IBM

IBM Input/Output Device Summary

Systems

GA32-0039-2

IBM

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Device Summary**

Systems

Preface

This publication has general information about IBM input/output (I/O) equipment (devices and systems) that can operate locally with large S/370, 303x, and 308x processors. (See *IBM System/370 System Summary: Processors* for a listing of specific processors.) These devices and systems can be attached to a channel or to an integrated adapter on the processor.

The purpose of this publication is to summarize high-level information of IBM I/O devices and systems for easy reference and comparison. The primary audiences for this publication are customer executives, data processing managers, persons in the data processing education environment, and IBM marketing representatives who need a general overview of the various IBM I/O equipment.

Input/output devices and systems that can be locally attached to a specific IBM processor are listed in the input/output configurator for that processor. For example, see *IBM System/370 Input/Output Configurator*, for System/370 I/O configurations.

Input/output devices are announced, withdrawn, and specifications are changed by IBM on a regular basis. For the most current information on availability and specifications of input/output devices, see your IBM sales representative.

Major Divisions of This Publication

This publication is divided into 11 parts and two appendixes. Each part describes devices that are similar in the work performed or storage device used, as follows:

- "Part 1. Auxiliary Processors and Channel Communication Units" describes the characteristics of auxiliary processors and channel communication units.

- "Part 2. Direct Access Storage Devices" describes and summarizes the characteristics of the direct access devices that use the magnetic disk to store data.

- "Part 3. Diskette Input/Output Devices" describes the characteristics of diskette input/output units.

- "Part 4. Magnetic Tape Devices" describes and summarizes th characteristics of magnetic tape devices.

- "Part 5. Display Devices" describes the characteristics of the cathode-ray tube display stations.

- "Part 6. Magnetic Character Readers" describes and summarizes the characteristics of magnetic character readers.

- "Part 7. Optical Readers" describes and summarizes the characteristics of optical readers.

- "Part 8. Printers" describes and summarizes the characteristics of serial, line, and page printers. Printers that are a part of a system, for example the 3270 Information Display System, are described as part of the system.

- "Part 9. Punched Card Devices" describes and summarizes the characteristics of card readers, card punches, and card printers.

- "Part 10. Controllers" describes the characteristics of controllers used to attach devices to a processor.

- "Part 11. Systems" describes the characteristics of systems that can attach to host processor's in the same way as input/output devices.

- "Appendix A. I/O Attachment Data" is a chart showing how I/O devices and systems attach to a processor.

- "Appendix G. Glossary and Abbreviations" defines terms and abbreviations used in this publication.

Related Publications

The following publications are referred to in this publication:

- *IBM Data Communication Device Summary*, GA27-3185, describes the devices that use communication systems to communicate with a host system.

- *IBM Data Processing Glossary*, GC20-1699, contains definitions of terms used in the data processing field.

- *IBM System/370 System Summary: Processors*, GA22-7001, contains summaries of processors that can be attached to a System 370.

- *IBM System/370 Input/Output Configurator*, GA22-7002, contains information on devices and systems that can be locally attached to, and communicate over communication lines with, a System/370.

- *IBM Input/Output Equipment Manual—Physical Planning for System/360 and System/370*, GC22-7064, describes the physical characteristics of input/output devices that attach to System/360 and System/370 processors.

- *IBM System/370 Installation Manual—Physical Planning* GC22-7004, describes the physical environmental characteristics that should be considered when installing IBM processors and input/output devices.

- *Tape Requirements for IBM One-Half Inch Tape Drives at: 556, 800, 1600, and 6250 BPI*, GA32-0006, describes the tape requirements for IBM one-half inch magnetic tape devices.

Summary of Amendments

Major Technical Changes - Third Edition

Incorporation of Outstanding Technical Newsletters

All outstanding technical newsletters (TNLs) at the time of this edition have been incorporated into this manual. Technical newsletters included are:

- GN32-0141
- GN32-0165
- GN32-0166
- GN32-0194
- GN32-0210
- GN32-0211
- GN32-0212
- GN32-0255
- GN32-0280
- GN32-0293
- GN32-0299.

Update of Input/Output Equipment Data

As part of the updating procedure, equipment that is no longer available has been deleted and new equipment has been added. This has also been done for different models of the equipment.

Input/output devices that do not attach to, or are not used by the processors described in the publication: *IBM System/370 System Summary: Processors* have also been deleted. In addition, references to System/360 processors have also been deleted because these processors are no longer available from IBM.

Content Organization

This publication has been completely arranged and formatted for easy reference. Similar device types are now grouped by part and each device is highlighted within the part.

The page numbering has been changed from simple sequential page numbers to page numbers that include the book part, the device machine number, and the section page. For example, 4-3420-3. The number 4- shows that we are in Part 4 (the part reserved for magnetic tape devices); the number 3420 shows that we are in the section that describes the 3420 Magnetic Tape Subsystem; and the -3 shows that we are on the third page of the 3420 section.

Devices within each part are arranged numerically. For example, in Part 4, the devices are; 3410, 3420, 3430, and 3480.

Contents

Figures

Part 1. Auxiliary Processors, Channel Communication Units, and Switching Management Systems

Contents

Introduction

This part describes auxiliary processors that attach to a channel to expand the capabilities of the host processor and channel communication units that allow the interconnection of multiple systems.

1-3088. Multisystem Channel Communication Unit

The 3088 Multisystem Channel Communication Unit (MCCU) Models 1 and 2 (Figure 1-3088-1) are self-powered devices that interconnect multiple systems by their block multiplexer channels. They provide a connection between any two selected channels in a network so that messages or data can be exchanged.

Model 1 allows up to four channels (Figure 1-3088-2 on page 1-3088-2), and Model 2 allows up to eight channels (Figure 1-3088-3 on page 1-3088-3), to be interconnected.

IBM programs that run on a System/370 channel-to-channel adapter operating in either System/360 compatibility mode or System/370 extended mode will also run on the 3088 Model 1 or 2.
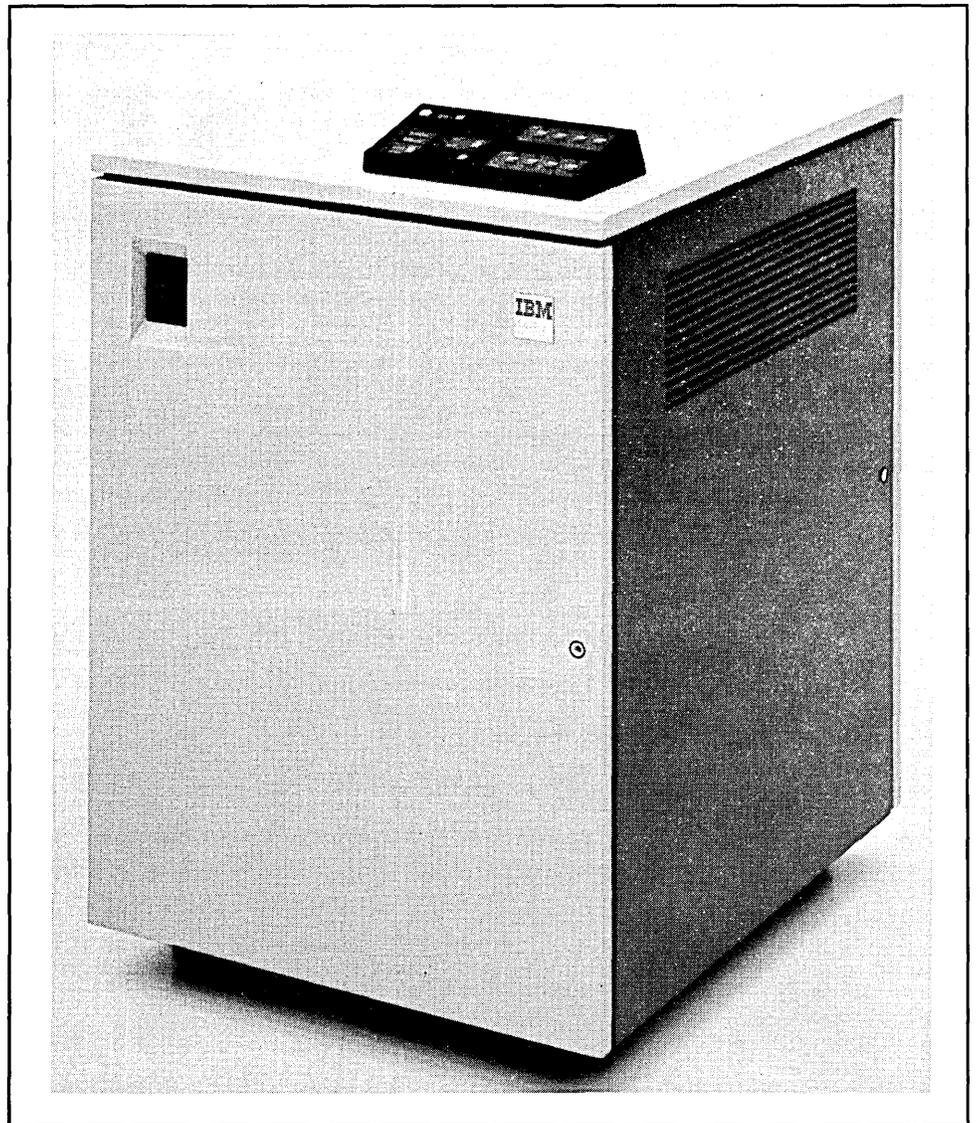
Figure 1-3088-1. 3088 Multisystem Channel Communication Unit (Design Model)

3088 Highlights

The highlights of the 3088 Multisystem Channel Communication Unit follow.

Processor Attachment

The 3088 requires a control unit position on a block multiplexer channel for each processor connected. The block multiplexer channels, which may be on the same or different systems, must be able to operate in high-speed-transfer mode and be capable of channel command retry.

Configurations

Depending on the number and types of I/O devices sharing it, each channel can be up to 122 meters (400 feet) from the 3088. Depending on the configuration, the 3088 can operate in high-speed-transfer mode at data rates of approximately 0.7 to 2.1 megabytes per second (The data rates are determined by delays in the channels, the cables, and the 3088.), or in data-streaming mode at data rates up to 3.0 megabytes per second. In certain 3031, 3032, and 3033 configurations where excessive data rates could cause overrun problems on high priority block multiplexer channels, the 3088 can be configured for a maximum data rate in high-speed-transfer mode of 1.2 megabytes per second. The 3088 Model 1 or 2 can be configured at installation to use either 32 or 64 unit addresses on each attached I/O interface. One of these addresses is reserved for diagnostic purposes while the rest are used to specify channel-to-channel paths. As a result, Model 1 supports up to 126, and Model 2 supports up to 252 channel-to-channel paths, which are distributed across the interfaces.
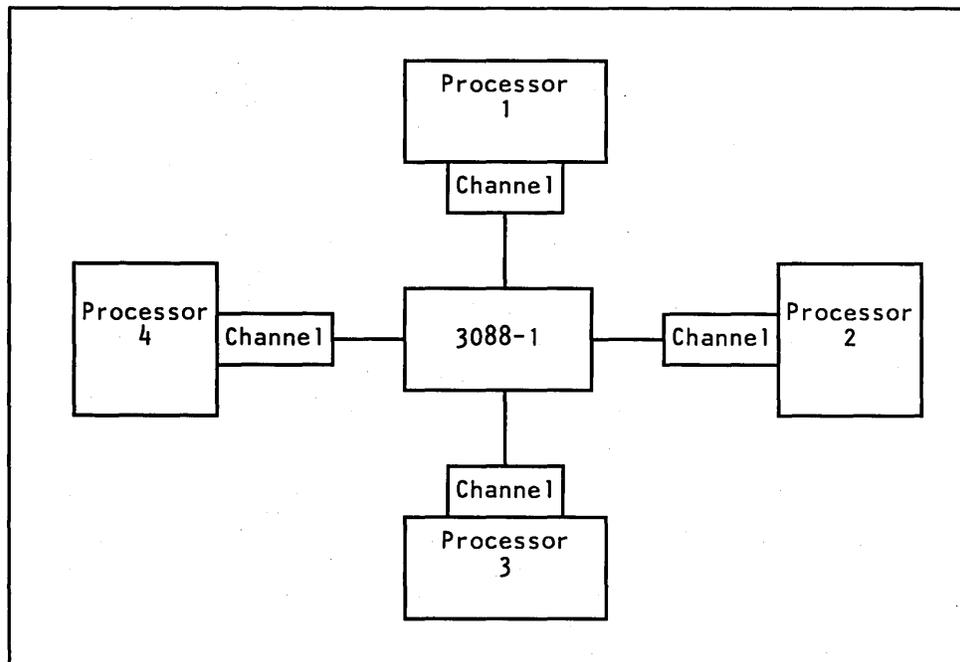
Figure 1-3088-2.   3088 Model 1 Configuration
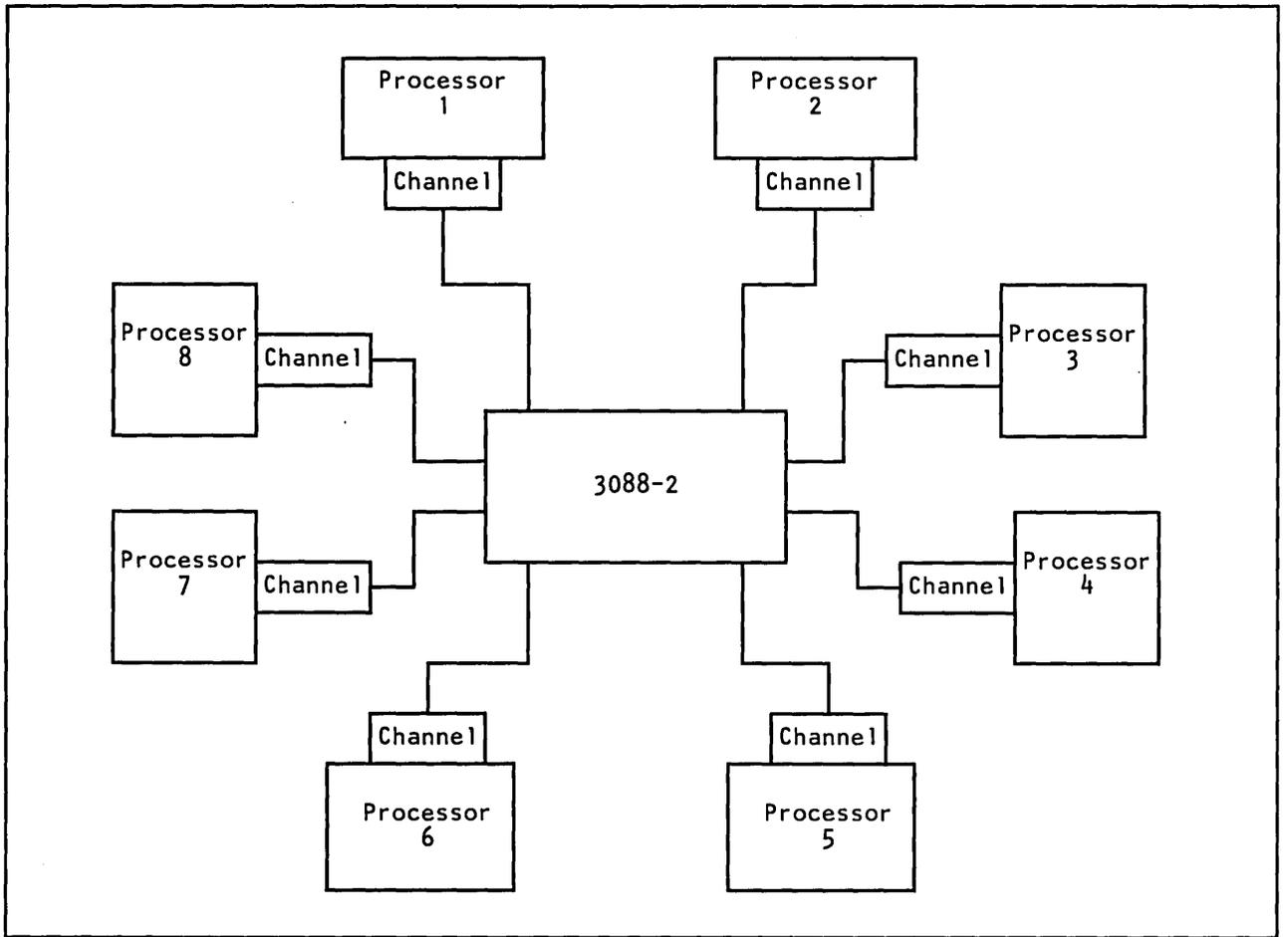
Figure   1-3088-3.   3088 Model 2 Configuration

1-3814. Switching Management System

The IBM 3814 Switching Management System Models A1-A4, B1-B4, and C1-C4 provide single-location control of switching between channels and switchable interfaces. Figure 1-3814-1 shows a 3814 Model A, with an IBM 3604 Keyboard Display Model 6, and a 3814 Model C. As many as 16 channels and eight switchable interfaces (with one or more I/O control units) or eight channels and 16 switchable interfaces may be switched.
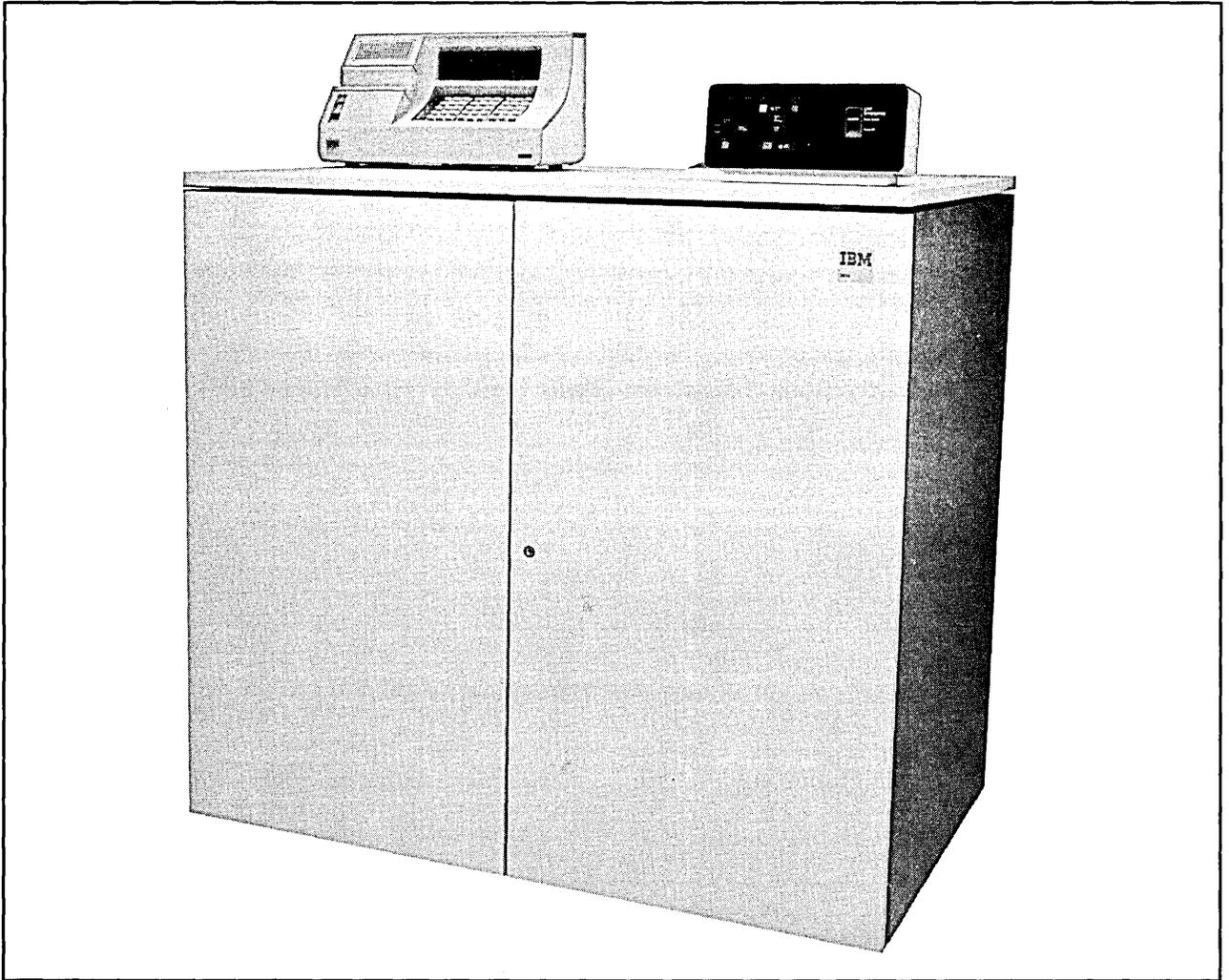
Figure 1-3814-1. 3814 Model A with 3604 Keyboard Display

The 3814 may also be equipped to:

- Control power sequencing of the switched control units

- Allow the multi-channel switches (for example, two-channel, four-channel) on control units to be operated remotely at the operator terminal

- Power the 3814 units on or off, under sequence control of the interconnected processors.

3814 Highlights

The highlights of the 3814 Switching Management System follow.

Unit Attachment

The units of the 3814 Switching Management System are attached to each other by signal loop cables that begin and end at the controller. If logically independent matrices are used, the 3814 models can be in as many as four locations up to 305 meters (1,000 feet) apart for a maximum of 128 nodes.

The controller (Models A1-A4) uses a locally attached IBM 3604 Keyboard Display Model 6, for operator control. A second 3604-6 may be remotely attached at any point in the loop. The 3604-6 has a function-selecting keyboard and a 240-character display.

The remote unit (Models B1-B4) is separately powered and can be located up to 305 meters (1,000 feet) from a 3814 Model A or B.

The expansion unit (Models C1-C4) is powered from and is physically attached to either a 3814 Model A directly or to a Model A through a Model B or Model C.

Switch Matrix

The first number of the switch expression specifies the number of channels and the second number specifies the number of switchable interfaces (with one or more I/O control units). Each model offers switch matrix sizes of 16 nodes (4 by 4) as indicated by the suffix 1, or 32 nodes (4 by 8, 8 by 4, or two 4 by 4 switch matrices) as indicated by the suffixes 2, 3, and 4, respectively. The intersections of the channel interfaces and switchable interfaces within the 3814 are called nodes. Combinations of nodes make up the switch matrix. Therefore, Model B3, for example, has an 8 by 4 switch matrix with 32 nodes.

Unit Power

The 3814 can be powered on either manually by the operator or automatically under the power sequence control of the interconnected processors. If the control unit power sequencing feature is installed and active, the control units can be powered on either manually by the operator or automatically by the 3814.

Configuration Switching

The operator can display the current switching configuration of the channels and the control units, modify the current configuration, or replace it with one of 78 stored switching configurations, or one of five stored two-channel switch configurations (up to 128 control units per 3814).

Security is controlled by passwords with up to three levels of authorization and three operator identification codes.

Special Features

A description of the 3814 special features follows.

Alternate Controller Attachment

The Alternate Controller Attachment feature can be installed on a 3814 Model A to allow attachment of a second 3814 Model A that also has the Alternate Controller Attachment and is within 150 feet of the first 3814 Model A. The second controller replaces the last Model B remote unit in a configuration. Either controller may be active while the other is in standby mode, as designated by the operator or as the result of an automatic backup control operation.

Display/Printer Attachment

The Display/Printer Attachment feature can be installed on each 3814 Model A. This feature allows one or two 3278-2 Display Stations and up to three 3287 Printers Model 1 or 2 to be attached for expanded switching management. Security is enhanced by a fourth level of authorization and, in addition, the use of up to 32 operator identification codes are allowed. The Display/Printer Attachment feature also allows 384 additional switching configurations and 320 additional two-channel switch configurations (up to 128 control units per 3814) to be stored. The 3278's can display switching configurations, and one 3278-2 or 3604-6 can be used to enter operator commands. The 3287-1's and 2's, which may be logically assigned as central, local, or remote printers, allow the printing of switching information such as current configurations, error messages, and activity history. In addition, installation names can be used to define logical configurations, logical channel/control unit interfaces, logical matrices, and control unit interfaces.

Expanded Storage

The Expanded Storage feature provides additional storage capacity in the 3814 Model A to allow the installation of either the Alternate Controller Attachment feature or the Display/Printer Attachment feature, or both.

Channel Expansion Internal

The Channel Expansion Internal feature, which can be installed only on a 3814 Model C, provides for the internal connection between a Model C and a 3814 Model A or B.

Channel Expansion External

The Channel Expansion External feature allows channels connected to a second 3814 to be connected through the second 3814 to control units that are attached to the first 3814. One or two of these features can be installed on a Model A, B, or C depending on the size of the matrix and the model selected.

Control Unit Power Sequencing

The Control Unit Power Sequencing feature provides power sequencing for up to four control units attached to the 3814. Up to four of these features can be installed on any model of the 3814.

Remote Two-Channel Switch Control

The Remote Two-Channel Switch Control feature allows remote control of multi-channel switch (for example, two-channel, four-channel) control units from the operator console of the 3814. One basic and three additional Remote Two-Channel Switch Control features can be installed on each 3814 Model A, B, or C.

System Power Sequencing-Additional

The System Power Sequencing-Additional feature allows a remote fifth, sixth, seventh, or eighth attached system to control the powering on of a 3814 Model A, B, or C.

1-3838. Array Processor

The 3838 Array Processor (Figure 1-3838-1) is a high-speed auxiliary processor that performs complex, repeated mathematical calculations in the analysis of periodically tested input data for petroleum industry applications.

The 3838 has the following bulk storage capacities:

• Model 1 has a capacity of 256K bytes.

• Model 2 has a capacity of 512K bytes.

• Model 3 has a capacity of 1,024K bytes.
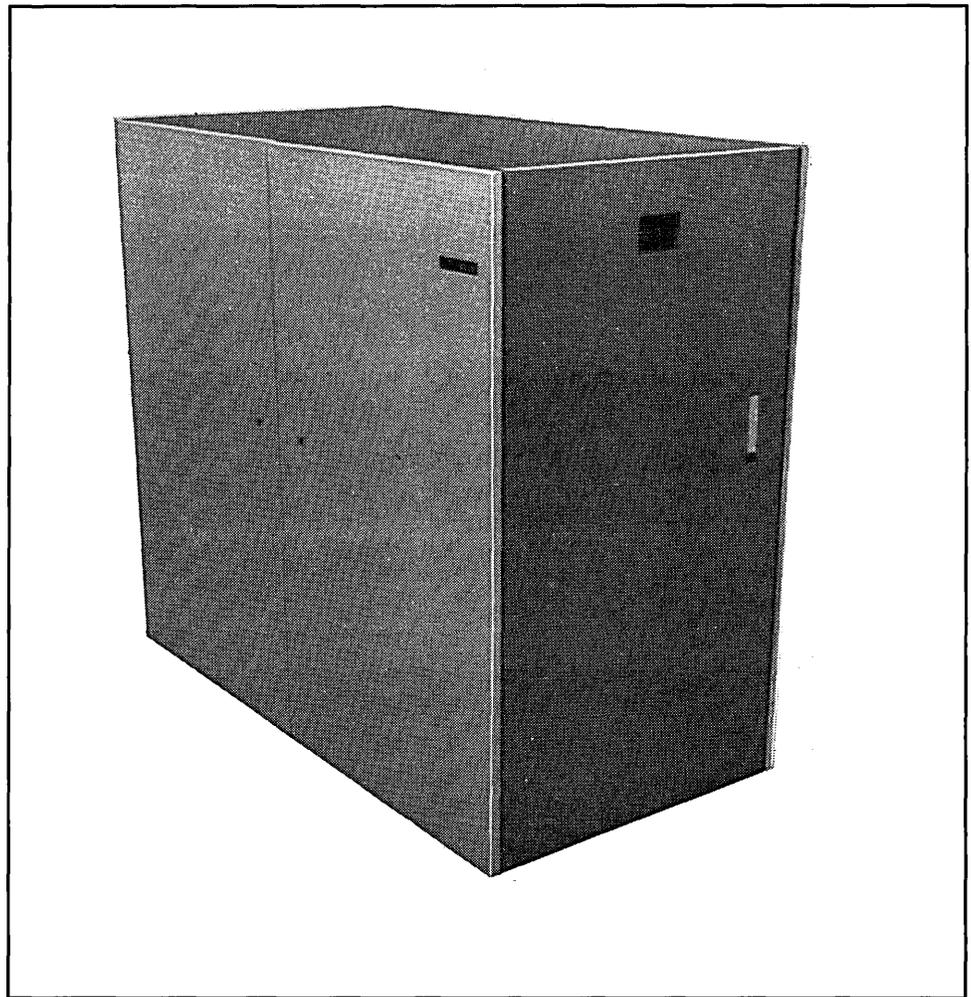
Figure 1-3838-1. 3838 Array Processor

3838 Highlights

The highlights of the 3838 Array Processor follow.

Processor Attachment

The 3838 can be attached to an IBM processor through a block multiplexer channel.

Operation

The calculations are user-specified tasks in the application program and are processed by the 3838 concurrent while other data is processed by the host processor. The 3838 generates either a single result or an array of results from its calculations. Input data elements can be 16-bit fixed-point halfwords, 32-bit floating-point words, or 64-bit floating-point doublewords. Among the calculations performed by the 3838 are: convolution, correlation, vector and scalar multiplication, vector addition, division, square root, format conversion, and branching and sequencing control.

Functional Units

The 3838 has the following functional units:

* Channel interface, supplies the link between the array processor and the processor through the block multiplexer channel.

* Control processor, receives commands from the processor over the channel interface, and schedules and controls the processing functions in the other elements of the 3838.

* Arithmetic processor, performs arithmetic operations. It includes: an arithmetic element control with writable control storage; arithmetic elements (2 four-stage adders, a four-stage multiplier, and a sine/cosine generator); and working storage (two 8,192-byte sections).

* Bulk storage, supplies storage for data buffers, coefficients, and program parameters. The interleaving operation of the storage modules in bulk storage reaches data rates of up to 40 megabytes per second.

* Data transfer controller, sends data and parameters between bulk storage and the other 3838 elements. The data transfer controller performs logical operations on data during a transfer between bulk storage and the working storage of the arithmetic processor.

3838 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Arithmetic Element Control Storage Additional

The Arithmetic Element Control Storage additional feature increases the control storage capacity by an additional 16,384 bytes for more algorithm capability.

Two Byte Interface

The Two Byte Interface feature allows the 3838 to operate with a block multiplexer channel at data transfer rates of up to 3 megabytes per second. The block multiplexer channel must also have the two-byte interface feature installed.

Data Streaming

The Data Streaming feature allows the 3838 to operate with a block multiplexer channel at data transfer rates of up to 3 megabytes per second. The block multiplexer channel must also have the data streaming function (standard, or feature) installed.

1-3848. Cryptographic Unit

The 3848 Cryptographic Unit Model 1 (Figure 1-3848-1) is an auxiliary unit that enciphers and deciphers data. It is designed to strengthen data processing installation and network security by supporting the encryption and decryption of stored data files as well as transmitted data. The major functions performed by the 3848 are internal control, data buffering (4,096-byte buffer), and encryption/decryption. It attaches to the virtual storage System/370 Models 145 through 168, and the 3031, 3032, and 3033 Processors.
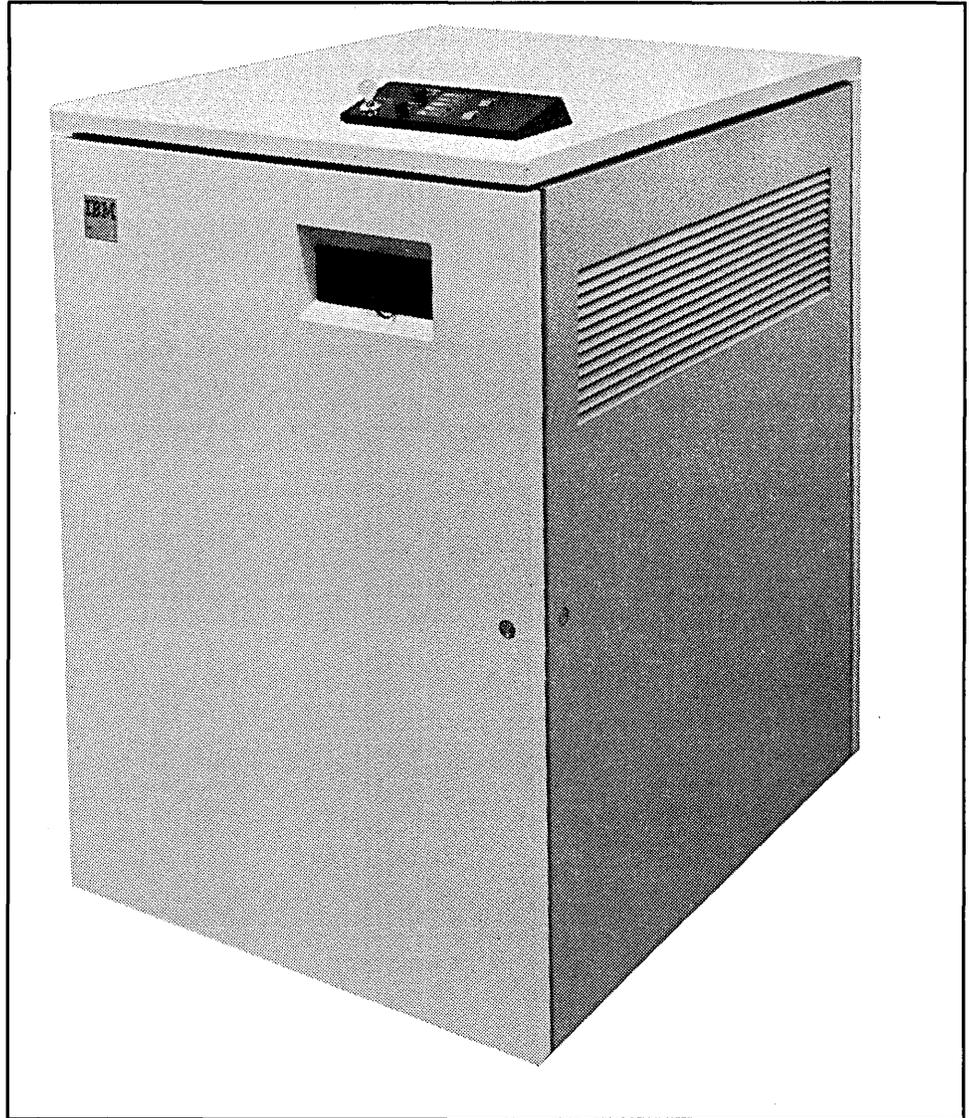
Figure 1-3848-1. 3848 Cryptographic Unit Model 1

3848 Highlights

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The highlights of the 3848 Cryptographic Unit follow.

Processor Attachment

The 3848 Cryptographic Unit requires a block multiplexer or selector channel for attachment to a processor.

Program Support

The 3848 enciphers and deciphers data under program control when operating with a System/370 selector or block multiplexer channel.

The 3848, which operates under the data encryption standard of the U.S. National Bureau of Standards, is controlled by the IBM Cryptographic Unit Support Program Product running under OS/VS1 or OS/VS2 (MVS).

Operation

The 3848 works as a system input/output device. Requests for the encryption or decryption of data may come from either an application program, or a subsystem such as the virtual telecommunications access method (VTAM) or the virtual storage access method (VSAM). VTAM operates with remote devices over communication lines, and VSAM operates with data storage devices. Data moves from processor storage through a channel to the 3848, where it is enciphered or deciphered, and returned to the processor. Enciphered or deciphered data then moves from the processor to its destination.

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Personalization/Key Entry Unit

The 3848 has a hand-held personalization key entry unit (P/KEU) and an operator control panel (Figure 1-3848-2 on page 1-3848-3). The P/KEU is an accessory that is available on a purchase-only basis. The P/KEU, when connected to the 3848, permits the operator to enter a unique, random-selected master key that supports the enciphering and deciphering of data. The key consists of two 8-byte blocks of data entered as hexadecimal characters. Character entry is aided by color-coded status indicator lights on the operator panel. Battery power protects the key from being erased if a power failure occurs.

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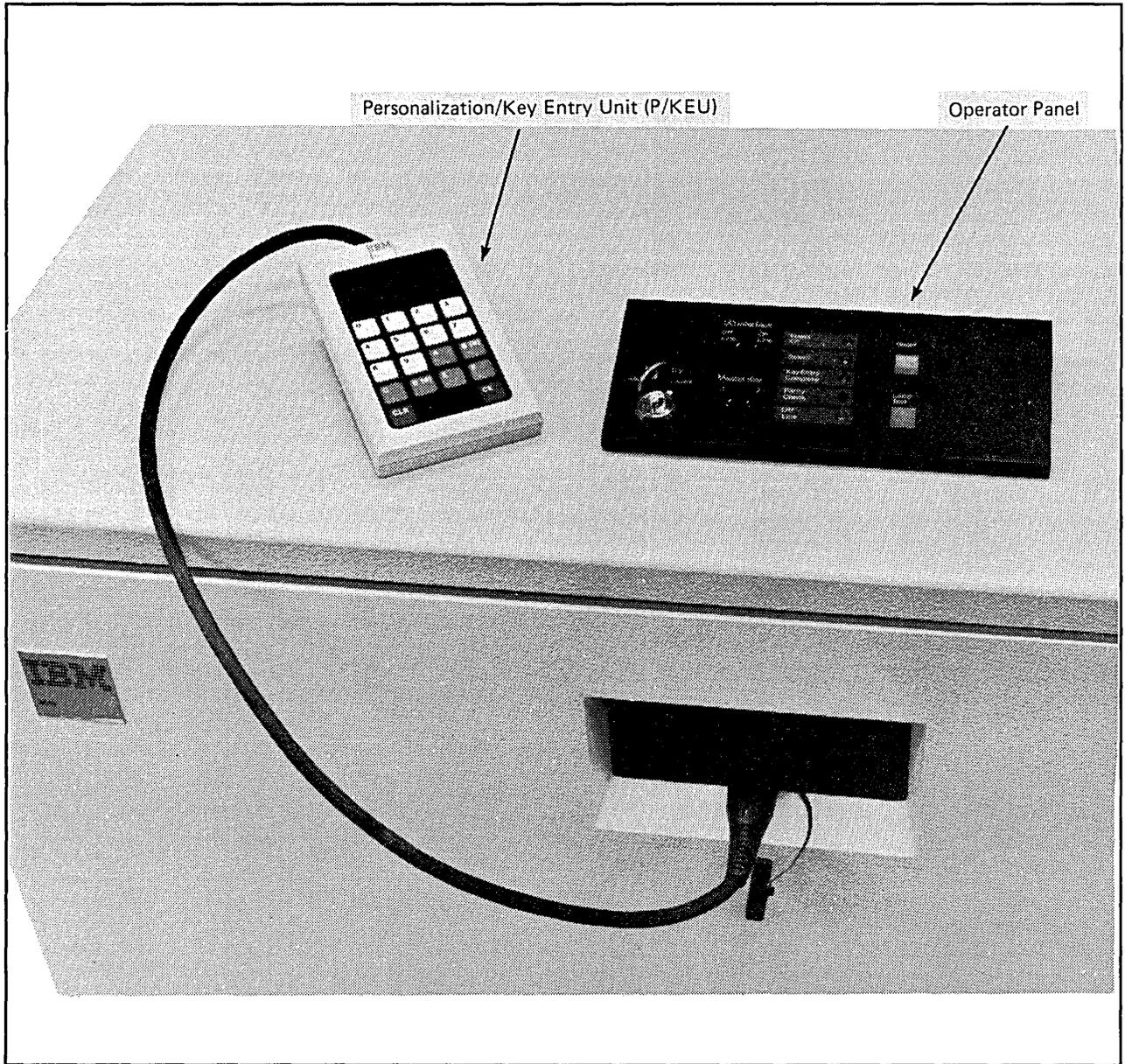
Figure 1-3848-2. 3848 Personalization/Key Entry Unit and Operator Panel

Part 2. Direct Access Storage Devices

Contents

Introduction

Direct access storage devices supply the storage capacity for large amounts of data and give direct access to physical records. They are used for storing programs, data bases, and other information needed for operating a system and implementing user applications.

Many direct access storage devices are available. All use magnetic disks to store data, but they vary in technical implementation. These technical variations result in differences in the time needed for locating and transferring data, and in storage capacities. The devices attach to different processors, using various attachment methods.

The following pages describe storage controls and disk storage devices.

DASD Data Comparison Tables

The individual device descriptions are preceded by Figure 2-1, Figure 2-2, Figure 2-3 and Figure 2-4, which compare the devices by features, characteristics, capacities, and performance. Features that are standard on most devices are summarized in Figure 2-2 on page 2-4 rather than in each individual device description.

CHARACTERISTICS	3880-1	3880-2	3880-3	3880-4	3880-11	3880-13
Commands Supported	Count, Key, Data	Count, Key, Data, Fixed Block	Count, Key, Data	Count, Key, Data	Count, Key, Data	Count, Key Data
Strings Attachable Standard	Eight; 4 on each Storage Director (SD)	Six; 4 on SD1, 2 on SD2 (3380s only)	Four; 2 for each Storage Director (SD)	Four on SD1	Five; 1 for paging SD, 4 for non-paging SDs	Two; Shared by both SDs
Attaches	*3333-1, 11 *3330-1,2,11 *3340 A2, A2F, B1,B2, B2F *3344 B2,B2F *3350 A2,A2F B2, B2F, C2 C2F	*3333-1, 11 *3330-1,2,11 *3340 A2, A2F, B1, B2 B2F *3344 B2, B2F *3350 A2, A2F, B2, B2F, C2, C2F *3375 A1, B1 *3380 (2 strings on one SD of a 3880-2)	*3380 A4, A4F, AA4, AAF, B4, B4F	*3350 A2, A2F, B2, B2F, C2, C2F *3333-1, 11 *3330-1, 11	*3380 AA4, B4	
Cache Storage	--	--	--	--	Accessed by SD 1 only	Accessed by both SDs

Figure 2-1.   Comparison of Storage Control Characteristics

FEATURES	NOTES	3330	3333	3340	3344	3350	3375	3380	3830	3880
Command Retry	1	Std	Std	-	-	Std	Std	Std	Std	Std
Rotation Position Sensing	2	Std	Std	Std	Std	Std	Std	Std	Std	Std
Multiple Request	3	Std	Std	Std	Std	Std	Std	Std	Std	Std
Record Overflow	4	Std	Std	Std	Std	Std	Std	-	-	Std
End of File	5	Std	Std	-	-	Std	Std	-	-	-
Multiple Track Operation	6	Std	Std	Std	Std	Std	Std	Std	Std	Std
Write Format Release	7	Std Mod 11	Std Mod 11	-	-	Std	-	Std	-	-
Primary Control Adapter	8	-	-	-	-	Spl	-	-	-	-
String Switch	9	-	Spl	Spl	-	Spl	Spl	-	-	-
Two Channel Switch	10	-	-	-	-	-	-	-	Spl	Spl (Pair)
Two Channel Switch Addition	10	-	-	-	-	-	-	-	Spl	Spl (Pair)
Remote Switch	11	-	-	-	-	-	-	-	Spl	Spl
Remote Switch Addition	11	-	-	-	-	-	-	-	Spl	Spl (Pair)
Fixed Head	12	-	-	Spl	Std (B2F only)	-	-	Spl	Std (A2F B2F,C2F)	
Eight Channel Switch	10	-	-	-	-	-	-	-	-	Spl
Remote Switch (Eight Channel)	11	-	-	-	-	-	-	-	-	Spl
Speed Matching Buffer	13	-	-	-	-	-	-	-	-	Spl

Figure 2-2. Comparison of Storage Controls and Disk Storage Features

* Standard (Std) features are part of the basic machine; special (Spl) features can be ordered. For possible limitations, consult your IBM sales representative.

Notes:

1. Command retry is a storage control and channel procedure that permits a command to be sent again without interrupting the program. It serves an important role as a means of correcting data data errors without involving system recovery procedures. It also is used to resend commands in other situations.

2. Rotational position sensing permits the channel to send a command to find a record, then disconnect while the disk rotates to the record's location. It is implemented in the storage control and is based on the division of the tracks into sectors that can be sensed during disk rotation.

3. Multiple requesting permits the storage control to execute multiple channel programs concurrently for its attached devices by queuing commands. Rotational position sensing at the disks and channel block multiplexing make multiple requests possible.

4. Record overflow permits a record to extend to another track to give a means of processing logical records that exceed the capacity of the track. It applies to count, key, and data records.

5. End of file permits defining the end of a logical record group. It applies to count, key, and data records.

6. Multiple track permits the storage control to select the next sequentially numbered head without sending Seek Head commands. It applies to count, key, and data records.

7. Write format release, or write padding, frees the subsystem and erases to the end of the track after a Write Format command. It applies to count, key, and data records.

8. Primary controller adapter permits the use of the alternate controller when switch selected from the second controller.

9. String switches permit disk storage units in a string to be accessed and shared by different storage controls on the same or different channels. String switch is not supported on Storage Director I on the 3880 Model 11.

10. Channel switches permit a storage control to be accessed and shared by different channels on the same/different processors. The Eight Channel Switch is not supported by 3880 Model 11 and is fully functional for the 3880 Model 13 only when it is connnected in a dual frame configuration.

11. Remote switches move the channel and string switch controls to a remote panel.

12. Fixed head feature eliminates track access time for some or all of the addressable locations.

13. Speed Matching Buffer feature allows 3375s to attach to channels with a data transfer rate of 1.5 to 1.859 megabytes. This feature is only supported by the 3880 Models 1 and 2.

CHARACTERISTICS	3330	3333	3340	3344	3350	3375	3380
Data Format	Count, Key, Data	Count, Key, Data	Count, Key, Data	Count, Key, Data	Count, Key, Data	Count, Key, Data	Count Key, Data
Storage	Removable Disk Pack	Removable Disk Pack	Removable Sealed Module	Fixed Sealed Asm	Fixed Sealed Asm	Fixed Sealed Asm	Fixed Sealed Asm
Fixed Heads	--	--	Some Tracks on 3348 Mod 70F Special Feature Required	Some Tracks on Model B2F	Some Tracks on Models A2F, B2F, C2F	--	--
Access Mechanism Per Drives	One	One	One	One	One	One	One
Drives Per Unit (by model)	1-Two 2-One 11-Two	1-Two 11-Two	A2-Two B1-One B2-Two	B1-One B2-Two	A2-Two A2F-Two B2-Two B2F-Two C2-Two C2F-Two	A1-One B1-One	A4-Two AA4-Two B4-Two
Units Per String (Maximum)	One 3333 + Three 3330s	One 3333 + Three 3330s	One 3340 Model A Three 3340 Model Bs or 3344 Model Bs	One 3340 Model A Three 3344 Model Bs	One 3350 Model A Three 3350 Model Bs or Two 3350 Model Bs and one Model C	One 3375 Model A Three 3375 Model Bs	One 3380 Model A Three 3380 Model Bs
Attaches To (Note)	3333 Models 1,11	3830 Model 2*; 3830 Model 3; 3880; ISC (145, 148, 158, 168); IFA (135; 138); DDA (125)	3830 Model 2*; 3880; ISC (145, 148, 158, 168); IFA (135, 138); DDA (115, 125)	3340 Model A2	3830 Model 2*; 3830 Model 3; 3880 ISC (145, 148, 158, 168)	3880 Models 1 and 2	3880 Models 2, 3, and 13

* Numbers within parentheses are models of System/370 processors.
NOTE: The number of strings that can be attached depends on the attachment method, the processor, and in some cases, special extension features.

Figure 2-3. Comparison of Disk Storage Characteristics

Disk Storage	Megabytes Per Access Mechanism	Megabytes Per Drive	Megabytes Per Unit	Megabytes Per String (Maximum Configuration)
3333/3330 3336-1 3336-11	100 200	100 200	200 400	800 1600
3340 3348-35 3348-70	35 70	35 70	70 140	280 560
3344	280	280	560	1820
3350	317	317	635	2540
3375	409.8	819.7	819.7	3270
3380	630	1260	2520	10080

Figure   2-4.   Comparison of Disk Storage Capacities

Disk Storage	Access Motion (Seek) Time, Average Milliseconds (See Note 1)	Rotational Delay Time, Average Milliseconds (See Note 2)	Data Rate, Kilobytes Per Second (See Note 3)
3333/3330	30	8.4	806
3340	25 *	10.1	885
3344	25 *	10.1	885
3350	25 *	8.4	1198
3375	19	10.1	1859
3380	16 *	8.3	3000

* Time with movable heads. Some models have fixed heads at some tracks.

Notes:

1. Access motion time, or seek time, is the time needed to position the access mechanism at the track (cylinder). If the mechanism is already at the correct track, or if fixed heads are used, there is no access motion.

2. Rotational delay time is the average time needed for the specified record to move to the read/write head so that the data transfer can begin.

3. Data rate is the speed at which bytes are transferred.

Figure   2-5.   Comparison of Disk Storage Performance

2-3330. Disk Storage and 3333 Disk Storage and Control

The 3330 Disk Storage provides large capacity, fast access, high data rate storage. The 3333 has, in addition, control functions for the attachment of 3330 Disk Storage modules.

The 3333 and 3330 Disk Storage (Figure 2-3330-1 on page 2-3330-2) can be used in a variety of configurations.

The 3333 has two models, 1 and 11, and the 3330 has three models, 1, 2, and 11:

- 3333 Model 1 is a string controller and contains two drives. It provides the logic and power for attaching up to three 3330 units. It uses IBM 3336 Disk Packs Model 1.

- 3333 Model 11 is a string controller and contains two drives. It provides the logic and power for attaching up to three 3330 units. It uses IBM 3336 Disk Packs Model 11.

- 3330 Model 1 contains two drives and can attach to a 3333 Model 1 or 11. It uses IBM 3336 Disk Packs Model 1.

- 3330 Model 2 contains one drive and can attach to a 3333 Model 1 or 11. It uses IBM 3336 Disk Packs Model 1.

- 3330 Model 11 contains two drives and can attach to a 3333 Model 1 or 11. It uses IBM 3336 Disk Packs Model 11.

All models of the 3333 and 3330 have an average seek time of 30 milliseconds, an average rotational delay of 8.4 milliseconds, and a data rate of 806,000 bytes per second.

3330 and 3333 Highlights

The highlights of the 3330 and 3333 Disk Storage follow.

Attachment of the 3330 and 3333

The 3333 can attach to the following IBM storage controls:

- 3830 Storage Control Model 2

- 3880 Storage Control Model 1, 2, or 11

- Integrated File Adapter (IFA)

- Integrated Storage Control (ISC)

- Direct Disk Attachment (DDA).
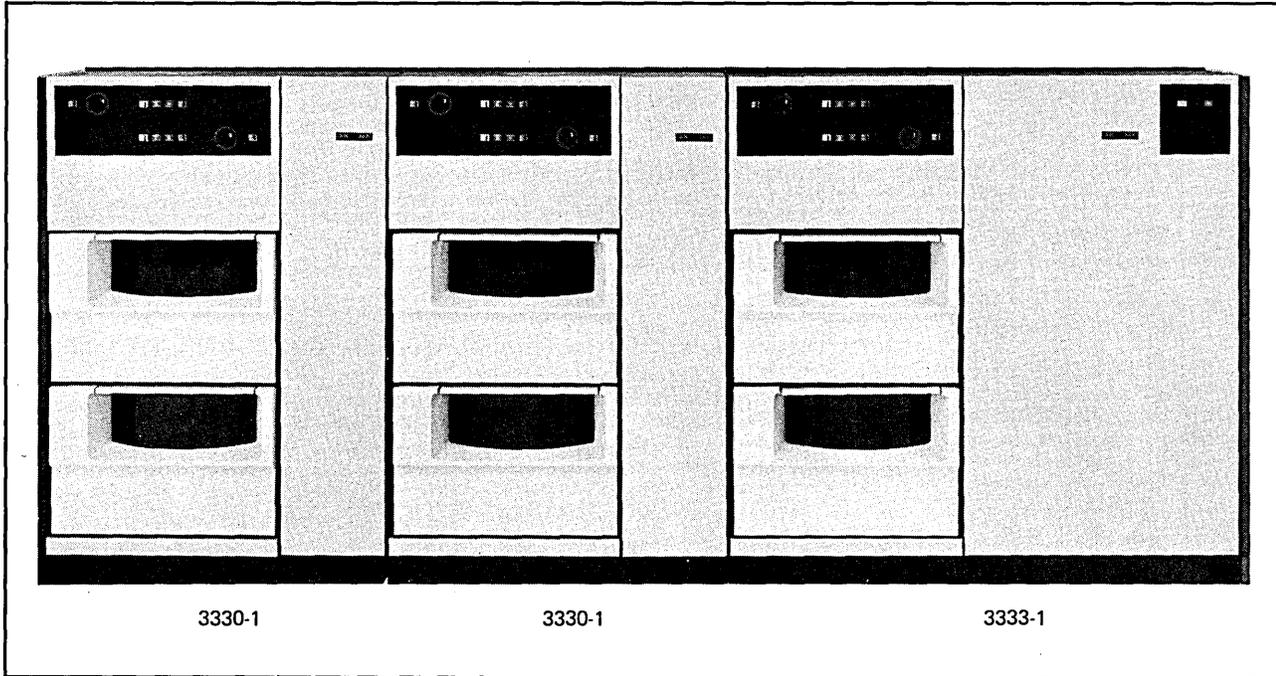
Figure 2-3330-1. 3330 Disk Storage and 3333 Disk Storage

3336 Disk Pack

The 3336 Disk Packs can be removed from the drives by the customer. The disk packs are mounted in drawers that open and close automatically. The disk packs are available in two models, 1 and 11. The 3336 Model 1 has a storage capacity of 100 megabytes. The 3336 Model 1 is interchangeable on the 3330 Models 1 and 2 and 3333 Model 1 drives. The 3336 Model 11 has a storage capacity of 200 megabytes. The 3336 Model 11 is interchangeable on the 3333/3330 Model 11's. It can not be used on 3330 Models 1 and 2 or the 3333 Model 1.

Data Format

The 3333/3330s use count, key, and data formatted records and the channel commands that support them. The user determines the length and arrangement of the records on the tracks.

3330/3333 Special Features

The following features can be ordered from an IBM sales representative.

String Switch

The String Switch feature permits the 3333 and its connected 3330 disk storage to be shared by two storage controls (or storage directors) on the same or different processors. The 3333/3330 string is made available to a channel by Enable/Disable switches on the operator panel or through commands.

Remote Switch Attachment

The Remote Switch Attachment feature moves the Enable/Disable switches of the String Switch feature from the 3333 operator panel to a configuration control panel.

2-3340. and 3344 Direct Access Storage

The 3340 provides multiple capacity, high-speed, direct access storage. The 3344 provides dual drive, large capacity storage via a 3340.

The 3340 Direct Access Storage Facility (Figure 2-3340-1) has two different storage capacities. The 3344 Direct Access Storage (Figure 2-3340-2 on page 2-3340-2) has four times the capacity of the largest 3340. Both the 3340 and 3344 are available with fixed heads on some tracks for faster access to high-priority data.

The 3340 is available in three models, A2, B1, and B2. They are described below.

* Model A2 is the string controller and contains two disk storage drives. It provides the logic and power for attaching up to three 3340 and 3344 Model B units, which can be intermixed in a string. The total number of drives that can be included in a string depends on the method of attaching the Model A2 to the processor. In all configurations, however, a string may include a maximum of eight drives.

* Model B1 contains one disk storage drive.

* Model B2 contains two disk storage drives.
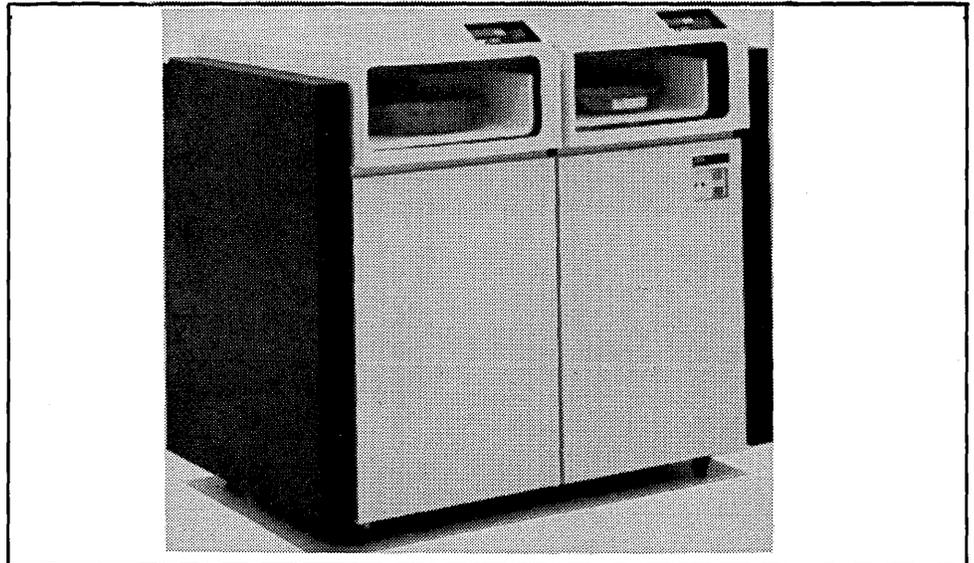
Figure 2-3340-1.   3340 Direct Access Storage Facility

The 3344 (Figure 2-3340-2 on page 2-3340-2) has two models, B2 and B2F. Both models contain two disk storage drives. Each drive has a fixed, sealed assembly of disks, a spindle, and an access mechanism with read/write heads. Model B2 has a storage capacity of 279,558,144 bytes and an average seek time of 25 milliseconds. Model B2F provides a storage capacity of 279,558,144 bytes with 1,004,160 bytes accessible by fixed heads with zero seek time. The 3344 attaches in a string to a 3340 Model A2. There are some prerequisites and limitations on the attachment of 3344s.
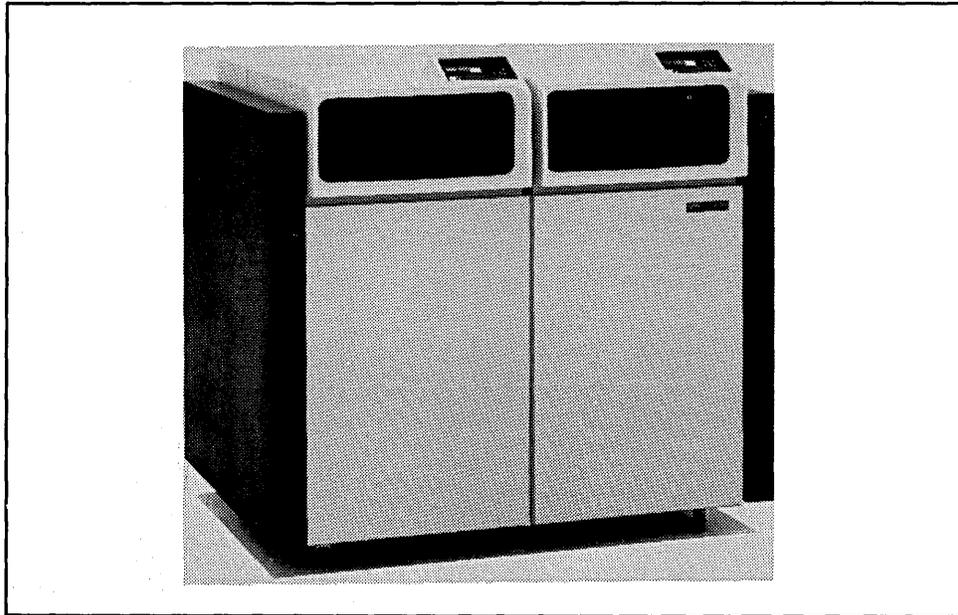
Figure 2-3340-2.   3344 Direct Access Storage

All models of the 3340/3344 have an average rotational delay time of 10.1 milliseconds and a data rate of 885,000 bytes per second.

3340 and 3344 Highlights

The highlights of the 3340 and 3344 Direct Access Storage follow.

Attachment of the 3340 and 3344

The 3340 Model A2 attaches to the following IBM storage controls:

*   3830 Storage Control Model 2

*   3880 Storage Control Model 1 or 2

*   Integrated File Adapter (IFA)

*   Integrated Storage Control (ISC)

*   Direct Disk Attachment (DDA)

*   Direct Access Storage Device (DASD) Adapter.

3348 Data Modules

The 3340 uses IBM 3348 Data Modules (Figure 2-3340-3). The 3348 is a sealed assembly that contains the disks, spindle, and access arms with read/write heads. The 3348 can be removed by the customer and is available in three models, 35, 70, and 70F. The Model 35 offers 34,944,768-byte capacity and the Model 70 offers 69,889,536-byte capacity. With both models, the average seek time is 25 milliseconds. The Model 70F has the same total capacity as the Model 70 but with 502,080 bytes of storage accessible by fixed heads with zero seek time. Models 35 and 70 are interchangeable on all drives, however, the Model 70F requires the Fixed Head feature on the 3340.
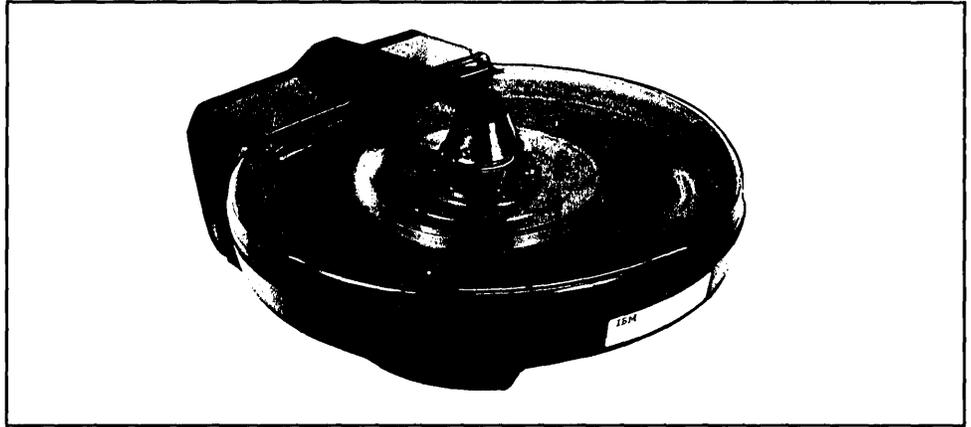
Figure 2-3340-3. 3348 Data Module

Data Format

The 3340 and 3344 use count, key, and data formatted records and the channel commands that support them. The user determines the length and arrangement of the records on the tracks.

3340 and 3344 Special Features

The following features can be ordered from an IBM sales representative.

Fixed Head

The 3340 Fixed Head optional feature permits Models A2, B1, and B2 to operate the 3348 Model 70F Data Modules. The 3344 Model B2F has standard fixed heads.

Rotational Position Sensing

The Rotational Position Sensing feature is optional on the 3340 and standard on the 3344. This feature permits the channel to disconnect during most of rotational delay time.

String Switch

The String Switch feature permits the 3340 Model A2 and its connected 3340 and 3344 disk storage to be shared by two storage controls on the same or different processors. The 3340 is made available to a channel by Enable/Disable switches on the operator panel or through commands.

Remote Switch Attachment

The Remote Switch Attachment feature moves the Enable/Disable switches of the String Switch feature from the 3340 operator panel to a configuration control panel.

2-3350. Direct Access Storage

The 3350 Direct Access Storage (Figure 2-3350-1) is a high-speed, large-capacity, disk storage device. The 3350 can attach to any virtual storage System/370 Processor (except Models 115 and 125); 4331 Model Group 2; 4341 Model Group 1 or 2; or 303X, 3042, and 3081 processors.

The 3350 has six models: A2, A2F, B2, B2F, C2, and C2F.

All models contain two drives with fixed, sealed assemblies of disks, spindles, and access mechanisms with read/write heads. Each drive has a storage capacity of 317.5 megabytes.
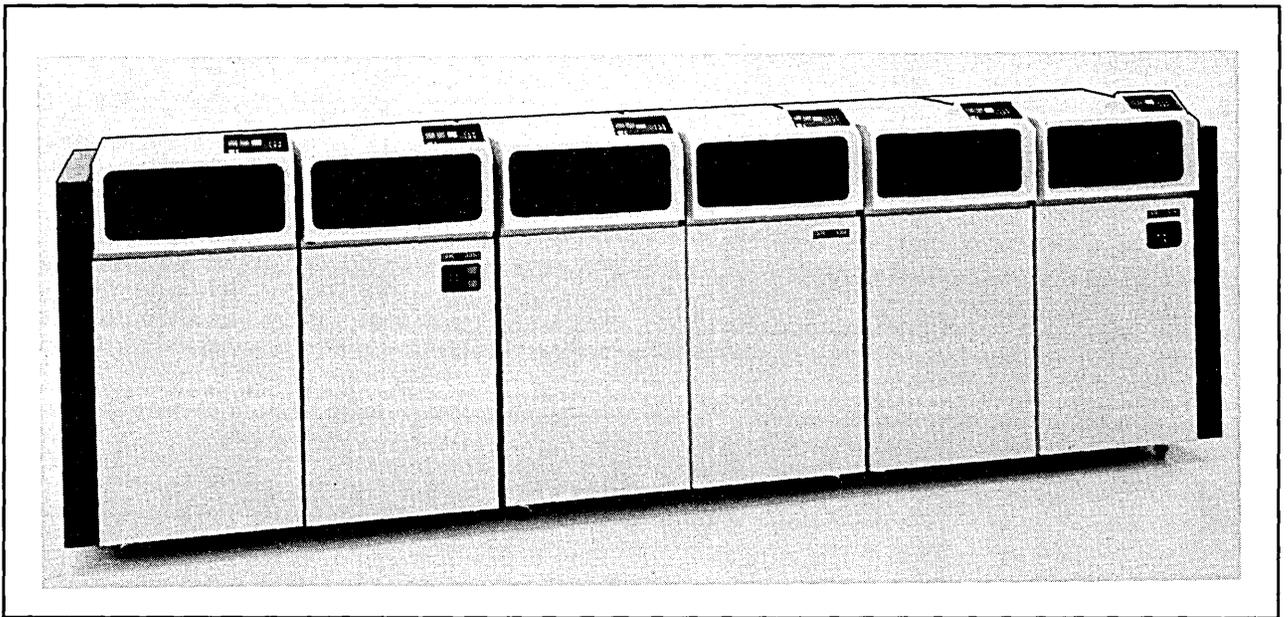
Figure 2-3350-1. 3350 Direct Access Storage

The characteristics of the six models are:

- Model A2 is a string controller and contains two disk storage drives. It provides power and logic to attach up to three units of Models B2 and B2F. One unit of Model C2 or C2F can be used in place of a Model B2 or B2F.

- Model A2F is the same as Model A2 except it has fixed heads on each drive for access to 1,144,140 bytes of the 317.5-megabyte storage.

- Model B2 contains two drives and attaches to a Model A2 or A2F.

- Model B2F is the same as the Model B2 except it has fixed heads on each drive for access to 1,144,140 bytes of the 317.5-megabyte storage.

- Model C2 contains two drives and supplies alternate controller functions in a 3350 string. It functions as a Model A or Model B depending on a manual switch setting. If a Model C2 is included in a string, a Primary Controller Adapter feature is needed on the Model A2 to which the Model C2 attaches.

- Model C2F is the same as Model C2 except it has fixed heads on each drive for access to 1,144,140 bytes of the 317.5-megabyte storage.

The average seek time with movable heads is 25 milliseconds, the average rotational delay is 8.4 milliseconds, and the data rate is 1,198,000 bytes per second.

3350 Highlights

The highlights of the 3350 Direct Access Storage follow.

Attachment of the 3350

The 3350 Model A2 attaches to the following IBM storage controls:

- 3830 Model 2

- 3880 Models 1, 2, and 11 (3350 Real Mode Only)

- Integrated Storage Control (ISC).

3350 Controller

The 3350 Direct Access Storage can include two controllers in a string of units. Besides the primary controller unit, an alternate controller unit, Model C2 or C2F, can be added. A manual switch on the C2 or C2F unit selects the controller that controls online operations. If the active controller needs service, the other controller can continue operations. When control is switched, however, status information is not preserved.

Modes of Operation

The 3350 operates in different modes. It functions in a real (3350) mode or in modes that are compatible with the IBM 3330 Disk Storage Models 1 and 11. The mode of operation, real (3350) or 3330-compatible, can be specified for each drive during manufacturing and can be changed in the field by a customer engineer. When the 3350 operates in compatibility mode, the storage capacity is 200 megabytes per drive. On Models A2F, B2F, and C2F the fixed heads have access to 742,710 bytes of data. The 3350 cannot operate in compatibility mode when attached to a 3880.

Data Format

The 3350 uses count, key, and data formatted records and the channel commands that support them. The user determines the length and arrangement of the records on the tracks.

3350 Special Features

The following features can be ordered from an IBM sales representative.

Primary Controller Adapter

The Primary Controller Adapter feature permits use of the alternate controller when it is selected through a switch on the alternate controller.

String Switch

The String Switch feature permits a 3350 Model A2 or A2F and C2 or C2F and connected disk storage to be shared by two storage controls. The 3350 is made available to a channel by Enable/Disable switches on the operator panel or through commands. The String Switch feature is not supported on Storage Director 1 of 3880 Model 11.

Remote Switch Attachment

The Remote Switch Attachment feature moves the Enable/Disable switches of the String Switch feature from the 3350 operator panel to a configuration control panel of a System/370 Model 158MP or 168MP.

2-3375. Direct Access Storage

The 3375 Direct Access Storage (Figure 2-3375-1) is a high-speed disk storage that provides intermediate direct access storage capacity for medium and large systems.

There are three models of the 3375; A1, B1, and D1:

* Model A1 contains the string controller and one head and disk assembly.

* Model B1 contains one head and disk assembly. Each head and disk assembly has two separately addressable actuators (access mechanisms). Each actuator services half the disks in the head and disk assembly. Seeking with either actuator can be overlapped with seeking, reading, or writing by the other actuator.

* Model D1 contains a string controller and one head and disk assembly. In addition, the Model D1 contains a dual controller function with a second path to each head and disk assembly. This second path may be attached to the same or to a different system.
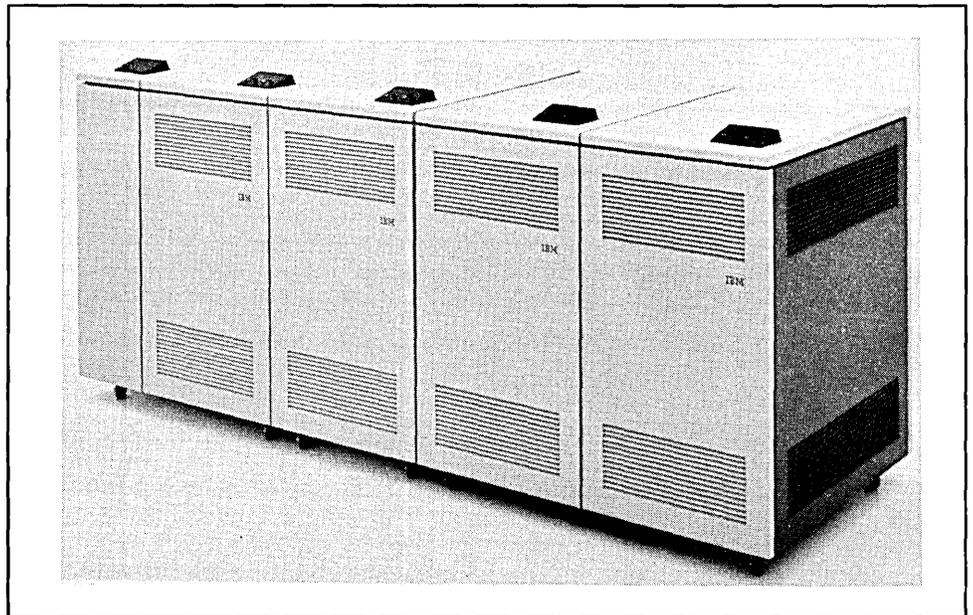
Figure 2-3375-1. 3375 Direct Access Storage

3375 Highlights

The highlights of the 3375 Direct Access Storage are as follows:

- Storage capacity is 819.7 megabytes per unit, or 3,270 megabytes per string of four.

- Data rate is 1.859 megabytes per second.

- Average access time is 19 milliseconds.

- Average rotational delay is 10.1 milliseconds.

- Rotational Position Sensing allows the channel and storage director to disconnect during rotational latency (delay).

Attachment of the 3375

The 3375 attaches to the following IBM processors through an IBM 3880 Storage Control Models 1, 2, or 4 and a block multiplexer channel:

- S/370 models 145, 145-3, 148, 155II, 158, 158-3, 165II, 168, and 168-3

- 3031, 3032, and 3033

- 3081, 3083, and 3084

- 3042 Attached Processor Model 2.

The 3375 attaches to the 3880 in strings consisting of one Model A and three Model Bs or one Model D1, one Model A1, and two Model Bs. A string with three Model Bs provides eight separately addressable actuators. Up to four strings of 3375s can attach to each storage director in a 3880-1 or to one storage director in a 3880-2.

Data Format

The 3375 uses count, key, and data formatted records and the channel commands that support them. The user determines the length and arrangement of the records on the track.

3375 Special Features

One special feature, String Switch, is available with the 3375; it can be ordered from your local IBM marketing representative.

String Switch

The String Switch feature allows a 3375 Model A1 and its attached Model B1s to be dynamically shared by two storage directors. The string can be dedicated to either storage director through use of a manually controlled switch on the Model A1 operator panel or switching can be accomplished under program control.

Speed Matching Buffer

The Speed Matching Buffer feature allows the 3375 to attach to block multiplexer channels that operate at data transfer rates as low as 1.5 MB/sec. This feature can be installed in one storage director of a 3880 Model 2 and both storage directors of a 3880 Model 1. The Speed Matching Buffer feature is required for attaching 3375s to most System/370 processors and to block multiplexer channels without the data streaming feature.

2-3380. Direct Access Storage

The 3380 Direct Access Storage (Figure 2-3380-1) is a high-speed, large capacity, disk storage device with an average seek time of 16 milliseconds and a data transfer rate of 3 megabytes per second.

Three models are available, A4, AA4, and B4. Two Model A units attach to a storage director in an IBM 3880 Storage Control, and one Model B unit attaches to the Model A units to form a string of disk storage.

All three models of the 3380 Direct Access Storage (A4, AA4, and B4) contain two disk storage drives. Each disk storage drive has two separately addressable actuators mounted in a sealed enclosure that contains the disks and read/write heads. The enclosure is removable by service personnel.

- Model A4 contains two disk storage drives and a controller that provides the control functions to attach to one 3880 storage director.

- Model AA4 contains two disk storage drives and through the addition of a second controller, the control functions to attach to two 3880 storage directors. The storage directors can be in the same 3880 Model 3 or 13, or in different 3880 Models 2 or 3. The 3880 Model 13 can only attach Models AA4 and B4. This model also provides the logic required for dynamic path selection.

- Model B4 contains two disk storage drives and can be attached to any Model A.
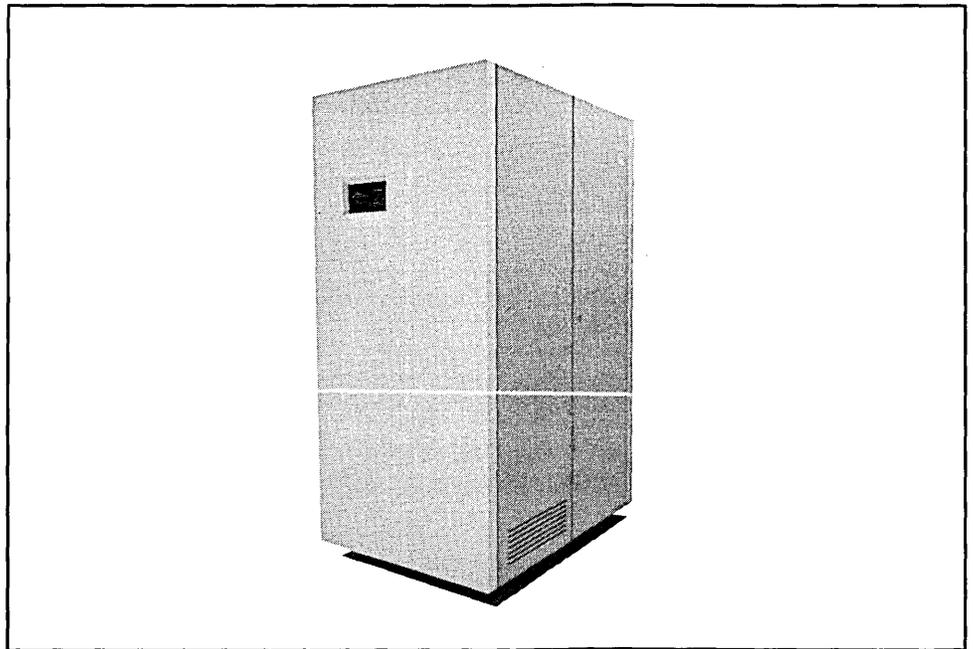
Figure 2-3380-1. 3380 Direct Access Storage

3380 Highlights

The highlights of the 3380 Direct Access Storage follow.

- Four separately addressable actuators operate independently in each model with each actuator accessing 630 megabytes of storage.

- Storage capacity is 2.52 gigabytes of online storage per unit, or 10.08 gigabytes per string of four. (A gigabyte is 1,000 megabytes.)

- Dynamic Path Selection, a function of the Model AA4 allows simultaneous data transfer operations and provides a dual access path to all actuators in a string.

- Rotational Position Sensing allows the channel and storage director to disconnect during rotational latency.

- Format Write Release allows the channel and storage director to disconnect while the remainder of a track is being erased following a format write record.

Attachment of the 3380

The 3380 attaches to the following IBM processors through an IBM 3880 Storage Control Model 2, 3, or 13 and a block multiplexer channel: (The 3880 Model 13 can only attach the 3380 Models AA4 and B4.)

- 3031, 3032, and 3033

- 3081, 3083, and 3084

- 3042 Attached Processor Model 2

- 4341 Model Groups 1 and 2, and 4381

- System/370 Models 158 and 168.

The Data Streaming feature is required on the 3031, 3032, 3033, or 3042 Model 2 to operate at the 3-megabyte-per-second data rate of the 3880. If the processors do not have the Data Streaming feature, the Speed Matching buffer feature is required in the 3880 Models 2 and 3. If the 3380 is attached to a 3880 Model 13, the processor must have a 3-megabyte-per-second channel. The Speed Matching Buffer feature is also required to attach the 3880 to System/370 Models 158 and 168. 3081, 3083, 3084, and 4381 attachment is always through a 3.0 MB/sec data streaming channel.

The 3380 attaches to the 3880 in strings of one Model A and up to three Model Bs. A string with three Model Bs provides 16 separately addressable actuators.

Two strings can be attached to one storage director in a 3880 Model 2 or 13 or to each storage director in a 3880 Model 3. A Model AA4 can attach to two storage directors. The storage directors can be in the same 3880 Model 3 or 13, or in different 3880 Models 2 or 3.

Dynamic Path Selection

A 3380 Model AA4 has two controllers that attach to two 3880 storage directors, providing two paths to 3380 drives. The 3380 models with two controllers contain logic for a collection of functions called dynamic path selection. Implementation of the functions requires operating system support. The dynamic path selections include:

- Simultaneous data transfer over two paths

- Automatic use of the other path in the event one of the controllers is unavailable

- Extension of device reservation to a group of paths having a common system identifier

- Reconnection to the first available path in a group of paths having a common system identifier, when operating with System/370 extended architecture.

Data Format

The 3380 uses count, key, and data formatted records and the channel commands that support them. The user determines the length and arrangement of the records on the track.

2-3830. Storage Control

The 3830 Storage Control (Figure 2-3830-1 on page 2-3830-2) supports disk storage types that include a string controller; therefore, different disk storage types can be supported and intermixed on the same control unit. For example, 3333/3330 Disk Storage and 3350 Disk Storage both can attach to a 3830 Model 2, and both can attach to the same 3830 Model 2. The 3830 supplies the control between the channel and the string controller. It contains its own power but it does not contain power for the attached disk storage.

The 3830 Model 2 supports the following types of disk storage:

- 3333 Disk Storage Models 1 and 11, (with controller) and attached 3330 Disk Storage Models 1, 2, and 11.

- 3340 Disk Storage Model A2, and attached 3340 Models B1 and B2. The larger capacity 3344 Models B2 and B2F can take the place of some of the 3340 Model B2.

- 3350 Direct Access Storage Model A2 or A2F (with controller), or Model C2 or C2F (with alternate controller) and attached 3350 Models B2 and B2F.

- Combinations of the following: 3333; 3340 Model A2; and 3350 Model A2 or A2F. These string controllers and attached disk storages can be intermixed on a 3830 Model 2; however, if a 3344 disk storage unit is included in a 3340 Model A2, neither a 3330 nor a 3350 disk storage unit can be attached to the same 3830 Model 2 storage control.

3830 Highlights

The highlights of the 3830 Storage Control follow.

Processor Attachment

The 3830-2 can attach through a block multiplexer channel to:

- System/370 Models 135 through 195 (see Note)

- 3031, 3032, and 3033

- 3081, 3083, and 3084

- 4331 Model Group 2, 4341.

Note: Attachment to System/370 Models 135 and 145 requires selector channels.
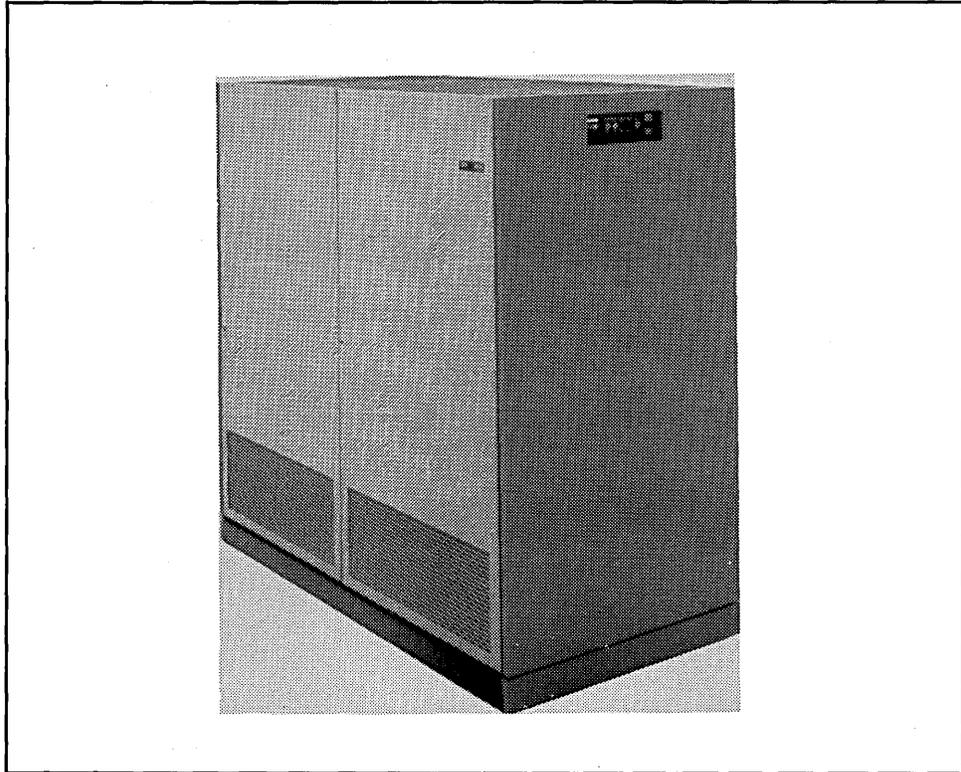
Figure 2-3830-1. 3830 Storage Control

Channel Commands Supported

The 3830 Storage Control supports channel commands used for count, key, and data formatted records.

3830 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Control Store Extension, Expanded Control Store, and Register Expansion

The Control Store Extension, Expanded Control Store, and Register Expansion features have a variety of functions. Depending on the attached disk storage type, one or more of these features are used to double the number of strings of disk storage that can be attached, and to intermix strings of different disk storage products. These features also support the String Switch and Fixed Head features on disk storage products.

The Control Store Extension feature uses 32 device addresses and permits attachment of two additional strings of 3333/3330s, or two additional strings of 3340s.

The combination of the Control Store Extension and the Register Expansion features uses 64 device addresses and permits attachment of two additional strings of 3340s, with 3344s attached to two of the four 3340 Model As.

The combination of the Control Store Extension, the Register Expansion, and the Expanded Control Store features uses up to 64 device address (8, 16, 32, and 64) depending on the configuration installed. This permits attachment of two additional strings of 3350s or any combination of two, three, or four strings of 3333/3330s, 3340s, and 3350s.

Two-Channel Switch

The Two-Channel Switch feature permits the 3830 Model 2 and attached disk storage to be shared by two different channels of the same or different processors. The storage control is available to a channel by Enable/Disable switches on the 3830 operator panel or through commands.

Two-Channel Switch, Additional

The Two-Channel Switch, Additional feature permits the 3830 Model 2 and attached disk storage to be shared by four different channels, two of which may be on the same processor.

The Two-Channel switch feature is a prerequisite for the Two-Channel Switch, Additional feature.

Remote Switch Attachment and Remote Switch Attachment, Additional

The Remote Switch Attachment and Remote Switch Attachment, Additional features move the Enable/Disable switches of the Two-Channel Switch feature from the 3830 operator panel to a configuration control panel.

2-3880. Storage Control

The 3880 Storage Control (Figure 2-3880-1) provides two independent control
unit paths, called storage directors, for control of 3330/3333, 3340/3344, 3350,
3370, 3375, and 3380 Direct Access Storage Devices.

The 3880 Storage Control Models 1, 2, 3, 4, 11, and 13 supply the control between
the channel and the controller of a string for disk drives.
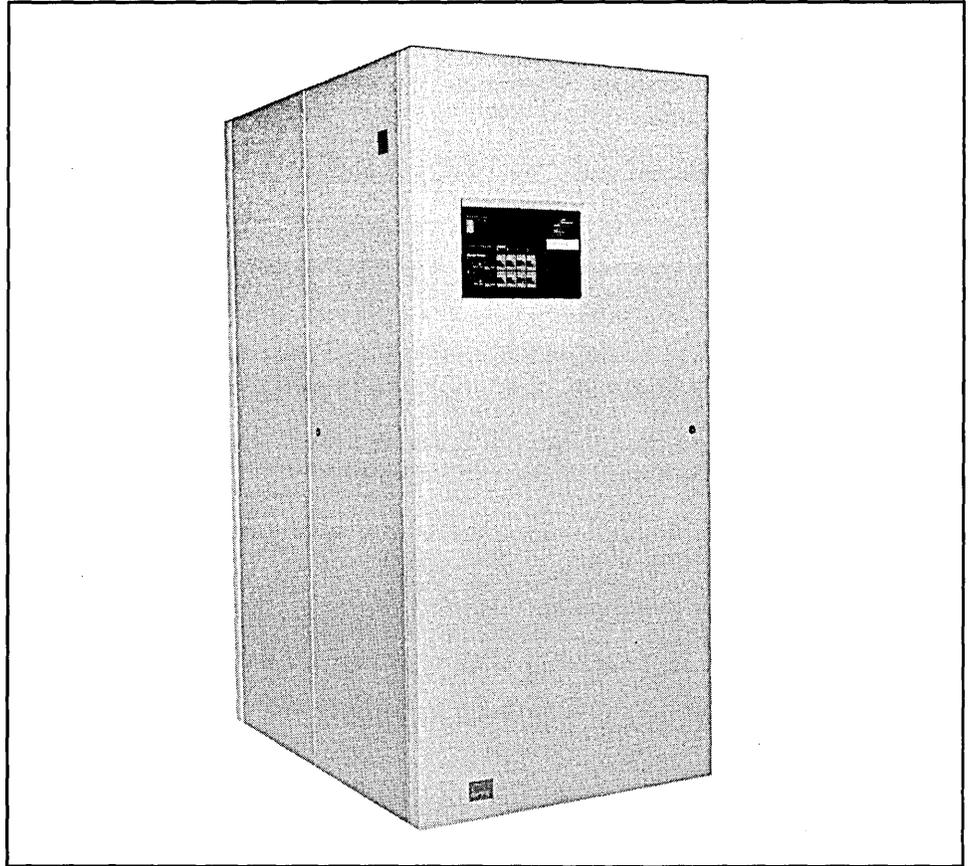
Figure 2-3880-1.   3880 Storage Control

The highlights of the 3880 Storage Control follow.

Processor Attachment

Each model of the 3880 provides different device attachment capabilities to satisfy the disk storage requirements for the IBM systems and processors shown in Figure 2-3880-2. Depending on the type of disk storage attached, the 3880 attaches to the system through standard or high-speed, block multiplexer channels.

System/Processor	3880 Models
System/370 Models 158 and 168	1, 2, 3, 11
System/370 Models 145, 145-3, 148, 155-II, 165-II	1, 2
3031, 3032, 3033, 3081, 3082, 3083, 3084, 3042-2	1, 2, 3, 11, 13

Figure 2-3880-2. 3880 Processor Attachment

Storage Directors

Each model of the 3880 contains one or two storage directors. Each storage director operates independently and each one provides the basic functions for storage control. That is, each storage director has its own data path, control path, and address for channel communication.

The storage director can be initialized to attach the following types of IBM disk storage devices: 3330/3333, 3340/3344, 3350, 3375, and 3380.

The five disk storage devices listed above are mutually exclusive on a storage director. For example, 3370s cannot attach to a storage director initialized for 3340s and 3344s, and 3340s and 3344s cannot attach to a storage director initialized for a 3330, 3333, and 3350 disk storage.

Channel Commands Supported

The 3880 supports both the channel commands used for count, key, and data formatted records, and the commands used for fixed-block formatted records. The commands supported by a director depend on the information in 3880 storage. For example, a director that supports 3340s would implement the commands used for count, key, and data records; a director that supports 3370s would implement the commands used for fixed-block records. When supporting commands for fixed-block records, the 3880 translates the block numbers in the address into the physical locations of the data on the disk.

Availability and Reliability

The 3880 has several advantages that help ensure data availability and reliability.

If service is needed, diagnostic information can be obtained and interpreted with a maintenance device (MD), used by the customer engineer. If one storage director fails, error sense information associated with the failing director can be transferred to the system through the other storage director.

Device Configurations

The disk storage configuration depends on the model of the 3880. For example, the paging storage director, storage director 1 of the Model 11, must use IBM 3350s as its disk storage device. Figure 2-3880-3 illustrates the various device configurations that may be attached to each model of the 3880.

Model	Storage Director 1	Storage Director 2
1	Up to 4 strings of 3330/3333/3350s or Up to 4 strings of 3340/3344s or Up to 4 strings of 3370s or Up to 4 strings of 3375s	Up to 4 strings of 3330/3333/3350s or Up to 4 strings of 3340/3344s or Up to 4 strings of 3370s or Up to 4 strings of 3375s
2	Up to 4 strings of 3330/3333/3350s or Up to 4 strings of 3340/3344s or Up to 4 strings of 3370s or Up to 4 strings of 3375s	Up to 2 strings of 3360s
3	Up to 2 strings of 3380s	Up to 2 strings of 3380s
4	Up to 4 strings of 3370s or Up to 4 strings of 3375s	Not available
11	Up to 1 full string of 3350s	Up to 4 strings of 3330/3333/3350s
13	Up to 2 3380 AA4s with up to 3 B4s attached to each AA4 and shared by both storage directors	

Figure 2-3880-3. 3880 Configurations

Dual Frame Configuration

Two 3880 Storage Control Model 13s can be connected to form a dual frame configuration. This configuration improves data availability by providing alternate data paths to the attached disk drives.

Cache Subsystem Storage

Two models of the 3880 Storage Control provide cache subsystem storage: Models 11 and 13. This cache storage acts as a high-speed buffer between the processor and the attached disk drives. The addition of the cache storage increases subsystem performance; the processor can access data in cache storage faster than it can access data on disk.

3880 Special Features

The following features can be ordered from an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Two-Channel Switch

The Two-Channel Switch feature (3880 Model 4 only) allows two channels to share the storage director and the attached disk drives.

Two-Channel Switch-Pair

The Two-Channel Switch-Pair feature allows each storage director and its attached devices to be shared by two channels. The operator's panel has two additional Enable/Disable switches with the Two Channel Switch-Pair feature.

Two-Channel Switch-Pair, Additional

The Two-Channel Switch-Pair, Additional feature allows each storage director and its attached devices to be shared by four channels. The Two-Channel Switch-Pair, Additional feature is a prerequisite for this feature. The operator's panel has four additional Enable/Disable switches with the Two-Channel Switch-Pair, Additional feature.

Eight-Channel Switch

The Eight-Channel Switch feature allows both storage directors and their attached devices to be shared by eight channels. The same eight channels must be switched to both storage directors. (For the Two-Channel Switch-Pair and the Two-Channel Switch-Pair, Additional Features, different channels can be switched for each storage director.) The Two-Channel Switch-Pair and the Two-Channel Switch-Pair, Additional features are prerequisites for this feature. The Eight-Channel Switch feature is not supported by the 3880 Models 4 and 11, and is fully functional for the 3880 Model 13 only when it is connected in a dual frame configuration. With the Eight-Channel Switch feature, the operator's panel has eight additional Enable/Disable switches.

Remote Switch Attachment

> The Remote Switch Attachment feature relocates the channel Enable/Disable switches from the 3880 operator panel to a remote location, usually on the processor's operator panel. This allows the operator to enable or disable the desired storage storage director from a central point rather than from unit to unit.

Remote Switch Attachment, Additional

> The Remote Switch Attachment, Additional feature relocates the four additional channel Enable/Disable switches provided by the Two-Channel Switch-Pair, Additional feature from the 3880 operator panel to a remote location.

Remote Switch Attachment for Eight-Channel Switch

> The Remote Switch Attachment for Eight-Channel Switch feature relocates the eight additional channel Enable/Disable switches provided by the Eight-Channel Switch feature from the 3880 operator panel to a remote location.

Speed Matching Buffer

> The Speed Matching Buffer for 3375s feature allows 3380s to attach to block multiplexer channels with a data rate between 1.5 and 1.859 megabytes per second. The Speed Matching Buffer feature is only supported by the 3880 Models 1 and 2. This capability allows sharing of 3375s by processors with different block multiplexer channel speeds while still taking advantage of high-speed channels.

Part 3. Diskette Input/Output Devices

Contents

Introduction

The diskette input/output devices read and write data on the IBM diskette, which permits an IBM processor to have access to the data through the diskette.

3-3540. Diskette Input/Output Unit

The 3540 Diskette Input/Output Unit (Figure 3-3540-1) is an efficient and economical data input/output device. There is no contention for devices between data entry and processing programs.

The 3540 has two models:

- Model B1 has one diskette drive.

- Model B2 has two diskette drives, which operate independently from each other. Each drive has a separate hopper and a separate stacker that can hold up to 20 diskettes.
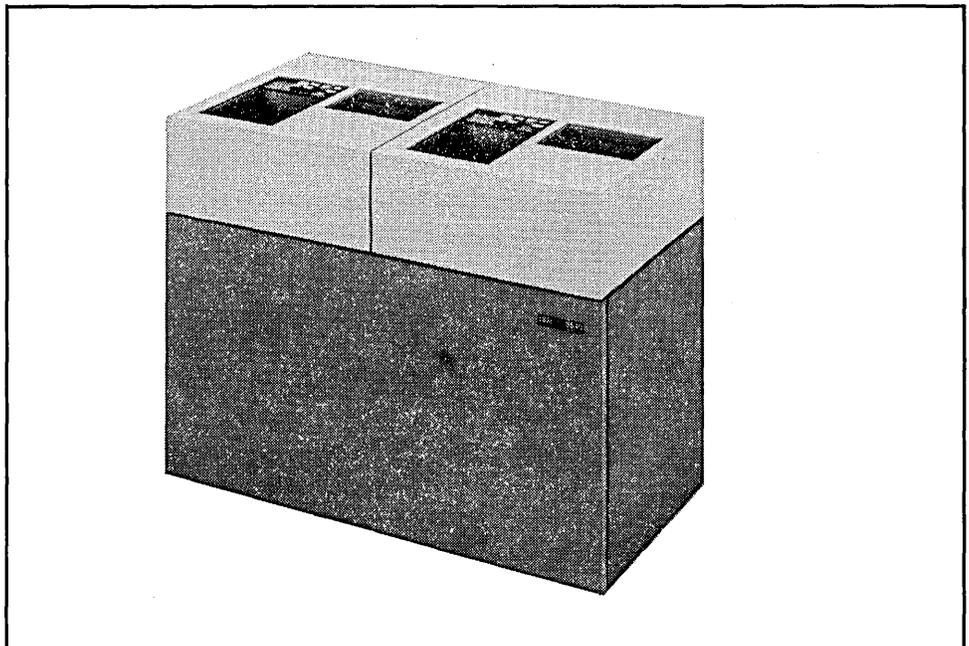
Figure 3-3540-1.   3540 Diskette Input/Output Unit

3540 Highlights

The highlights of the 3540 Diskette Input/Output Unit follow.

Processor Attachment

The 3540 needs a control unit position on a system channel. The 3540 attaches to a byte multiplexer channel, block multiplexer channel, or selector channel.

IBM Diskette

The 3540 reads and writes on the IBM diskette, which is the same diskette used by the 3740 Data Entry System. The 3540 reads up to 3600 diskette records per minute and writes up to 2200 records per minute.

Automatic Feed

Under program control, diskettes are automatically fed, one at a time, from the hopper and mounted on the drive spindle for a read or write operation. At the end of the operation, the diskette is automatically removed from the spindle and stacked, which permits uninterrupted processing. Diskettes are loaded and removed by the program while the device is operating.

Data Integrity

Data integrity is ensured because each diskette goes through label checking before the data is read.

Part 4. Magnetic Tape Devices

Contents

Introduction

The IBM magnetic tape devices read and write on 12.7 millimeter (1/2 inch) magnetic tape mounted on reels or in tape cartridges. The reels can be 158.75, 177.8, 215.9, or 266.7 mm (6.25, 7.0, 8.5, or 10.5 in.) in diameter. Tape cartridges are 109 x 125 mm (4.3 x 4.9 inches) in size. The tape units, which operate at data densities up to 37885 bytes per inch (BPI), use IBM Multi-System tape or equivalent competitive tape.

The 1/2 inch tape devices operate in seven- or nine-track format except the 3480, which operates in eighteen-track format only. The seven-track format uses the seven-bit binary-coded decimal (BCD) representation so that each track represents a bit of the BCD code. The nine-track uses eight of the nine bits for data and the one bit for parity. The eighteen-track format uses bytes of data written serially along each track of the tape. The data bits can represent an alphanumeric or special character, two decimal digits, one signed decimal digit, or eight binary digits.

A practical use of a magnetic tape device is to create a data file on a reel of tape or tape cartridge that can be stored offline.

Magnetic Tape Data Comparison Table

Figure 4-1 on page 4-3, following, gives a comparison of the characteristics of magnetic tape devices.

| MAGNETIC TAPE UNIT | | NOMINAL INTERBLOCK GAP | | | | | | | |
| | | MILLIMETERS | | | | INCHES | | | |
NUMBER	MODEL	SEVEN TRACT	NINE TRACK	6250 BPI	18 TRACK	SEVEN TRACK	NINE TRACK	6250 BPI	18 TRACK
3410/ 3411	1	---	15.2	---	---	---	0.6	---	---
	2	---	15.2	---	---	---	0.6	---	---
	3	---	15.2	---	---	---	0.6	---	---
3420	3	19.1	15.2	---	---	0.75	0.6	---	---
	4	---	15.2	7.6	---	---	0.6	0.3	---
	5	19.1	15.2	---	---	0.75	0.6	---	---
	6	---	15.2	7.6	---	---	0.6	0.3	---
	7	19.1	15.2	---	---	0.75	0.6	---	---
	8	---	15.2	7.6	---	---	0.6	0.3	---
3430	A01	---	15.2	7.6	---	---	0.6	0.3	---
	B01	---		11.4	---				
3480	B22	---	---	---	2.0	---	---	---	0.08

Figure 4-1 (Part 1 of 3). Comparison of Magnetic Tape Device Characteristics

| MAGNETIC TAPE UNIT | | NOMINAL DATA RATES | | | | TAPE SPEED | |
| | | (KILOBYTES PER SECOND) | | | | | |
NUMBER	MODEL	SEVEN TRACK	NINE TRACK	6250 BPI	18 TRACK	M/SEC	IN/SEC
3410/ 3411	1	6.9	20.0	---	---	0.318	12.5
	2	13.9	40.0	---	---	0.635	25.0
	3	27.8	80.0	---	---	1.270	50.0
3420	3	41.7	120.0	---	---	1.905	75.9
	4	---	120.0	470	---	1.905	75.0
	5	69.5	200.0	---	---	3.175	125.0
	6	---	200.0	780	---	3.175	125.0
	7	111.2	320.0	---	---	5.080	200.0
	8	---	320.0	1250	---	5.080	200.0
3430	A01	---	80.0	312	---	1.270	50.0
	B01			312	---	1.270	50.0
3480	B22	---	---	---	3000	2.0	78.7

Figure 4-1 (Part 2 of 3). Comparison of Magnetic Tape Device Characteristics

| MAGNETIC TAPE UNIT | | NOMINAL INTERBLOCK BAP | | | | REWIND TIME (SEC) | REWIND AND UNLOAD TIME (SEC) | NOMINAL READ ACCESS TIME * (MS) |
| | | MILLISECONDS | | | | | | |
NUMBER	MODEL	SEVEN TRACK	NINE TRACK	6250 BPI	18 Track			
3410/ 3411	1	60.0	48.0	---	---	180	---	15.0
	2	30.0	24.0	---	---	180	---	12.0
	3	15.0	12.0	---	---	120	---	6.0
3420	3	10.0	8.0	---	---	60	66	4.0
	4	---	8.0	4.0	---	60	66	2.3
	5	6.0	4.8	---	---	60	66	2.9
	6	---	4.8	2.4	---	60	66	1.6
	7	3.8	3.0	---	---	45	51	2.0
	8	---	3.0	1.5	---	45	51	1.1
3430	A01	---	12.0	6.0	---	162	---	6.0
	B01			9.0	---	162	---	6.0
3480	B22	---	---	---	**	48 **	57 **	**

* Read access time is the interval from the beginning of a Forward Read operation, when the tape is not at load point, until the first data byte is read after the tape has reached the correct speed from a stopped state. The times given for 3420 Models 4, 6, and 8 are for 6250 BPI operation.

** The actual 3480 tape drive characteristics can be masked by the action of the buffer.

Figure 4-1 (Part 3 of 3). Comparison of Magnetic Tape Device Characteristics

4-3410. Magnetic Tape Unit and 3411 Control

The 3410 Magnetic Tape Unit (Figure 4-3410-1 on page 4-3410-2) and 3411 Magnetic Tape Unit and Control subsystem includes one 3411 tape unit and control and up to five 3410 tape units.

The 3410 and the 3411 look similar and each contains one tape unit, but the 3411 also contains the common control unit and power supply. The 3411 Model 1 can attach up to three 3410 Model 1's, the 3411 Model 2 up to five 3410 Model 2s, and the 3411 Model 3 up to five 3410 Model 3s.

The 3410 and 3411 are each available in three models, as follows:

- Model 1 has a nominal data rate of 20 kilobytes per second, a tape speed of 317.5 millimeters (12.5 inch) per second, and a rewind time of 3 minutes for a full reel.

- Model 2 has a nominal data rate of 40 kilobytes per second, a tape speed of 635 millimeters (25 inch) per second, and a rewind time of 3 minutes for a full reel.

- Model 3 has a nominal data rate of 80 kilobytes per second, a tape speed of 1270 millimeters (50 inch) per second, and a rewind time of 2 minutes for a full reel.

The 3410 tape units must be the same model as the 3411.

3410/3411 Highlights

The highlights of the 3410 and 3411 follow.

Processor Attachment

The 3411 Magnetic Tape Unit and Control is versatile and attaches to various systems and devices. It can attach to a control unit position on a system channel, or through an integrated adapter on a system or device. The 3411 attaches to a byte multiplexer channel, block multiplexer channel, or selector channel.

Desk-Height Horizontal Transport Deck

Both the 3410 and 3411 are desk-height units that have tapes mounted horizontally rather than vertically. A transparent sliding cover, similar to the cover of a roll-top desk, allows easy access to the tape reels.

Tape-Threading Path

A simplified tape-threading path and a push-pull quick release latch (for quicker mounting and removing of the tape supply reel) increase ease of operation.

)
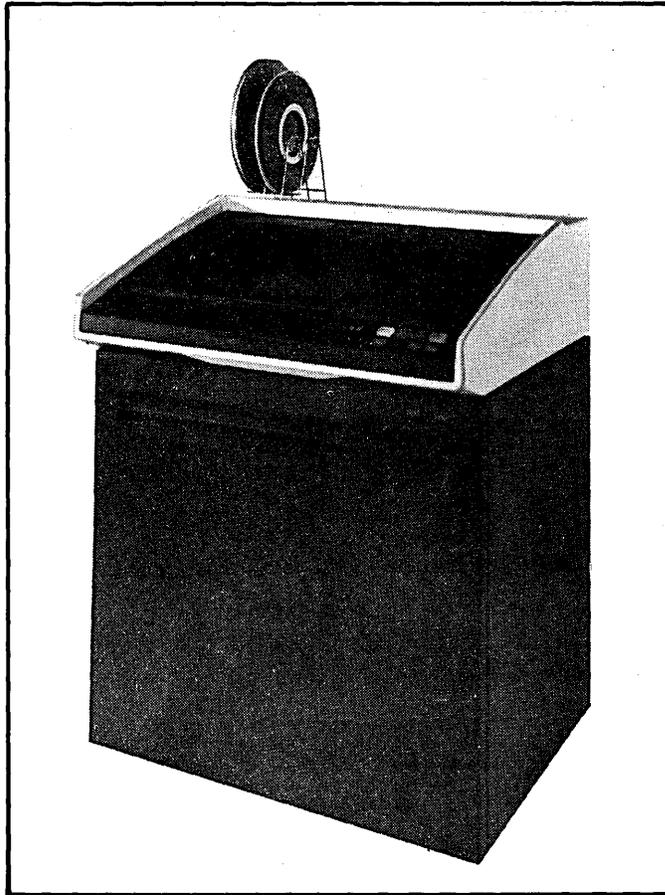
Figure 4-3410-1. 3410 Magnetic Tape Unit

Compact Design

The diagnostic capabilities of the units permit normal servicing to be done from the front, and internal cables between the tape units and the tape control remove the requirement for under-the-floor cables. Both these designs permit the units to be placed side-by-side and near to walls, to permit better use of space.

Independent Tape Unit Attachment

Independent attachment of a 3410 and a 3411, through radial attachment, permits a 3410 to be taken out of operation for maintenance without changing cables or interrupting the work done by other units.

Error Correction

Single-track read errors are corrected in flight in 1600 BPI phase-encoding (PE) recording mode, and track-in-error detection is supplied for nine-track 800 BPI recording.

Parity Checking

Parity checking is done during tape reading (in both 800 and 1600 BPI recording) and during read-back check of tape writing.

Amplitude Checking

In 1600 BPI PE recording mode, the amplitude of the signal is checked against a predetermined threshold level. This check determines if the signal of the data being recorded is strong enough to permit the data to be read.

Read Backwards

Tapes can be read by the 3410 and 3411 in a forward or backward direction. The data conversion function is inoperative during a backward read operation of seven-track tapes.

3410/3411 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Single Density Tape Unit

The Single-Density Tape Unit feature permits the 3410 or the tape unit on the 3411 to operate at 1600 BPI (PE mode only).

Dual-Density Tape Unit

The Dual-Density Tape Unit feature, available for both the 3410 and 3411, permits the nine-track tape units to read and write either at 800 BPI in non-return-to-zero change-on-ones recording (NRZI) mode or at 1600 BPI in phase-encoded mode. This feature is especially useful in library conversion and for data interchange between systems. Where only 1600 BPI (PE mode) operations are performed, the Single-Density feature is needed.

Seven Track Tape Unit

The Seven-Track Tape Unit feature permits a 3410 or 3411 to operate at 200, 556, or 800 BPI in NRZI mode, in seven-track format only.

System/Communication Attachments

These features permit 3410/3411 tape units to attach to certain communication controllers, to the 3800 Printing Subsystem, and to certain S/370 Processors.

)

4-3420. Magnetic Tape Unit

The 3420 Magnetic Tape Unit (Figure 4-3420-1) offers compatibility with existing seven- and nine-track tape volumes and programs. It also offers enhanced reliability, availability, and serviceability features.

Figure 4-3420-1. 3420 Magnetic Tape Unit

The 3420 has six models, as follows:

- Model 3 has a nominal data rate of 120 kilobytes per second, a tape speed of 1.905 meter (75 inch) per second, and a rewind time of 60 seconds for a full reel.

- Model 4 has a nominal data rate of up to 470 kilobytes per second, a tape speed of 1.905 meter (75 inch) per second, and a rewind time or 60 seconds for a full reel.

- Model 5 has a nominal data rate of up to 200 kilobytes per second, a tape speed of 3.175 meter (125 inch) per second, and a rewind time of 60 seconds for a full reel.

- Model 6 has a nominal data rate of up to 780 kilobytes per second, a tape speed of 3.175 meter (125 inch) per second, and a rewind time of 60 seconds for a full reel.

- Model 7 has a nominal data rate of up to 320 kilobytes per second, a tape speed of 5.080 meter (200 inch) per second, and a rewind time of 45 seconds for a full reel.

- Model 8 has a nominal data rate of up to 1250 kilobytes per second, a tape speed of 5.080 meter (200 inch) per second, and a rewind time of 45 seconds for a full reel.

3420 Highlights

The highlights of the 3420 Magnetic Tape Units follow.

Processor Attachment

The 3420 Magnetic Tape Unit attaches to a control unit position of a system or device through the 3803 Tape Control Unit.

Tape Path

Tape wear and contamination are minimized by extensive use of air bearings and surface treatments. The path that the tape takes through the tape unit, from reel to reel, permits the recording side of the tape to touch only two surfaces during read and write operations: the tape cleaner and the read/write head. In addition, the cleaning mechanism (supplied only on Models 4, 6, and 8) removes loose contaminants from the tape and protects the read/write head from tape contamination during rewind and tape load and unload operations.

Read-Access Time

Each model of the 3420 has a short nominal read-access time that can improve system throughput. Optical tachometers, built into the tape unit, sense small variations in the speed of the capstan and the tape and generate corrective signals. This precise control is one of the keys to the 3420's quick read-access and rewind times.

Automatic Threading and Cartridge Loading

An automatic reel latch mechanically seats the file reel in position and pneumatically locks it on the hub for tape movement. Automatic threading and cartridge loading reduces the time to mount and remove tapes.

Independent Tape-Unit Attachment

Radial attachment of a 3420 permits it to be taken out of operation for maintenance without changing cables or interrupting the work done by the other units.

Nine-Track 1600 BPI Phase-Encoding Operation

Data is recorded parallel by bit, serially by byte at 1600 BPI, phase encoded, in nine tracks across the width of the tape. This operation is available on all models of the 3420. See "3420 Special Features."

Parity Checking (PE Mode)

Each byte is checked for odd parity while the tape is read. Data written on tape is read back instantly and checked, as in a read operation with full parity checking.

Error Correction

Single-track errors consisting of missing or incorrectly read bits are corrected "in flight" during 1600 BPI (PE mode) read operation.

In 6250 BPI (GCR mode), there is "in-flight" detection and correction of single-track errors during write operations and double-track errors during read operations.

Read Backwards

Tapes can be read by the 3420 in a forward or backward direction. The data conversion function is inoperative during a backward read operation of seven-track tapes.

3420 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Dual Density

The Dual Density feature is for Models 3, 5, and 7 only and permits the tape unit to operate in 800 BPI NRZI nine-track format as well as in 1600 BPI (PE mode).

Seven Track

The Seven Track feature is for Models 3, 5, and 7 only and permits the tape unit to operate at either 556 or 800 BPI NRZI in the seven-track format.

6250 Density

> The 6250 Density feature is for Models 4, 6, and 8 only, and permits the tape unit to operate in 6250 BPI nine-track format.

6250/1600 Density

> The 6250/1600 Density feature is for Models 4, 6, and 8 only, and permits the tape unit to operate at 6250 BPI density and 1600 BPI density.
>
> 6250 BPI is synonymous with group coded recording (GCR) and is a recording mode of the 3420 Models 4, 6, and 8. When the 3420 records at 6250 BPI (GCR mode), the nominal interblock gap (IBG) is 7.6 millimeter (0.3 inch), instead of 15.2 millimeter (0.6 inch) as at 1600 BPI (PE mode), and makes more tape space available to the user.
>
> Also with 6250 BPI (GCR mode), self-adjusting gain control is used, which adjusts the read amplitude to a signal recorded at the beginning of the tape to improve read performance.

4-3430. Magnetic Tape Subsystem

The 3430 Magnetic Tape Subsystem (Figure 4-3430-1) is a half-inch-tape subsystem that reads and writes data in Group Coded Recording (GCR) mode and Phase Encoded (PE) mode at a lower cost than previous IBM tape subsystems that have the same recording capabilities. The 3430 subsystem records data in GCR mode at 246 bytes per millimeter (6250 bytes per inch) and in PE mode at 63 bytes per millimeter (1600 bytes per inch).
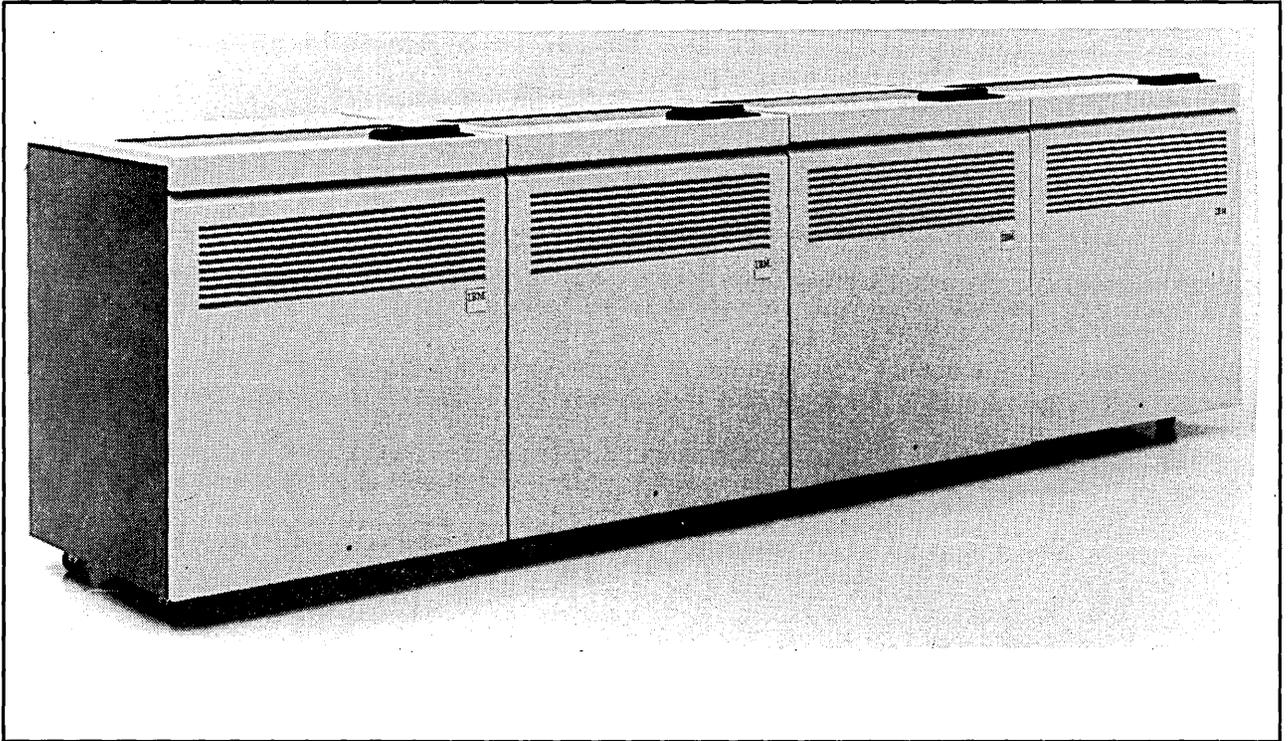
Figure 4-3430-1. 3430 Magnetic Tape Subsystem

The 3430 is available in two models: Model A01 and Model B01. The minimum configuration for the 3430 subsystem is one Model A01; the the maximum is one Model A01 and three Model B01's. The Model A01 contains the tape control and a tape unit in a single frame; the Model B01 contains only a tape unit.

The cables for each Model B01 attach directly to the Model A01. Therefore, if a Model B01 has a load or mechanical failure, it can be disconnected without affecting the rest of the subsystem. Most servicing can be done through the front of the units. The units require only 900 millimeters (36 inches) for service clearance behind the units.

Both models are 1 meter (39 inches) high and have horizontal tape transport decks, which permit easy tape reel mounting. The models may be positioned either side-by-side or at any angle up to 90 degrees. Direct cabling between the tape units eliminates the need for under-the-floor cabling.

3430 Highlights

The highlights of the 3430 Magnetic Tape Subsystem follow.

Processor Attachment

The 3430 Magnetic Tape Subsystem attaches to various processors through a standard System/370 block multiplexer or selector channel.

Data Rate and Tape Speed

The data rate in PE mode is 80 kilobytes per second. In GCR mode the data rate is 312 kilobytes per second. In both modes, the approximate tape speed in 127 centimeters (50 inches) per second and the approximate rewind time is 2.7 minutes.

Error Checking

During read and write operations, the tape control checks that the data is recorded correctly. In PE and GCR modes, the tape control checks the data by checking parity. In GCR mode, the tape control also checks the data by using error correction codes.

During read operations in GCR mode, when the operator loads the tape on the tape unit, the tape unit measures and adjusts the read signal amplitudes to ensure that the tape unit can correctly read the data.

During write operations, the tape control checks that the data is recorded correctly. First, the tape control checks the data after it is sent from the channel. Then, the tape control checks the data before it is sent to the tape unit. After the tape unit records the data on tape, the tape control checks the data the same way it is checked during read operations. In GCR mode, the tape control automatically corrects single-track errors.

Error Correction

During read operations in PE mode, the tape control automatically corrects single-track errors. In GCR mode the tape control automatically corrects single-track errors and double-track errors.

During write operations in GCR mode, the tape control automatically corrects single-track errors.

Error Analysis

The microprocessor executes a diagnostic program to automatically check the subsystem each time the operator turns on the subsystem power. First, the program checks the microprocessor. Then, each time the operator loads a reel of tape on the tape unit, the program tests the tape unit logic, tape unit hardware, and the data paths between the tape control and the tape unit.

During the diagnostic program, any errors are identified, coded, and sent to the host processor for further analysis. The error analysis from the diagnostic program helps a service representative quickly identify errors. Temporary errors are logged in the host processor. Microprogram or microprocessor failures stop subsystem operations and cause an error code to appear in the window of the customer engineer (CE) panel on the Model A01. If a code appears in the window, record the code and call a service representative.

4-3480. Magnetic Tape Subsystem

The 3480 Magnetic Tape Subsystem (see Figure 4-3480-1) consists of a buffered, microprocessor-controlled 3480-A22 Control Unit and compact 3480-B22 Tape Units. Each tape unit contains two microprocessor-controlled tape drives that use cartridge-enclosed magnetic tapes.
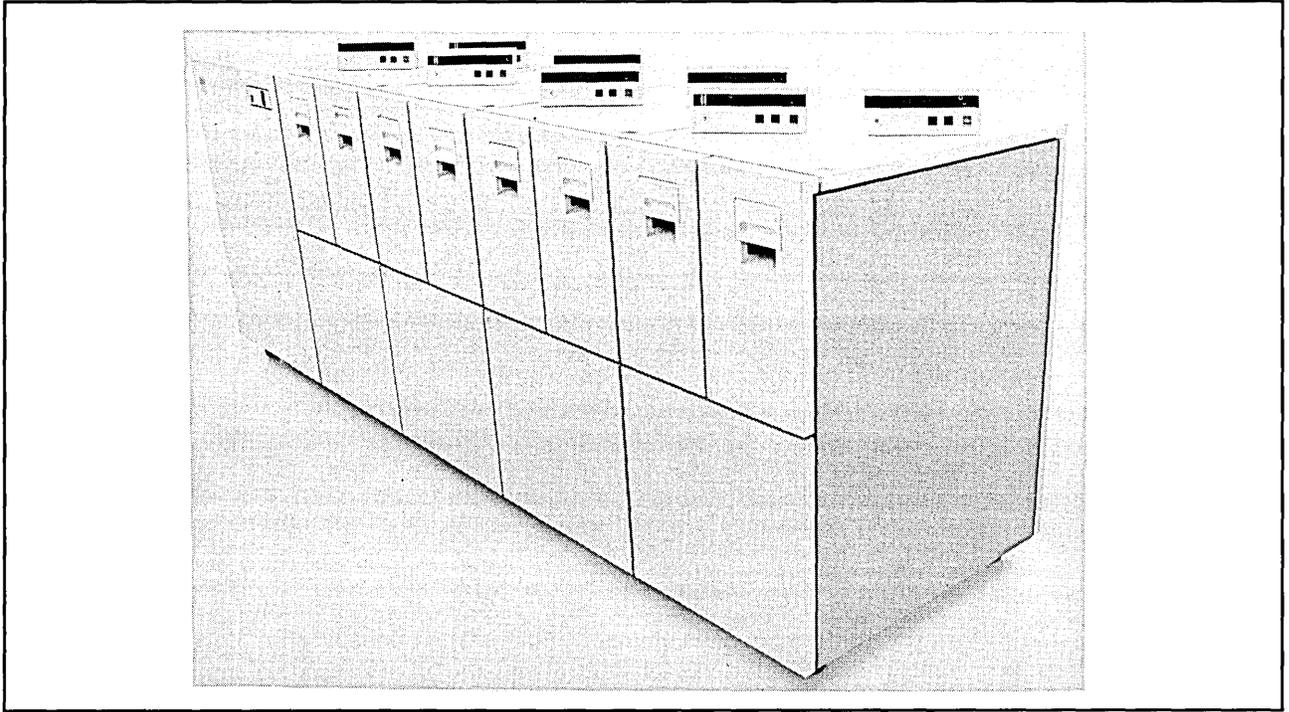
Figure 4-3480-1. 3480 Magnetic Tape Subsystem

3480 Highlights

The IBM 3480 Magnetic Tape Subsystem has the following standard features:

∘ Compact design with table-height front loading for ease of operation.

• A small reel of chromium-dioxide tape that is enclosed in a compact cartridge for greater tape protection. With a 4K-byte or larger block size, the 18-track, high density tape can store more data than an IBM standard 2400-foot tape recorded at 6250 BPI.

• A tape drive with microprocessor controls that are used to move the tape without the need for capstans or complex vacuum columns.

• Advanced servicing techniques that increase the time the subsystem is available to the customer.

- Standard message display (with appropriate host operating system support) for presenting information to the operator.

- Nominal data rate of 3.0 megabytes per second.

- Data density of approximately 1500 bytes per millimeter (approximately 38,000 bytes per inch).

- 512K-byte electronic buffer.

- Internal workload balancing to provide more efficient use of available resources.

- Resident error recovery procedures that handle most of the temporary errors that might occur, thus reducing processor and channel usage.

Configurations

The smallest 3480 subsystem consists of one control unit, a single-channel attachment to a host processor, and two tape drives in a tape unit. The largest 3480 subsystem, with all special features, contains:

- Two control units

- Eight channel attachments

- Sixteen tape drives (in eight tape units).

In this configuration, a communication path exists between the two 3480 control units and also between each control unit and all of the sixteen tape drives in the subsystem.

Components

The 3480 Magnetic Tape Subsystem is made up of 3480 control unit(s) and 3480 tape unit(s). A subsystem must have at least one control unit and one tape unit with two tape drives.

Each control unit interprets channel commands, controls the data flow, and allocates buffer space among the attached active tape drives. The buffer, managed by the control unit microprocessor, allows data to be transferred at up to the maximum channel data transfer rate of 3.0 megabytes per second. The control unit, by prereading multiple data records from the tape drives into the buffer, can give rapid control unit responses to host data requests. The control unit can also accept multiple records from a host system for each tape drive independent of current tape drive activity.

Processor Attachment

The 3480 subsystem can be attached to various IBM processors through a 2.0 megabyte-per-second streaming channel, 3.0 megabyte-per-second streaming channel, or non-streaming block-multiplexer channel.

3480 Standard Features

All standard magnetic tape features such as read, write, read backward, automatic tape threading, file protection, and so on, are available. New standard features, in addition to those described in "Highlights," include high-speed search, processor assignment that permits a selected tape drive to be assigned to a specific host system, and read/write buffering of data.

3480 Programming Support

The 3480 Magnetic Tape Subsystem is supported in full-function mode for all conventional tape drive requirements, including access methods, utilities, and JCL, as well as the new 3480 standard features. The MVS S/370 or XA System Products - JES2 or JES3 operating system, with the appropriate Data Facility Product (DFP) licensed program product are required.

The 3480 Magnetic Tape Subsystem is supported in compatibility mode (a subset of full-function mode) and supports most conventional tape drive requirements, including access methods, utilities, and JCL. The MVS S/370 or XA System Product - JES2 or JES3 operating system, with the appropriate Data Facility Product (DFP) licensed program product are required.

Most application programs that execute with currently available IBM tape subsystems will also execute with the 3480 subsystem without recompiling or editing, except for JCL changes. Contact a National Accounts Division (NAD) marketing representative for the appropriate program product release levels.

3480 Special Features and Accessories

With the addition of one or more of the following special features and accessories, the 3480 subsystem can include up to two 3480 control units, be able to address up to sixteen tape drives, and have up to eight channels for communication with the host system(s):

- Channel Attach, Additional

- Dual Control Unit Communications Coupler

Channel Attach, Additional

Each 3480 control unit has one channel attachment. The Channel Attach, Additional feature permits an additional channel connection to a host system. Up to three of these features can be added to a 3480 control unit for a total of four channel connections. These channel connections may be either to the same host system or to different host systems.

Dual Control Unit Communications Coupler

The Dual Control Unit Communications Coupler accessory creates a communication path between two 3480 control units and establishes a subsystem with two control units. Either 3480 control unit can operate independently, or with the other. This accessory permits either 3480 control unit to address any tape drive in the subsystem, regardless of the control unit to which the tape drive is physically attached. One 3480 Magnetic Tape Subsystem, using the units, features, and accessories offered, can be assembled in a variety of configurations.

4-3803. Tape Control

The 3803 Tape Control (Figure 4-3803-1) is the control unit for the 3420 Magnetic Tape Unit. The 3803 uses monolithic circuitry for all logic and control functions. The monolithic read-only control storage of the 3803 contains all the information needed to coordinate effective operation of the 3420 Magnetic Tape Unit. The 3803 also has diagnostic capabilities that can quickly pinpoint problems.
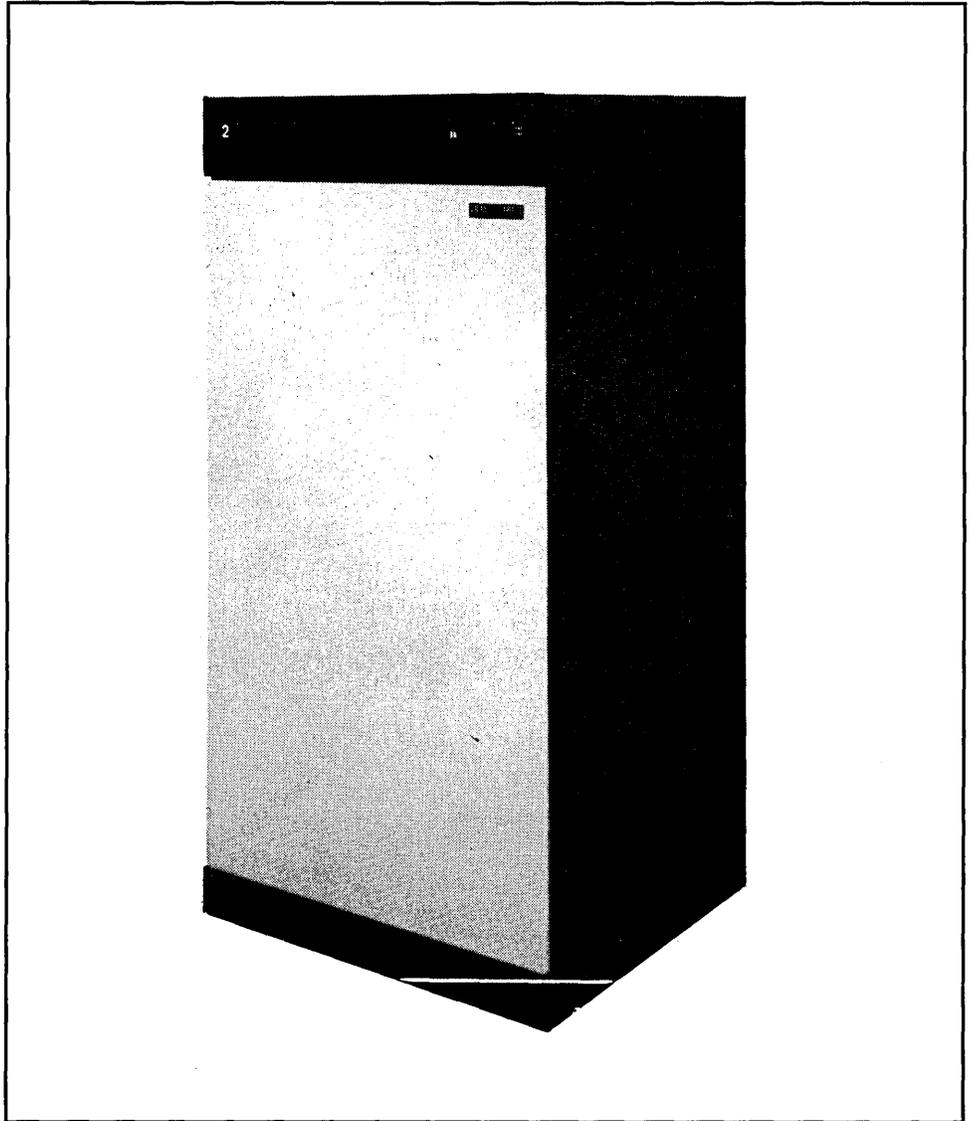
Figure 4-3803-1.   3803 Tape Control Unit

The 3803 has three models, as follows:

- Model 1 is the control unit for 3420 Models 3, 5, and 7.

- Model 2 is the control unit for 3420 Models 3 through 8. Seven- and nine-track 3420s and multiple densities can be mixed on the Model 2 when it has the appropriate features installed.

- Model 3 is the control unit for 3420 Models 3 and 5 for attachment to smaller IBM processors.

3803 Highlights

The highlights of the 3803 Tape Control follow.

Processor Attachment

The 3803 Tape Control requires a control unit position on the processor channel. Depending on the processor, either a selector channel or block multiplexer channel is required.

Radial Attachment

Through a radial interface attachment, up to eight 3420s can be connected to a 3803 to permit maintenance on a 3420 without changing cables or interrupting the work done by any of the other units. This attachment makes it possible to change tape units online and offline for easier maintenance. (Previous IBM tape units are connected to their control units serially through units placed next to them.)

Encode Checking

The 3803 Model 2 uses an improved encode-checking method that permits error correction in 6250 BPI mode for any single track, or a combination of two tracks simultaneously, while the tape is in motion.

3803 Special Features

The following features can be ordered through the IBM sales representative to expand or customize the user's operation. For more information about features, see the IBM sales representative.

The 3803 must have the appropriate density and tape format features to control the 3420 tape units attached to it (such as Single-Density, Dual-Density, and Seven-Track).

Remote Switch Attachment

The Remote Switch Attachment feature (for the Models 1 and 2 only) make it possible to enable and disable the two channel switch feature on the 3803 from a remote console such as the configuration control panel of a System/370 Model 158MP or 168MP.

Tape Switching

The tape switching feature on 3803 Models 1 and 2 permits as many as sixteen 3420s to be changed among two, three, or four 3803s.

Two-Channel Switch

With the Two-Channel switch feature installed, a 3803 Model 1 or 2 can attach to a second channel and change between two channels under program control. This feature permits one or more processors to have access to tape units that otherwise might not be available to them.

Part 5. Display Devices

Contents

Introduction

Display devices supply high-speed visual communication between an IBM processor and its user. Tables, graphs, charts, and alphameric data are displayed on a cathode-ray tube and/or printers. Keyboards and a light pen are used to enter and change processor information.

5-3251. Display Station

The 3251 Display Station Model 1 (Figure 5-3251-1) is an interactive computer graphics display station for the display of graphic and alphameric data generated by an IBM processor. The display station has attachments for operator interaction with the displayed picture, which permits considerable interactive operator-machine communications.

The 3251 is a free-standing, table-top display, that easily fits into a user's office environment. Its keyboard special features are separate and movable for operator convenience.
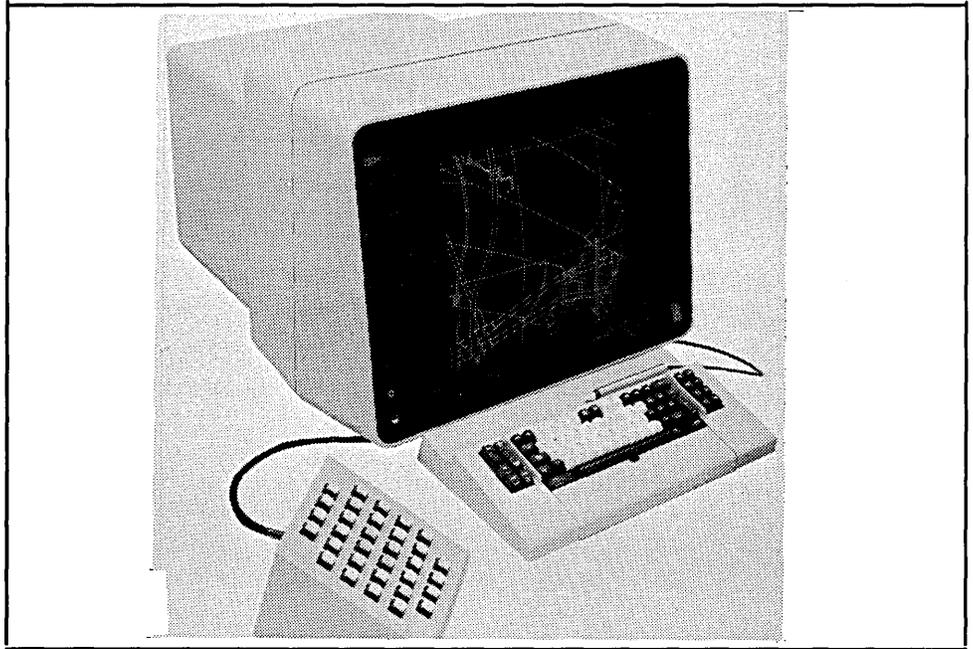
Figure 5-3251-1. 3251 Display Station

3251 Highlights

The highlights of the 3251 Model 1 Display Station follow.

Configuration of the 3251 Attachment to a Control Unit

With the 3255 Display Control Model 1 or 2 and the 3258 Control Unit, the 3251 Model 1 forms part of the 3250 Graphics Display System and can be used in multiple display station configurations for computer-aided design, computer-aided manufacturing, and scientific analysis applications. It is particularly suited to those applications that need considerable interaction.

Up to two 3251s can be attached to each 3255 Model 1 and up to three 3251s can be attached to each 3255 Model 2; the first 3251 must be adjacent to the 3255, the others may be up to 15.2 meters (50 feet) from the 3255. Up to sixteen 3251s can be attached, through 3255s, to each channel-attached 3258; the 3255s can be located up to 1525 meters (5,000 feet) from the 3258 using readily available coaxial cable (this distance can be increased by using coaxial cable of a higher specification).

CRT Display Characteristics

The characteristics of the CRT display are:

• A 534 millimeter (21 inch) diagonal, directed beam, display unit that has a 305 by 305 millimeter (12 by 12 inch) viewing area.

• Vector graphics—straight lines that can be displayed between any of the 1024 by 1024 addressable positions on the screen. Through display buffer orders, vector endpoint coordinates can be expressed in absolute form or incrementally, relative to the current beam position.

• Graphical data that can be displayed as a series of points (point plot orders), or in one of four line types: solid, dotted, dashed, or dot-dashed (vector plot orders).

• A high-quality character set that comprises both uppercase and lowercase, which can be displayed either horizontally or vertically (90 degrees counterclockwise) in any of four sizes.

• Eight programmable intensities (including blank) for points, vectors, or characters; the three brightest levels can be sensed by the light pen.

• Audible and visible (blink) alerts that can be programmed to notify the display station operator of exceptional conditions.

Program Support

Software support is provided through Graphic Programming Services (GPS), which includes the Graphic Access Method (GAM), and the Graphic Subroutine Package (GSP). Support under VM/CMS is provided by Graphics Access Method/System Product (GAM/SP). These are system control programs running under OS/VS1 and OS/VS2 operating systems.

3251 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operations. For more information about features, see an IBM sales representative.

Alphanumeric Keyboard

An alphanumeric keyboard feature supplies a typewriter-like layout for entering data and controls. The keyboard for U.S. English, U.K. English, French, German, and Italian character sets has 75 keys with two shifts, and has uppercase and lowercase alphabets, numbers, symbols, and control functions. The Katakana character set needs a 76-key, four-shift keyboard and has alphameric data, symbols, control functions, and Katakana characters. Input is aided through a visible cursor on the screen and display buffer orders that specify fields which the operator can or cannot use for input. An alternate alphanumeric keyboard feature, which includes the above functions, also provides a numeric keypad and extends the supported character set to include special drafting characters.

Program Function Keyboard

The program function keyboard feature supplies 32 backlit keys for operator interaction with an IBM processor program. When a key is pressed, a unique code transfers to the processor; the processor program communicates with the operator by making inactive one or more backlit keys. The keyboard is at an angle for operator convenience.

Light Pen

The light pen feature supplies a hand-held, pen-like device for interaction with the displayed image. When the light pen is pointed at a component of the displayed image, it permits sensing and, under program control, selection of that component. A tip switch on the pen permits the selection to be indicated to the processor program, also under program control.

5-3277. Display Station

The 3277 Display Station Model 2 (Figure 5-3277-1) is a high-performance cathode-ray tube (CRT) station for displaying alphameric data, and for entering data into and retrieving data from a processor through a 3274 Control Unit. The 3277 permits an operator to use the keyboard and selector light pen to display and manipulate data on the CRT screen.

The 3277 Display Station is considered to be a unit of the 3270 Information Display System, although it can attach to other systems, such as the 3790 Communications System, with the appropriate adapter.

The character set of the 3277 includes 36 alphameric and 27 special characters. A choice of keyboards, a selector light pen, and a set of program function keys supply input flexibility.

The 3277 Model 2 displays up to 1,920 characters in 24 lines of up to 80 characters per line and requires a 3274 Control Unit with a Type B adapter to attach to a control unit position on a system channel.
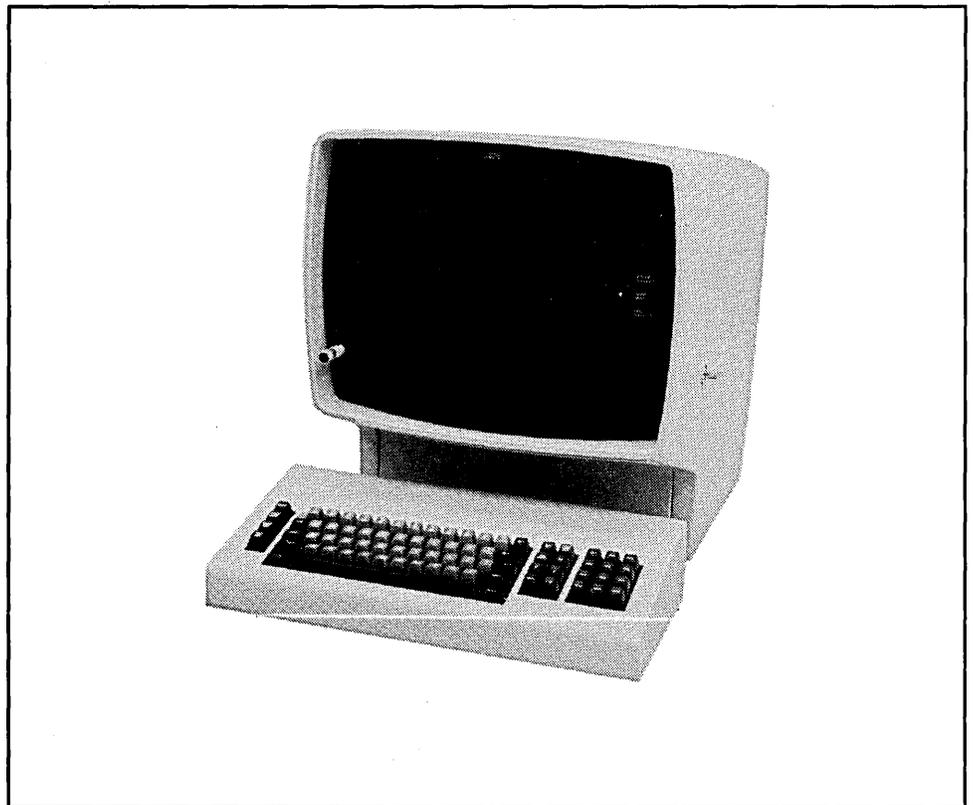
Figure 5-3277-1.   3277 Display Station

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3277 Highlights

The highlights of the 3277 Display Station follow.

- Fields specified by the program. Individual fields of data on the screen of the 3277 can be program-specified for protected or unprotected storage, alphameric or numeric display, nondisplay, and normal or brightened character intensity.

- Editing. Typamatic, cursor, tab, back-tab, protected-data, insert and delete, extended erase, and clear screen capabilities.

- Input flexibility. A choice of keyboards, selector light pen, and programmable function keys.

- Output flexibility. Allows screen information to be directed to another display or to a hard copy device under program control.

3277 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operations. For more information about features, see an IBM sales representative.

Audible Alarm

The Audible Alarm feature supplies an alarm that sounds when a character is entered in the next-to-last position on the display screen. The alarm can also be activated, under program control, to alert the operator to a special condition.

Data Analysis-APL feature

The Data Analysis-APL feature supplies an interactive APL or text capability.

Keyboards

Ten keyboards are available. The keyboards have 66 or 78 keys for alphameric, control, or program selection. Keyboards are available for use with EBCDIC, ASCII, and APL character sets, and for either text, typewriter, or data entry modes of operation.

Keyboard Numeric Lock

The Keyboard Numeric Lock feature supplies a means of alerting the keyboard operator to certain keying errors. When the cursor is positioned within a numeric input field and the keyboard numeric lock feature has been installed, the keyboard is electrically locked if any key is pressed other than the numerals 0 through 9, minus sign, decimal sign, or duplicate (DUP).

Operator Identification Card Reader

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                    The Operator Identification Card Reader feature gives the ability to enter magnetically coded data from a 53.9 by 85.7 millimeter (2-1/8 by 3-3/8 inch) plastic data-processing card with an encoded magnetic stripe. Badges and ID cards are examples of plastic data-processing cards.

Security Keylock

                    The Security Keylock feature prevents modification and display of data in the display terminal unless the key is in the ON position.

Selector Light Pen

                    The Selector Light Pen feature supplies a hand-held, pen-like device for interaction with the displayed image. When the light pen is pointed at a component of the displayed image, it permits sensing and, under program control, selection of that component. A tip switch on the pen permits the selection to be indicated to the processor program, also under program control.

5-3278. Display Station

The 3278 Display Station Models 1, 2, 3, 4, and 5 (Figure 5-3278-1 on page 5-3278-2) use a cathode-ray tube (CRT) for displaying data, and a keyboard for entering data into and retrieving data from a processor through a 3274 Control Unit. The 3278 handles alphameric and graphic data. It permits the operator to use the keyboard and selector light pen to display and manipulate data on the display screen. The 3278 Display Station is considered to be a unit of the 3270 Information Display System.

The 3278 Display Station is available in five models and can display up to 3564 characters on the screen:

- Model 1 displays 960 characters (12 lines of 80 characters).

- Model 2 displays 1920 characters (24 lines of 80 characters).

- Model 3 displays 2560 character (32 lines of 80 characters).

- Model 4 displays 3440 characters (43 lines of 80 characters).

- Models 5 displays 3564 characters (27 lines of 132 characters).

When operating in 3277-compatible data format, the 3278 Model 1 displays 480 characters (40 characters per line), and Models 2, 3, 4, and 5 display 1920 characters (80 characters per line).

A choice of keyboards, a selector light pen, a magnetic slot reader, a magnetic hand scanner, and program function keys give input flexibility.

A 3278 Display Console Model 2A is also available. It is the primary console for selected processors. An available processor console position and a Operator Console Keyboard feature are required.

3278 Highlights

The highlights of the 3278 Display Station follow.

- Fields specified by the program. Individual fields of data on the screen of the 3277 can be program-specified for protected or unprotected storage, alphameric or numeric display, nondisplay, and normal or brightened character intensity.

- Editing. Typamatic, cursor, tab, back-tab, protected-data, insert and delete, extended erase, and clear screen capabilities.

- Input flexibility. A choice of keyboards, selector light pen, and programmable function keys. An optional Magnetic Slot Reader and Magnetic Hand Scanner are available for the input of magnetically encoded data.

- Output flexibility. Allows screen information to be directed to another display or to a hard-copy device under program control.

Figure 5-3278-1. 3278 Display Station

3278 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operations. For more information about features, see an IBM sales representative.

Keyboards

Eleven keyboards are available. The keyboards have 75 or 87 keys for alphameric, control, or program selection. Keyboards are available for use with EBCDIC, ASCII, and APL character sets, and for either text, typewriter, or data entry modes of operation.

APL/Text

The APL/Text feature, with its prerequisite Extended Character Set Adapter feature, enables the 3278 to display (with modified user application programs) the 222-character APL/text character set, including the 94-character EBCDIC set.

Audible Alarm

> The Audible Alarm feature is an alarm that sounds when a character is entered in the next-to-last position on the display screen. The alarm can also be activated, under program control, to alert the operator to a special condition.

Extended Character Set Adapter

> The Extended Character Set Adapter feature supplies the additional control and buffering necessary to have access to the APL/text feature.

Keyboard Numeric Lock

> The Keyboard Numeric Lock feature alerts the keyboard operator to certain keying errors. When the cursor is positioned within a numeric input field and the keyboard numeric lock feature has been installed, the keyboard is electrically locked if any key is pressed other than the numerals 0 through 9, minus sign, decimal sign, or duplicate (DUP).

Magnetic Reader Control

> The Magnetic Reader Control feature permits the attachment of a magnetic slot reader or a magnetic hand scanner.

Programmed Symbols (PS)

> The Programmed Symbols (PS) feature permits the customer to specify, store, have access to, and display symbols and special characters. It also supplies graphic capability.

Security Keylock

> The Security Keylock feature supplies a lock and key control over the display station and all attached devices, such as the selector light pen, keyboard, and magnetic slot reader.

Selector Light Pen

> The Selector Light Pen feature is a hand-held, light-sensitive pen that enables the operator to interact directly with the display image by selecting fields of data for input to the host system.

Switch Control Unit

> The Switch Control Unit feature permits changing operational control of the display station between two different control units.

Magnetic Slot Reader

The Magnetic Slot Reader allows the reading of magnetic stripe card stock, badges, and credit-type cards. Both numeric and alphanumeric encoded characters can be read.

Magnetic Hand Scanner

The Magnetic Hand Scanner allows for the reading of magnetic stripe tags and labels. Both numeric and alphanumeric encoded characters can be read. This feature is available only with 3278s attached to 3274 Control Units.

5-3279. Color Display Station

The 3279 Color Display Station Models S2A, S2B, S3G, 2X, and 3X (Figure 5-3279-1), are table-top displays that use high-resolution color cathode-ray tubes (CRT). They can be used in clusters with the 3274 Control Unit or the 3276 Control Unit Display Station, and in combination with 3278 Display Stations and 3287 and 3289 Printers. When connected to the 3274 Control Unit, the 3279 can also be used in combination with the 3277 Display Stations and the 3284, 3286, and 3288 Printers.

The 3279 is available in five models:

- Model S2A offers base-color mode only with a screen capacity of 1920 characters in 24 lines of 80 characters.

- Model S2B offers both base-color and extended-color modes, extended highlighting, and APL/text capability with a screen capacity of 1920 characters in 24 lines of 80 characters.

- Model S3G offers both base-color and extended-color modes, extended highlighting, APL/text capability, and programmed symbols with a screen capacity of 2560 characters in 32 lines of 80 characters.

- Model 2X displays up to 1920 characters in 24 lines of 80 characters.

- Model 3X displays up to 2560 characters in 32 lines of 80 characters.
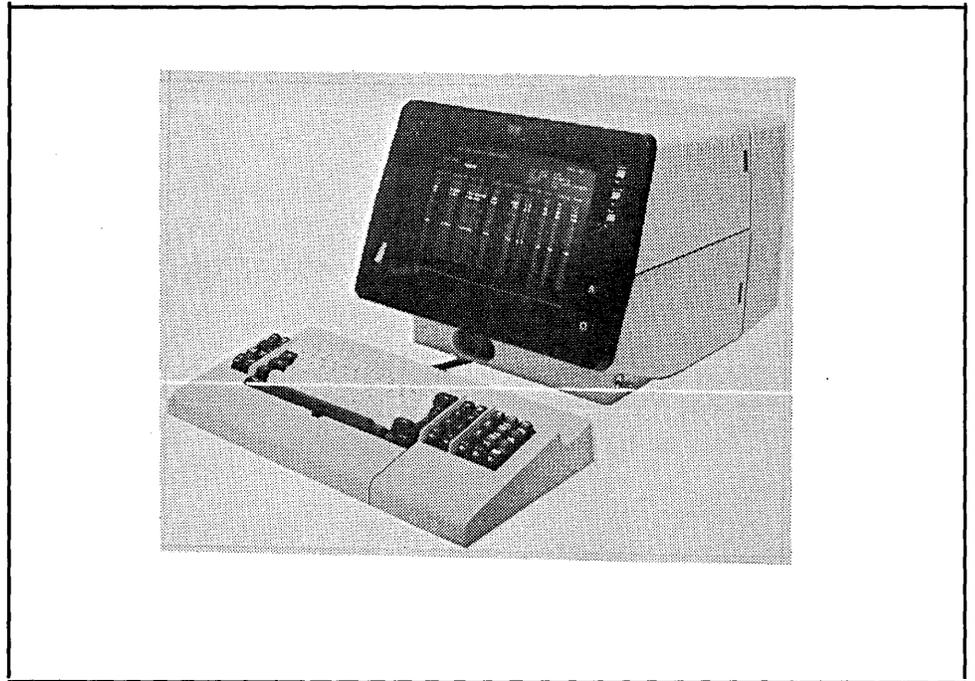
Figure 5-3279-1.   3279 Color Display Station

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A 3279 Color Display Console Model 2C is also available. It serves as the primary console for selected processors. An available processor console position and an Operator Console Keyboard feature are required.

3279 Highlights

The highlights of the 3279 Color Display Station follow.

- Fields specified by the program. Individual fields of data on the screen can be specified as protected or unprotected, alphameric or numeric data, nondisplay, normal intensity, or brightened intensity. In base-color mode, the combinations of protected/unprotected and normal/brightened attributes are also used to determine the color of the characters displayed in the field.

- Editing. Typamatic, cursor move, cursor select, tab, back-tab, protected-data, insert and delete, extended erase, home key, and clear screen capabilities.

- Input flexibility. A choice of keyboards, selector light pen, and programmable function keys. An optional Magnetic Slot Reader and Magnetic Hand Scanner are available for the input of magnetically encoded data.

- Output flexibility. Allows screen information to be directed to another display or to a hard copy device under program control.

- Security. Fields used to enter sensitive data, such as a password, can be defined by the programmer as non-display; the information keyed into a non-display field is passed to the host but is not displayed on the screen. In addition, each 3279 has a security lock and, by removing the key, the operator can prevent unauthorized use of the terminal.

3279 Attachment

The different models of the 3279 can be attached as follows:

- All models of the 3279 can be attached to all models of the 3274 Control Unit.

- Models S2A, S2B, and 2X of the 3279 can be attached to any model of the 3276 Control Unit Display Station (except Model 1).

- Models S3G and 3X of the 3279 can be attached to any model of the 3276 Control Unit Display Station (except Models 1and 2).

3279 Programming Support

The existing host application programs that support the 3278 Display Station attached to a 3274 Control Unit or a 3276 Control Unit Display Station, support the 3279 Color Display Station operating in the monochrome and base-color modes. Optimum use of colors in the base-color mode may need changes to the customer-written programs.

Functions and features such as extended highlighting, extended color, and programmed symbols available on the 3279 Models with the extended function feature, need extensions to the 3270 data stream, and the displays must be attached to a 3274 Control Unit that has the appropriate features.

3279 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operations. These features are available only for the 3279 Models 2X and 3X. For more information about features, see an IBM sales representative.

Keyboards

There are eleven types of keyboards from which to choose; all types can be used with 3279 Models 2X and 3X, but only three of them can be used with 3279 Models S2A, S2B, and S3G. The keyboards have 75 or 87 keys for alphameric, control, or program selection. Keyboards are available for use with EBCDIC, ASCII, and APL character sets, and for either text, typewriter, or data entry modes of operation.

Extended Function

The Extended Function feature provides extended color, extended highlighting, and the capability to display the APL/Text character set. (This feature is standard on the 3279 Models S2B and S3G.)

Inhibit Keyboard Numeric Lock

The Inhibit Keyboard Numeric Lock feature provides a method for the operator to override the numeric lock and enter non-numeric characters into an input field that has been programmed to accept only the numeric character set - numbers 0 through 9, minus sign, decimal sign, or duplicate (DUP).

Magnetic Reader Control

The Magnetic Reader Control feature permits the attachment of a magnetic slot reader or a magnetic hand scanner.

Magnetic Slot Reader

The Magnetic Slot Reader allows the reading of magnetic stripe card stock, badges, and credit-type cards. Both numeric and alphanumeric encoded characters can be read.

Magnetic Hand Scanner

                  The Magnetic Hand Scanner allows for the reading of magnetic stripe tags and labels. Both numeric and alphanumeric encoded characters can be read. This feature is available only with 3278s attached to 3274 Control Units.

Programmed Symbols (PS)

                  The Programmed Symbols (PS) feature (standard on the 3279 Model S3G, optional on the 3279 Model 3X) permits storage of and access to either two or six sets of 190 symbols. These symbols can be specified by the user to meet requirements for technical symbols, foreign language letters, or sets of graphic elements for pictorial display.

Selector Light Pen

                  The Selector Light Pen feature is a hand-held, light-sensitive pen that enables the operator to interact directly with the display image by selecting fields of data for input to the host system.

3279 Accessories

                  The following accessories can be ordered through an IBM sales representative to expand or customize the user's operations. These accessories are available only for the 3279 Models 2X and 3X. For more information, see an IBM sales representative.

Switch Control Unit

                  The Switch Control Unit permits changing operational control of the display station between two different control units.

Tilt/Rotate

                  The Tilt/Rotate unit fits under the 3279 and allows the operator to adjust the angle of the display to suit the working environment.

5-3767. Communication Terminal

The 3767 Communication Terminal Models 1, 2, and 3 (Figure 5-3767-1) contain all functions and controls in one integrally designed desk-top unit. This terminal is a keyboard/bi-directional printer device for entering data into and retrieving data from a processor through a 2701 Data Adapter Unit.

The 3767 is available in three models:

*   Model 1 prints up to 40 cycles per second.

*   Model 2 prints up to 80 cycles per second and includes dual 256-byte line buffers and has full buffer editing capability.

*   Model 3 prints up to 120 cycles per second and includes dual 256-byte line buffers and has full buffer editing capability.
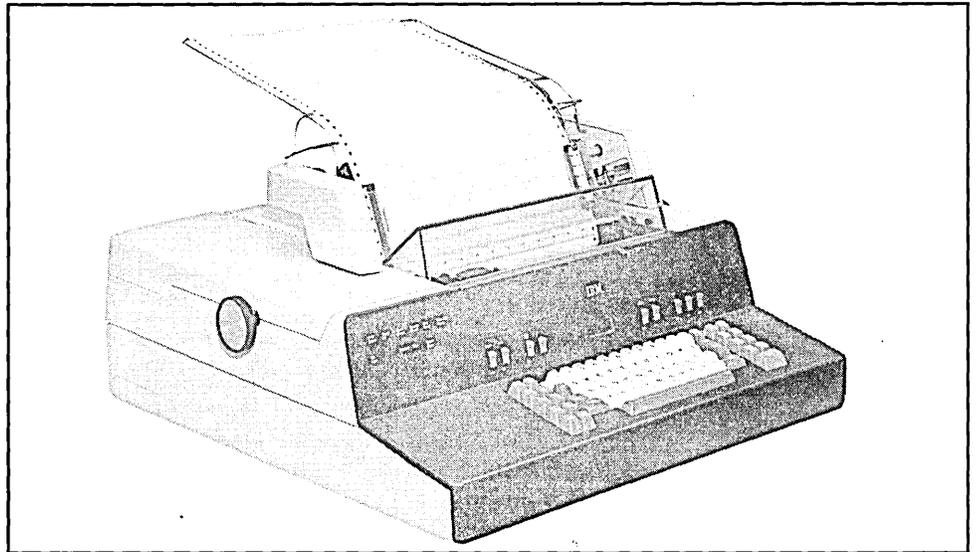
Figure 5-3767-1. 3767 Communication Terminal

3767 Highlights

The highlights of the 3767 Communication Terminal follow.

Printer

Maximum printer throughput is obtained with bi-directional serial matrix printing. The printer dot matrix is 4 of 7 wide by 8 high to give legibility with character spacing at 10 characters to the inch. Line spacing is 6 lines to the inch. Multipart (up to six part) forms, and continuous forms maybe used. Maximum form width is 15 inches.

Keyboard

The keyboard is available in EBCDIC or Correspondence arrangements and includes Typamatic on the hyphen, underscore, backspace, and space keys. There are 44 standard alphanumeric data keys, function keys, indicator lights, mode switches, and a 3-position numeric print position indicator display available to the operator.

Security Enhancement

The print suppress function permits selected data fields to be entered without being printed. An optional security keylock and optional Magnetic Stripe Reader for customer identification are also available.

3767 Special Features

In addition to special features for Acoustic Couplers, EIA Interfaces, Start/Stop options, and various modem options, the following special features are also available.

Alternate Character Set

The Alternate Character Set feature provides a switch control for printing an alternate set of graphic characters.

ASCII Character Set

The ASCII Character Set feature permits the use of a 48 character ASCII keyboard and graphics instead of the EBCDIC or Correspondence keyboards.

Buffer with Edit

The Buffer with Edit feature provides two 256 byte buffers (Model 1) or two additional 256 byte buffers (Models 2 and 3) for receiving data. On key entry, these features provide full buffer (512 or 1024) edit capability under key control.

Calculate Scientific

The Calculate Scientific feature allows (in offline mode and under switch control) a standard keyboard to be used for arithmetic and calculating functions; i.e., square root, logarithms, constants, trigonometric functions, and basic addition, subtraction, division, and multiplication. Sixteen digits are allowed for input and output calculations and two memories are provided for the temporary storage of totals.

Variable Width Forms Tractor

The Variable Width Forms Tractor feature provides a forms feeding device for continuous edge-punched forms. Forms from 3 to 15 inches may be used.

Vertical Forms Control

The Vertical Forms Control feature allows vertical forms to skip to preset locations on the form.

5-8775. Display Terminal

The 8775 Display Terminal Models 11 and 12 (Figure 5-8775-1) consist of a display unit, and an attached keyboard. Special features include a selector light pen and magnetic slot reader.

The 8775 is available for attachment to S/370 processors in two models:

* Model 11 offers a screen capacity of 960, 1920, or 2560 display characters in a 9 by 16 dot-character matrix.

* Model 12 offers a screen capacity of 960, 1920, or 2560 display characters in a 9 by 16 character matrix, and 3440 characters in a 9 by 12 dot-character matrix.
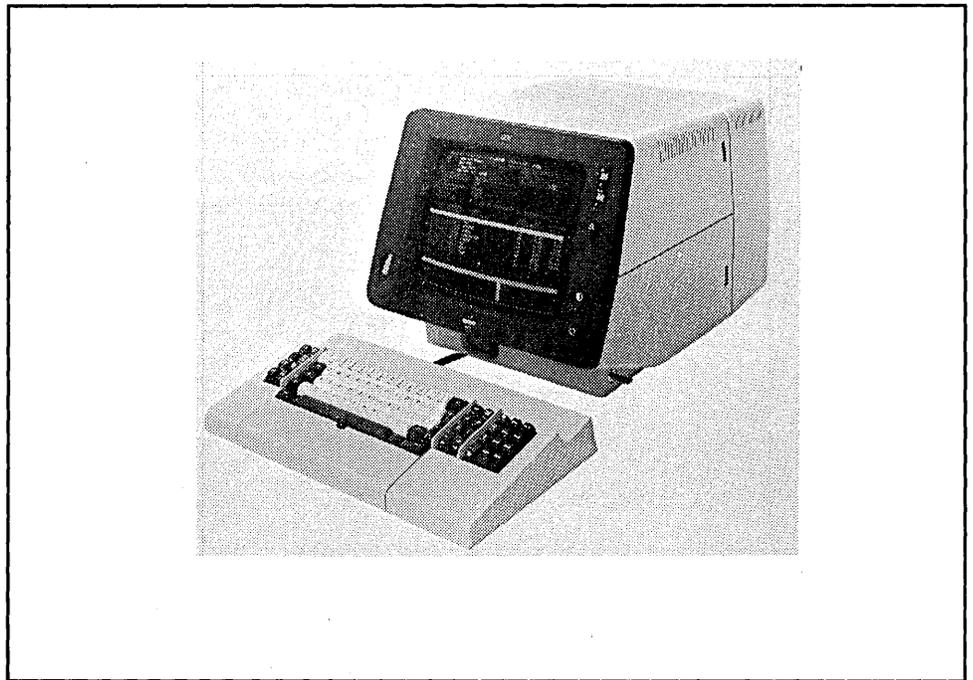
Figure 5-8775-1. 8775 Display Terminal

8775 Highlights

The highlights of the 8775 Display Terminal follow.

Processor Attachment

Models 11 and 12 of the 8775 attach to a S/370 processor through a 3704/3705 controller. The logical structure formats, protocols, and operational sequences used for transmitting data between an 8775 and a S/370 processor are specified by the System Network Architecture (SNA).

8775 Programming Support

Programming support for the 8775 is supplied by the Distributed Processing Programming Executive (DPPX) and the Distributed Processing Control Executive (DPCX) program products described below.

DPPX Support

The DPPX base and associated DPPX program products support consists of:

• The 3270 Data-Stream Compatibility (DPPX/DSC) program product, which enables existing System/370 applications to be used with the 8775.

• Basic support for writing application programs. Application programs that take advantage of the 8775's enhanced functions can be written at the data-stream level using DPPX Base support.

• High-level support for writing application programs. The Distributed Presentation Services program supplies high-level support for writing applications that take advantage of 8775 functions. Such applications can be written in COBOL (DPPX/COBOL) or Assembler (DPPX/ASSM) language. The Distributed Presentation Services program has two components: Interactive Map Definition (a special feature) and Format Management (the base product). Interactive Map Definition enables formatted screens to be interactively designed during program development; Format Management supplies an interface enabling the application program to use the screens that have been designed, and build the needed format on the screen at run time.

• Control of the 8775 microcode library and loading of the 8775 enhanced function feature and the multiple partitions and scrolling feature.

DPCX Support

The DPCX Base program and DPCX Feature support is as follows:

- The single-station 8775 Display Terminal is supported as a 3276.

- The 3270 Data-Stream Compatibility (DPPX/DSC) program product enables existing System/370 applications to be used with the 8775.

- The user programs can communicate with the 8775 using full-screen processing.

8775 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operations. For more information about features, see an IBM sales representative.

Audible Alarm

The Audible Alarm feature supplies a short variable-amplitude tone alarm when a character is entered in the next-to-last position of the partition under keyboard operation. The alarm can also be activated, under program control, to alert the operator to a special condition.

Enhanced Function Feature

The Enhanced Function feature controls the action of the operator and assists as follows:

Highlighting: This function highlights 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: This function displays data in up to eight user-defined rectangular areas, each area functioning as a separate display. Also, the operator can continue to enter data in one partition while the application program processes data in or writes to another partition.

Field Validation: This function permits the application program to identify data fields as:

- Mandatory Enter. Fields that must be completed before the ENTER key is pressed.

- Mandatory Fill. Fields that must be completed before the cursor can be moved to another field.

- Trigger Field. Automatic data transfer to the processor. The function is triggered by the operator's attempt to move the cursor from the designated field.

Keyboard

The keyboard features allow a choice of 75- and 87-key typewriter keyboards, two types of data entry keyboards, APL and overlay keyboards, and Japanese English and Japanese Katakana keyboards.

Each keyboard is movable and each has editing features such as: repeat-action, 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 alphameric, special symbol, and cursor move keys have repeat-action capability. Fields of data can be sensed by positioning the cursor and pressing the Cursor Select key instead of using the selector light pen.

Keyboard Numeric Lock

The Keyboard Numeric Lock feature supplies a means of alerting the keyboard operator to certain keying errors. When the cursor is positioned within a numeric input field and the keyboard numeric lock feature has been installed, the keyboard is electrically locked if any key is pressed other than the numerals 0 through 9, minus sign, decimal sign, or duplicate (DUP).

Magnetic Reader Control

The Magnetic Reader Control feature permits the attachment of a magnetic slot reader that reads encoded information from a magnetic stripe. The magnetic slot reader is available as a part number from an IBM sales representative or can be ordered by feature code for a new terminal.

Monocase Switch

The Monocase Switch feature permits the choice of displaying either uppercase characters only or both uppercase and lowercase characters.

Multiple Partitions and Scrolling

The Multiple Partitions and Scrolling feature gives the ability to divide the screen in up to eight user-defined rectangular data areas. Vertical scrolling within a specified partition is achieved without intervention by the host system. Line-by-line scrolling is controlled from the keyboard using the scroll-up and scroll-down keys.

Note: The multiple partitions and scrolling feature and the enhanced function feature may be present on the same terminal, but the user can only select the functions of one and not of both features at any one time.

Programmed Symbols (PS)

The Programmed Symbols (PS) feature permits storage of and access to either two or six sets of 190 symbols, which can be specified by the user to meet requirements for technical symbols, foreign language letters, or sets of graphic elements for pictorial display.

Security Keylock

The Security Keylock feature prevents modification and display of data in the display terminal unless the key is in the ON position.

Selector Light Pen

The Selector Light Pen feature permits the operator to select information from the display screen and cause the selections to be identified to the application program.

Set Up Keylock

The Set Up Keylock feature controls access by the operator to change the unit address of the terminal through the keyboard.

Part 6. Magnetic Character Readers

Contents

Introduction

Magnetic character readers use magnetic ink character recognition (MICR) to read and sort card and paper documents in banking applications. These devices operate on documents when the type font (MICR E13B), print quality, and code-line arrangement meet the specifications recommended by the American Bankers Association.

Magnetic Character Reader Data Comparison Table

Figure 6-1 compares the data for the magnetic character readers described in this chapter.

I/O DEVICES	MODELS	DOCUMENT SIZES AND SPECIFICATIONS MILLIMETER	INCH	MAXIMUM SPEED (DOCUMENTS PER MINUTE)	STACKERS (POCKETS)	READING * CAPABILITY
1255	1	w = 64 to 108	w = 2.5 to 4.25	500 (6-inch documents)	6	Reads magnetically inscribed MICR E13B printing that meets specifications recommended by the American Bankers Assoc. Technical Committee on Mechanization of check handling.
	2	1 = 146 to 225	1 = 5.75 to 8.875	750 (6-inch documents)	6	
	3	t = 0.076 to 0.178	t = 0.003 to 0.007	750 (6-inch documents)	12	
1419	1	w = 70 to 93 1 = 152 to 225 t = 0.076 to 0.178	w = 2.75 to 3.66 1 = 6 to 8.875 t = 0.003 to 0.007	1600	13	
3890	A1, B1	w = 70 to 106 1 = 123 to 222 t = 0.064 to 0.178	w = 2.75 to 4.17 1 = 4.85 to 8.75 t = 0.0025 to 0.007	2400 (Minimum)	6	
	A2, B2				12	
	A3, B3				18	
	A4, B4				24	
	A5, B5				30	
	A6, B6				36	

w = width 1 = length t = thickness

* There are more capabilities and features available, see the IBM sales representative for more information.

Figure 6-1. Comparison Data for Magnetic Character Readers

6-1255. Magnetic Character Reader

The 1255 Magnetic Character Reader (Figure 6-1255-1 and Figure 6-1255-2 on page 6-1255-2) can read and sort a variety of magnetically inscribed documents at relatively high speeds.

In a typical application, the 1255 performs selective data storing from MICR-encoded checks for updating of demand-deposit accounts. Continuous document loading, optimum document stacking, and simplicity of operation help improve throughput.
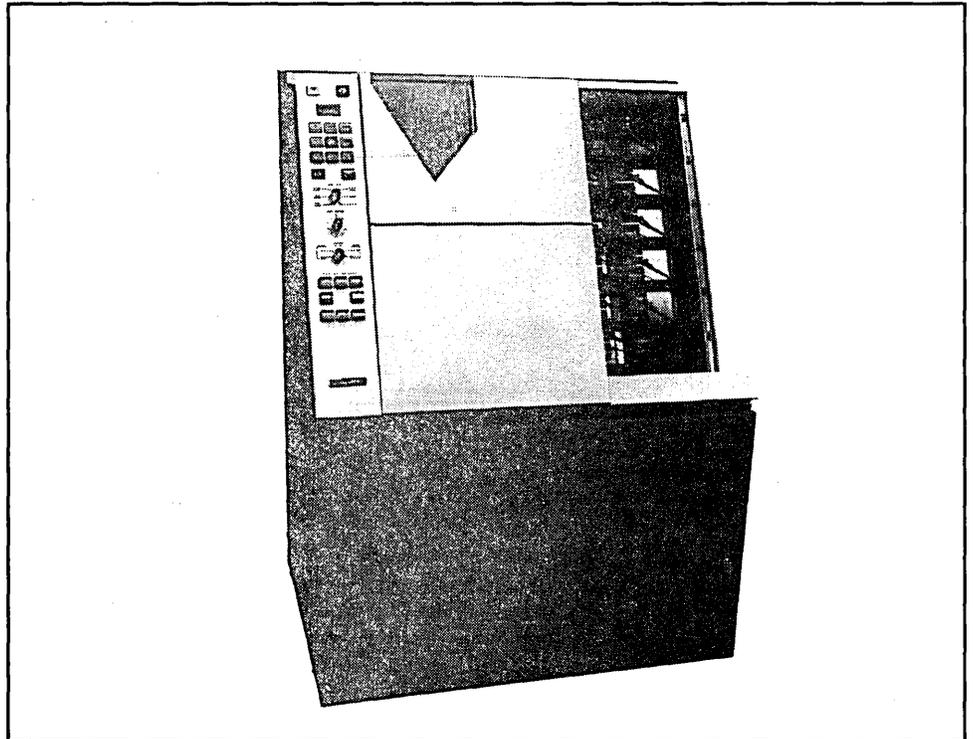
Figure 6-1255-1. 1255 Magnetic Character Reader Model 1 or 2

The 1255 is available in three models:

- Model 1 reads and sorts up to five hundred 152 millimeter (6 inch) long documents per minute into six stackers.

- Model 2 reads and sorts up to seven hundred fifty 152 millimeter (6 inch) long documents per minute into six stackers.

- Model 3 reads and sorts up to seven hundred fifty 152 millimeter (6 inch) long documents per minute into 12 stackers.

The speed of processing varies with the 1255 model as well as with factors such as document length and paper quality.
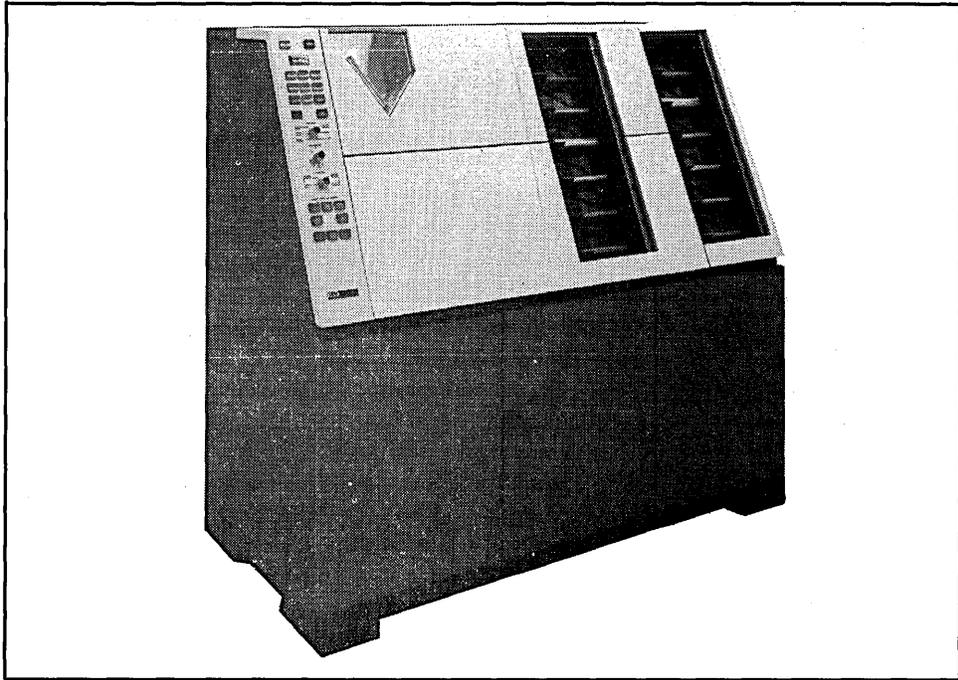
Figure 6-1255-2. 1255 Magnetic Character Reader Model 3

1255 Highlights

The highlights of the 1255 Magnetic Card Reader follow.

Processor Attachment

The 1255 needs one control unit position on a system channel.

Document Feed

The documents can be intermixed and can range from 64 to 108 millimeter (2.5 to 4.25 inch) wide, 146 to 225 millimeter (5.75 to 8.875 inch) long, and 0.076 to 0.178 millimeter (0.003 to 0.007 inch) thick.

Stackers

The 1255 has horizontal stackers; each one can hold a 635 millimeter (2.5 inch) stack of documents. Models 1 and 2 have six stackers in one vertical bay, and the Model 3 has 12 stackers in two bays.

Operator Panel

The operator panel contains switches, indicators, and an operator-resettable document counter. This panel is grouped with the feed hopper and the stackers for operator convenience. This grouping also makes operator training easier, and helps minimize space needs.

Offline Sorting

The 1255 can also be used offline to perform fine sorting of checks (usually by account number) or validity checking without sorting. An operator panel switch permits the 1255 to change from online to offline operation and vice versa.

1255 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Dash Symbol Transmission

The Dash Symbol Transmission feature transmits the E13B dash symbol (Figure 6-1255-3) from the transit field to storage.

High-Order Zero & Blank Selection

The High-Order Zero & Blank Selection feature is an offline feature for the Model 3. It permits selection of specified documents into a specific stacker. These are documents that have only blanks in the sort position and in all higher order positions of the field.

Self-Checking Number/Improved Recognition

The Self-Checking Number/Improved Recognition feature reduces account number rejects besides performing the basic self-checking number function. The account field is especially subject to folds, banding, and print specification deviations. Character rejects are reduced relative to the damage of the documents, thereby reducing the user's check-processing expense.

51-Column Card Sorting

The 51-Column Card Sorting feature permits the 1255 to read and sort 51-column cards that are magnetically inscribed.
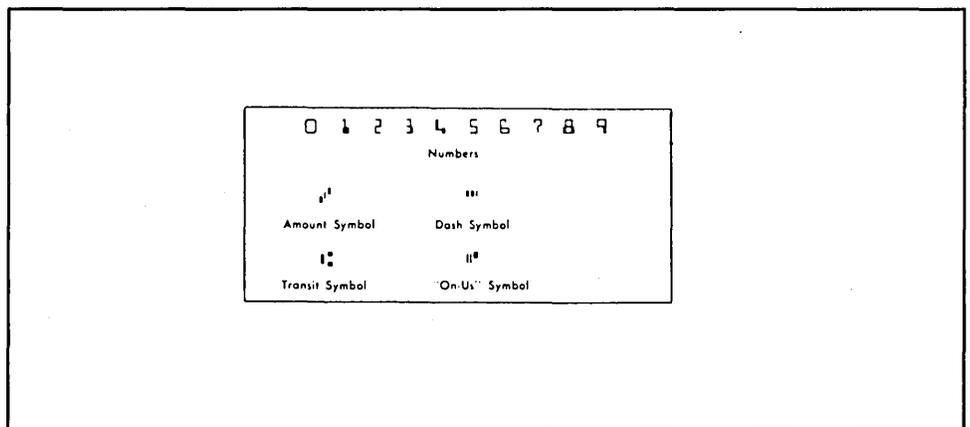
Figure 6-1255-3. Font E13B Magnetic-Ink Characters

6-1419. Magnetic Character Reader

Data inscribed magnetically on checks (Figure 6-1419-1) and other banking documents is read at nominal speeds of 1600 documents per minute by the 1419 Magnetic Character Reader Model 1. Specific speeds vary with document length as well as with the program used.
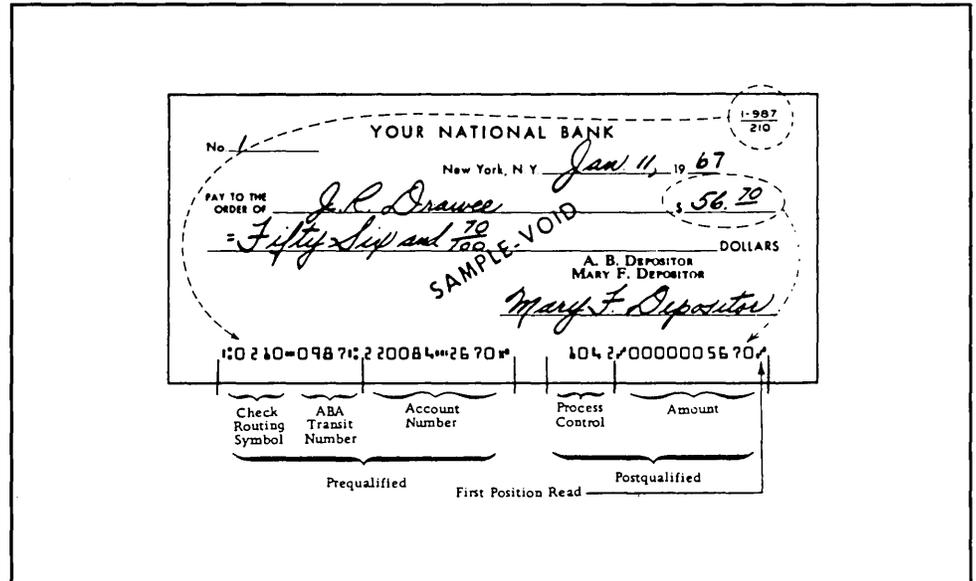
Figure 6-1419-1. 1419 Magnetic Inscription, Character Translation and Field Definitions

1419 Highlights

The highlights of the 1419 Magnetic Card Reader follow.

Processor Attachment

The 1419 needs a channel control unit position on a system channel.

Stackers

The 1419 has 13 stackers for a wide range of sorting or selection needs. As the documents are read, they can be sorted into as many as 13 pockets classified as follows: A, B, 0 through 9, and R (reject). All magnetic inscriptions can be checked for validity.

Document Feed

Documents read by the 1419 can be of intermixed sizes and thicknesses, as typically encountered in check-handling operations. The standard minimum length is 152 millimeter (6 inch); shorter documents, such as the 51-column postal money order need the 51-Column Card Sort feature and can be read into the system at a maximum rate of 1960 documents per minute.

These shorter documents can be intermixed with standard-length documents, and can also be sorted if a no-charge 51-Column Card Sorting special feature for that purpose is installed. If the feature is not installed on the 1419, 51-column cards and other documents shorter than 127 millimeter (5 inch) are sent to the reject pocket. If the feature is installed, 1419 speed is reduced by an amount that increases slightly with the average length of documents and is 4.3 percent for 51-column cards, and 5.3 percent for 152 millimeter (6 inch) checks.

1419 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. The list of features may not be complete and more may be available. For more information about features, see an IBM sales representative.

Batch Numbering

The Batch Numbering feature supplies an automatic method of advancing a batch number document identification under program control. It contains a six-position impact printer that prints up to 999,999 in any one of six locations on the back of the document. The high-order digit is set by hand and the remaining digits are advanced under program control.

Dash Symbol Transmission

The Dash Symbol Transmission feature distinguishes U.S. from Canadian transmit-routing numbers (leftmost eight magnetic digits) to prevent duplications.

Endorser

The Endorser feature permits the 1419 to print the bank's endorsement on the back of each document without reducing its operating speed.

Expanded Capability

The Expanded Capability feature supplies a command for operation under OS, which removes the exposure to data overruns caused by 1419s interfering with other 1419s operating on the same channel.

Multiple Column Control

The Multiple Column Control feature permits the 1419 to select documents with specific numbers in four or less columns of any field.

Program Control for Pocket Lights

The Program Control for Pocket Lights feature improves control of output batches by stopping the reading-sorting operation and turning on pocket lights(s) when a predetermined number of documents has entered one of the corresponding six pockets (with a second feature, 12 pockets) specified by the program.

Self-Checking Number

The Self-Checking Number feature automatically performs mathematical proof that account numbers are correctly recorded and read.

Split Field

The Split Field feature separates any field into two elements after the first ABA dash symbol that follows a digit.

51-Column Card Sorting

The 51-Column Card Sorting feature permits the 1419 to sort 51-column card documents, which can be intermixed with documents and cards within specifications.

6-3890. Document Processor

The 3890 Document Processor (Figure 6-3890-1) has continuous operation (often with only one operator) for reading magnetically inscribed data from card and paper documents into an IBM processor at a rate of 2400 documents 152 millimeter (6 inch) long per minute. Actual throughput varies with the length of the documents. The built-in control and logic functions permit the 3890 to operate time-independently of the IBM processor during online operation. The 3890 can also be used offline for document sorting. It attaches to an IBM processor through a byte or block multiplexer channel.
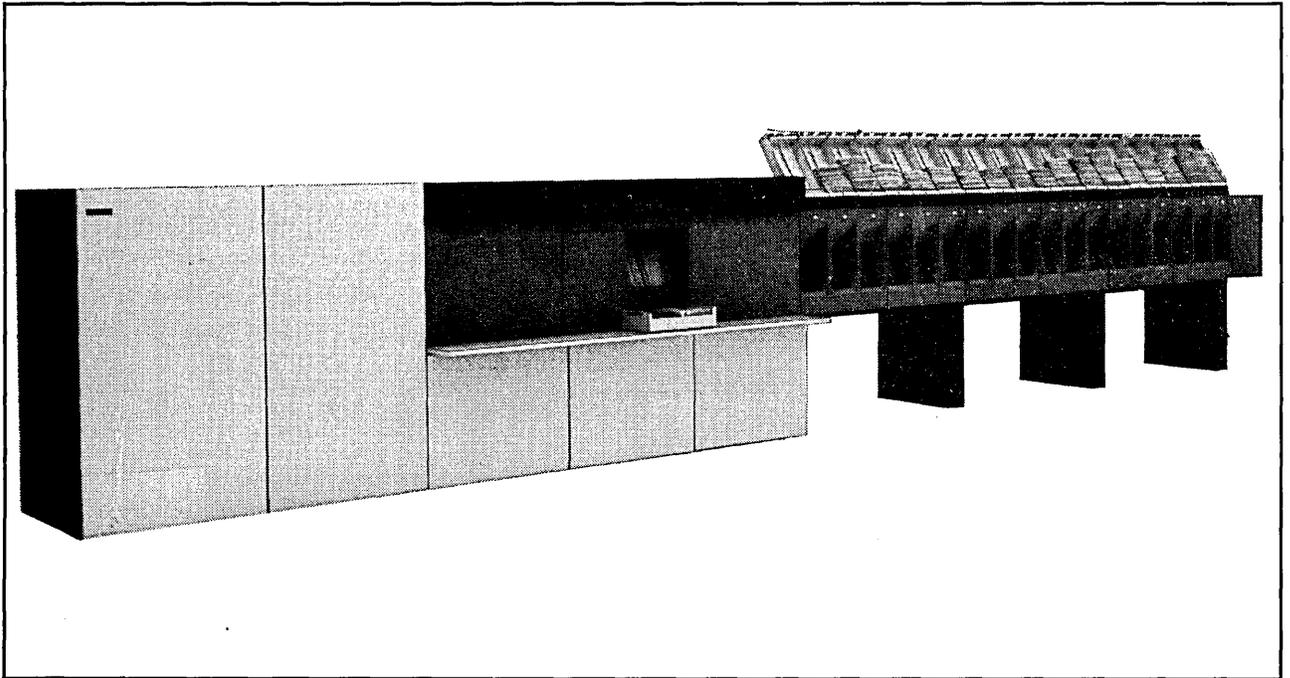
Figure 6-3890-1. 3890 Document Processor Model A3

The 3890 Document Processor is available in 20 models. The following table (Figure 6-3890-2) gives the significant characteristics of each model.

Model	No. of Stackers	Read Rates*	Storage	Storage IP**	Input Hopper	Micro- Filming	SYS / 370 Attach
A1	6	2400	13 313	10 240	4800	OPT	OPT
A2	12	2400	13 313	10 240	4800	OPT	OPT
A3	18	2400	13 313	10 240	4800	OPT	OPT
A4	24	2400	13 313	10 240	4800	OPT	OPT
A5	30	2400	13 313	10 240	4800	OPT	OPT
A6	36	2400	13 313	10 240	4800	OPT	OPT
B1	6	2400	29 696	26 624	4800	OPT	OPT
B2	12	2400	29 696	26 624	4800	OPT	OPT
B3	18	2400	29 696	26 624	4800	OPT	OPT
B4	24	2400	29 696	26 624	4800	OPT	OPT
B5	30	2400	29 696	26 624	4800	OPT	OPT
B6	36	2400	29 696	26 624	4800	OPT	OPT
E3	18	1680	13 312	10 240	3800	STD	STD
E4	24	1680	13 312	10 240	3800	STD	STD
E5	30	1680	13 312	10 240	3800	STD	STD
E6	36	1680	13 312	10 240	3800	STD	STD
F3	18	1680	29 696	26 624	3800	STD	STD
F4	24	1680	29 696	26 624	3800	STD	STD
F5	30	1680	29 696	26 624	3800	STD	STD
F6	36	1680	29 696	26 624	3800	STD	STD

* The minimum read rate for 6—inch documents

** Storage capacity with image processing

Figure 6-3890-2. 3890 Model Characteristics

3890 Highlights

The highlights of the 3890 Document Processor follow.

Processor Attachment

The 3890 requires a control unit position on a processor's byte or block multiplexer channel.

Stackers

Each stacker pocket holds 800 to 1000 documents per pocket (up to 36 pockets are available). All but the last 200 to 300 documents can be unloaded by the operator without stopping the 3890.

Input Hoppers

The input hopper on Models A and B have a built-in jogger and hold approximately 4800 documents. The input hopper on Models E and F hold approximately 3800 documents.

Merge Feed

The merge feed unit permits the merging of documents into a normal input stream from a separate hopper.

Logic and Control Part

The control program is loaded online from an IBM processor or loaded offline from a removable IBM diskette. The logic capability permits the following standard programmable functions: split field, self-check number verification, multiple-column control, and base-number conversion.

Documents

The documents can be intermixed and can range from 123 to 223 millimeter (4.85 to 8.75 inch) long, 70 to 106 millimeter (2.75 to 4.17 inch) wide, and 0.064 to 0.178 millimeter (0.0025 to 0.007 inch) thick.

3890 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operations. For more information about features, see an IBM sales representative.

Item Numbering/Endorsing

The Item Numbering/Endorsing feature permits the printing of an eight-digit number or full endorsement on the back of each document. The new endorser design reduces the time needed to change the plate by the operator. This is for users that need to print different endorsements for different types of work.

Microfilming

The Microfilming feature permits selective filming of some or all items being processed without reducing throughput. Document filming can be either front and back or front only. Filming and indexing are separately controlled. The film cassette (available as an accessory) has a capacity of up to 610 meters (2000 feet) of 0.069 millimeter (0.0027 inch) thick polyester thin-base 16 millimeter film, which will record approximately 380,000 front-and-back images of an average document mix. Loading and unloading of the film from the cassette into the film transport is automatic, under operator control.

Part 7. Optical Readers

Contents

Introduction

Online optical readers can enter data into a system directly from machine-readable source documents, thereby eliminating transcription operations such as card punching, verifying, and taping. This also reduces data-entry transcription errors, one of the most important advantages of the optical readers. Consequently, optical readers offer reduced processing costs, quicker turnaround, fewer data-entry errors, and improved overall system efficiency. Nurses, teachers, sales people, meter readers, driver's license applicants, and many others can originate data that can be directly entered for processing.

Optical Reader Data Comparison Table

Figure 7-1 compares data for the optical character readers described in this chapter.

| I/O DEVICES | DOCUMENT SIZES | | BCD | OCR-A | OCR-B | MARK READ | HANDPRINT NUMBERS |
	MILLIMETER	INCH					
1287	w = 57 to 76 l = 76 to 229	2.25 to 5.91 3 to 9	No	Yes	No	No	Yes
1288	w = 76 to 229 l = 165 to 356	3 to 9 6.5 to 14	No	Yes	No	Yes	Yes
3881	w = 76 to 229 l = 76 to 305	3 to 9 3 to 12	Yes	No	No	Yes	No
3886	w = 76 to 229 l = 76 to 305	3 to 9 3 to 12	No	Yes	Yes	No	Yes

w = width l = length

* There are more capabilities and features are available, see an IBM sales representative for more information.

Figure 7-1. Comparison of Optical Character Reader Characteristics

7-1287. Optical Reader

The 1287 Optical Reader (Figure 7-1287-1) can read typed and machine-printed alphameric data and hand-printed numbers, letters, and marks from cut-form documents that have a variety of formats, orientations, types of data, and field lengths. The data of source documents can be organized in fixed- or variable-length fields, in columns or rows, and can be read in any sequence.

The 1287 is available in three models:

- Model 1 reads up to 24 lines of data from a document, each line may have as many as 84 characters.

- Model 3 has the capabilities of the Model 1 plus the ability to read the alphameric OCR-A font size I (Figure 7-2) printed by the IBM SELECTRIC ⊙ typewriter or 1403 Printer.

- Model 5, as its basic function, reads multiple lines of handprinted digits and some alphabetic characters (0 through 9, C, S, T, X, and Z) from cut-form documents.
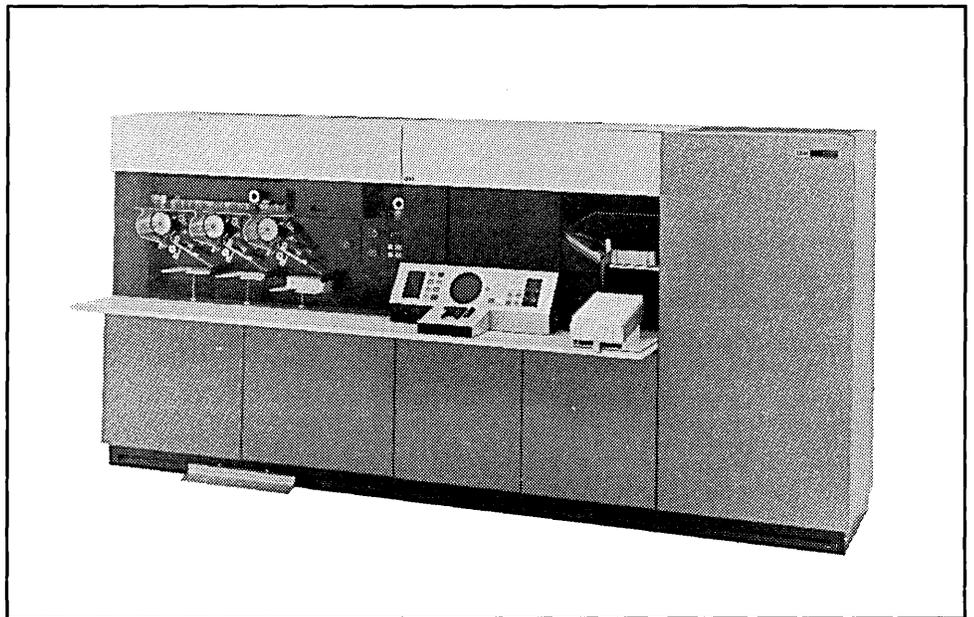
Figure 7-1287-1. 1287 Optical Reader Model 5

1287 Highlights

The highlights of the 1287 Optical Reader follow.

Processor Attachment

The 1287 contains its own control unit and needs a control unit position on a system channel. It can attach to a byte multiplexer channel, block multiplexer channel, or selector channel.

Document Sizes

The 1287 reads data from input forms in a variety of widths and lengths. The document size can range from 76 to 229 millimeter (3 to 9 inch) in length and 57 to 150 millimeter (2.25 to 5.91 inch) in width.

Throughput Rates

The speed of document processing varies with the size of each document and the number of characters and fields to be read, and is calculated from established formulas. Maximum document throughput can be as high as 665 documents per minute for 76 millimeter (3 inch) stubs, each with one field of 20 machine-printed characters.

Character Recognition

The 1287 reads the symbols and characters of the OCR-A font sizes I and IV (Figure 7-1287-2 on page 7-1287-3). Reading ability can be expanded with special features. When the 1287 encounters a character that it does not recognize, it automatically starts another scan operation. If the character is not recognized after 10 scan operations, the 1287 either displays the character on a cathode-ray tube for keyboard (online) correction and then goes to the next character, or the unrecognized character is transmitted to the processor as the standard EBCDIC substitute character code.

IBM 1428 Font	OCR-A Font Size I	OCR-A Font Size IV	Farrington Selfchek 7B* Font	Handprinted Character Set	NCR Optical Font (NOF)**		OCR-A Font Size I IBM SELECTRIC (or equivalent)®			IBM 1403 (or equivalent)		
0	0	0	0	0	0	ó	0	A	N :	0	A	N
1	1	1	1	1	1	P	1	B	0 ;	1	B	0
2	2	2	2	2			2	C	P .	2	C	P .
3	3	3	3	3	2	d	3	D	Q ,	3	D	Q ,
4	4	4	4	4			4	E	R /	4	E	R /
5	5	5	5	5	3	Ψ	5	F	S -	5	F	S -
6	6	6	6	6			6	G	T *	6	G	T *
7	7	7		7	4	Η	7	H	U •	7	H	U •
8	8	8	5	8			8	I	V &	8	I	V &
9	9	9	6	9	5	₩	9	J	W		9	J	W
C	C		7	C			Y	K	X -	Y	K	X
N	N		8	S	6	blank	J	L	Y	J	L	Y
S	S		9	T			H	M	Z blank	H	M	Z
T	T			Z	7						blank	
X	X			X			Expanded Symbol Set					
Z	Z				8		+ %					
|	|						= '					
	J				9		{ "					
	Ч						} "					
⌐	⌐											
blank	blank			blank								

*Farrington Selfchek 7B shown by permission of Farrington Manufacturing Co.
**NCR Optical Font shown by permission of National Cash Register Co.

Note: Characters and symbols are shown reduced in size.

Figure 7-1287-2. 1287 Readable Fonts, Letters, and Symbols

1287 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Expanded Symbol Set

The expanded symbol set feature increases the reading capability of the 1287 Model 3 by permitting it to read the symbols +, =, {, }, ?, %, ', and " made by an IBM Selectric typewriter or similar machine.

Farrington 7B Font

The Farrington 7B Font feature permits Models 1 and 3 to read characters in Farrington Selfchek (Trademark of Farrington Manufacturing Company) on documents imprinted by credit-plate imprinters.

Machine Printed OCR Font

The Machine Printed OCR Font feature permits the Model 5 to read numeric 1428, OCR-A, and Farrington Selfchek 7B fonts, each in separate specified fields in a document.

Numeric Handwriting

The Numeric Handwriting feature permits the 1287 to read handprinted numbers and letters (0 through 9, C, S, T, X, and Z, blockprinted with a number 2 pencil or with HB lead) and numbers printed in Gothic 3/16-inch font.

Optical Mark Reading

The Optical Mark Reading feature permits Models 1, 3, and 5 to recognize penciled marks entered as data. The marks (made with a number 2 pencil) can be vertical, at an angle of 45 degrees, or horizontal.

Serial Numbering

The Serial Numbering feature permits operator-controlled numbering of documents for visual reading. Documents as small as 76 by 121 millimeter (3 by 4.75 inch) can be numbered from 00000 to 99999.

1428 and ANSCS OCR Font

The 1428 and ANSCS OCR Font feature permits Models 1 and 3 of the 1287 to read the 1428 and OCR-A fonts separately in specified fields in a document.

7-1288. Optical Page Reader

The 1288 Optical Page Reader Model 1 (Figure 7-1288-1) reads data from cut-form documents that range in size from 76 by 165 millimeter (3 by 6.5 inch) to 229 by 356 millimeter (9 by 14 inch). Because the 1288 can read mixed data on documents smaller than punched cards and as large as legal-size forms, it can be used in a variety of applications in government, business, and industry.
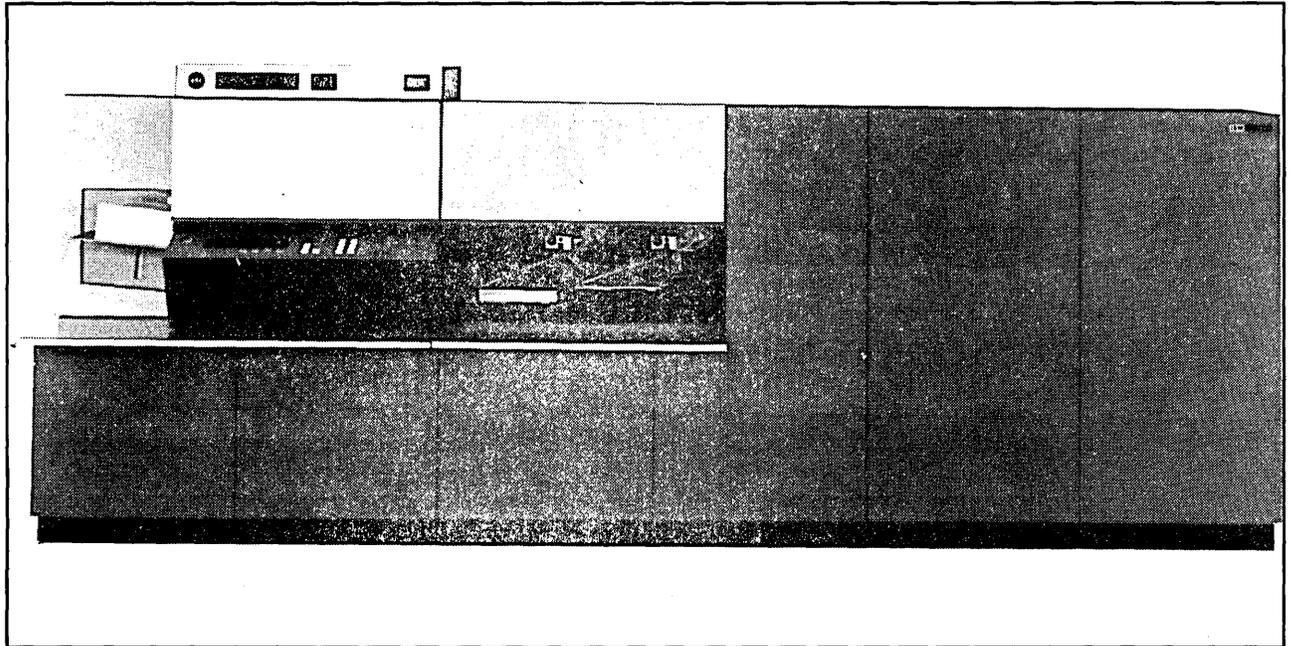
Figure 7-1288-1.   1288 Optical Page Reader

1288 Highlights

The highlights of the 1288 Optical Page Reader follow.

Processor Attachment

The 1288 contains its own control unit and needs a control unit position on a system channel. It can attach to a byte multiplexer channel, block multiplexer channel, or selector channel.

Modes of Operation

The 1288 can process both formatted and unformatted documents. In formatted mode, the 1288 reads fixed- and variable-length fields in any sequence. In unformatted mode, the machine reads multiple and continuous variable-length lines of alphameric data, up to 6 lines per inch, right- or left-justified.

Processing Speed

The speed of document processing varies with the size of each document, the format (if any), and the organization of the processing program, and can be calculated from established formulas.

Input Hopper

The input hopper unit of the 1288 can hold a 254 millimeter (10 inch) stack of documents, and the two output stackers can hold either a 114 millimeter (4.5 inch) stack of short documents or a 76 millimeter (3 inch) stack of long documents. After each document is read, it is routed to one of the two output stackers; one stacker is reserved for documents that contain unrecognizable characters.

Unrecognizable Characters

When the 1288 encounters a printed Gothic or handprinted character that it does not recognize, it automatically scans it again. If the character remains unreadable, the 1288 transmits a substitute character to the processor and, under program control, sends the document to the output stacker for offline correction.

1288 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Expanded Symbol Set

The expanded symbol set feature permits the 1288 to read the symbols +, =, {, }, %, ?, ', and " made by an IBM Selectric typewriter or similar machine.

Numeric Handwriting

The numeric handwriting feature permits the 1288 to read handprinted numbers and letters (0 through 9, C, S, T, X, and Z) and printed numbers in 3/16-inch Gothic font.

Optical Mark Reading

The optical mark reading feature permits the 1288 to read vertical or 45-degree-angle penciled lines entered as data.

Serial Numbering

The serial numbering feature permits operator-controlled numbering of documents for visual reading. Documents as small as 76 by 121 millimeter (3 by 4.75 inch) can be numbered from 00000 to 99999.

7-3881. Optical Mark Reader

The 3881 Optical Mark Reader Model 1 (Figure 7-3881-1) is well suited for convenient, quick, and economical data input in a variety of applications in industry, commerce, and institutional organizations. This high-speed optical mark reader reads penciled and machine-printed marks on a variety of document sizes, weights, and formats.

The 3881 can do a variety of applications because of its internal processor, its high-density mark reading (up to 2480 mark positions per 229 by 305 millimeter (9 by 12 inch) form, and its flexible forms-feeding transport. Adjusting the reader for documents of different sizes takes only a few seconds.

The 3881 is available in three models:

- Model provides online attachment to a processor. Documents are read under processor program control and data is transferred to the processor.

- Model 2 operates independently of a processor. Documents are read under 3881 control and output is written on an IBM 3410 Magnetic Tape Unit.

- Model 3 operates independently of a processor. Documents are read under 3881 control and output is written on an IBM Diskette Unit.
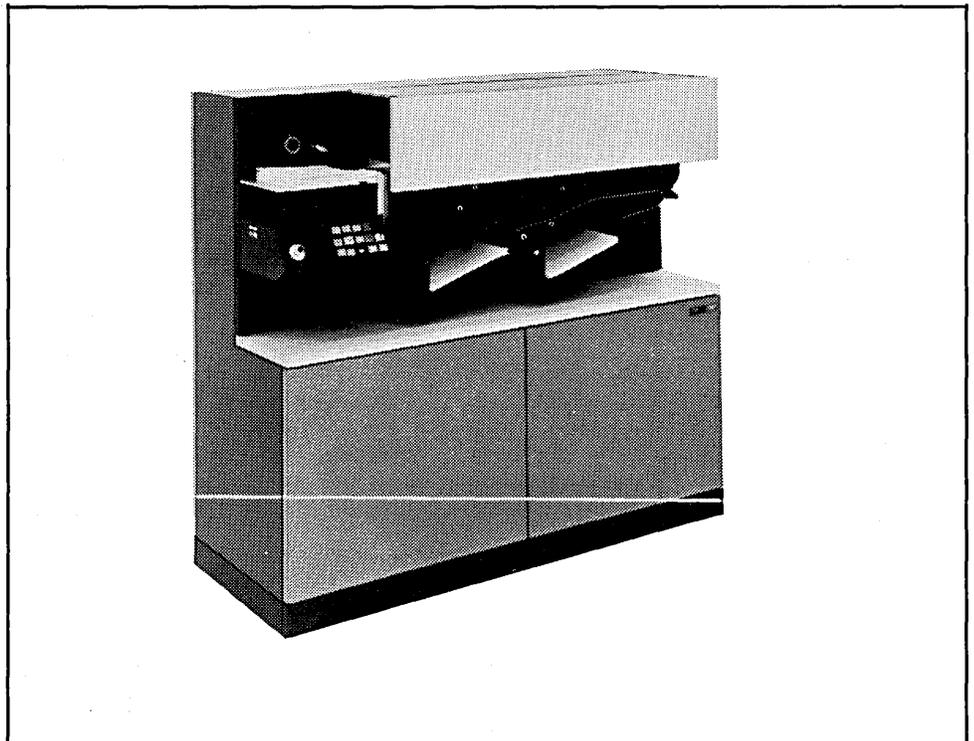
Figure 7-3881-1. 3881 Optical Mark Reader

3881 Highlights

The highlights of the 3881 Optical Mark Reader follow.

Processor Attachment

The 3881 Model 1 contains its own control unit and needs a control unit position on a byte or block multiplexer channel.

Form Sizes

The 3881 is flexible. It can be easily adjusted to read data from forms ranging in size from 76 by 76 millimeter (3 by 3 inch) bill stubs to 229 by 305 millimeter (9 by 12 inch) sheets. It accepts paper ranging from 20-pound stock to card stock and it can read as many as six different formats on the same-size document, in a single pass.

Document Feed

Documents are sent through the read area from a 600-sheet hopper and then into one of two stackers, in the sequence in which they are entered. The processed documents go into a 600-sheet stacker, and those with errors are sent to a 100-sheet select stacker.

Processing Speed

The 3881 can read as many as 100 documents 76 by 76 millimeter (3 by 3 inch) per minute and 66 documents 216 by 279 millimeter (8.5 by 11 inch) per minute. Data is sent to the processor, one page at a time, from the 3881 buffer.

3881 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operations. For more information about features, see an IBM sales representative.

BCD Read

The BCD Read feature permits the 3881 to read turnaround documents, which are forms printed by line printers as output from a data-processing system, distributed for action, then returned to be read as input to the system.

Document Counter

The Document Counter feature makes two 5-position counters available, which can be increased by one for each document processed by the 3881. The counters can be reset to zero by hand. Counter 1 increases by 1 for each document processed and counter 2 increases by 1 for each document routed to the select stacker.

Dual Density

The Dual Density feature permits the 3881 to write on the 3410 Magnetic Tape Unit in either 800 BPI (NRZI mode) or 1600 BPI (phase-encoded mode). This feature is available for Model 2 only.

Expanded Storage

The Expanded Storage feature gives an additional 512 bytes of storage needed in situations where the number of formats, fields, and characters processed is more than the maximum number of positions available in the basic data storage.

Serial Numbering

The Serial Numbering feature permits operator-controlled numbering of documents for visual reading. Documents as small as 76 by 121 millimeter (3 by 4.75 inch) can be numbered from 00000 to 99999.

7-3886. Optical Character

The 3886 Optical Character Reader (Figure 7-3886-1) is an online optical reader for an IBM processor. The 3886 is a compact, economical version of the larger IBM optical character readers. This buffered general-purpose unit reads machine-printed OCR-A and -B font characters and symbols, handprinted numbers, and printed 3/16-inch Gothic numbers (Figure 7-3886-2 on page 7-3886-3) from a variety of documents.

The 3886 has one input hopper and two output stackers, each of which can hold a one-inch stack of documents. The two stackers permit separation of the processed documents from the documents containing errors.

The 3886 is available in two models:

- Model 1 provides online attachment to a processor. Documents are read under processor program control and data is transferred to the processor.

- Model 2 operates independently of a processor. Documents are read under 3886 control and output is written on an IBM 3410 Magnetic Tape Unit.
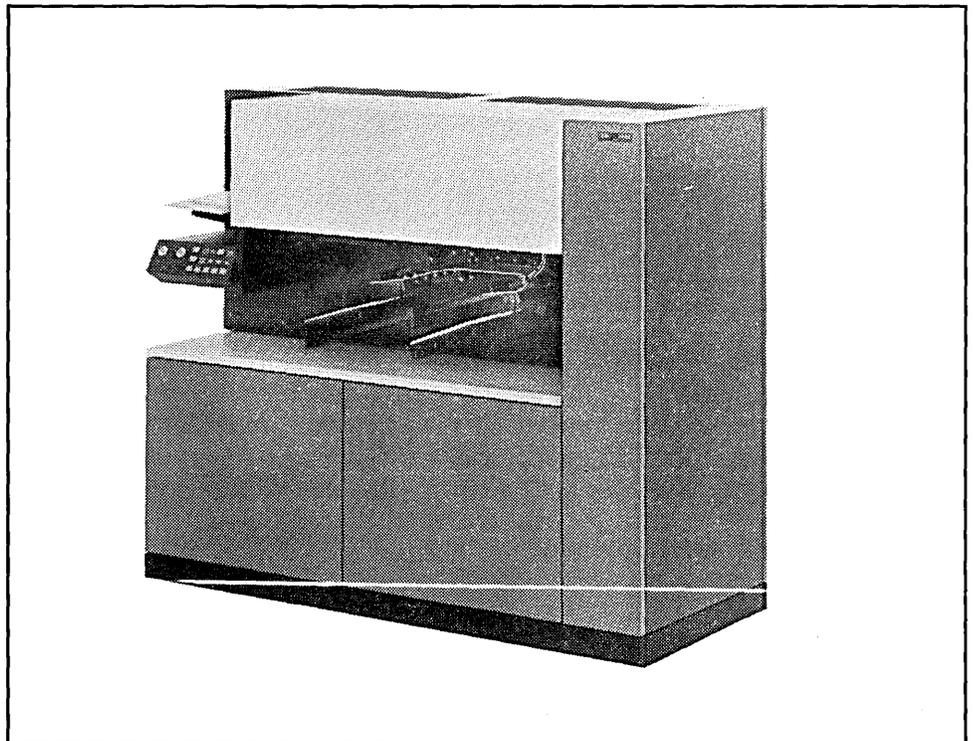
Figure 7-3886-1. 3886 Optical Character Reader

3886 Highlights

The highlights of the 3886 Optical Character Reader follow.

Processor Attachment

The 3886 Model 1 contains its own control unit and needs a control unit position on a system channel. It can attach to a byte multiplexer channel, block multiplexer channel, or selector channel.

Document Feed

The documents can have a variety of formats, types of data, field lengths, and background colors and shades. The 3886 reads multiple lines of print from forms ranging in size from 76 to 229 millimeter (3 to 9 inch) wide (the direction of printing), and 76 to 305 millimeter (3 to 12 inch) long. The acceptable weight of paper ranges from 16-pound stock to card stock.

Control Circuits

The 3886 uses several new technologies that make it a compact and highly reliable modular device. A powerful microcoded recognition and control processor performs machine-control and character-recognition functions, permitting the 3886 to perform sophisticated data and blank editing as well as output record formatting.

Processing Speed

The speed of document processing varies with document length, number and kind of characters to be read, amount of editing and formatting specified, and the programs used. Speeds range from approximately 4.4 to 94 documents per minute. The low rate could be, for example, for 216 by 279 millimeter (8.5 by 11 inch) sheets with 29 lines per sheet, 78 characters per line (approximately 2260 characters); the high rate could be for 76 millimeter (3 inch) machine-printed turnaround documents, each with a single eight-character line.
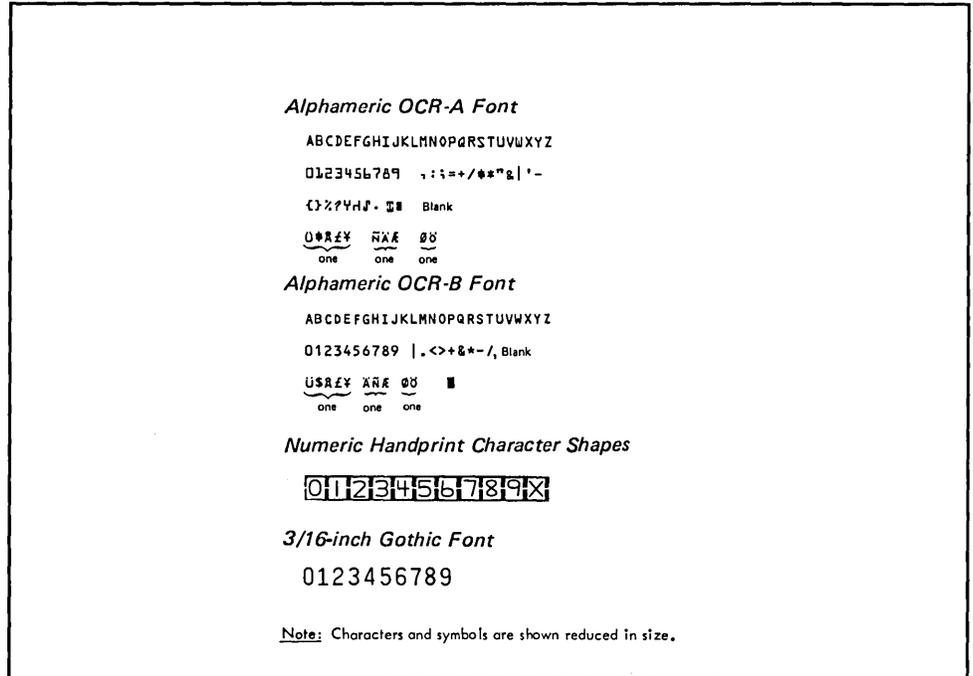
Figure 7-3886-2. 3886 Model 1 Readable Fonts, Letters, Numbers, and Symbols

3886 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation.

Data Storage, Additional

OCR-B font and numeric handprinting recognition need the Data Storage, Additional feature to execute the more complex character shapes that appear in them.

Hopper and Stacker Capacity, Additional

The Hopper and Stacker Capacity, Additional feature permits the 3886 hopper and stacker to hold 102 millimeter (4 inch) stacks of documents.

Instruction Storage, Additional

The Instruction Storage, Additional feature supplies the necessary additional storage increases of 8192 bytes for microcode that needs storage capacity greater than is available in the basic 3886 storage.

Line Marking

The Line Marking feature permits the 3886 to print any one of 15 codes on any line of a document and at the bottom of a page. The user chooses the meaning and application of the codes, such as pointing to a field in error.

Numeric Handwriting

The Numeric Handwriting feature makes it possible to have machine reading of handprinted numbers and the letter X.

Serial Numbering

The Serial Numbering feature permits operator-controlled numbering of documents for visual reading. Documents as small as 76 by 121 millimeter (3 by 4.75 inch) can be numbered from 00000 to 99999.

Tape Adapter, Dual Density

The Tape Adapter, Dual Density feature supplies the adapter for the 3886 Model 2 to attach a 3410 Magnetic Tape Unit Model 1 for recording in 1600 BPI (PE mode) or 800 BPI (NRZI mode).

Tape Adapter, Single Density

The Tape Adapter, Single Density feature supplies the adapter for the 3886 Model 2 to attach a 3410 Magnetic Tape Unit Model 1 for recording in 1600 BPI (PE mode).

Video Collect Features

The various video collect features permit the direct attachment of a display station to the 3886.

Part 8. Printers

Contents

Introduction

The printers described in this chapter are document output devices for IBM processors that print on continuous forms. Each printer can print by character, by line, or by page. The rated speed of these printers varies from 85 characters per second to 215 pages (an 8-1/2 inch page) per minute. The printed line may be from 96 to 204 characters long. The vertical line spacing may vary from 6 to 12 lines per inch and the pitch may be 10, 12, or 15 characters per inch. Each printer has characteristics and features that are suitable for its different applications.

Printer Data Comparison Table

Figure 8-1 gives a comparison of data for the printers described in this chapter.

PRINTER	MODEL	CONTROL UNIT	NUMBER OF PRINT POSITIONS	MAXIMUM PRINT SPEED	PRINT METHOD
1403	N1	2821	132	1100 lpm	Impact
1443	N1	Internal	120	240 lpm	Impact
3203	1	Integrated	132	600 lpm	Impact
	2	Integrated	132	1200 lpm	Impact
	3	3770	132	1000 lpm	Impact
	4	Integrated	132	1200 lpm	Impact
	5	Internal	132	1200 lpm	Impact
3211	1	3811	132	2000 lpm	Impact
3262	5	Integrated	132	650 lpm	Impact
3287	1	3274	132	80 lpm	Impact
	2	3274	132	120 lpm	Impact
	1C	3274	132	80 lpm	Impact
	2C	3274	132	120 lpm	Impact
3800	1, 3	Internal	204*	20040 lpm**	Non-Impact***
4245	1	Integrated	132	2000 lpm	Impact

* 204 positions at 15 characters per inch (the number of characters per inch may be greater for 3800-3 when printing proportionally spaced fonts).

** 3800 with forms length of 11 inches and 12 inches.

*** Electrophotographic, laser.

Figure 8-1. Comparison Data for Printers
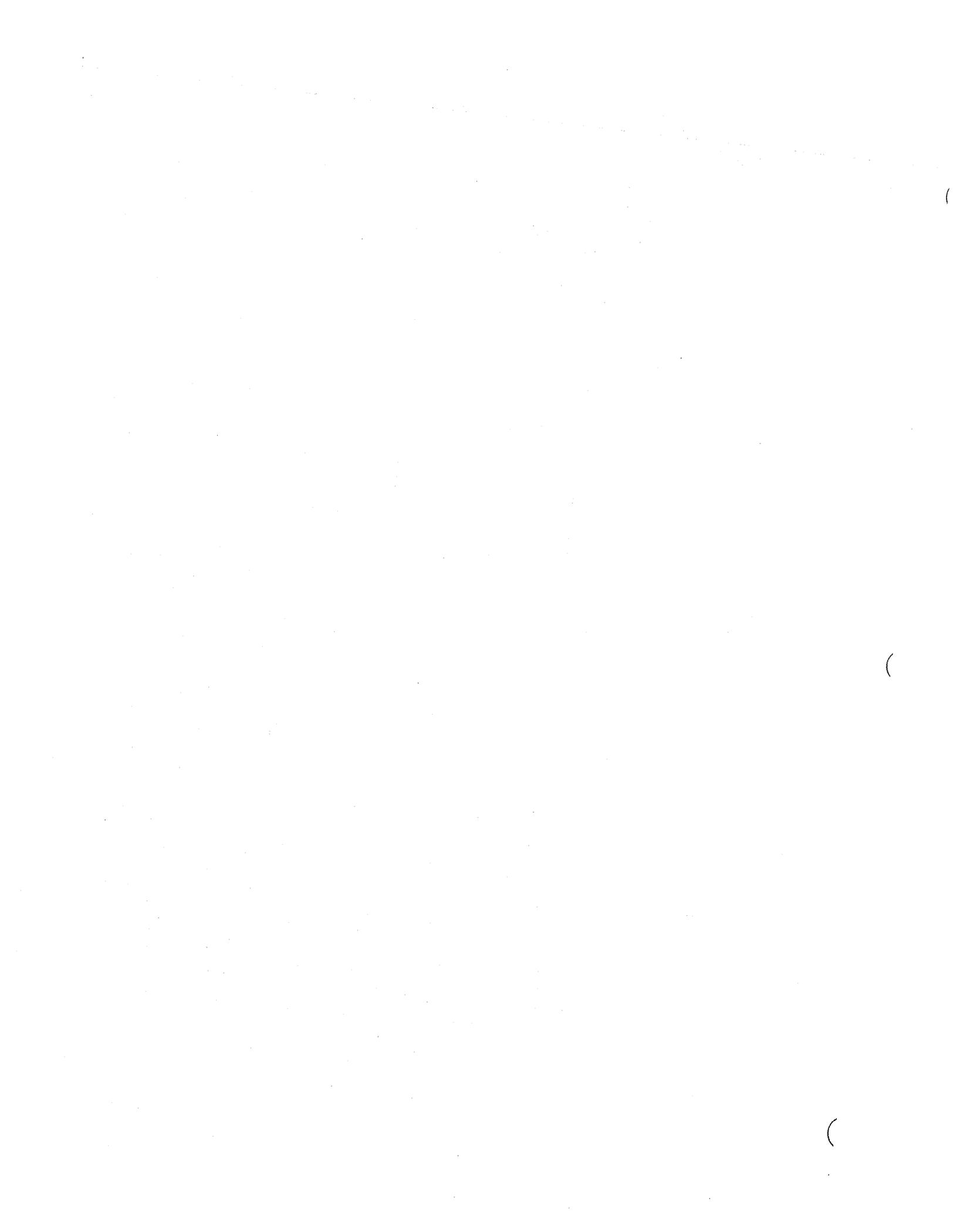
8-1403. Printer Model N1

The 1403 Printer (Figure 8-1403-1) provides printed output from its attached processor. The Model N1 has 132 print positions and prints up to 1100 lines per minute. It can operate at greater speeds with the Universal Character Set feature, described later.
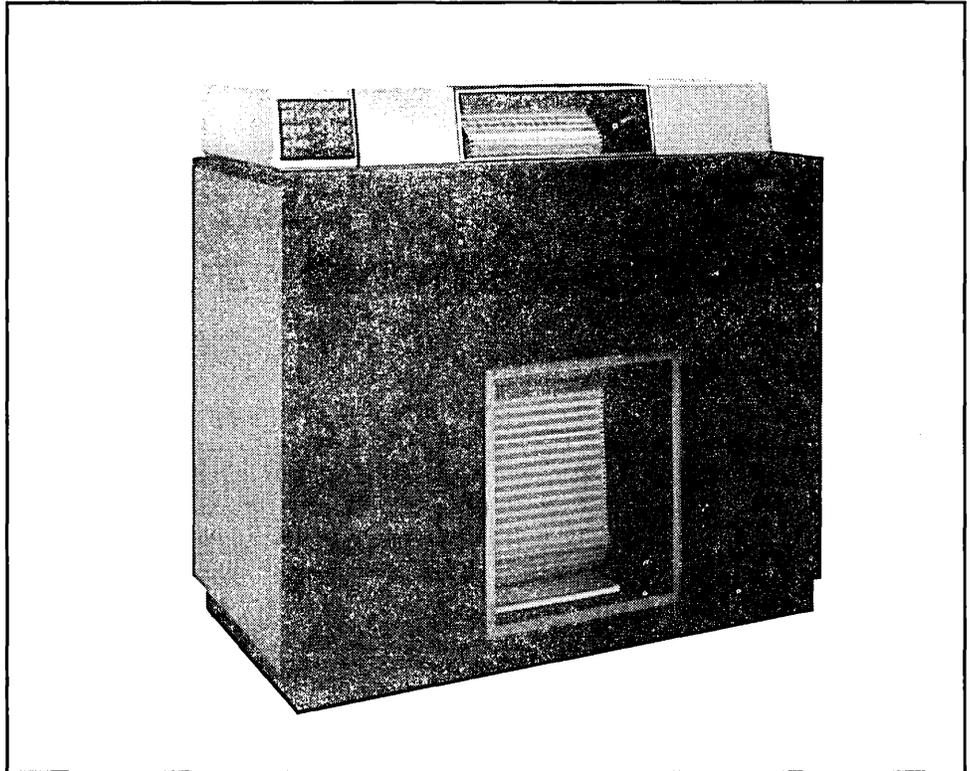
Figure 8-1403-1. 1403 Printer

1403 Highlights

The highlights of the 1403 Printer follow.

Processor Attachment

The attachment and control for 1403 printers are supplied by a 2821 Control Unit or by an integrated printer attachment. Up to three 1403s, depending on the 2821 model, can be controlled by a 2821. One 1403 can be controlled by an integrated printer attachment. The 2821 needs a control unit position on a system channel and can attach to a byte multiplexer channel, block multiplexer, channel, multiplexer channel, or selector channel.

Dual-Speed Carriage

The dual-speed carriage supplies a high-speed and a low-speed forms skip operation, as follows:

- High-speed skips are at 1.9 meters (75 inch) per second when more than eight lines are skipped.

- Low-speed skips are at 86 millimeters (33 inch) per second.

Covers

The 1403 Model N1 has sound-absorbent covers that extend to the floor, power-operated front and top covers, and a forms cart.

Print Cartridge

The Model N1 uses a train of characters not linked together. Characters are printed 10 to the inch, and lines are spaced either 6 or 8 to the inch under operator control.

At least one 1416 Interchangeable Train Cartridge is needed for each Model N1. The chain or train cartridge has 240 type positions, which, before the introduction of the universal character set (UCS) feature, were divided into five equal sets of 48 characters each. The rated maximum printing speed of a given printer is based, partially, on this division into five equal sets. If characters are included only once, twice, or even four times on the chain or train, the rated maximum printing speed is necessarily reduced. The reduction, however, is not linear, because of factors other than the number of character sets (for example, single spacing versus skipping). Conversely, if the characters are included more than five times, the printing speed is increased beyond the rated maximum.

The Model N1 has a maximum rated speed of 310 lines per minute (lpm) when its chain contains the conventional five sets. If the installed set contains 240 different characters (the widest possible variety), printing takes place on the Model 2 at up to 140 lpm. The maximum printing speeds, with UCS, are controlled electronically and are 1400 lpm for Model N1.

1403 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operations. For more information about features, see an IBM sales representative.

Selective Tape Listing

The Selective Tape Listing feature is available for the Model N1. It allows for the substitution of longitudinal strips for the normal paper sheet forms. See Figure 8-1403-2 on page 8-1403-3 for the different selective tape formats available.

MAXIMUM NUMBER OF TAPES	WIDTH		CHARACTERS PER TAPE
	MILLIMETER	INCH	
4	79	3.1	29
8	38	1.5	13
Note: A combination of widths less than 335 millimeters (13.2 inch) wide can be printed.			

Figure 8-1403-2.   1403 Selective Tape Characteristics

Each tape is individually line-spaced under program control, with no skipping permitted. The operator can easily change from tapes to standard forms, or vice versa. A new Selective Tape Listing feature is available for a Model N1. This feature permits skipping at the rate of 838 millimeters (33 inch) per second over a distance fixed by IBM Field Engineering adjustment at a value in the range of 76 to 558 millimeters (3 to 22 inch), instead of the repeated line spacing needed by the other type of selective tape feature. Operation is quieter. Changing from tape listing mode to full-sheet printing is easy and other new operator conveniences have a beneficial effect on the feature's overall efficiency.

Universal Character Set

The universal character set (UCS) gives the user the ability to load up to a maximum of 240 sets of discrete code into a special storage area in the 2821 Control Unit. The codes in 2821 storage match specifically and sequentially the characters on the train or chain. The user can order any characters for a given set, including custom designs for special applications.

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8-1443. Printer

The 1443 Printer Model N1 (Figure 8-1443-1) prints from 200 to 600 lines per minute; the print speed is determined by the number of characters in the set being used.
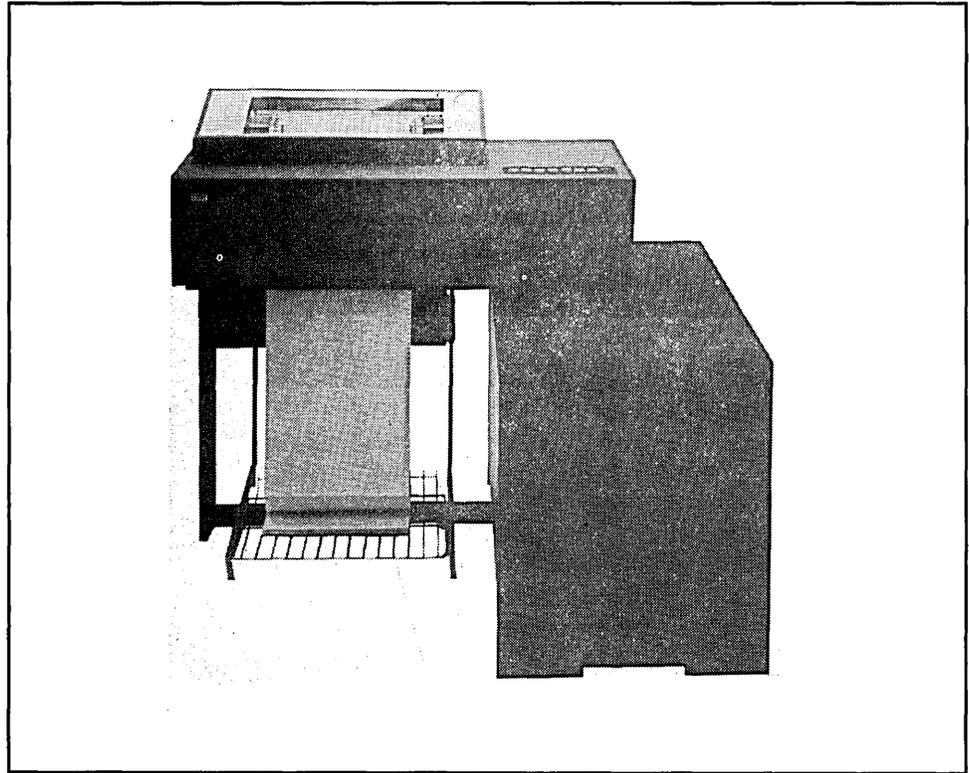
Figure 8-1443-1. 1443 Printer Model N1

1443 Highlights

The highlights of the 1443 Printer follow.

Processor Attachment

No external control unit is needed for attachment; the control circuits and print storage buffer are inside the 1443 Model N1. The 1443 needs a control unit position on a system channel.

Character Sets

The 1443 Model N1 prints up to 600 lines per minute with a 13-character set. The 1443 also has 39-, 52-, and 63-character sets which print at 300, 240, and 200 lines per minute, respectively.

The 52-character set is standard, and the other sets are available through the selective character set special feature. The user can order any characters for any set, including custom-made designs of special graphics.

Print Line

The standard print line for all sets is 120 characters, spaced horizontally at 10 characters to the inch. Twenty-four additional printing positions are available as a special feature, increasing the total number of printing positions to 144.

Printing Operation

All characters of the print set are on one type bar that moves back and forth across the paper. The bar is so made that each different character passes each print position. Printing takes place when the character to be printed matches the character read from the printer's self-contained storage buffer.

Carriage Control

A tape-controlled carriage, working under program control, advances paper and supplies the vertical print formats. Lines are spaced 6 or 8 to the inch under operator control. Skipping is at 381 millimeters (15 inch) per second.

1443 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Print Positions, 24 Additional

The Print Positions, 24 Additional feature increases the print span from 120 to 144 positions.

Selective Character Set

The Selective Character Set feature is needed if any type bar other than the standard 52-character bar is used. This feature supplies the controls that permit the 1443 to use all available character sets.

8-3203. Printer

The 3203 Printer (Figure 8-3203-1) combines advanced functions and components to offer greater speed, quieter operation, improved efficiency, and greater reliability than is now available with the 1403 Printer.

All models of the 3203 print either 6 or 8 lines per inch, under operator control. The printing rates in alphameric lines per minute (lpm) follow:

- Model 1 - 600 lpm
- Model 2 - 1200 lpm
- Model 3 - 1000 lpm
- Model 4 - 1200 lpm
- Model 5 - 1200 lpm.
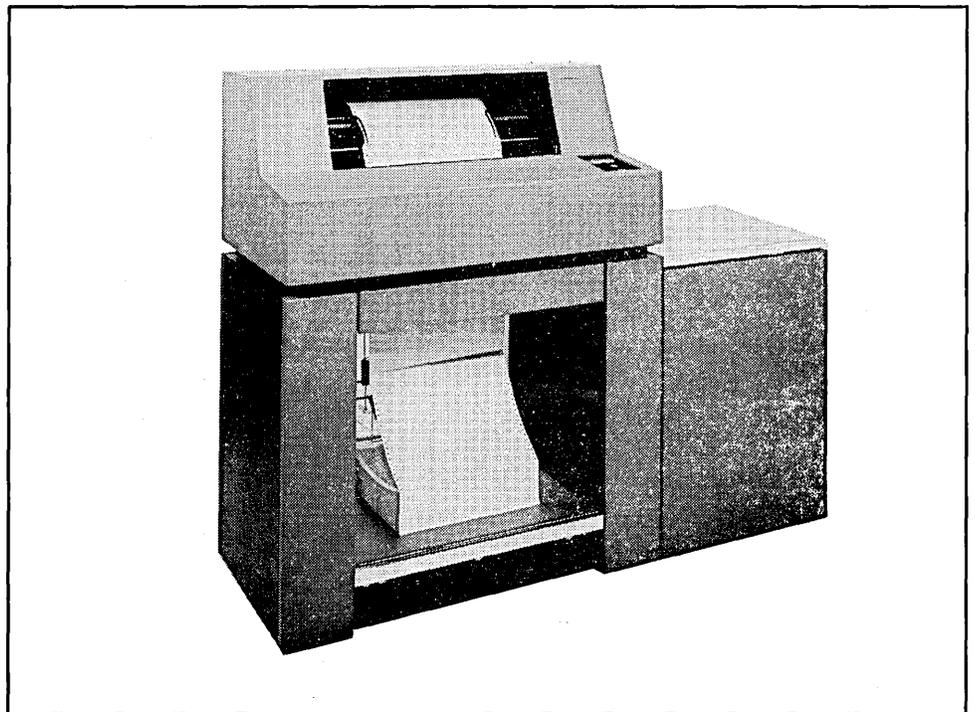
Figure 8-3203-1.   3203 Printer

3203 Highlights

The highlights of the 3203 Printer follow.

Processor Attachment

The 3203 Models 1, 2, and 4 attach to processors that have an integrated 3203 printer attachment, thereby eliminating the need for a separate channel or control unit. Only the 3203 Model 5 attaches to a control unit position on a channel because it has an internal control unit. The Model 3 attaches to a IBM 3777 Communication Terminal.

Train Printing

The 3203 uses the IBM 1416 Interchangeable Train Cartridge, which is the same cartridge used by the 1403 Model N1. The train printing method used by the 3203 maintains a high-quality of printing.

Forms

The 3203 uses margin-punched, pin-fed, continuous forms. The size of individual documents that make up the continuous forms can range from 88.9 to 508 millimeters (3.5 to 20 inch) wide and from 76 to 610 millimeters (3 to 24 inch) long.

Universal Character Set

The universal character set (UCS) gives the user the ability to load up to a maximum of 240 discrete codes into a special storage area. The UCS permits optimizing the character arrangement to maximum printing speeds for different applications.

Power-Assisted Stacker

A power-assisted stacker improves the stacking of forms and reduces the need for operator attention.

Forms-Control Buffer

The forms-control buffer controls the vertical format and movement (spacing and skipping) of the forms, and removes the need for separate carriage-control tapes.

Vacuum Cleaning System

The vacuum cleaning system continuously cleans the print train, and the operator can also use it to clean the print area.

3203 Special Features

The following feature can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about this feature, see an IBM sales representative.

Speed Enhancement

The Speed Enhancement feature gives the Model 3 the capability to operate at 1200 lines per minute.

8-3211. Printer

The 3211 Printer Model 1 (Figure 8-3211-1) is a high-speed printer with speeds of 2000 lines per minute single spaced, using a 48-element character set. The printer uses a train of characters that are not linked together. Ten characters are printed to the inch, and six or eight lines to the inch are spaced under program control.
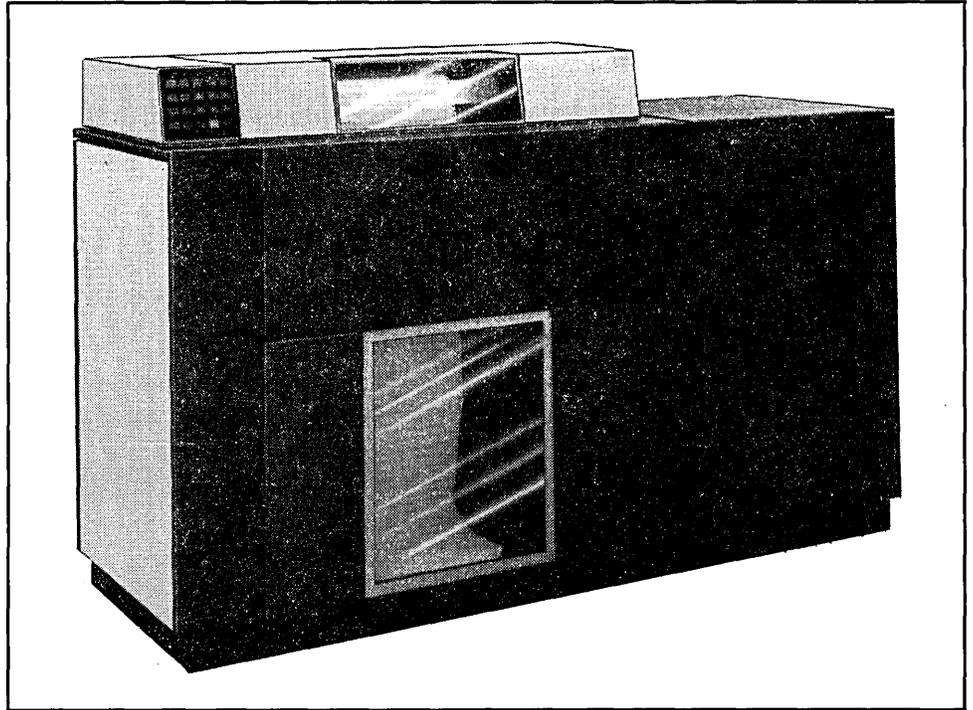
Figure 8-3211-1. 3211 Printer and 3811 Printer Control Unit

3211 Highlights

The highlights of the 3211 Printer follow.

Processor Attachment

The 3211 Printer is controlled and buffered by a 3811 Control Unit. The 3811 control unit is physically attached to the 3211 Printer. The 3811 needs a control unit position on a system channel and can attach to a byte multiplexer channel, block multiplexer channel, or selector channel.

Interchangeable Train Cartridge

The 3216 Interchangeable Train Cartridge contains a continuous train of 432 characters. EBCDIC permits using up to 254 different characters (alphabetic, numeric, and special) on a print train.

Universal Character Set

The universal character set (UCS) gives the user the ability to load up to a maximum of 240 sets of discrete code into a special storage area. The UCS permits optimizing the character arrangement to maximum printing speeds for different applications.

Program-Controlled Carriage

The vertical format for each form is stored in the control unit by the program. Forms movement (spacing and skipping) is initiated by the program as specified in the stored format. Line feeding (6 or 8 lines per inch) is also controlled by the stored format.

Form Sizes

The form width can vary from 88.9 to 476.25 millimeters (3.5 to 18.75 inch); the minimum length is 76 millimeters (3 inch).

Self-Adjusting Power Stacker

The self-adjusting power stacker advances and stacks the forms for optimum high-speed forms movement. It varies with the thickness of the forms.

Automatic Forms-Thickness Control

The automatic forms-thickness control adjusts the platen to the appropriate setting for the forms used. This ensures maximum print quality and maintains enough clearance for high-speed forms movement.

Motorized Cover

The cover on the printer gives controlled access to the forms transport area. When a forms condition occurs, the cover movement immediately alerts the operator that action is needed.

Speed

The printer speed varies with the arrangement of the characters in the type array and the number of arrays in the print train. By optimizing the universal character set, each application can attain maximum printing speeds, based on the frequency of the characters in the print train. Speeds up to 2500 lines per minute, with reduced character sets and customized print trains, are possible.

3211 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

OCR Print Package

The OCR Print Package feature supplies additional manual operator platen controls needed for optical-character-recognition (OCR) applications.

Print Positions, 18 Additional

The Print Positions, 18 Additional feature increases the print positions from 132 to 150. The operation of the 3211 remains the same.

3811 Printer Control Unit

The 3811 Printer Control Unit Model 1 (Figure 8-6) is the control unit for the 3211 Printer. The 3811 is physically attached to the 3211 and contains the electronic circuits needed to adapt the printer to the channel.

The logic, buffers, and controls for the universal character set and forms-control buffer are located in the 3811.

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8-3262. Line Printer

The 3262 Line Printer Model 5 (Figure 8-3262-1) is controlled by the host system. It supplies impact printing capabilities for small and intermediate systems. The 3262 uses a steel band etched with 288 characters. Continuous forms are pin fed and margin holes are already punched. The pin-feed tractors can be adjusted to feed forms from 89 to 406 millimeters (3.5 to 16 inch) overall width. The form length can be 76 to 356 millimeters (3 to 14 inch).
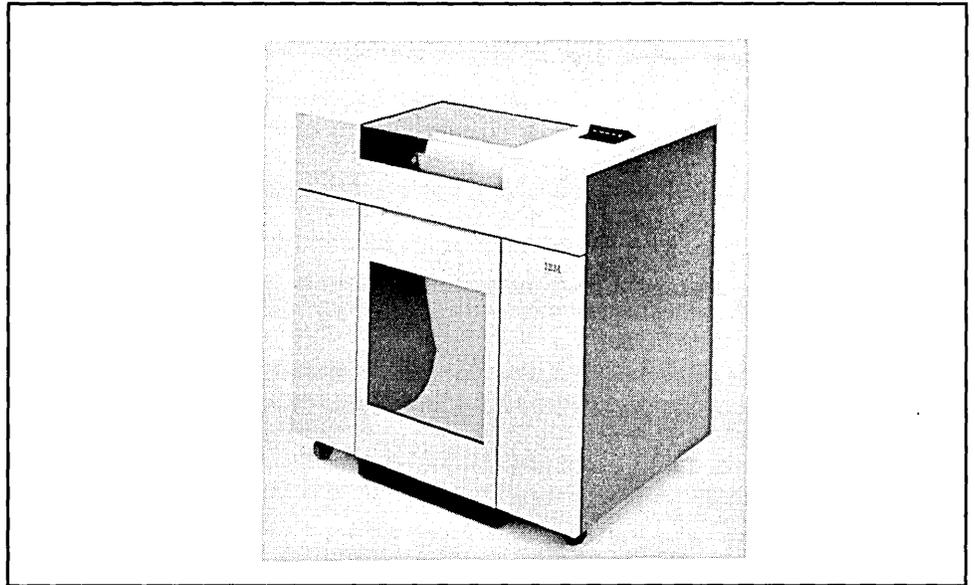
Figure 8-3262-1. 3262 Line Printer

The rated printing speed in single-spaced lines per minute (lpm) varies with the size of the character set on the print belt. Figure 8-3262-2 gives the rated speed of the 3262 Model 5.

Character Set	Nominal Speed
48-character	650 lpm
64-character	466 lpm
96-character	363 lpm
128-character	252 lpm

Figure 8-3262-2. 3262 Printer Rated Speeds

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3262 Highlights

The highlights of the 3262 Printer follow.

Processor Attachment

The 3262 Printer Model 5 requires an available system channel control unit position.

Print Characteristics

The print line is 132 characters long, spaced 2.54 millimeters (0.10 inch) on centers. Vertical line spacing is 6 or 8 lines per inch. System programs control all printing and forms movement.

8-3287. Printer

The 3287 Printer (Figure 8-3287-1) is a table-top matrix printer with bidirectional printing capability.

Four models are available; the following table indicates the print rate and color capabilities.

- Model 1 has a maximum print rate of 80 characters per second and prints in monochrome mode.

- Model 2 has a maximum print rate of 120 characters per second and prints in monochrome mode.

- Model 1C has a maximum print rate of 80 characters per second when printing in monochrome mode. It can also print in four-color mode.

- Model 2C has a maximum print rate of 120 characters per second when printing in monochrome mode. It can also print in four-color mode.

Models 1, 1C, 2, and 2C have a 1968-character buffer capacity. An additional 2048 bytes of buffer is available for printouts of 2560, 3440, or 3564 characters.
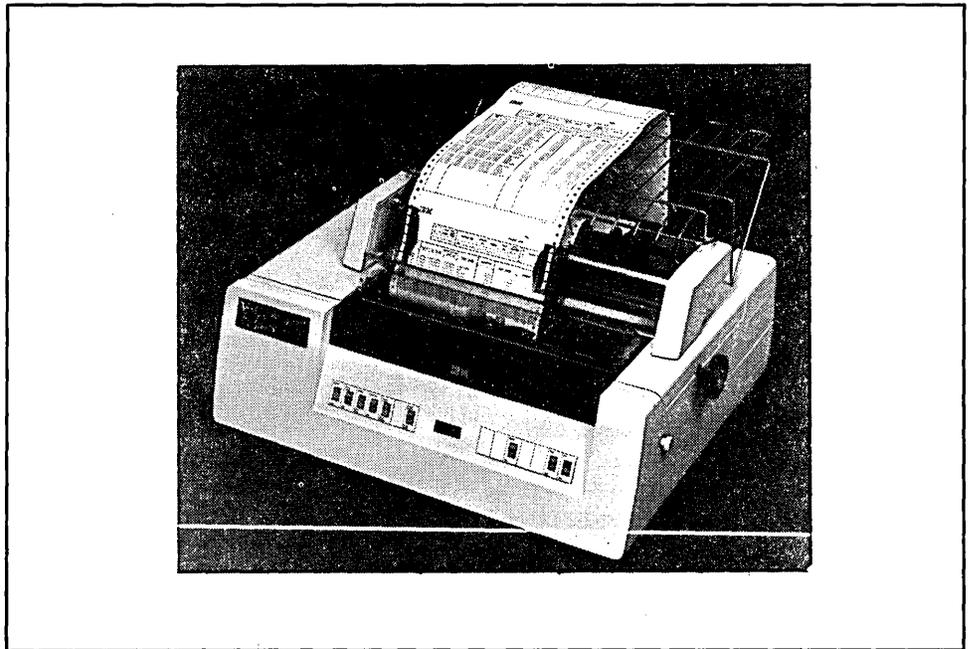
Figure 8-3287-1. 3287 Printer

3287 Printer Highlights

Highlights of the 3287 Printer follow.

Processor Attachment

The 3287 Printer Models 1 and 2 can be directly attached to a 308X processor through a 3082 Processor Controller.

Control Unit Attachment

The 3287 attaches to a 3274 Control Unit, using up to 1500 meters (4920 feet) of cable length from the 3274 Type A terminal adapter, or up to 610 meters (2000 feet) cable length from the 3274 Type B terminal adapter, as follows:

*   The 3287 Models 1 and 2 attach to either a Type A or Type B terminal adapter on the 3274 Control Unit, based upon the 3287 attachment feature selected. The 3287 Models 1C and 2C attach only to a Type A terminal adapter.

*   The 3287, when attached to a 3274 Model 1A or 1D with Configuration Support C, supports extended highlighting (underscoring only), programmed symbols (PS), and graphics.

    Note: The application used may also reduce the throughput of the 3287 when the 3287 prints using PS.

*   The 3287 Models 1C and 2C, when attached to a 3274 Model 1A or 1D with Configuration Support C, supports four-color mode printing on a character or field basis.

Printed Output in Four-Color Mode

The throughput of the 3287 Models 1C and 2C may be reduced when they print in color mode, because the print head must make a separate pass for each color used on a given line. Character positions 1 through 120 can print in four-color or monochrome mode; character positions 121 through 132 can print only in black.

8-3800. Printing Subsystem

The 3800 Printing Subsystem (Figure 8-3800-1) is a high-speed, general-purpose, non-impact printer. It uses a low-powered laser and electrophotographic technology to generate printed output. This technology allows all models of the 3800 to use a wide variety of type sizes, styles, and weights to generate quality printing. Printing is repeated for each copy so that every copy has the quality of an original.

The 3800 Printing Subsystem is available in two models:

- Model 1
- Model 3.

Note: A 3800 Model 8 is available in selected World Trade Countries. For information see *Introducing the IBM 3800 Printing Subsystem Model 8*, GA32-0055.

A general description of the 3800 Printing Subsystem follows. Details for each model are given in the following sections.
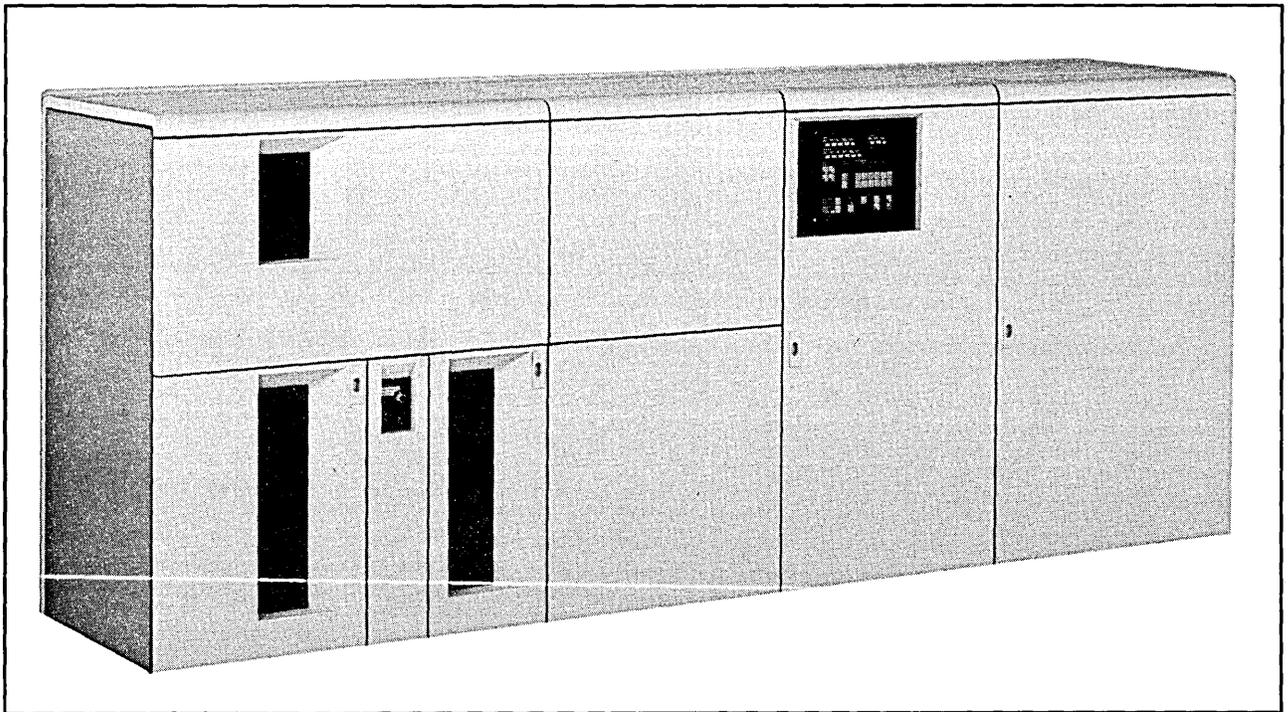
Figure 8-3800-1. 3800 Printing Subsystem

3800 Highlights

The highlights of the 3800 Printing Subsystem follow.

Electrophotographic Process

The electrophotographic process includes the following:

- A revolving drum on which a charged photoconductor is selectively discharged by a low-power laser to generate images of the printed data

- A developer station where the toner is attracted to the image

- A transfer station where the toner is transferred to the paper

- A fuser station that fuses the toner onto the paper

- A cleaning station that removes any residual toner from the photoconductor after a sheet has been printed

- A charge station that recharges the photoconductor

- A forms overlay station that exposes form images or other fixed data on the photoconductor.

The electrophotographic process offers many advantages when compared to impact printing. Some advantages are:

- Greater speed

- Wider variety of print sizes, styles, and weights

- Increased legibility of all copies

- Elimination of carbon paper

- Reduction or elimination of preprinted forms

- Performance of a wide variety of copy modification functions

- Burst, trim, and stack printed output, if desired

- Lower total printing costs by saving paper and reducing post-printing offline operations.

Printer Operation

For all models, data to be printed is transmitted from the processor to the printer and stored. When the printer receives the amount of data needed to print a full sheet, microcode, through interaction with various storage areas, modulates the laser beam on the photoconductor. Exposure of the photoconductor is by horizontal-line scanning. The image is developed, transferred to paper, and fused. The photoconductor is cleaned and recharged after each exposure. Finished copies are folded and stacked in the continuous forms stacker or the edges of the finished copies are trimmed, each sheet is separated, and the separated sheets are stacked by the Burster-Trimmer-Stacker feature.

Figure 8-3800-2 shows the functional units used by all models of the 3800 Printing Subsystem.
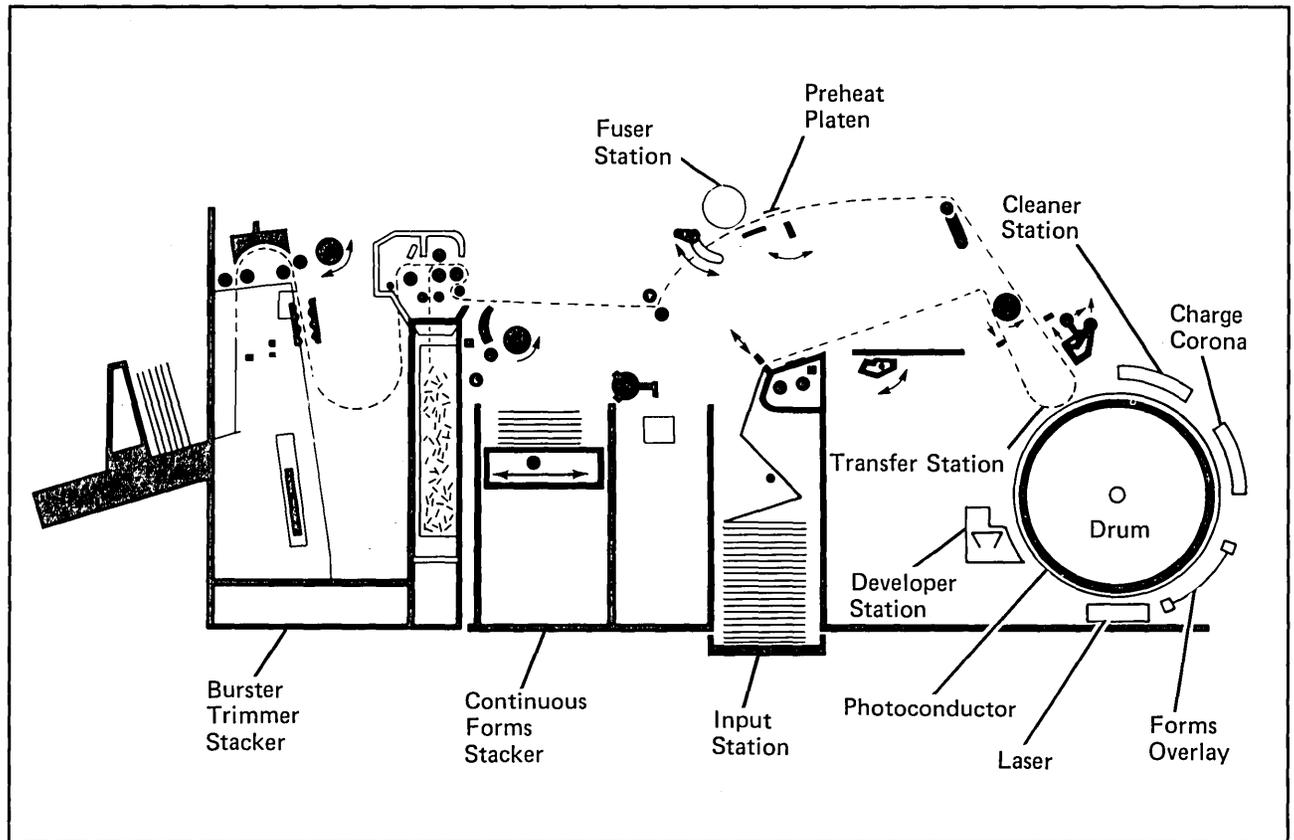
Figure 8-3800-2. 3800 Printing Subsystem Functional Units

Paper Used

All models of the 3800 use single-ply, edged-punched, perforated, and folded continuous forms in a variety of length and width combinations.

The printer uses common-use size paper in combinations of five lengths and ten widths or ISO size paper in combinations of six lengths and thirteen widths.

Printing Options

The 3800 Printing Subsystem has the following printing options, any combination of the methods is allowed.

- Preprinted forms can be used.

- The form image can be printed using the laser.

- The form image can be printed using a forms overlay (or in the Model 3, an electronic overlay or forms overlay).

A forms overlay is a negative which has the image of a form and is installed before printing. An electronic overlay is the image of a form that is stored separately and is printed at the same time as the laser-printed data. The Model 3 can print using either a forms overlay or an electronic overlay. The image from either type of overlay can be printed on any number of copies. Forms overlays can also be used for printing pictorial line art or halftones on copies.

Speed of Printing

See Figure 8-3800-3 on page 8-3800-5 and Figure 8-3800-4 on page 8-3800-5 for maximum rated speeds of the different models of the 3800, using common-use size forms or ISO size forms.

Common-Use Size Forms

FORMS	LENGTH	FORMS PER MINUTE (MAXIMUM)	LINES PER MINUTE (SINGLE COPY)			
INCH	MM		6 LINES PER INCH	8 LINES PER INCH	10 LINES PER INCH*	12 LINES PER INCH
3-1/2	90	526	7890	10 520	13 150	15 780
5-1/2	140	334	9018	12 024	15 030	18 036
7	178	263	9468	12 624	15 780	18 936
8-1/2	216	215	9675	12 900	16 125	19 350
11	279	167	10 020	13 360	16 700	20 040

* Only the Model 3 can print at 10 lines per inch.

All models of the 3800 can print at the same maximum speed. Printing speed depends on the information to be printed and the size of the paper.

Figure 8-3800-3. 3800 Printing Speeds Using Common-Use Size Forms

ISO Size Forms

FORMS	LENGTH	FORMS PER MINUTE (MAXIMUM)	LINES PER MINUTE (SINGLE COPY)			
INCH	MM		6 LINES PER INCH	8 LINES PER INCH	10 LINES PER INCH*	12 LINES PER INCH
3	76	597	7164	9552	11 940	14 328
4	102	454	8172	10 896	13 620	16 344
6	152	286	8580	11 440	14 300	17 160
8	203	215	9030	12 040	15 050	18 060
10	254	167	9018	12 024	15 030	18 036
12	305	143	9438	12 584	15 730	18 876

* Only the Model 3 can print at 10 lines per inch.

All models of the 3800 can print at the same maximum speed. Printing speed depends on the information to be printed and the size of the paper.

Figure 8-3800-4. 3800 Printing Speeds Using ISO Size Forms

Copy Modification

Copy modification permits printing predefined data on any specified copy. Any modification can vary from copy to copy.

The effect of forms overlay and copy modification is equal to the use of conventional numbered, preaddressed, multiple-part forms.

Job and Copy Separation Marking

All models of the 3800 use job and copy separation marks, which aid in separating the sheets after printing. These identifying marks are software controlled and require no operator intervention.

Job Recovery

All models of the 3800 keep track of the position of each sheet of data while that data is in the print buffer and until it is past the fuser station.

3800 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the printer's operation. For more information about features, see an IBM sales representative.

Burster-Trimmer-Stacker

The Burster-Trimmer-Stacker feature bursts printed output into individual sheets with the right and left carrier strips trimmed off. Jobs or single copies are separated by offsetting one job or copy from another in the stacker and are ready for distribution without post-printing delays.

Two-Channel Switch

The Two-Channel Switch feature is an operator-controlled two-channel switch, which permits all models of the 3800 to obtain data from one of two separate processors.

Dynamic Switch

Automatic switching is performed by the Dynamic Switch feature for two processors sharing main storage, and for two channels on a single processor for all models that have the Two-Channel Switch feature installed.

Remote Switch Attachment

The Remote Switch Attachment feature is available for all models that have the Two-Channel Switch feature installed. It permits enabling, disabling and two-channel switching of the printer at a remote control panel.

Model 1 Printing Subsystem

3800 Model 1 Highlights

The highlights of the 3800 Printing Subsystem Model 1 follow.

Processor Attachment

The 3800 Model 1 attaches to a processor using a control unit position on a byte multiplexer channel, block multiplexer channel, or selector channel.

Print Density

The Model 1 has a print density of 180 x 144 pels per square inch.

Print Positions

The Model 1 has a maximum of 136 print positions at 10 characters per inch (cpi) and 163 and 204 print positions at 12 and 15 cpi, respectively. The vertical line spacing is under microcode control and can be 6, 8, or 12 lines per inch (lpi). A sheet can have any combination of characters per inch and lines per inch. There are 92 different character sets available.

Storage for Printing

Figure 8-3800-5 shows the different types of storage for printing in the 3800 Printing Subsystem.

Storage	Model 1
Electronic Character Generator	128 positions standard; 127 positions, additional feature (16K bytes standard)
Writeable Control Storage	64K bytes standard

Figure 8-3800-5.   3800 Printing Subsystem Model 1 Printing Storage

Electronic Character Generation: One hundred twenty eight (128) writable character generation storage positions are standard in the Model 1 and are organized in two 64-position writable character generation modules (WCGMs). Character sets are dynamically selected without operator intervention.

Graphic character modification permits user-modified or IBM-designed characters to take the place of an equal number of standard characters in the character generation storage.

Writeable Control Storage: Writable control storage (WCS) is a storage area of 64K bytes in the Model 1. WCS accepts channel data and stores the microcode that controls the printer.

3800 Model 1 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the printer's operation. For more information about features, see an IBM sales representative.

127 Writable Character Generation Storage Positions, Additional

The Model 1 has 128 writable character generation storage positions. An additional 127 storage positions can be added to permit a maximum print capability of 255 different characters.

Tape-To-Printing Subsystem

The Tape-to-Printing Subsystem feature permits the 3800 Model 1 to be operated from magnetic tape. The printer can be attached to a 3410/3411 Model 3 Magnetic Tape Subsystem or a 3803 Model 1 or 2 with the 3420 Models 3 through 8 Magnetic Tape Subsystem. All the recording densities permitted for the magnetic tape subsystem can be used. The configuration of the I/O devices can be arranged to let the tape-to-printing subsystem be used online through a separate switchable path from the tape control to the system.

Selection of 3800 Model 1 functions, when the printer is attached to a magnetic tape subsystem, can be accomplished by three methods:

* A user-generated control tape

* Controls available on the 3800 Model 1 internal diskette

* Entries at an auxiliary operator panel.

These methods can be used separately or together to achieve flexible use of the 3800 Model 1 printing functions. For example, a control tape can be used for multiple print jobs, and additional parameters can be entered at the auxiliary operator panel. Internal diskette controls can also be used or a standard set of control tapes can be created and maintained for use when they are needed.

If control tapes are used, the Offline IBM 3800 Utility program (Program Product 5748-UT2) is available to help the user prepare them. The utility program operates independently of the printer. Print selections are specified to the utility program through control statements, and the utility program produces a control tape containing instructions for printing one or more data sets.

The Tape-to-Printing Subsystem feature supports all IBM System/360 and System/370 print tape formats. Print tape formats generated by the following companies are also supported if they are as specified in *Operator/Reference Manual for the IBM 3800 Tape-to-Printing Subsystem Feature*:

* Burroughs B7000/B6000 — Burroughs Corporation, Detroit, Michigan

* Honeywell Series 60 (level 66/6000) — Honeywell Information Systems, Waltham, Massachusetts

* Sperry Univac 1100 Series — Sperry Univac, Roseville, Minnesota

Model 3 Printing Subsystem

The Model 3 prints in two different modes of operation: compatibility mode, which allows most 3800 Model 1 applications to run unchanged, and page mode, which is outlined below.

3800 Model 3 Highlights

The highlights of the 3800 Printing Subsystem Model 3 follow.

Processor Attachment

The Model 3 attaches to a processor using a control unit position on a block multiplexer channel or a selector channel.

Printing Characteristics

In addition to the printing characteristics of the Model 1, the Model 3 can:

- Print at any point within the printable area of a sheet

- Print proportionally spaced fonts

- Store up to 700,000 bytes of data on different font styles

- Store up to 127 electronic overlays (depending on their complexity)

- Accept and print unordered data

- Print text and/or images such as graphics, company logos, and signatures within the printable area of a sheet.

Print Density

The Model 3 has a print density of 240 x 240 pels per inch. The Model 3 can store images that are scanned at other than 240 x 240 density; however, all images are printed at 240 x 240 density.

Print Positions

The Model 3 offers the same combinations of characters per inch, lines per inch, and print positions as the 3800 Model 1. In addition, the Model 3 can also print at 10 lines per inch. The Model 3 can make available the same character sets as the Model 1 and in addition also offers over 180 different font sizes, styles, and weights.

The Model 3 can print using both fixed-space fonts and proportionally spaced fonts.

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Printing Options

In addition to the printing options described for all models; the Model 3 can orient the printing in three different directions, 0 degrees (left to right, top to bottom), 90 degrees, and 270 degrees.

Storage for Printing

Figure 8-3800-6 shows the different types of storage for printing in the 3800 Printing Subsystem.

Storage	Model 3
Accumulator	768K, or 1280K* bytes, optional
Raster Pattern Storage	256K bytes standard 256K bytes, additional feature
Writeable Control Storage	512K bytes standard

Figure 8-3800-6.   3800 Printing Subsystem Model 3 Printing Storage

Raster Pattern Storage: Fonts are stored as raster images in raster pattern storage (RPS), diskette font storage, or both.

Graphic character storage depends on the size of the fonts. Approximately 700,000 bytes of diskette font storage are provided on the internal diskette; fonts stored in diskette font storage are sent to raster pattern storage automatically when the font is needed for printing characters.

Raster pattern storage is 256K bytes standard (K equals 1,024).

Writeable Control Storage: Writeable control storage (WCS) is a storage area of 512K bytes standard. WCS stores the microcode that controls the printer and accepts channel data.

3800 Model 3 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the printer's operation. For more information about features, see an IBM sales representative.

Accumulator

The Accumulator feature consists of an 768K byte storage that stores the printable area of an 8-1/2 x 11-inch page in raster form at 240 x 240 pel density.

(

The accumulator is used automatically when data for a page is too complex to be printed using writable control storage and raster pattern storage. For example, if raster pattern storage is not large enough to hold all the desired raster images or text for a page, microcode causes the page to be stored in the accumulator in raster form. Thus, a page of virtually unlimited complexity can be printed by combining a succession of raster data for the page. The accumulator can also be used as storage for large raster images sent by the host processor for printing and as storage (one at a time) for electronic overlays.

Accumulator Expansions: Two optional storage increments can be added to enlarge the Accumulator feature to 1024K bytes (which permits a 14 7/8 x 11 inch common-use size page) or to 1280K bytes (which permits a 378 x 30.5 millimeters ISO size page).

ISO Paper Sizes, Additional

Note: This feature is available for E/ME/A World Trade countries.

The ISO Paper Sizes, Additional feature adds two paper lengths to those already available. The additional lengths are: 8 1/3, and 12 1/2 inch. This feature also provides a method that permits printing within 1/3 inch of the bottom of the physical page, and begins printing at 2/3-inch from the top of the physical page.

Raster Pattern Storage, Additional

Raster Pattern Storage is a storage area of 256K bytes. This feature adds 256K bytes (512K bytes, total) that can be used to increase the flexibility of page composition. For example, with this feature, complex pages using a large number of different fonts and/or raster images can be printed.

8-4245. Printer

The 4245 Printer Model 1 (Figure 8-4245-1) combines advanced functions and components to offer greater speed than is now available with the 3203 Printer.
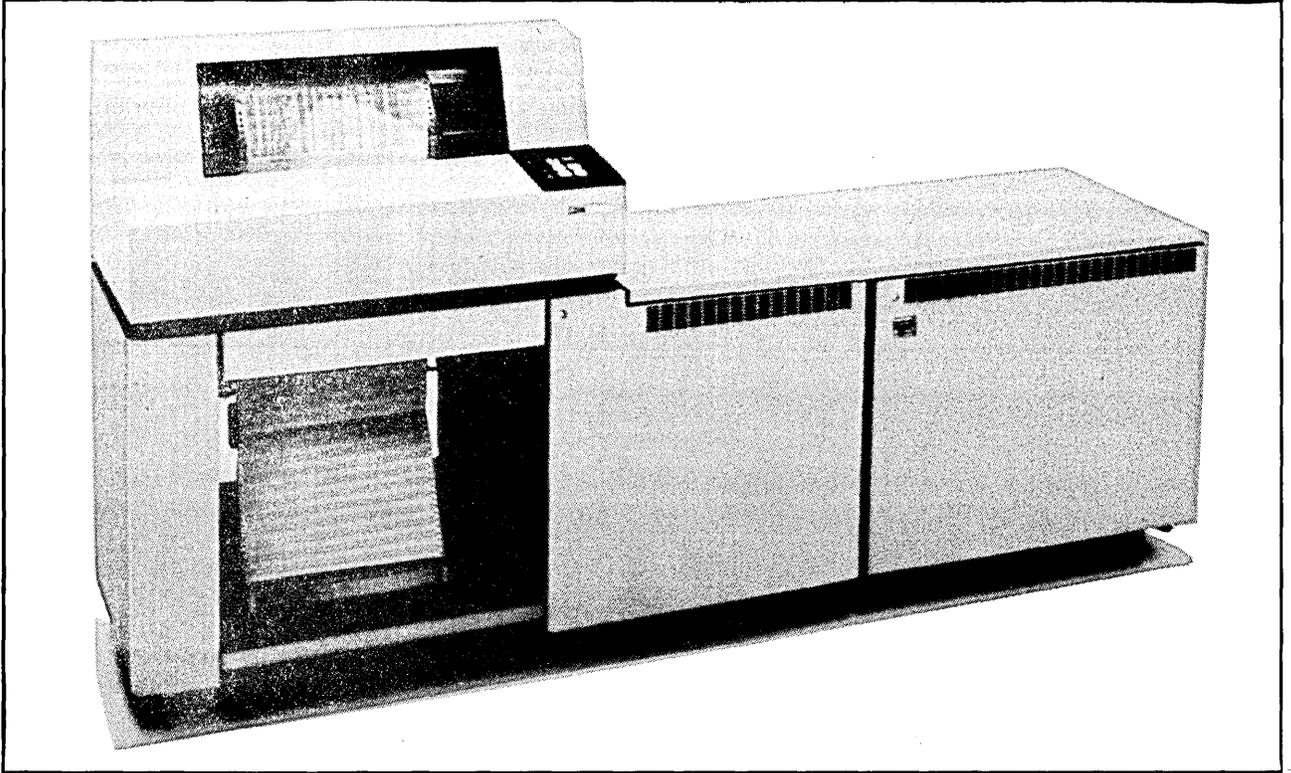
Figure 8-4245-1.   4245 Printer

The 4245 Printer prints either 6 or 8 lines per inch, under operator control. Figure 8-4245-2 shows the nominal printing rates in alphameric lines per minute (lpm) printing at 6 lines per inch.

Character Set	Speed
48	2000 lpm
52	1820 lpm
50/54/63/64	1620 lpm
94/116	1130 lpm
108/124/127	820 lpm

Figure 8-4245-2.   4245 Printer Speeds

4245 Highlights

Processor Attachment

The 4245 Printer requires a control unit position on the processor.

Print Band

The 4245 Printer uses an interchangeable print band. The method of printing is similar to the 3203 Model 5.

Universal Character Set (UCS)

The ability to print with a universal character set (UCS) is a standard feature of the 4245 Printer. The character arrangements of all print bands are permanently stored in the controller unit, eliminating the need for loading the UCS buffer when the print band has been changed.

Forms

The 4245 Printer uses margin-punched, pin-fed, continuous forms. The size of individual documents that make up the continuous forms can range from 89 to 559 millimeters (3.5 to 22 inch) wide and from 76 to 610 millimeters (3 to 24 inch) long.

Forms Control Buffer

The forms control buffer controls the vertical format and movement (spacing and skipping) of the forms, and removes the need for separate carriage-control tapes.

Power-Assisted Stacker

A power-assisted stacker reduces the need for operator attention.

Vacuum Cleaning System

The vacuum cleaning system continuously cleans the print band. A separate hose connects to the vacuum cleaning system, enabling the operator to clean the print area.

Part 9. Punched Card Devices

Contents

Introduction

The following devices operate on either 80- or 96-column cards (Figure 9-1). The punched card can be used to enter and retrieve data from a processor. It can also be used to store data. Payroll checks are one of the practical applications of these devices.
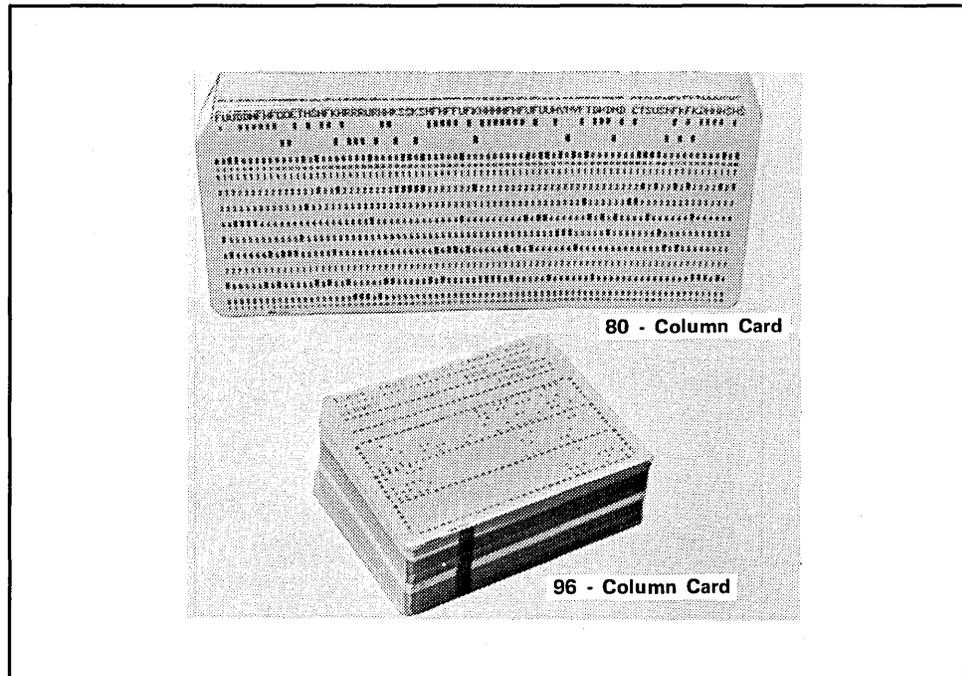
Figure 9-1. 80- and 96-Column Cards

Some of these devices have buffers which gives them storage to use to compensate for a difference in data flow rates, or time of occurrence of events, when transferring data from one device to another.

Punched Card Data Comparison Table

Figure 9-2 on page 9-3 gives a comparison of data for the card devices described in this chapter.

CARD UNIT	MODEL	READ SPEED	PUNCH SPEED	READ AND PUNCH SAME CARD IN ONE PLACE	SELF CONTAINED CONTROL UNIT	BUFFERS
1442	N1	400	160 cc/s *	Yes	Yes	None
	N2	---	160 cc/s *	---	Yes	None
2501	B1	600	---	---	Yes	None
	B2	1000	---	---	Yes	None
3505	B1	800	---	---	Yes	Read
	B2	1200	---	---	Yes	Read
	P1	100	100 c/m **	Yes	No	Read, Punch, Print
3525	P2	200	200 c/m **	Yes	No	Read, Punch, Print
	P3	300	300 c/m **	Yes	No	Read, Punch, Print

*   265 cards per minute if the unit punches columns 1 through 10;
    91 cards per minute if it punches all 80 columns.

** With card read feature installed.

Legend: cc/s ---card columns per second
          c/m ---cards per minute

Figure   9-2.   Comparison Data for Card Devices

9-1442. Model N1/N2 Card Read Punch and Card Punch

The 1442 Card Read Punch Model N1 reads and punches the 80-column card. It uses a single common card path for reading and punching, and reads and punches cards serially by card column. Serial card feeding, past a read station and then a punch station, makes it possible for the program to read data from a card and then punch data (such as the results of a calculation) into the same card during a single card pass. The appearance of the unit is similar to that of the 1442 Model N2 shown in Figure 9-1442-1 on page 9-1442-2.

1442 Highlights

The highlights of the 1442 Card Read Punch follow.

Processor Attachment

No external control unit is needed; the control circuits are inside the 1442. The 1442 Model N1 attaches through a control unit position to a system channel.

Speed

The Model N1 reads or punches cards at the following maximum rates:

- Reads 400 cards per minute

- Punches 160 card columns per second.

Punching speed varies with the location of the last column punched. Interspersed blank columns between fields are considered punched columns. In terms of cards per minute, the rated speed for punching columns 1 through 10 is 265; for punching columns 1 through 80 it is 91.

Hopper and Stackers

The read hopper holds 1200 cards. Card movement is from the hopper to the read station, to the punch station, then to one of the two stackers (pockets). Each stacker holds 1300 cards, and cards can be removed by the operator from either stacker without stopping the machine.

Read and Punch Modes

There are two modes of reading and punching cards, as described below. Data mode 1 is the normal mode of operation; data mode 2 needs a special feature called Card Image.

In data mode 1, the Model N1 can read and punch the 256 different combinations of holes needed by the extended binary-coded decimal interchange code (EBCDIC). For the 256 combinations, multiple punches in a single card column are needed; however, no more than one punch is permitted in rows 1 through 7. (Rows 12, 11, 0, 8, and 9 permit 32 possible combinations, which, multiplied by the eight possibilities in rows 1 through 7, equal the needed 256.) For multiple punches in rows 1 through 7, the card image special feature is needed.

Operations that use the Card Image feature are in data mode 2, which is the card image or column binary mode. The Card Image feature permits the low-order six bits of bytes read from the processor to be punched alternately into the upper six and lower six rows of a card, enabling 160 such truncated bytes to be placed in the card. In a read operation, the information is read column by column and transmitted to the processor byte by byte, the two high-order bits (0 and 1) being set to zero.

1442 Special Features

The following feature can be ordered through an IBM sales representative to expand and customize the user's operation. For more information about features, see an IBM sales representative.

Card Image

The Card Image feature permits processing of cards with multiple punches in rows 1 through 7 of a single column.

1442 Card Punch Model N2

The 1442 Card Punch Model N2 (Figure 9-1442-1) can be connected to an IBM processor to supply the card punching function only. Punching operations, speeds, internal controls, punching in data mode 2, and all other features related to punching are the same as those of the 1442 Card Read Punch Model N1, except that the Model N2 has only one 1300-card stacker.
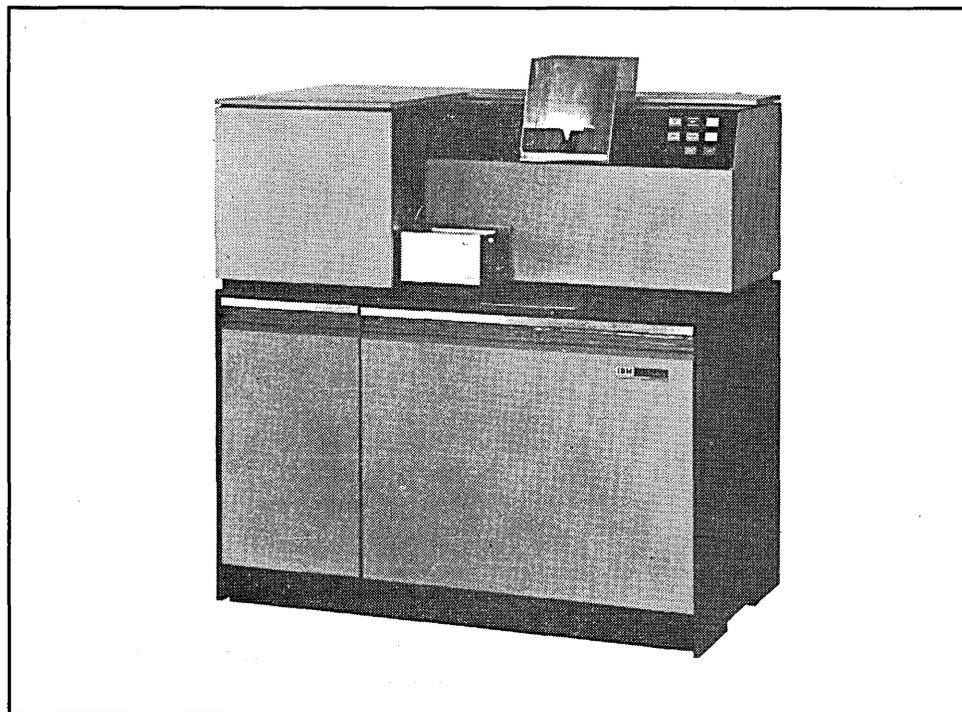
Figure 9-1442-1. 1442 Card Punch Model N2

9-2501. Card Reader

The 2501 Card Reader (Figure 9-2501-1) is a punched-card input device for an IBM processor. The 2501 is available in two models. The difference in models is the rated speed that they can read 80-column cards.

- Model B1 - reads at 600 cards per minute
- Model B2 - reads at 1000 cards per minute.
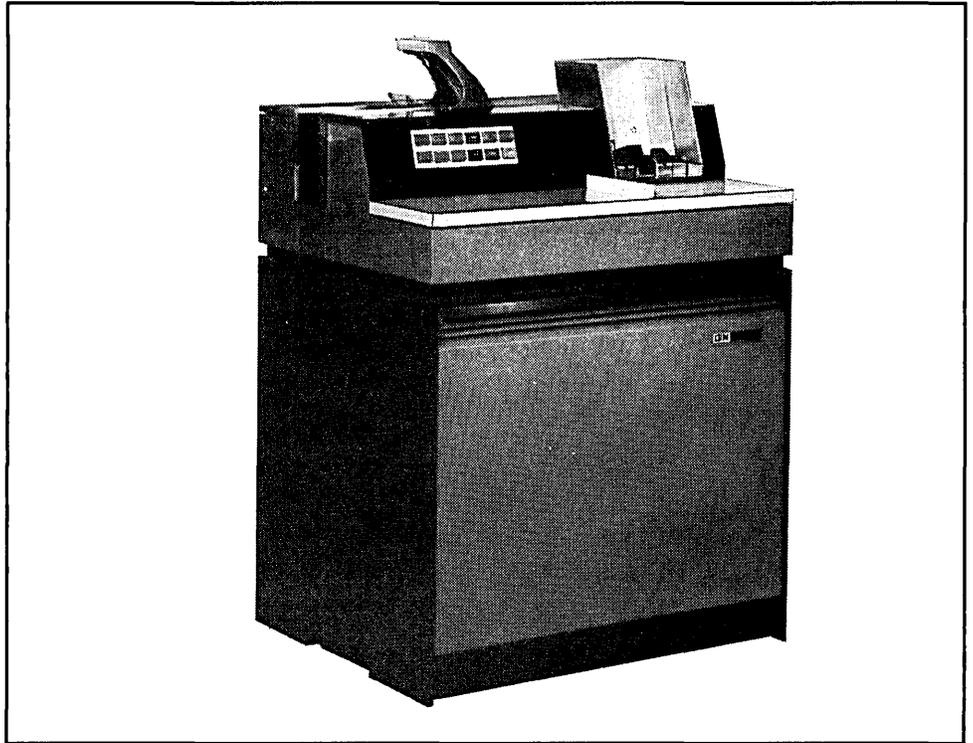
Figure 9-2501-1.   2501 Card Reader

2501 Highlights

The highlights of the 2501 Card Reader follow.

Processor Attachment

No external control unit is needed; the control circuits are inside the device. The 2501 needs a control unit position on a system channel.

Reading Operation

Cards are read by photocells that convert the light passing through punched holes into electrical energy. Cards are read serially by column.

The 2501 can read EBCDIC in standard data mode 1. For the 256 combinations in EBCDIC, multiple punches in a single card column are needed; however, no more than one punch is permitted in rows 1 through 7. For multiple punches in rows 1 through 7, the Card Image special feature is needed. See "Read and Punch Modes" in the 1442 Model N1 description earlier in this chapter for a description of the reading operation in card image mode.

Hopper and Stacker

The feed hopper has a 1200-card capacity, and cards can be removed from the single 1300-card stacker by the operator without stopping the reader.

2501 Special Features

The following feature can be ordered through an IBM sale representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Card Image

The Card Image feature permits processing of cards with multiple punches in rows 1 through 7 of a single column.

9-3505. Card Reader

The 3505 Card Reader Models B1 and B2 (Figure 9-3505-1) is an 80-column, punched-card, input device for an IBM processor. It is a high-speed, fully buffered, card reader, containing its own control unit.

The 3505 is available in two models:

- Model B1 has a rated card speed of 800 cards per minute.

- Model B2 has a rated card speed of 1200 cards per minute.
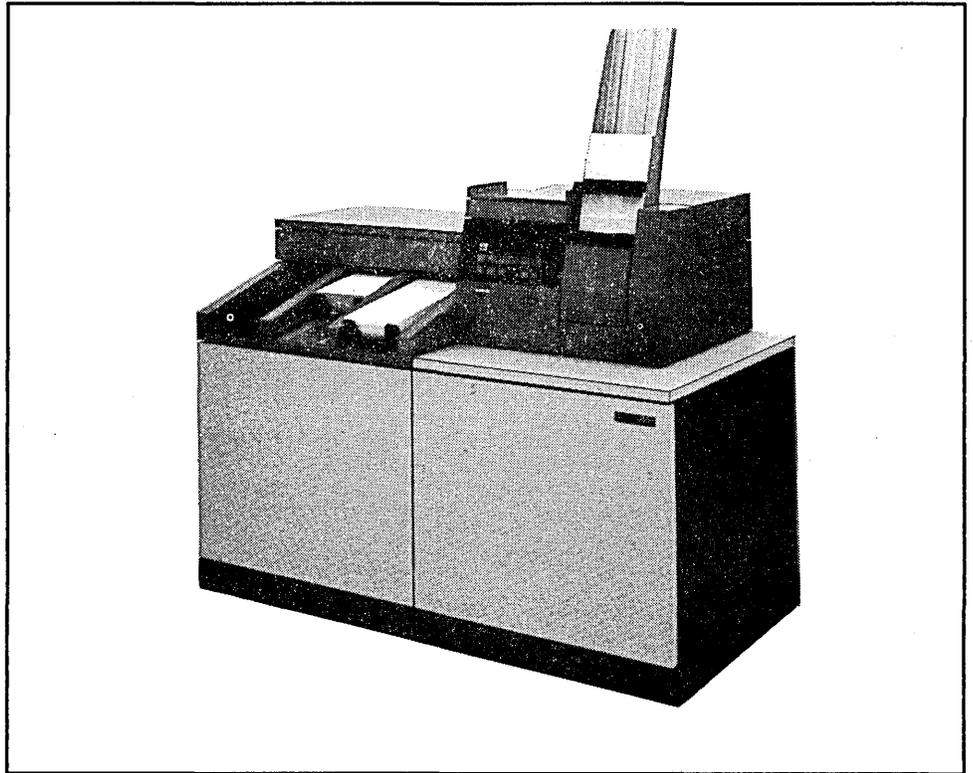
Figure 9-3505-1.   3505 Card Reader

3505 Highlights

The highlights of the 3505 Card Reader follow.

Processor Attachment

The 3505 requires a control unit position on a system channel. Depending on the processor, either a byte or block multiplexer channel, or a selector channel must be available.

File Feed and Stackers

Both models of the 3505 have a 3000-card capacity file feed and two 1750-card capacity stackers.

Control Unit

The control unit with buffers, housed within the 3505:

* Contains its own microprocessor and resident programs (microcode) for error detection and recovery assistance

* Keeps a log of recent errors (especially helpful in device maintenance)

* Prevents channel overrun

* Permits card data to be transferred in burst mode.

Error Recovery Support

The 3505 needs less error-recovery support than other I/O devices such as the 2540 Card Read Punch, because many of the functions performed by the program support are already performed by the 3505 (for example, automatic feed retry).

The 3505 has error-retry capabilities; it retries cards that fail to feed on the first try, and signals a hopper misfeed if subsequent retry operations are unsuccessful.

Operator Panel

The 3505 has a recovery-oriented operator panel. The indicators on the panel show the precise action to be performed for all normal stops and most error stops, or they direct the operator to a corrective procedure. Operating keys are located in the same general area for ease of control.

Read Column Eliminate

The read column eliminate capability gives the user, under program control, the ability to suppress the reading of selected card columns and substitutes blanks in these columns in the buffer.

Read and Validity Checks

The 3505 reads cards serially by column. During card reading, a card is checked for invalid codes or open-punched card scores. Machine checks are also made for off-punched or mispositioned cards.

3505 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Optical Mark Read

The Optical Mark Read feature permits the 3505 to read up to 40 columns of marked data. Pencil-marked, machine-printed, nonreflective-marked, and punched data can be read from a card.

Selective Stacker

The Selective Stacker feature supplies a third stacker (second logical stacker), which permits time-independent card selection under program control.

3525 Card Print Control

The 3525 Card Print Control feature supplies the control necessary for the basic Card Print feature installed on the 3525.

3525 Punch Adapter

The 3525 Punch Adapter feature permits attachment of the 3525 Card Punch, without its Card Read feature.

3525 Read Punch Adapter

The 3525 Read Punch Adapter feature permits attachment of the 3525 Card Punch that has the Card Read feature installed.

51/80-Column Interchangeable Read Feed

The 51/80-column Interchangeable Read Feed feature permits the feeding of either 51-column cards or standard 80-column cards in the read feed of the machine. The 51 columns are equal to columns 15 through 65 of an 80-column card.

9-3525. Card Punch

The 3525 Card Punch (Figure 9-3525-1) is an 80-column, punched-card, output device. When equipped with the appropriate special features, it can read and print as well as punch 80-column cards in a single pass through the machine.

The 3525 has three models:

- Model P1 has a rated speed of 100 cards per minute.

- Model P2 has a rated speed of 200 cards per minute.

- Model P3 has a rated speed of 300 cards per minute.
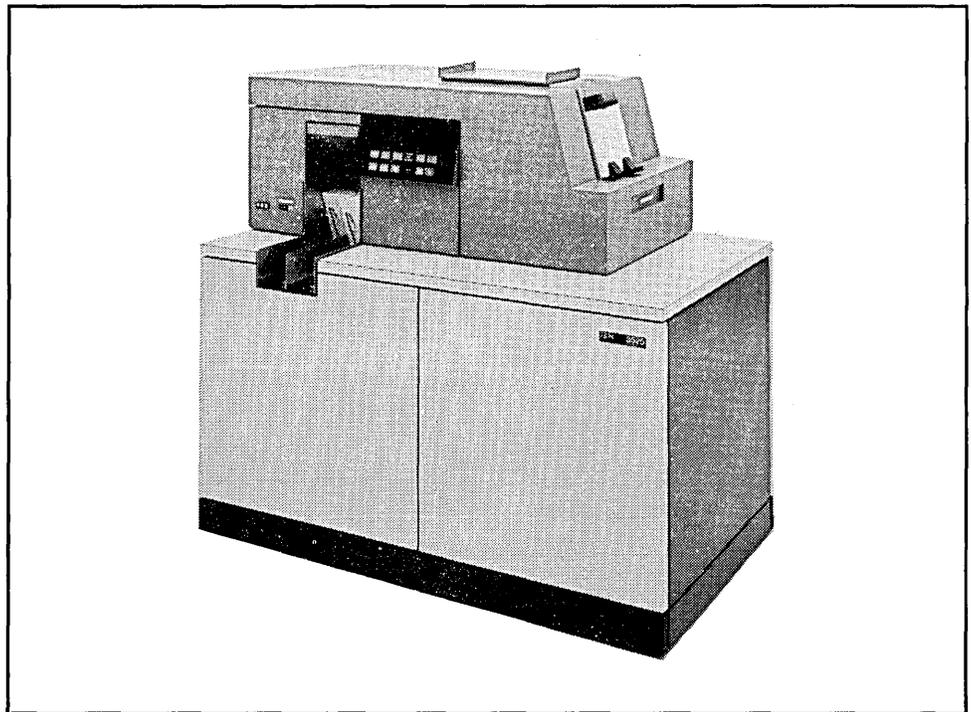
Figure 9-3525-1.   3525 Card Punch

3525 Highlights

The highlights of the 3525 Card Punch follow.

Processor Attachment

The 3525 attaches to an IBM processor through the 3505 or through an integrated attachment. It needs a control unit position on a system channel.

Functional Units

The 3525 has a 1200-card capacity hopper and two 1200-card capacity stacker.

Error-Recovery Support

The 3525 needs less error-recovery support than other I/O devices such as the 2540 Card Read Punch, because many of the functions performed by the program support are already performed by the 3525 (for example, automatic punch retry).

On recognizing a card with a punch error, the 3525 sends that card to an error stacker for later examination and retries correct punching.

Operator Panel

The 3525 has a recovery-oriented operator panel. The indicators on the panel show the precise action to be performed for all normal stops and most error stops, or they direct the operator to a corrective procedure. Operating keys are located in the same general area for ease of control.

Punch Checking

The 3525 checks card punching by monitoring the movement of all 80 punches. A card in which a punching error is sensed is automatically directed to a dedicated, 200-card capacity error stacker and followed by two automatic punching retry operations. Either the extended binary-coded decimal interchange code or card image can be punched.

3525 Special Features

The following features can be ordered through an IBM sales representative to expand or customize the user's operation. For more information about features, see an IBM sales representative.

Card Read

The Card Read feature supplies an optical hole-sensing station ahead of the punch station. The cards are read parallel by row. This feature permits the 3525 to read 3504 and 3505 program cards and execute the program. The read column eliminate capability is standard with this feature and gives the ability, under program control, to suppress the reading of selected card columns.

Multiline Card Print

The Multiline Card Print feature gives the ability to print, under program control, on any or all of the 25 printing lines on a card.

Two-Line Card Print

The Two-Line Card print feature provides the same function as the multiline card print, with the exception that printing is limited to lines 1 and 3. Maximum speed in cards per minute, when printing, varies with the machine model only.

Part 10. Controllers

Contents

Introduction

Controllers allow local or remote attachment of other devices (printers, displays, and so on) to a processor channel. Remote device attachments to a controller require either customer or common carrier communication facilities.

For a description of remote devices and systems that can be attached see *IBM Data Communication Device Summary*, GA27-3185.

10-2701. Data Adapter Unit

The 2701 Data Adapter Unit Model 1 (Figure 10-2701-1) provides for the following attachments:

- Four half-duplex start/stop communication lines with speeds up to 600 bits-per-second

- Four (maximum of two operating simultaneously) half-duplex synchronous communication lines with line speeds up to 400 bps

- Four parallel data acquisition devices.

Various combinations (up to four of the preceding attachment configurations) are possible to permit the use of a wide variety of communication devices.
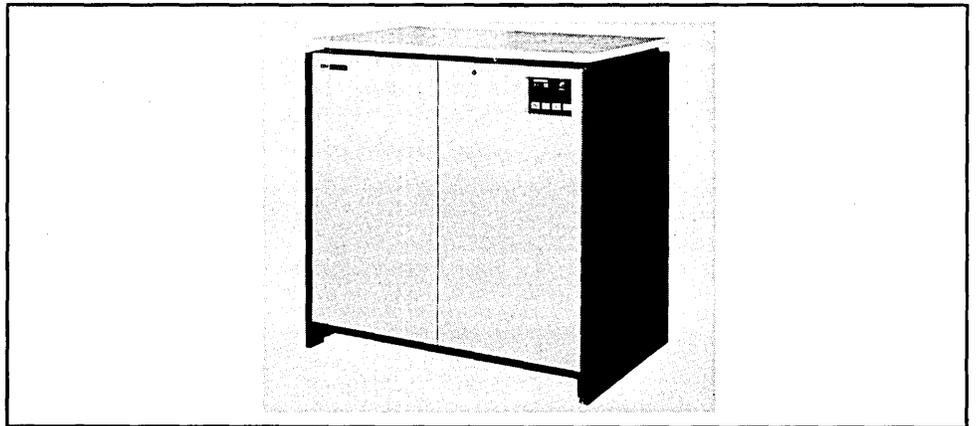
Figure 10-2701-1.   2701 Data Adapter Unit

2701 Highlights

The highlights of the 2701 Data Adapter Unit follows:

Processor Attachment

The 2701 requires a control unit position on a system channel. Depending on the processor used, this is either a multiplexor channel (byte or block) or a selector channel.

Terminal Attachment

The 2701 can, with the appropriate adapter, attach many types of devices. Start/stop terminals, fixed 4-out-of-8 Code terminals, binary synchronous terminals, and parallel data services are available.

Special features for the 2701 are available to allow many additional functions. These include:

- Auto Call. Provides auto dialing for switched networks.

- Channel Interface, Second. Provides connection to a second processor channel.

- Dual Code. Provides a second code type for use with the synchronous data adapter

- Dual Communication Interface. Provides for the connection of the synchronous data adapter to the second facility.

- Expanded Capability. Permits additional combinations of adapters.

- Expansion Feature. Permits the use of additional adapters.

- Terminal Adapter Type I. Controls data transfer between Type I terminals and the processor.

- Terminal Adapter Type II. Controls data transfer between Type II terminals and the processor.

- Terminal Adapter Type III. Controls data transfer between Type III terminals and the processor.

- 1200 BPS Line Adapter Leased. Provides for use with leased line communication facilities.

- 1200 BPS Line Adapter Switched. Provides for use with switched telephone network facilities.

- Parallel Data Adapter. Provides a 16-bit wide path, expandable to 48-bits.

- Selectable Synchronous Clock. Provides for 600 or 1200 bps operation.

- Synchronous Data Adapter Type I. Provides for use of 4-out-of 8 code synchronous terminal.

- Synchronous Data Adapter Type II. Provides for use of binary synchronous terminals.

- Telegraph Adapter. Provides for use of teletypewriter terminals.

10-2821. Control Unit

The 2821 Control Unit (Figure 10-2821-1) contains the control and buffer circuits to transmit information between the associated channel and the 2540 Card Read Punch, and one or more 1403 Printers Model 2, 7, or N1.

Six models of the 2821 are available:

• Model 1 controls a 2540 Card Read Punch and one printer

• Model 2 controls one printer

• Model 3 controls two printers (optional third printer)

• Model 4 controls a 2540 Card Read Punch and one 1404 Printer

• Model 5 controls a 2540 Card Read Punch and two printers (optional third printer).

• Model 6 - Controls a 2540 Card Read Punch
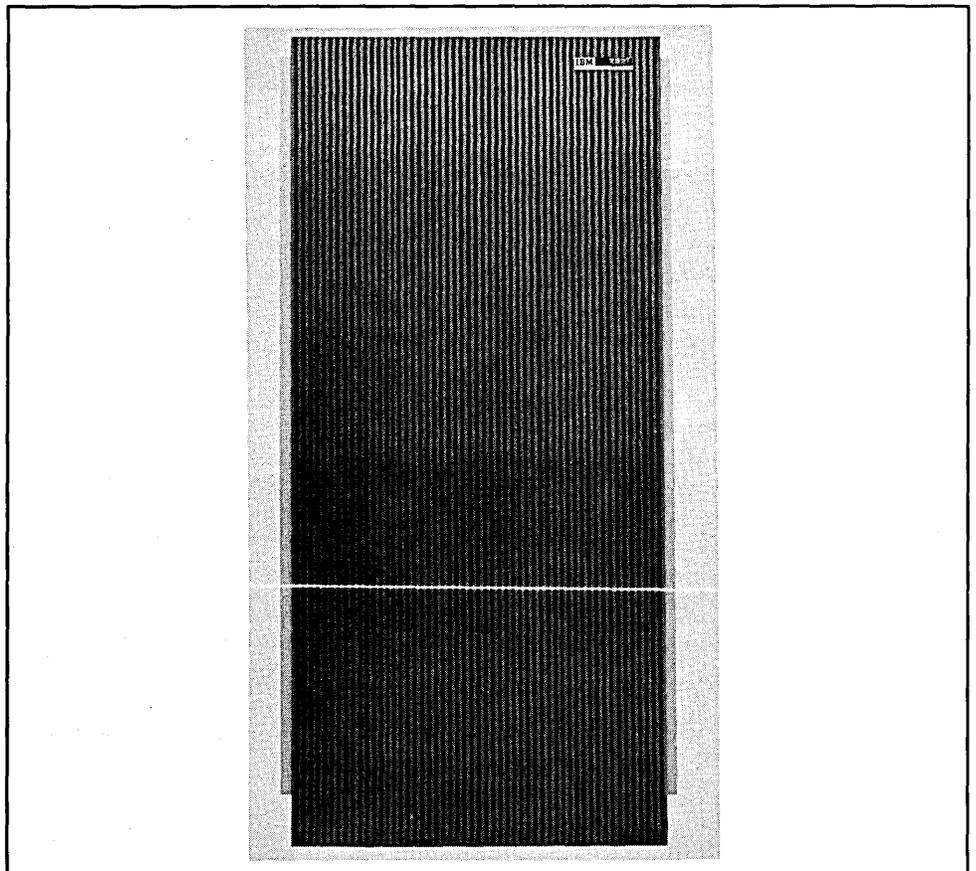
Figure 10-2821-1. 2821 Control Unit

2821 Highlights

The highlights of the 2821 Control Unit follow.

Processor Attachment

The 2821 requires a control unit position on a system channel. Depending on the processor used, this is either a multiplexer channel (block or byte), or a selector channel.

Buffers

The buffers in the 2821 permit the sending of accumulated data to and from the channel at a much quicker rate per byte than would be possible by direct transmission to or from the attached device.

2821 Special Features

2821 special features are available to allow many additional functions. These include:

- Column Binary. Allows processing of cards with multiple significant digit punching.

- 1100 lpm Printer Adapter. Permits attachment of a 1403 Model 3 or N1 printer.

- Third Printer Control. Allows the attachment of a third printer.

- Two Channel Switch. Allows the 2821 to be attached to a second processor channel.

10-3704. Communication Controller

The 3704 Communication Controller (Figure 10-3704-1) provides for the attachment to a processor of local input/output devices and remote input/output devices that communicate over various common carrier or equivalent customer owned communication facilities.

The 3704 is a modular, programmable unit that provides a high degree of flexibility for tailoring to a teleprocessing system's requirements.

Four models of the 3704 are available:

*   Model A1 contains 16K bytes of storage.

*   Model A2 contains 32K bytes of storage.

*   Model A3 contains 48K bytes of storage.

*   Model A4 contains 64K bytes of storage.
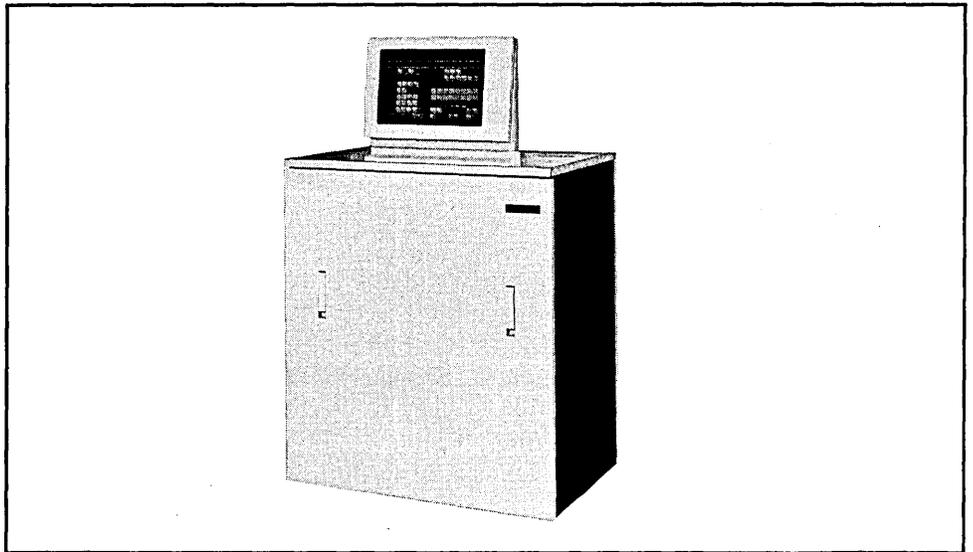
Figure 10-3704-1.   3704 Communication Controller

3704 Highlights.

The highlights of the 3704 Communication Controller follow.

Processor Attachment

The 3704 requires a control unit position on a processor's byte multiplexer channel.

Local I/O Device Attachment

Up to two start/stop or synchronous input/output devices may be locally attached to a 3704.

Remote I/O Device Attachment

The 3704 can attach remote I/O devices that operate over common carrier or equivalent customer owned communication facilities. A maximum of 32 lines can be attached.

3704 Special Features

Special features for the 3704 are available to allow many additional functions. These include:

- Channel Adapter. Provides for 3704 attachment to a processor's byte multiplexer channel.

- Two Channel Switch. Provides for the 3704 Channel Adapter attachment to two processor channels.

- Line Interface Base. Various types of Line Interface Bases are available to provide for the attachment of up to 8 Line Sets to different kinds of communication lines.

- Line Set. Various types of Line Sets are available to accommodate different communication line protocols.

- Modem Attachment Base. Provides for the attachment of selected modem devices.

10-3705. Communication Controllers

The 3705 Communication Controller is available in two basic models; the 3705 Model II and the 3705 Model 80. Each basic model is also available in sub-models depending on storage capacities and/or number of line attachments.

3705 Model II Communication Controller

The 3705 Model II Communication Controller (Figure 10-3705-1) provides for the attachment to a processor of local input/output devices and remote input/output devices that communicate over various common carrier or equivalent customer owned communication facilities.

The 3705 Model II is a modular, programmable unit that provides a high degree of flexibility for tailoring to a teleprocessing system's requirements.
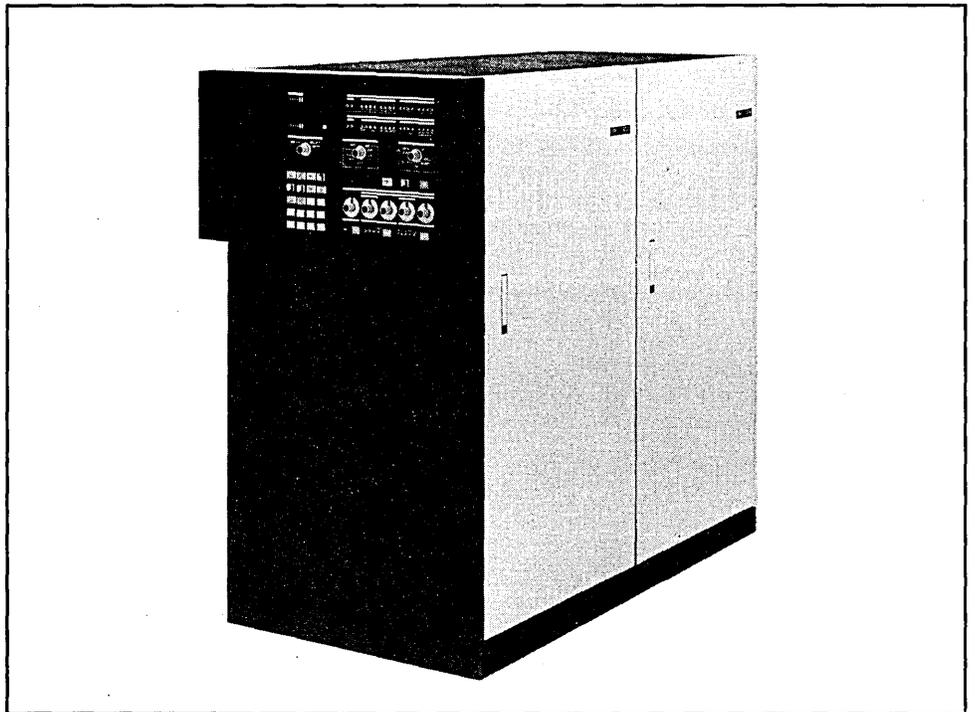
Figure 10-3705-1.   3705 Model II Communication Controller

The maximum number of communication lines that can be physically attached to a 3705 Model II is 352; however, the maximum number of communication lines capable of concurrent operation is a function of the speed of the lines, type of channel adapter, storage size, and the programming mode of operation.

The 3705 Model II contains monolithic storage with cycle times of 1.0 microseconds for models E, F, G, and H; and 900 nanoseconds for models J, K, and L.

3705 Model II Models

The 3705 Model II contains multiple models E1 through E8, F1 through F8, G1 through G8, H1 through H8, J1 through J4, K1 through K4, and L1 through L4.

The alphabetic code (E through L) designates the number of frames in the 3705 Model II.

E represents one frame.
F or J represent two frames.
G or K represent three frames.
H or L represent four frames.

The numeric code (1 through 8) designates the storage size in K-bytes.

1 = 32   5 = 160
2 = 64   6 = 192
3 = 96   7 = 224
4 = 128 8 = 256

Within the 3705 Model II Models E, F, G, and H, the storage is contained within the first frame with 32K bytes minimum expandable in increments of 32K bytes to a maximum of 256K bytes. For the 3705 Model II Models J, K, and l, 256K bytes of storage are contained in the first frame; additional storage in increments of 64K bytes is contained in the second frame for a maximum storage of 512K bytes.

For example, a 3705 Model II Model F4 contains two frames and 128K bytes of storage; a 3705 Model II Model L3 has four frames and 448K bytes of storage.

3705 Model II Machine Organization

The basic 3705 Model II consists of a central control unit with 32K bytes of storage and an operator's control panel. In addition to the base unit, a machine must have the following minimum features.

- A Channel Adapter feature or a Remote Program Loader feature

- A Communication Scanner feature to provide for the connection between the Attachment Base feature and the Line Interface Base features

- An Attachment Base feature which provides a common connection between the Communication Scanner feature and the Central Control Unit

- A Line Interface Base feature which provides the connection between the Communication Scanner feature and the various Line Set features

- A Line Set feature which provides the interface to a communications facility

- A Business Machine Clock feature which provides for the clocking of data in and out of the Communication Scanner.

3705 Model II Highlights

The highlights of the 3705 Model II Communication Controller follow.

Processor Attachment

The 3705 Model II requires a control unit position on a system channel. Depending on the processor used, this is either a multiplexer channel (byte or block) or a selector channel.

Local I/O Device Attachment

Input/output synchronous, half-duplex, or duplex terminals may be directly attached to the 3705 Model II using the appropriate Line Set features.

Remote I/O Device Attachment

The 3705 Model II can attach remote I/O devices that operate over common carrier or equivalent customer owned communication facilities.

3705 Model II Special Features

Special features of the 3705 Model II are available to allow many additional functions. These include:

- Channel Adapter. Provides the logical interface between the 3705 Model II and a processor's channel.

- Communication Scanner. Provides the logical common connection between the Line Interface Bases with their respective Line Sets and the Central Control Unit.

- Attachment Bases. Provides the physical and logical connection between the Channel Adapter and Central Control Unit and between the Central Control Unit and various Communication Scanners.

- Line Interface Base. Provides the physical attachment of line sets to the 3705 Model II

- Line Set. Provides the electronic logic necessary to meet the individual requirements of the communication facility.

- Two-Channel Switch. Provides for the 3705 Model II Channel Adapter attachment to two processor channels.

3705 Model 80 Communication Controller

The 3705 Model 80 Communication Controller (Figure 10-3705-2) provides for the attachment to a processor of local input/output devices and remote input/output devices that communicate over various common carrier or equivalent customer owned communication facilities.

The 3705 Model 80 contains all the required features and functions to run duplex or half-duplex data transmission communication lines to an EIA or CCITT interface in the multiplexer. Depending on the application, only a Channel Adapter or Remote Program Loader must be selected. All models contain 256K bytes of storage.
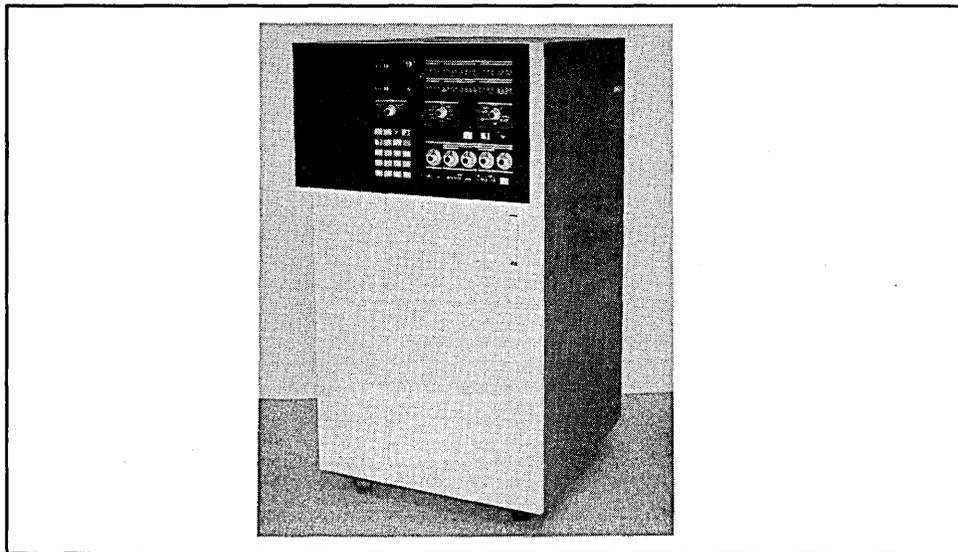
Figure 10-3705-2. 3705 Model 80 Communication Controller

Three models of the 3705 Model 80 are available for EIA RS-232C/CCITT V.24 line attachments.

- Model M81 provides for four line attachments.

- Model M82 provides for ten line attachments.

- Model M83 provides for sixteen line attachments.

3705 Model 80 Highlights

The highlights of the 3705 Model 80 Communication Controller follow.

Processor Attachment

The 3705 Model 80 requires a control unit position on a system channel. Depending on the processor used, this is either a multiplexer channel (byte or block) or a selector channel.

I/O Device Attachment

The 3705 Model 80 can attach local or remote input/output devices that operate over PTT, common carrier, or equivalent customer owned communication facilities.

3705 Model 80 Special Features

Special features of the 3705 Model 80 are available to allow many additional functions. These include:

- Direct Attachment. Allows devices to be directly connected to the 3705 Model 80 using an EIA RS-232C/CCITT V.24 line attachment. This allows direct attachment of start/stop, binary synchronous, or synchronous data link control protocols up to 2400 bps.

- Line Attachments and Line Sets. Provides the electronics necessary to meet the requirements of specific communication facilities.

- Channel Adapter. Provides the logical interface between the 3705 Model 80 and a processor.

- Remote Communication Controller. Allows a 3705 Model 80 to be used as a remote concentrator with a communications link to a local 3705 communication controller. The remote communication controller acts as an extension of the local controller passing data over the communication link to the local communication controller and on to the host processor.

- Two-Channel Switch. Provides for the 3705 Model II Channel Adapter attachment to two processor channels.

- Remote Program Loader. Provides for the remote loading of the NCP. This feature also allows a 3705 Model 80 to be locally attached to a processor through its Channel Adapter, and remotely attached to another processor through another locally attached 3705 communication controller.

10-3725. Model 1 and 2 Communication Controllers

The 3725 Communication Controller is available in two basic models; the 3725 Model 1 (Figure 10-3725-1) and the 3725 Model 2 (Figure 10-3725-2 on page 10-3725-2).

The 3725 Model 1 and Model 2 Communication Controllers control data communication between modem-attached or direct-attached terminal (or processor) devices, and one or more host systems. By enhancements to the storage size and internal processing speed, the 3725 accommodates large networks with high speed lines.

The 3725 is a modular, programmable communication controller. It runs under control of the Advanced Communications Function for Network Control Program (ACF/NCP) or Emulation Program (EP/3725). ACF/NCP communicates with an SNA access method located in one or more host processors.
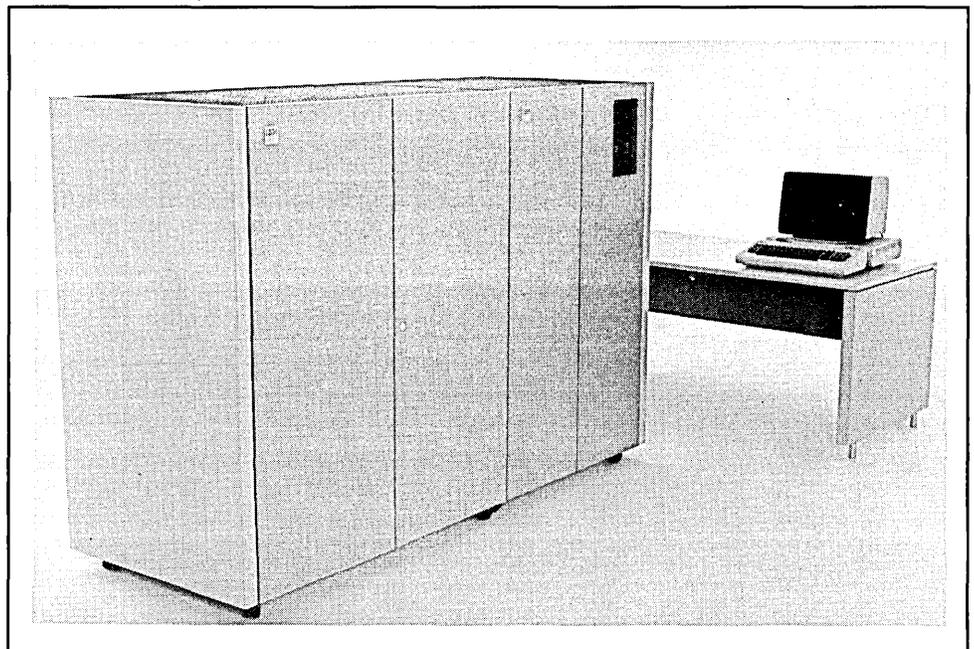
Figure 10-3725-1.   3725 Model 1 Communication Controller

Maintenance and Operator Subsystem

The maintenance and operator subsystem (MOSS) contains a microprocessor, storage, diskette drive, and control panel. One or two operator consoles may be connected. The MOSS with an attached 3727 console provides network management functions, error logging, machine status display, CCU services, scanner services, line services, diagnostics, and utilities.
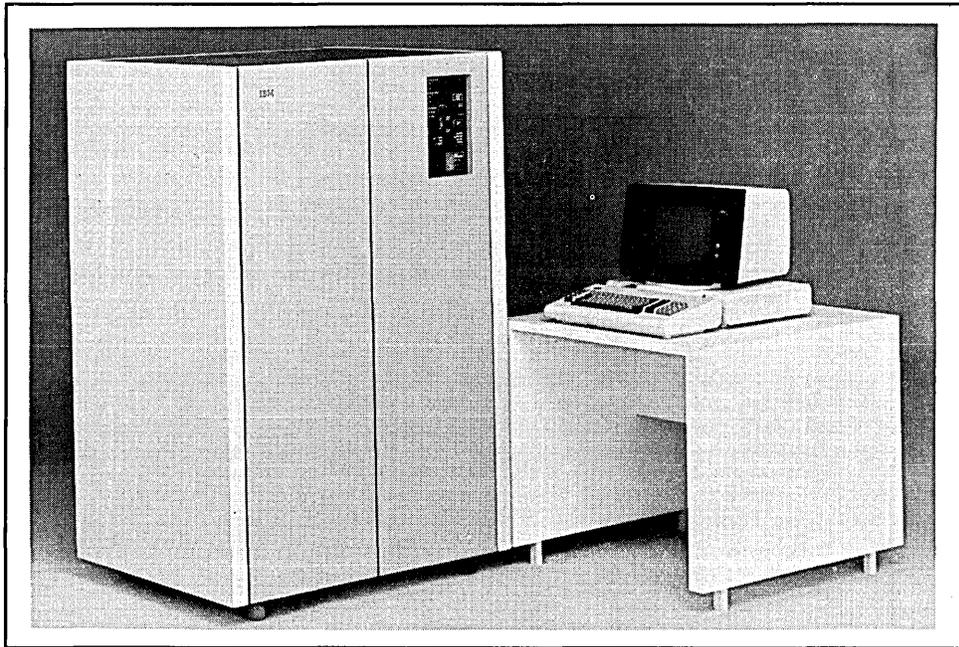
Figure 10-3725-2.   3725 Model 2 Communication Controller

3725 Highlights

The 3725 expands IBM's communication controller family, and:

- Preserves compatibility with existing IBM 3704/3705 Communications Controllers

- Increases performance through:

  — Greater internal processing power and throughput
  — Larger storage capacity

- Complements and enhances system management functions by providing:

  — Increased operator control through Network Communications Control Facility (NCCF)
  — Improved problem determination through Network Problem Determination Application (NPDA)

- Improves attachment capabilities by offering:

  — Direct attachment (up to 56,000 bps)
  — High-speed attachment (256,000 bps)
  — More duplex lines
  — More host attachments
      — On the Model 1 -- up to eight, with six operating concurrently)
      — On the Model 2 -- up to two
  — Support for new X.21 and X.25 protocols

- Provides an enhanced operator interface, and powerful host-independent maintenance functions through the use of a 3727 Operator Console.

- Simplifies the machine structure by using only:

  - One scanner type
  - One channel adapter type
  - Seven storage sizes (only one on the Model 2)
  - Five line attachment types

- Uses advanced LSI technology to:

  - Improve reliability, availability, and serviceability (RAS)
  - Reduce power consumption
  - Reduce floor space requirements

- Uses new versions of Network Control Program and Emulation Program

Machine Units

Model 1: The 3725 Model 1 is packaged in two units:

- The 3725 Communication Controller, which is basic. This contains the central control unit (CCU), the storage, and the maintenance and operator subsystem (MOSS). It can accommodate up to 96 lines and four channel connections.

- The 3726 Communication Controller Expansion, which is optional. This can accommodate an additional 160 lines and four channel connections, bringing the number of lines to 256 and the number of channel connections to eight.

The 3727 Operator Console, consists of logic, display, and keyboard elements. It provides the operator access to the 3725 via the MOSS. Optionally another 3727 can be connected to the 3725. Only one operator console can be active at a time.

The IBM 7427 Console Switching Unit may be used at the primary or the alternate position, or both, to concentrate several controllers to one operator console.

The central control unit (CCU) executes the control program housed in the main storage. It controls the channel adapters, the communication scanners, and the data transferred between them.

Main storage can be 512K to 2048K bytes, by increments of 256K (K equals 1024). The main storage houses the control program and provides the data space for the attached telecommunication lines. Single-bit error correction is provided on main storage. Storage protection is provided to improve control program reliability.

Model 2: The 3725 Model 2 is packaged in a single unit, the 3725 Model 2 Communication Controller. This contains the central control unit (CCU), the storage, and the maintenance and operator subsystem (MOSS). It can accommodate up to 24 lines and two channel connections. The 3727 Operator Console consists of logic, display, and keyboard elements. It provides the operator access to the 3725 via the MOSS. Only one operator console can be active at a time.

The IBM 7427 Console Switching Unit may be used at the primary or the alternate position, or both, to concentrate several controllers to one operator console.

The central control unit (CCU) executes the control program housed in the main storage. It controls the channel adapters, the communication scanner, and the data transferred between them.

The main storage size is 512K bytes. The main storage houses the control program and provides the data space for the attached telecommunication lines. Single-bit error correction is provided on main storage. Storage protection is provided to improve control program reliability.

Processor Attachment

The 3725 can be channel-attached, or it can be link-attached through another 3725 or IBM 3705 Communication Controller. These capabilities allow network growth by permitting combinations of 3725 and other IBM communication controllers in a networking environment.

Channel adapters provide the physical connections to byte-multiplexer, block-multiplexer, or selector channels. Channel adapters fitted with two-processor switches provide a second channel connection to a host, but only one connection is active at one time. This increases availability and improves performance for multiprocessor systems.

Line Attachment

The 3725 Model 1 allows attachment of up to 256 lines; the Model 2 allows attachment of up to 24 lines. The lines can be either half-duplex or duplex, using either synchronous or asynchronous protocols, at line speeds from 50 to 256,000 bits per second (bps).

Telecommunication lines, usually terminated by a modem, are connected via cables to line interface couplers in the 3725.

Line attachment bases house communication scanners and line interface couplers, supporting up to 32 telecommunication lines in the Model 1 and 24 lines in the Model 2. Each communication scanner contains a microprocessor, storage for the scanner microcode, and data space for the lines. A scanner supports a mix of line speeds and communication protocols. For example, SDLC and BSC, or SDLC only, or BSC and asynchronous, or BSC, SDLC and start-stop.

Five types of line interface couplers are available to cover the range of interfaces. An optional clock feature provides clocking at speeds from 50 to 56,000 bps for equipment that is not clocked by a DCE, such as asynchronous terminals and direct-attached terminals.

Direct Attachment of Terminals

Data terminal equipment operating at speeds of up to 56,000 bps, depending on the distance, can be connected directly to the 3725, without intervening data circuit-terminating equipment or telecommunication lines. Maximum distance for direct attachment is 600 meters (1968 feet).

Controller Reliability, Availability, and Serviceability

The controller hardware, the control program, and the MOSS work together to provide enhanced reliability, availability, and serviceability. The following features contribute to this:

- LSI technology with high reliability.

- Storage protection mechanisms.

- Error detection/correction code on scanner and main storage.

- Extensive hardware fault-checking logic.

- Continued operation and controlled shutdown in various failure situations. The 3725's functional building block design isolates most failures within a single building block. This allows continued operation of the 3725 despite unrecoverable failures, such as MOSS failure, channel adapter failure, or communication scanner failure.

- Interactive console guidance facilities.

- Concurrent maintenance of portions of the MOSS.

- Removable MOSS diskettes for easier engineering changes. The diskettes also store error messages, microcode, IPL code, and other key data.

- Automatic power-on when lost power is restored.

The hardware and microcode provide enhanced RAS functions:

- Alert messages to host processor in NCP mode and alarm messages to the MOSS console
- Host-independent problem determination and isolation for most hardware failures

Communication Network Management

The network control program in the 3725 supports communication network management by sending explicit failure alert messages from the MOSS to the host system for display.

Similar alarm messages are sent to the operator console of the 3725.

The 3725 offers many maintenance facilities and CNM support, allowing rapid repair of failures:

- Customer notification at the 3725 (alarms)

- Problem isolation at the 3725 (maintenance)

- Centralized customer notification at the host console (alerts) when NCP is installed at the 3725

- Network-oriented customer notification and improved problem determination aids at the NCCF console, if CNM facilities are installed in the host and NCP in the 3725.

Note: The first two facilities listed above are host-independent and are provided whatever the level of programming support in the host.

Programming Support

The 3725 operates under the control of either:

- Advanced Communications Function for Network Control Program (ACF/NCP), or

- Emulation Program for the IBM 3725 (EP/3725)

Both programs are IBM licensed program products.

NCP provides major capabilities for networks based on systems network architecture (SNA). NCP is not limited to SDLC devices, and existing start-stop and binary synchronous networks can be migrated to the 3725. NCP has a feature called partitioned emulation programming (PEP) extension that allows some of the attached lines to be controlled in emulation mode.

NCP works with the following access methods:

- ACF/Virtual Telecommunications Access Method (VTAM) Version 1 and 2

- ACF/Telecommunications Access Method (TCAM) Version 2

NCP operates with the following host-resident programs:

- Network Communication Control Facility (NCCF). This provides a program base on which the user may build other IBM-supplied or user-supplied programs. It provides activities and functions collectively called communication network management (CNM).

- Network Problem Determination Application (NPDA), which is a CNM processor that operates under NCCF.

- ACF/System Support Programs (ACF/SSP) Version 2.

Network Terminal Option (NTO) is an IBM licensed program product available to provide start-stop support for NCP.

EP works with the following access methods operating under virtual operating systems:

- TCAM
- Basic Telecommunications Access Method (BTAM)
- BTAM Extended Support (BTAM-ES)

Software Migration

The 3725 is not limited to running host SNA applications, since applications that ran with the 3704/3705 communications controllers will also run on the 3725, while allowing future SNA expansions.

The 3725 also supports networks based on the IBM 2701 Data Adapter Unit, IBM 2702 Transmission Control, or IBM 2703 Transmission Control. It also supports networks in which these units are emulated on a 3704/3705 via the partitioned emulation programming (PEP) extension of the NCP or via the emulation program. The NCP with the PEP feature permits migration from the 2701, 2702, 2703, and 3704/3705/EP controllers.

The 3725 offers a path for conversion from existing systems and for continuing growth. A system designed around a 3704/3705 may be transferred to the 3725 after regeneration of the control program. The control program generation deck that was used in the 3704/3705 program generation can be used with some modifications to control cards (assuming that the controller has the same line configuration and that the storage capacity installed is adequate).

Growth in line capacity is accomplished by additions to an otherwise unchanged existing machine. A graphic representation of the actual machine can be produced for use in ordering and installing machine upgrades. Growth may also be accomplished by field upgrading a 3725 Model 2 to a 3725 Model 1. The reverse process is, however, not possible.

Part 11. Systems

Contents

Introduction

The systems described in this chapter interact with IBM processors to transmit data from or to the system through the processor's channel or integrated attachment.

Additional information and details about these system can be obtained from the system library manuals for each system. See your sales representative.

11-3250. Graphics Display System

The 3250 Graphics Display System (Figure 11-3250-1) supplies interactive graphics capabilities for its host system. Graphic and alphameric information is displayed on a cathode-ray tube. Two types of keyboard and a light pen can be installed to permit the operator to interact with the displayed image and the host system, and to update stored data.
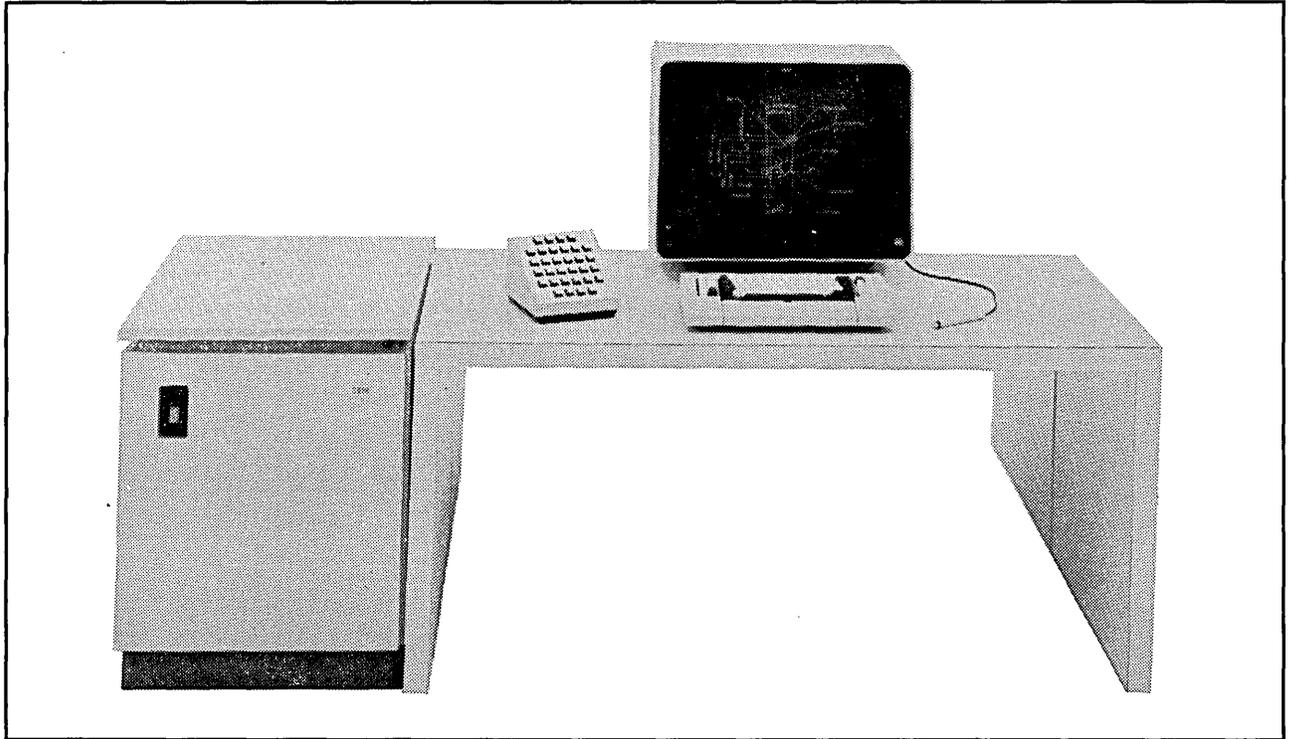
Figure 11-3250-1. 3250 Graphics Display System

Interactive computer graphics are used in a large and still growing variety of applications. Some of the most complex and highly developed applications are found in the automotive and aerospace industries, in which complete geometric definitions of products are specified through interactive graphic displays linked to powerful processors. Other industries that use interactive computer graphics include shipbuilding, electronics, architecture, and general mechanical engineering.

A key characteristic of these applications is the large amount of operator-initiated interactions with the system through input devices and the displayed graphic information. Rapid interaction with large amount of graphic and alphameric data is the normal mode of operation.

Several logically distinct and important functions contribute to the value of an application:

- Entering and editing data

- Updating and controlling changes

- Modeling geometric designs

- Sending data to other functions.

The importance of these functions varies from one application to another. In some applications, such as integrated circuit layout or precision mapping, data entry and editing are important because large amount of precise data must be accurately generated. In other applications, such as computer-aided design engineering, change control can be important.

3250 Highlights

The highlights of the 3250 Graphics Display System follow.

Image Display

Information can be presented graphically (graphs or maps) and alphamerically (descriptive data). The images appear as a series of points, lines, and characters, and can be readily modified by the entry of additional information. Lines are displayed in one of four types of lines: solid, dotted, dashed, or dot-dashed. Each element of the image can be displayed at one of eight programmable intensity levels.

3250 Program Compatibility

The 3250 is generally upward compatible from the 2250 Graphic Display Unit Model 3. Valid programs written for the 2250 can be used on the 3250 without change, with the following minor exceptions:

- The 3250 supports one cursor per display station.

- Some earlier undefined orders have a defined function in the 3250.

- Lowercase characters are displayed as lowercase by the 3250.

- The 3250 does not have Program Function Keyboard overlay sense switches.

- The 3250 shares display buffers with a maximum of two display stations.

- Undefined characters in 3250 text strings are treated as blanks or nulls.

Channel Attachment

The 3250 Graphics Display System attaches to a host system through an I/O channel. This attachment gives two-way communication between the units of the 3250 system and the graphics application program. The 3250 system can be attached to any of the following types of I/O channels:

- Byte multiplexer channel operating in burst mode

- Block multiplexer

- Selector.

System Units

A description of the 3250 Graphics Display System units follows.
Figure 11-3250-2 illustrates a simplified configuration of a 3250 System.
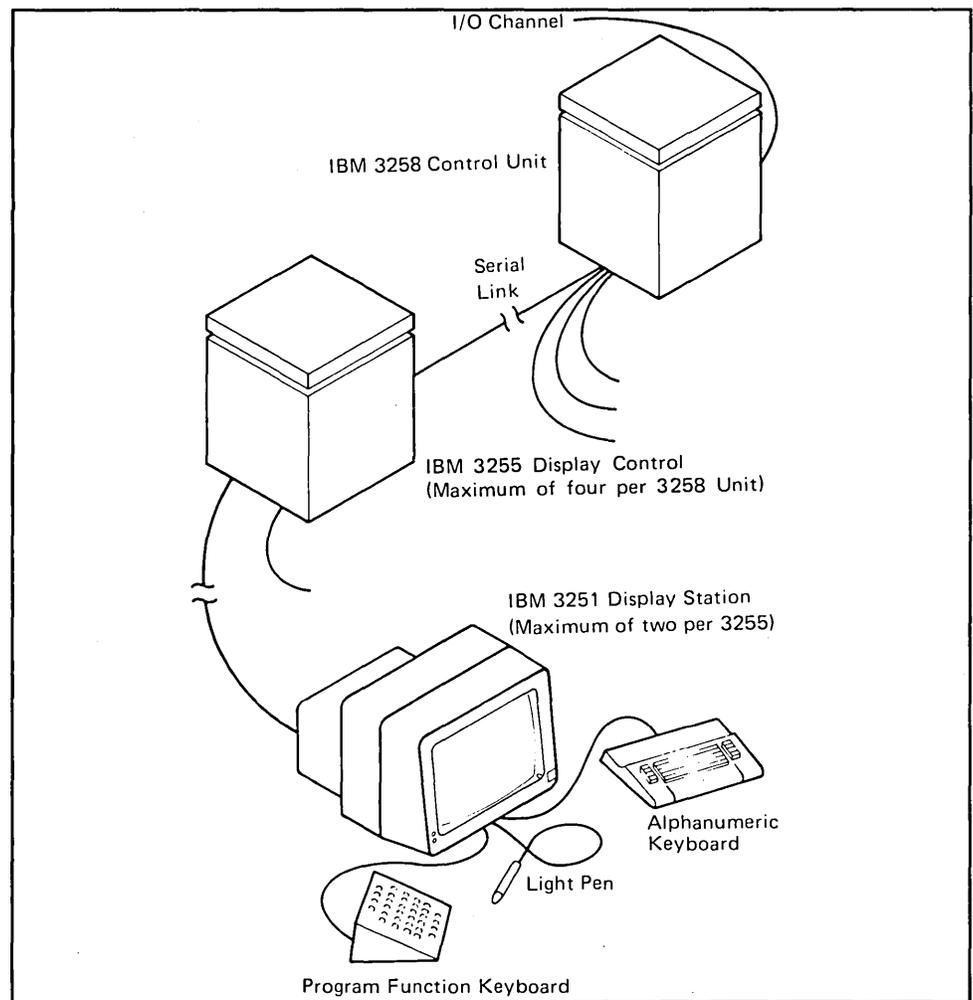
Figure 11-3250-2. **3250 System Simplified Configuration**

3251 Display Station

The 3251 Display Station (Figure 11-3250-3) is a free-standing, table-top-mounted, interactive CRT display station for the input and display of graphic and alphameric data generated in an IBM processor. The display station can have an alphanumeric keyboard, a program function keyboard, and a light pen through the installation of special features.
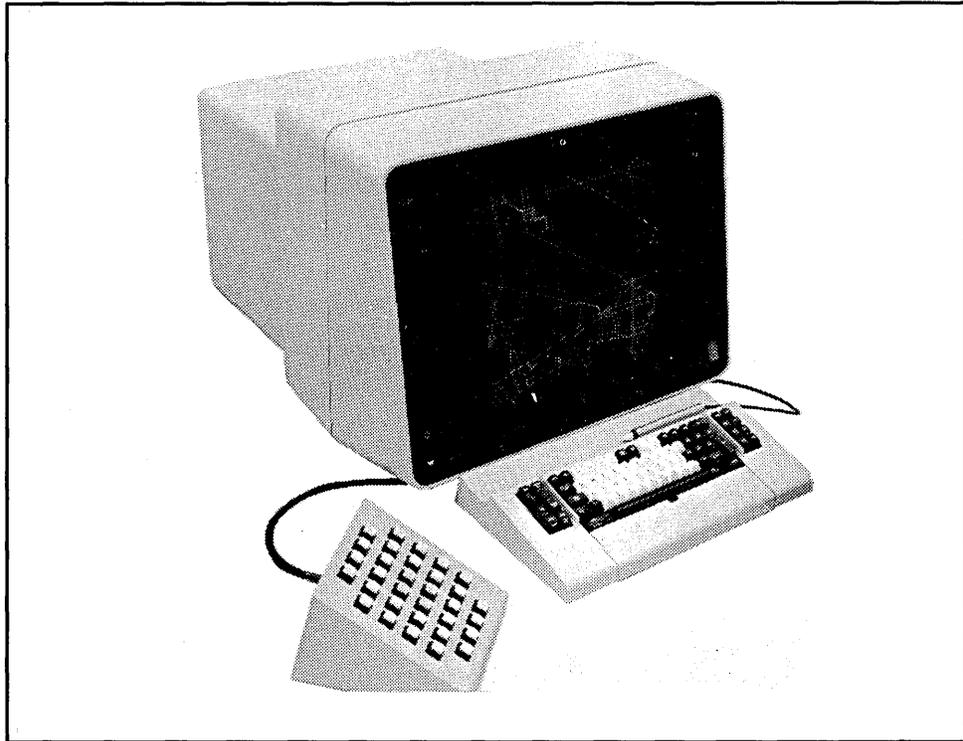
Figure 11-3250-3. 3251 Display Station

3255 Display Control Unit

The 3255 Display Control Unit Model 1 (Figure 11-3250-4 on page 11-3250-6) is a free-standing, floor-mounted unit that supplies common controls and attachments for one or two 3251. The 3255 has a 32,768-byte user-programmable display buffer that is shared by the attached 3251's. If the 3250 uses only one display station, that display can use the entire display buffer.

The logic circuits in the 3255:

- Accept data from, and pass data to, the serial link to the 3258

- Maintain and execute a buffer program for each attached 3251

- Generate the beam deflection and intensity signals for producing the image on the screen of each attached 3251

- Supply a light pen interface for each attached 3251

- Supply a keyboard interface for each attached 3251

- Supply an interface between the buffer programs and through the 3258 Control Unit, the host system.

Display Buffer: In the 3255, a 32,768-byte buffer is available to the buffer programs controlling the attached 3251s. Buffer programs are created and updated by the application program in the host system. The programs are then sent to the 3255 through the 3258 and the serial link. The functions of the buffer program are to generate the display image and to monitor the keyboards and light pen to accept operator actions.

The buffer programs consist of graphic orders, graphic and alphameric data, and control orders, which control:

- Regeneration of the displayed image

- Sensitivity of the displayed image to a light pen operation

- Data entry from the alphanumeric keyboard.

The 3258 Control Unit Model 1 (Figure 11-3250-4) is a free-standing, floor-mounted unit that attaches a 3250 System to a standard System/370 block multiplexer, selector, or byte multiplexer (burst mode) channel interface. The 3258 supports a burst mode data rate of up to 250,000 bytes per second, when the rate is not limited by the channel data rate.

The 3258 is a channel-attached control unit that supplies an interface between the connected 3255 Display Control and the channel of the host system. Up to four 3255 Display Control Units can be attached to the 3258 through individual coaxial links of 1 megabit per second. These links can be up to 1525 meter (5000 feet) in length (longer by request for price quotation [RPQ]) for local attachment. In addition, RPQs are available that permit remote connection of 3255s to a 3258 through communication systems. These systems permit display stations to be placed far from the central data-processing complex.
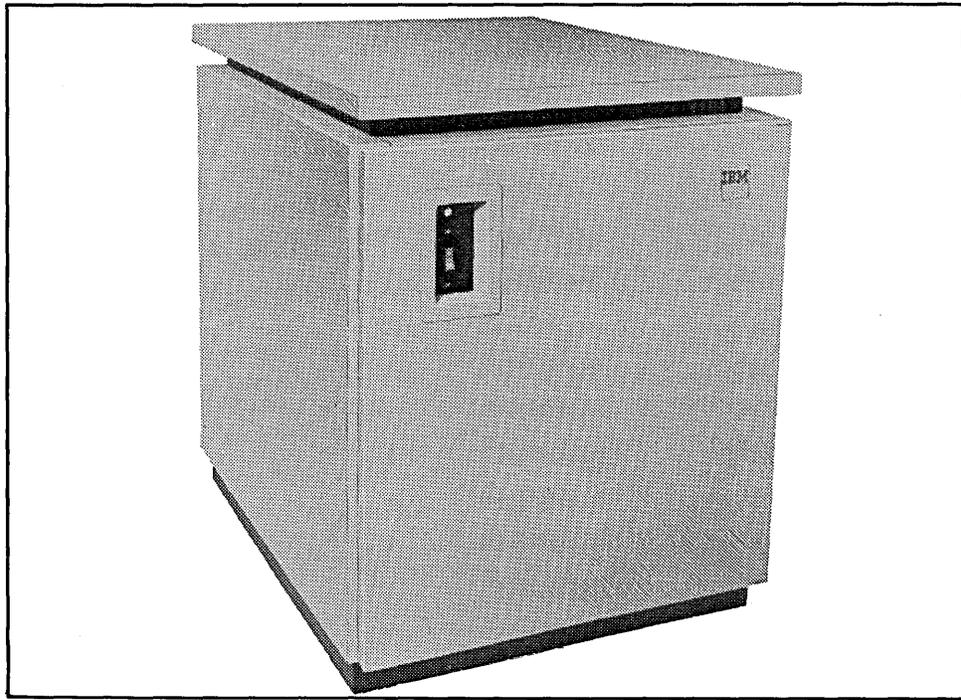
Figure 11-3250-4. 3255 Display Control Unit or 3258 Control Unit

11-3270. Information Display System

The 3270 Information Display System (Figure 11-3270-1) is composed of units and features selected from a family of display products. A combination of products can be selected and tailored to meet the needs of most alphameric and graphic display applications.
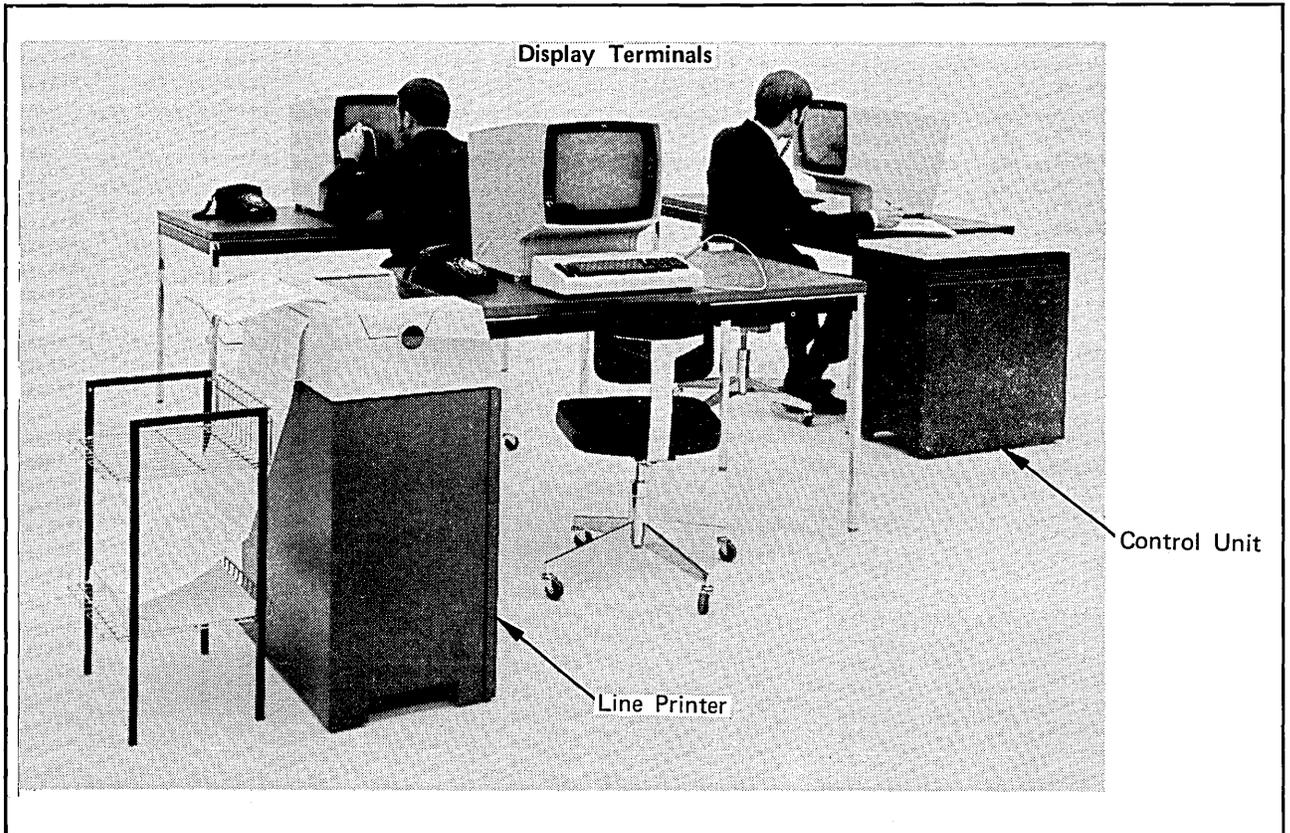
Figure 11-3270-1.   3270 Information Display System: Line Printer, Display Terminals, and Control Unit

3270 Highlights

The highlights of the 3270 Information Display System follow.

System Configuration

The 3270 Information Display System has configuration flexibility. It consists of a control unit and a cluster of up to 32 units, which can include:

• Display stations, with display capabilities from 480 to 3564 characters

• Matrix printers with a maximum print rate of 120 characters per second.

The 3270 system can be attached locally (directly to a host system channel), or it can be attached remotely to a host system. Only local channel attachment is described in this publication. Remote attachment is described in *IBM Data Communication Device Summary.*

System Units

A description of the 3270 System units follow.

3274 Control Unit

The 3274 cluster control unit can control up to 32 display stations and printers. Five models supply local channel attachment:

- Models A21 and A31 attach to the processor through a selector, multiplexer, or block multiplexer channel for local (SNA version) mode of operation.

- Models 21B, 21D, and 31D attach to the processor through a selector, multiplexer, or block multiplexer channel for local 3272 version (non-SNA) mode of operation.

Models 21C, 31C, and 51C are used to communicate with a processor via a 3704/05 Communication Controller, a 2701 Data Adapter unit, or an Integrated Communications Adapter.

Customized System Diskette: As part of the 3274 installation procedure, a customized system diskette is generated. The generation process is done by the customer at installation time by inserting diskettes in the 3274 and keying in system configuration parameters at a 3278 or 3279 display station attached to the 3274. The customized system diskette can be duplicated, or it can be regenerated to reflect configuration data that is changed.

Types of Terminal Adapters: Terminals that can attach to the 3274 are attached to two types of terminal adapters: Type A and Type B. The Type A adapter can attach Category A terminals, and the Type B can attach Category B terminals, as follows:

- Category A Terminals: 3262 Line Printer, 3278 Display Stations, 3279 Color Display Stations, 3287 Printer, and 3289 Line Printers

- Category B Terminals: 3277 Display Stations, 3284 Printers, 3286 Printers, and 3287 Printers

3277 Display Station

The 3277 Display Station is a cathode-ray tube display station used in clusters with a control unit for displaying alphameric data, and for entering and retrieving data. This display station can display up to 1920 characters per screen display. The 3277 attaches up to 610 meters (2000 feet) cable length from the control unit.

For additional information about the 3277 Display Station refer to "Chapter 5. Display Devices."

3278 Display Station

The 3278 Display Station displays up to 3564 characters per screen display. An operator information area is supplied at the bottom of the screen, in which operator messages can be displayed to indicate certain conditions. The 3278 attaches up to 1500 meters (4920 feet) cable length from the 3274 Control Unit.

For additional information about the 3278 Display Station refer to "Chapter 5. Display Devices."

3279 Color Display Station

The 3279 Color Display Station displays up to 2560 characters per screen display. An operator information area is supplied at the bottom of the screen, in which operator messages can be displayed to indicate certain conditions.

For additional information about the 3279 Display Station refer to "Chapter 5. Display Devices."

3287 Printer

The 3287 Printer is a table-top matrix printer with bidirectional printing capability. Four models are available with print rates of 80 or 120 characters per second and color capabilities of either monochrome or four-color.

For additional information about the 3287 Printer refer to "Chapter 8. Printers."

3289 Line Printer

The 3289 Printer Models 1 and 2 (Figure 11-3270-2 on page 11-3270-4) are a floor-standing line printers with integral forms stand/stackers. Both models have a 4016-character buffer capacity.

The maximum print rates, using 48 character print sets, are as follows:

* Model 1, 155 lines per minute
* Model 2, 400 lines per minute.

Actual printer throughput varies with the operational and system characteristics. Factors such as control-unit configuration, line-transmission rate, output format, buffer sizes, character set, and program-application processing must be considered in determining throughput.

Control Unit Attachment: The 3289 attaches to the 3274 Control Unit (Type A terminal adapter only). It attaches up to 1500 meters (4920 feet) cable length from a 3274.
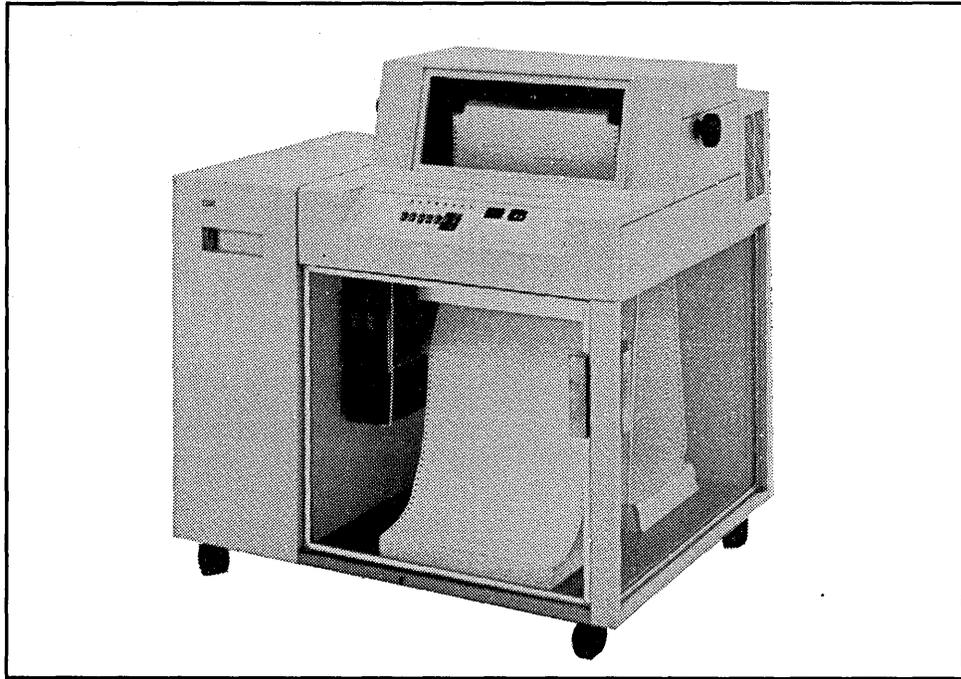
Figure 11-3270-2. 3289 Line Printer

11-3730. Distributed Office Communication System

The 3730 Distributed Office Communication System is a distributed text processing system built around the 3791 Controller. The system supplies functions for document creation, editing, storage, retrieval, and printing. It can operate as a stand-alone system, as a host-attached system, or as a concurrent 3730-3790 system. The concurrent 3730-3790 system can operate as a stand-alone unit or attached to a host system.

System Units

A description of the major units of the 3730 follow.

3732 Text Display Station

The 3732 Text Display Station Model 1 (Figure 11-3730-1) includes a 1920-character display and special feature keyboard. The display is a 15-inch (diagonal) cathode-ray tube that supplies 24 lines of 80 characters each. The top and bottom lines are reserved for system use, which leaves 22 lines available for text entry. The keyboard contains a central text-entry section that is similar in layout to a typewriter keyboard. In addition, the keyboard contains 29 function and control keys.
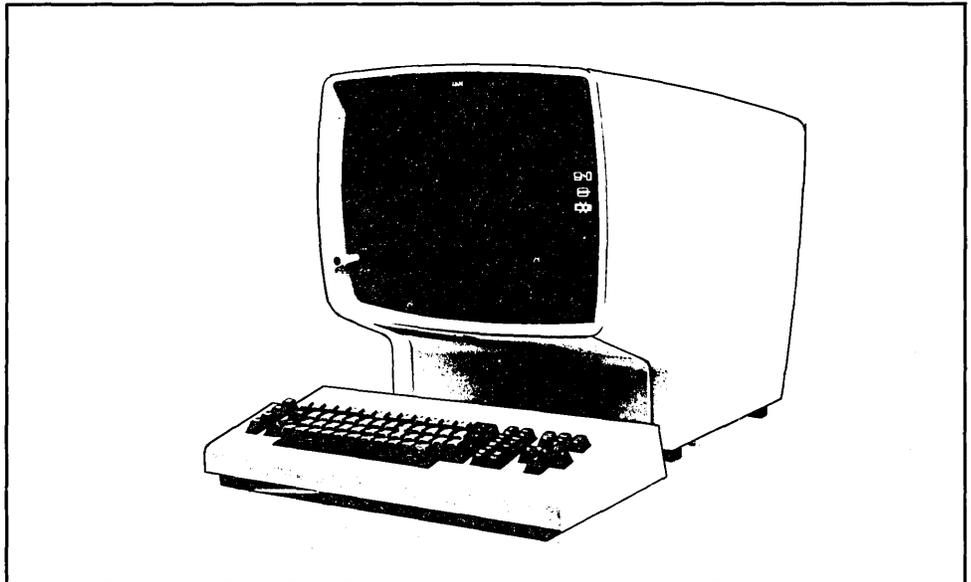
Figure 11-3730-1. 3732 Text Display Station

3736 Printer

The 3736 Printer Model 1 (Figure 11-3730-2) is a bidirectional, serial-impact printer that prints on single sheets (cut forms) or on continuous forms. It has the following characteristics:

- Prints up to 55 characters per second

- Prints 6 lines per inch (when using single-line spacing)

- Has interchangeable 96-character print wheels, with four available type styles.
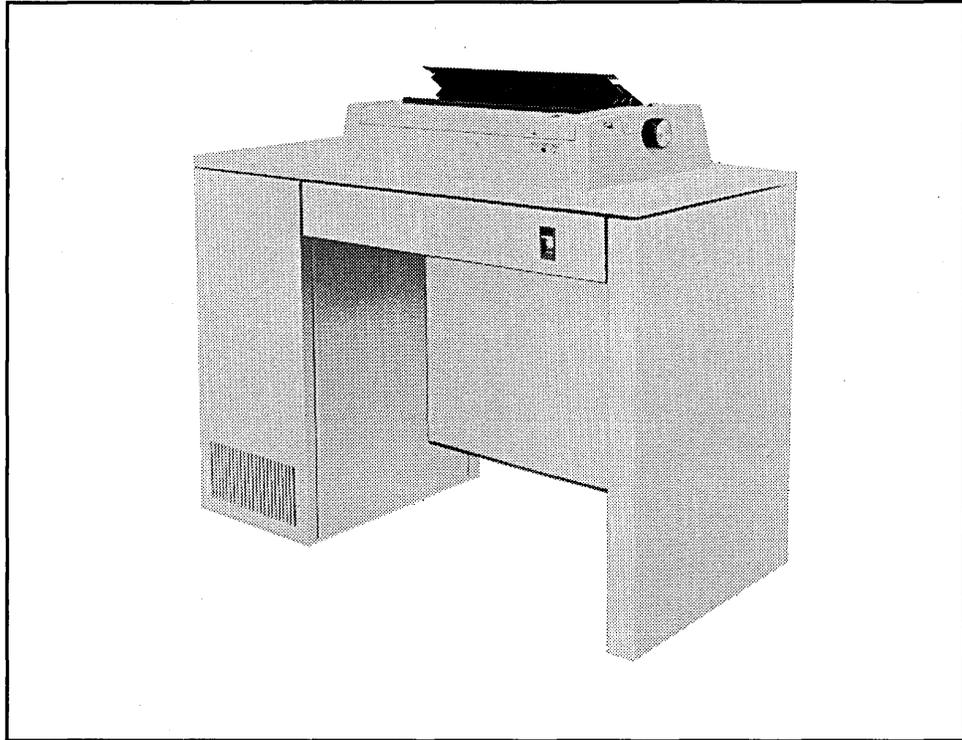
Figure 11-3730-2. 3736 Printer

3791 Controller

The 3791 Controller is the intelligent base for attaching 3732 Display Stations and 3276 Printers to a processor.

For additional information about the 3791 Controller refer to "3790 Communication System" following.

11-3790. Communication System

The 3790 Communication System (Figure 11-3790-1) is an operator-oriented system that consists of a 3791 Controller and its attached operator stations and auxiliary control units. The operator stations can be keyboard-printers, keyboard-displays, or a combination of these devices.
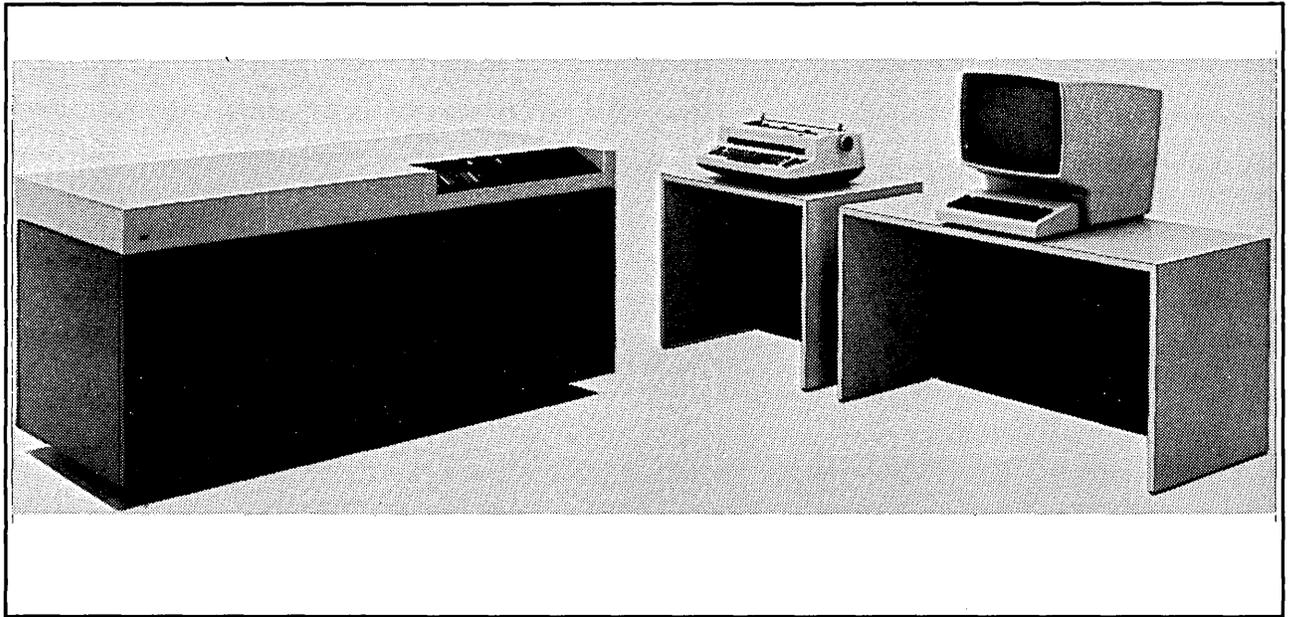
Figure 11-3790-1. 3790 Communication System

System Units

A description of the 3790 system units follows.

3791 Controller

The 3791 Controller (Figure 11-3790-2 on page 11-3790-2), equipped with the local channel attachment, attaches directly to a host system's byte multiplexer or block multiplexer channel. The 3790 system performs functions specified by programs that are sent to the 3791 Controller from the host system. These programs permit the 3790 to operate without supervision from, or interaction with, the host system, except when data or programs are exchanged between systems. The controller contains:

- Control storage for supporting features, functions, and operator stations

- Diskette storage for packed transmission data and for backup of application data sets

- Disk storage for 3790 programs, transaction records, and application data sets. Based on the model, the 3791 can have 3.9 to 26.9 million bytes of storage.

Three models of the 3791 Controller are available.

- Model 1C provides 10 million bytes of disk storage.

- Model 2A provides 20 million bytes of disk storage.

- Model 2B provides 30 million bytes of disk storage.
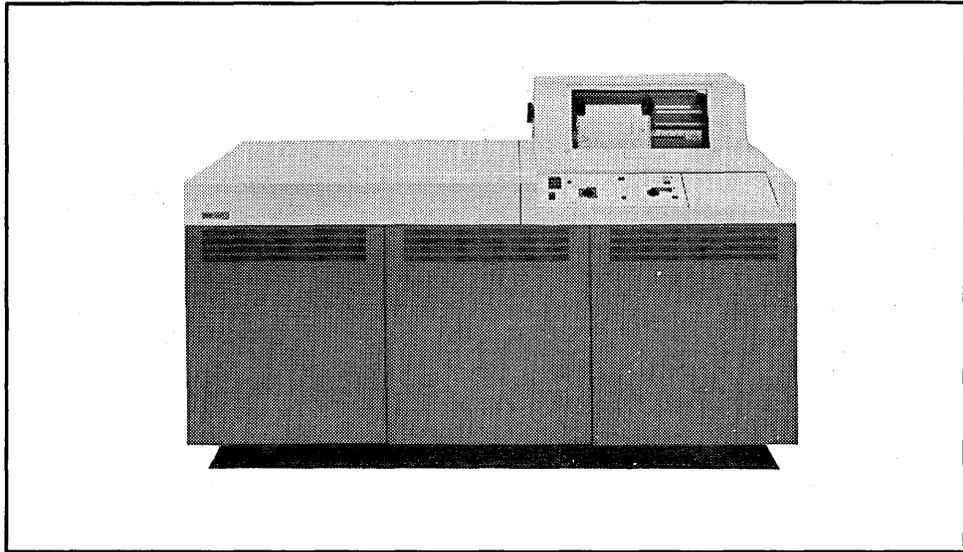
Figure 11-3790-2. 3791 Controller

The 3791 Controller has either a local or a remote attachment to a host system and can have two special features:

- One line printer with 80 or 132 print positions and speeds of 155 or 410 lines per minute (See Figure 11-3790-3 on page 11-3790-3)

- One 3411 Magnetic Tape Unit Model 1, with no other units can be attached.

Line Printer	Print Positions	Speed lpm	Characters in Set
3791, 3792	80* or 132*	155	48
	80* or 132*	120	64
	80* or 132**	80	96
3791	80* or 132*	40	128
	132***	410	48
	132***	300	64
	132***	230	96
	132***	160	128
Special Features: * Line Printer - 80 print positions (155 lpm) ** Line Printer - 132 print positions (155 lpm) *** Line Printer - 132 print positions (410 lpm)			

Figure 11-3790-3. 3791/3792 Line Printer Attachment Print Rates

3792 Auxiliary Control Unit

The 3792 Auxiliary Control Unit Model 1 (Figure 11-3790-4), which can be placed up to 610 meters (2,000 feet) from the 3791 Controller, adds operator stations in the system (some can be remote from the 3790 site) and offers:

- The capability to attach up to four 3793 Keyboard-Printers

- A line printer as a special feature

- Special features for communicating with 2741 Communications Terminals

- A Security Keylock special feature that controls power to the 3792.
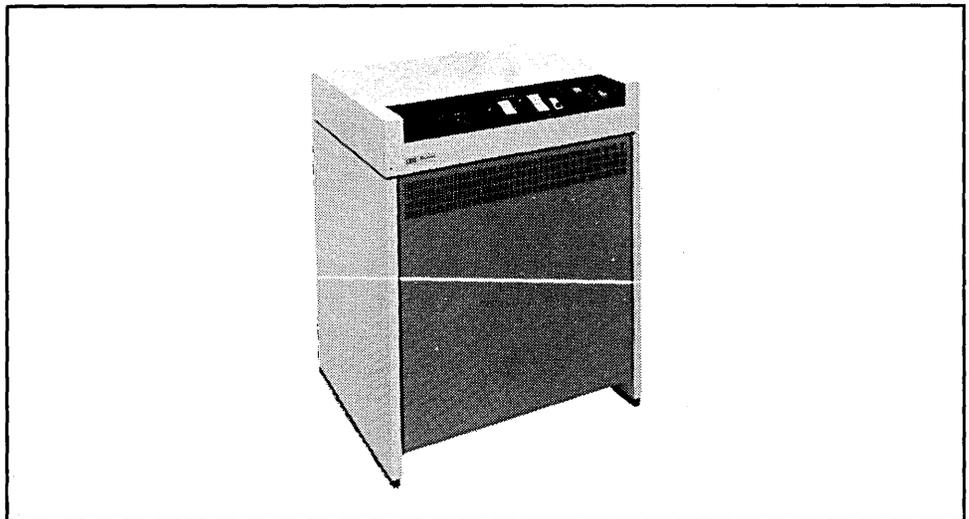
Figure 11-3790-4. 3792 Auxiliary Control Unit

The 3793 Keyboard-Printer Model 1 (Figure 11-3790-5) is a data-entry operator station that can be attached to the 3791 or to the 3792 to supply printed output. The 3793 is similar in outward appearance to a Selectric typewriter. The 3793 has a friction-feed platen, with a pin-feed platen available as a special feature. The maximum print line is 130 print positions at 10 characters per inch; spacing is 6 lines per inch.

The 3793 keyboard is similar to a normal office typewriter keyboard and includes control keys, operator guidance indicators, and system indicators. Also included on the keyboard is a 10-key arrangement of dual-function keys that can be used for entering numeric data. A special feature supplies a power-line keylock for security.
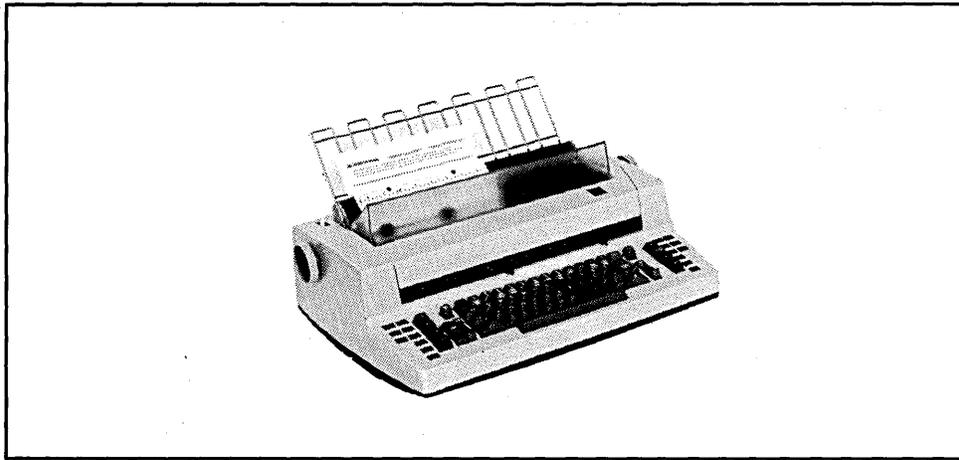
Figure 11-3790-5. 3793 Keyboard-Printer

3277 Display Station

The 3277 Display Station attaches to the 3791 to supply a CRT (cathode ray tube) display and a 63-character set keyboard. See "3277 Display Station" in Chapter 5 for more information.

3790 Communication System/Data Entry Configuration

The 3790 Communication System/Data Entry Configuration is designed for production keying of transcription data using the 3760 Key Entry Station, and for payment-transaction processing using the 3762 Payment Transaction Processor. It cannot be used with any other 3790 configuration.

The 3760 and 3762 stations, described below, attach to the 3791 Controller Model 1C, 2A, or 2B.

3760 Key Entry Station

The 3760 Key Entry Station (Figure 11-3790-6) has a keyboard and a display panel for each operator station. Any task that does not need document processing can be done on a 3760 as well as on a 3762 station. The 3760 has three models:

- Model 1 has two keyboards, two displays, a direct connection to a power source, and a cable connection to the 3791 Controller.

- Model 2 has two keyboards, two displays, and must be attached to a Model 1 for power and control. Up to two Model 2s can attach to a Model 1.

- Model 3 has one keyboard, one display, a direct connection to the power source, and cable connections to up to four 3791 Controllers. When a Model 3 is attached to more than one controller, only one connection can be used at a time.
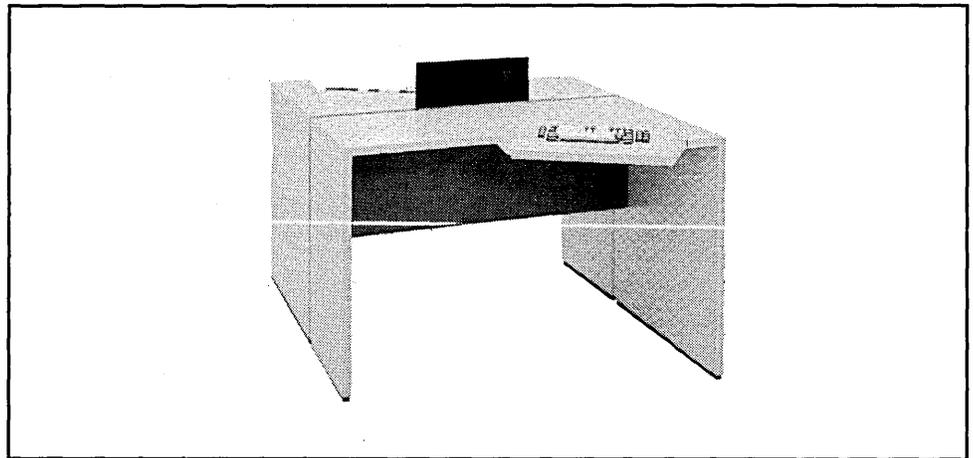
Figure 11-3790-6. 3760 Key Entry Station

3762 Payment Transaction Processor

The 3762 Payment Transaction Processor Model 1 (Figure 11-3790-7) consists of two operating stations housed in a single physical unit. Each station includes a keyboard, a document entry slot, a display panel, two document pockets, a document path, and optionally, a journal tape print device. Each document path includes an optical-character- recognition reader and can optionally include an inscriber, audit trail printer, and endorser. The 3762 has a direct connection to a power source and a cable connection to the 3791 Controller.
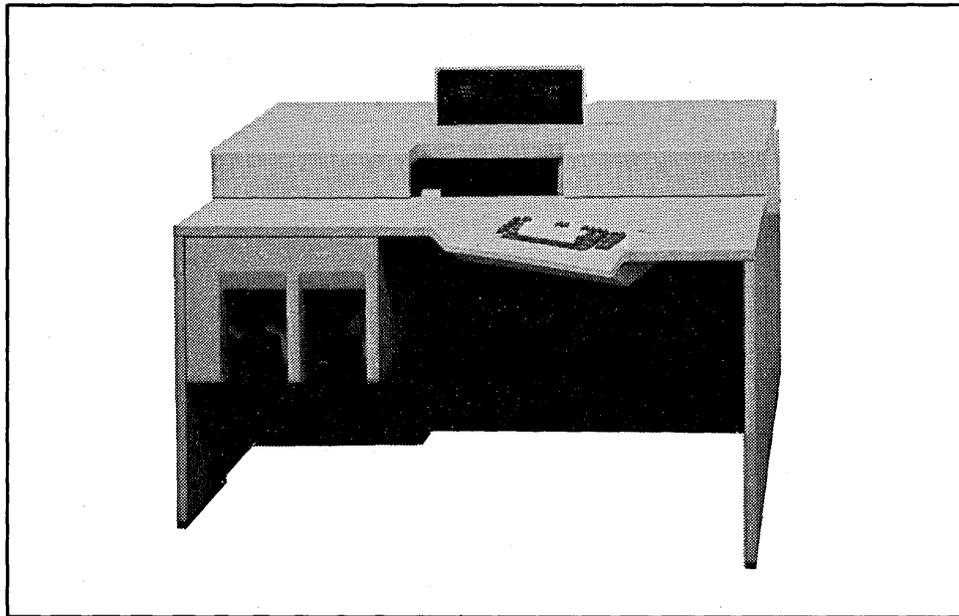
Figure 11-3790-7. 3762 Payment Transaction Processor

Restrictions

The maximum number of units that can be attached to a 3791 Controller is specified by the controller's eight ports. One cable can be attached to each of these ports. Therefore, the maximum number of 3762s or, in a combined system of 3762s, 3760 Model 1's, and 3760 Model 3s that can be attached is eight (16 operator positions or 15, if one 3760 Model 3 is included). To expand the number of operator stations in a combined system, 3760 Model 2s can be attached to the 3760 Model 1's (up to a maximum of 24 operator positions).

11-3850. Mass Storage System

The 3850 Mass Storage System (Figure 11-3850-1) gives low-cost mass storage for as many as 472,000 million bytes of data under the control of a virtual-storage IBM processor. Direct-access device utilization is improved because only active data occupies direct-access device space. The 3850 combines many of the advantages of tape and disk systems.

The 3851 Mass Storage Facility has 20 models. They differ in the number of mass storage controls, data recording devices, data recording controls, and cartridge cells they contain, as shown in Figure 11-3850-2 on page 11-3850-2.

3851 Mass Storage Facility Models A1, B1   **System/370 Model 158**   **3330 Disk Storage**
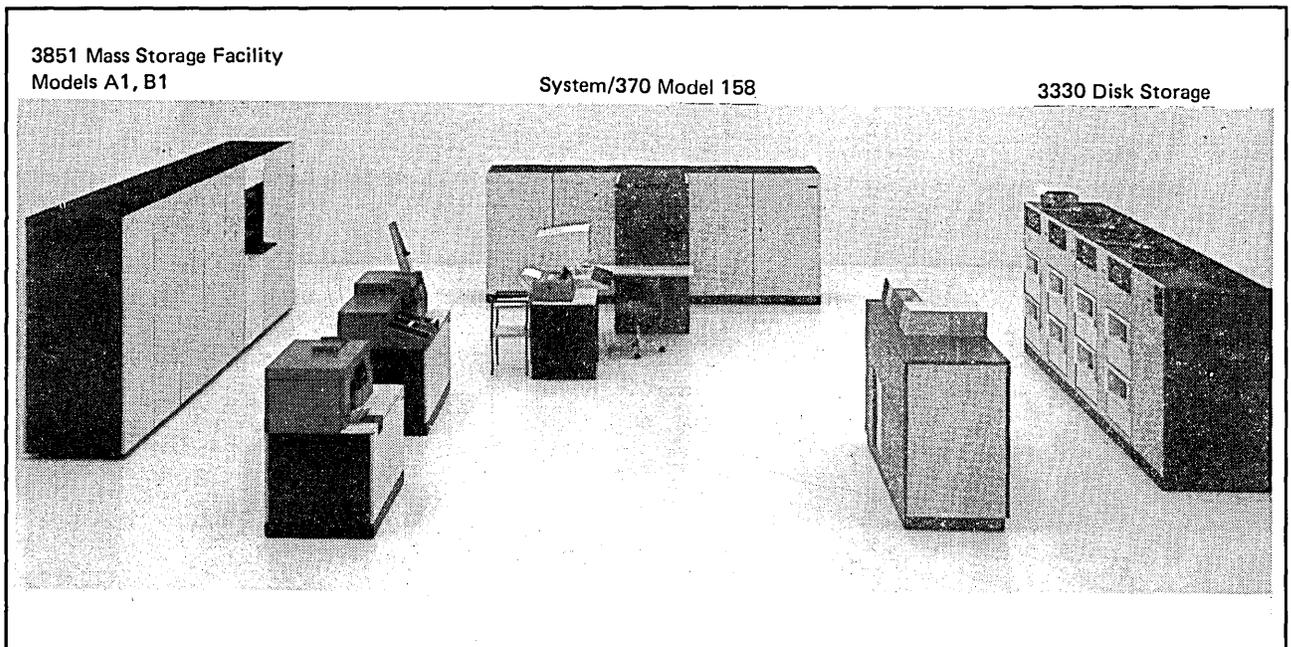
Figure 11-3850-1. 3850 Mass Storage System with 3851 Mass Storage Facility, System/370 Model 158, and 3330 Disk Storage

The smallest model contains a cartridge entry frame that consists of one cartridge access station, two data recording devices, one data recording control, and 706 cartridge cells. Larger models, in addition to the cartridge entry frame, can have up to three extension frames. Extension frames supply additional data recording devices, data recording controls, and cartridge cells. A storage extension frame contains 1338 cartridge cells; a data extension frame contains 1338 cartridge cells, two data recording devices, and one data recording control.

The first character of the model designation specifies the number of mass storage controls: A represents one and B represents two. The second character (0, 1, 2, or 3) specifies the number of storage extension frames, and the third character (1, 2, 3, or 4) specifies the combination of cartridge entry frames and data extension frames. The sum of the second and third characters cannot exceed 4.

Either one or two Model-A Mass Storage Facilities, or one Model-B Mass Storage Facility, can be attached to a System/370 to become a part of the Mass Storage System. Two Model A's may be configured to permit a capacity of up to 472,000 million bytes.

Mass Storage Facility Models *	Number of Data Recording Devices	Number of Data Recording Controls	Maximum ** Number of Cartridges	Maximum Usable Capacity (10 Bytes)
A01, B01	2	1	706	35.3
A02, B02	4	2	2044	102.2
A03, B03	6	3	3382	169.1
A04, B04	8	4	4720	236.0
A11, B11	2	1	2044	169.1
A12, B12	4	2	3382	236.0
A13, B13	6	3	4720	236.0
A21, B21	2	1	3382	
A22, B22	4	2	4720	
A31, B31	2	1	4720	

* Model A's contain one mass storage control, Model B's contain two.

** This is the maximum number of cartridges, cells, or both in each Mass Storage Facility. Nine cartridge cells are reserved in each model; six for maintenance, two for misplaced cartridges, and one for the accessor.

Figure 11-3850-2. 3851 Mass Storage Facility Characteristics by Model

3850 Highlights

The highlights of the 3850 Mass Storage System follow.

Operation

Data under control of the 3850 Mass Storage System is stored on data cartridges. When data is requested, it is moved online from the cartridges to direct access storage devices (DASD) in a process called staging. After data has been staged, the processor has access to it as if it were on a 3330-type DASD. After the data is no longer needed and if it has been modified, it will be moved back onto the data cartridge in a process called destaging.

Processor Attachment

Each mass storage control in the 3851 Mass Storage Facility attaches to a control unit position on a processor's byte or block multiplexer channel.

System Units

Following are the logical units of the Mass Storage System (See Figure 11-3850-3)
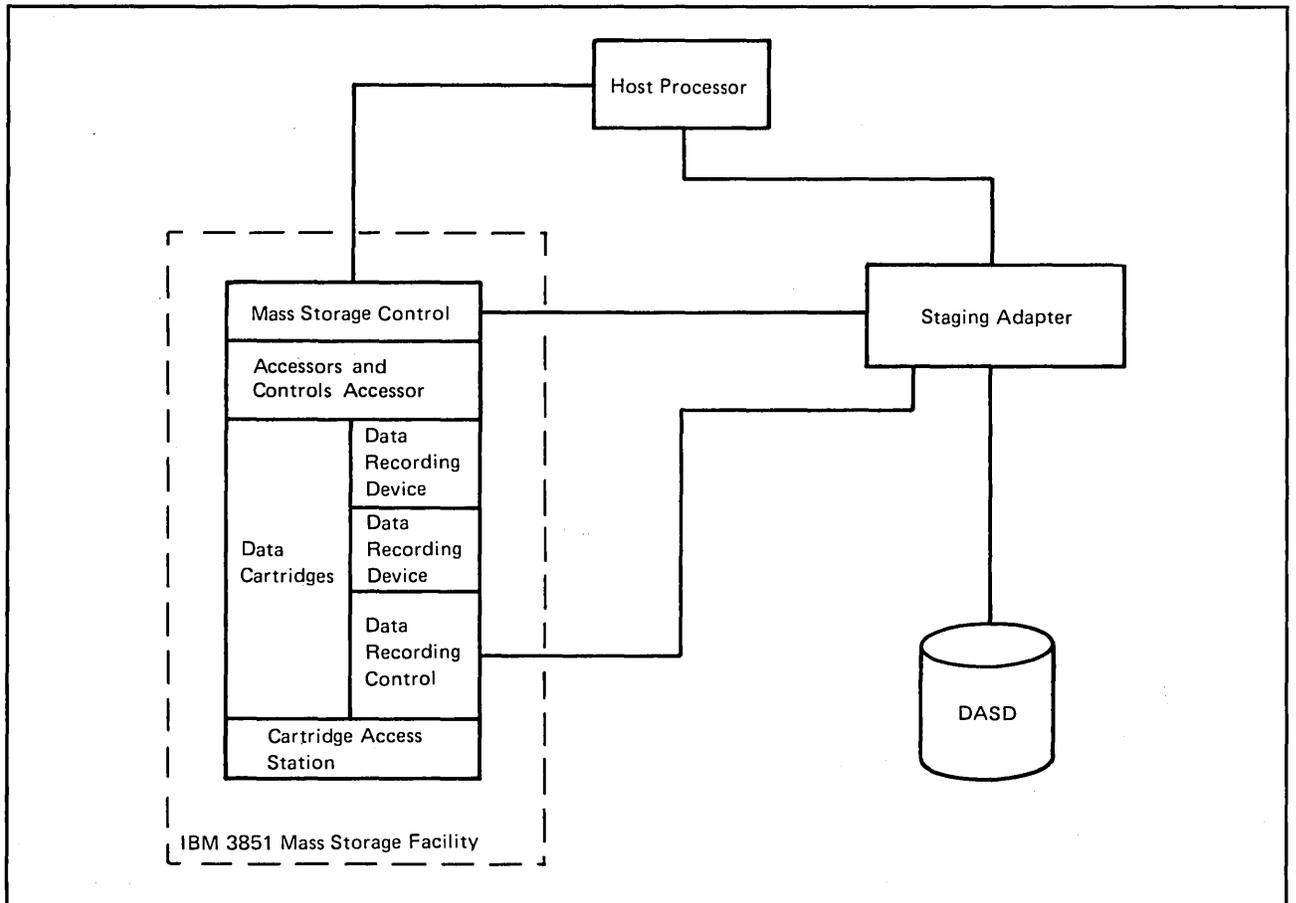
Figure 11-3850-3. 3850 Mass Storage System Logical Units

3851 Mass Storage Facility

The 3851 Mass Storage Facility supplies the large capacity storage and control facility for attachment to a virtual storage IBM processor. A description of Mass Storage Facility functional units follow.

Mass Storage Control: The mass storage control coordinates the operation of the 3850 Mass Storage System, which includes the following:

- Accepting requests for data from the processor

- Maintaining an inventory of data cartridges stored in the 3851 to determine the location of data needed

- Allocating space on DASD for data to be staged

- Allocating a data recording device

- Instructing the accessor to move the data cartridge from its cell to the data recording device

- Initiating and monitoring the staging operation

- Performing error recovery procedures that include alternate-path-retry operation and device reallocation for the staging operation

- Performing the destaging operation when the data is no longer needed.

Storage Cells for Data Cartridges: A mass storage volume has two data cartridges. Data cartridges reside in cartridge storage cells. Because all cartridges under control of the mass storage control are physically resident in the 3851 Mass Storage Facility, the amount of floor space needed for storage is greatly reduced.

Data Recording Devices: Each cartridge can store approximately 50.2 million bytes of data. Two cartridges equal the capacity of one 3336 Disk Pack Model 1. Data is written on and read from the cartridge by a data recording device and its associated data recording control.

Accessors and Accessor Controls: Two accessors and their associated accessor controls move the data cartridges between the storage cells and the data recording device.

Cartridge Access Station: The cartridge access station permits entry and removal of data cartridges.

Staging Adapter

The staging adapter performs all the staging and destaging operations, and permits the processor to access the staged data. The staging adapter can be either a 3830 Storage Control Model 3 or an Integrated Storage Control with the Staging Adapter (ISCSA) feature on a System/370 Model 158 or 168. Data is normally staged to 3330 or 3333 disk units. The 3350 staging feature is available on a 3830 Model 3 to permit staging data to 3350 disk units. With this feature installed, only 3350 disk units can be attached to that 3830. This feature is not available on an integrated storage control.

Direct Access Storage Devices

The direct access storage device (DASD) portion of the Mass Storage System has either 3333 Disk Storage and Controls Model 1 or 11 and 3330 Disk Storage Model 1, 2, or 11, or 3350 Direct Access Storage Models A2, A2F, B2, B2F, C2, or C2f units. The 3330/3333 and 3350 storage units make data available to an IBM processor for processing.

Disk Storage Configuration

The 3330 and 3350 Disk Storage series configuration varies with the 3851 configuration. A maximum of thirty-two 3330 drives can be attached to a 3830 Model 3 or to each path of the integrated storage controls of processors with the staging adapter feature. For 3330 Models 1 and 2, sixteen of these drives can be used as staging drives for the Mass Storage System. The additional disk drives are used for standard DASD operations. For 3330 Model 11, a maximum of eight drives can be used as staging drives. 3350 drives used for staging are configured the same as 3330 Model 11 drives but cannot be connected to the ISCSA. Access to the 3350 drives is in 3330 Model 11 mode.

Appendix A. I/O Attachment Data

IBM input/output (I/O) devices and systems for local operation with IBM processors operate through one control unit position (two are needed for the 3851 Mass Storage Facility Model B's) on an IBM channel, or through an integrated adapter on the processor. The control unit function can be part of the I/O device, part of the system, part of the integrated adapter on the processor, or a physically separate device.

Figure A-1 lists the I/O devices and systems and their method of attachment arranged by category. For more information about their attachment capabilities to IBM processors, see the input/output configurator for a specific processor.

I/O DEVICE, CONTROL UNIT, OR SYSTEM		MODEL	MEANS OF ATTACHMENT TO CHANNEL ADAPTER
Auxiliary Processors and Channel Communication Units	3088 Multisystem Channel Communication Unit	1, 2	Direct
	3814 Switching Management System	A1-A4,	Direct
		B1-B4,	3814-A1, A2, A3, A4
		C1-C4	3814-B1, B2, B3, B4
	3838 Array Processor	1, 2, 3	Direct
	3848 Cryptographic Unit	1	Direct
Direct Access Storage Devices	3330 Disk Storage	1, 2, 11	3333-1, 11
	3333 Disk Storage and Control	1, 11	Direct, 3880, 3830-2, 3
	3340 Direct Access Storage	A2	Direct, 3830-2, 3880
		B1, B2	3340-A2
	3344 Direct Access Storage	B2, B2F	3340-A2
	3350	A2, A2F	Direct, 3830-2, 3 3880
		B2, B2F C2, C2F	3350-A2, 3350-A2F
	3375 Direct Access Storage	A1, B1 , D1	3380-A4, AA4, B4
	3380 Direct Access Storage	A4, B4, AA4	3880-2, 3
		AA4, B4	3880-13
	3830 Storage Control	2	Direct
	3880 Storage Control	1, 2, 3, 4, 11, 134	Direct
Diskette Input/Output Devices	3540 Diskette Unit	B1, B2	Direct

Figure A-1 (Part 1 of 4).   Attachment Data for Local I/O Equipment

I/O DEVICE, CONTROL UNIT, OR SYSTEM		MODEL	MEANS OF ATTACHMENT TO CHANNEL ADAPTER
Magnetic Tape Devices	3410 Magnetic Tape Unit	1, 2, 3	3411-1, 2, 3
	3411 Magnetic Tape Unit and Control	1, 2, 3	Direct
	3420 Magnetic Tape Subsystem	3, 5	3803-1, 2, 3
		7	3803-1, 2
		4, 6, 8	3803-21, B2, B3, B4
	3430 Magnetic Tape Subsystem	A01 B01	Direct 3480-A22
	3803 Tape Control	1, 2, 3	Direct
Display Devices	3251 Display Station	1	3255-1, 3258-1
	3277 Display Station	2	3274
	3278 Display Station	1 ---5	3274
	3279 Display Station	S2A, S2B S3G, 2X, 3X	3274
	3767 Communication Terminal	1, 2, 3	2701
	8775 Display Terminal	11, 12	3705
Magnetic Character Readers	1255 Magnetic Character Reader	1, 2, 3	Direct
	1419 Magnetic Character Reader	1	Direct
	3890 Document Processor	A1-A6, B1-B6, E3-E6, F3-F6	Direct
Optical Readers	1287 Optical Reader	1, 2, 3	Direct
	1288 Optical Page Reader	1	Direct
	3881 Optical Character Reader	1	Direct
	3886 Optical Character Reader	1	Direct

Figure   A-1 (Part 2 of 4).   Attachment Data for Local I/O Equipment

I/O DEVICE, CONTROL UNIT, OR SYSTEM		MODEL	MEANS OF ATTACHMENT TO CHANNEL ADAPTER
Printers	1403 Printer	N1	2821
	1443 Printer	N1	Direct
	3203 Printer	1, 2, 4	Direct
	3211 Printer	1	3811
	3262	5	Direct
	3287 Printer	1, 2	Direct
		1C, 2C	3274
	3800 Printing Subsystem	1, 3	Direct
	4245 Printer	1	Direct
Punched Card Devices	1442 Card Read Punch	N1	Direct
	1442 Card Punch	N2	Direct
	2501 Card Reader	B1, B2	Direct
	3505 Card Reader	B1, B2	Direct
	3525 Card Punch	P1 -- P3	Direct or 3505
Controllers	2701 Data Adapter Unit	1	Direct
	2821 Control Unit	1 -- 6	Direct
	3704 Communication Controller	A1, A2, A3, A4	Direct
	3705-11 Communication Controller	E1, E8, F1, F8, G1, G8, H1, H8, J1, J4, K1, K4, L1, L4	Direct
	3705-80 Communication Controller	M81, M82, M83	Direct
	3725 Communication Controller	1 2	Direct Direct

Figure   A-1   (Part 3 of 4).   Attachment Data for Local I/O Equipment

I/O DEVICE, CONTROL UNIT, OR SYSTEM		MODEL	MEANS OF ATTACHMENT TO CHANNEL ADAPTER
Systems	3250 Graphics Display System	N/A	3258 to Channel
	3270 Information Display System	N/A	3274 to Channel
	3730 Distributed Office Communication System	N/A	3791 to Channel
	3850 Mass Storage Management System	A01-A04 A11-A13 A21-A22 A31 B01-B04 B11-B13 B21-B22 B31	Direct

Figure   A-1 (Part 4 of 4).   Attachment Data for Local I/O Equipment

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 Dictionary for Information Processing, 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. ANSI definitions are preceded by an asterisk (*).

The following terms are defined as they are used in this publication. If you do not find the term you are looking for, see the *IBM Data Processing Glossary*.

A/FE. Americas/Far East.

* alphameric. Synonym for alphanumeric. Pertains to a character set that contains letters, digits, and usually other characters, such as punctuation marks.

* BCD. Binary coded decimal notation.

* Binary coded decimal notation. (ISO) A binary-coded notation in which each of the decimal digits is represented by a binary numeral. For example, in binary-coded decimal notation that uses the weights 8-4-2-1, the number twenty three is represented by 0010 0011 (compare its representation 10111 in the pure binary numeration system). Synonymous with binary-coded decimal code, binary-coded decimal representation, coded decimal notation.

bits per second. In serial transmission, the instantaneous bit speed with which a device or channel transmits a character.

block multiplexer channel. A multiplexer channel that interleaves blocks of data.

BPI. Bytes per inch.

bps. Bits per second.

buffer. A routine or storage used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transferring data from one device to another.

burst mode. A mode in which data is transmitted by means of burst transmission.

byte multiplexer channel. A multiplexer channel that interleaves bytes of data.

* channel. A path along which signals can be sent, for example, data channel, output channel.

common-use sizes. A set of paper form sizes used on the IBM 3800 Printing Subsystem that have been selected as those most commonly used throughout the world.

* console. A part of a computer used for communications between the operator or maintenance engineer and the computer.

cpi. Characters per inch.

CRT. Cathode-ray tube.

cryptographic. Pertains to equipment that transforms data to mask its actual meaning to an unauthorized user.

customer set up products. IBM products such as the 3767 Communication Terminal and 3770 Data Communication System which can be installed by the customer.

DASD. Direct access storage device.

data density. On magnetic tape, the number of bytes per inch.

data mode 1. On 80-column punched card devices, standard code used is EBCDIC or data mode 1. This code uses eight binary positions for each character format, plus a position for parity checking. Two hundred fifty-six (256) characters can be coded, including both uppercase and lowercase alphabetic characters, a wide range or special characters, and many control characters that are meaningful to some input/output devices.

data mode 2. This feature is also known as column binary and card image. It enables the reader to suspend validity checking for column binary data.

data transfer rate (effective). In data communications the average number of bits, characters, or blocks per unit time transferred from a data source and accepted as valid by a data link. The data transfer rate is usually expressed in bits, characters, or blocks per second, minute, or hour.

DDA. Direct disk attachment.

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

DPCX. Distributed processing control executive.

DPPX. Distributed processing programming executive.

dual density. A feature that permits a program to use a tape unit in either 800 or 1600 bytes per inch recording.

EBCDIC. Extended binary-coded decimal interchange code.

E/ME/A. Europe/Middle East/Asia.

extended binary-coded decimal interchange code. A set of 256 characters, each represented by eight bits.

* form overlay. Synonym for form flash. (SC1) A projected pattern such as a report form, grid, or map used as background for a display image.

GAM. Graphics access method.

* gangpunch. To punch identical hole patterns into each punch card of a card deck.

GCR. Group coded recording.

GPS. Graphic programming services.

graphic programming services. In OS/360 and OS/VS, a number of services provided for use in designing and executing programs that communicate with a user at a display station.

graphics access method. A facility that supports IBM display devices through the use of graphic programming services (GPS) and the graphic subroutine package (GSP).

group coded recording. Group coded recording is synonymous with 6250 bits per inch recording. In contrast with phase encoded recording, non-return-to-zero change-on-ones recording.

GSP. Graphic subroutine package.

host system. The data processing system to which a communication system is connected and with which the system can communicate.

IBG. Interblock gap.

IFA. Integrated file adapter.

ISO. International Organization for Standardization.

* input/output. (ISO) Pertaining to a device or channel that may be involved in an input process, and, at a different time, in an output process.

Integrated file adapter. An adapter that permits connection of multiple disk storage devices to a processing unit.

interblock gap. (ISO) The space between two consecutive blocks on a data medium.

ISCSA. Integrated storage control with the staging adapter.

K-byte. Each K-byte equals 1,024 bytes and refers to storage capacity.

* loop. In data communications, an electrical path connecting a station and a channel.

lpm. Lines per minute.

magnetic character recognition. The character recognition of characters printed with ink that contain particles of a magnetic material. Contrast with optical character recognition.

maintenance device. The maintenance device is a primary maintenance tool for some IBM products. It is programmable, small, and lightweight. It consists of two units, the keyboard display unit and the basic unit, connected to each other by a cable.

MD. Maintenance device.

MICR. (ISO) Magnetic ink character recognition.

microprocessor. A processing unit, or part of a processing unit, that consists of microcode.

MP. Multiprocessor.

MSS. Mass storage system.

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

multiprocessor. A system consisting of two or more processing units (or ALUs, or processors) that can communicate without manual intervention.

MVS. Multiple virtual storage. An alternate name for OS/VS2 release 2.

nondestructive cursor. On a CRT display device, a cursor that can be moved within a display surface without changing or destroying the data displayed on the screen.

non-return-to-zero change-on-ones recording. (ISO) Nonreturn-to-reference recording of binary digits such that the ones are represented by a change in the condition of magnetization, and the zeros are represented by the absence of a change. This method is called (mark) recording because only the one or mark signals are explicitly recorded. Synonymous with non-return-to-zero (mark) recording, NRZ(M).

NRZI. Non-return-to-zero change-on-ones recording.

OCR. Optical character recognition.

optical character recognition. (ISO) Character recognition that uses optical means to identify graphic characters. Contrast with magnetic ink character recognition.

OS/VS1. A virtual storage operating system that is an extension of the IBM System/360 Operating System that supports multiprogramming with a fixed number of tasks.

OS/VS2. A virtual storage operating system that is an extension of the IBM System/360 Operating System that supports multiprogramming with a variable number of tasks.

PE. Phase encoding.

pels. Picture elements.

phase encoding. Synonym for phase modulation recording. (ISO) A method of recording on magnetic tape in which each storage cell is divided into two regions which are magnetized in opposite senses; the sequence of these senses indicates whether the binary character represented is zero or one.

read/write head. (ISO) A magnetic head capable of reading and writing.

remote. In data communication, devices that are connected to a data processing system through a data link.

* reproduce. Synonym for duplicate. (ISO) To copy from a source to a destination that has the same physical form as the source, e.g., to punch new punched cards with the same pattern of holes as an original punched card.

rotational delay. In a rotating storage device, the time period between the request and the positioning of the desired record under the read head.

rotational position sensing. A feature that permits a disk storage device to disconnect from a block multiplexer channel (or its

equivalent), allowing the channel to service other devices on the channel during positional delay.

SCP. System control programming.

SDLC. Synchronous data link control.

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

SNA. System network architecture

summary punch. (ISO) A card punch that may be connected to another device, such as a tabulator, to enter data that was calculated or summarized by the other device.

system control programming. IBM-supplied programming that is fundamental to the operation and maintenance of the system. It serves as an interface with program products and user programs and is available without additional charge.

systems network architecture. 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.

throughput. (ISO) A measure of the amount of work performed by a computer system over a given period of time, for example, jobs per day.

universal character set. A printer feature that permits the use of a variety of character arrays.

using system. In a teleprocessing environment, the remote system that is operating the I/O devices at the remote site.

virtual storage. (ISO) The concept of storage space that may be regarded as addressable main storage by the user of a computer system in which virtual addresses are assigned to real addresses. The size of virtual storage is limited by the addressing scheme of the computing system and by the amount of auxiliary storage available, and not by the actual number of main storage locations.

51-column card. A punch card that has been altered to be equivalent to the 80-column card but includes only column 15 through 65. The remainder of the card is missing.

80-column card. Synonym for Hollerith card. A punch card characterized by 80 columns and 12 rows of punch positions.

96-column card. A punch card characterized by 32 columns and 22 rows. The top four rows are for printing and the other 18 rows are for punching. The punch rows of the card are divided into three strips of 32 columns and 6 rows. It is possible to print 128 characters and to punch 96 positions on a card.

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