the system control fields in the PSV and in control vectors, those that modify system control fields in the floating-point status vector, those that modify or inspect the contents of the translation table, and those with the capability to modify or inspect the contents of any register set.
- Application Mode: Only those instructions are valid that do not affect system integrity and that do not pertain to I/O functions. Supervisor-privileged instructions and I/O-privileged instructions are not valid in application mode.

Four condition indicators reflect the results of arithmetic, logical, and I/O operations. These operations can indicate the existence of one or more of five possible conditions by setting the appropriate values in the condition indicators. The specific meaning of any condition depends on the operation that sets the indicators. All operations that set the condition indicators place new values in all four of the indicators. Once set, the condition indicators remain unchanged until modified by an instruction that causes new conditions to be indicated.

The register set numbers record the primary and secondary register set assignment for each program. Each program is assigned two sets of eight 32-bit general registers. These registers can be used for temporary operand storage, address specification, and as accumulators.

Floating-Point Status Vector (8140 Only)

The floating-point status vector (FSV) contains information used to control floating-point operations. The floating-point register set assignment, the precision of floating-point operations, and control information for processing floating-point program exceptions are contained in the FSV. The FSV also records floating-point exceptions or equipment checks detected during floating-point operations.

The register set assignment contains the number of the floating-point register set assigned to the program associated with this FSV. Each program can be assigned one set of four 64-bit floating-point registers.

The precision of floating-point operations is controlled with a 1-bit field in the FSV. When short-precision is specified, floating-point operands are 32 bits in length. When long-precision is specified, floating-point operands are 64 bits in length. For operations on short-precision operands, the low-order 32 bits of floating-point register operands are ignored.

Certain floating-point exceptions can be masked to be detected or to be ignored. The exception mask field provides for the following exceptions to be masked: Significance, Exponent Overflow, and Exponent Underflow. When the mask bit is zero, the condition results in a program exception interrupt sequence. When the mask bit is one, no program interrupt occurs when the condition is detected.

The equipment check bit is set when a data or control error is detected during floating-point operations. The remaining field in the FSV records program exception conditions associated with the floating-point operations.

Register Storage Organization

Register storage is organized into 64 principal register sets and 64 adjunct register sets. A register set contains eight registers.

Eight sets of floating-point registers are provided for processors that implement floating-point operations. Floating-point registers are physically separate from adjunct and principal register storage. One floating-point register set contains four floating-point registers.

Principal Register Sets

The registers in the principal register sets are 32 bits in length. The principal register sets are divided into three categories and contain the following:

- Four sets are provided as save areas for primary and secondary program status vectors (PSVs).
- Eight sets are provided for channel pointers.
- Forty-eight sets are assignable to programs as general registers.
- Four sets are reserved (see Figure 7-1).

The PSV save areas are used for saving active PSVs and introducing new PSVs.

The channel pointers contain the logical addresses of the next data transfer, to or from main storage, during channel I/O operations. Channel pointers and channel I/O operations are described later in this chapter under "I/O Operations."

The remaining register sets contain general register sets that are assignable to programs.

Figure 7-1 shows the organization of the principal register sets.

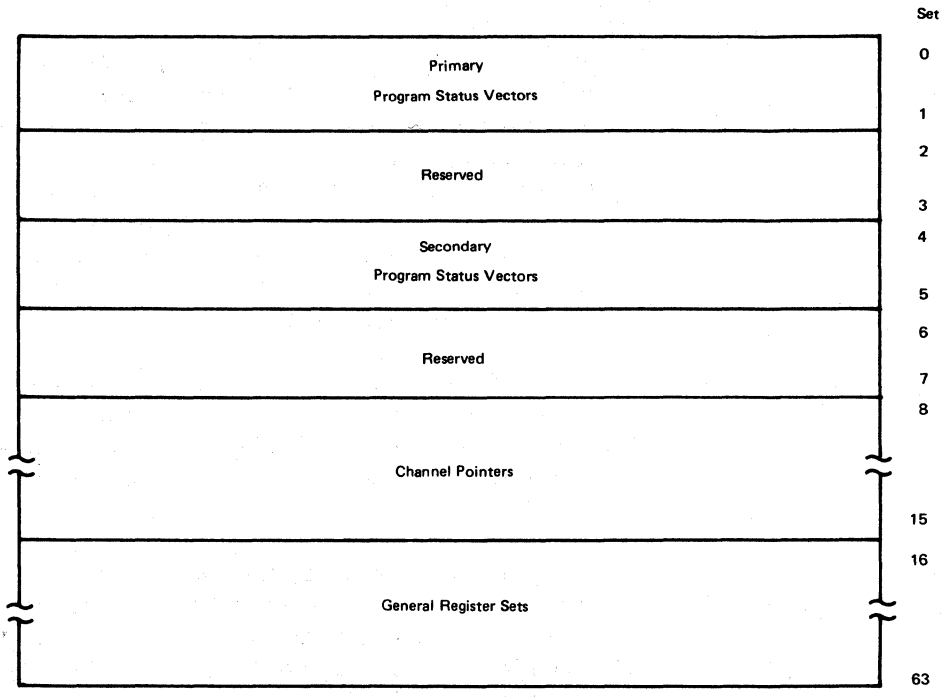


Figure 7-1. Principal Register Sets

Adjunct Register Sets

The adjunct registers are 16 bits in length. An adjunct register set is paired with each of the first 16 principal register sets. Four sets are reserved. The adjunct registers contain address control vectors (ACVs). An ACV is paired with each PSV and channel pointer to define the logical address space assigned to a PSV and to a channel pointer.

Figure 7-2 shows the relationship between principal and adjunct register sets.

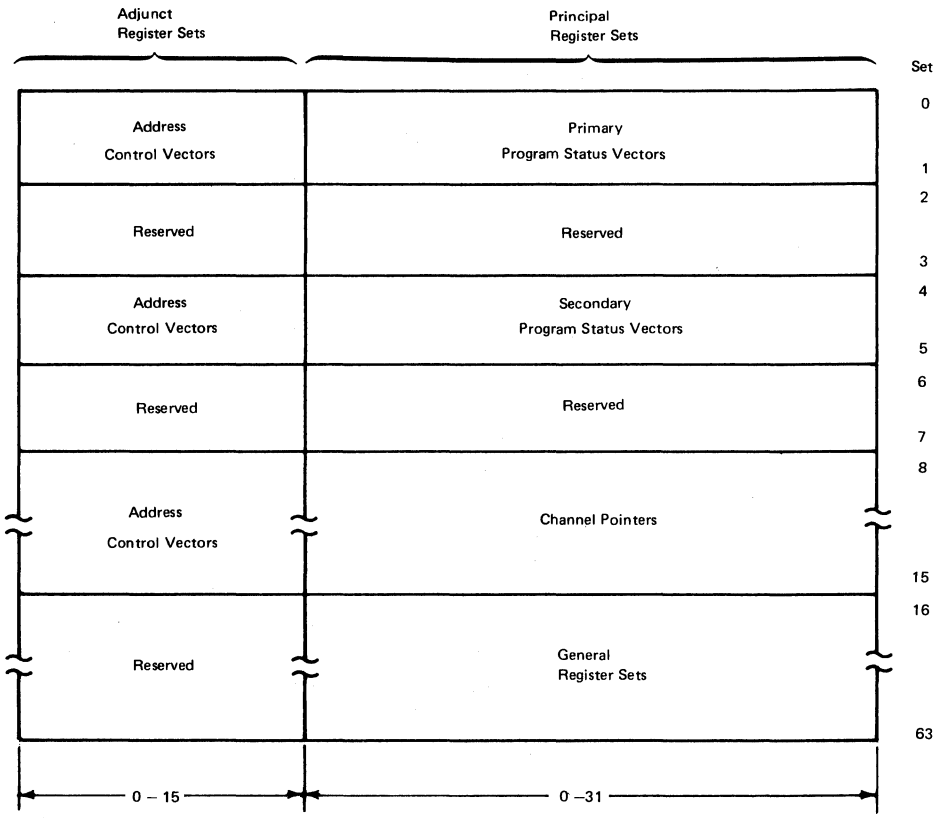


Figure 7-2. Relationship of Principal and Adjunct Register Sets

Floating-Point Register Sets (8140 Only)

A floating-point register is 64 bits in length. Floating-point operands may be 32 or 64 bits in length, depending on the setting of the precision bit in the floating-point status vector (FSV). The FSV identifies which of the eight sets of floating-point registers is assigned to a program. The contents of floating-point registers can be inspected and modified using floating-point instructions; instructions that access the principal and adjunct registers cannot access floating-point registers.

Storage Control

This section describes how the 8100 programs, using logical addresses, access processor storage. Program addresses, or logical addresses, are not used to directly access processor storage. The processor relocates all logical addresses into the processor address space with the dynamic address relocation mechanism. The relocated address is translated with the dynamic address translation mechanism before processor storage is accessed. Both the dynamic address relocation mechanism and the dynamic address translation mechanism are described in this section.

The management of the processor address space is program-defined; the address conversion is performed automatically by the processor.

Two levels of storage access protection are provided by the dynamic address relocation mechanism and the dynamic address translation mechanism. Storage access protection is described later in this chapter under "Storage Access Protection."

Logical Addresses

The 8100 programs and data areas used during channel I/O operations (CHIO) are defined within a logical address space. The size of the program or the length of the CHIO data area determines the extent of the logical address space. The address of a byte location in a logical address space is a logical address. Within a logical address space, logical addresses are contiguous from 0 to the address that expresses the maximum extent of the logical address space. An address control vector (ACV) is associated with each program and CHIO operation. The address-limit field of the ACV defines the size of the logical address space to the processor.

Dynamic Address Relocation

All logical addresses are relocated in the processor address space by the dynamic address relocation mechanism. The address-base field of the ACV defines where, in the processor address space, the logical address space is relocated. Logical addresses are converted into relocated addresses by the dynamic address relocation mechanism to identify a byte location in the processor address space.

Processor Address Space

The 4M byte processor address space comprises the total range of addresses that are available to the processor. The processor address space contains all of the logical address spaces as they have been relocated by the dynamic address relocation mechanism. Each logical address space is relocated in the processor address space on a boundary that is an integral multiple of its size. A supervisor program must determine which set of addresses in the processor address space are allocated for each logical address space. During this allocation process, the address-base and address-limit field values for the ACV associated with the program or CHIO operation are defined.

Figure 7-3 provides an overview of the relationship between logical address space and the processor address space.

Dynamic Address Translation

The dynamic address translation (DAT) mechanism translates relocated addresses into real processor storage addresses. The 4M byte processor address space is represented by 2048 entries in the translation table provided by the DAT mechanism. The translation table is a high speed storage array that is physically separate from processor storage. Each entry in the translation table corresponds to a block of 2048 addresses in the processor address space. Each logical address space is relocated into a portion of the processor address space represented by a corresponding set of contiguous translation table entries. The address-base field in the ACV identifies the first translation table entry of the set that is allocated to the program or CHIO operation. When a logical address is converted to a relocated address with DAT active, the relocated address serves as an index into the translation table to select the translation table entry associated with that logical address. The translation table entry provides the processor with the real address for the main storage access. Main storage allocation is facilitated, because each translation table entry is associated with a separate 2048-byte block of main storage. The translate table entries associated with a logical address space are contiguous; the 2048-byte blocks of main storage with which the translation table entries are associated are not required to be contiguous.

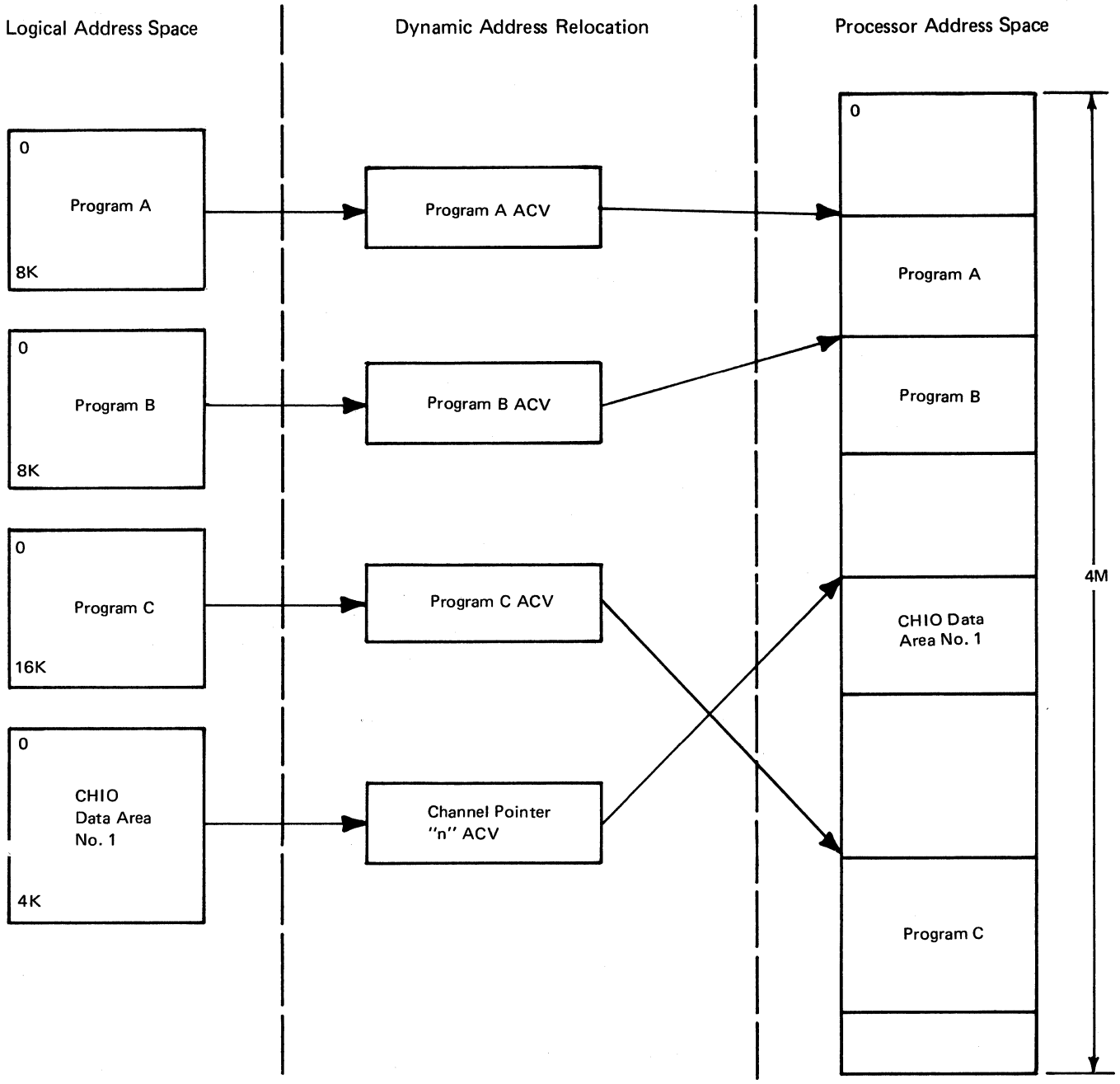


Figure 7-3. Relocating Logical Address Spaces in the Processor Address Space

Figure 7-4 provides an overview of the correspondence between a logical address space, the processor address space represented by the translation table, and main storage. In this example, Program A is defined in a 16K-byte logical address space. Program A logical address space is relocated into the 4M processor address space using the contents of the ACV associated with Program A PSV. The processor address space is expanded to 4M bytes because the translation bit in the ACV is one. Program A is relocated into eight translation table entries that represent Program A address space in the processor address space. The relocated addresses are not used to access main storage with DAT active, rather, they access the translation table entries associated with Program A in the processor address space. The DAT mechanism translates the relocated addresses into real addresses for the main storage access. Each of the translation table entries is associated with a 2K block of main storage in which a portion of Program A has been stored.

Storage Access Protection

The dynamic address relocation mechanism provides storage protection in the form of logical address space isolation. The limits of each logical address space are defined by an ACV. The dynamic address relocation mechanism ensures that the limits of each logical address space are not exceeded by storage access requests from the program or channel I/O operation with which the logical address space is associated. If an attempt is made to access a storage location associated with a logical address greater than the limit of the logical address space, a program exception occurs.

The dynamic address translation mechanism provides protection against improper storage access through the access control field in each translation table entry. The access control field is defined individually for each 2K block of the processor address space. Using the dynamic address translation mechanism, several programs can access a single 2K block of main storage. The access protection can be separately defined for each program that accesses that block of main storage. Access control also provides a means to segregate the programs instruction area from its data area or I/O area.

The access protection provided by the dynamic address translation mechanism is as follows for each 2K block of processor address space:

- Block Invalid: no access is permitted.
- Store Protection: store access is not permitted.
- Execution Protection: instruction-fetch access is not permitted.

  Channel Store Protection: channel I/O operations for store access are not permitted.

Processor Control

8100 processors provide for program execution on eight levels of processing priority. These priority levels are numbered 0–7. Level 0 is defined as the highest priority level, level 1 is the next highest priority level, and so on, to level 7, which is defined as the lowest priority level.

Dispatching Priority Level

The processor gives control to programs in response to requests for program execution. The processor contains dispatching logic to automatically determine the highest priority request for program execution and to give control to the program on that level. Requests for program execution are received from three sources: those created by an executing program, signals from I/O devices, and requests generated by the processor as a result of detecting system check conditions. The processor contains special control vectors to record and maintain these requests for program execution.

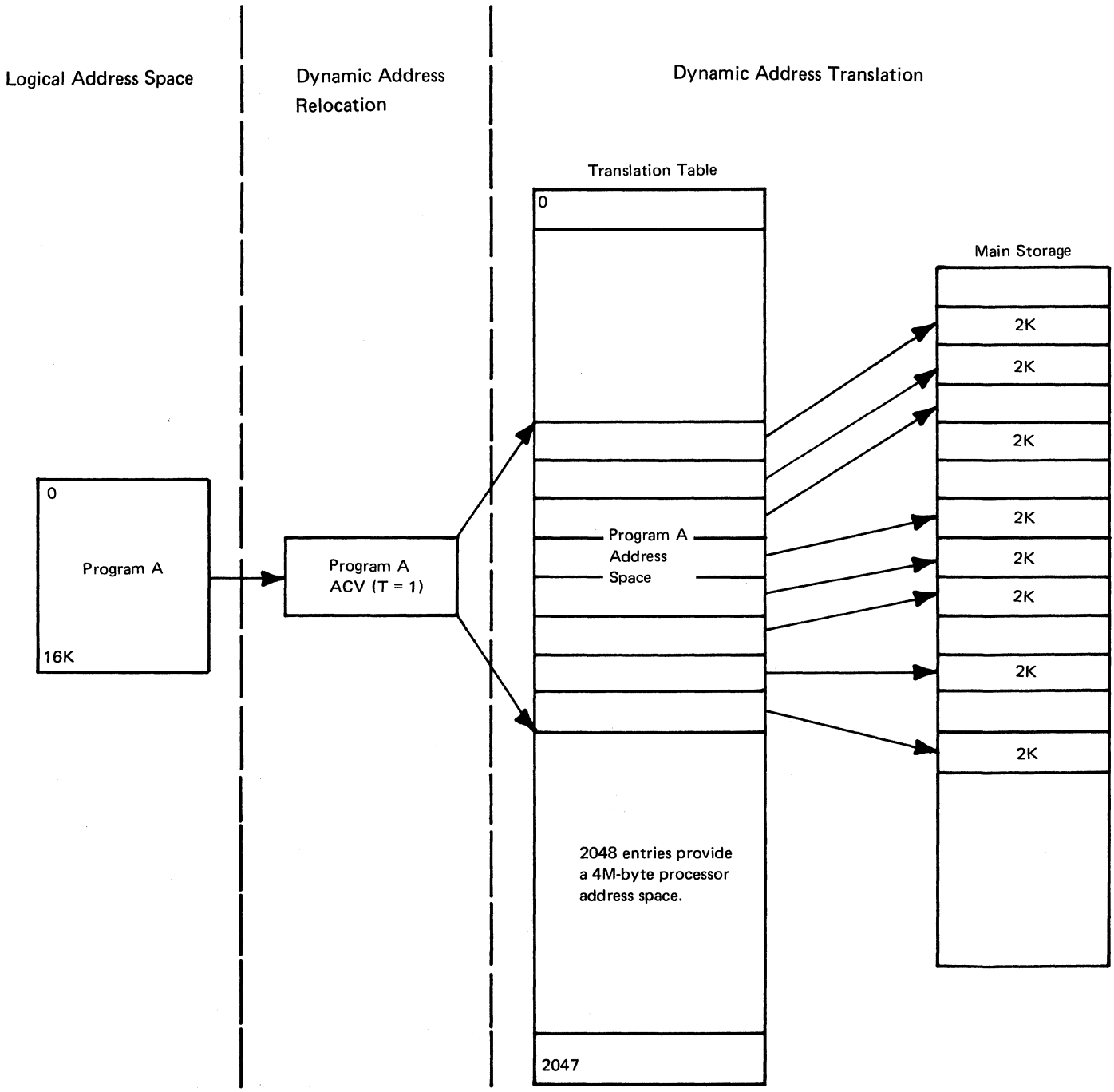


Figure 7-4. Using Translated Addresses to Access Main Storage

Requests for program execution on a specific level are called interrupt requests. Programmed and I/O interrupt requests can be received for levels 0–7; error interrupt requests are only associated with level 0. When a request for program execution is received for a priority level that is of higher priority than the current level, the processor's dispatching logic initiates an interrupt sequence. An interrupt sequence consists of storing the current PSV in its fixed location in register storage, updating certain control vectors, and activating the new PSV/ACV pair for the priority level being dispatched.

Enabling and Disabling Priority Levels

An interrupt request for a higher-priority level than is currently active may or may not result in an interrupt sequence. Priority levels can be enabled or disabled for interrupt requests. When a priority level is enabled, the level can be given control in response to an interrupt request. When a priority level is disabled, all interrupt requests for that level remain pending until that level is enabled. Two masks are provided to control the enabling and disabling of priority levels, the common mask and the master mask. The common mask permits each level to be enabled or disabled, individually. The master mask enables or disables levels 1–7 collectively.

Dual PSVs per Priority Level

Two PSV/ACV pairs are defined for each priority level; one is designated the primary PSV/ACV pair, and the other is designated the secondary pair. The primary and secondary PSV/ACV pairs are distinguished physically by the fixed locations in register storage where they are stored; their formats are identical. Dual PSV/ACV pairs for each level allow a supervisor program and an application program to be defined on the same priority level. An instruction is provided that permits control to be exchanged between two programs on the same priority level. When the instruction is executed, the current PSV is stored in its fixed location in register storage, and the opposite PSV/ACV pair is activated on the current priority level.

The primary and secondary PSVs differ in the processing of program exceptions. When a program exception is detected with the secondary PSV active, the secondary PSV is stored in its fixed location in register storage, and the primary PSV/ACV pair is activated for the current level. When a program exception is detected with the primary PSV active, the primary PSV is stored, and an error interrupt request is generated for priority level 0. Thus, the supervisor program for each priority level can be written to process program exception conditions detected during the execution of the application program on that priority level.

Program Environment

The priority level structure and the unique set of fixed register locations for each PSV and ACV permit the definition of a distinct environment for each program. When a new PSV and ACV are introduced, the state of the associated program is defined. The program environment includes the definition of the program's logical address space, general register sets, and the program status and control information used during the execution of the program. The supervisor program establishes the program environment when it initializes the PSV and ACV in its fixed save area prior to giving the program control. The allocation of general register sets from the group of principal register sets and the dynamic address relocation facility allow the supervisor to define a distinct execution environment for the program. This environment is preserved automatically when the program's execution is interrupted and subsequently resumed. This capability permits fast response to requests for program execution. It also allows a single copy of a program to be associated with more than one priority level.

I/O Operations

I/O operations provide for the transfer of information between an I/O device and a general register or main storage. Programmed I/O (PIO) transfer a fixed amount of data to or from a general register; channel I/O (CHIO) operations transfer variable-length blocks of data to or from main storage.

PIO operations and CHIO operations share the I/O interface. The I/O interface consists of a 18-bit data bus, including parity, and control lines to synchronize the transfer of information across the I/O interface. The processor includes the channel logic that controls the flow of information across the I/O interface. When the channel is not controlling an I/O operation, it monitors the attached devices for CHIO data transfer requests and I/O interrupt requests.

Programmed I/O

An I/O instruction transfers a byte or halfword of data between an I/O device and a general register specified as an operand of the instruction. Two I/O instructions are provided for the transfer of a byte of data, a third I/O instruction transfers a halfword of data.

The I/O device is selected with an 8-bit address specified in the instruction. Each device is assigned a unique address. These addresses are called programmed I/O (PIO) addresses.

The I/O instruction also specifies the programmed I/O (PIO) command. A PIO command is an 8-bit code that identifies the operation that the device is to perform. In general, PIO commands are for specific devices. Four PIO commands are implemented by all devices. They are:

Reset Device

Reset Basic Status Register under Mask

Set Basic Status Register under Mask

Read Basic Status Register

When an I/O instruction is executed, the PIO address and command are sent to the device across the I/O interface. The device whose address matches the address specified in the I/O instruction is selected for the data transfer operation. The command specifies the direction of data transfer and operation to be performed by the selected device. The PIO operation is completed when the data has been transferred to or from the selected device.

Channel I/O

Channel I/O (CHIO) operations provide for the transfer of variable-length blocks of data between some I/O devices and main storage. Certain control information can alos be placed into register storage. Data is transferred to or from a logical address space assigned for the CHIO operation. The logical address space is assigned to a CHIO operation by the supervisor program. Logical address spaces are defined by an address control vector (ACV) that is paired with the channel pointer to be used during the CHIO operation. The channel pointer contains the logical address of the location of the data to be transferred. The address may be placed in the channel pointer either by the program before the CHIO operation is initiated, or as part of the operation. There are 64 channel pointers defined in fixed locations in principal register sets; each channel pointer is paired with an ACV in a corresponding fixed location in an adjunct register set.

A channel control vector (CHCV) is used to initiate a CHIO operation. The CHCV specifies which channel pointer is to be used and the CHIO command to be executed. CHIO commands are executed by the channel and the I/O devices and specify such operations as reading and writing.

Ordinarily, the program initiates a CHIO operation with a PIO instruction. However, depending on the device and type of operation, the CHIO operation can be initiated by the device asynchronous to program execution. The capability of a device to execute CHIO operations independently from program execution is a device-dependent function and is not described here.

Channel I/O Transfer Sequence

The program initiates a CHIO operation by issuing a PIO command to the I/O device. The device recognizes the command as a start-CHIO operation. The term start CHIO is the generic name for a class of device-specific commands. It is used here to denote any PIO command that causes the device to initiate and execute a CHIO operation.

The start-CHIO command may be an immediate-type command, where the accompanying data is ignored. Conversely, the command may specify a write operation, where the data provides control information, such as the CHCV, which the device uses in the execution of the CHIO operation.

Control information may also be supplied to the device by means of one or more PIO instructions which are executed prior to issuing the start-CHIO command. Alternatively, the CHIO operation may consist of writing control information to the device followed by the reading or writing of data. In this case, the distinction between control information and data is made at the I/O device; the channel treats the entire operation as a data transfer.

When the CHIO operation is initiated at the device, the device is set up to issue service requests to the channel, and the channel and device assume subsequent control of the operation. The device requests service of the channel whenever it is ready to send or receive a burst of information. When the channel grants service to the device, the device becomes logically connected to the channel and responds by transferring the CHCV to the channel. The channel decodes the CHCV, including the command code, fetches the storage address from the channel pointer designated in the CHCV, and initiates the reading or writing of the burst of information. The device maintains the data count of the burst, while the channel maintains and updates the storage address as information is transferred to or from main storage. At the end of each burst data transfer, the channel stores the updated channel pointer in its fixed location in register storage.

The CHIO operation may consist in one or more burst transfers. The number of bursts and the amount of information transferred during each burst depend on the device and the type of operation. The CHIO operation is concluded when the last burst of the operation has been executed.

CHIO Request Priority

A variety of devices implement CHIO operations, each requiring a different priority of service response from the channel. Unbuffered high-speed devices require an immediate response from the channel; buffered devices can permit some delay in response to a request for a CHIO burst transfer. Three levels of priority are defined for requests for CHIO burst transfers. They are:

Channel Request High

Channel Request Medium

Channel Request Low

Devices are physically attached to one of these request priorities during the manufacturing process.

A set of hardware switches are also provided to define the priority of CHIO requests among groups of I/O device. The priority assigned to each group of devices is defined during installation, and can be subsequently changed by maintenance personnel. Thus, system performance requirements can be individually tailored to meet the needs of each application.

Programmable Priority Level Assignments

Individual system requirements may specify that an I/O device be associated with more than one program. System design flexibility is enhanced by the ability to assign an I/O device to a different priority level for each program with which it is associated.

In 8100, I/O devices are assigned to a specific priority level through programming. A unique PIO command permits the supervisor program to define the priority level with which a device is to be associated. When the device is to be associated with a different program that executes on another priority level, the device can be assigned to that priority level by the supervisor program. Specifically, the assignment of an I/O device to a priority level determines the priority level on which I/O interrupts are reported by that device. Multiple devices can be assigned to a single priority level.

I/O Interrupt Sublevel Assignments

One or more devices can present interrupt requests for a specific priority level. The 8140 processor provides sixteen sublevels for each priority level to identify the devices that are presenting interrupt requests for a priority level. The 8130 processor provides this facility through the System Expansion feature. The sublevel assignment provides a unique, user-defined identification for each device assigned to a specific priority level. Only one device can be assigned to each sublevel; up to sixteen devices can be assigned to a specific priority level.

The sublevel assignment for each device is made during the execution of the PIO command that assigns the device to a specific priority level. A special PIO command is defined to read the sublevel assignments for the device or devices that are presenting interrupt requests for a specific priority level. The program can then process the requests in a user-defined order. The priority of each sublevel is thus determined by the order in which it is processed, rather than through a hardware-defined priority structure.

The programmable sublevel facility decreases program overhead by removing the need to "poll" each device for status when an interrupt request is received. Program design flexibility is enhanced through the ability to assign each device to a priority level and define its sublevel identification through programming.

Chapter 8. Input/Output Functions and Features

This section describes all of the options and features that can be selected for the IBM 8100 Information System. Chapter 6, "Unit Configurations," defines which option or feature may be attached or selected for each unit in the system. This section is not intended to be used to configure an 8100 Information System, but it may be useful when used with the *IBM 8100 Information System Configurator,* GA27-2876.

Direct Access Storage

Two types of direct access storage are available to provide high-speed, high-capacity online storage for the 8100 Information System.

The first type has 23 to 64 million bytes of storage depending upon the model processor or expansion unit selected. Some models use fixed heads to provide quick access to a portion of the disk storage.

The second type is the IBM Diskette 2D drive, which uses removable media (diskettes) with a maximum storage capacity of 1 million bytes. This disk storage device reads or writes on IBM diskettes type 1, 2, or 2D.

See Figure 8-1 for the disk storage capacity options and Figure 8-2 for the data transfer time.

	Total Storage	Movable Head Storage	Fixed Head Storage
Nonremovable Media	29,327,360 23,592,960 64,520,192 58,785,792	29,327,360 23,461,888 64,520,192 58,654,720	None 131,072 None 131,072
Removable Media (2D Diskette)	1,212,476	1,212,476	N/A

Figure 8-1. Disk Storage Capabity Options (in Bytes)

	Feature or Option	Track to Track Access	Average Access Delay	Average Rotational Delay	Data Rate (bps)
Nonremovable Media (Disk)	Movable Heads	9 ms	27 ms	9.6 ms	1,043K
	Fixed Heads		0	9.6 ms	1,043K
Removable Media (Diskette)	Diskette 2D Drive Movable Heads	40 ms	225 ms	83.4 ms	62K (with Type 2D Diskette)

- Average Access Time = Time required to move the disk heads half way across the disk surface. This includes head load and settle time if applicable.
- Average Rotational Delay = Time required to read half of a track.
- Track to Track Access = Time required to move the disk head to an adjacent track. This includes head load and settle time if applicable.

Figure 8-2. Average Data Transfer Time

Three types of diskettes are available for use with the diskette 2 drive. They are:

- Type 1: Data on one side only. Maximum storage is 256K bytes.
- Type 2: Data on two sides. Maximum storage is 512K bytes.
- Type 2D: Data on two sides. High-density recording. Maximum storage is 1 million bytes.

The total amount of usable storage on any diskette depends upon the diskette type selected and the format of your records on the diskette.

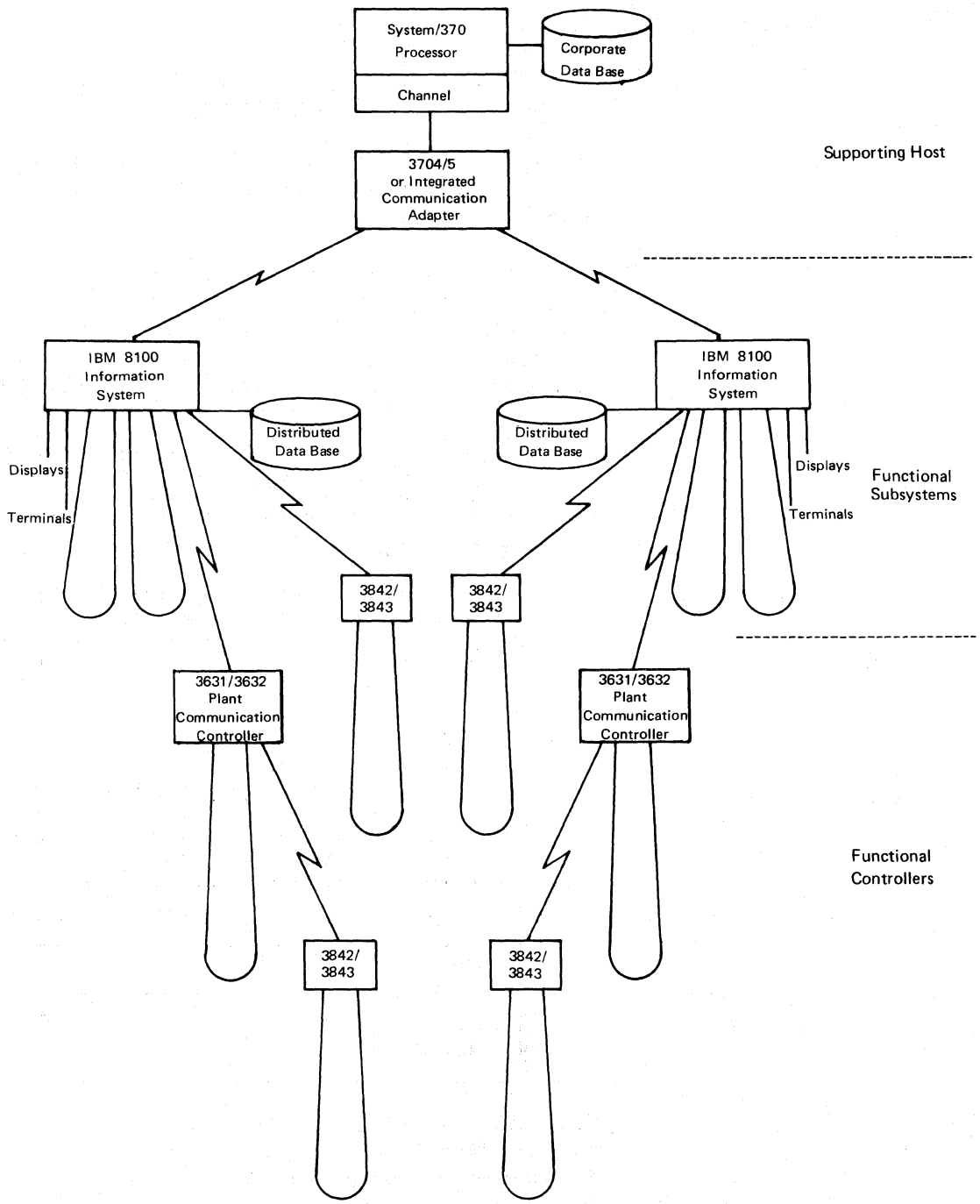


Figure 8-3. Distributed System Network

Communication Capabilities

Each communication adapter controls one loop or data link or one "direct connection" to an I/O unit that is a limited distance from the 8100 system. Synchronous data link control (SDLC), binary synchronous communication (BSC), or start-stop (S/S) communication protocols are supported.

Note: *The SDLC communications adapter, which supports the SDLC protocol, can be used in conjunction with a loop adapter to control a directly attached loop instead of a data link. Refer to "Loop Attachments" later in this section.*

Figure 8-3 shows the parts of a distributed system network.

SDLC

The SDLC communications adapter can connect to analog networks, digital networks, or direct connections. Analog network speeds range from 600 bps to 9600 bps, digital network speeds range from 2400 bps to 9600 bps, and direct connection speeds range from 600 bps to 9600 bps.

The maximum distance for direct connection through an EIA RS-232-C interface is 12.2 meters (40 feet). The maximum distance for direct connection through a V.35 interface is 304.8 meters (1000 feet).

Note: *The 8100 Information System communicates with data link attached loops through an SDLC communications adapter. Refer to "Loop Attachments" later in this section.*

The 8100 Information System can use the SDLC communications adapter to communicate with the following:

- System/370 host through the 3704/3705 or Integrated Communication Adapter with line speeds up to 56,000 bits per second
- Other 8100 Information Systems
- 3276 Control Unit Display Station, Models 11, 12, 13, 14
  - 3278 Display Station, Models 1, 2, 3, 4
  - 3287 Printer, Models 1, 2
  - 3289 Line Printer, Models 1, 2
- 3631 and 3632 Plant Communication Controller (see note):
  - 3641 Reporting Terminal
  - 3642 Encoder Printer
  - 3643 Keyboard Printer
  - 3644 Automatic Data Unit
  - 3645 Printer
  - 3646 Scanner Control Unit

  Note: *If a 3631 or 3632 Plant Communication Controller is connected, only the devices listed can be attached to its loop.*
- 3767 Communications Terminal, Models 1, 2, 3
- 3842/3843 Loop Control Unit

BSC

The BSC communications adapter can connect to analog networks, digital networks, or direct connections. Analog network speeds range from 600 bps to 9600 bps, digital network speeds range from 2400 bps to 9600 bps, and direct connection speeds range from 600 bps to 9600 bps.

Start-Stop

The S/S communications adapter can connect to analog networks or direct connections. Analog network speeds and direct connection speeds range from 110 bps to 300 bps for the 8130, and from 110 to 1200 bps for the 8140.

S/S direct connections are through an EIA RS-232-C interface; maximum distance is 12.2 meters (40 feet).

The 8100 Information System can use the S/S communications adapter to communicate with the 2741 Communication Terminal and devices like those using the Teletype 33/35* protocol.

Loop Attachments

A loop consists of cabling and accessories that allow multiple I/O units to be connected to a common cabling system that includes both indoor and outdoor cables. Cabling for the loop is a shielded, two twisted pair cable. The accessories include various types of connection boxes for connecting I/O units to the loop.

The loop can be directly attached or data link attached to an 8100 Information System (8130 Processor, 8140 Processor, or the 8101 Storage and I/O Unit). A directly attached loop operates at 9600, or 38.4K bps, and a data link attached loop operates at 1200 or 2400 bps. **Note:** *The loop speed selected is dependent upon the capabilities of the attached devices and system requirements.* Only one directly attached loop, or loop with second lobe, per system can operate at 38.4K bps. I/O units that are attachable to a directly attached loop are also attachable to a data link attached loop. All devices attached to a given loop must operate at the same loop speed. To facilitate single terminal loop operation, IBM makes available a Single Device Attachment Cable Assembly. For additional information about IBM attachable devices, refer to Chapter 10.

In addition to the capability of attaching a wide variety of I/O units, the loop design allows for error recovery and problem determination. The wrap capability in the loop station connector (LSC) and loop wiring concentrator (LWC) allows an alternate signal path to be used to bypass a wiring failure on the loop; the bypass capability in the LWC allows a failing I/O unit or radial cable to be removed from the loop signal path, while allowing the remainder of the loop to operate normally. The LSC automatically bypasses the station and keeps the loop operational whenever an I/O unit is powered off or unplugged.

The loop configuration permits, without recabling or reprogramming, the relocation of devices on the loop to anywhere else on the same loop where there are LSCs and power available. In conjunction with the bypass capability of the LSC, relocation and reconnection to the loop can be accomplished while the loop is operational. Data may be lost during loop reconnection.

*Trademark of Teletype Corporation

Directly Attached Loop

A directly attached loop requires that the controlling unit have an SDLC Communication Adapter feature (1602) and a Loop Adapter feature (4830). In addition, a directly attached loop can have a second lobe if the second lobe feature (4835) is installed for that loop. A lobe is a portion of a loop that has a driver at one end of the lobe and a receiver at the other end of the lobe, neither of which is in an I/O unit.

The use of multiple lobes is recommended for increased I/O device availability for cabling alterations or failures, simpler installation planning and control, and greater loop cabling distance: In the event of a malfunction on one lobe or for planning alterations, the affected lobe can be bypassed, keeping all other lobes operational.

For details, refer to the *IBM 8100 Information System Loop Installation Manual–Physical Planning,* GA27-2878.

Data Link Attached Loop

A data link attached loop requires an SDLC communications adapter with appropriate modems from the 8100 Information System to the site of the data link attached loop. At the remote site, a 3842 (U.S.A. and Canada) or 3843 (World Trade) Loop Control Unit provides the interface between the data link and the data link attached loop. The 3842 runs at 2400 bps. The 3842 contains a 2400 bps modem; the 3843 requires a modem. The 3843 runs at the speed of the attached modem. The second lobe feature is not available on a data link attached loop.

Loop-Attachable I/O Units

The following IBM devices may be attached to loops controlled by the IBM 8100 Information System:

- 3276 Control Unit Display Station, Models 11, 12, 13, 14
- 3287 Printer, Model 11, 12
- 3289 Line Printer, Model 3
- 3641 Reporting Terminal, Models 1, 2
- 3642 Encoder Printer, Models 1, 2
- 3643 Keyboard Display, Models 2, 3, 4
- 3644 Automatic Data Unit
- 3645 Printer
- 3646 Scanner Control Unit
- 8775 Display Station

The IBM 3289 Line Printer Model 3 or the IBM 3276 Control Unit/Display Station can be attached to a directly attached or data link attached loop. I/O units can then be attached to these units as follows:

- IBM 3289 Line Printer Model 3:
  - 3501 Card Reader
  - 3782 Card Attachment Unit, Model 1 attaches the 3521 Card Punch
  - 3782 Card Attachment Unit, Model 2 attaches the 2502 Card Reader
- 3276 Control Unit Display Station, Models 11, 12, 13, 14
  - 3278 Display Station, Models 1, 2, 3, 4
  - 3287 Printer Models 1, 2
  - 3289 Printer Models 1, 2

Display and Printer Adapter

The 8101 I/O Expansion Unit with a Device Attachment feature can accommodate the attachment of up to four of the following IBM I/O devices in any combination:

- 3277 Display Station Models 1 and 2
- 3284 Printer Models 1 and 2
- 3286 Printer Models 1 and 2
- 3287 Printer Models 1 and 2
- 3288 Line Printer Model 2

Each Display and Printer, Additional (1506) allows the attachment of up to four more of these I/O devices in any combination; however there are limits to the attachment of some device types. See "8101 Storage and I/O Unit" in Chapter 6 for details. A maximum of six Device Attachment features can be selected for one 8101 Storage and I/O Unit, allowing a maximum total of 24 of these I/O devices. Each I/O device is connected to the Storage and I/O Unit by a single coaxial cable that has a maximum length of 610 meters (2000 feet).

Note: *Refer to Chapter 10 for more complete descriptions of the attachable I/O devices.*

Operator Panels

Three types of operator panels are available for the 8100 Information System: the basic operator panel (BOP) and an expanded function operator panel (Figures 8-3 and 8-4), and the 8101 operator panel is shown in Figure 8-5. These panels are mounted on the top front of the processor.

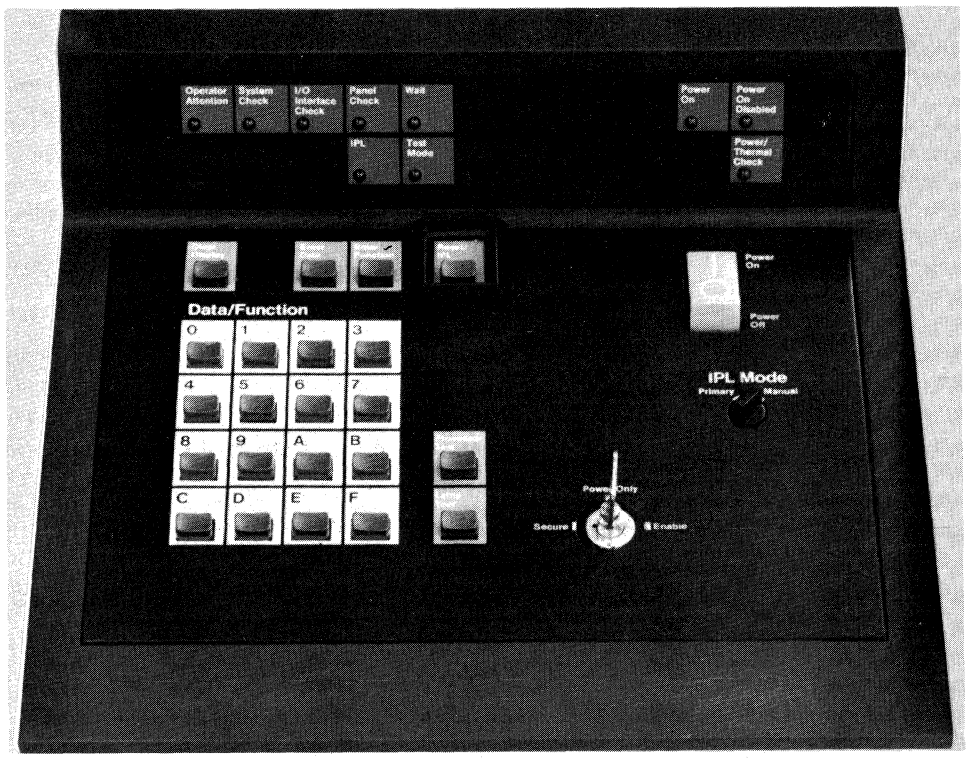


Figure 8-4. Basic Operator Panel with Features (Design Model)

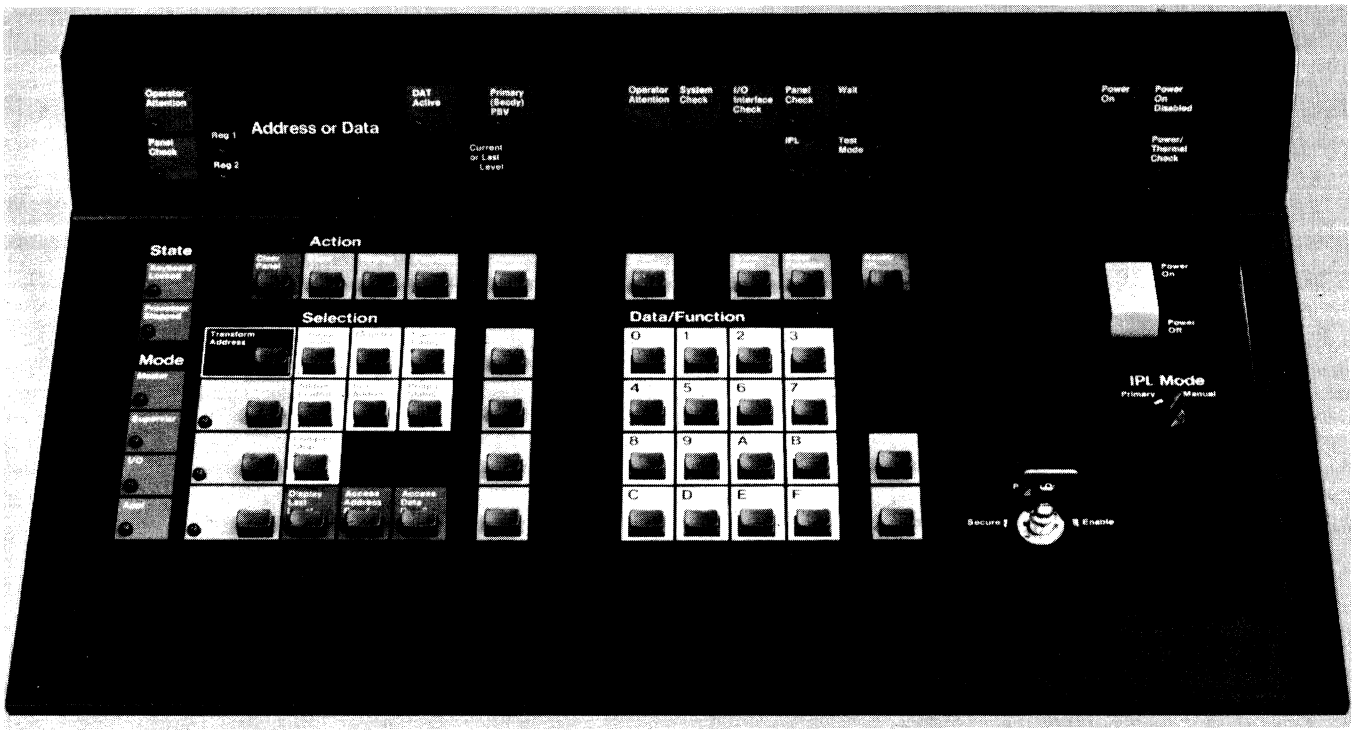


Figure 8-5. Expanded Function Operator Panel with Features (Design Model)

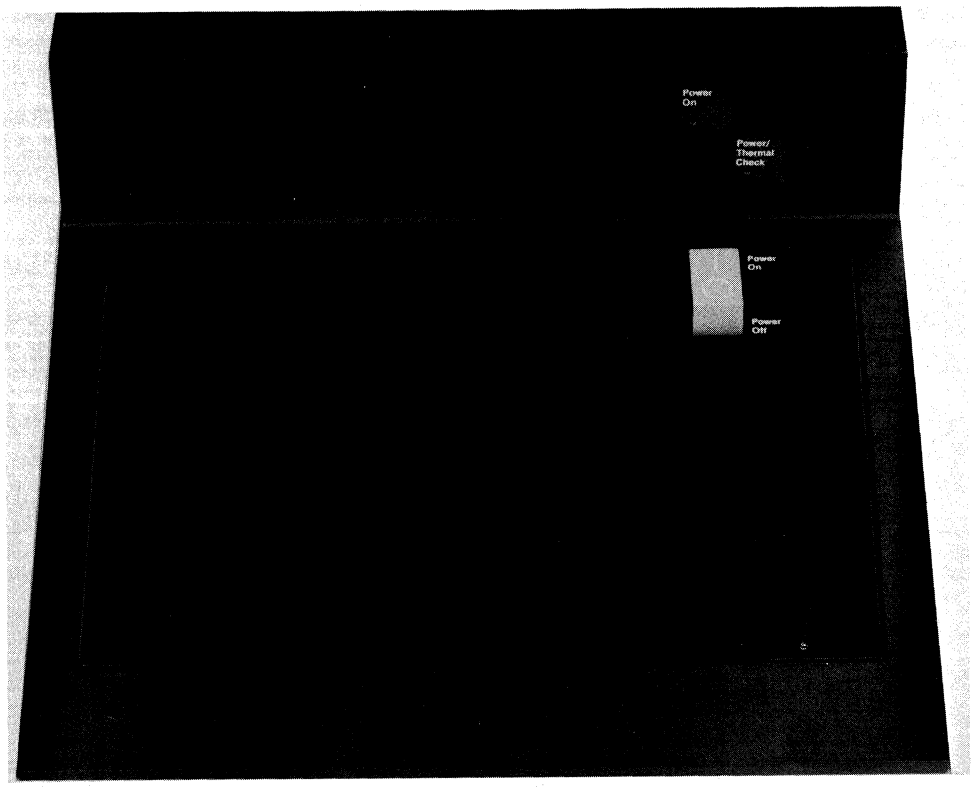


Figure 8-6. Storage and Input/Output Operator Panel (Design Model)

Basic Operator Panel

The basic operator panel provides the means for:

- Entering data, functions, IPL parameters
- System reset/IPL
- System/diagnostic information in the basic panel display register
- Indicating power-system status
- Power on/off
- Power-control and panel-input security if the key-lock feature is installed

Expanded Function Operator Panel (8140 Only)

The expanded function operator panel (EFOP) feature is provided in addition to the basic panel as a program diagnostic aid. The EFOP provides all of the function of the BOP and, additionally, the following functions:

- Read/Write Capability
  - Main storage
  - General registers
  - Translation table
  - Processor control information
  - Instruction address
  - Program status
- Additional functions
  - Translate logical address
  - Stop on address compare
  - Activate program
  - Instruction step
  - Start
  - Stop on system check
  - Stop
- Indicators
  - Panel register 1
  - Panel register 2
  - Current or last priority level with primary/secondary prostatus vector indications
  - Last priority level with primary/secondary program statusvector indications
  - Program mode
  - Translation active
  - Processor state
  - Operator attention
  - Panel check
  - Data or Address Display

Chapter 9. Communication Capabilities

The attachment capability of the IBM 8100 Information System for data communication supports a wide variety of line protocols, line speeds, and facilities to meet requirements of price and performance.

There are many alternatives for data communication between remote processors and for data communication between processors and remote devices. Synchronous data link control (SDLC) and binary synchronous communication (BSC) protocols are supported over both conventional analog and digital transmission facilities. Start-stop (S/S) is also supported over the conventional analog facility. Attachment to the analog and digital facilities is accomplished by selecting the appropriate communication facilities (Figures 9-1 through 9-3). Selection of the appropriate communication facilities is achieved by selecting the appropriate communication adapter (SDLC or BSC, S/S) and the proper signal converter or integrated modem to be used in accordance with the selected protocols.

Synchronous Data Link Control (SDLC)

SDLC supports six different types of ports (the EIA/CCITT port itself supports both analog and digital networks):

- EIA RS-232-C/CCITT V.24/V.28 X.21 bis
  - Digital network
  - Analog network
- Loop adapter (1 or 2 lobes)
- 1200-bps integrated modem
- Data-phone* digital service adapter (DDSA)
- CCITT V.35 direct connect
- EIA RS-232-C/CCITT V.24/V.28 direct connect

*Trademark of American Telephone & Telegraph Co.

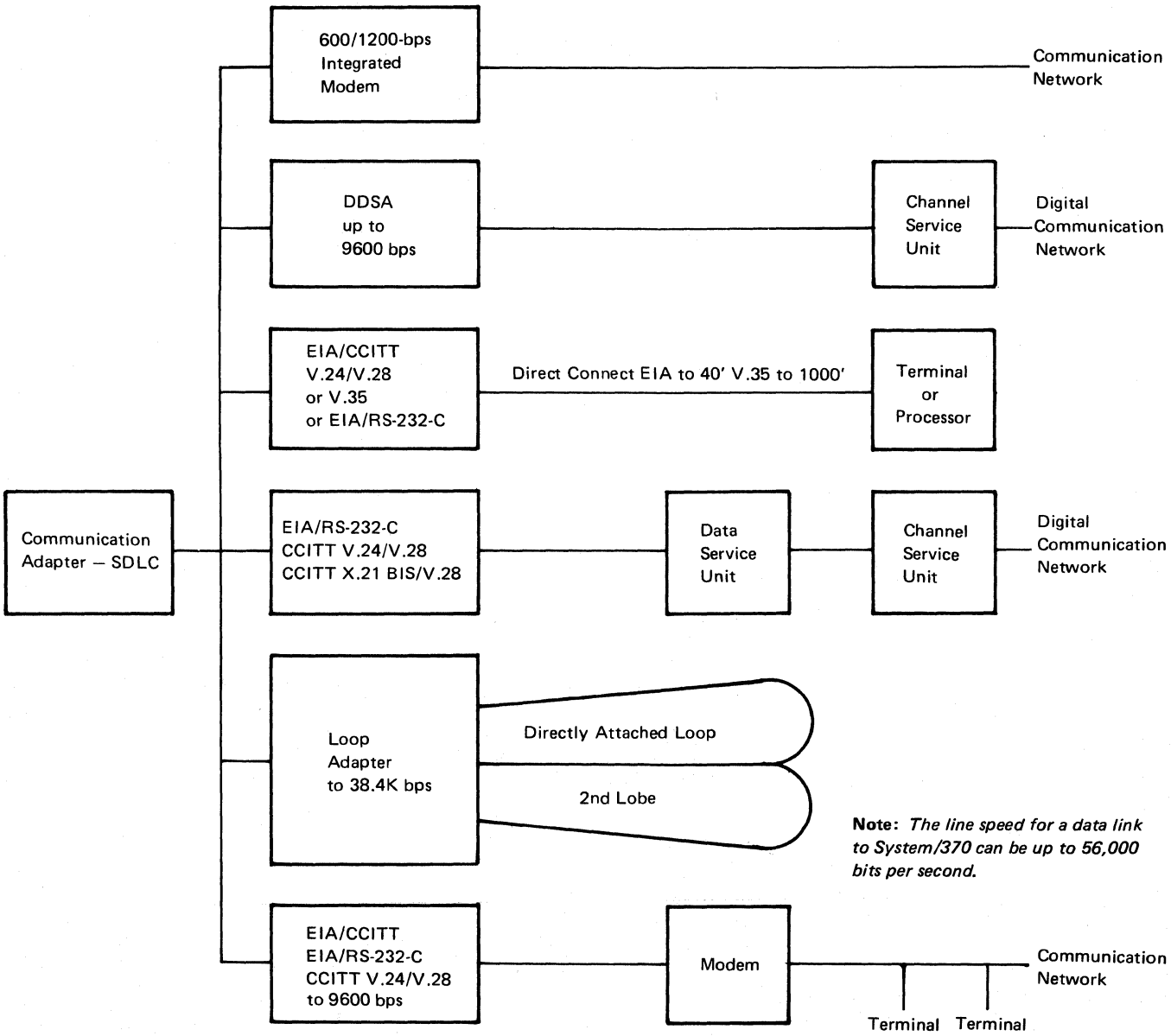


Figure 9-1. SDLC

Binary Synchronous Communication (BSC)

Four different types of ports are supported by BSC:

- EIA RS-232-C/CCITT V.24/V.28
  - Digital network
  - Analog network
- 1200-bps integrated modem
- Data-phone* digital service adapter (DDSA)
- EIA RS-232-C/CCITT V.24/V.28 direct connect

*Trademark of American Telephone & Telegraph Co.

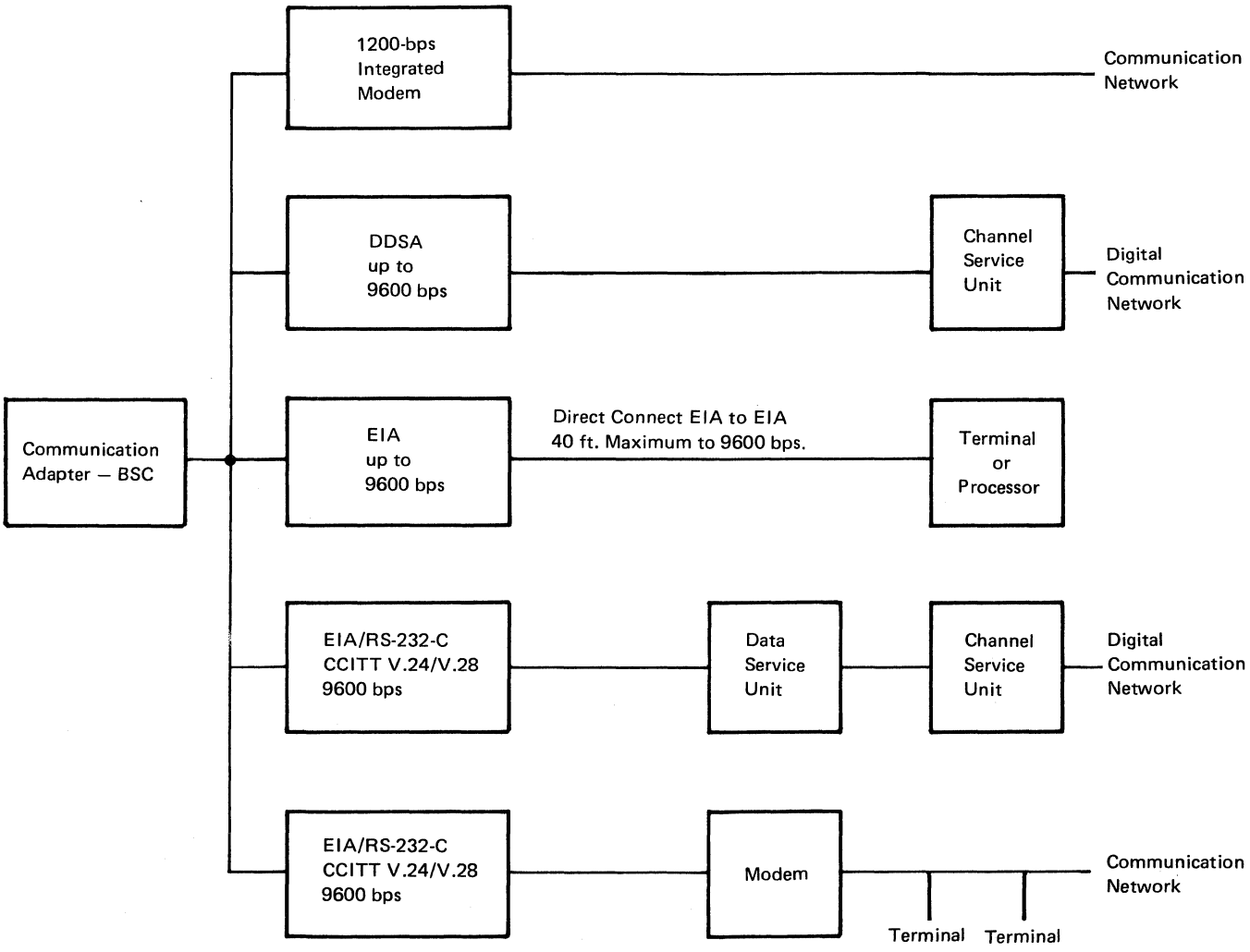
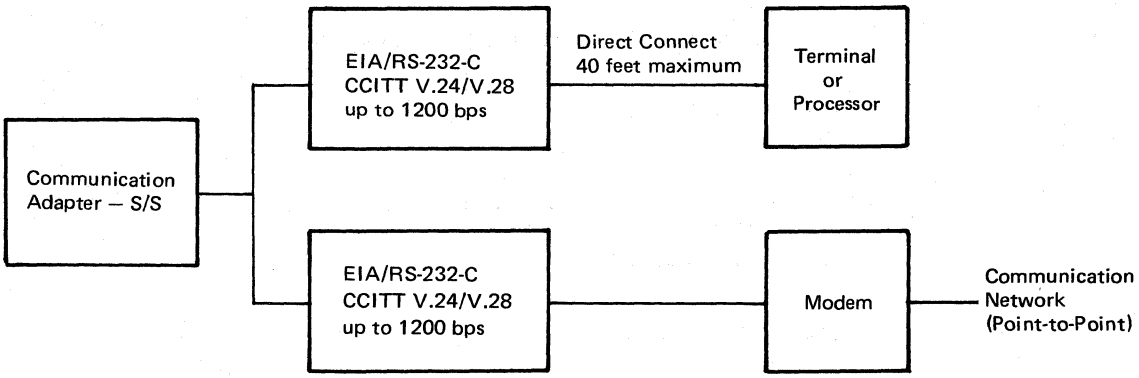


Figure 9-2. BSC

Start-Stop (S/S)

Two types of ports are supported by S/S:

- EIA RS-232-C/CCITT V.24/V.28
  - Analog network
- EIA RS-232-C/CCITT V.24/V.28 direct connect



Note: *All speeds given are maximum speeds.*

Figure 9-3. Start-Stop

Chapter 10. Attachable IBM Devices

This chapter lists and briefly describes all of the IBM devices that may be attached and used on the IBM 8100 Information System. For further information on which IBM licensed program supports each device, refer to the DPPX or DPCX *General Information* manuals.

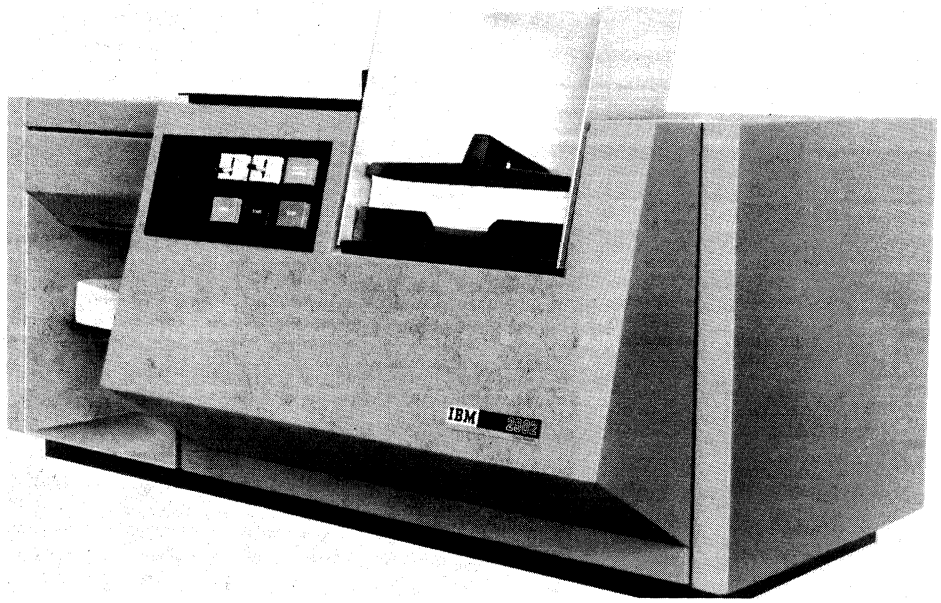
Note: *The devices in the following list are presented as they can be attached to the 8100 Information System; for example, the 3278 Display Station is indented below the 3276 Control Unit/Display Station, because it attaches to the 8100 system through the 3276. (The descriptions that follow the list of attachable devices are presented in a numerical sequence.)*

List of attachable IBM devices:

2741 Communication Terminal	
3276 Control Unit Display Station	Models 11, 12, 13, 14
3278 Display Station	Models 1, 2, 3, 4
3287 Printer	Models 1, 2
3289 Line Printer	Models 1, 2
3277 Display Station	Models 1, 2
3284 Printer	Models 1, 2
3286 Printer	Models 1, 2
3287 Printer	Models 11, 12
3288 Line Printer	Model 2
3289 Line Printer	Model 3
3782 Card Attachment Unit	Model 1
3521 Card Punch	
3782 Card Attachment Unit	Model 2
2502 Card Reader	Model A1
3501 Card Reader	
3630 Plant Communication System	
3631 Plant Communication Controller	Models 1A, 1B
3632 Plant Communication Controller	Models 1A, 1B
Plant Communication Devices	
3641 Reporting Terminal	Models 1, 2
3642 Encoder Printer	Models 1, 2
3643 Keyboard Display	Models 2, 3, 4
3644 Automatic Data Unit (ADU)	Model 1
3645 Printer	
3646 Scanner Control Unit	
Magnetic Hand Scanner, Part Number 4123495	
Magnetic Slot Reader, Part Number 4123500	

3750 Switching System	
3767 Communication Terminal	Models 1, 2, 3
3842 Loop Control Unit, 2400 bps	
3843 Loop Control Unit, 2400 bps (World Trade)	
3872 Modem	
3874 Modem	
3875 Modem	
3976 Modem	Models 1, 3
8775 Display Terminal	
8809 Magnetic Tape Unit	Models 1A, 1B, 2, 3

IBM 2502 Card Reader with IBM 3782 Card Attachment Unit



The IBM 2502 Card Reader reads 80-column cards at speeds up to 150 cards per minute (Model A1). Special features permit the electronic reading of 51/80-column cards or of 66/80-column cards interchangeably. The operator can easily change the machine to read either standard 80-column cards or either of the shorter length cards. Both short length cards (51 or 66) cannot be read by the same machine, however, and only one card reader can be attached to the 3289 Model 3 Line Printer.

The 2502 attaches to the 3289-3 Line Printer via the 3782 Model 2 Card Attachment Unit.

IBM 2741 Communication Terminal

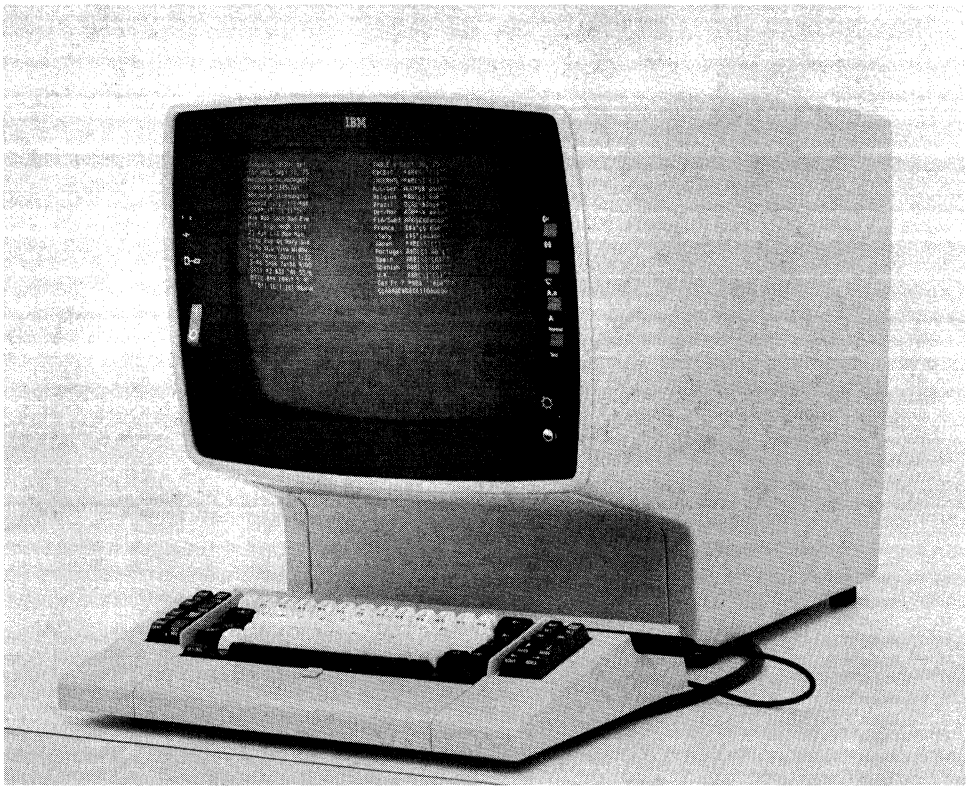
The IBM 2741 Communication Terminal is a modified SELECTRIC ® typewriter with electronic controls that enable it to operate as a remote conversational terminal, thus permitting direct access to System/370. Intended primarily for text-handling and scientific applications, the 2741 Communication Terminal permits persons at remote points to utilize the problem-solving capability of the 8100 system. Some of the uses of the terminal are:

- Online scientific computation
- Online computer programming
- Text handling (especially technical writing, proposal writing, and editing)

The 2741, considered by itself, is a typewriter capable of encoding the characters typed and presenting the signal to a communication channel. Therefore, the applications of this terminal are mostly determined by the program used by the 8100 system with which it is associated.

The 2741 attaches to the 8100 Information System through a start/stop communication facility.

IBM 3276 Control Unit/Display Station



The IBM 3276 Control Unit/Display Station is a cluster control unit able to control up to seven additional display stations and printers (in addition to the integrated display station that is a part of the 3276) for remote-data half duplex communication, or attachment to the data link attached loop.

The 3276 can have display sizes of up to 3440 displayed characters per screen:

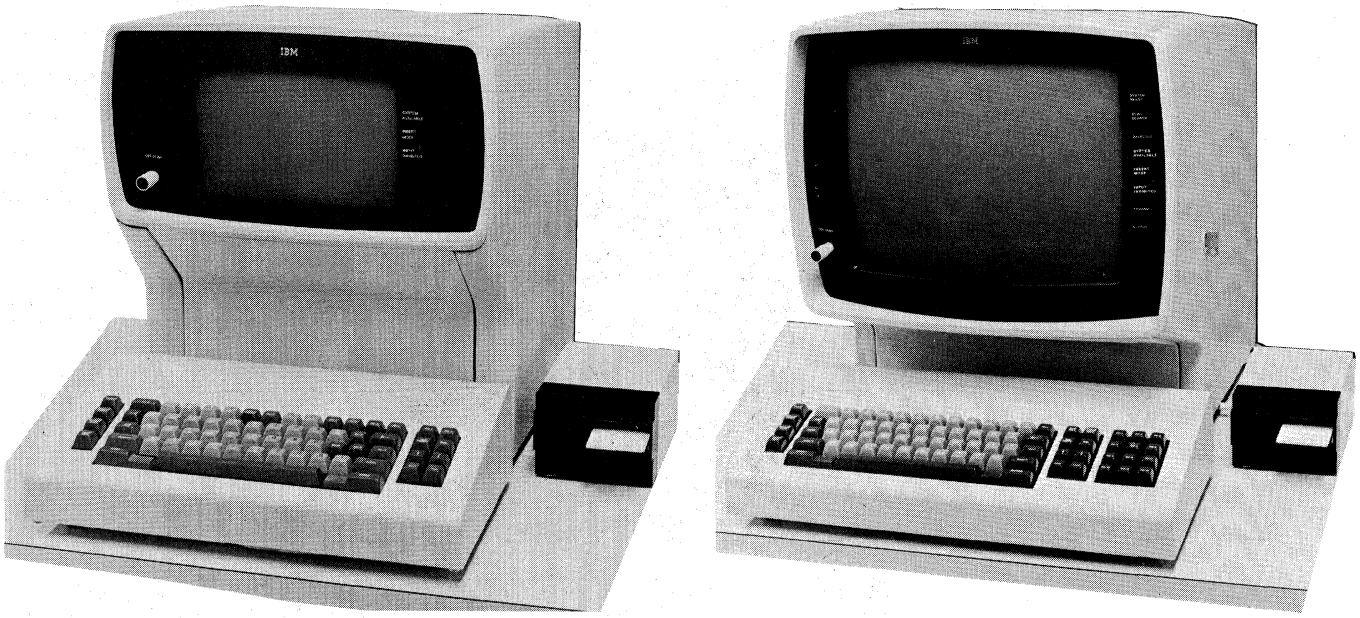
- Model 11 - 960-character display
- Model 12 - 1920-character display
- Model 13 - 2560-character display
- Model 14 - 3440-character display

When operating in 3277-compatible format, the 3276 Model 11 displays 480 characters (40 characters per line), and Models 12, 13, and 14 display 1920 characters (80 characters per line).

Models 11 thru 14 attach to the 8100 Information System via direct connect or data link and adhere to SDLC protocol at speeds of 2400 or 9600 bps.

The 3278 Display Station, the 3287 Printer, and the 3289 Line Printer can be attached.

IBM 3277 Display Station Models 1 and 2



The IBM 3277 Display Station is a high-performance cathode-ray tube (CRT) for displaying alphameric data and for entering data into and retrieving data from the 8100 system. The 3277 permits an operator to use the keyboard or light pen or both to display and manipulate data on the CRT screen.

The 3277 is available in two models. Model 1 displays up to 480 characters in 12 lines of up to 40 characters per line, and Model 2 displays up to 1,920 characters in 24 lines of up to 80 characters per line. The character set includes 36 alphameric and 27 special characters. A choice of keyboards, a selector light pen, and a set of program function keys provide input flexibility. Output flexibility is enhanced because information on the screen can be directed to another display or to a 3284, 3286, 3287, or 3288 Printer.

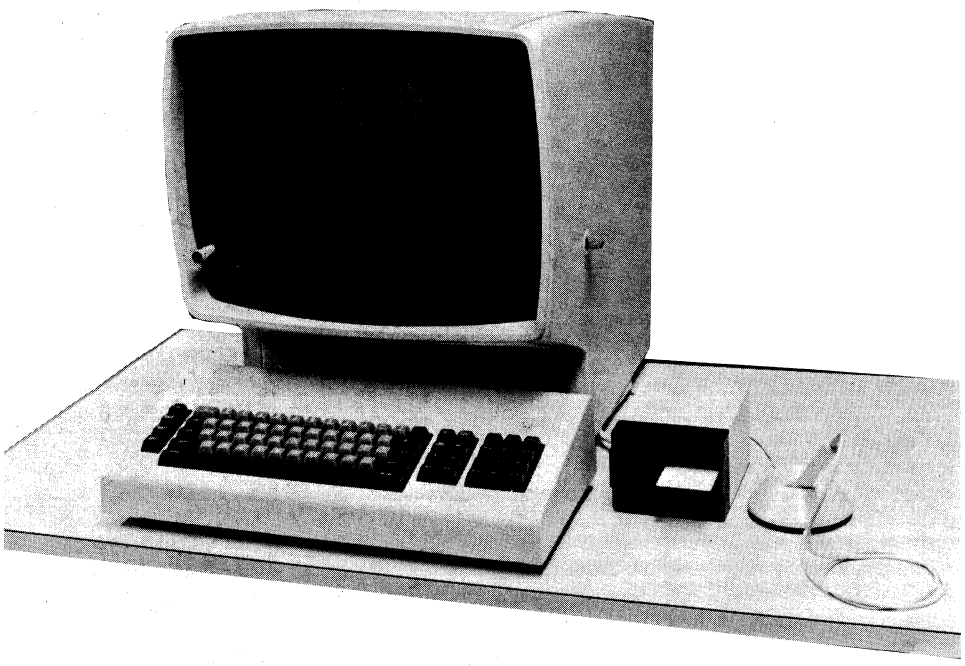
Individual fields of data on the screen can be program-defined for protected or unprotected storage, alphameric or numeric display, nondisplay, and normal or brightened character intensity. Program definition may also allow or disallow selector light pen detection.

Optional features include:

- Keylock, which provides key-operated security control of the display image
- Selector light pen, which provides the selection of parts of a display image for further processing
- Copy, which requests copying from one display to another display or to a printer
- Audible alarm, which sounds when a character is entered into the next-to-last position on the screen

The 3277 is attached to the 8100 Information System via the Display and Printer Attachment Type I or II in the 8101.

IBM 3278 Display Station



The IBM 3278 Display Station is available with display sizes of up to 3440 displayed characters per screen:

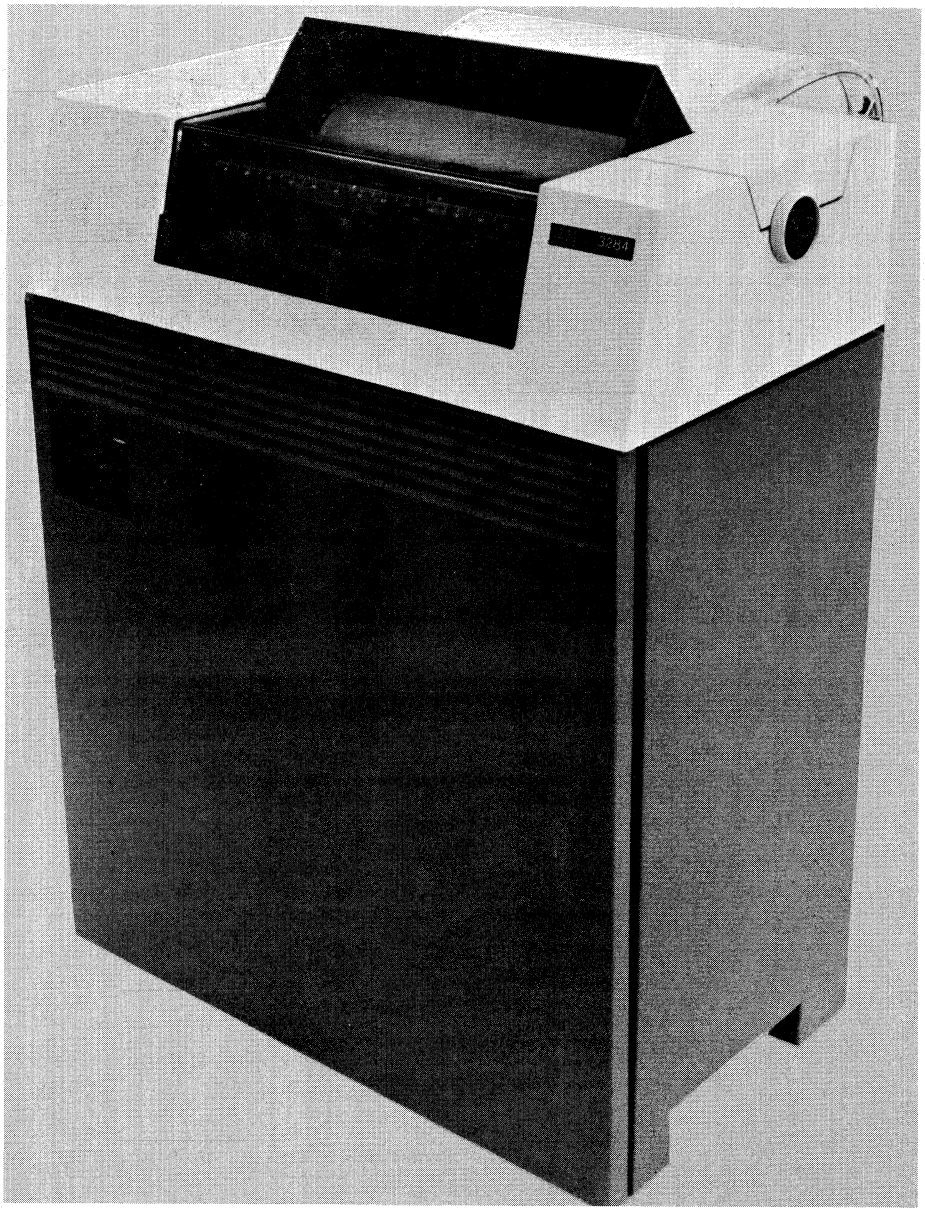
- Model 1 - 960-character display
- Model 2 - 1920-character display
- Model 3 - 2560-character display
- Model 4 - 3440-character display

When operating in 3277-compatible format, the 3278 Model 1 displays 480 characters (40 characters per line), and Model 2 displays 1920 characters (80 characters per line).

The 3278 attaches to the 8100 Information System through the 3276 Control Unit/Display Station.

Attachment can be up to 1 500 meters (4,920 feet) maximum cable length from the 3276.

IBM 3284 Printer

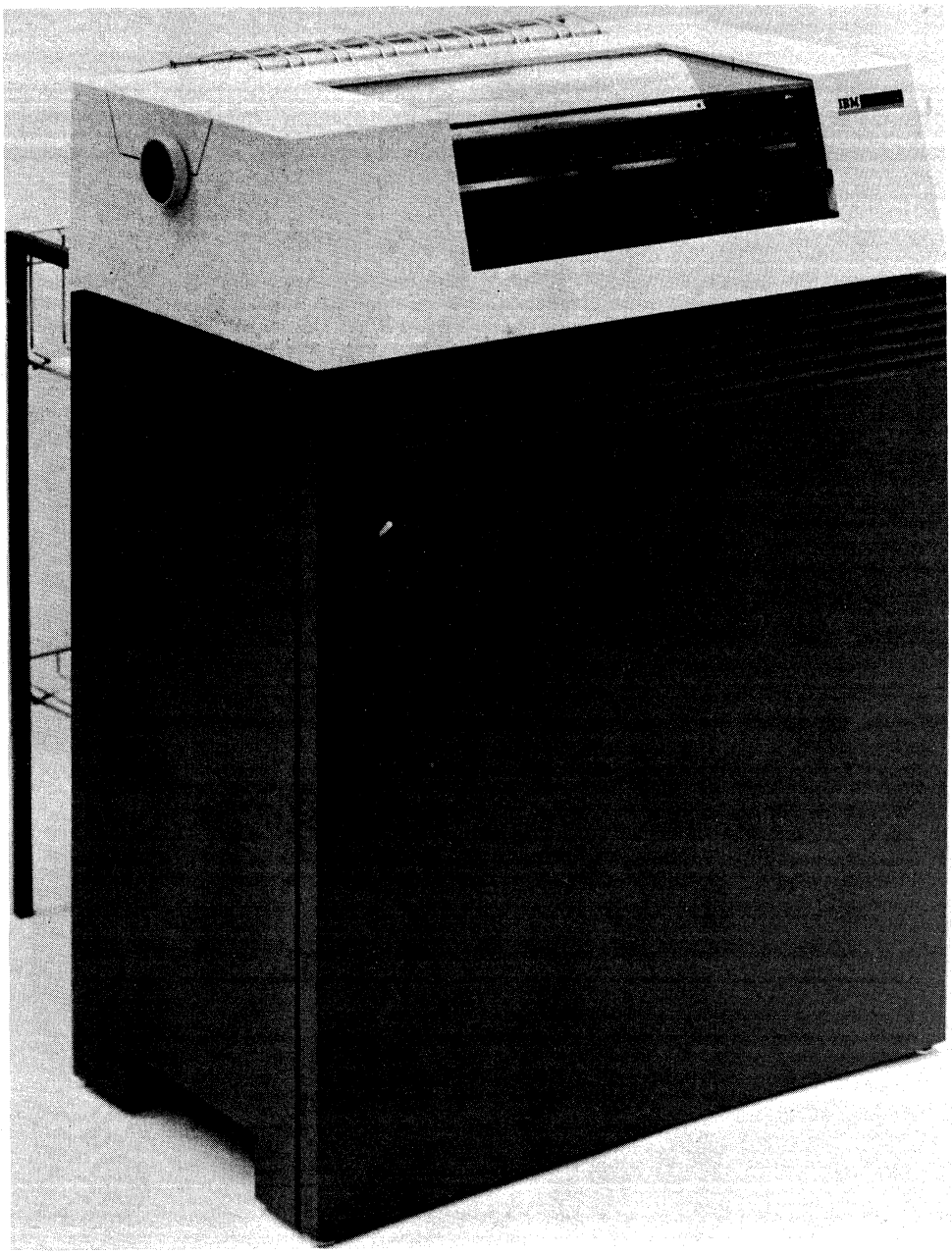


The IBM 3284 Printer is available in two models:

- Model 1 - 480-character buffer capacity with a 40-character-per-second printout rate
- Model 2 - 1,920-character buffer capacity with a 40-character-per-second printout rate

The 3284 attaches to the 8100 Information System via the Display and Printer Attachment Type I or II in the 8101.

IBM 3286 Printer

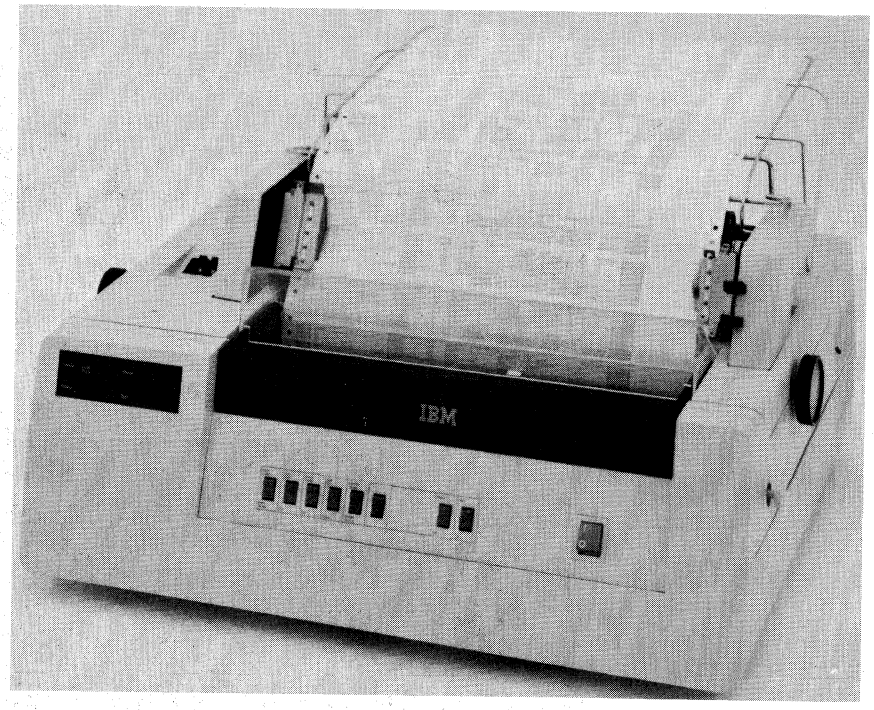


The IBM 3286 Printer is available in two models:

- Model 1 - 480-character buffer capacity with a 66-character-per-second printout rate
- Model 2 - 1,920-character buffer capacity with a 66-character-per-second printout rate

The 3286 attaches to the 8100 Information System via the Display and Printer Attachment Type I or II in the 8101.

IBM 3287 Printer



The IBM 3287 Printer is a table-top printer with bidirectional printing capability.

The 3287 is available in four models:

- Model 1 and 11 - 80-cps maximum print rate
- Model 2 and 12 - 120-cps maximum print rate

Note: *Actual printer throughput depends upon operational and system characteristics. Factors such as configuration and line transmission speed, output format, and programming application processing must all be considered in determining actual throughput.*

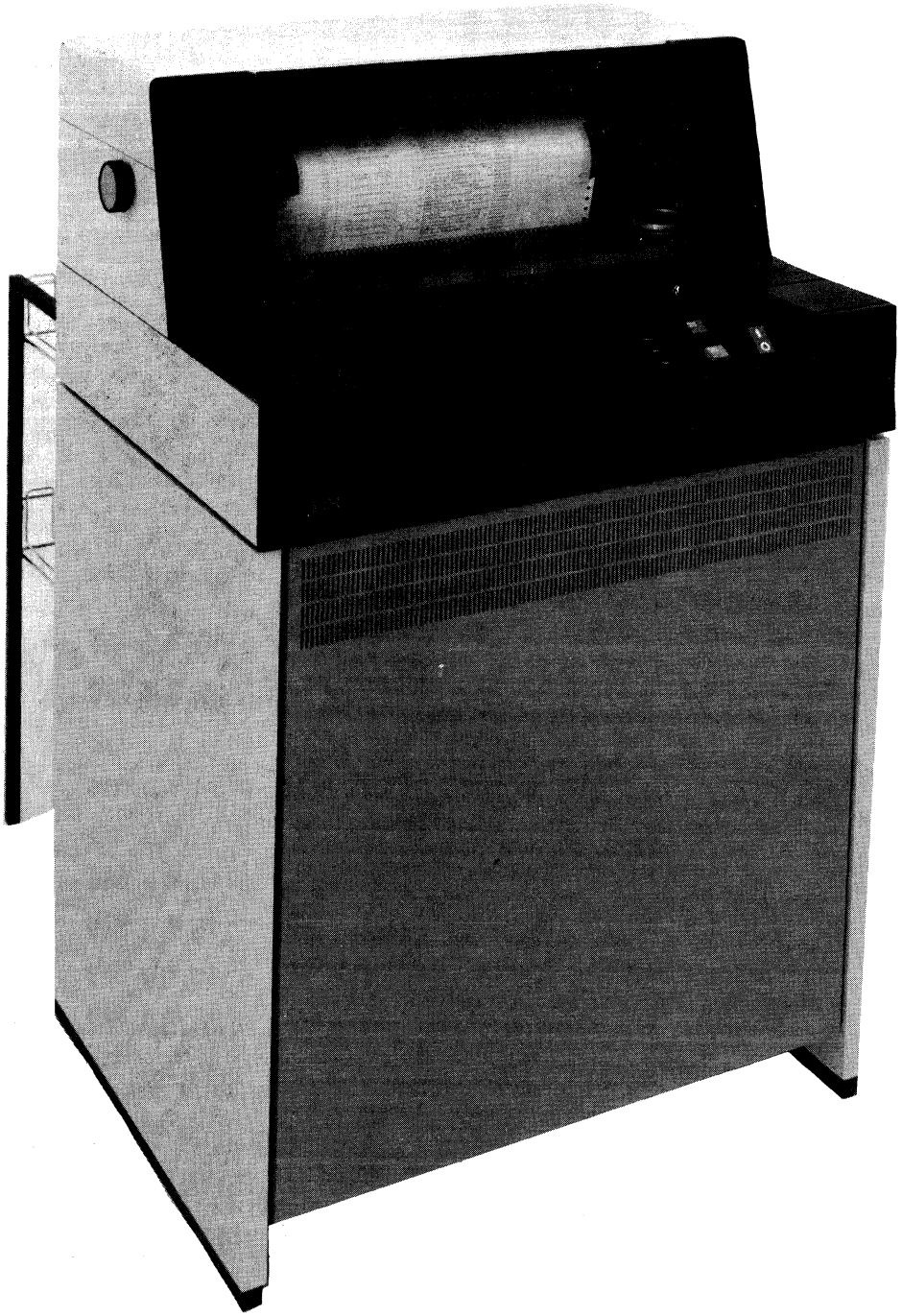
The 3287 Models 1 and 2 attach to an 8100 system loop through the 3276 Control Unit/Display Station. Attachment can be up to 1 500 metres (4,920 feet) maximum cable length from the 3276.

The 3287 Models 1 and 2 can also attach to the Display and Printer Attachment Type I or II in the 8101 with a maximum cable length of 2000 feet.

The 3287 Models 11 and 12 attach directly to an 8100 system loop.

Note: *The 3287 and 8775 are the only IBM devices that can operate on a 38.4K-bps directly attached loop.*

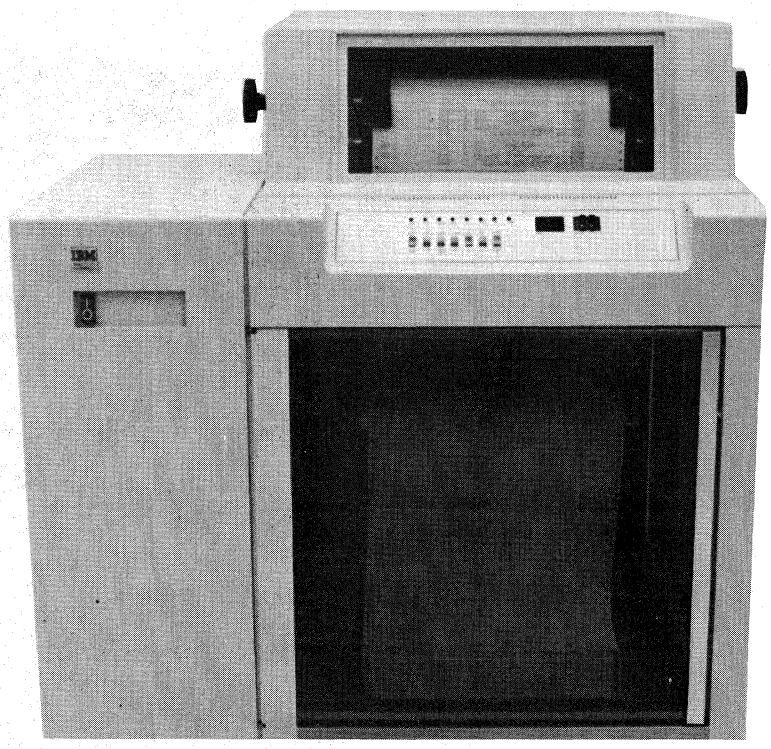
IBM 3288 Line Printer



The IBM 3288 Line Printer Model 2 has a 1,920-character buffer capacity. The print rate is 120 lines per minute.

The 3288 attaches to the 8100 Information System via the Display and Printer Attachment Type I or II in the 8101.

IBM 3289 Line Printer Models 1 and 2



The IBM 3289 Line Printer Models 1 and 2 are floorstanding line printers with integrated forms stand/stacker that prints up to 400 lines per minute.

The 3289 is available in two models whose model numbers relate to print speeds:

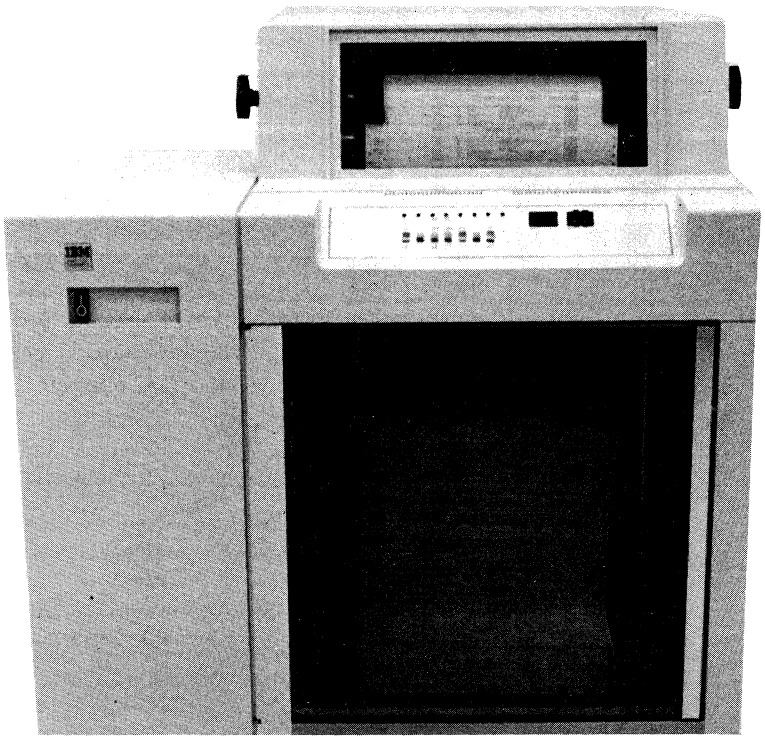
- Model 1 - Up to 155 lines per minute using the 48-character set
- Model 2 - Up to 400 lines per minute using the 48-character set

Note: *Actual printer throughput depends upon operational and system characteristics. Maximum print speed may be affected by such factors as communication line speed, control unit load, and application program.*

The 3289 Models 1 and 2 attach to the 8100 Information System through the 3276 Control Unit/Display Station.

Attachment can be up to 1 500 metres (4,920 feet) maximum cable length from the 3276.

IBM 3289 Line Printer Model 3



The IBM 3289 Line Printer Model 3 is a floorstanding line printer with integrated forms stand/stacker that prints up to 400 lines a minute.

The 3289-3 is attached to either directly attached or data link attached loops and can have the following devices attached to it:

- 3782 Model 1 Card Attachment Unit, which attaches the 3521 Card Punch
- 3782 Model 2 Card Attachment Unit, which attaches the 2502 Model A1 Card Reader
- 3501 Card Reader

Note: *The 3289-3 Line Printer can only have one card reader attached to it.*

Maximum print speed of the 3289-3 is as follows:

400 lpm using the 48-character set

300 lpm using the 64-character set

230 lpm using the 94-character set

160 lpm using either the 116 or 127 character set (French Canadian and Katakana respectively)

Note: *Actual printer throughput depends on operational and system characters. Maximum print speed may be degraded by such factors as loop speed, control unit load, application programs, and multiple device operation.*

Character Set

The character set of the 3289-3 is contained on a continuously rotating metal belt, with inking supplied by a ribbon. The character set desired (48, 64, 94, 116, or 127-character set) must be specified when the printer is ordered. Additional print belts can be purchased and can be changed by the operator.

The printing speed automatically adjusts to the size of the character set contained on the print belt. For example, depending on the job's printing requirements, the 48-character set belt can be substituted for the 94-character set belt to nearly double the printing speed.

Using the 48- or 64-character set belt, the printer converts the 26 lowercase alphabetic characters (a through z) to uppercase and prints them. For Katakana machines, those codes equivalent to EBCDIC lowercase alphabetic characters are converted to uppercase alphabetic characters when a 48 or 64 character set, Japanese/English belt is installed. Maximum print line length is 132 characters.

The 116-character Canadian-French belt is interchangeable with 48-, 64-, and 94-character set Canadian-French belts. The 127-character set Katakana belt is only interchangeable with the 48- or 64-character set Japanese/English belts.

Forms

The 3289-3 uses a forms tractor for feeding 1-part to 6-part edge-punched continous forms. The tractors are adjustable to accept forms ranging from 88.9 to 381.0 mm (3.5 to 15.0 in) wide.

Special Features

An audible alarm alerts the operator to certain conditions that require manual intervention, and a keylock disables all operator activity related to input, output, or control of data at the printer. Each of the Card I/O devices is attached as a feature.

Vertical Forms Control

Vertical forms control allows the forms to be formatted vertically by skip areas and print areas. Once the format is set, printer control characters contained in the print data cause the forms to advance as specified text areas are printed.

Horizontal Format Control

Horizontal format control horizontally formats print lines by print areas and tab areas and eliminates the need to transmit spaces within the line. Once the format is set, Horizontal Tab (HT) characters contained in a line of print data causes tabbing (skipping) over areas that are not to be printed. A Set Horizontal Format (SHF) message from the processor performs this setup.

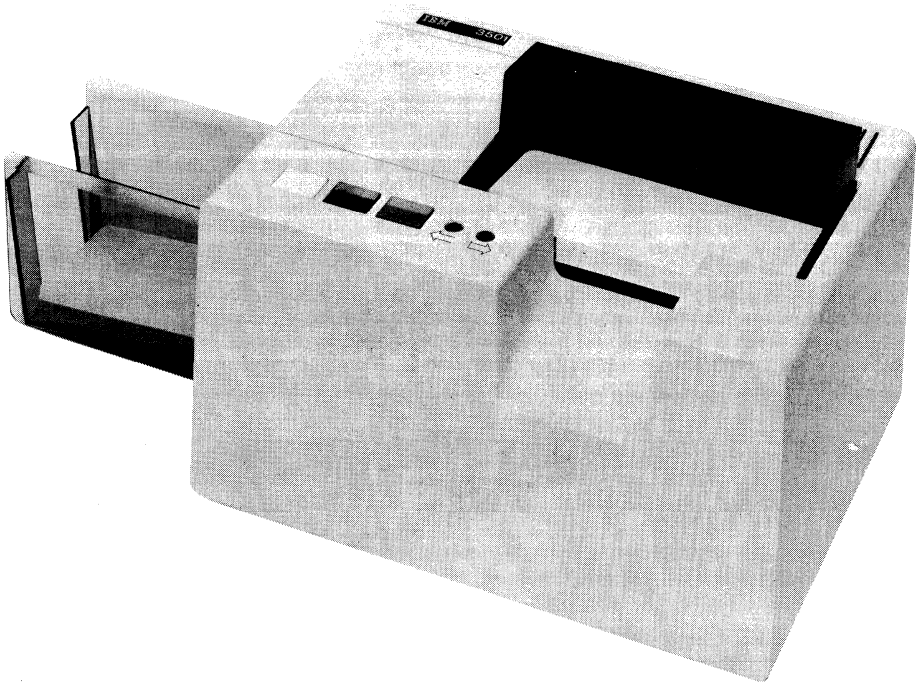
Directly Attached Loop

When the 3289-3 is attached to the 8100 Information System via a directly attached loop, it transmits and receives data at a maximum speed of 9600 bps.

Data Link Attached Loop

When the 3289-3 is attached to an 8100 system data link attached loop, it transmits and receives data at either of two selected speeds. The two speeds are 1200 and 2400 bits per second. These speeds, matched to the loop when the printer is installed, are switch-selectable by the operator.

IBM 3501 Card Reader

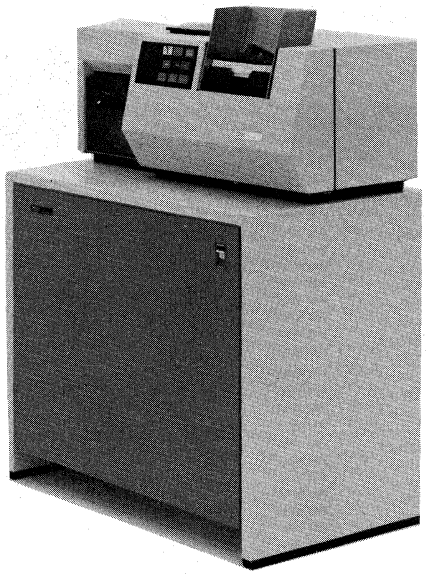


The IBM 3501 Card Reader reads 80-column cards at 50 cards per minute (maximum). This compact unit is suitable for desk-top use.

The 3501 attaches to the 8100 Information System via the 3289 Model 3 Line Printer.

No special features are available for the 3501, and it cannot be installed if a 2502 Card Reader is already attached.

IBM 3521 Card Punch with IBM 3782 Card Attachment Unit



The IBM 3521 Card Punch punches 80-column cards at 50 cards per minute (maximum). Special features permit card reading or card punching with checking and card printing. The 3521 speed is reduced to 25 cards per minute during printing of Katakana.

The 3521 attaches to the 3289 Model 3 Line Printer via the 3782 Model 1 Card Attachment Unit.

Note: *The 3289-3 Line Printer can only have one card reader attached, whether it is a 3501, 2502 or the card read/punch checking feature of the 3521.*

Card Read Feature

This feature adds a read station for reading 80-column cards and for punch-checking.

During punching, data punched into the card is compared with the data that was intended for punching. If the data does not compare, the punch stops and an error is indicated. Data is also checked for invalid characters, or multi-punches in rows 1 through 7. The punch-check can be disabled to prevent an error indication when the 3521 is punching perforated or prepunched cards.

During reading, data is also checked for invalid characters and for multi-punches in rows 1 through 7.

Card Print Feature

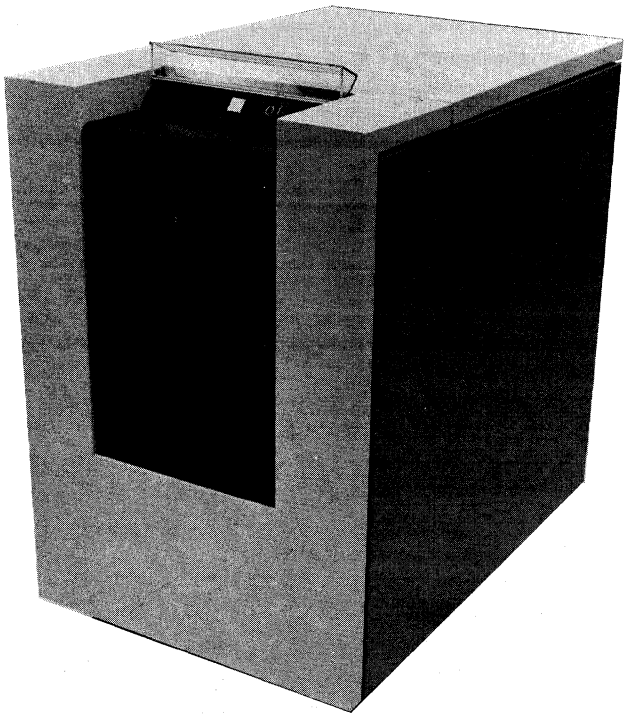
With this feature, the 3521 can print (interpret) cards as they are punched or read. Printing is under control of the user-written program. Printing is above the 12 row (top) of the card, column-for-column.

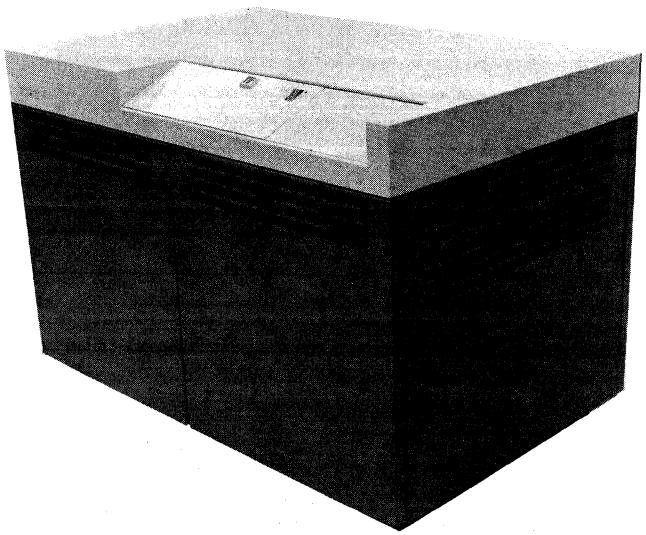
The EBCDIC 64-character set is standard. The characters are 0.062 inch wide by 0.079 inch high. Ink is supplied by an ink roll in contact with the type faces and is transferred directly from the type face to the card; no ribbion is used.

Katakana Card Print Feature

This feature allows the 3521 to print (interpret) the Katakana 127-character set on the card.

IBM 3631/3632 Plant Communication Controllers





The IBM 3631 and 3632 Plant Communication Controllers are programmable controllers that coordinate the communication traffic among the IBM 3640 Plant Communication Terminals and the host. Control and application storage can be extended in 16K byte increments. For host communication, any one of three SDLC communication adapters and an external modem to the 8100 system can be utilized. Each controller can support up to two directly attached or data link attached loops for 3640 terminal attachment.

The 3631 Model 1A incorporates an IBM Diskette 1 drive (one-sided 256K-byte diskette) and the 3631 Model 1B and both models of the 3632 incorporate an IBM Diskette 2 drive (one or two-sided 512K-byte diskette). Diskette space unused by control and application code is available for customer data.

The 3632 controller has either a 5 million byte or 9.2 million byte disk.

Key 3631 and 3632 functions are:

- Line control
- Message assembly
- Data conversion
- Data and message editing
- Error control
- Message buffering and queueing
- Message logging
- Statistics recording

The 3631/3632 Controllers are attached to the 8100 Information System through a 2400-bps SDLC data-link communication facility.

IBM 3641 Reporting Terminal

The IBM 3641 Reporting Terminal is an input/output device that can be used for data collection and response in a wide range of industrial work zones or offices. Input data may be entered from a keyboard and, optionally, from a Magnetic Hand Scanner or Magnetic Slot Reader, 80-column Punched Card Reader, 10-column Numeric Punched Hole Badge Reader, or a customer device connected to a Digital Input/Digital Output Adapter. Output may be directed to a 22-position alphanumeric display, or optionally to a customer device connected to the Digital Input/Digital Output Adapter. The application program formats an input area on the display where keyed data appears.

Basic Features–Display and Keyboard

There are two models of the 3641 Reporting Terminal. Both Models 1 and 2 have a single line 22-position display, and a choice of two keyboards.

The display is bright and flicker-free. Numeric, alphabetic, and special characters may be displayed. The characters are formed in a 5x7 dot matrix (each dot is formed by a 3x3 array of smaller dots). Character size is 9.04 x 6.30 mm (.356 x .248 in).

Both 3641 models must be equipped with one of the two keyboards. The keyboards consist of the following keys:

- 35-Position Keyboard:

  10 Numeric Keys
  5 Special Symbol Keys
  15 Function Keys
  5 Control Keys

- 70-Position Keyboard:

  26 Alphabetic Keys
  10 Numeric Keys
  9 Special Symbol Keys
  20 Function Keys
  5 Control Keys

An overlay is placed over the 3641 keys with printed characters on it to define the keyboard character set and control keys. The section of the overlay that goes over the function keys is transparent with no printing. Function key paper masks are available that are placed over the function keys and can be seen through the overlay. Customer printed or typed information on the mask defines the use of the function keys. The overlay and mask are installed from the outside of the unit by the user.

Optional Features

Both 3641 models may have:

- A Magnetic Reader Attachment feature for connection of either a Magnetic Hand Scanner or a Magnetic Slot Reader.
- A Digital Input/Digital Output (DI/DO) Adapter for attaching specialized devices such as scales, panel meters, analog to digital converters, solid state relays, transducers, etc. to the 3641.

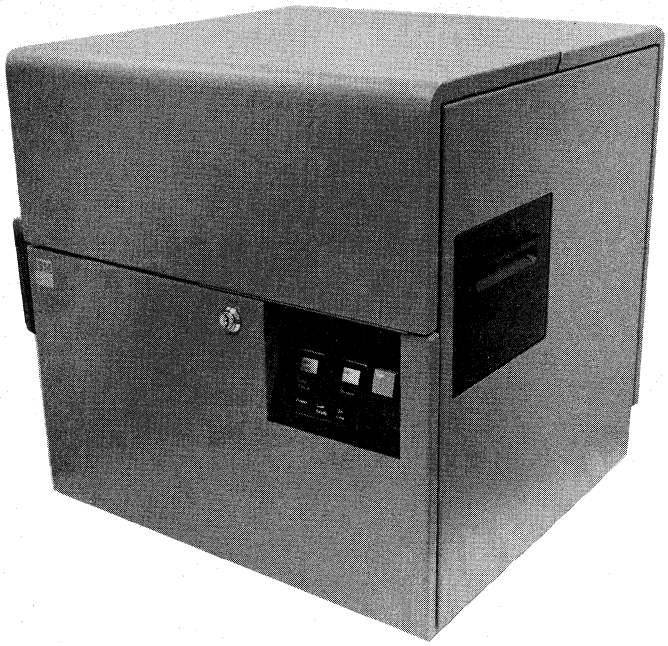
In addition, the 3641 Model 2 may have the following features:

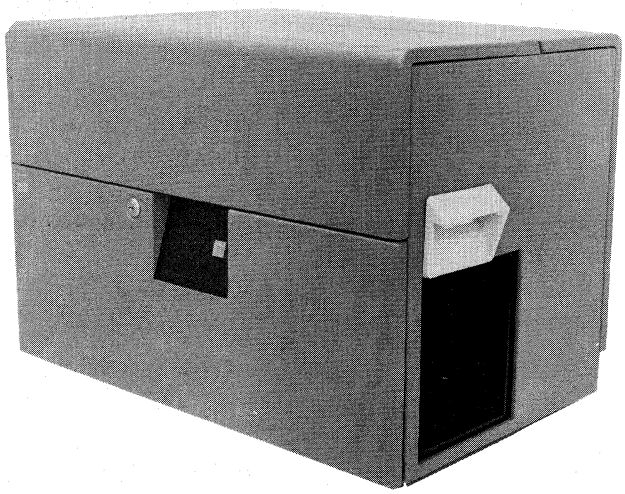
- An 80-column Punched Card Reader for reading hand-inserted standard 80-column tabulating cards.
- A Numeric Punched Hole Badge Reader for reading hand-inserted punched badges.

Note however, that only two of the following features may be installed: 80-column card reader, punched hole badge reader or Magnetic Reader Attachment.

The 3641 attaches to the 8100 Information System via a directly attached or data link attached loop, or through the 3631/3632 Plant Communication Controller. The 3641 maximum communication line speed is 9600 bps.

IBM 3642 Encoder Printer





The IBM 3642 Encoder Printer is a work station output device that prints and magnetically encodes data on magnetic stripe documents. Output for the 3642 is prepared by user-written application programs.

The 3642 can be used in a wide range of industrial work zones and office areas to produce working documents where they are needed. In this way, human and machine readable documentation can be more easily kept current and synchronized with data in the information system.

There are two models of the 3642:

- Model 1 provides magnetic stripe encoding and ten lines of printing on hand-fed documents.
- Model 2 provides the capabilities of the Model 1. In addition, the Model 2 can automatically feed and burst continuous forms. The Model 2 may be used unattended.

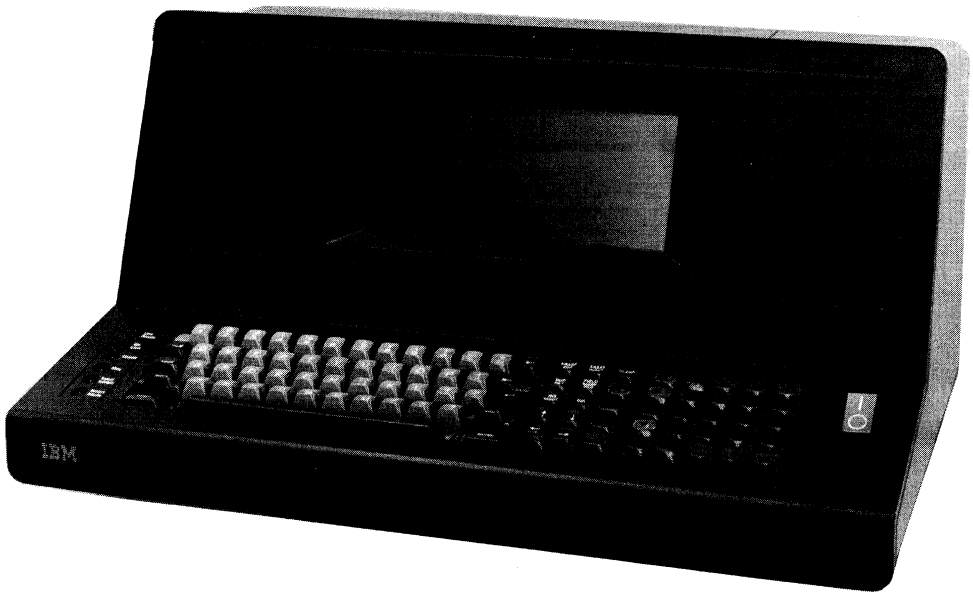
Both models have a 400-form output stacker. The Model 2 has a 400-form input hopper. This hopper is not used when documents are hand-fed on the Model 2. The Model 2 automatically bursts continuous forms into single forms.

Encoding is possible on a maximum 12.7 cm (5.0 in) of magnetic stripe at a density of 5 bits/mm or 128 bits/inch. This allows approximately 100 numeric digits on the stripe. It is also possible to encode alphabetic and special characters.

Printing is possible at 10 characters/inch on ten lines spaced 5 mm (0.2 in) apart. Up to 70 columns of printing on the longest form are possible. Printing is accomplished using a drum printer with 48 characters for each line. Normally, each line contains the same character set.

The 3642 attaches to the 8100 Information System via a directly attached or data link attached loop, or through the 3631/3632 Plant Communication Controller. The 3642 maximum communication line speed is 9600 bps.

IBM 3643 Keyboard Display



The IBM 3643 Keyboard Display is an interactive input/output terminal that brings display capability to a wide range of industrialized work zones or offices.

The 3643 can be used for many applications, including activity reporting, receiving and inspection, and stores or warehouse control. The terminal, which consists of three models, can be used interactively with the system by the operator, accept operator entered data, present messages from the system, and provide guidance messages for the operator. The definition of function keys can be selected to reflect plant floor operations. The keyboard includes lights for indicating terminal status and message waiting conditions. The display uses an IBM gas panel display technology that provides a constant, flicker-free image.

Three models of the 3643 are available:

- Model 2 - 240-character display consisting of six lines of 40 characters each, using a 7 x 9 dot matrix to form each character
- Model 3 - 480-character display consisting of 12 lines of 40 characters each, using a 7 x 9 dot matrix to form each character
- Model 4 - 1024-character display consisting of 16 lines of 64 characters each, using a 5 x 7 dot matrix to form each character

Each model has the option of an alphanumeric or expanded alphanumeric keyboard.

A Magnetic Reader Attachment feature is also available for connection of either a Magnetic Hand Scanner or a Magnetic Slot Reader.

The customer must specify one of two keyboard options:

- A 74-key (77-key for Katakana) alphanumeric keyboard with:

  Numerics 0 - 9
  Alphabetics A - Z
  Special Symbols
  Control Keys
  Eight Function Keys

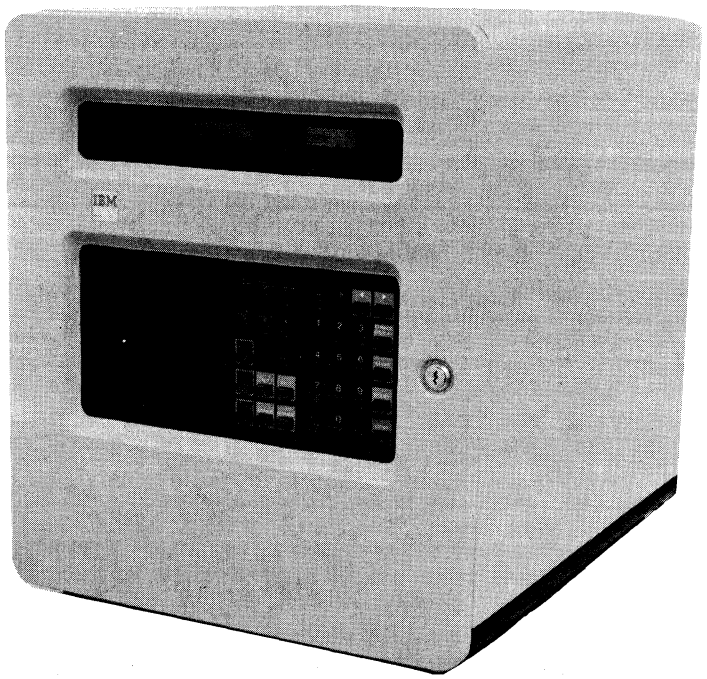
- A 94-key (92-key for Katakana) expanded alphanumeric keyboard, which adds 20 function keys (15 for Katakana) to the above.

For flexibility in meeting varying customer applications, both keyboards have a combination of engraved and nonengraved keytops. Both preprinted and blank labels are supplied to tailor the keyboard to the user's application. Overlays are provided to protect customer inscribed blank labels.

The symbols and graphics supported for individual countries vary. Keyboards for individual countries are selected by the appropriate specify code.

The 3643 attaches to the 8100 Information System via a directly attached or data link attached loop, or through the 3631/3632 Plant Communications Controller. The 3643 maximum communication line speed is 9600 bps.

IBM 3644 Automatic Data Unit



The IBM 3644 Automatic Data Unit Model 1 is a terminal that attaches to the 8100 Information System via the communication loop to provide system connection to a variety of distributed sensors, actuators, and production and laboratory equipment. The 3644 can collect data from the attached devices on a cyclic or interrupt driven basis. It can forward the data to the 8100 system directly or examine the data when specific conditions exist. It can also generate and send responses to the attached devices without interacting with the 8100 system.

The user may customize the 3644 to specific application needs by using a fill-in-the-blanks program specification procedure to define input/output channel parameters, to specify the initial state of stored data values, and to select from a list of available functions. The user may store the resulting parameter tables in the host system, transfer them to the 8100 system, and load them into the 3644 at power-on. The user can modify 3644 operations while the 3644 is active through user-written application programs. A variety of routines allow the 3644 to perform user-defined decision making functions and data filtering without the involvement of the 8100 system.

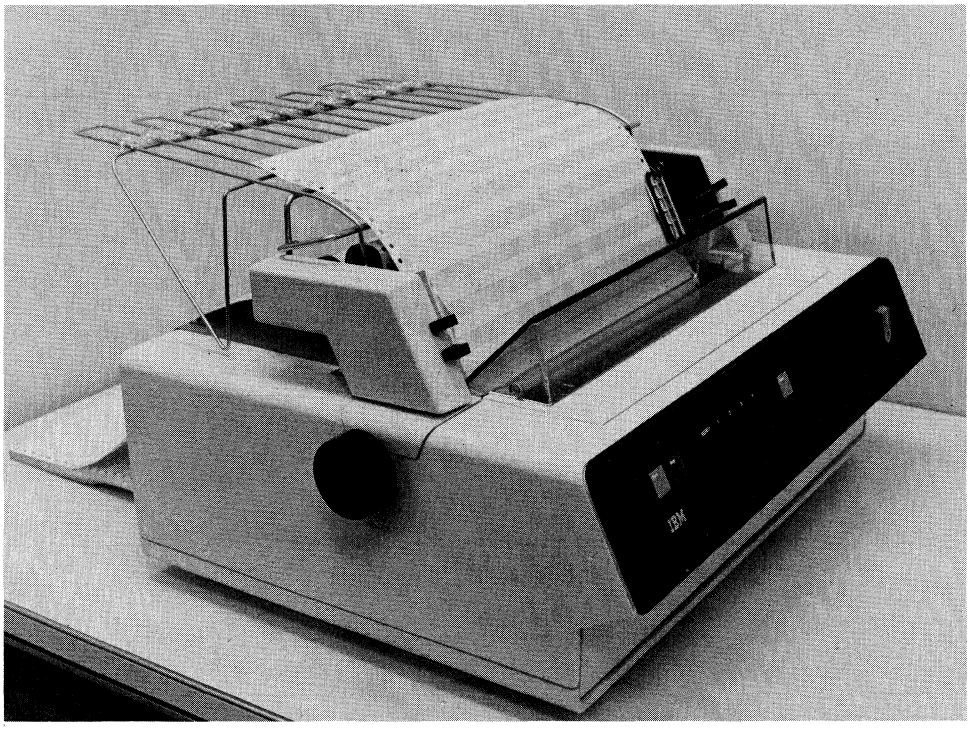
The 3644 includes an internal micro-controller and storage. User-defined parameter tables and data resident in storage are interpreted by IBM provided control routines executed by the micro-controller.

Optional Feature

The Manual I/O feature provides a 22-position display and a 35-position alphameric/function keyboard which allows inquiry into data and status contained in the 3644 internal storage facility when online. Manual control of the 3644 and inquiry and modification of 3644 data and status are possible when offline.

The 3644 attaches to the 8100 Information System via a directly attached or data link attached loop, or through the 3631/3632 Plant Communication Controllers. The 3644 maximum communication line speed is 9600 bps.

IBM 3645 Printer



The IBM 3645 Printer terminal is a serial matrix table top printer. It is capable of printing bidirectionally at 120 characters per second (cps) using a 94 character set. It has 132 print positions per line with character spacing of 10 per inch.

The print character is produced by a wire matrix consisting of eight wires. Most characters are formed by seven of the wires printing dots in up to four of seven horizontal positions. The eighth wire is used to print certain special symbols.

Printing direction can be from left to right and right to left, minimizing the loss of throughput due to print head return. Vertical spacing of lines is six lines per inch (lpi). The printer accepts up to six part continuous forms when used with the Variable Width Forms Tractor. It provides quality printing on single sheets or on an original and up to three carbon copies of continuous forms. Five and six part forms should be tried for acceptable quality in customer applications.

Up to four part cut forms can be used with the standard friction feed. Two forms tractors for handling continuous forms are offered as special features. The forms tractor features are recommended for any multipart or continuous forms. Maximum overall forms width is 381 mm (15.0 in). Card stock forms are not recommended.

Features

The Standard Character Print feature provides a dot matrix character of 2.972 mm (0.117 in) high by 1.829 mm (0.072 in) wide at 10 characters per inch.

The Large Character Print feature provides for three large character size printing options under program control.

- Approximately twice standard size
- Approximately four times standard size
- Approximately eight times standard size

Intermixing print character sizes on a single line can be accomplished by printing standard size followed by a carriage return, and then printing 2, 4, or 8 times standard.

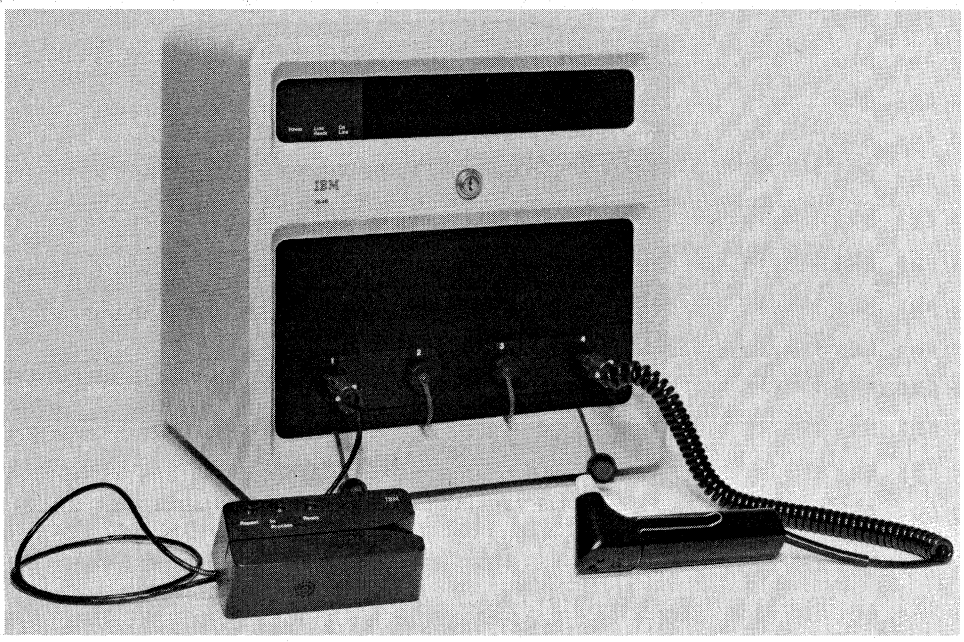
A Variable Width Forms Tractor is available as a special feature and provides form feeding for continuous margin punched forms. The feature is required with the Large Character Print feature. Up to six-part forms may be used, porvided the total thickness does not exceed 0.46 mm (0.018 in). Five- and six-part forms should be tried on an individual basis for acceptable feeding, registration, and print quality. Overall forms width from 76.2 to 381 mm (3 to 15 in) can be used.

A Separator Bar Tractor is available as a special feature for feeding continuous margin punched forms. Up to four-part forms may be used, provided the total thickness does not exceed 0.3 mm (0.012 in). It includes a separator bar to allow the manual separation of forms at the perforations, to within 40 mm (1.5 in) of the print line. Perforated carrier strips on both sides of the form are recommended for clean separation.

Forms width more than four parts or without perforations require trial and approval by the customer to determine if acceptable feeding, registration, print quality, and separation can be obtained. Overall forms width from 127 to 378 mm (5 to 14.85 in) can be used.

The 3645 attaches to the 8100 Information System via a directly attached or data link attached loop, or through the 3631/3632 Plant Communications Controller. The 3645 maximum communication line speed is 9600 bps.

IBM 3646 Scanner Control Unit with Magnetic Hand Scanner and Magnetic Slot Reader



(Design Model)

The IBM 3646 Scanner Control Unit, Model 1 is a dedicated magnetics attachment device. Two attachment ports are standard with an option of two additional ports.

One IBM Magnetic Hand Scanner or IBM Magnetic Slot Reader may be attached to each port. Each attachment port has its own sub address and operates independently. The magnetic readers each have 1.5 m (5 ft.) cords and can use a single 6 m (19.7 ft.) or 12 m (39.4 ft.) extension cord.

The Scanner Control Unit can be used at quality control stations, assembly areas, shipping and receiving docks, piecework control stations, etc. Operator feedback is provided by three lights and buzzer on the slot reader and hand scanner.

The Scanner Control Unit is equipped with three status indicators which only need to be observed under abnormal circumstances. It may be located on a bench, table, or an accessory bracket may be purchased enabling mounting of the 3646 on a wall or column.

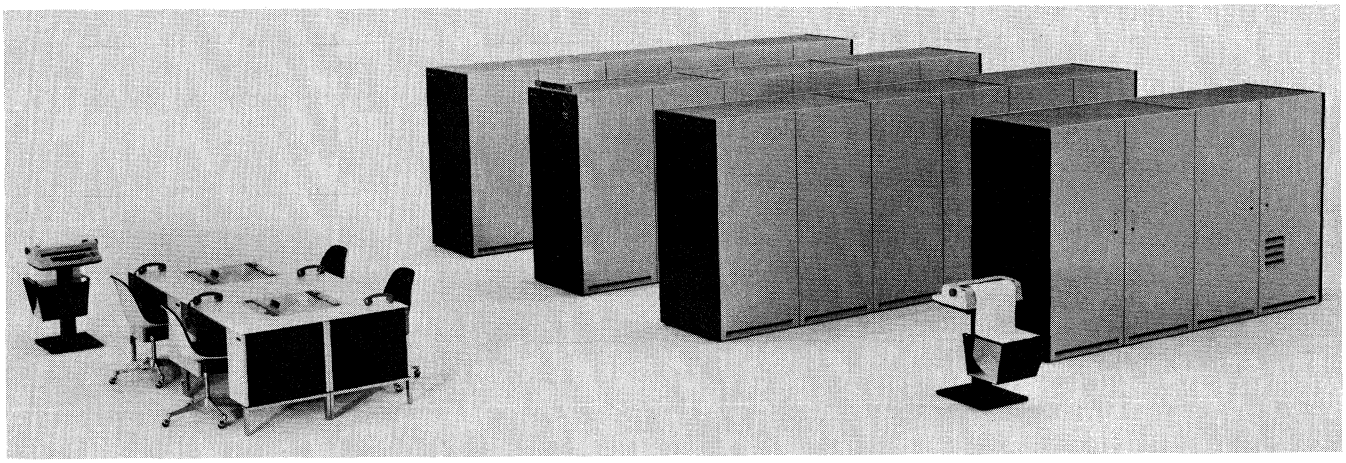
The 3646 attaches to the 8100 Information System via a directly attached or data link attached loop, or through the 3631/3632 Plant Communication Controller. The 3646 maximum communication line speed is 9600 bps.

The IBM Magnetic Hand Scanner, part number 4123495, and the IBM Magnetic Slot Reader, part number 4123500, are used to read data encoded on a variety of magnetic striped adhesive labels, tags, plastic cards or badges. The Magnetic Hand Scanner is a light-weight hand-held device. The Magnetic Slot Reader can be free-standing or mounted on a flat surface using holes provided on the bottom of the slot reader. Both units contain three lights and a buzzer to provide information to the operator.

Both devices are plug-compatible and may be attached to all models of the 3641 Reporting Terminal, the 3643 Keyboard Display, and the 3646 Scanner Control Unit. An optional Magnetic Attachment feature is required on the 3641 and 3643.

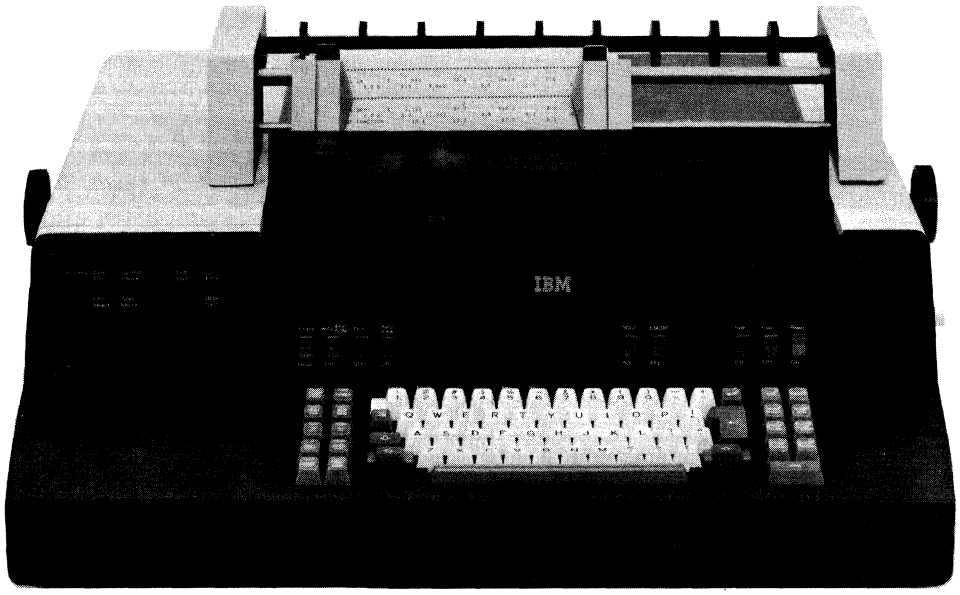
The Magnetic Hand Scanner is supplied with a coiled cord which extends to 1.5 m (5 ft) and the Magnetic Slot Reader is supplied with a 1.5 m (5 ft) uncoiled cord. A single uncoiled extension cord may be used between the magnetic reader and the terminal adapter and is available in two lengths: 6 m (19.7 ft) and 12 m (39.4 ft).

IBM 3750 Switching System (Not Available in U.S.)



The IBM 3750 is a voice and data communications system designed for use on customer premises with connection to the public switched and/or leased telephone network. For more information, refer to the 3750 System Library.

IBM 3767 Communication Terminal



The IBM 3767 Communication Terminal is a compact, movable, desk-top terminal that furnishes access to the 8100 System via data link.

Some of the online uses of the 3767 are:

- Computer programming
- Data entry
- Data base inquiry and update

When it is not communicating with the 8100 System, the 3767 can be used for normal secretarial typing.

The IBM 3767 is available in three models with the following characteristics:

Model	Printing Rate (Characters per second)	Buffer Size
3767-1	40 cps average	512 bytes optional
3767-2	80 cps maximum	512 bytes basic
3767-3	120 cps maximum	512 bytes basic

Buffer expansion special features for up to 1,024 bytes are available for all three models.

Safeguards against unauthorized use of the terminal are provided by:

- Security keylock (optional), which provides a key-operated switch
- Magnetic stripe reader (optional), which reads information from a magnetically striped and encoded ID card

Print suppress (standard), which allows selected data fields to be entered without being printed.

Other features include:

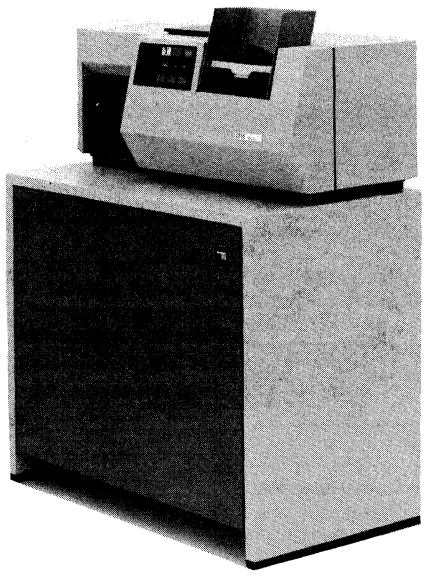
- Bidirectional printing (standard), which increases throughput by reducing the number of carriage returns
- Alternate character set (optional), which provides a switch control for printed graphics alternate to those selected by keyboard specification
- Calculate-scientific (optional), which, in offline mode under switch control and using the same keyboard, allows the following calculations to take place:

Addition	Exponential
Subtraction	Common logarithm
Multiplication	Natural logarithm
Division	Exponential constant
Inverse calculation	Circular constant
Square root	Trigonometrical functions
Statistical value	

Two storages are provided for temporary storage of totals.

The 3767 is attached to the 8100 Information System via an SDLC data-link communication facility.

IBM 3782 Card Attachment Unit with IBM 3521 Card Punch



The IBM 3782 Card Attachment Unit, provides facilities and mounting for attaching the IBM 2502 Card Reader or the IBM 3521 Card Punch to the IBM 3289 Model 3 Line Printer.

The 3782 Model 1 attaches the 3521 Card Punch. The 3782 Model 2 attaches the 2502-A1 Card Reader.

IBM 3842/3843 Loop Control Unit

The IBM 3842 and 3843 Loop Control Units are used to connect the loop to a data link. The 3842 contains a modem that can communicate with the IBM 3872 Modem and operates at 1200 or 2400 bps and the adapter unit for loop connection. The 3843 is designed for use in countries other than the U.S. and Canada and requires two modems which operate at 2400 bps, and provide connection to the 3843.

IBM 3872 Modem 1200/2400 bps

IBM 3874 Modem 2400/4800 bps

IBM 3875 Modem 4800/7200 bps

The IBM 3872, 3874, and 3875 Modems are a family of synchronous modems with half-speed capability that provides teleprocessing products with the modulation/demodulation function required for transmitting data over common-carrier nonswitched voice-grade lines, equivalent privately owned nonswitched lines, or public switched telephone networks.

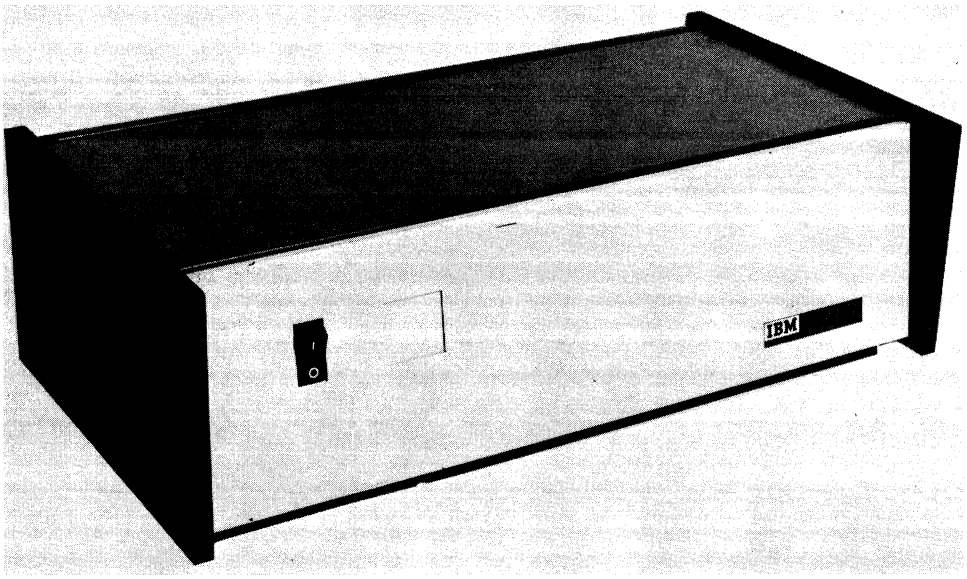
These three modems can accommodate configurations which include point-to-point, multipoint, and switched network operation. The operator panel controls and indicators allow the operator to quickly localize problems by performing local and end-to-end testing.

Transmission may be full duplex, half duplex, or half speed. Speeds range from 2400 bps to 7200 bps: the 3872 transmits data at 2400 bps and 1200 bps half-speed, the 3874 transmits data at 4800 bps and 2400 bps half-speed, the 3875 transmits data at 7200 bps and 3600 bps half-speed. The three modems can be used with SDLC, BSC.

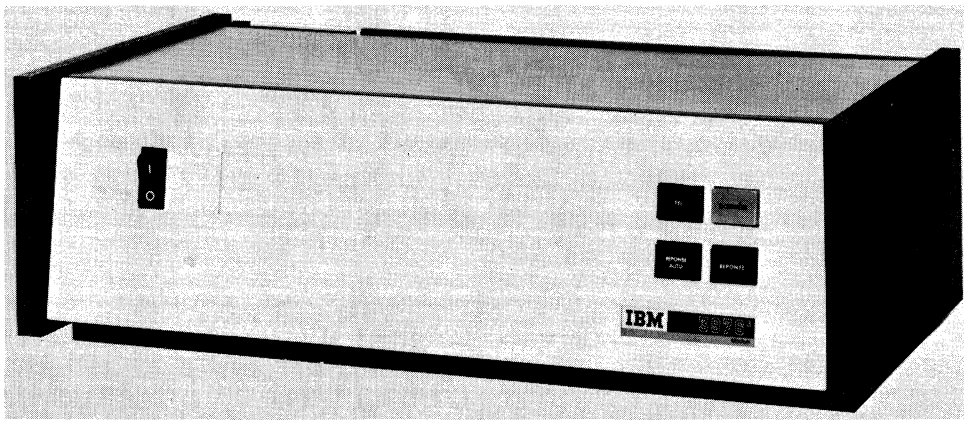
Optional features include:

- Alternate voice, which provides signaling capability and a socket on the operator panel to plug in a handset for voice communication
- Fan-out, which allows the attachment of up to three IBM devices at one location. It also allows up to three IBM communications controllers, or integrated communications adapters at a central site to share the same modem for backup purposes.

IBM 3976 Modem Model 1 (Not Available in U.S.)



IBM 3976 Modem Model 3 (Not Available in U.S.)

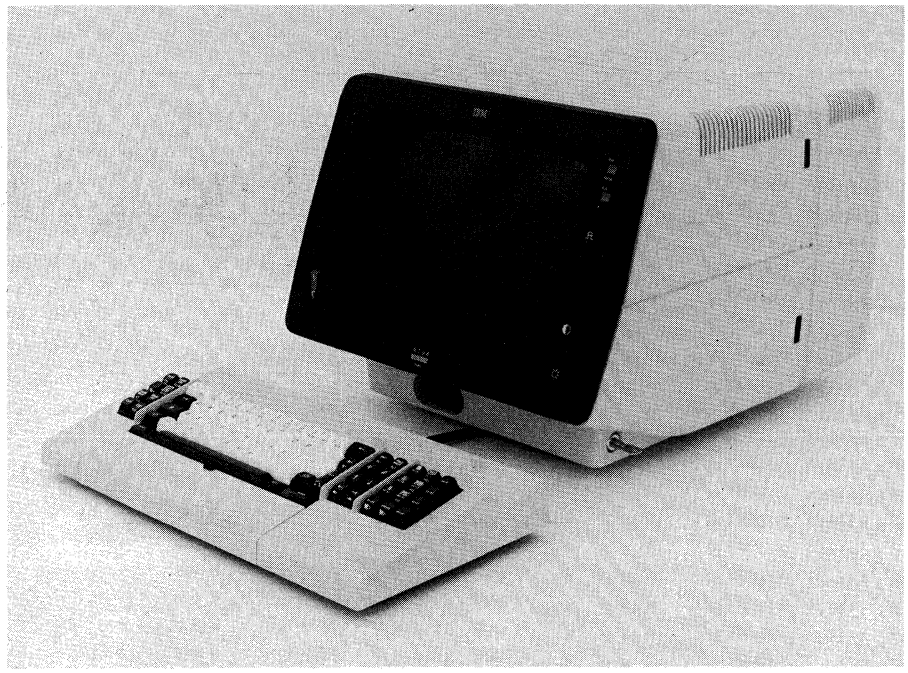


The IBM 3976 Modem is designed for use in World Trade countries. It is a frequency modulation modem, providing serial transmission of binary information.

The 3976 Model 1 operates in duplex or half-duplex mode over a two-wire, nonswitched, telephone line. Its transmission speed is up to 200 bps.

The 3976 Model 3 operates in half-duplex mode over a two-wire, switched, telephone line or in continuous carrier mode over a four-wire, non-switched telephone line. Its transmission speed may be 600 or 1200 bps.

8775 Display Terminal



(Design Model)

The IBM 8775 Display Terminal is a multi-function, cathode ray tube display that can be connected to the 8100 Information System by a directly attached loop at 9600 or 38.4K bps or a data link attached loop at 1200 or 2400 bps. **Note**: *The 3287 and 8775 are the only IBM devices that can operate on a 38.4K-bps loop.* Highlighting, multiple partitions, and extended data entry capabilities are available. A Keyboard or a Selector Light Pen permit an operator to display and manipulate data on the screen. Other functions include Audible Alarm, Security Keylock, or Magnetic Slot Reader. The 8775 meets both general and unique display requirements with its set of basic and optional features.

The 8775 communicates with an 8100 processor using Synchronous Data Link Control (SDLC) over either a directly attached or a data link attached loop.

Highlights

The 8775 Model 1 displays up to 2560 characters in a 9x16 character matrix. The Model 2 displays up to 2560 characters in a 9x16 matrix or 3440 characters in a 9x12 character matrix.

The number of characters displayed is determined under operator control. All configurations include 62 alphanumeric and 32 special characters, the Space and Null characters. The 8775 uses 3270 Field Formatting capability, which permits individual fields of data on the screen to be program defined with various attributes, such as protected/unprotected, alphanumeric/numeric, normal/highlighted intensity, displayable/nondisplayable, and selector light pen detection allowed/disallowed.

Enhanced function consisting of Highlighting, Multiple Partitions, and Field Validation is offered.

Operator Factors

The design of the 8775 Display Terminal offers the following features:

- Anti-Glare: The screen is coated to make it less reflective
- Tilted Screen: Allows the operator to take up a comfortable viewing posture.
- Variable Tilt: This mechanism provides a 5 degree variation in device angle to accommodate operator's preference and variances of desk top heights.
- Low Profile: Allows the operator to view and interact with a larger segment of the operational environment.
- Reduced Height: The weight of the terminal, approximately 21 Kg (or 45 lbs), makes it easier to site or relocate.

Variable contrast, brightness and audible alarm volume controls, features of the IBM 3270 Information Display System, are retained on the 8775.

Editing Function

Cursor move, tab, home key, back tab, insert, delete, extended erase (erase to end-of-field, erase all keyboard input data, and erase entire screen) and cursor select keys are all basic. All alphanumeric, special symbol, and cursor move keys have typematic capability. Double speed cursor typamatic is attained with a simultaneous depressing of the ALT key and a horizontal cursor positioning key. The cursor select function provides an alternative to the Selector Light Pen function. Fields of data may be selected by positioning the cursor then using the Cursor Select Key.

Input Flexibility

A choice of keyboards or the Selector Light Pen provide input flexibility. Fields of data can be selected by positioning the cursor and operating the cursor select key, instead of using the Selector Light Pen. Twelve Program Function (PF) keys are basic with all typewriter keyboards; seven or more PF keys are available on all Data Entry Keyboards.

Security Function

A special nondisplayed input mode provides for fields of data to be program-defined so that they will accept data entered from the keyboard without displaying the data on the screen. A Security Keylock (optional) prevents modification or display of data in the display terminal unless the key is turned to the "on" position. The Set-up Keylock (optional) controls access via the keyboard to change the terminal address. Those capabilities and the terminal's ability to identify itself to the host program, allow customer-supplied security program routines to help to control access to data and to help to maintain an audit of actions. A Magnetic Slot Reader is available to enter system user identification.

Communication

All 8775 display terminals are attached to customer-owned loops. A directly attached loop may operate at 38.4K bps or 9600 bps, this operating speed being determined by the customer at order time. A data link attached loop operating at 2400 bps (1200 bps half-speed option) may be connected to the 8100 system via the 3842 Loop Control Unit and the 3872 Modem. The 3842 can be connected multipoint or point-to-point on a leased transmission facility to a 3872 Modem at the 8100 site of operation. Other synchronous modems with clocking and the 3843 Loop Control Unit may replace the 3872 and 3842s.

Features

The 8775 Display Terminal provides a choice of the following features:

- Enhanced Function:

  Highlight: Provides the ability to highlight data on a per character basis in one of three user selectable modes (blink, reverse video, or underscore) and additionally on a field basis for intensity.

  Multiple Partitions: Provides the ability to display data in up to eight user defined rectangular partitions, and for the 8130 or 8140 processor or user to interact individually with the data within each partition.

  Field Validation:

  Mandatory Enter: Data must be entered into this field to permit entry to the system.

  Mandatory Fill: All positions in this field must be filled to permit entry to the system.

  Trigger Field: Causes the contents of the field to be sent from the display when data has been entered into the field and the cursor leaves the field.

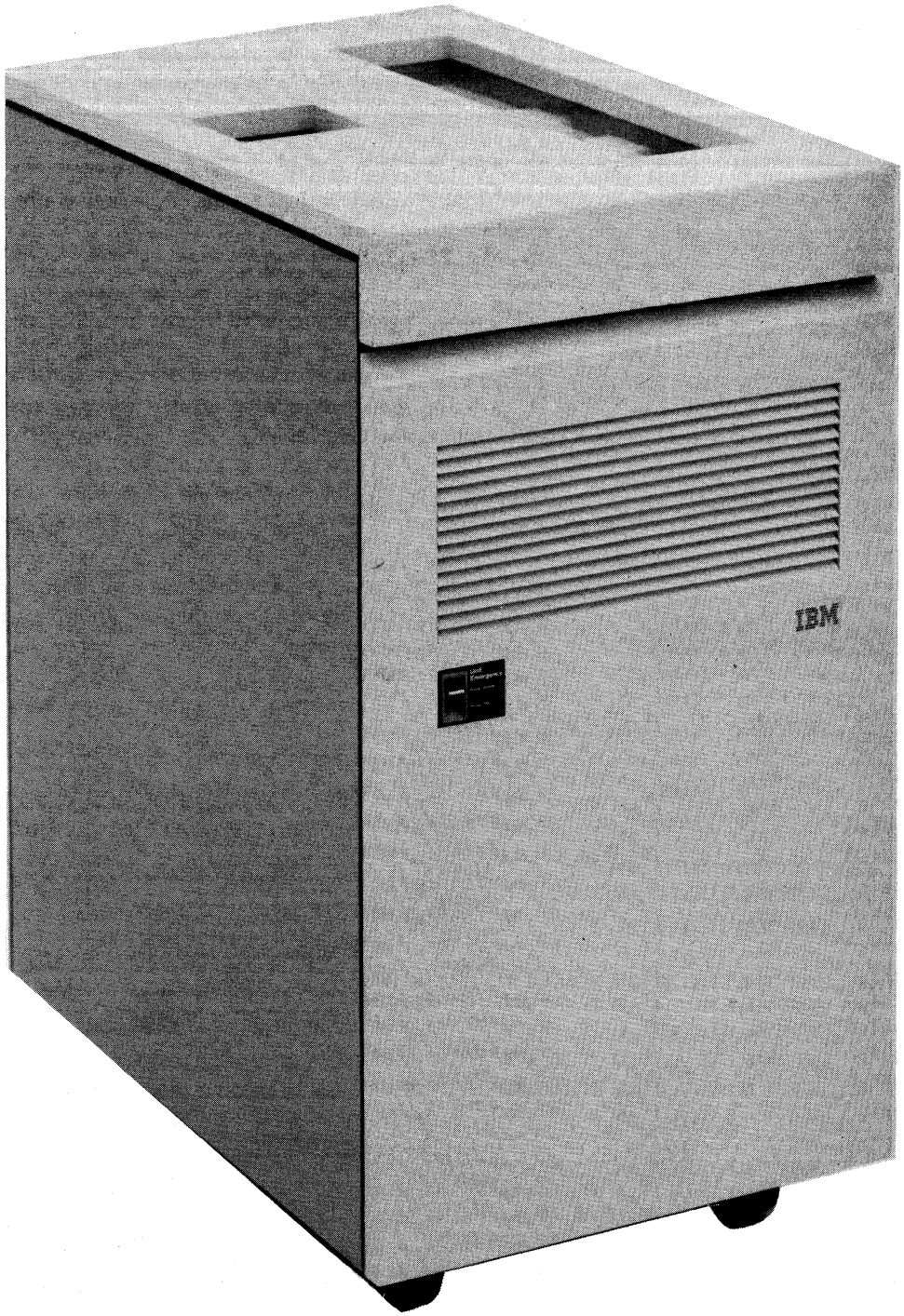
  Keyboard: Offers the choice of a typewriter keyboard, extended typewriter keyboard, two types of data entry keyboards and Japanese Katakana Keyboard.

  Each keyboard is movable, with editing features, such as typamatic, cursor move, tab, back tab, protect data, insert, delete, extended erase (erase to end-of-field, erase all keyboard input data, and erase entire screen) and cursor select.

  All alphanumeric, special symbol and cursor move keys have typamatic capability. Fields of data can be detected by positioning the cursor and pushing cursor select key in lieu of using the Selector Light Pen.

- *Selector Pen:* Allows the operator to select information from the display screen and cause those selections to be identified to the application program.
- *Audible Alarm:* Sounds a short variable amplitude tone when a character is entered into the next to last position of the partition under keyboard operation or under program control to alert the operator.
- *Security Keylock:* Normally prevents modification and display of data in the display terminal unless key is turned to the 'on' position.
- *Numeric Lock:* In normal operation, this feature provides the capability to lock the keyboard if a non-numeric key (other than 0-9, minus (-), decimal sign, or DUP) is depressed in a predefined numeric-only field.
- *Set Up Keylock:* Helps to control access by the operator to change via the keyboard the unit address of the terminal.
- *Mono-case Switch:* Allows the choice to display either uppercase characters only or both uppercase and lowercase characters.
- *Magnetic Slot Reader:* A free standing Magnetic Slot Reader that reads encoded information from a magnetic stripe.

IBM 8809 Magnetic Tape Unit



(Design Model)

The IBM 8809 Magnetic Tape Unit attaches to the 8100 Information System through a Processor or a Storage and I/O Unit. It provides high-speed save/restore capabilities for disk (DASD) and satisfies DB/DC journaling, tape interchange, and processing requirements for the 8100 system.

The 8809 is a 9-track, reel-to-reel, magnetic tape unit that utilizes the industry standard tape density and format for phase encoded (PE) 1600 bytes-per-inch operation. It operates in either 0.3175 meters-per-second (12.5 ips) start/stop mode, which provides a 20K-byte instantaneous data rate for journaling and processing, or 2.54 meters-per-second (100 ips) streaming mode, which provides a 160K-byte instananeous data rate for save/restore. The 8809 accepts half-inch tape with reel sizes of 6.25, 7.0, 8.5, and 10.5 inches. However, the 10.5 inch large hub or padded hub for 1200 feet of tape can not be used on 8809.

The 8809 can also operate with either a 0.6 inch inter-block gap (IBG) or a 1.2 inch IBG. The speed and IBG settings are under program control of the 8100 system. Tapes written in either mode are identical, and either gap size can be read on other IBM 2400 or 3400 1600-bpi PE tape drives.

Mode changes are accomplished by a command issued from the 8100 system and can be made at any point on the tape.

In start/stop mode, the 8809 operates the same as current tape products, for example, starting and stopping within the inter-block gap (IBG).

In the streaming mode, the 8809 takes advantage of the fact that large amounts of data are generally transmitted in load/dump applications. Therefore, the 8809 maintains tape velocity through the gap, anticipating the next command. If the next command occurs during the gap crossing and is functionally consistent with the current tape direction and mode setting, the operation continues without loss of time because of start/stop or repositioning. If commands from the 8100 system are discontinued or arrive after the gap crossing (command overrun), the 8809 automatically repositions the tape for the next command.

The 8809 is available in four models, and up to four 8809 units may be attached in series.

Model 1A and 1B - This is the first 8809 in a string of 8809 units. The Model 1A attaches to an 8101 Storage and I/O Unit. The Model 1B attaches to either the 8130 or 8140 processor. The unit has power for itself and for the second 8809 unit in a string of four. It also contains the 8100 attachment feature (8809 Adapter) and, when there are multiple tape units, it also contains the Multiple Attachment feature.

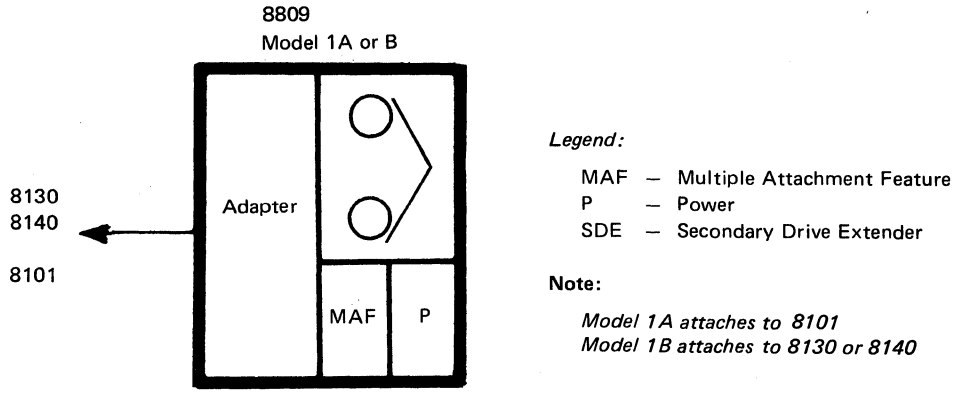
Model 2 - This is the second and fourth drives in a string of 8809 units. It does not contain power (it receives power from the Model 1 and Model 3 when configured in a four-drive string. The Model 2 also contains the Secondary Drive Extender to allow additional attachment.

Model 3 - This is the third drive in a string of 8809 units. It also contains a Secondary Drive Extender to allow additional attachment. The Model 3 has its own power, and supplies power to the fourth tape drive, which is the second model 2.

8809 characteristics are:	**Start/Stop**	**Streaming**
• Tape Speed	.3175 M/s (12.5 ips)	2.54 M/s (100 ips)
• Data Rate, nominal	20K bytes/second	160 bytes/second
• Write access time, nominal	35 ms	295 ms
• Read access time, nominal	29 ms	295 ms

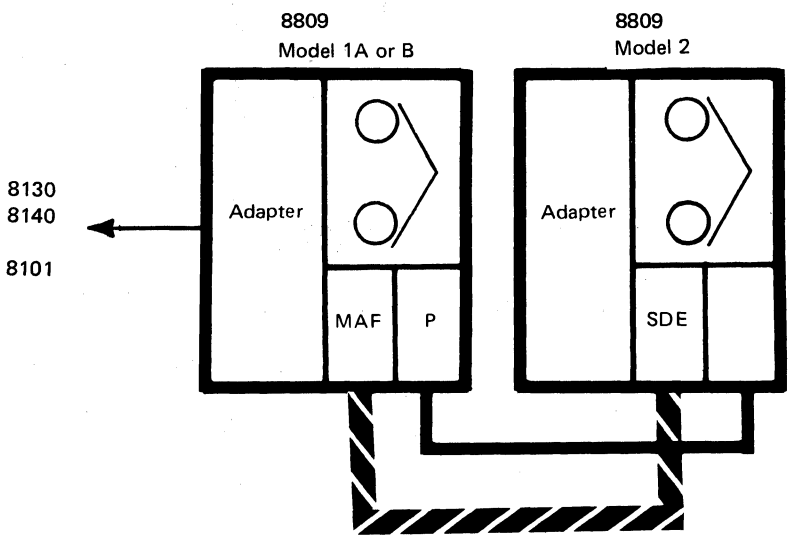
- Half-inch tape, reel-to-reel, nine-track
- Record density: 1600 bytes per inch
- Rewind Speed: 200 ips
- Rewind time (2400'): 2.6 minutes
- Reel capacity: 30 MB (2K blocks)

Single 8809 Configuration

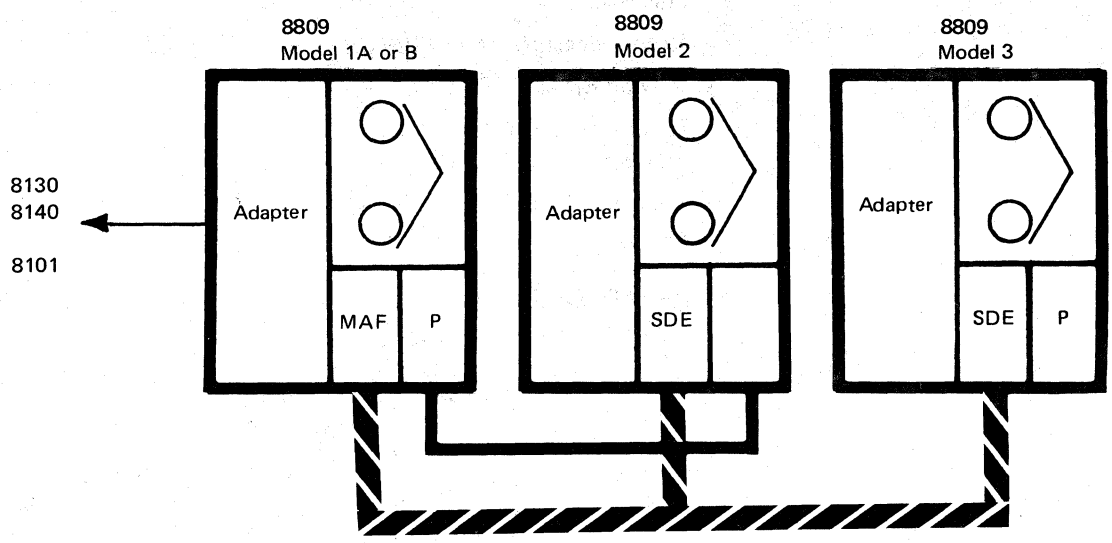


The 8809 Model 1 is used in a single tape configuration. It contains the 8100 Tape Adapter; it also has its own power supply.

Two 8809s Configuration

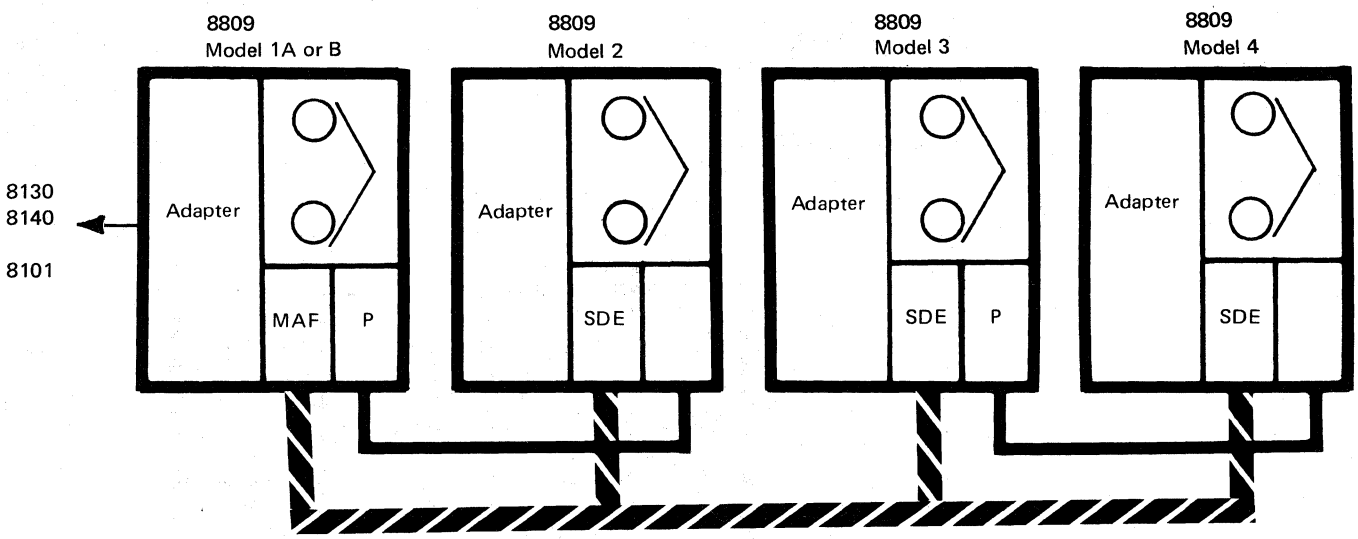


Three 8809s Configuration



The Model 3 attaches to the Secondary Drive Extender of the Model 2. The Model 3, however, has its own power supply.

Four 8809s Configuration



The fourth 8809 attached to an 8100 system is another Model 2. It is connected to the previous Model 3 Secondary Drive Extender. The last unit receives power from the Model 3.

This is the end of the technical overview. You may:

- Continue with the *Distributed Processing Programming Executive (DPPX) Base General Information,* GC27-0400.
- Continue with the *Distributed Processing Control Executive (DPCX) General Information: Introduction,* GC27-9075.
- Continue with the *IBM 8100 Information System Configurator,* GA27-2876.

Glossary

This glossary includes definitions developed by the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO). This material is reproduced from the *American National Dictionary for Information Processing*, copyright 1977 by the Computer and Business Equipment Manufacturers Association, copies of which may be purchased from the American National Standards Institute, 1430 Broadway, New York, New York 10018.

A

ACV. Address control vector.

adapter. In 8100, hardware that is generally required to transfer data and commands between the processor and an I/O device.

address control vector (ACV). In 8100, the formatted information used to control dynamic address relocation (DAR) and the activation of dynamic address translation (DAT).

address limit. In 8100, the field of an address control vector (ACV) that designates the maximum logical address in a logical address space. It is used to check the validity of a logical address during dynamic address relocation (DAR).

adjunct register. In 8100, a 32-bit register used as storage for an address control vector (ACV); only the low-order 16 bit positions are available to the program.

adjunct register set. In 8100, a set of eight adjunct registers located consecutively in the adjunct register group.

application program. (1) A program written for or by a user that applies to a particular application. (2) In data communication, a program used to connect and communicate with terminals in a network, enabling users to perform application-oriented activities.

assembler. (ISO) A computer program used to assemble.

B

basic operator panel (BOP). In 8100, a display control panel that enables the user to input information, display system status, control powering and IPL, control panel access, and override normal IPL parameters.

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

BSC. Binary synchronous communication.

C

CCITT V.35 feature. In 8100, a feature that allows devices using the V.35 interface to be attached to the system.

channel control vector (CHCV). In 8100, the formatted information that specifies the controlling parameters, such as the channel I/O command, used during a channel I/O operation.

channel I/O (CHIO) operation. In 8100, the transfer of data between main storage and an I/O device. The operation consists of one or more channel I/O burst operations.

channel pointer (CHP). In 8100, the principal register, containing the logical address used during a channel I/O (CHIO) operation.

channel request. In 8100, a signal from an adapter indicating that the adapter is requesting permission to start a channel I/O (CHIO) operation.

channel request priority. In 8100, logic in the system control facility (SCF) that establishes the priority of I/O adapter channel requests according to one of three priority chains, and to the setting of four switches on the secondary control facility (SSCF) to which an adapter is attached.

CHIO. Channel I/O operation.

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

condition indicators. In 8100, the four bits in a program status vector (PSV) that reflect the result of a previous arithmetic, logical, or I/O operation.

D

DAR. Dynamic address relocation.

DAT. Dynamic address translation.

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

data link attached loop. In 8100, a data communication transmission loop used to attach I/O devices to the system by a data link facility rather than directly by cables. Contrast with *directly attached loop.*

Data-phone* Digital Service. A service leased from Bell Telephone to allow the use of their digital data service communications facility.

data set. (1) The major unit of data storage and retrieval in the operating system, consisting of a collection of data in one of several prescribed arrangements and described by control information to which the system has access. (2) (SC1) In data communication, a combination of data transmission signaling equipment and a telephone set in one functional unit. (3) In DPCX, a collection of related records in a prescribed arrangement and described by control information to which DPCX has access.

data transmission interface. (SC1) A shared boundary defined by common physical interconnection characteristics, signal characteristics, and functional characteristics of the interchange circuits.

digital data service adapter feature. In 8100, a feature that allows the system to be connected to a Data-phone digital service network.

direct access. (ISO) The facility to obtain data from a storage device, or to enter data into a storage device, in such a way that the process depends only on the location of that data and not on a reference to data previously accessed.

directly attached loop. In 8100, a loop that connects to the loop adapter by cables, rather than through a data link facility, and allows attachment of a variety of I/O devices. Contrast with *data link attached loop.*

disk storage. In 8100, a fixed-disk file that, through different combinations of head options, can have variable byte capacities.

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*Trademark of American Telephone & Telegraph Co.

diskette 1. A generic term for any diskette that is the media used to record single density information on one physical side. See *IBM Diskette 1.*

diskette 2. A generic term for any diskette that is the media used to record single density information on both physical sides. See *IBM Diskette 2.*

diskette 2D. A generic term for any diskette that is the media used to record double density information on both physical sides. See *IBM diskette 2D.*

diskette 2D drive. In 8100, a diskette drive that can read and write double density information on both sides of an IBM diskette 2D or equivalent, and single density information on one side of an IBM diskette 1 or equivalent.

diskette drive. In 8100, a generic term for *diskette 2 drive.*

dual program status vectors. In 8100, the association of two program status vectors (PSVs) with each priority level, used to facilitate the definition of both an application program and a supervisory program on a single priority level.

dynamic address relocation (DAR). In 8100, the mapping of logical storage addresses to relocated storage addresses.

dynamic address translation (DAT). In 8100, the mapping of relocated storage addresses to real storage addresses.

E

EIA/CCITT V.24 feature. In 8100, a feature that allows devices using the EIA/CCITT V.24 interface to be attached to the system.

expanded function operator panel. In 8100, a panel that permits the user to alter, display, and control various areas of the processor unit and storage.

F

floating-point register. In 8100, a 64-bit register used for floating-point operations.

floating-point register set. In 8100, a set of four floating-point registers located consecutively in the floating-point register group.

floating-point status vector (FSV). In 8100, the formatted information used to allocate floating-point registers, to control exception masking, to control precision, and to hold and indicate floating-point check and program-exception conditions related to floating-point operations.

FSV. Floating-point status vector.

G

general register. In 8100, a 32-bit register, in the primary or secondary register set, generally used for storage-address modification and generation, fixed-point (binary) arithmetic, and logical (boolean) operations.

H

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

I

IBM diskette 1. A flexible diskette that is the media used to record single density information on one physical side. Synonymous with *diskette 1.*

IBM diskette 2. A flexible diskette that is the media used to record single density information on both physical sides. Synonymous with *diskette 2.*

IBM diskette 2D. A flexible diskette that is the media used to record double density information on both physical sides. Synonymous with *diskette 2D.*

initial program load (IPL). (1) The initialization procedure that causes an operating system to commence operation. (2) The process by which a configuration image is loaded into storage at the beginning of a work day or after a system malfunction.

input/output (I/O). (1) (ISO) Pertaining to a device whose parts can be performing an input process and an output process at the same time. (2) Pertaining to either input or output, or both.

instruction address. In 8100, the logical address that is used to fetch an instruction.

interface. * A shared boundary. An interface might be a hardware component to link two devices or it might be a portion of storage or registers accessed by two or more computer programs.

interrupt request. In 8100, a request for processing on a particular priority level. It may be generated by the active program, the central processing unit, or an I/O device.

IO. INPUT/OUTPUT (byte) instruction.

I/O. Input/output.

I/O interrupt request vector (IOIRV). In 8100, the formatted information used to generate an interrupt request generated by an I/O device.

IOH. INPUT/OUTPUT (halfword) instruction.

IOI. INPUT/OUTPUT (byte, immediate) instruction.

IOIRV. I/O interrupt request vector.

IPL. Initial program load.

K

keylock feature. In 8100, a processor feature that prevents unauthorized system access by means of a three-position, key-operated switch.

L

line discipline. A set of rules for the orderly transfer of data from one location to another using communication facilities. In 8100, the line disciplines used are synchronous data link control (SDLC), binary synchronous communication (BSC), and start-stop (S/S).

lobe. In 8100 directly attached communication loops, one of two segments of the loop.

logical address. In 8100, the storage address that is either supplied to or by a program during the fetching and execution of an instruction, or is used in a channel pointer during a channel I/O (CHIO) operation. Contrast with *relocated address.*

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logical address space. In 8100, the set of logical addresses numbered sequentially from zero to one less than the address limit. See also *address limit.*

loop adapter. In 8100, circuitry that allows devices using a directly attached loop to communicate with the system.

loop station connector (LSC). In 8100, loop hardware used to attach an I/O unit or a controller to a loop.

loop wiring concentrator (LWC). In 8100, loop hardware that provides for the attachment of a cluster of I/O units to a loop without having a large number of drops on the loop cable.

LSC. Loop station connector.

LWC. Loop wiring concentrator.

M

main storage. (ISO) Program-addressable storage from which instructions and other data can be loaded directly into registers for subsequent execution or processing.

modem. (1) * (modulator-demodulator) A device that modulates and demodulates signals transmitted over data communication facilities. (2) In 8100, a modem is required at each end of a data link in an analog network. After data has been serialized by a control device, a modem converts (modulates) the binary signals to audio-frequency signals for transmission over communication lines and reconverts (demodulates) the signals at the other end.

multispeed clock feature. In 8100, a speed-variable feature that allows up to 16 communication lines to be directly connected to the 8100 system.

N

node. In 8100, a junction point in a network, represented by a physical unit.

P

port. (1) (SC1) A functional unit of a node through which data can enter or leave a data network. (2) In DPPX, the shared boundary between I/O layers.

principal register. In 8100, a 32-bit register used as a general register, as storage for half of a program status vector (PSV), or for storage of a channel pointer.

principal register group. In 8100, all principal registers available to the processor.

principal register set. In 8100, a set of eight principal registers located consecutively in the principal register group.

priority level. In 8100, a number ranging from 0 to 7, that designates a relative precedence among interrupt requests, such that processing on one level may be temporarily suspended when an interrupt request is generated for a level of higher priority (lower number).

program. (1) (ISO) A series of actions designed to achieve a certain result. (2) Loosely, a routine. (3) (ISO) To design, write and test computer programs. (4) Loosely, to write a routine.

program mode (PM). In 8100, the field in a program status vector (PSV) that controls which instructions may be executed by the associated program.

program status vector (PSV). In 8100, the formatted information used to control the order in which instructions are executed, to allocate general registers, and to hold and indicate the status of the central processing unit in relation to a particular program.

protocol. In SNA, the sequencing rules for requests and responses by which network addressable units in a communication network coordinate and control data transfer operations and other operations. Synonymous with *line discipline.*

PSV. Program status vector.

R

real address. In 8100, the address of a physical main storage location.

register. (ISO) A storage device, having a specified storage capacity such as a bit, a byte, or a computer word, and usually intended for a special purpose.

relocated address. In 8100, the address in the processor's address space that is derived during dynamic address relocation (DAR) by concatenating the high-order bits of the address base with the low-order bits of the logical address. Synonym for *real address* when dynamic address translation (DAT) is not active.

remote job entry (RJE). (ISO) Submission of a job through an input unit that has access to a computer through a data link.

RJE. Remote job entry.

S

SDLC. Synchronous data link control.

SDLC communications adapter. In 8100, the adapter that allows system connection to a variety of devices that use synchronous data link control (SDLC) facilities. It also provides for attachment of loop facilities through the loop adapter.

SNA. Systems network architecture.

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

start-stop transmission. (SC1) Asynchronous transmission such that a group of signals representing a character is preceded by a start element and is followed by a stop element.

storage. (1) (ISO) The action of placing data into a storage device. (2) (ISO) The retention of data in a storage device. (3) *A storage device.

subroutine. (1) *(ISO) A sequenced set of statements that may be used in one or more computer programs and at one or more points in a computer program. (2) *A routine that can be part of another routine.

subsystem support program. A generic name for any program that is part of the Subsystem Support Services. A subsystem support program is executed in the host system.

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

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system. *(ISO) In data processing, a collection of men, machines, and methods organized to accomplish a set of specific functions.

systems network architecture (SNA). The total description of the logical structure, formats, protocols, and operational sequences for transmitting information units through the communication system. Communication system functions are separated into three discrete areas: the application layer, the function management layer, and the transmission subsystem layer. The structure of SNA allows the ultimate origins and destinations of information–that is, the end users–to be independent of, and unaffected by, the specific communication-system services and facilities used for information exchange.

T

translation control bit. In 8100, the bit in an address control vector (ACV) used to activate dynamic address translation (DAT).

translation table. In 8100, the table that correlates relocated addresses with real addresses during dynamic address translation (DAT).

translation table entry. In 8100, an entry in the translation table that contains access control information and the block address associated with a 2048-byte block of physical main storage.

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An Introduction
to the IBM 8100
Information System

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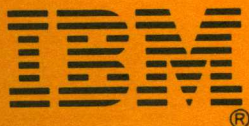

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