

## Chapter 1. Audio Communication Devices

The audio communication devices supply audio responses to digital inquiries from telecommunication devices.

### 7770 Audio Response Unit Model 3

The 7770 Audio Response Unit Model 3 (Figure 1-1) supplies a composed audio response to digital inquiries from a 1001 Data Transmission Terminal, a telephone set, or other inquiry-type terminals.

The highlights of the 7770 follow.

#### Voice Communication

The spoken response is composed from an American-English vocabulary recorded earlier in a male or female voice on a magnetic drum inside the 7770. The response is transmitted over suitable common-carrier communication facilities back to the inquiring terminal. When the 7770 is operating in conversational mode, the inquiry-response sequence can be repeated any number of times without dialing the 7770 again.

#### Operation

To make an inquiry of the 7770, the calling party enters a series of characters from his or her terminal. The 7770 passes these characters one by one through the byte multiplexer channel to the processor, which processes the inquiry and sends a response message back, character by character, to the 7770. This response message is a series of drum word addresses that the 7770 uses to select the correct words for its spoken reply. There are no limits to the length of the inquiry or of the response.

#### Attachment to a Processor

The 7770 Audio Response Unit Model 3 attaches to an IBM processor through the byte multiplexer channel. Each 7770 occupies one control-unit position and needs one byte multiplexer subchannel for each communication line.

#### Telecommunication Facilities

The basic 7770 operates four half-duplex, voice-grade communication lines, but this capacity can be expanded in four-line additions to 48 lines. Random inquiries on all input/output lines can be responded to simultaneously. A common carrier must supply all data sets.

### 32-Word Vocabulary

Each 7770 comes with a 32-word vocabulary that can be expanded with a special feature. Vocabulary words can be specified by the user as described by the message specifications. However, lengthy words must be divided and will be considered as two words. The vocabulary can be changed at any time by removing the drum and replacing it with another that has a different vocabulary. One word of each user vocabulary must be silence.

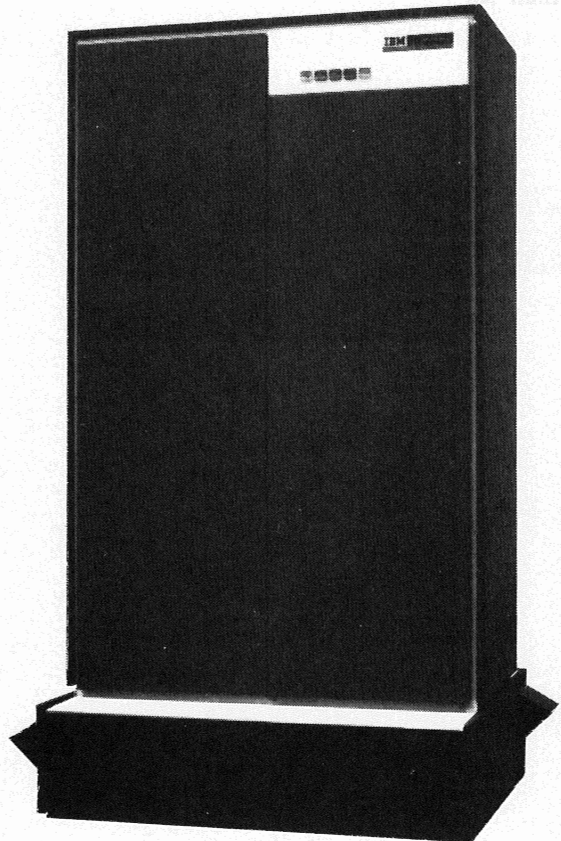


Figure 1-1. IBM 7770 Audio Response Unit

### Special Features

The following features can be ordered through the 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 the IBM sales representative.

**End Of Inquiry (EOI) Disable**

The end of inquiry disable feature permits an EOI character on pushbutton telephones to be used as a data character instead of an EOI character.

**I/O Line Expander**

Each I/O line expander feature permits attachment of four additional input/output lines. A maximum of 11 of these features is permitted.

**I/O Line Frame**

The I/O line frame feature supplies an additional frame when the number of input/output lines is more than 16.

**I/O Line Panel**

An I/O line panel feature is needed for each group of eight input/output lines or portion thereof added beyond the first eight lines. A maximum of five panels is permitted.

**Vocabulary Words, Additional**

The vocabulary words, additional feature permits increments of 16 words to be added, up to a maximum of 128 words.

## Chapter 3. Direct Access Storage Devices

**OBsolete**

Direct access storage devices supply the capacity for storing 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.

A variety of direct access storage devices is available. All use magnetic disks to store data, but they vary in technical implementation. These variations in technology result in differences in the time needed for locating and transferring data, and in storage capacities. The devices also vary in terms of the processors to which they can be attached and the attachment methods.

The following section describes the storage controls and the disk storage devices. The individual descriptions are followed by Figures 3-11 through 3-15, which compare the products by features, characteristics, capacities, and performance. Features that are standard on most products are described in summary in Figure 3-11 rather than included in each individual device description.

### 2835 Storage Control

The 2835 Storage Control and the 2305 Fixed Head Storage (Figure 3-1) are always used together. The 2835 supplies all the controls between the channel and the 2305 disk storage. The 2835 also supplies power for the disk storage. The 2835 Model 2 supports one or two 2305 Model 2 units.

The highlights of the 2835 follow.

#### Attachment to a Processor

The 2835 Model 2 can attach to: System/360 Models 85 and 195; System/370 Models 145, 148, 155, 158, 165, 168, 195; and to 3031, 3032, 3033, and 4341 Processors. It attaches through a block multiplexer channel.

#### Channel Commands Supported

The 2835 supports channel commands used for count, key, and data formatted records.

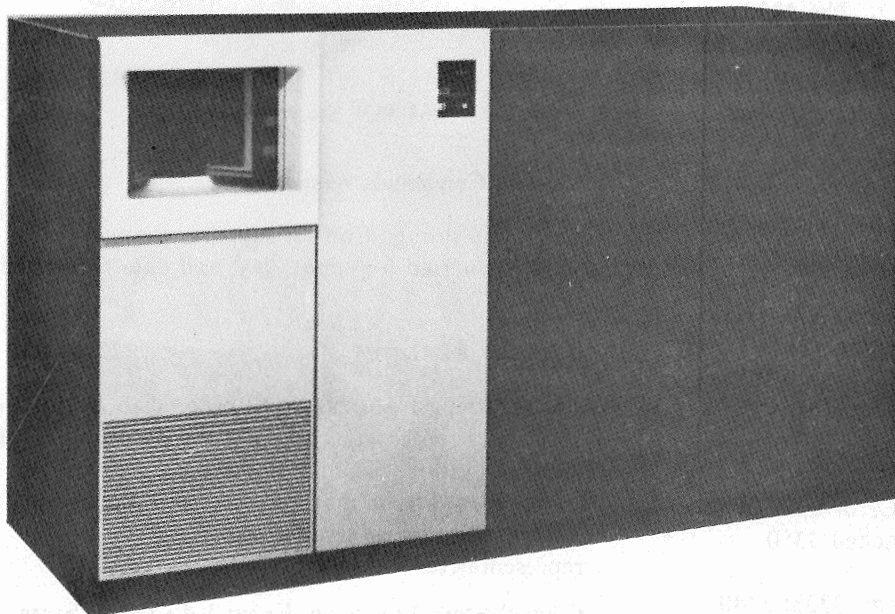


Figure 3-1. IBM 2835 Storage Control and IBM 2305 Fixed Head Storage

## ***Special Features***

The following features can be ordered through the 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 the IBM sales representative.

### **Two Channel Switch**

The two channel switch feature permits the 2835 and its attached 2305 Fixed Head Storage drives to be shared by two different channels of the same or different processors. The storage control 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 two channel switch feature from the 2835 operator panel to a configuration control panel of a System/370 Model 158MP or 168MP.

## **3830 Storage Control**

The 3830 Storage Control 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 none for the attached disk storage.

The 3830 has two models: Models 2 and 3. Model 2 supports the following types of disk storage:

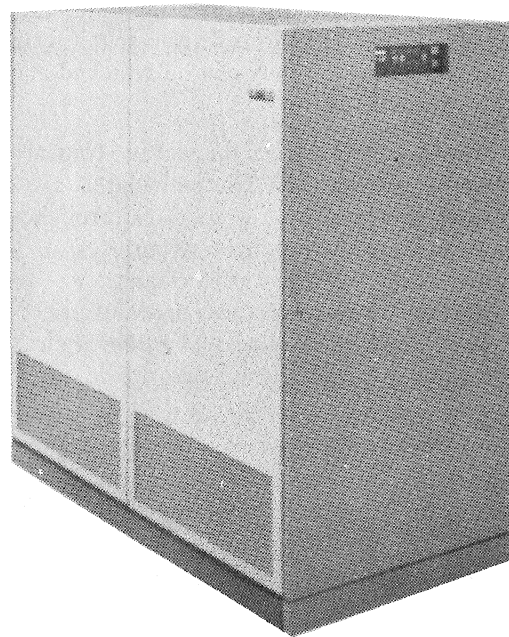
- 3333 Disk Storage Models 1 and 11, (with controller) and attached 3330 Disk Storage Models 1, 2, and 11.
- 3340 Disk Storage Models A2 or A2F (with controller), and attached 3340 Models B1 and B2. The larger capacity 3344 Models B2 and B2F can take the place of some of the 3340 Models B2 and B2F.
- 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 or A2F; 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 or A2F string, neither a 3330 nor a 3350 disk storage unit can be

attached to the same 3830 Model 2 storage control.

Model 3 supplies the attachment of 3333/3330 and 3350 disk storage drives in a 3850 Mass Storage System.

### **Attachment to a Processor**

The 3830 can attach through a block multiplexer channel to: a System/360 Model 195; System/370 Models 135, 138, 145, 148, 155, 158, 165, 168, and 195; and 3031, 3032, 3033, and 4341 Processors. It can also attach to System/370 Models 135 and 145 selector channels.



**Figure 3-2. IBM 3830 Storage Control**

### **Channel Commands Supported**

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

## ***Special Features***

The following features can be ordered through the 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 the 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



## 2305 Fixed Head Storage

The 2305 Fixed Head Storage consists of one drive with permanently mounted disks. All addressable tracks have fixed read/write heads, which completely eliminates track seek time.

The 2305 attaches to a 2835 Storage Control, which supplies all the controls and power for the 2305 disk storage.

The only available model of the 2305, Model 2, has one read/write fixed head per track. It has a storage capacity of 11.2 megabytes, an average data locate (rotational delay) time of 5.0 milliseconds, and a data rate of 1.5 megabytes per second. One or two Model 2 units can attach to a 2835 Storage Control Model 2.

### Data Format

The 2305 Fixed Head Storage uses count, key, and data formatted records and the channel commands that support them.

## 3310 Direct Access Storage

The 3310 Direct Access Storage (Figure 3-6) attaches to a 4331 Processor by way of an integrated direct access storage device (DASD) adapter.

The 3310 has four models:

- Model A1 contains a controller and one disk storage drive.
- Model A2 contains a controller and two disk storage drives. It provides the logic for attaching Model B1 or B2.
- Model B1 contains one disk storage drive.
- Model B2 contains two disk storage drives.

The highlights of the 3310 follow.

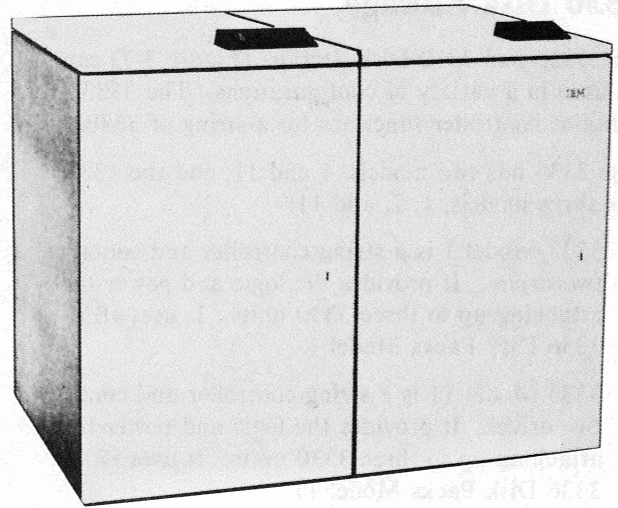


Figure 3-6. IBM 3310 Direct Access Storage

### Attachment of the 3310

The two Models B of the 3310 attach to the DASD adapter through a Model A2; Model A1 attaches alone to the adapter. A string consists of a Model A2 and Model B1 or B2 for a total of up to four drives. Up to four strings can attach to the DASD adapter.

### Storage Drive

The disks, spindle, and access mechanism with its read and write heads are sealed in an enclosure and permanently mounted on a drive. Each drive has a storage capacity of 64,520,192 bytes for a total of approximately 258 megabytes per maximum string.

The 3310 has an average seek time of 27 milliseconds, an average rotational delay of 9.6 milliseconds, and a data rate of 1,031,000 bytes per second.

### Data Format

The 3310 uses a fixed-block record format and the channel commands that support it. Records are formatted in a fixed record length on the tracks, and data is stored and transferred in 512-byte blocks.

## 3333 Disk Storage and Control and 3330 Disk Storage

The 3333 and 3330 Disk Storage (Figure 3-7) can be used in a variety of configurations. The 3333 contains controller functions for a string of 3330s.

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.

The highlights of the 3330 and 3333 follow.

### 3336 Disk Pack

IBM 3336 Disk Packs are removable from the drives by the customer. The disk packs are mounted in drawers that open and close automatically. The 3336 Disk Pack Model 1 has a storage capacity of 100 megabytes, and the Model 11 has a storage capacity of 200 megabytes. The 3336 Model 1 is interchangeable on 3330 Models 1 and 2 and 3333 Model 1 drives. It cannot be used on Model 11 of either the 3333 or 3330. The 3336 Model 11 is interchangeable on the 3333/3330 Model 11s. It cannot be used on 3330 Models 1 and 2 or 3333 Model 1. The 3336 Model 1 can be factory-converted to a 3336 Model 11.

### Attachment of the 3330 and 3333

The 3333 can attach to a 3830 Storage Control Model 2 or 3, a 3880 Storage Control Model 1 or 2, an integrated storage control (ISC), integrated file adapter (IFA), or direct disk attachment (DDA).

### 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.

### Special Features

The following features can be ordered through the 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 the IBM sales representative.

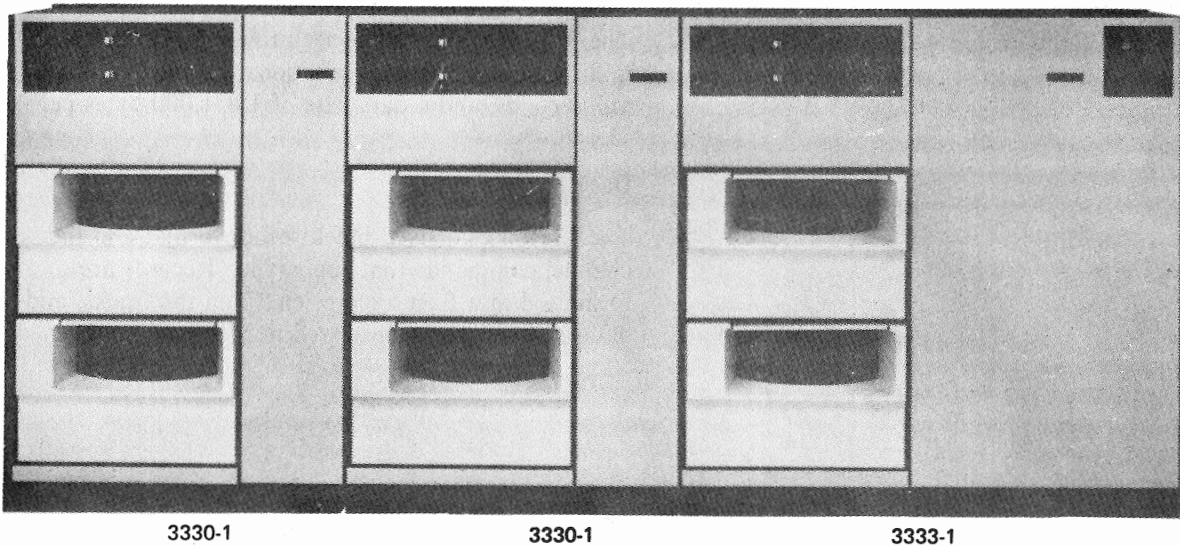


Figure 3-7. IBM 3330 and 3333 Disk Storage

### 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, but when control is switched, 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 at manufacture 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.

### Attachment of the 3350

The 3350 Model A2 attaches to the following storage controls: 3830 Storage Control Models 2 and 3, 3880 Storage Control Models 1 and 2 (3350 real mode only); and Integrated Storage Control (ISC).

### 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.

### Special Features

The following features can be ordered through the 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 the 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.

### 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.

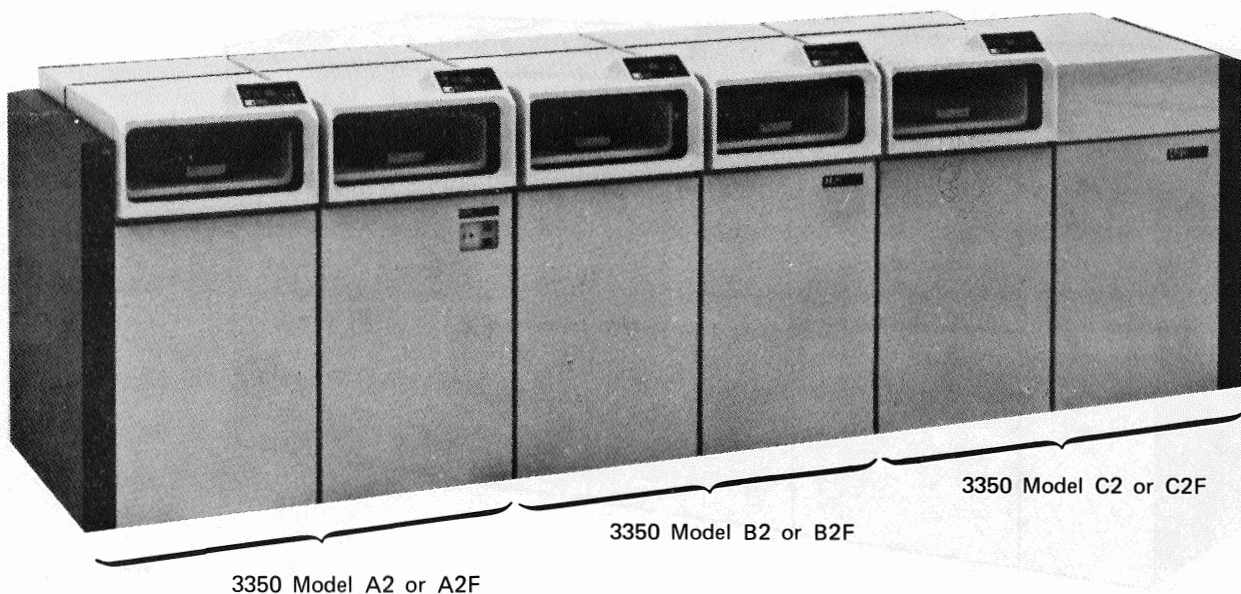


Figure 3-11. IBM 3350 Direct Access Storage

*OBSOLETE*

## 3370 Direct Access Storage

The 3370 Direct Access Storage is a high-speed, fixed-media, disk storage for attachment to a 4331 Model Group 1 or 2, 4341 Model Group 1 or 2, or 3081 Processor.

The 3370 has two models, A1 and B1:

- Model A1 is a string controller and contains one drive with two access mechanisms. It supplies the logic for attachment of up to three Model B1 units.
- Model B1 contains one drive with two access mechanisms.

The 3370 has an average seek time of 20 milliseconds, an average rotational delay of 10.1 milliseconds, and a data rate of 1,859 kilobytes per second.

The highlights of the 3370 follow.

### Access Operation

The 3370 Direct Access Storage (Figure 3-12) overlaps operations by having two access mechanisms for each drive. Each access mechanism is separately addressable and can access 285.6 megabytes of data. One access mechanism services one-half of the disks on the drive and the other services the other half. While one access mechanism is seeking or transferring data, the other can be seeking data on the same drive.

The disks, spindle, and access mechanism with read/write heads are permanently mounted on the drive.

### Attachment of the 3370

The 3370 Model A1 attaches to a 3880 Storage Control Model 1 or 2, which attaches to a 4331 Model Group 2, or 4341 Model Group 1 or 2. The 3370 also can be attached by an integrated adapter to a System/38; however, the units have different model designations, Models A11 and B11.

### Data Format

The 3370 uses a fixed-block record format and the commands that support it. Records are formatted in a fixed record length on the tracks, and data is stored and transferred in 512-byte blocks.

### Serviceability

If service is needed on the 3370, diagnostic information can be obtained and interpreted with a maintenance device (MD) used by the customer engineer.

### Special Features

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

### String Switch

The string switch feature permits the 3370 Model A1 and its connected disk storage to be shared by two storage controls. These controls may be either 3880s or DASD adapters.

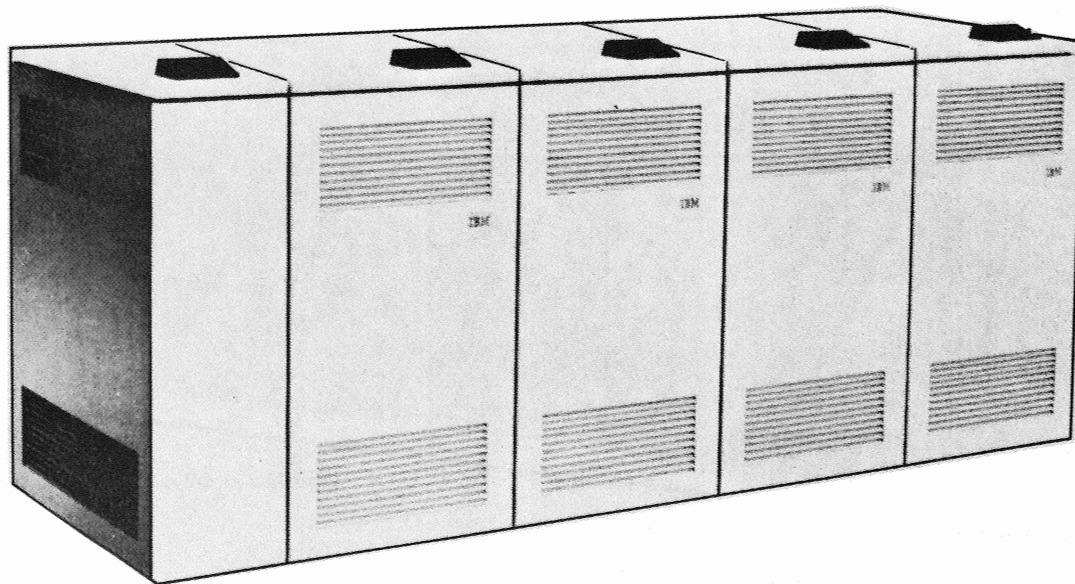


Figure 3-12. IBM 3370 Direct Access Storage



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

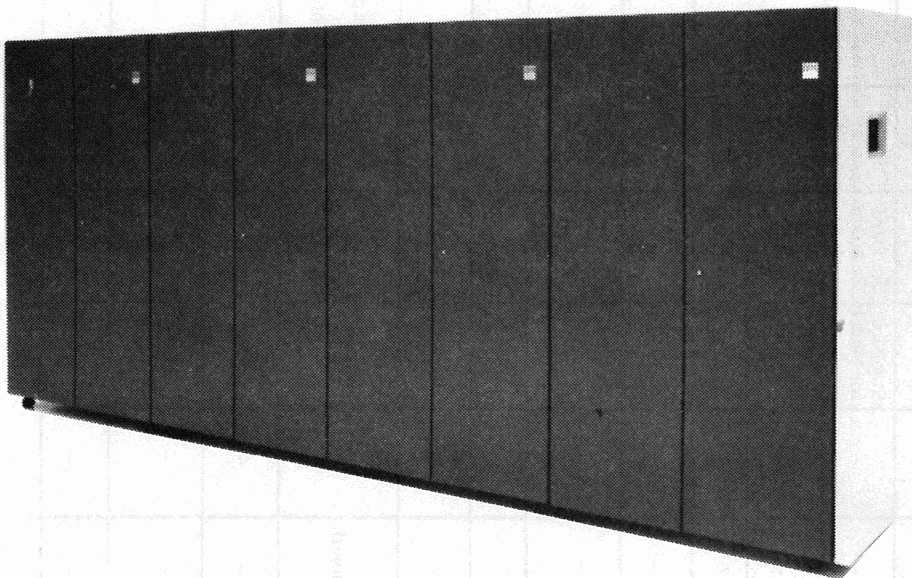
Two strings can be attached to one storage director in a 3880 Model 2 or to each storage director in a 3880 Model 3. Models AA4 and AAF can attach to two storage directors. The storage directors can be in the same 3880 Model 3 or in different 3880 Models 2 or 3.

**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.

**Data Comparison Tables**

Figures 3-15 through 3-19 give comparisons of data for the storage controls and disk storages mentioned in this chapter.



**Figure 3-14. 3380 Direct Access Storage**



Features*	Notes	Storage Controls			Disk Storage									
		2835	3830	3880	2305	3310	3330	3333	3340	3344	3350	3370	3375	3380
Command Retry	1	—	Supported	Supported	—	Standard	Standard	Standard	—	—	Standard	Standard	Standard	Standard
Rotational Position Sensing	2	Supported	Supported	Supported	Standard	Standard	Standard	Standard	Special	Standard	Standard	Standard	Standard	Standard
Multiple Requesting	3	Supported	Supported	Supported	Standard	—	Standard	Standard	Standard	Standard	Standard	—	Standard	Standard
Record Overflow	4	Supported	Supported	Supported	Standard	—	Standard	Standard	Standard	Standard	Standard	—	Standard	—
End of File	5	—	—	—	—	—	Standard	Standard	Standard	Standard	Standard	—	Standard	Standard
Multiple Track Operations	6	Supported	Supported	Supported	Standard	—	Standard	Standard	Standard	Standard	Standard	—	Standard	Standard
Write Format Release	7	—	—	—	—	—	Standard for Model II	Standard for Model II	—	—	Standard	—	—	Standard
Primary Controller Adapter	8	—	—	—	—	—	—	—	—	—	Special	—	—	—
String Switch	9	—	—	—	—	—	—	Special	Special	—	Special	Special	Special	—
Two Channel Switch	10	Special	Special	Special (Pair)	—	—	—	—	—	—	—	—	—	—
Two Channel Switch, Additional	10	—	Special	Special (Pair)	—	—	—	—	—	—	—	—	—	—
Remote Switch	11	Special	Special	Special	—	—	—	—	—	—	—	—	—	—
Remote Switch, Additional	11	—	Special	Special	—	—	—	—	—	—	—	—	—	—
Fixed Head	12	—	—	—	Standard	—	—	—	Special	Standard (Model B2F only)	Standard (Models A2F, B2F, and C2F only)	—	—	Standard (Models A4F, AAF, and B4F only)
Eight Channel Switch	10	—	—	Special	—	—	—	—	—	—	—	—	—	—
Remote Switch (For Eight Channels)	11	—	—	Special	—	—	—	—	—	—	—	—	—	—
Speed Matching Buffer	13	—	—	Special	—	—	—	—	—	—	—	—	—	—

\* Standard features are part of the basic machine; special 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 errors without involving system recovery procedures. It also is used to send again commands in other situations.*
2. *Rotational position sensing permits the channel to send a command to find a record and 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 block multiplexing in the channel 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 group of records. 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 use of the alternate controller when selected through a switch on the alternate 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.*
10. *Channel switches permit a storage control to be accessed and shared by different channels on the same or different processors.*
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 3380s to attach to channels with a data transfer rate of less than 3 megabytes.*

Figure 3-15. Comparison of Features for Storage Controls and Disk Storage

Characteristics	Storage Controls			
	2835	3830-2	3880-1, 2	3880-3
Commands Supported	Count, Key, Data	Count, Key, Data	Count, Key, Data; Fixed Block	Count, Key, Data
Strings Attachable (Standard)	—	Two	Eight; Four for Each Storage Director	Four; Two for Each Storage Director
Strings Attachable (Special)	—	Special Extension Features for Two Additional Strings	—	—
Attaches	2305 Model 2	<ul style="list-style-type: none"> <li>● 3333 Models 1, 11</li> <li>● 3330 Models 1, 2, 11</li> <li>● 3340 Models A2, A2F, B1, B2, B2F</li> <li>● 3344 Models B2, B2F</li> <li>● 3350 Models A2, A2F, B2, B2F, C2, C2F</li> </ul>	<ul style="list-style-type: none"> <li>● 3333 Models 1, 11</li> <li>● 3330 Models 1, 2, 11</li> <li>● 3340 Models A2, A2F, B1, B2, B2F</li> <li>● 3344 Models B2, B2F</li> <li>● 3350 Models A2, A2F, B2, B2F, C2, C2F</li> <li>● 3370 A1, B1</li> <li>● 3380 (2 strings on one storage director of a 3880-2)</li> <li>● 3375 Models A1, B1</li> </ul>	<ul style="list-style-type: none"> <li>● 3380 Models A4, A4F, AA4, AAF, B4, B4F</li> </ul>

Figure 3-16. Comparison of Characteristics for Storage Controls.

Characteristics	Disk Storage									
	2305	3310	3330	3333	3340	3344	3350	3370	3375	3380
Data Format	Count, Key, Data	Fixed Block	Count, Key, Data	Count, Key, Data	Count, Key, Data	Count, Key, Data	Count, Key, Data	Fixed Block	Count, Key, Data	Count, Key, Data
Storage	Fixed Disks	Fixed Sealed Assembly	Removable Disk Pack	Removable Disk Pack	Removable Sealed Module	Fixed Sealed Assembly	Fixed Sealed Assembly	Fixed Sealed Assembly	Fixed Sealed Assembly	Fixed Sealed Assembly
Fixed Heads	All Tracks	—	—	—	Some Tracks on 3348 Model 70F (Requires Special Feature)	Some Tracks on Model B2F	Some Tracks on Models A2F, B2F, and C2F	—	—	Some Tracks on Models A4F, AAF, and B4F
Access Mechanisms Per Drive	None	One	One	One	One	One	One	Two	One	Two
Drives Per Unit (By Model)	2-One	A1-One A2-Two B1-One B2-Two	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	A1-One B1-One	A4-Two AA4-Two A4F-Two AAF-Two B4-Two B4F-Two
Units Per String (Maximum)	Two	One 3310 Model A2 + One 3310 Model B2	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 3350 Model C	One 3370 Model A + Three 3370 Model Bs	One 3375 Model A + Three 3375 Model Bs	One 3380 Model A + Three 3380 Model Bs
Attaches to  <b>Note:</b> The number of strings that can be attached depends on the attachment method, the processor, and, in some cases, special extension features.	2835 Model 2	DASD Adapter (4331)	3333 Model 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), DASD Adapter (4331)	3340 Model A2	3830 Model 2*, 3830 Model 3, 3880, ISC (145, 148, 158, 168)	3880*, DASD Adapter (4331, System/38)	3880 Model 1 or 2	3880 Model 2 or 3
*Numbers within parentheses are models of the System/370 or processor numbers.										

Figure 3-17. Comparisons of Characteristics for Disk Storage

Disk Storage	Megabytes Per Access Mechanism	Megabytes Per Drive	Megabytes Per Unit	Megabytes Per String (Maximum)
2305 Model 2		11.2	11.2	22.4 (2 Drives)
3310	64	64	128	256 (4 Drives)
3333/3330				
3336 Model 1	100	100	200	800 (8 Drives)
3336 Model 11	200	200	400	1,600 (8 Drives)
3340				
3348 Model 35	35	35	70	280 (8 Drives)
3348 Model 70	70	70	140	560 (8 Drives)
3344	280	280	560	1,820 (2 Drives 3340 Model A, 6 Drives 3344)
3350	317	317	635	2,540 (8 Drives)
3370	285	571	571	2,284 (4 Drives)
3375	409.8	819.7	819.7	3,270 (4 Drives)
3380	630	1,260	2,520	(4 Units 10,080 8 Drives)

Figure 3-18. Comparison of Capacities for Disk Storage

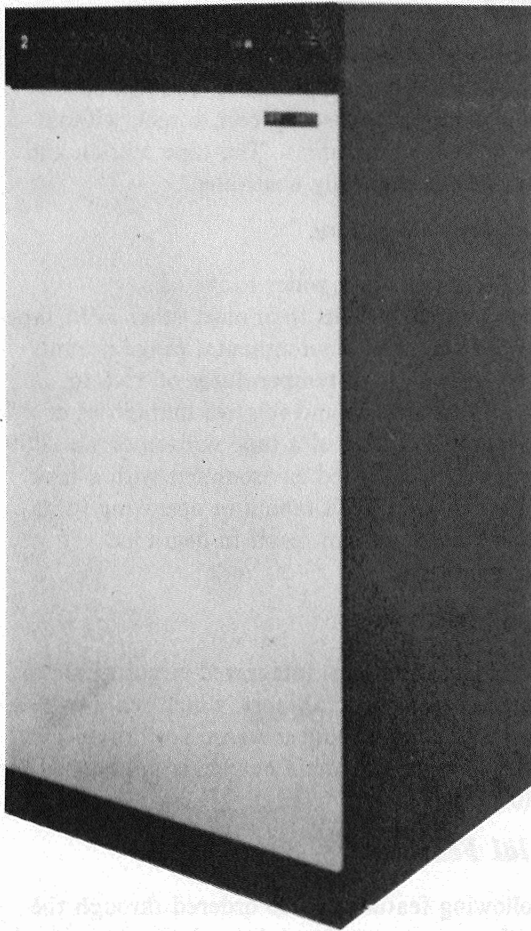
Disk Storage	Access-Motion (Seek) Time, Average Milliseconds (See Note 1)	Rotational Delay Time, Average Milliseconds (See Note 2)	Data Rate Kilobytes Per Second (See Note 3)
2305 Model 2	0	5.0	1,500
3310	27	9.6	1,031
3333/3330	30	8.4	806
3340	25*	10.1	885
3344	25*	10.1	885
3350	25*	8.4	1,198
3370	20	10.1	1,859
3375	19	10.1	1,859
3380	16*	8.3	3,000

\*Times 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 (cylinder) 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 turn to the read/write head so that the data transfer can begin.
3. Data rate is the instantaneous speed at which bytes are transferred.

Figure 3-19. Comparison of Performance for Disk Storages



**Figure 7-3. IBM 3803 Tape Control Unit Model 1**

### ***Special Features***

The following features can be ordered through the 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 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 possible the enabling and disabling of 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.

### **8809 Magnetic Tape Unit Models 1A, 1B, 2, and 3** *obsolete*

The 8809 Magnetic Tape Unit (Figure 7-4) supplies high-speed save and restore capabilities for: DASD, journaling for data base/data communication, tape swapping, and processing of the host system.

The 8809 is available in four models, which may be attached to either an 8100 System (four 8809s maximum) or a 4331 or 4341 Processor (up to six 8809s maximum). A Model 1A or 1B must be the first drive in the string. The attachment of the four models is as follows:

- Model 1A attaches either directly to the 4331 or 4341 Processor or to the 8101 Storage and I/O Unit of an 8100 System. It supplies power to an attached Model 2.
- Model 1B attaches directly to the 8100 System because it contains a Tape Unit Adapter that is not present in the Model 1A. It also supplies power to an attached Model 2
- Model 2 attaches to a Model 1A or 1B and is the second, fourth, or sixth (4331 or 4341 Processor only) unit in the string. This model contains no power.
- Model 3 attaches to a Model 2 and is the third or fifth (4331 or 4341 Processor only) unit. It supplies power to an attached Model 2.

Each model can operate in start-and-stop or streaming mode with a rewind time of 2.6 minutes for a full reel.

The highlights of the 8809 follow.

### **Attachment to a Processor**

The 8809 Magnetic Tape Unit attaches to an IBM processor through an integrated tape adapter.



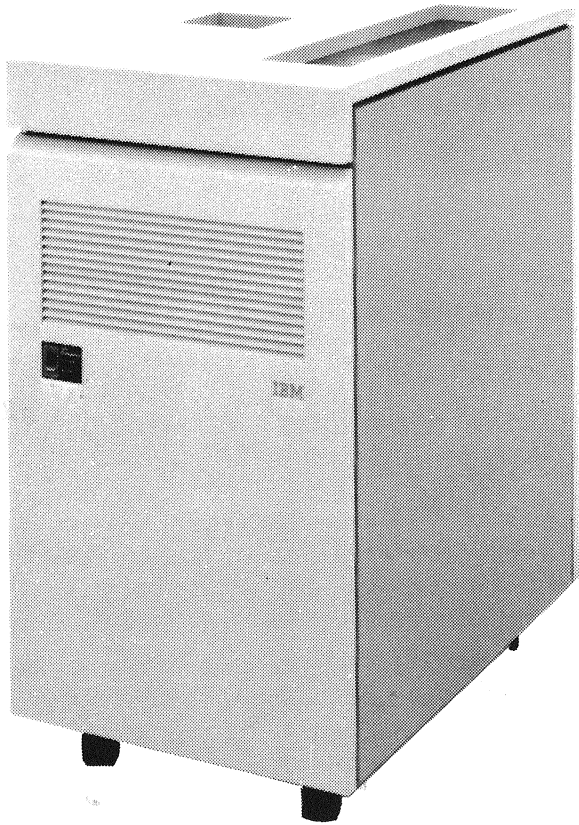


Figure 7-4. IBM 8809 Magnetic Tape Unit

### Modes of Operation

The 8809 operates in two modes:

- Start-and-stop mode, which moves tape at 317.5 mm (12.5 in.) per second with a nominal data rate of 20 kilobytes per second and starts and stops within the IBG.
- Streaming mode, which moves tape at 2540 mm (100 in.) per second with a nominal data rate of 160 kilobytes per second and maintains velocity through the IBG while anticipating the next command.

### 1600 BPI PE Mode

The 8809 uses the 1600 BPI phase-encoded tape format, which is compatible with IBM 2400-and 3400-series tape units.

### Tape Path

The 8809 uses a simplified reel-to-reel tape path design. After the tape is threaded and loaded, the tape unit moves tape directly reel to reel, without capstan or vacuum columns. The tape tension and velocity are electronically controlled.

### Environmental Conditions

The 8809 operates in a wider range of environmental conditions than most other IBM tape units. This extended environmental range permits the 8809 to operate at temperatures of 15.6 to 37.8°C (60 to 100°F) and relative humidities of 8% to 80%. The swapping of a tape written on an 8809 operating in its extended environment with a tape written on another IBM tape unit operating in its normal environment can result in degraded performance.

### Reduced Maintenance

The 8809 tape unit uses integrated circuitry and a simplified reel-to-reel transport, which reduce the need for maintenance and increase performance reliability. Preventive maintenance is not needed for the 8809.

### Special Features

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

### 8100 System Multi-Drive

The 8100 system multi-drive feature is needed on a 8809 Model 1B if more than one tape unit (additional Model 2 or Model 3) is attached to an 8100 System.

### Data Comparison Table

Figure 7-5 gives a comparison of data for the magnetic tape devices mentioned in this chapter.

Magnetic Tape Unit		Nominal Data Rates (kilobytes per second)				Tape Speed		Nominal Read Access Time* (ms)	Nominal Interblock Gap						Nominal Interblock-Gap Time			Rewind Time (sec)	Rewind and Unload Time
		556 BPI	800 BPI	1600 BPI	6250 BPI	m/sec	in./sec		mm			in.			ms				
Number	Model	Seven Track NRZI	Seven or Nine Track NRZI	Nine Track PE							Seven Track	Nine Track	6250 BPI	Seven Track	Nine Track	6250 BPI	Seven Track	Nine Track	6250 BPI
3410/ 3411	1	6.9	10	20	—	0.318	12.5	15.0	19.1	15.2	—	0.75	0.6	—	60.0	48.0	—	180	—
	2	13.9	20	40	—	0.635	25.0	12.0	19.1	15.2	—	0.75	0.6	—	30.0	24.0	—	180	—
	3	27.8	40	80	—	1.270	50.0	6.0	19.1	15.2	—	0.75	0.6	—	15.0	12.0	—	120	—
3420	3	41.7	60	120	—	1.905	75.0	4.0	19.1	15.2	—	0.75	0.6	—	10.0	8.0	—	60	66
	4	—	—	120	470	1.905	75.0	2.3	—	15.2	7.6	—	0.6	0.3	—	8.0	4.0	60	66
	5	69.5	100	200	—	3.175	125.0	2.9	19.1	15.2	—	0.75	0.6	—	6.0	4.8	—	60	66
	6	—	—	200	780	3.175	125.0	1.6	—	15.2	7.6	—	0.6	0.3	—	4.8	2.4	60	66
	7	111.2	160	320	—	5.080	200.0	2.0	19.1	15.2	—	0.75	0.6	—	3.8	3.0	—	45	51
	8	—	—	320	1250	5.080	200.0	1.1	—	15.2	7.6	—	0.6	0.3	—	3.0	1.5	45	51
8809**	1A, 1B, 2, 3	—	—	20	—	0.318	12.5	44.0	—	15.2	—	—	0.6	—	—	48.0	—	156	—
8809***	1A, 1B, 2, 3	—	—	160	—	2.540	100.0	335.0	—	15.2	—	—	0.6	—	—	6.0	—	156	—

\*The read access time is the interval from the beginning of a forward read operation, when the tape is not at a 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.  
\*\*8809 is operating in start/stop mode.  
\*\*\*8809 is operating in the streaming mode.

Figure 7-5. Comparison of Characteristics for Magnetic Tape Devices

## Chapter 9. Printer-Keyboards

The printer-keyboard units permit interaction between the system and the operator; this results in a message flow between the operator and the system.

### 3215 Console Printer-Keyboard Model 1

The 3215 Console Printer-Keyboard (Figure 9-1) permits communication between the system and the operator, and gives printed output. Under program control, printing occurs at up to 85 characters per second, relative to the system.

The highlights of the 3215 follow.

#### Printer Characteristics

Character spacing is 10 characters per inch and up to 126 characters per line. Both left and right margins are fixed as specified by the platen width used. Vertical single spacing is 6 lines per inch; double spacing is 3 lines per inch. All power, control, and data signals come from the processor.

#### Characters Printed

The 3215 prints 26 alphabetic, 10 numeric, and up to 29 special characters from the extended binary-coded decimal interchange code (EBCDIC). Other unique graphics are available for language and special character needs.

#### Control Functions

All functions of the 3215: printing, spacing, carrier return, and vertical spacing are controlled either by hand or by program control.

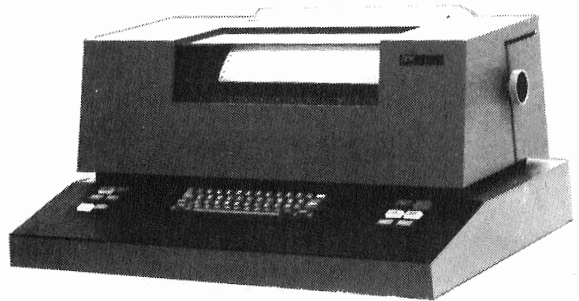


Figure 9-1. IBM 3215 Console Printer-Keyboard

## Recovery and Status Information

The 3800 has page accounting and configuration information that is used for recovery and status actions. Four two-byte (halfword) counters keep track of the page as it moves from the page buffer to the stacker.

## Special Features

The following features can be ordered through the 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 the 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 postprinting delays.

### Extended Graphics

The extended graphics feature permits the 3800 to print characters that are twice the width of standard characters (that is, a 7.5-pitch in place of two 15-pitch) as a single extended graphics character,

and to intermix these with various character sets now available for the 3800. A 3800 with the extended graphics feature can process jobs that do not contain extended graphics data, because the standard 3800 functions are not affected except for a slight reduction in the page buffer capacity.

This feature operates with the Common Use or ISO size paper and on 50 or 60 hertz machines. Separate microcode diskettes are used for the extended graphics feature. This feature does not function with the IBM 3800 tape-to-printing subsystem feature.

**Note:** This feature is only available for A/FE World Trade countries.

### 127 Writable Character Generation Storage Positions, Additional

The 127 writable character generation storage positions, additional feature supplies additional character-generation storage for 127 characters to permit a maximum print capability of 255 different characters.

### Remote Switch Attachment

The remote switch attachment supplies two-channel switching at a configuration control panel.

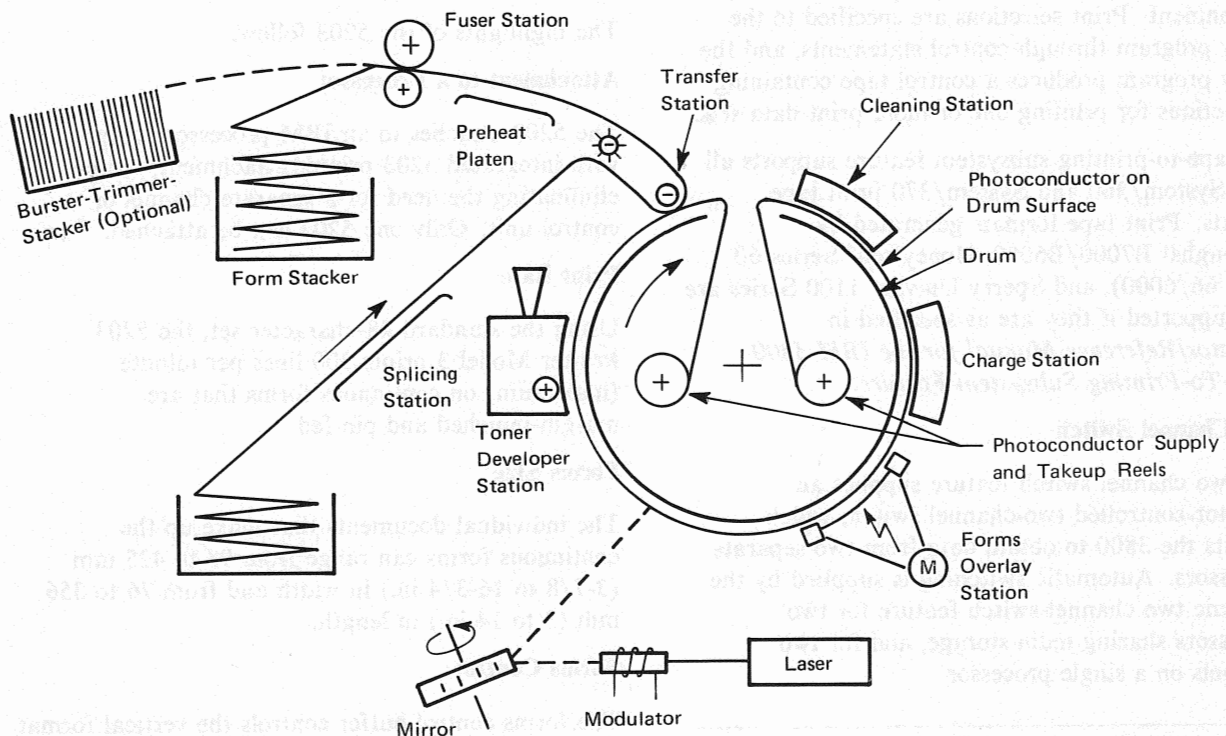


Figure 10-14. Path of Paper Forms through the 3800 Printing Subsystem

## Tape-To-Printing Subsystem Feature

The tape-to-printing subsystem feature permits the 3800 to be operated from magnetic tape data. 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 magnetic tape recording densities permitted for the magnetic tape subsystem can be used. The configuration can be arranged to let the tape subsystem be used online by supplying a separate switchable path from the tape control to the system.

Selection of 3800 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 internal diskette, or entries at the auxiliary operator panel. These methods can be used alone, or in combination, to achieve flexible use of the 3800 printing functions. For example, a control tape may be used for multiple print jobs, with additional parameters entered at the auxiliary operator panel for some jobs. Internal diskette controls can be used for other jobs. A standard set of control tapes can be created and maintained for use when they are needed.

If control tapes are to be used, the Offline IBM 3800 Utility program (Program Product 5748-UT2) is available to help the user prepare them. The utility program operates in an online system environment. 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 print data sets.

The tape-to-printing subsystem feature supports all IBM System/360 and System/370 print tape formats. Print tape formats generated by Burroughs<sup>1</sup> B7000/B6000, Honeywell<sup>2</sup> Series 60 (level 66/6000), and Sperry Univac<sup>3</sup> 1100 Series are also supported if they are as specified in *Operator/Reference Manual for the IBM 3800 Tape-To-Printing Subsystem Feature*.

### Two Channel Switch

The two channel switch feature supplies an operator-controlled two-channel switch, which permits the 3800 to obtain data from two separate processors. Automatic switching is supplied by the dynamic two channel switch feature for two processors sharing main storage, and for two channels on a single processor.

<sup>1</sup> Burroughs Corporation, Detroit, Michigan

<sup>2</sup> Honeywell Information Systems, Waltham, Massachusetts

<sup>3</sup> Sperry Univac, Roseville, Minnesota

## 3811 Printer Control Unit Model 1

The 3811 Printer Control Unit Model 1 is the control unit for the 3211 Printer. The 3811 (Figure 10-6) is physically attached to the 3211 and contains the electronic circuits needed to adapt the printer to the channel.

The highlights of the 3811 follow.

### Attachment to a Processor

The 3811 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. The 3811 Control Unit supplies all the necessary electronic controls and buffers to adapt the 3211 Printer to the I/O channel supplied by the processor.

### Functional Units

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

## 5203 Printer Model 3

The 5203 Printer Model 3 (Figure 10-15) is a line printer that prints 10 characters per inch. The standard 5203 has 96 print positions but can be expanded through special features to 120 or 132 positions.

The highlights of the 5203 follow.

### Attachment to a Processor

The 5203 attaches to an IBM processor equipped with integrated 5203 printer attachment, thereby eliminating the need for a separate channel or control unit. Only one 5203 can be attached.

### Print Rate

Using the standard 48-character set, the 5203 Printer Model 3 prints 300 lines per minute (maximum) on continuous forms that are margin-punched and pin-fed.

### Forms Size

The individual documents that make up the continuous forms can range from 98 to 425 mm (3-7/8 to 16-3/4 in.) in width and from 76 to 356 mm (3 to 14 in.) in length.

### Forms Control

The forms control buffer controls the vertical format and movement (spacing and skipping). The 5203



has vertical line spacing of either 6 or 8 lines per inch that is under operator control.

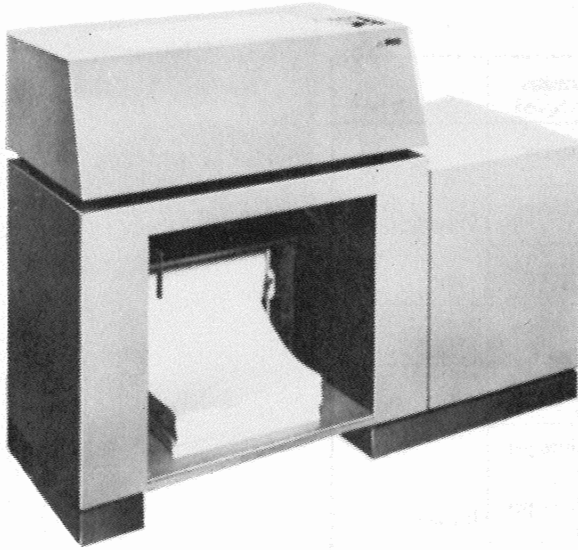


Figure 10-15. IBM 5203 Printer Model 3

### **Special Features**

The following features can be ordered through the 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 the IBM sales representative.

#### **Interchangeable Train Cartridge, Additional**

The interchangeable train cartridge, additional feature supplies an additional operator changeable train cartridge that contains from 48 to 120 different characters.

#### **Print Positions, 24, 12, and 36 Additional**

The print positions, 24, 12, and 36 additional feature increases the number of print positions from 96 to 120, from 120 to 132, and from 96 to 132.

#### **Universal Character Set Attachment**

The universal character set attachment feature is needed if any interchangeable train cartridge with more than 48 different characters is used.

## **5213 Printer Model 1**

*OBSOLETE*

The 5213 Printer Model 1 (Figure 10-16) can operate as a table-mounted console printer for IBM processors.

The highlights of the 5213 follow.

#### **Attachment to a Processor**

The 5213 attaches to an IBM processor through an integrated printer attachment.

#### **Printer Characteristics**

The 5213 uses a 62-character set and prints serially at 85 characters per second. The maximum print line is 132 positions at 10 characters per inch, with line spacing of 6 lines per inch.

#### **Forms**

The 5213 uses continuous forms that are pin-fed and margin-punched. The individual documents that make up the continuous forms can range from 76 to 356 mm (3 to 14 in.) in length; document width is 352 mm (13-7/8 in.) from left to right of the margin-punched centers. Multiple-part forms can be printed, having a maximum thickness of 0.457 mm (0.018 in.).

#### **Forms Control**

The 5213 has a pin-feed platen and a high-speed carrier-return. It also has single-space forms indexing under program control.

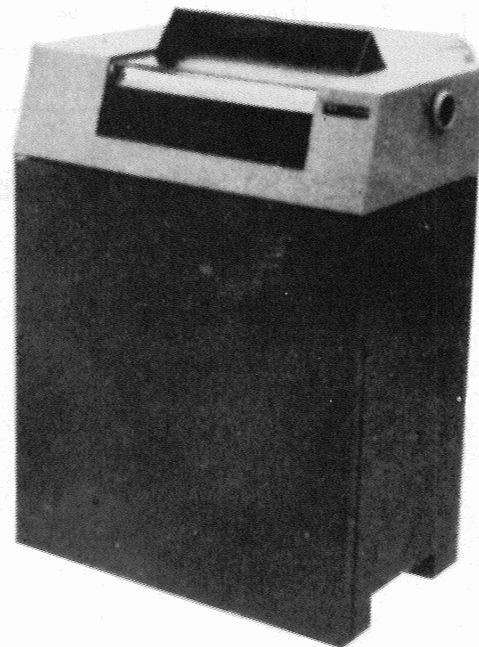


Figure 10-16. IBM 5213 Printer Model 1

## Data Comparison Table

Figure 10-17 gives a comparison of data for the printers mentioned in this chapter.

I/O Device	Model	Control Unit	Number of Print Positions	Maximum Print Speed	Print Method
1403	2	2821	132	600 lines per minute	Impact
	7		120	600 lines per minute	
	N1		132	1,100 lines per minute	
1443	N1	Internal	120	240* lines per minute	Impact
3203	1	Integrated	132	600 lines per minute	Impact
	2	Integrated	132	1,200 lines per minute	
	3	3770	132	1,000 lines per minute	
	4	Integrated Attachment	132	1,200 lines per minute	
	5	Internal	132	1,200 lines per minute	
3211	1	3811	132	2,000 lines per minute	Impact
3262	1, 2, 3	Integrated Attachment	132	650 lines per minute	Impact
	11, 12, 13		132	325 lines per minute	
3800	1	Internal	204**	20,040***	Nonimpact, electro-photographic, laser
5203	3	Integrated Attachment	96	300 lines per minute	Impact
5213	1	Integrated Attachment	132	85 characters per second	Impact, serial, matrix
* 1443 Model N1 with 52-character set ** 204 positions at 15 characters per inch ***3800 with forms length of 279 mm (11 in.) and 12 lines per inch					

Figure 10-17. Comparison Data for Printers

### 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.

### Special Features

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

### 2520 Card Read Punch Model B1

The 2520 Card Read Punch Model B1 (Figure 11-4) is a combined punched-card input and output unit for IBM processors.

The highlights of the 2520 Model B1 follow.

### Card-Processing Speed

The 2520 Model B1 reads and punches cards at a maximum rate of 500 per minute.

### Reading Operation

Operation of the 2520 Model B1 is the same as for the 1442 Model N1 or 2501 with respect to reading cards serially by column. Cards move past a read station and then past a punch station. Prepunched cards can be fed through the punch station without a special feature. As in the 2501, cards are read by photocells that convert the light passing through punched holes into electrical energy. The reading operations do not go through a buffer.

### Punching Operation

The punching operation of the 2520 differs from that of the 1442; punching is parallel by row instead of serially by column. Each card is fed in parallel and read serially while the preceding card, its axis turned 90 degrees, is passing by the punch station (Figure 11-5). The 2520 punching operations go through a buffer.

### Attachment to a Processor

No external control unit is needed; the control circuits are inside the device. The 2520 needs a control unit position on a system channel.

### Read and Punch Modes

The 2520 can read and punch 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 "Data Mode 2" in the 1442 Model N1 description earlier in this chapter for a description of the reading and punching operations in card image mode.

### Hopper and Stackers

The feed hopper has a 1200-card capacity. There are two stackers. The operator can remove cards from both 1300-card stackers while the machine is running.

### Special Features

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

### Card Image

The card image feature permits punching of cards with multiple punches in rows 1 through 7 of a single column.



Figure 11-4. IBM 2520 Card Read Punch Model B1

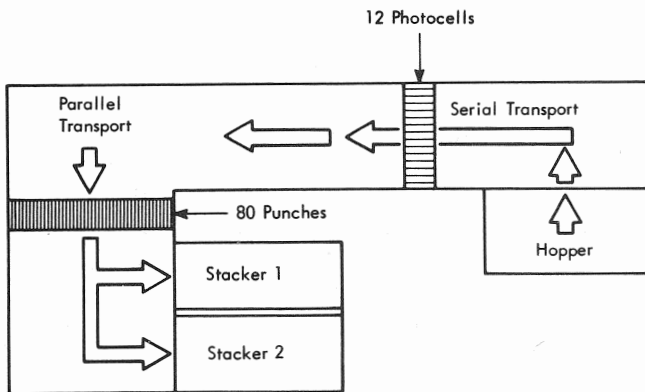


Figure 11-5. Card Path in the 2520 Card Read Punch Model B1

**OBSELETE**

## 2520 Card Punch Models B2 and B3

The 2520 Card Punch Model B2 or B3 can be connected to an IBM processor to supply the punching function only.

The highlights of the 2520 follow.

### Card-Punching Speed

Models B2 and B3 are externally the same (and the same as the 2520 Model B1 shown in Figure 11-4), except that the maximum card-punching rate of Model B2 is 500 per minute; that of Model B3 is 300 per minute.

### Similarities to the 2520 Model B1

Internal controls, punching in data mode 2, the punching speed of Model B2, and all other features related to punching are the same as those of the 2520 Card Read Punch Model B1.

### Special Features

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

### Card Image

The card image feature permits punching of cards with multiple punches in rows 1 through 7 of a single column by suspending validity checking.

## 2540 Card Read Punch Model B1

**OBSELETE**

The 2540 Card Read Punch (Figure 11-6) is an input and output, 80-column card device for an IBM processor. The 2540 can read and punch EBCDIC.

The highlights of the 2540 follow.

### Card-Processing Speed

The 2540 reads cards at a maximum rate of 1000 per minute, and punches cards at a maximum rate of 300 per minute. The card reading and punching facilities are separate entities, and can take place simultaneously.

### Hoppers and Stackers

The read hopper, with its file feed, holds 3100 cards. The punch hopper holds 1350 cards. Five 1350-card stackers are located between the read and punch ends of the 2540; three stackers can be used in reading and three in punching. The center stacker can be fed with either punched or read cards, but should be reserved for one or the other during a run. The operator can remove cards from any pocket without stopping the machine.

### Attachment to a Processor

The 2540 is controlled and attached to the channel by a 2821 Control Unit. (See "2821 Control Unit Models 1, 2, 3, 5, and 6," described under Chapter 10.)

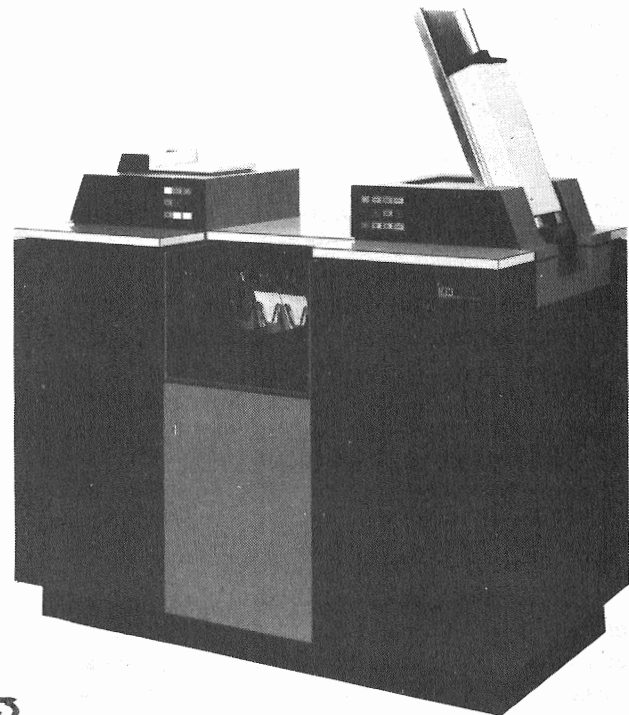


Figure 11-6. IBM 2540 Card Read Punch

### Special Features

The following features can be ordered through the 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 the IBM sales representative.

#### **Punch Feed Read**

The punch feed read feature permits the 2540 to punch output data into the same card from which input data was read. Column binary cards cannot be read in the punch feed. Unless this feature is installed, only blank cards can be fed through the punch facility.

#### **Two Channel Switch Adapter**

The two channel switch adapter feature permits the read and punch feed of the 2540 to be reset independently. This is needed if the 2540 is to be used with a 2821 that has a two channel switch feature installed.

#### **51-Column Interchangeable Read Feed**

The 51-column interchangeable read feed feature permits feeding 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. (51-column cards can be postal money orders, installment payments, inventory cards, for example, a detached 51-column stub from an 80-column card.) Installation of this feature permanently reduces the maximum card-reading speed to 800 cards per minute. The first two read pockets are modified so that the operator can adjust for either an 80- or 51-column

operation. During the time that the pockets are set for 51-column cards, the capacity of the two pockets is reduced to 800 cards each and 80-column cards cannot be fed.

**OBSOLETE**

## **2560 Multi-Function Card Machine Models A1 and A2**

The 2560 Multi-Function Card Machine (Figure 11-7) supplies the combined functions of a card reader, card punch, and card collator for an IBM processor. The 2560 permits cards to be collated, gangpunched, reproduced, summary punched, and classified in a single pass, under program control.

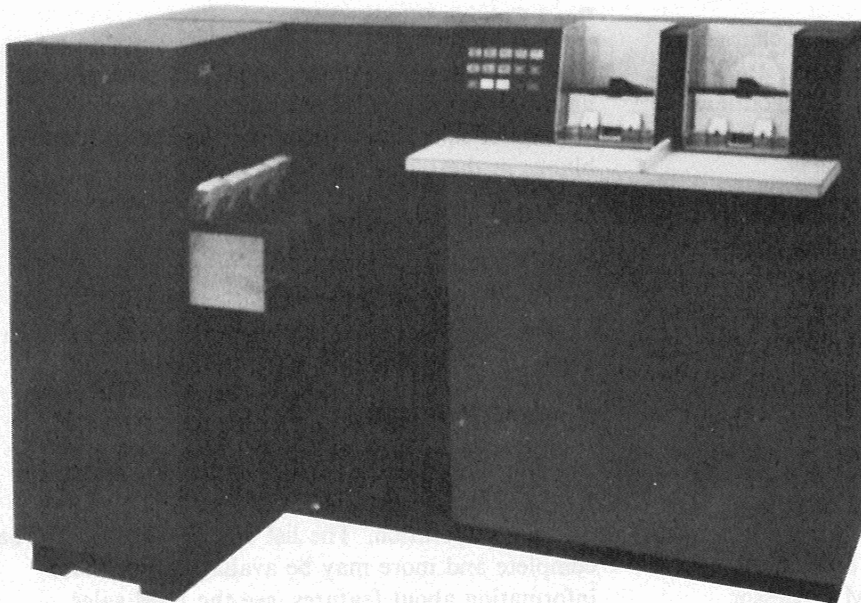
There are two models of the 2560:

- Model A1 reads 500 cards per minute from either of two hoppers, punches at 160 columns per second, prints at 140 columns per second, and has five stackers.
- Model A2 reads at 310 cards per minute from either of two hoppers, punches at 120 columns per second, and has four stackers.

The highlights of the 2560 follow.

#### **Attachment to a Processor**

The 2560 attaches to an IBM processor through an integrated attachment.



**Figure 11-7. IBM 2560 Multi-Function Card Machine**



## Functional Units

Both models have two 1200-card hoppers (primary and secondary), a read station, a punch station, and four or five 1300-card stackers.

## Read and Punch Operations

Cards from either the primary or secondary hopper can be read, punched, and fed into any of the stackers. While in the read station, cards are checked for data validity, off-register punching, and correct alignment. The output per minute varies with the number of columns punched per card. For example, the output rates for Models A1 and A2 vary from 91 and 65 cards per minute respectively when column 80 is the last column punched, to 260 and 173 cards per minute respectively when punching stops at column 10.

## Special Features

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

## Card Print

The card print feature (Model A1 only) supplies two, four, or six printing heads for serial printing as the card moves through the print station. Each printing head can be adjusted by hand to print in any one of 25 line positions not occupied by another head. Line positions are above the 12-punch position, on each row of punch positions, between the rows of punch positions, and below the 9-punch position.

Each printing head can print 62 different characters plus a blank, as transmitted from storage. Character spacing is 10 to the inch, and each line can be 64 characters long. Printing extends from approximately column 2 to column 75.

Printing speed is 140 characters per second, regardless of the number of lines printed. Six hundred 64-character lines per minute (100 cards per minute) can be printed if six lines are printed on each card; this time includes card movement and registration.

The card print feature permits cards to be printed (interpreted) in the same pass with other operations.

## 3504 Card Reader Models A1 and A2

The 3504 Card Reader supplies an 80-column, punched-card, input unit for an IBM processor.

It is available in two models:

- Model A1 reads 800 cards per minute.
- Model A2 reads 1200 cards per minute.

The highlights of the 3504 follow.

## Functional Units

The 3504 Card Reader (Figure 11-8) is a high-speed device, that has 3000-card file feed and two 1750-card nonprogrammable stackers.

## Attachment to a Processor

The 3504 attaches to an IBM processor through an integrated attachment.

## Error-Recovery Support

The 3504 needs less error-recovery support than 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 3504 (for example, automatic feed retry).

The 3504 also 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 3504 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

Card reading in a 3504 is serially by column. The card read is checked for invalid codes or open-punched card scores. Machine checks are also made for off-punched or mispositioned cards.

## Special Features

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

### **51/80-Column Interchangeable Read Feed**

The 51/80-column interchangeable read feed feature gives the attachments necessary to feed and read 51-column cards.

### **Optical Mark Read**

The optical mark read feature permits the 3504 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.

## **3505 Card Reader Models B1 and B2**

The 3505 Card Reader Models B1 and B2 (Figure 11-8) 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.

The highlights of the 3505 follow.

### **Attachment to a Processor**

The 3505 needs a control unit position on a system channel.

### **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**

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



**Figure 11-8. IBM 3504 or 3505 Card Reader**

## ***Special Features***

The following features can be ordered through the 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 the 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 feeding 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.

## **3525 Card Punch Models P1, P2, and P3**

The 3525 Card Punch (Figure 11-9) 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.

The highlights of the 3525 follow.

### **Attachment to a Processor**

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.



Figure 11-9. IBM 3525 Card Punch

### ***Special Features***

The following features can be ordered through the 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 the 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 is the same in 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.

## **5425 Multi-Function Card Unit Models A1 and A2**

The 5425 Multi-Function Card Unit (Figure 11-10) is a 96-column punched-card device for an IBM processor. It can function as a card reader, card punch, collator, and interpreter. The consolidation of these functions into one unit reduces card handling and the overall time to complete a job. In a single pass and under program control, the 5425 permits 96-column cards (Figure 11-1) to be collated, gangpunched, reproduced, summary-punched, printed, and classified. It also sorts cards, using a multiple pass method under program control.

Externally, both models of the 5425 look the same, and both have two 2000-card hoppers, a read station, a punch station, a print station, and four 600-card stackers; the exceptions are:

- Model A1 reads 250 cards per minute, punches 60 cards per minute, and prints 60 cards per minute.
- Model A2 reads 500 cards per minute, punches 120 cards per minute, and prints 120 cards per minute.

These print rates are for the first, second, and third lines, but they are reduced if the fourth line is printed.

The highlights of the 5425 follow.

#### **Attachment to a Processor**

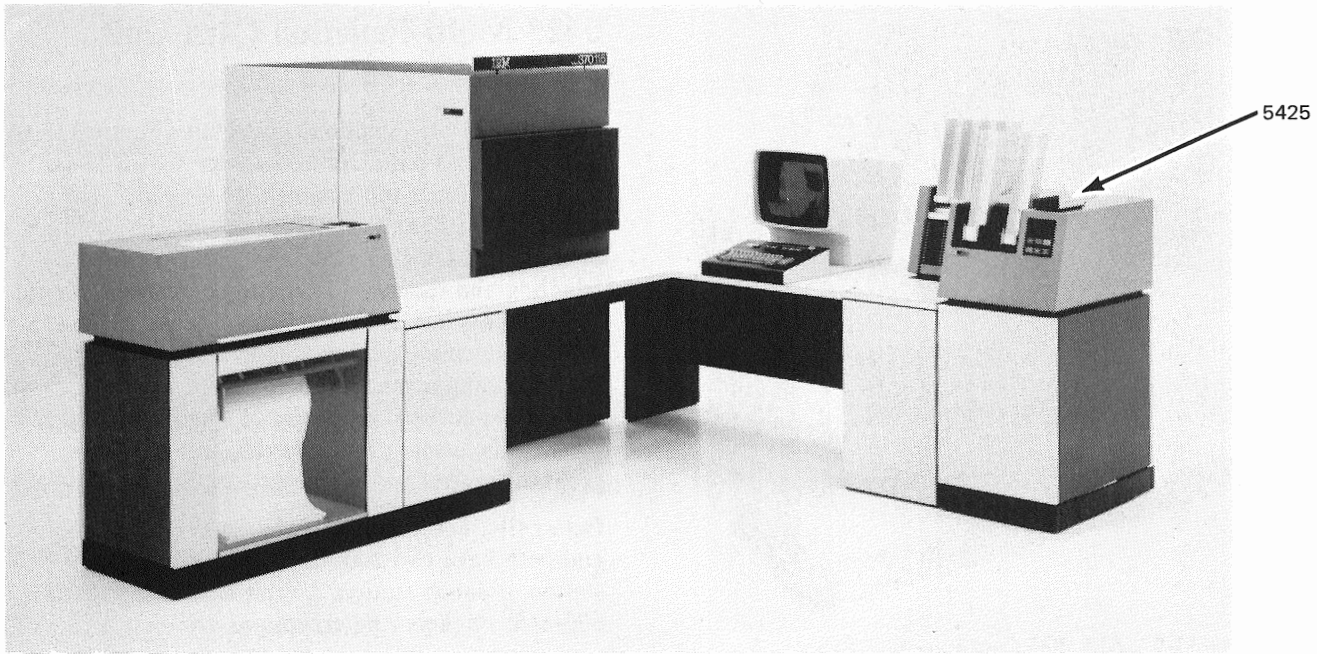
The 5425 attaches to an IBM processor through an integrated attachment.

#### **Card Path**

The primary and secondary hoppers feed cards through the read station into wait stations. From the wait stations, the cards pass through the punch station and the print station, and move into a selected stacker.

#### **Printing**

At the print station, up to four lines (with as many as 32 characters per line) can be printed, using characters from the standard 64-character set.



**Figure 11-10. IBM 5425 Multi-Function Card Unit with System/370 Model 115**

## Data Comparison Table

Figure 11-11 gives a comparison of data for the card devices mentioned in this chapter.

Card Unit	Model	Read Speed (cards per minute)	Punch Speed	Read and Punch Same Card in One Pass	Self-Contained Control Unit	Buffers
1442	N1	400	160 cc/s (see Note 3)	yes	yes	none
1442	N2	—	160 cc/s (see Note 3)	—	yes	none
2501	B1	600	—	—	yes	none
2501	B2	1,000	—	—	yes	none
2520	B1	500	500 c/m	yes	yes	punch
2520	B2	—	500 c/m	—	yes	punch
2520	B3	—	300 c/m	—	yes	punch
2540	1	1,000 (see Note 1)	300 c/m	yes	no	read, punch
2560	A1	500	160 cc/s (see Note 4)	yes	no	none
2560	A2	310	120 cc/s (see Note 5)	yes	no	none
3504	A1	800	—	—	no	read
3504	A2	1,200	—	—	no	read
3505	B1	800	—	—	yes	read
3505	B2	1,200	—	—	yes	read
3525	P1	100 (see Note 2)	100 c/m	yes	no	read, punch, print
3525	P2	200 (see Note 2)	200 c/m	yes	no	read, punch, print
3525	P3	300 (see Note 2)	300 c/m	yes	no	read, punch, print
5425	A1	250	60 c/m	yes	no	none
5425	A2	500	120 c/m	yes	no	none

**Notes:**

- 800 if the 51/80-column interchangeable read feed feature is installed.
- With the card read feature installed.
- 265 cards per minute if the unit punches columns 1 through 10; 91 cards per minute if it punches all 80 columns.
- 260 cards per minute if the unit punches columns 1 through 10; 91 cards per minute if it punches all 80 columns.
- 173 cards per minute if the unit punches columns 1 through 10; 65 cards per minute if it punches all 80 columns.

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

Figure 11-11. Comparison Data for Card Devices



OB SOLETE

## Chapter 12. Punched Tape Devices

The punched tape devices use paper tape to enter data into a processor. The tape can be 11/16-inch (five-track telegraphic code), 1-inch (eight-track code), or 7/8-inch (six- and seven-track codes) wide.

### 2671 Paper Tape Reader

The 2671 Paper Tape Reader (Figure 12-1) is an input unit for an IBM processor. It is especially designed for data communication, source recording, scientific data processing, and data gathering.

The highlights of the 2671 follow.

#### Read Operation

The 2671 photo-electrically reads strips of 5-, 6-, 7-, or 8-channel paper tape at a rate of up to 1000 characters per second. After acceleration time (approximately 8 milliseconds), the data rate reaches 1000 characters per second for strips. With spooling facilities, this rate can vary between 500 and 1000 characters per second, as determined by the length of a record.

Tape width is 17.5 mm (11/16 in.) (for five-track telegraphic code), 22.2 mm (7/8 in.) (six- and seven-track codes), or 1 inch (25.4 mm) (eight-track code).

The basic 2671 reads strips of paper tape from 229 mm to 6.10 m (9 in. to 20 ft) in length, including a 152.4 mm (6 in.) leader and 76 mm (3 in.) trailer. Tape code translation is under program control.

#### Operator Panel

Various switches on the 2671 panel aid operator functions and contribute to program efficiency. Examples are: end-of-record indications, parity checking (odd, even, or none), track suppression, and transmission or nontransmission to the processor of indications about deleted positions on tape.

#### Attachment to a Processor

The 2671 and the 2822 Paper Tape Reader Control (Figure 12-1) are usually attached to an IBM processor through a byte multiplexer channel, but they can be attached to another channel on some processors.

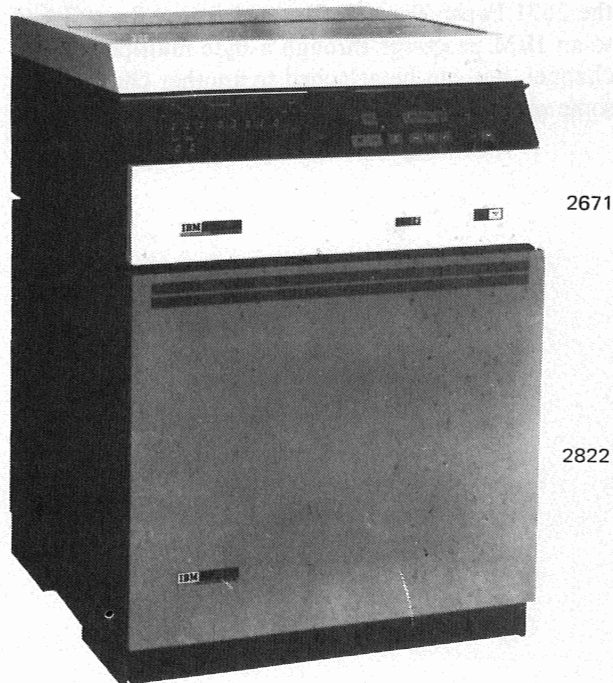


Figure 12-1. IBM 2671 Paper Tape Reader and IBM 2822 Paper Tape Reader Control

### Special Features

The following features can be ordered through the 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 the IBM sales representative.

#### Center Roll Feeding

Spooling facilities are optional. The center roll feeding feature permits the 2671 to feed tape from the center of 266.7 mm (10.5 in.) rolls.

#### Supply Option

The supply option feature permits the 2671 to feed tape from a 266.7 mm (10.5 in.) reel (tape is fed from the outside of the reel).

#### Take-Up Option

The take-up option feature permits the 2671 to rewind tape on 266.7 mm (10.5 in.) reels.

## **2822 Paper Tape Reader Control**

The 2822 Paper Tape Reader is the control unit for the 2671 Paper Tape Reader and is usually attached to an IBM processor through a byte multiplexer channel, but can be attached to another channel on some processors.

### **Functional Units**

The 2822 supplies status and data information from the 2671 to the processor. It also checks for parity and signals the end of record and the end of tape.

## 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 Bs 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 further 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 or Adapter	
<b>Audio Communication Devices</b>	7770 Audio Response Unit*	3 Direct	
<b>Auxiliary Processors</b>	3838 Array Processor	1 through 3 Direct	
<b>Direct Access Storage Devices and Control Units</b>	2305 Fixed Head Storage	2 2835 Model 2	
	2835 Storage Control	2 Direct	
	3310 Direct Access Storage	A1, A2	Direct
		B1, B2	3310 Model A2
	3330 Disk Storage	1, 2	3333 Models 1 and 11
		11	3333 Models 1 and 11
	3333 Disk Storage and Control	1	Direct 3830 Model 2 3830 Model 3 3880
		11	Direct 3830 Model 2 3830 Model 3 3880 Model 1 or 2
	3340 Direct Access Storage Facility	A2	Direct 3830 Model 2 3880 Model 1 or 2
		B1, B2	3340 Model A2
	3344 Direct Access Storage	B2, B2F	3340 Model A2
	3350 Direct Access Storage	A2, A2F	Direct 3830 Model 2 3830 Model 3 3880 Model 1 or 2
		B2, B2F C2, C2F	3350 Model A2 3350 Model A2F
	3370 Direct Access Storage	A1	Direct 3880 Model 1 or 2
		B1	3370 Model A1
	3375 Direct Access Storage	A1	3880 Model 1 or 2
		B1	3375 Model A1
3380 Direct Access Storage	A4, AA4 A4F, AAF	3880 Model 2 or 3	
	B4, B4F	3380 Models A4, AA4 A4F or AAF	
3830 Storage Control	2, 3	Direct	
3880 Storage Control	1, 2, 3	Direct	
<b>Diskette Input/Output Devices</b>	3540 Diskette Input/Output Unit	B1, B2 Direct	

\*For attachment to a channel for operation with one or more attached inquiry terminals.

Figure A-1 (Part 1 of 3). Attachment Data for Local I/O Equipment

I/O Device, Control Unit, or System	Model	Means of Attachment to Channel or Adapter	
Display Devices and Control Units	3251 Display Station	1 3255 Model 1 3258 Model 1	
	3255 Display Control	1 3258 Model 1	
	3258 Control Unit	1 Direct	
	3272 Control Unit	1, 2 Direct	
	3277 Display Station	1, 2 3272 Models 1 and 2	
	3279 Color Display Station	2A, 2B, 3A, 3B 3274 Models 1A, 1B, and 1D	
	3732 Text Display Station	N/A Direct	
	8775 Display Terminal	1, 2 11, 12 Direct or Data Link Data Link	
Magnetic Character Reading Devices	1255 Magnetic Character Reader	1 through 3 Direct	
	1419 Magnetic Character Reader	1 through 5 Direct	
	3890 Document Processor	A1 through B6 Direct	
Magnetic Tape Devices and Control Units	3410 Magnetic Tape Unit	1 through 3 3411 Models 1 through 3	
	3411 Magnetic Tape and Control	1 through 3 Direct	
	3420 Magnetic Tape Unit	3, 5 7 4, 6, 8	3803 Models 1 through 3 3803 Models 1 and 2 3803 Model 2
		3803 Tape Control	1 through 3 Direct
		8809 Magnetic Tape Unit	1A, 1B, 2, 3 8809 Models 1A and 1B
	Optical Readers	1287 Optical Reader	1 through 4 5 Direct Direct
1288 Optical Page Reader			1 Direct
3881 Optical Mark Reader		1 Direct	
3886 Optical Character Reader		1 Direct	
Printer-Keyboards and Consoles		3215 Console Printer-Keyboard	1 Direct
Printer and Control Units	1403 Printer	2, 7, N1 2821 Models 1, 2, 3, and 5 Direct	
	1443 Printer	N1 Direct	
	2821 Control Unit	1, 2, 3, 5, and 6 Direct	
	3203 Printer	1, 2, 4 Direct	
	3211 Printer	1 3811 Model 1	
	3213 Console Printer	1 Direct	
	3262 Line Printer	1, 11 2, 12 3, 13	Direct System Loop 3274 Models 1A, 1B, and 1D
		3284 Printer	1, 2 3272 Models 1 and 2
		3286 Printer	1, 2 3272 Models 1 and 2
	3287 Printer	1, 2 Direct	
	3288 Line Printer	2 3272 Model 2	
	3736 Printer	N/A Direct	
	3800 Printing Subsystem	1 Direct	
	3811 Printer Control Unit	1 Direct	
	5203 Printer	3 Direct	
	5213 Printer	1 Direct	

Figure A-1 (Part 2 of 3). Attachment Data for Local I/O Equipment

I/O Device, Control Unit, or System	Model	Means of Attachment to Channel or Adapter
<b>Punched Card Devices</b>	1442 Card Read Punch	N1, N2 Direct
	2501 Card Reader	B1, B2 Direct
	2520 Card Read Punch	B1 Direct
	2520 Card Punch	B2, B3 Direct
	2540 Card Read Punch	1 2821 Models 1, 5, and 6
	2560 Multi-Function Card Machine	A1 Direct
		A2 Direct
	3504 Card Reader	A1, A2 Direct
	3505 Card Reader	B1, B2 Direct
	3525 Card Punch	P1 through P3 3505 Models B1 and B2 Direct
<b>Punched Tape Devices and Control Units</b>	2671 Paper Tape Reader	1 2822 Model 1
	2822 Paper Tape Reader Control	1 Direct
<b>Systems</b>	3250 Graphics Display System	N/A 3258
	3270 Information Display System	N/A 3272 Models 1 and 2
	3272 Control Unit	1, 2 Direct
	3730 Distributed Office Communications System	N/A 3791 Models 11C, 12A, and 13B
	3790 Communication System	N/A 3791 Models 1A, 1B, 1C, 2A, and 2B
	3791 Controller	1A, 1B, 1C, 2A, 2B, 11C, 12A, 12B Direct
	3850 Mass Storage System	N/A 3851 Models A01, A02, A03, A04, A11, A12, A13, A21, A22, A31, B01, B02, B03, B04, B11, B12, B13, A21, A22, A31
	3851 Mass Storage Facility	A01, A02, A03, A04, A11, A12, A13, A21, A22, A23, A31 B01, B02, B03, B04, B11, B12, B13, B21, B22, B23, B31 3830 Model 3 Direct

Figure A-1 (Part 3 of 3). Attachment Data for Local I/O Equipment