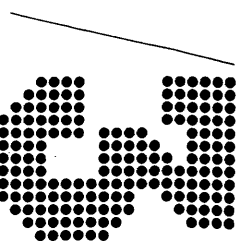
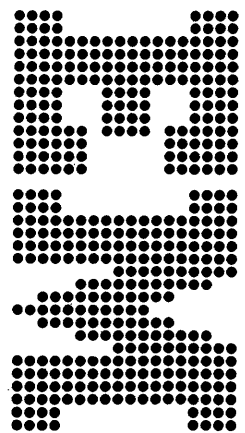
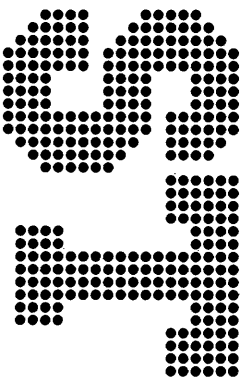
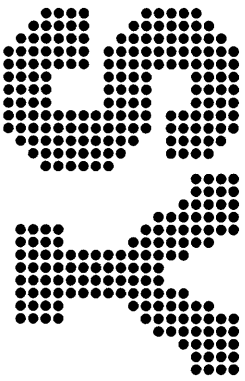


IBM System/3 Model 12 Introduction



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File No. S3-20

This publication is intended primarily for data processing managers, system analysts, application programmers and others interested in an introduction to the System/3 Model 12.

It is an introduction to the System/3 Model 12 that summarizes its functions and program characteristics. It also describes the features, programs, the 3340 Direct Access Storage Facility, FET memory, and compares the Model 12 with Models 8 and 10.

Chapter 1 briefly describes the system and the devices available for use with the Model 12 and compares them to Model 8 and Model 10 devices.

Chapter 2 summarizes and briefly describes the system control programs (SCP) and program products (PP) available for use with Model 12.

Chapter 3 briefly describes the communications programming available for use with Model 12.

Chapter 4 explains how the Model 12 operates.

Chapter 5 describes the SCP facilities in greater detail.

Chapter 6 briefly describes the features of the 3340 Direct Access Storage Facility and compares the 3340 and the 5444 Disk Storage Drive.

The *Glossary* defines terms and abbreviations used in the publication.

The reader should have a basic knowledge of data processing, fundamental operating system concepts, and card and disk system concepts. If additional information is needed on disk concepts, it can be found in the *IBM System/3 Disk Concepts and Planning Guide*, GC21-7571.

First Edition (June 1975)

Changes are periodically made to the information herein. Before using this publication in connection with the operation of IBM systems, refer to the latest System/3 Bibliography, GC20-8080, for the edition that is applicable and current.

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A form for reader's comments is provided at the back of this publication. If the form has been removed, send your comments to IBM Corporation, Publications, Department 245, Rochester, Minnesota 55901. Comments become the property of IBM.

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IBM System/3 Model 12

The Model 12 is a disk oriented, general purpose computer that uses system control programming and program products that are compatible with the Model 8 and Model 10.

The Model 12 offers high performance disk facilities combined with the latest in memory technology to provide a low-cost batch processing and communication system. The same input/output devices featured on the Model 10 are used on the Model 12, with exception of the 5444 or 5445 disk drive. These disk drives are replaced by the 3340 Direct Access Storage Facility, which has a faster access time and a larger storage capacity.

The Model 12 provides for online terminal applications through the use of optional communication features.

SYSTEM HIGHLIGHTS

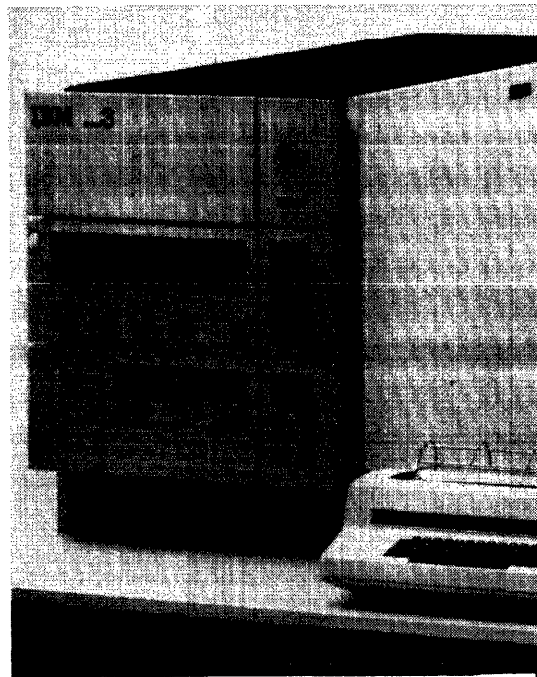
- The 5412 Processing Unit includes 32K bytes of main storage. The storage size can be increased to 48K or 64K bytes (K = 1024).
- The dual program feature allows two programs to reside in main storage at the same time and share the processing unit resources.
- Print spooling is available as a Model 12 system control program (SCP) option.
- Program products include Disk RPG II, COBOL, Basic Assembler, FORTRAN IV, Disk Sort, 1255 Utility, DATA/3, Disk Resident Card Utilities, and Tape Sort.
- The 3340 Direct Access Storage Facility is available with a capacity of 102.94 million bytes.
- Direct attachment of the 3741 Data Station/Programmable Work Station provides high-speed diskette input/output. The 3741 can be attached in addition to card input/output.
- The 1403 Printer or the 5203 Printer, (each offered in three models) may be attached to the system.
- The system uses either the 5424 Multi-Function Card Unit or the 1442 Card Read Punch. In addition, a cardless version is available as an option by using a directly attached 3741.
- The 3410/3411 Magnetic Tape Subsystem is available.
- The 5471 Printer-Keyboard is available and can be used as an operator console.
- Two binary synchronous communications adapters, BSCA-1 and BSCA-2, are offered, and are identical in function to other System/3 BSCAs.

- The integrated communications adapter is offered and permits the attachment of one remote and two local communication lines.
- The local display adapter allows direct attachment of up to twelve 3277 Display Stations and/or 3284, 3286, and 3288 auxiliary printers.

5412 PROCESSING UNIT

5412 Processing Unit	Storage Size (bytes)
Model B16	32,768 (32K)
Model B17	49,152 (48K)
Model B18	65,536 (64K)

The 5412 Processing Unit is available with 32K, 48K, or 64K bytes of storage and has the same instruction set, cycle time, and access time as the System/3 Model 10. (See glossary for these definitions.)



5412 Processing Unit

Main storage is metal oxide semiconductor field effect transistor (MOSFET). Highly integrated monolithic systems technology (MST) is used for logic circuitry.

Data and instructions are stored as EBCDIC characters; each EBCDIC character is stored in an 8-bit byte, and a ninth bit is added for parity checking.

Main storage cycle time is 1.52 microseconds.

Cycle steal provides overlapped I/O processing and instruction execution.

Serial I/O Channel (SIOC)

The SIOC attaches a 1255 Magnetic Character Reader Model 1, 2, or 3, or a 3881 Optical Mark Reader Model 1.

The 1255 Magnetic Character Reader Model 1 reads and/or sorts up to 500 six-inch documents per minute into six stackers. Model 2 reads and/or sorts up to 750 six-inch documents per minute into six stackers. Model 3 reads and/or sorts up to 750 six-inch documents per minute into 12 stackers.

The 3881 Optical Mark Reader Model 1 reads from 4000 to 6000 documents per hour, depending on the size of the document.

Dual Program Feature (DPF)

The dual program feature enables the system to load and execute two independent programs on a time-sharing basis. It also enables the operator to control each program independently; either program may be initiated, restarted after a program halt, run to completion, or terminated.

Integrated Communications Adapter (ICA)

The ICA provides up to three communications interfaces: two local and one remote. When more than one interface is present, only one is active at a time; it is selected by the operator through a manually controlled switch. EBCDIC or ASCII transmission code, but not both, may be used. The ICA cannot be used with BSCA line 2 or the local display adapter.

- *8000 bps local interface* permits a local attachment of one 3271 Model 1 or 2 Control Unit, or one 3275 Model 1 or 2 Display Station to the 5412 without the use of a communications line or modems.
- *2400 bps local interface* permits local attachment of one binary synchronous terminal (such as a 3741 Data Station Model 2 or Programmable Work Station Model 4) to the 5412 without the use of a communications line or modems.
- *Synchronous line, medium speed* provides one medium-speed binary synchronous communications line interface to an external-modem. The communications network attachment may be point-to-point (switched), point-to-point (nonswitched), or multipoint (control station). Maximum transmission rate is 4800 bps for switched operation and 7200 bps for nonswitched operation.

Binary Synchronous Communications Adapter (BSCA)

The BSCA enables other systems and terminals to communicate in binary synchronous mode. System/3 can operate on a multipoint line as either a control station or a tributary station, or in a point-to-point switched or leased communication line. Auto-answer capability is standard in switched network versions.

EBCDIC or ASCII transmission code, but not both, may be used. If BSCA-1 is installed on the system, one of the following can also be installed:

BSCA-2
Integrated Communications Adapter
Local Display Adapter

Subfeatures include:

- EIA local attachment (EIA/CCITT local attachment outside the U.S.A.) which permits attachment of one 3271 Control Unit or one 3275 Display Station to the System/3 without the use of a data communications line and modems at either device
- 1200 bps integrated modem for binary synchronous data transmission at 1200 bps over nonswitched facilities or switched network (outside the U.S.A., non-switched facilities only)
- Station selection
- Auto call
- Text transparency
- Internal clock

Local Display Adapter

The Local Display Adapter provides for the direct attachment of 3277 Model 1 or 2 Display Stations and 3284/86/88 matrix printers without the requirement of a 3271 Control Unit and a remote communications line. The terminals are attached via the basic attachment feature, with coaxial cable, up to 2000 feet from the system.

It interacts with the program like a BSCA device (EBCDIC only, no text transparency). Up to 12 devices, display stations, or printers can be used.

This feature cannot be used with BSCA line 2 or ICA.

Terminals Operating with Model 12	Type Comm ¹	Programming Support ²				Communications Code ²					Communication Network ²			
						EBCDIC		ASCII		PTTC ⁵	Point-to-Point		Multipoint	
		RPG II	MLMP	MLTA ⁶	CCP	Normal	Trans- parency	Normal	Trans- parency			Switched	Nonswitch	Tributary Station
1050	SS	—	—	X	X	—	—	—	—	X	X	X	—	X
2740 Model 1	SS	—	—	X	X	—	—	—	—	X	X	X	—	X
2740 Model 2	SS	—	—	X	X	—	—	—	—	X	—	X	—	X
2741	SS	—	—	X	X	—	—	—	—	X	X	X	—	—
CMCST	SS	—	—	X	X	—	—	—	—	X	X	—	—	—
System/360 and System/370	BSC	X	X	—	X	X	X	X	—	—	X	X	X	—
System/360 Model 20	BSC	X	X	—	X	X	X	X	—	—	X	X	—	—
1130	BSC	X	—	—	—	X	X	—	—	—	X	X	—	—
2780	BSC	X	X	—	—	X	X	X	—	—	X	X	—	—
2770	BSC	X	X	—	—	X	X	X	—	—	X	X	—	—
System/7	BSC	X	X	—	X	X	X	X	—	—	X	X	—	X ³
2972-8, 11	BSC	—	X	—	—	X	—	—	—	—	—	—	—	X
3735	BSC	—	X	—	X	X	—	X	—	—	X	—	—	X
System/3, 6, 8, 10, 12, 15	BSC	X	X	—	X	X	X	X	—	—	X ⁴	X	X	X ³
3270	BSC	—	X	—	X	X	—	X	—	—	X ⁴	—	—	X
3741 Model 2 and 4	BSC	X	X	—	X	X	X	—	—	—	X	X	—	X ³
System/7 ACC	SS	—	—	X	X	—	—	—	—	X	X	X	—	X
System/32	BSC	X	X	—	X	X	X	X	—	—	X	X	—	X ³

¹Type of communication

SS = start/stop

BSC = binary synchronous communication

²X = supported

— = not supported

³Not supported by RPG II.

⁴3275 switched support by ML/MP only

⁵PTTC = paper tape transmission code

⁶MLTA = multiple line terminal adapter (RPO feature)

3340 DIRECT ACCESS STORAGE FACILITY

Configurations	3340 Main Data Area Storage in Millions of Bytes	5444 Simulation Area Storage in Millions of Bytes (note)
3340 Model C2	81.60	21.34

Note: Includes program, backup, and reserved areas.

The System/3 Model 12 requires a 3340 Direct Access Storage Facility Model C2. The 3340 Model C2 uses two Model 70 data modules. Each data module is divided into a main data area and four 5444 simulation areas. The main data area provides 40.80 million bytes of data and storage. The 5444 simulation areas provide 9.83 million bytes of storage for data files and libraries (user programs, system programs, and procedures). The remaining .84 million bytes are reserved for system use. The simulation areas make the 3340 compatible with other System/3s using 5444 disk drives.



3340 Model C2 (102.94 megabytes)

	IBM 3340 Direct Access Storage Facility (Model C2)
Minimum access time (ms)	10
Average access time (ms)	25
Maximum access time (ms)	50
Data transfer rate (bytes/second)	885,000
Rotational speed (rpm)	2900 (approximately)
Bytes per record (sector)	256
Records (sectors) per track	48
Bytes per track	12,288
Tracks per cylinder	20
Bytes per cylinder	245,760
Cylinders per data module ¹	207
Bytes per data module ¹	50,872,320
Tracks per data module ¹	4140
Records (sectors) per data module ¹	198,720
¹ Excluding alternate tracks and CE tracks.	

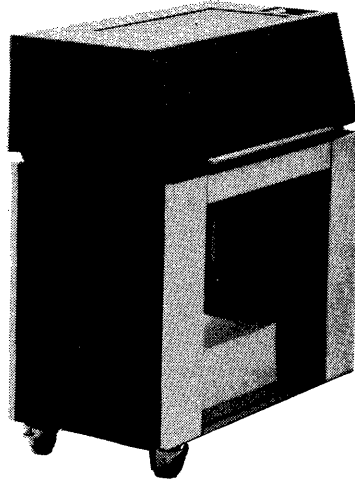
For more information on the 3340 see *3340 Features and Comparison to the 5444* in Chapter 6.

5203 PRINTER

Model	Maximum Print Speed	Print Positions
1	100 lines per minute	96, 120, or 132
2	200 lines per minute	96, 120, or 132
3	300 lines per minute	96, 120, or 132

One of the three models of the 5203 Printer can be attached to a System/3 Model 12.

Each model produces a line with 96, 120, or 132 print positions. The standard 48-character set can be expanded to as many as 120 characters by using the interchangeable chain cartridge (for Models 1 and 2) or the interchangeable train cartridge (for Model 3).



5203 Printer

The 5203 Printer uses a type cartridge with 240 characters. (The standard set of graphics is repeated five times.) Vertical spacing can be set at six or eight lines per inch by the operator. Horizontal spacing is 10 characters per inch.

A dual feed carriage special feature can be installed in place of the standard carriage. This feature allows two sets of nonoverlapped forms to be printed simultaneously and controlled independently. When this feature is used, the number of horizontal printing positions is reduced by 17.

Model 1 prints 100 lines per minute, the Model 2 prints 200 lines per minute, and the Model 3 prints 300 lines per minute. The rated output is based on using the standard character set, single line spacing, and only one program level (when DPF is installed).

1403 PRINTER

Model	Maximum Print Speed	Print Positions
5	465 lines per minute	132
2	600 lines per minute	132
N1	1100 lines per minute	132

Note: A 5421 Printer Control Unit is required to attach a 1403 Printer.

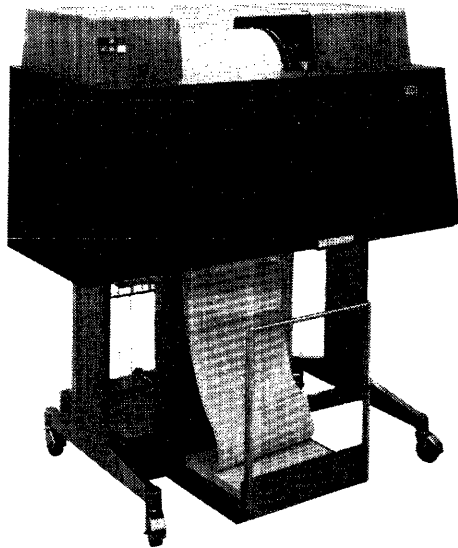
The 1403 Printer Model 2, 5, or N1 can be attached to System/3 Model 12 via the 5421 Printer Control Unit. Each model produces a print line with 132 print positions. The standard 48-character set can be expanded to as many as 120 characters by using the universal character set feature.

Note: The Models 2 and 5 require an interchangeable chain cartridge adapter special feature for installation of the universal character set.

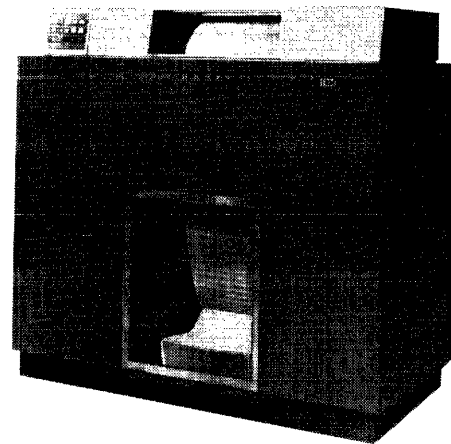
Vertical spacing can be set at six or eight lines per inch by the operator. Horizontal spacing is ten characters per inch.

Various type fonts, styles, and character arrangements are available.

The rated output of the three 1403 models offered are based on using a standard print chain cartridge (48-character set repeated five times), single line spacing, and only one active program level when DPF is installed. The model 5 prints 465 lines a minute, Model 2 prints 600 lines a minute, and the Model N1 prints 1100 lines a minute.



1403 Printer Model 2 and Model 5



1403 Printer Model N1

5471 PRINTER-KEYBOARD

Characteristics

- Typewriter style printer-keyboard
- 44 character keys, shift, space, carrier return
- Rated speed—15.5 characters per second
- 15 inch carriage
- 125 print positions
- 6 lines per inch pin feed platen

The 5471 Printer-Keyboard is optional. It is mounted on the console work table, and serves as an operator/system communication device, an inquiry device, or a secondary printer.

The keyboard is typewriter style with 44 character keys, shift, space and carrier return.

The printer prints 15.5 characters per second and has a 15-inch carriage. It produces a 125-position line (10 characters per inch). Vertical spacing is 6 lines per inch. Forms are fed and controlled by a pin feed platen.



5471 Printer-Keyboard

3741 MODELS 1 AND 2 DATA STATION AND MODELS 3 AND 4 PROGRAMMABLE WORK STATION

Model	Name
1	Data station
2	Data station with BSCA
3	Programmable work station
4	Programmable work station with BSCA

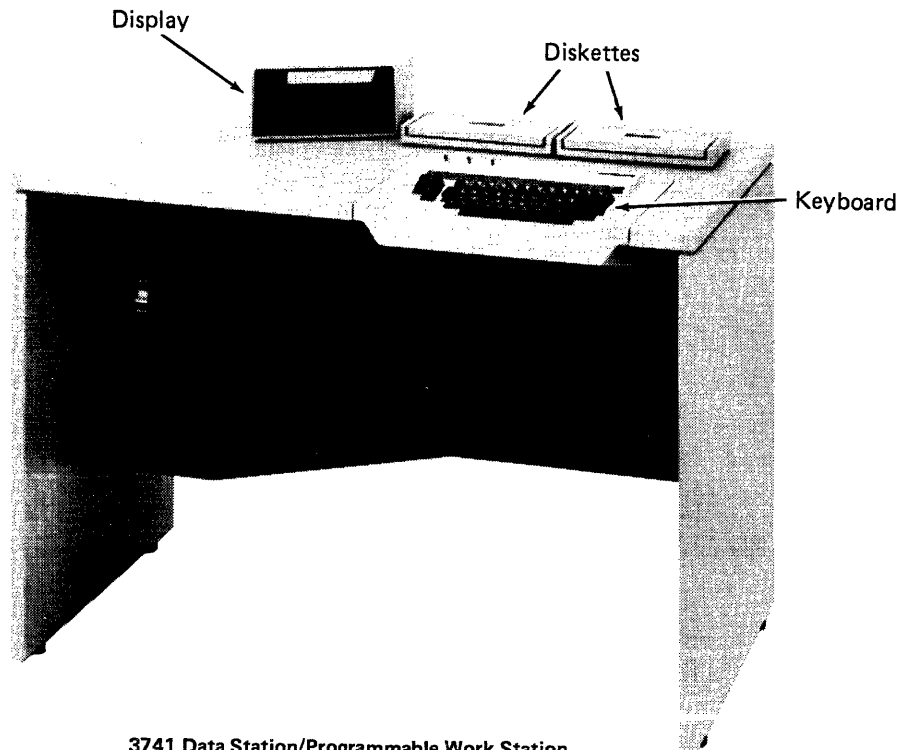
Diskette

Bytes per record	1-128
Records per track	26
Tracks per diskette	73
Data sets per diskette	1-19
Records per diskette	1898

The 3741 can be used as an offline data entry device (as part of the 3740 Data Entry System), as an online I/O device attached directly to the Model 12, or as a terminal device in a teleprocessing environment.

The 3741 Model 1 or 2 Data Station is a single-operator key entry station used to record data onto magnetic diskettes.

- Model 1 has 128-character records, 10 standard program levels, and a 240-character (6 rows of 40 characters) display which provides operator guidance.
- Model 2 has the same functional characteristics as Model 1. A binary synchronous communications adapter, switched or nonswitched, point-to-point, or non-switched multipoint, auto answer, EBCDIC transparency standard (except when transmitting or receiving blocked data) can be used. It can be used as a remote terminal at 1200, 2000, or 2400 bps over appropriate communications facilities.



The 3741 Model 3 or 4 Programmable Work Station can perform data station functions and execute under the control of an application program written in application control language (ACL). System/3 does not support ACL; however, it can be used for offline applications.

- Model 3 executes programs written in ACL and optionally creates object programs from ACL source programs, and has the same functional characteristics as a Model 1 when not under ACL program control.
- Model 4 has the same functional characteristics as Model 3 and has the binary synchronous communications capability of the Model 2, and can operate with the same functional characteristics as the Model 2 when not under ACL program control.

The 3741 Models 2 and 4 can be attached to the System/3 Model 12 via the BSCA or ICA attachments for the use of input and output of data only.

One 3741 (Model 1, 2, 3, or 4) can be attached directly to the System/3 Model 12 and provides input or output of data, and input of necessary information used to control system functions.

The 3741 directly attached to System/3 reads approximately 1500 records per minute from the diskette and writes approximately 1000 records per minute to the diskette, depending on the complexity of the application and assuming that:

- Records are transferred between the 3741 and a 3340 Direct Access Storage Facility.
- The 3741 has 128-byte records and is double buffered.
- 3340 block size is 1024 bytes (8 records per block) and is double buffered.
- The system is dedicated (the dual program feature is not used) and the operation is error-free with no alternate tracks assigned on the disk.

When the 3741 is offline, an optional second diskette drive enables the user to merge records from the second diskette and the keyboard onto the other diskette; copy a data file from the second diskette onto the other; and copy data from more than one diskette onto a single diskette.

When the 3741 is directly attached to System/3, the two diskettes are not separately addressable; rather, they are used to simplify online operation when handling large quantities of data. For example, when reading data into System/3, control can be switched automatically between the first and second diskettes to provide a continuous input of data.

Record insert is also optional and enables the user to add records within an existing data set. This feature is used to update files in an offline data entry application.

Note: In this publication, 3741 refers to an I/O device directly attached to the system; the 3741 used as a terminal device is so noted.

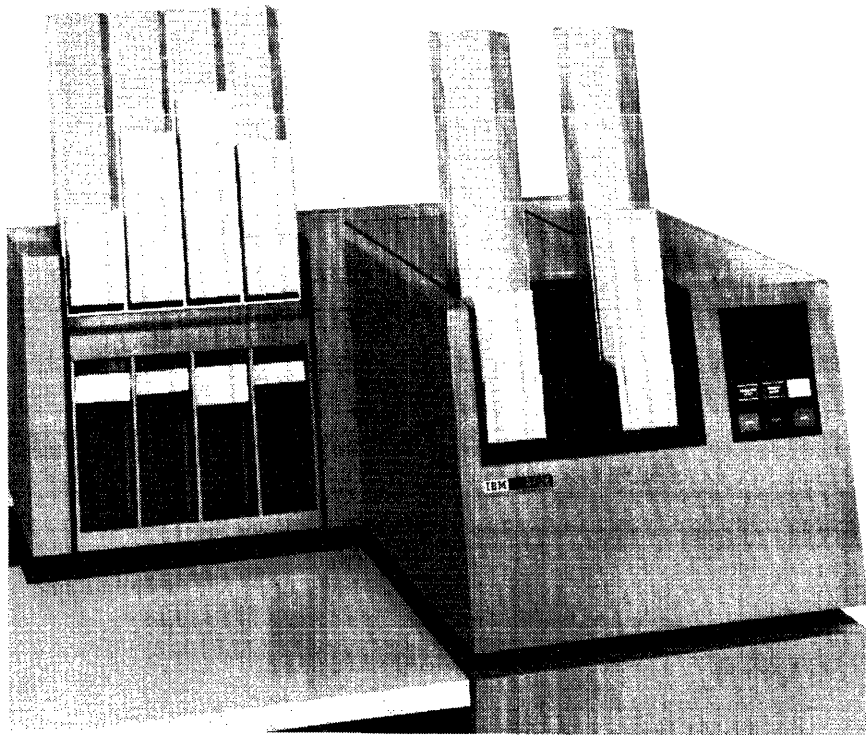
5424 MULTI-FUNCTION CARD UNIT

Model	Name	Maximum Throughput (cards per minute)			Card Cols	Stackers		Hoppers	
		Reading	Punching	Printing		No.	Capacity	No.	Capacity
A1	Multi- function card unit	250	60	60	96	4	600	2	2000
A2		500	120	120	96	4	600	2	2000

The 5424 Multi-Function Card Unit (MFCU) is a 96-column card device that reads or feeds cards from either of two hoppers, and punches, prints and stacks cards in any of four stackers.

Two models are available. Model A1 reads 250 cards per minute and punches or prints 60 cards per minute. Model A2 reads 500 cards per minute and punches or prints 120 cards per minute.

The MFCU can process two separate files. One can be an input file and the other an output file, or both files can be input files. Cards from the two files can be combined during processing. The MFCU can be used to match records within two files, merge two files, select records, or sort card files.



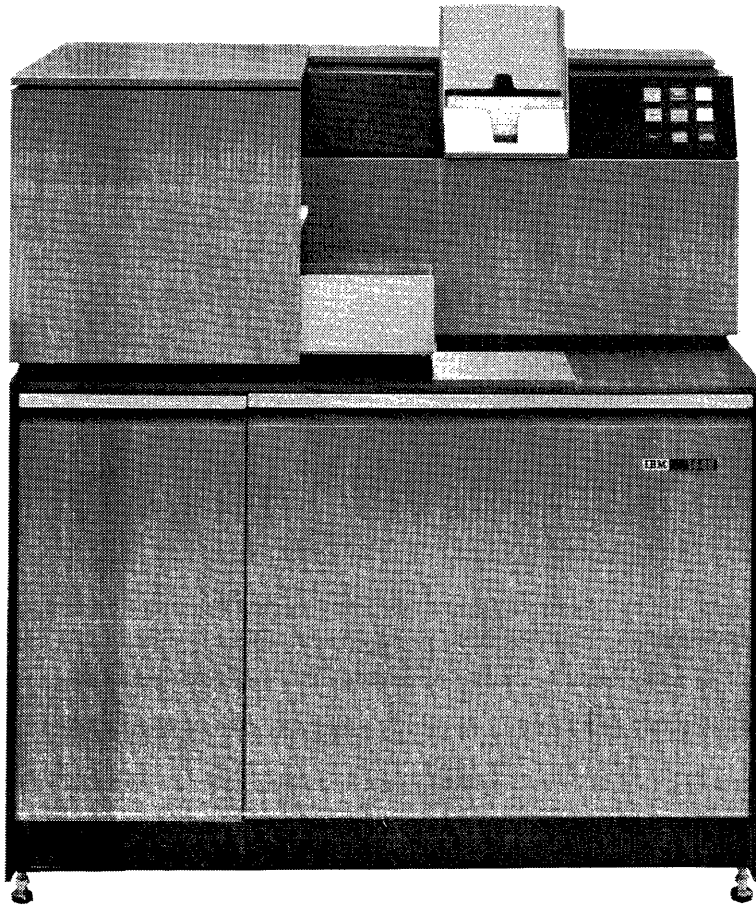
5424 Multi-Function Card Unit

1442 CARD READ PUNCH

Model	Name	Maximum Throughput			Card Cols	Stackers		Hoppers	
		Reading (cards per minute)	Punching (columns per second)	Printing		No.	Capacity	No.	Capacity
6	Card read punch	300	80	None	80	2	1300	1	1200
7		400	160	None	80	2	1300	1	1200

The 1442 Card Read Punch, Model 6 or Model 7, can be attached to the System/3 Model 12 and provides 80-column card reading and punching. Model 6 reads 300 cards per minute and punches 80 columns per second. Model 7 reads 400 cards per minute and punches 160 columns per second.

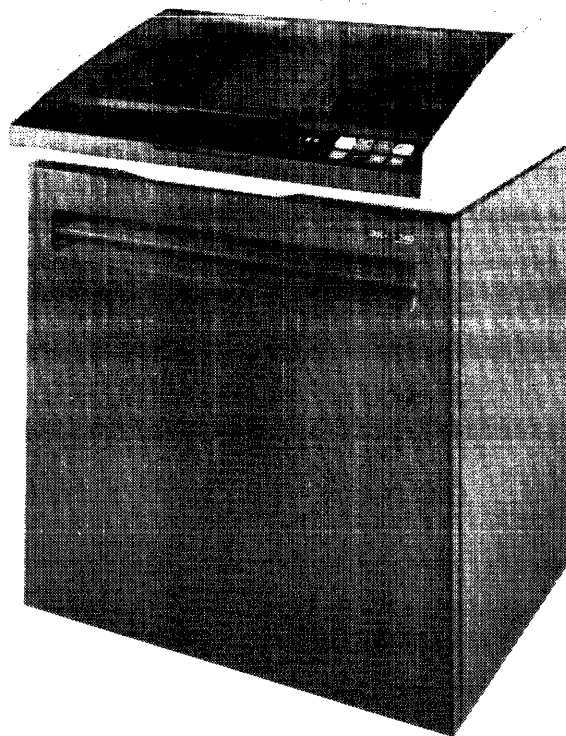
The 1442 reads, punches without feeding, punches and feeds, stacks cards in either of two stackers, and reads column binary (card image). The read column binary operation is supported only by Basic Assembler.



1442 Card Read Punch

3410/3411 MAGNETIC TAPE SUBSYSTEM

	3411 Magnetic Tape Unit and Control (maximum 1) 3410 Magnetic Tape Unit (maximum 3)		
	Model 1	Model 2	Model 3
Data rate (kilobytes/second)			
at 1600 bpi	20	40	80
at 800 bpi	10	20	40
at 556 bpi	6.9	13.9	27.8
at 200 bpi	2.5	5	10
Recording density (bpi)			
for 9-track	800/1600	800/1600	800/1600
for 7-track	200/556/800	200/556/800	200/556/800
Tape speed (inches per second)	12.5	25	50
Nominal interblock gap (inches)			
for 9-track	.6	.6	.6
for 7-track	.75	.75	.75
Nominal interblock gap time (ms)			
for 9-track	48	24	12
for 7-track	60	30	15
Rewind time full reel (min)	3	3	2



3410 Magnetic Tape Unit

The 3410/3411 Magnetic Tape Subsystem reads and writes half-inch magnetic tape. The 3410 is a tape unit only; the 3411 is a tape unit and a control unit. Up to four tape units can be attached to System/3 Model 12, and all the units must be the same model.

The 3410/3411 Models 1, 2, and 3 reads or writes up to 20, 40 and 80 kilobytes per second, respectively. Recording density is 800 or 1600 bits per inch (bpi) for 9-track tape, or 200, 556, or 800 bpi for 7-track tape.

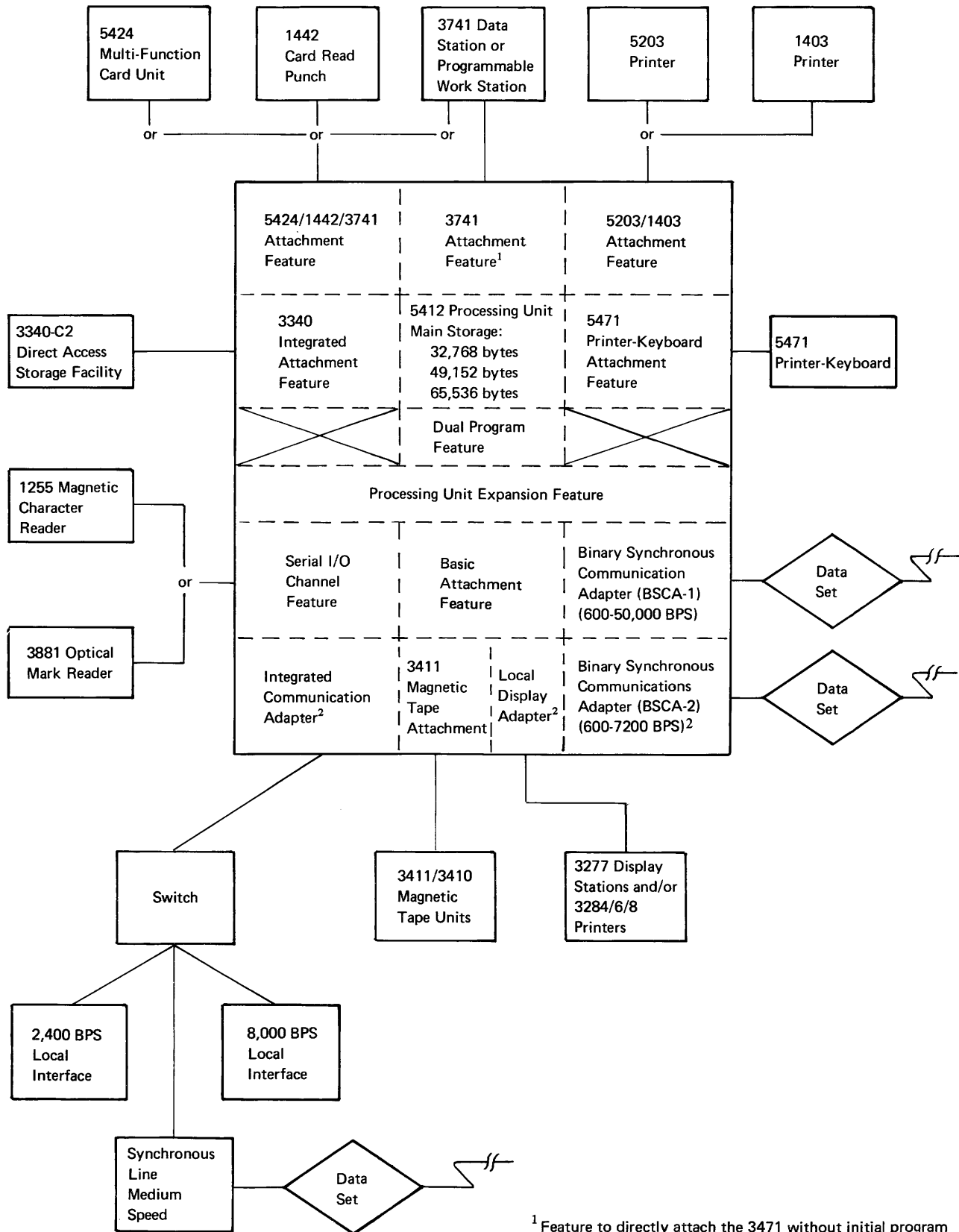
Both the 3410 and 3411 are desk-high units with horizontally mounted tape reels. A transparent sliding cover provides easy access to the tape reels.

Each 3410/3411 tape unit must be equipped with a special feature that specifies the read/write format desired. The features are single density, dual density, and 7-track. Dual-density and 7-track features cannot be installed on the same tape unit.

	Model 8	Model 10 Disk	Model 12
Processing Unit Storage Size	16K, 32K, 48K, or 64K	8K, 12K, 16K, 24K, 32K, 48K, or 64K (RPQ)	32K, 48K, or 64K
Disk storage drive (select one combination)	<ul style="list-style-type: none"> ● 5444-A1 ● 5444-A2 ● 5444-A2 and A3 ● 5444-A2 and A2 	<ul style="list-style-type: none"> ● 5444 (1 or A1) ● 5444 (2 or A2) ● 5444 (2 and 3) or (A2 and A3) ● 5444 (2 and 2) or (A2 and A2) ● 5445-1 ● 5445-1 and 2 ● 5445-3 <p style="text-align: right;">} Optional (in addition to one above)</p>	<ul style="list-style-type: none"> ● 3340-C2
Card device (select one configuration)	Not applicable	<ul style="list-style-type: none"> ● 5424 (A1 or A2) ● 1442 (6 or 7) 	<ul style="list-style-type: none"> ● 5424 (A1 or A2) ● 1442 (6 or 7) <p style="text-align: right;">} Optional if 3741 attached</p>
Printer (select one)	<ul style="list-style-type: none"> ● 5203 (1, 2, or 3) 	<ul style="list-style-type: none"> ● 5203 (1, 2, or 3) ● 1403 (2 or N1) 	<ul style="list-style-type: none"> ● 5203 (1, 2, or 3) ● 1403 (5, 2 or N1)
3410/3411 Magnetic Tape Subsystem — Models 1, 2, or 3 (select one configuration)	Not applicable	<ul style="list-style-type: none"> ● 3411 ● 3411 and 3410 ● 3411, 3410 and 3410 ● 3411, 3410, 3410 and 3410 <p style="text-align: right;">} Optional</p>	<ul style="list-style-type: none"> ● 3411 ● 3411 and 3410 ● 3411, 3410 and 3410 ● 3411, 3410, 3410 and 3410 <p style="text-align: right;">} Optional</p>
Other devices	<ul style="list-style-type: none"> ● 3741 (1, 2, 3 or 4 via direct attachment) } One required ● 5471-1 ● 3741 (2 or 4 via ICA or BSCA) ● 3271 (1 or 2) or 3275 (1 or 2) via ICA or BSCA } Optional ● 1255 (1, 2 or 3) } via SIOC ● 3881-1 	<ul style="list-style-type: none"> ● 3741 (1, 2, 3 or 4 via direct attachment) ● 5471-1 or 5475-1 ● 3741 (2 or 4 via ICA or BSCA) ● 3271 (1 or 2) or 3275 (1 or 2) via ICA or BSCA } Optional ● 1255 (1, 2 or 3) } via SIOC ● 1270 (WTC only) ● 3881-1 	<ul style="list-style-type: none"> ● 3741 (1, 2, 3 or 4 via direct attachment) ● 5471-1 ● 3741 (2 or 4 via ICA or BSCA) ● 3271 (1 or 2) or 3275 (1 or 2) via ICA or BSCA } Optional ● 3277 (1 or 2), 3284 (1 or 2), 3286 (1 or 2), and/or 3288-2 via Local Display Adapter ● 1255 (1, 2 or 3) } via SIOC ● 3881-1

Note: Each bullet represents a valid configuration for that device or device category. One configuration is required for each device or device category unless otherwise specified.

SYSTEM/3 MODEL 12 CONFIGURATION



¹ Feature to directly attach the 3741 without initial program load (IPL) capability when either the 5424 or 1442 is attached.
² Local Display Adapter, ICA, and BSCA-2 are mutually exclusive.

Chapter 2. System/3 Model 12 Programming Support

The System/3 Model 12 programming support (Figure 1) consists of the system control program (SCP) and program products (PP).

SYSTEM CONTROL PROGRAMMING

SCP consists of the disk system management programs and system utility programs stored in *libraries* on 3340 data modules and loaded into main storage as required. An *object library* stores the system control programs, program products, and user-generated object programs; a *source library* stores source programs and operation control language procedures. These libraries may be on the same or on a different data module and may reside along with data files. For additional information, refer to *System Control Programming Facilities* in Chapter 5.

Disk System Management

- The initial program load program starts the system by loading the supervisor into main storage. On the Model 12, initial program loading is from the first 3340 Direct Access Storage Facility only.
- The supervisor controls overall system operations and performs general functions required by the scheduler and all processing programs. The supervisor resides in the lowest area of main storage throughout system operation.
- The scheduler, loaded by the supervisor, initiates execution, allocates required system resources, and provides termination functions for each new program.
- Data management routines can be included in the users problem programs to relieve the programmer of the detailed programming associated with the transfer of data between auxiliary storage and programs.

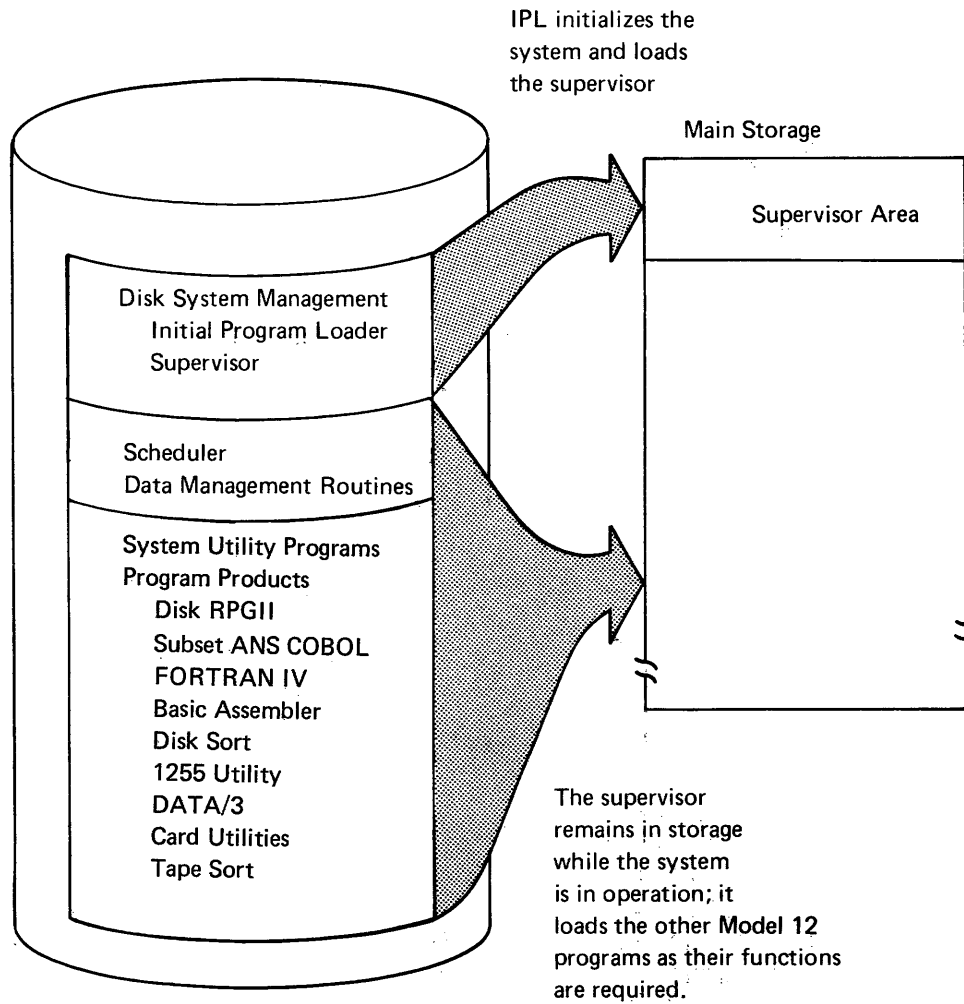


Figure 1. System/3 Model 12 Programming Support.

Print Spool Function

The print spool function is designed to decrease the execution time of programs that are delayed by waiting for the printer. Instead of printing the output data at the time of execution, it is stored on the 3340 data module in an area called the print queue. The print spool function requires a 5471 printer-keyboard to be attached to the system or have the dual program feature on the 5412 processing unit.

Print spooling offers the following operational advantages:

- Program execution is not affected by the speed of the system printer.
- For systems with DPF, programs requiring printed output can be run in both program levels at the same time.
- The output data can be stored in the print queue until it is convenient to print.
- If the printer becomes inoperative, or is busy, the processing unit continues processing and storing the output data in a print queue. When the printer is again available, the spool print writer program gets the data from the file and causes it to be printed (Figure 2).
- Spooling can increase the throughput of the system depending on how the I/O devices are used, the sequence of the programs run, and the speed of the printer. The execution time of printer-bound programs can be decreased by servicing requests at disk speed.
- The operator controls execution of the spooling function.

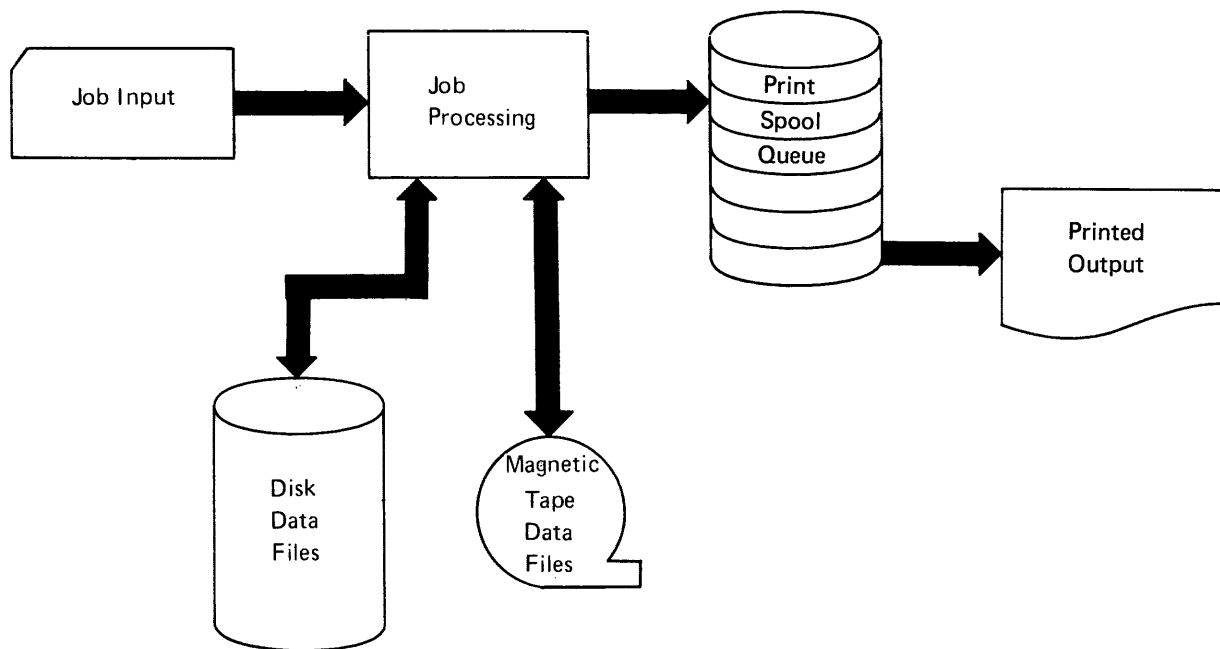


Figure 2. Processing with Print Spooling

Figure 3 shows an example of processing with and without the System/3 Model 12 spooling facilities. The upper portion shows the processing of a job stream in a program level without the spooling facility. Note that job 1, which requires a great deal of printing time, slows down the program execution. The lower portion of the figure shows the processing times of the same job stream with spooling. Here, the total time is divided into the CPU processing time in one program level, the time the stored output spends in the print queue, and the printer time required for the spool print writer program executing in the other program level to print the output.

Although the time between the reading of a job and its completion increased when spooling is used, overall system performance is usually improved. This can be seen from the difference between points 2 and 3 when all five jobs are finished processing. In addition, the CPU is available for processing other jobs, because between points 1 and 2, the only activity is the printing of the output queues, which requires little CPU time.

This is only an example of spooling performance. The actual throughput depends, for example, on the I/O use of each program, the sequence of the particular jobs, and the rate of the printer.

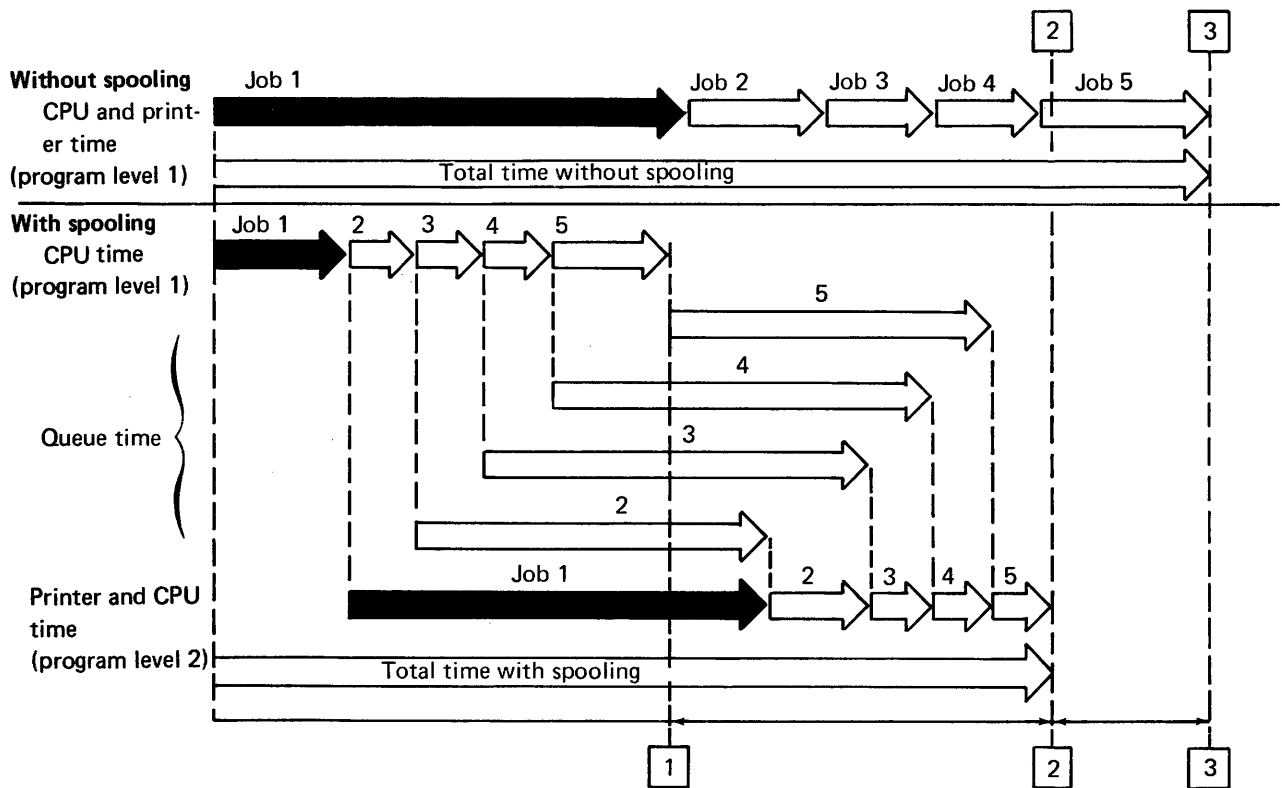


Figure 3. Processing Jobs with and without Print Spool on a System/3 Model 12 with Dual Programming Feature

System Utility Programs

System utility programs enable the user to service libraries, data files, application programs, and input/output units. Some of the system utility programs are listed below. See Chapter 5 for more information on these and other system control programs.

- The library maintenance program allows the user to produce, maintain, and service the source and object libraries.
- The dump/restore program copies a 3340 main data area or simulation area to magnetic tape and restores a disk area from tape previously created by this program.
- The copy/dump program provides file-to-file copies and, for disk only, volume-to-volume copies.
- The disk initialization program performs surface analysis and formats the 3340 data modules according to SCP requirements.
- The file and volume label display program prints information about the contents of a 3340 data module.
- The file delete program deletes data files from a 3340 data module.

PROGRAM PRODUCTS

Program products satisfy specific application requirements and operate under control of the system control program.

The following program products are available for use on the Model 12. They reside on the 3340 Direct Access Storage Facility.

- Disk RPG II
- Subset ANS COBOL
- FORTRAN IV
- Basic Assembler Program
- Disk Sort Program
- Tape Sort Program
- 1255 Utility Program
- Disk Resident Card Utilities
- DATA/3 (an application program product)

Figure 4 shows which devices these program products use.

Read Chart	3340 C2	1403 2, 5, N1 or 5203 1, 2, 3	5471 Printer-Keyboard	3741 1, 2, 3, 4 (direct attach)	5424 A1, A2	1442 6, 7	3410/3411 1, 2, 3	BSCA, ICA or Local Display Adapter	3881	1255 1, 2, 3	Minimum Program Level Size (number x 1024 bytes)
Compile RPG II	R	R	O	O	O	O	N	N	N	N	8
Execute	R	O	O	O	O	O	O	O	N	N	8
Compile COBOL	R	R	O	O	O	O	N	N	N	N	12
Execute	R	O	O ⁵	O ⁵	O	O	O	N	N	N	8
Compile FORTRAN IV	R	R	O	O	O	O	N	N	N	N	9
Execute	R	O	O	N	O	O	O	N	N	N	8
Assemble Assembler	R	R	O	O	O	O	N	N	N	N	10
Execute	R ³	O	O	O	O	O	O	O	O	O	8 ³
Disk Sort	R	O	O ¹	O ¹	O ¹	O ¹	O	N	N	N	8
Tape Sort	R	O	O ¹	O ¹	O ¹	O ¹	R	N	N	N	8
Card Utilities	R	R	O ¹	O ¹	R ²	R ²	N	N	N	N	8
1255 Utilities	R	R	O ¹	O ¹	O ¹	N	O	N	N	R	10
Generation DATA/3	R	R	O	O	O	O	N	N	N	N	20
Execution	R	R ⁴	R ⁴	O	O	O	N	R	N	N	24

Note: R = required, O = optional and N = not supported.

¹ Used to read specifications.

² Card I/O as required.

³ Assembler stand-alone programs are an exception.

⁴ Either 5203, 1403, or 5471 is required.

⁵ This device is supported only by using the ACCEPT statement.

The appropriate program product reference material will contain specific device requirements.

In the following discussions of program products, references are made to the system input, the system punch, and the system logging devices.

System input devices are:

- 5424 Multi-Function Card Unit
- 1442 Card Read Punch
- 3741 Data Station/Programmable Work Station (directly attached)
- 5471 Printer-Keyboard

System logging devices are:

- 5471 Printer-Keyboard
- 1403 Printer
- 5203 Printer

System punch devices are:

- 5424 Multi-Function Card Unit
- 1442 Card Read Punch
- 3741 Data Station/Programmable Work Station (directly attached)

Disk RPG II (Program Product 5705-RG1)

The RPG II compiler processes an RPG II source program. The RPG II linkage editor produces an object program, which is either cataloged in an object library or written to the system punch device. The user can request a source program listing, diagnostic messages, and a main storage map.

To use the RPG II compiler, the user supplies information about the application program to be written. The program can be described on specification sheets prior to entering the source statements into the system. The specification sheets are: *auto report, control card and file description, extension and line counter, telecommunications, input, calculation, and output-format.*

Source programs can be read from the system input device or from a source library entry. Work files for the compiler are in a 5444 simulation area. Object programs support sequential, direct, and indexed file organization on the 3340 main data areas. Only sequential and direct, single-volume files are supported in the 5444 simulation areas. Files on the 3741 are sequential only.

Model 12 RPG II includes support that is offered as extra features in Model 6 and/or Model 10 RPG II.

Available features for the RPG II compiler include:

- Auto report, which enhances the RPG II language by providing functions that eliminate much of the preparation and coding usually required.
- Telecommunications support, in which BSCA files are supported as input, output, combined, or demand files in RPG II. See *Communications Programming* in Chapter 3.
- Magnetic tape support, which processes data or record address files on magnetic tape. The files are consecutive, input or output, in blocked or unblocked format, and may be fixed or variable length.

Subset ANS COBOL (Program Product 5705-CB1)

The COBOL compiler processes a COBOL source language program. The system's overlay linkage editor produces an object program, which is either cataloged in an object library or written to the system punch device. The user can request a program listing, diagnostic messages, and a main storage map.

The functional processing modules of the American National Standards Institute (ANSI) Standard COBOL included in this compiler are:

- 1 Nucleus 1, 2
- 1 Sequential access 1, 2
- 1 Random access 0, 2
- 1 Library 0, 2
- 2 Table handling 1, 3
- 1 Segmentation 0, 2

Source programs can be read from the system input device or the source library. Work files for the compiler are in a 5444 simulation area.

Object programs support sequential, direct, and indexed file organizations in the 3340 main data areas. Only sequential and direct, single-volume files are supported for the 5444 simulation areas.

Files on the 3741 are sequential only, and can be processed by a COBOL object program after the data is copied to a 3340 using an SCP utility program. (The System/3 COBOL language supports the 3741 only through the use of the ACCEPT statement.)

FORTRAN IV (Program Product 5705-F01)

The System/3 FORTRAN compiler processes a FORTRAN IV source program. The system's overlay linkage editor produces an object program, which is either cataloged in an object library or written to the system punch device. The user can request a source program listing, diagnostic messages, and a main storage map.

The System/3 FORTRAN IV language contains those features defined in American National Standard Basic FORTRAN, X3.10-1966 and additional language features often available only with full FORTRAN IV compilers.

The source programs can be read from the system input device or the source library. Work files for the compiler are in a 5444 simulation area.

The object programs support sequential and direct file organizations in the 3340 main data areas. Sequential and direct, single-volume files are supported for the 5444 simulation areas.

Files in the 3741 are sequential only, and they can be processed by a FORTRAN object program after the data is copied to a 3340 using an SCP utility program. (The System/3 FORTRAN language does not support the 3741.)

The System/3 FORTRAN IV Library contains:

- Mathematical subroutines to perform arithmetic operations
- Service subroutines to provide program diagnostic aids and program control
- A commercial subroutine package to perform functions equivalent to the 1130 Commercial Subroutine Package

Basic Assembler Program (Program Product 5705-AS1)

The Basic Assembler program processes source programs written in the Basic Assembler language and produces relocatable modules that can be link-edited into executable object programs.

The Basic Assembler can also assemble relocatable subroutines for use with Model 12 RPG II, COBOL, or FORTRAN IV. These subroutines are coded by the user and assembled separately. The process of program linking is accomplished by the overlay linkage editor (COBOL and FORTRAN) or the RPG II linkage editor during compilation of the RPG II, COBOL, or FORTRAN IV source program.

Source programs are read from the system input device, or a source library on the 3340, or a source file generated by the macro processor.

The Basic Assembler can be used to create a stand-alone program. The object program is punched into cards, and program loading is performed with an initial program load through the alternate IPL device (MFCU or 1442). Stand-alone programs are coded entirely by the user and are not dependent on other programming support.

Disk Sort (Program Product 5705-SM1)

The Disk Sort program sorts a file into ascending or descending sequence, and requires an input file, a work file, and an output file.

Specifications are described on a simple coding sheet. The specifications are entered into the system via the system input device or stored in the procedure or source library on disk. Sort diagnostics and messages can be printed on the system logging device.

Input File: Disk Sort accepts input from a 3340 Direct Access Storage Facility or from a unit of the 3410/3411 Magnetic Tape Subsystem. The Disk Sort program will accept up to eight disk or tape input files. A disk input file can have sequential, indexed or direct organization. The tape input file characteristics are:

- Minimum record or block length of 18 bytes
- Maximum record length of 4,096 bytes
- Maximum block length of 32,768 bytes
- Fixed length records (variable length records cannot be processed)

- Blocked or unblocked records
- EBCDIC or ASCII format
- Single or multiple volumes
- 9-track (800/1600 bpi) or 7-track (200/556/800 bpi)

Work File: The work file resides on a 3340 data module. Work space can be specified by the user or can be allocated automatically by the program.

Output File: The output file resides on a 3340 data module or on a unit of the 3410/3411 Magnetic Tape Subsystem. A disk output file must have sequential organization. Tape output files have the same characteristics as tape input files.

Tape Sort Program (Program Product 5705-SM2)

The Tape Sort program sorts a tape file into ascending or descending sequence. A configuration that includes three or four 3410/3411 tape units is required. Tape Sort requires an input file, three work files, and an output file.

Input File: The input file resides on any unit of the 3410/3411 Magnetic Tape Subsystem. The input file characteristics are:

- Minimum record or block length of 18 bytes
- Maximum record or block length of 9999 bytes
- Fixed-length records (variable-length records cannot be processed)
- Blocked or unblocked records
- EBCDIC or ASCII format
- Single or multiple volumes
- 9-track (800/1600 bpi) or 7-track (200/556/800 bpi)

Work Files: Three work tapes are required; a fourth can be used if available. Work tapes must be single volume and either 7- or 9-track.

Output File: The output file can reside on any unit of the 3410/3411 Magnetic Tape Subsystem. Characteristics of tape output files are the same as for tape input files. The output is a file of records containing the sorted control fields and/or the data fields the user has specified.

Disk Resident Card Utilities (Program Product 5705-UT1)

The Disk Resident Card Utilities provide the following programs:

Sort/Collate Program: Sorts or collates files of cards into the specified sequence. It uses the 5424 MFCU.

Card List Program: Lists cards on the printer. It accepts input from the system input device. Output is printed on the 1403 or 5203 Printer.

Reproduce/Interpret Program: Reproduces cards, with reformatting options, or interprets cards. When reproducing, the program uses the MFCU-1 for input and the MFCU-2 for output.

Gangpunch Program: Uses 5424 MFCU and provides:

- Interspersed master-card gangpunching
- Count-controlled gangpunching
- Matching master cards and detail cards on a control field and punching master information into the detail card when a match occurs

1255 Utility Program (Program Product 5705-UT2)

This utility program (1) enables the 1255 Magnetic Character Reader to read MICR encoded documents, (2) accumulates document totals and amount fields for each stacker, and (3) places the data from the documents on output disk, tape, or printer files. The program fulfills the basic requirements of the ON-US data capture run required for all demand deposit application programming.

DATA/3 (Program Product Application 5705-XX1)

DATA/3 is used to generate RPG II source programs that support a terminal-oriented system. See *Communications Programming* in Chapter 4.

When the Model 12 is used for online data entry and inquiry with local or remote display stations, the following programming facilities can be used:

- DATA/3 (an application program product)
- BSCA Multiline/Multipoint (ML/MP) (a function of the SCP)
- Communications Control Program (CCP) (a function of the SCP)

When the Model 12 is used with local or remote terminals, the following programming can be used:

- RPG II telecommunications support (a function of the RPG II program product)
- BSCA Multiline/Multipoint (ML/MP) (a function of the SCP)
- Communications control program (CCP) (a feature of the SCP)
- Multiple line terminal adapter (MLTA) IOCS, which is furnished as support for part of the MLTA RPQ for a synchronous (start/stop) line control

When the Model 12 is used as a work station for a System/360 or System/370, MULTI-LEAVING remote job entry work station support (a feature of the SCP) can be used.

RPG II TELECOMMUNICATIONS SUPPORT

The RPG II telecommunications support allows the user to describe BSCA files in the application program. The System/3 then can be used in point-to-point switched, point-to-point nonswitched, or multipoint network (as a tributary station).

RPG II programs may be generated to send or receive binary synchronous data over voice-grade or high-speed communications lines in one of the following modes:

- Receive only
- Receive with conversational reply
- Transmit only
- Transmit with conversational reply
- Transmit and receive

RPG II language features used for communications are:

- Input, output, and combined files
- Demand files
- Blocking and deblocking of records
- Dual I/O areas

BSCA and ICA features, options, and capabilities supported by the RPG II telecommunications support are:

- Manual call
- Manual answer
- Auto call (BSCA only)
- Auto answer
- Medium speed
- High speed (BSCA only)
- Station selection (BSCA only)
- EBCDIC data transparency
- Intermediate block checking
- EBCDIC or ASCII code

The communications environment is described as RPG II telecommunications specifications, and are included in the RPG II source program.

DATA/3

DATA/3 provides a simplified method of performing operations using 3270 Information Display Terminals. DATA/3 operates on either a dedicated system or with dual programming. By using the dual program feature, one part of the system can do batch processing while the other part is executing terminal-oriented programs created by DATA/3.

During execution of DATA/3 generated programs, the terminal operators can inquire into files, update files, or enter data into files.

Programs generated by DATA/3 operate under control of the CCP or disk system management.

DATA/3 generates RPG II source programs, which are then compiled like any other RPG II program.

DATA/3 uses an RPG-like program definition and a data definition coding form. The program offers up to four separate program security checks. Two are available in the DATA/3 generated program; two additional checks are available when running under CCP.

Standard prompting and operational techniques for the user are also available.

MULTILINE/MULTIPOINT (ML/MP)

Multiline/Multipoint is a binary synchronous communications (BSC) function of System/3 system control programming. ML/MP provides the assembler programmer access to the BSC I/O routines that support the binary synchronous communications adapter (BSCA), the local display adapter, or the integrated communications adapter (ICA) as an I/O device.

ML/MP enables the assembler programmer to transmit and receive binary synchronous data over two telecommunications lines simultaneously (each line requires a BSCA or ICA). The two lines can be used on the same program or can be used independently in separate program levels. The lines can be nonswitched or switched.

The ML/MP user specifies the functions of ML/MP I/O routines by using macro instructions. Linkage to the ML/MP routines is assembled as part of the user's program. The overlay linkage editor is then used to incorporate the ML/MP routines in the user's object program.

COMMUNICATIONS CONTROL PROGRAM (CCP)

The communications control program is a system control programming feature that controls concurrent execution of several application programs, thereby providing System/3 Model 12 with multitasking. CCP can be used in one program level of a dual programming system, or it can be used in a dedicated system.

Multitasking

Multitasking allows two or more programs, called tasks, to execute concurrently within a single program level. The purpose of multitasking is to make more efficient use of CPU time.

Main Tasks and Subtasks

In multitasking, one main program, the main task, attaches one or more subprograms or subtasks. The main task gets control from the supervisor and then initiates, or attaches, the subtasks. The main task and its attached subtasks always reside in the same program level.

In System/3 Model 12, the communications control program (CCP) is the main task permitting several application programs (up to eight subtasks) to share processing unit resources. CCP provides the control program services needed to operate a communications-based information processing system. CCP enables an online network of terminals to call a predefined set of application programs as needed and access a common set of disk files.

Control Program Services

Five types of control program services are performed:

- Task management – Allows several user application programs, initiated independently, to execute together under CCP.
- Communications management – CCP controls input from and output to terminals in the system.
- Program management – CCP handles requests from terminals and the system operator to execute application programs together.
- File management – CCP manages access by user programs to user data files.
- Display format facility for the 3270.

Programming Facilities

Programs that run under CCP can be written in:

- RPG II – The EXIT/RLABL operation or a special file is used for terminal I/O.
- COBOL and FORTRAN – The CALL statement is used for terminal I/O.
- Basic Assembler – A macro instruction can be used for terminal I/O.

Figure 5 shows CCP (the main task) controlling three user application programs (the subtasks).

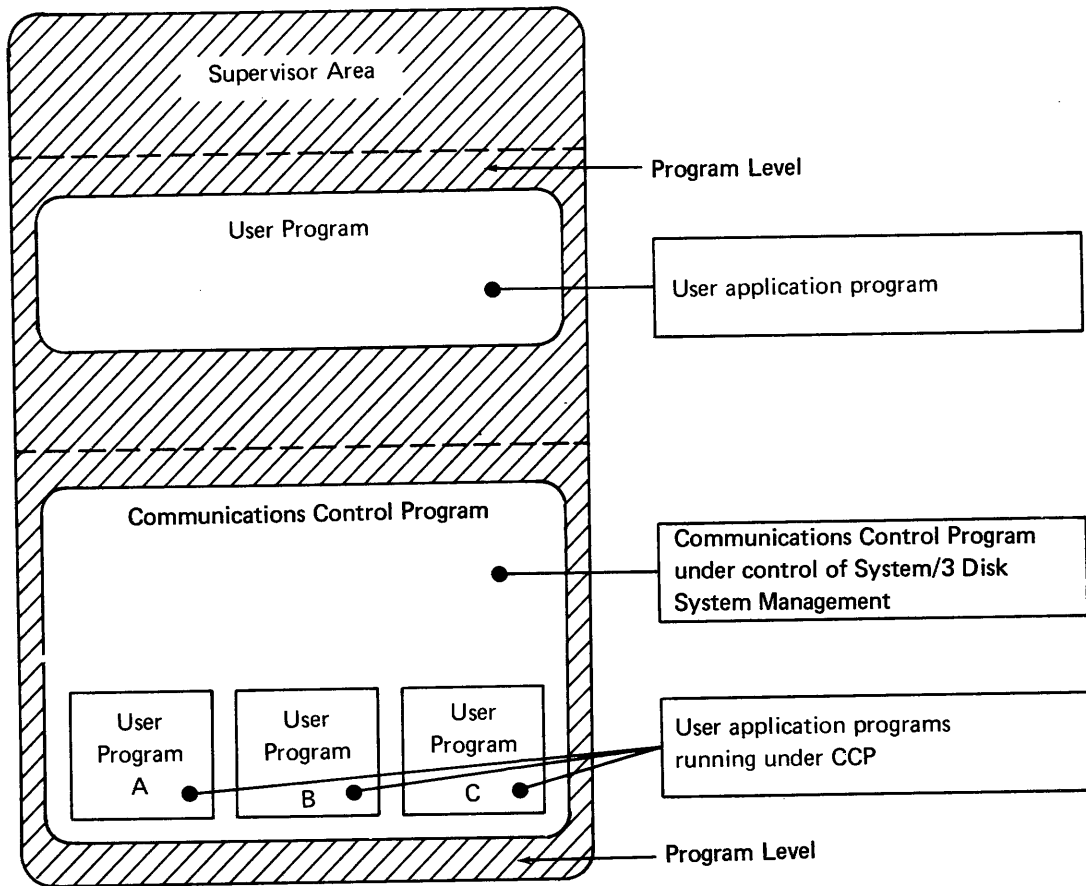


Figure 5. Communications Control Program

MULTI-LEAVING REMOTE JOB ENTRY WORK STATION

The MULTI-LEAVING Remote Job Entry Work Station (MRJE/WS) program is a feature of the SCP that provides the System/3 user with the ability to submit OS jobs via the BSCA or ICA to a System/360 or System/370. Output from the OS jobs can be returned to the submitting System/3, directed to another work station, or directed to the central system I/O devices. The telecommunications programming of the System/3 MRJE/WS performs the functions necessary to establish line connections, send and receive data, and execute the correct termination procedures.

The System/3 MRJE Work Station program communicates with RES, JES2, JES3, HASP-II V3.1, HASP-II V4.0, ASP V2.6, and ASP V3.0. These facilities support a line discipline which permits maximum overlapping of I/O devices at the work station and the central system through the intermixing of input and output data streams on the communication lines. This fully synchronized, two-directional transmission of a variable number of data streams between two computers using BSC facilities is called MULTI-LEAVING.

Input to the MRJE/WS program may be from:

- 1442 Card Read Punch
- 3340 Direct Access Storage Facility
- 3410/3411 Magnetic Tape Subsystem
- 3741 Data Station/Programmable Work Station (directly attached)
- 5424 Multi-Function Card Unit
- 5471 Printer-Keyboard

Output from the MRJE/WS program may be directed to:

- 1442 Card Read Punch
- 3340 Direct Access Storage Facility
- 3410/3411 Magnetic Tape Subsystem
- 3741 Data Station/Programmable Work Station (directly attached)
- 5203 or 1403 Printer
- 5424 Multi-Function Card Unit
- 5471 Printer-Keyboard

Both the programmer and the operator play an important role in the efficient operation of a data processing system.

- The programmer writes and tests programs, prepares the required control statements, and documents the programs and their operation.
- The operator sets up the system and initiates program execution using the instructions given by the programmer.

ROLE OF THE PROGRAMMER

The primary responsibility of the programmer is to:

- Design an application or individual program
- Code the programs in a source language, such as RPG II, using coding sheets as a guide
- Prepare operation control language (OCL) statements to be used to compile the source programs
- Compile the source programs to generate object programs
- Prepare OCL statements required for the execution of the object programs
- Prepare test data
- Test and debug the programs
- Document the programs, their functions and operating procedures; prepare run sheets for the operator, including setup of input/output devices
- Explain to the operator how the programs are to be used

OPERATOR'S DUTIES

The primary duties of the operator in a computer installation are to:

- Start up the system
- Prepare the I/O devices for each individual job using the instructions (program run sheet) provided by the programmer
- Initiate the execution of jobs
- Interpret and respond to the system's or program's requests for information or action

- Cancel the execution of a job in case of an unexpected error in the program
- Occasionally prepare OCL statements to use the system utility programs
- Initiate and control spooling of printer output

SYSTEM ACTION

The system:

- Stops when a condition occurs that requires the attention of the operator
- Provides information such as diagnostic, warning, or informational messages
- Allows the operator, in many cases, to select one of several options to a halt condition

Halt codes are displayed in a message display unit on the CPU. Using the halt guide, the system operator can determine the meaning of the two-position code and take whatever recovery action is required.

CONTROLLING PROGRAM PROCESSING

A program and the environment in which it is to be run must be defined to the system by means of operation control language (OCL) statements. OCL statements specify:

- System information and options
- Assignment of system devices
- Whether programs are to be compiled, link-edited, or executed
- The library or device from which the user or system program is to be loaded
- The files to be processed and the location of these files

OCL statements are read from the system input device, or in the case of procedures, from the procedure library in a 5444 simulation area. All OCL statements—except the comment (*) and end-of-job (/&) statements, and the end-of-file (/*) statement—begin with a // in positions 1 and 2.

The following list illustrates the variety of options the user can specify in his OCL on the Model 12:

Statement Identifier	Keyword	Explanation
// DATE		Sets the date
// JOB		First statement of a group of jobs
	SPOOL	Whether the group is to be spooled
	PRIORITY	Priority of the group's spooled printer output
// LOAD		Identifies program to be executed; object program is in system input device (LOAD *) or in object library (LOAD name,unit)
// CALL		Identifies an OCL procedure
// FILE		Describes data files to be used in program
	NAME	Name of file in program
	UNIT	Unit containing file
	PACK	Name of disk
	LABEL	Name of file on disk
	RECORDS	Number of records in disk file
	TRACKS	Number of tracks in disk file
	RETAIN	Retention code
	DATE	Creation date
	LOCATION	Location of file on disk
	HIKEY	Used for multi-volume indexed files
	BLKL	Tape block length
	RECL	Tape record length
	REEL	Labeled or unlabeled tapes
	RECFM	Tape record format
	END	End-of-job tape option
	DENSITY	Density of tape
	ASCII	Recording mode for tape
	DEFER	Deferred mount of tape files
	CONVERT	Tape data conversion
	TRANSLATE	Tape data translation
	PARITY	Tape parity
// BSCA		Allows change of BSCA/ICA lines
	LINE	Change to line 1 or 2

Statement Identifier	Keyword	Explanation
// SWITCH		Sets user program switches
// COMPILE		For program compilations
	SOURCE	Name of source program
	UNIT	Location of source program
	OBJECT	Location of object program
// PAUSE		Halt and wait for operator action
// RUN		End of OCL for a program
// READER		Change system input device: CONSOLE, 3741, 1442, MFCU 1, or MFCU 2
// PUNCH		Change system punch device: 3741, 1442, MFCU1, or MFCU2
// LOG		Change system logging device: CONSOLE, PRINTER, ON, OFF
// FORMS or // PRINTER		Describe system print device
	DEVICE	Type of printer
	LINES	Number of lines per page
	FORMSNO	Identifies forms type
	COPIES	Number of copies
	ALIGN	Forms alignment
// IMAGE		Change printer chain image
// HALT		Halt at end of program
// NOHALT		Do not halt at end of program
// LOCKOUT		Improve program load time in DPF system
// PARTITION		Set size of program level in DPF system
*		Comment
/&		End of job
/*		End-of-data file

OPERATOR CONTROL COMMANDS

Operator control commands (OCC) monitor and communicate with the spooling function. Eight functions are provided in a spooling environment to enable the operator to:

- Initiate spooling at IPL or start the spool writer
- Stop the spool writer
- Restart the job's printed output at the beginning
- Prevent a job on the queue or the entire print queue from being scheduled for output
- Release a job, or entire print queue from the hold state
- Change the priority, the number of copies, or the forms type of a job on a queue
- Cancel a job or the entire print queue
- Determine the content of the print queue
- Terminate the spool writer—causes the spool writer program to go to end of job

Chapter 5. System Control Programming Facilities

This chapter contains additional information about:

- Data management
- System utility programs
- Additional SCP facilities
- Main storage requirements

DATA MANAGEMENT

Data management routines provide an interface between the user program and the required data files. Data management services are provided for disk files, diskette files, card files, tape files, printer files, and printer-keyboard files.

Disk Data Management

These file organizations are supported for the 3340 Direct Access Storage Facility:

- Sequential – Records are arranged in a physical sequence, but not necessarily a logical sequence.
- Indexed – Records are arranged in a logical sequence by key; an index to these keys permits random processing of individual records.
- Direct – Records are arranged so that there is a relationship between the contents of the records and their position in the file.

Note: Only sequential and direct, single-volume files are supported in the 5444 simulation area.

These files may be processed consecutively, sequentially, or randomly. A maximum of 1000 files can be stored on one data module main data area and a maximum of 50 files can be stored in each 5444 simulation area.

The following features are supported by the SCP disk data management routines:

- Records may span physical disk boundaries (sectors or tracks); therefore, disk space is not wasted.
- Record sizes from 1 byte to 32K bytes may be used. (A particular program may restrict the maximum size; for example, using RPG II, the maximum disk record is 9999 bytes.)

- The fixed-length records may be blocked or unblocked. The blocking factor may vary from program to program.
- Multi-volume files, sequential or indexed, may be either online or offline but direct multi-volume files must be online. Multi-volume files are supported on two-drive systems only.

Diskette Data Management

The following features are supported by the SCP diskette data management for a 3741 directly attached to the System/3:

- Fixed-length, unblocked records
- Logical sequential organization
- Record sizes from 1 to 128 bytes
- Single or double buffering
- Only one diskette file may be used at a time
- A diskette file may be contained in one or more data sets on one or more diskettes.

Card I/O Data Management

The following features are supported by the SCP card data management for the devices listed:

5424 MFCU

- Read 96 columns
- Punch 96 columns
- Print 1-32 positions on 1-4 lines
- Feed
- Stacker select
- Single or double buffering
- Combined file processing
- 64 EBCDIC characters for read, punch, or print

1442 Card Read Punch

- Read 80 columns
- Punch 1-80 columns
- Read card image (column binary)
- Stacker select
- Single or double buffering
- Combined file processing
- 256 EBCDIC characters for read or punch (except for card image mode)

Tape Data Management

Magnetic tape is used as a data storage medium only. Libraries and programs are not supported on tape although they can be contained in data files on tape.

The following features are supported by the SCP tape data management:

- Fixed or variable-length records
- Blocked or unblocked records
- Block size from 18 bytes to 32K bytes
- Multi-volume files
- Unlabeled or labeled (ANSI or IBM Standard labels) tapes
- EBCDIC or ASCII recording format
- Tape error statistics

Printer Data Management

The following features are supported by printer data management for the 5203/1403 Printer:

- Print 96-, 120-, or 132-position line on the 5203
- Print 132-position line on the 1403
- Skip to specified line number before or after print
- Space 0, 1, 2, or 3 lines before or after print
- Page overflow detection

- Supports the 5203 dual feed carriage and interchangeable chain cartridge
- Universal character set feature

Printer-Keyboard Data Management

The following features are supported by 5471 Printer-Keyboard data management:

- Record length from 1 to 125 bytes
- One space before or after print

SYSTEM UTILITY PROGRAMS

The system utility programs allow the user to maintain disks and perform basic functions necessary for the operation of the system. Some of the programs are described below.

Library Maintenance Program

The library maintenance program allows the user to create, maintain, and service the source and object libraries. The principle functions of the library maintenance program are to:

- Add, delete, or rename source programs, procedures, and object programs in the user's program libraries
- Allocate or reallocate disk space to the libraries
- Display library contents
- Copy any or all of a library from one disk to another
- Copy a module into a library from the system input device
- Copy a module into a library from a file in a 5444 simulation area
- Copy a module to the system punch device from a library
- Copy a module to the system print device from a library
- Modify entries in the source library

The library maintenance program requires a dedicated system; that is, it cannot be used when a program is running in the other program level.

Copy/Dump Program

The copy/dump program supports both file-to-file copies (COPY) and volume-to-volume copies (DUMP). The file-to-file routines:

- Provide an easy-to-use method of creating a file backup.
- Provide a method of moving files from one location to another, allowing both file limit modification and reorganization.
- Support one input and one output per execution.
- Support sequential, indexed, or direct disk files as input.
- Allow printer output in addition to disk output.
- Support the deletion of records from files through the specification of a deletion code and position within each record. The deleted records are printed.

The volume-to-volume routines allow the user to copy an entire 3340 main data area to another 3340 main data area for backup, or copy a 5444 simulation area (F1, R1, F2, R2) to another 5444 simulation area.

Disk Utility Programs

Programs that can be used with the 3340 Direct Access Storage Facility are:

- Disk initialization program, which performs surface analysis on the user's disk and formats the disk according to SCP requirements
- Alternate track assignment program, which assigns an alternate track in place of a defective one and prints the data content of the area in error
- Alternate track rebuild program, which corrects data on the assigned alternate track
- File and volume label display program, which displays the entire volume table of contents of a disk area, or the information pertaining to a single file
- File delete program, which deletes data files from a disk

ADDITIONAL SYSTEM CONTROL PROGRAMMING FACILITIES

Overlay Linkage Editor

The overlay linkage editor creates loadable programs from multiple relocatable object modules. Output from the overlay linkage editor can be cataloged in the object library and/or written to the system punch device. Overlay structures can be created automatically or as designated by the user. The overlay linkage editor is used by the COBOL and FORTRAN compilers, and by the Basic Assembler program.

Note: The RPG II compiler uses the RPG II linkage editor, rather than the system's overlay linkage editor.

System Generation

When a user installs a system, a system generation (SYSGEN) is performed to create a supervisor and data management support for the particular configuration, and to include the program products that have been ordered. During system generation, the source and object libraries are established.

Rollout/Rollin Capability

Rollout/rollin is the ability to roll out a program during its execution, bring in an inquiry program, execute the inquiry program, and restart (rollin) the original program when the inquiry program has finished executing. Rollout/rollin is:

- Supported in program level 1 only
- *Supported by RPG II and FORTRAN
- Available to Basic Assembler users
- Not supported for sorts, utilities, system utility programs, CCP or by COBOL

Checkpoint/Restart Capability

Checkpoint/Restart is the ability to write checkpoint records that allow the user to resume execution of programs from the last checkpoint (rather than from the beginning) in case processing is terminated due to a machine failure or an operator initiated cancel. Checkpoint/Restart is:

- Supported in program level 1 only
- Supported by COBOL
- Available to Basic Assembler users

Macros

The macro processor uses macro prototype definitions to expand keyword macro statements coded by the user. The resulting expanded code is in a form that can be processed by the Basic Assembler. Macros provide:

- System services
- General I/O support
- Disk device support
- Card device support
- Tape device support
- Diskette device support

- Printer device support
- Printer-keyboard device support
- Communications support (ML/MP and MLTA)

Label Processing

Data files on a 3340 main data area and 5444 simulation areas are identified and accessed by standard System/3 labels, which are stored in a volume table of contents (VTOC) on each 3340 data module.

Data sets on a 3741 diskette are identified by labels, but System/3 does not access the data by means of the label. The user positions a diskette at the proper data set label for processing prior to putting the 3741 online to System/3.

Libraries

The *source library* is an area on disk for storing procedures and source statements. *Procedures* are groups of OCL statements used to load programs. The statements can be followed by input data for the programs. (Procedures for utility programs can, for example, contain utility control statements.) *Source statements* are sets of data, the most common of which are RPG II source programs and disk sort sequence specifications.

The *object library* is an area on disk for storing object programs and routines. *Object programs* are programs and subroutines in such a form that they can be loaded for execution. (They are sometimes called *executable object programs*.) *Routines* are programs and subroutines that need to be link-edited into object programs before they can be loaded for execution. (They are sometimes called *nonexecutable object programs*.)

Dual Programming

Under normal operating conditions, only one program can be processed at a time. With the dual program feature (DPF), two programs can be in main storage at the same time. Only one program can be executing instructions at any one time.

When DPF is being used, main storage contains the supervisor and two programs. Control is transferred from one program to the other whenever the program that is executing must await completion of an input or output operation. For example, one program requests a print operation, but the printer is still busy with a previous request. Control is then transferred to the other program level.

Similarly, one program requests that a record be read for processing. Since the program must wait until reading is completed before it can process the data, control is transferred to the other program level. Similarly, control is transferred when a halt occurs in one program level.

Most programs wait a significant amount of time for I/O completion. If both programs are waiting, the program whose I/O is completed first receives control.

Figure 6 shows how main storage is organized in a DPF environment. The storage areas occupied by the two programs are called program level 1 and program level 2. Each level must have a minimum of 8K bytes if each level is executing instructions. The library maintenance program (SCP), and macro processor (SCP) require a dedicated system. They cannot be executed when the other program level is active.

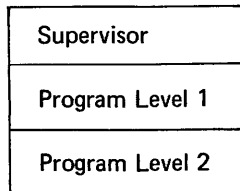


Figure 6. Main Storage in a DPF Environment

System Input

The system input device is called the READER, and on the Model 12, it can be the 5424 MFCU, or the 1442 Card Read Punch, or the 5471 Printer-Keyboard, or the directly attached 3741 Data Station/Programmable Work Station.

The reader is used for certain system functions; the device used as the reader may also be used in application programs where the device is supported.

The reader is used to:

- Read OCL statements
- Read control statements for the system utility programs
- Load object programs
- Read input for the MODIFY function and reader-to-library function of the library maintenance program
- Read source input for:
 - Macro processor
 - RPG II compiler, including auto report specifications and compile-time tables
 - COBOL compiler
 - FORTRAN compiler
 - Basic Assembler
- Read relocatable input for the Overlay Linkage Editor
- Read specifications for Disk Resident Card Utilities
- Read specifications for the Disk Sort program
- Read specifications for the 1255 Utility program

- Read specifications for the Tape Sort program
- Read specifications for the following CCP programs:

- Assignment build
- Assignment list
- User security information build
- Display format generator
- Disk-to-printer dump program
- File recovery program
- CCP startup
- CCP generation

System Punch

The system punch device is called the PUNCH, and on the Model 12, it can be the 5424 MFCU, or the 1442 Card Read Punch, or the directly attached 3741.

The device assigned as the punch can also be used for output data from a user application program.

The punch is used to:

- Provide optional output from the overlay linkage editor
- Provide optional output from the RPG II compiler
- Provide output from the library-to-punch function of the library maintenance program
- Provide output by the CCP generation print/punch utility

MAIN STORAGE REQUIREMENTS

Main storage requirements for the supervisor depend on which system generation options the user selects at system generation time:

- Dual program feature
- 3410/3411 Magnetic Tape Subsystem
- 5471 Printer-KeyBoard
- BSCA/ICA/Local Display Adapter
- 3741 Data Station Programmable Work Station, directly attached
- Print Spool

The following table can be used for planning purposes:

Disk Drives (see notes)	Dedicated System		Dual Programming	
	with 5471	no 5471	with 5471	no 5471
3340 C2	8.25 K	8.00 K	9.25 K	9.00 K

Notes:

1. K = 1024 bytes (decimal)
2. For BSCA-2 or ICA or Local Display Adapter and/or ML/MP, add 0.25K bytes to the above numbers.
3. For 3741 directly attached, add 0.75K bytes to the above numbers.
4. For 3410/3411, add 0.75K bytes to the above numbers.
5. For Print Spool, add to the above numbers:

One level: 6K or
Two levels: 7K

Main storage requirements for selected SCP programs are (size is the minimum main storage, in bytes, excluding supervisor requirements):

Program	Size
Library maintenance	8K (note 1, 2)
Copy/dump	8K (note 1)
Disk initialization	8K
Alternate track assignment	8K
Alternate track rebuild	8K
File and volume label display	10K (note 3)
File delete	8K
Overlay linkage editor	8K (note 1)
Macro processor	12K (note 1, 2)
\$RSALT	8K
\$SCOPY	8K
\$INIT	8K
\$TVES	8K
Tape initialization	8K

Notes:

1. Uses more main storage, if available.
2. Requires a dedicated system (cannot be used with dual programming).
3. Requires additional storage, up to a total of 18K bytes, if sort option is used.

Chapter 6. 3340 Features and Comparison to the 5444 and 5445

The 3340 Direct Access Storage Facility offers increased file capacity and improved performance over both the 5444 Disk Storage Drive and 5445 Disk Storage. One or two 3340 drives can be online to the IBM System/3 Model 12. The 3340 uses the IBM 3348 Model 70 Data Module as a storage medium.

3340 DISK STORAGE CONCEPT

The 3340 which provides direct access storage for the System/3 Model 12, is a modular, high-speed, large capacity storage facility for data base/data communications or general purpose storage.

The 3340 drive uses the 3348 Data Module (or equivalent) as the storage medium. The 3340 contains the necessary mechanical and electrical components to house, load, provide air filtration, and drive the 3348 Data Module. Together, a 3340 and 3348 have:

- Less than 20 seconds start time
- 25 milliseconds average access time
- 10.1 milliseconds average rotational delay
- 885,000 bytes per second nominal data transfer rate

The 3340 has the following features which are not found on the 5444 or 5445:

- A data module instead of a disk pack
- Defect skipping

The data module is a sealed cartridge that contains disks, spindle, read/write heads, and access arms. The use of the data module provides the following advantages for the System/3 Model 12:

- Drive capacity is approximately 51 megabytes
- Preventive maintenance of the heads, disks, and spindle is eliminated by reducing the exposure to outside contamination
- Reliability is improved by dedicated read/write heads. Each head reads only the data it previously wrote.

The following 3340 features, available on System/370, are not available on System/3:

- Remote switch attachment
- String switch

- Fixed head feature
- Rotational position sensing

3340 CONFIGURATION

The 3340 configuration for the Model 12 is a Model C2 (two drives) (Figure 7).

Each drive of the 3340:

- Responds to commands from the 5412 CPU (control)
- Houses, loads, provides air filtration, and drives the 3340 data module
- Positions access mechanism with voice-coil drive and maintains track following with an electronic servo system
- Selects the head
- Reads or writes data
- Provides safety and servicing information for subsystem and system evaluation

TIMING

The total access and data transfer time consists of access motion, head selection, rotational delay, and data transfer times.

Access Motion Time

Access motion time is the time required to position the access mechanism at the specified cylinder. If the access mechanism is already at the proper cylinder, access motion time is zero. If the access mechanism is moved, the following times are required.

Minimum	—	10 milliseconds
Average	—	25 milliseconds
Maximum	—	50 milliseconds

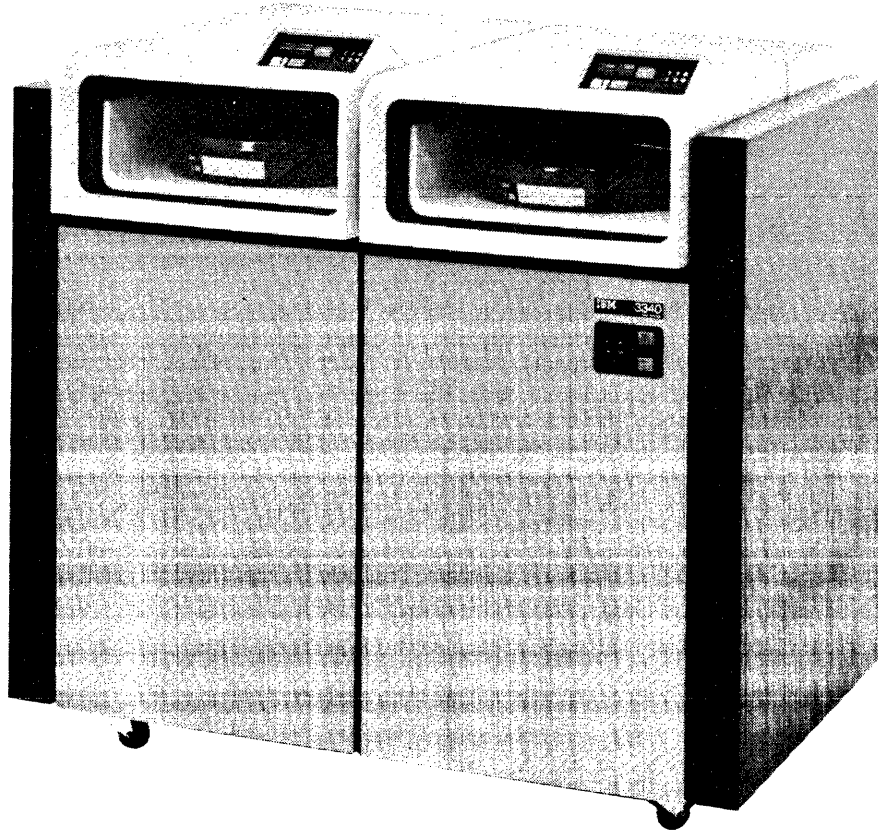
Rotational Delay

Rotational delay is the time required for the desired record area to reach the read/write head so that data transfer can begin. The average rotational delay for a 3340 is 10.12 milliseconds. However, due to the way that the 3340 is supported by System/3 programming, an average rotational delay of 10.8 milliseconds should be used for planning purposes.

Data Transfer

Nominal data transfer rates for the disk drives are:

Bytes per second — 885,000
Microseconds per byte — 1.13



IBM 3340 Model C2 (two drives)

Figure 7. 3340 configuration model

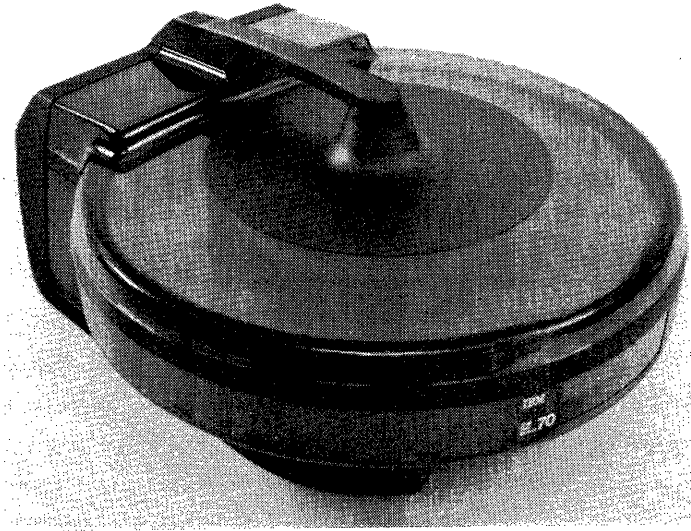
Comparative Access Times

Figure 8 illustrates the access times for the 5444 and 5445 disk storage drives and the 3340.

3348 DATA MODULE

On the System/3 Model 12, the 3340 drives use the IBM 3348 Model 70 Data Module. Due to the formatting required by System/3, the capacity of a data module is 51 megabytes. This chapter describes the Model 70 data module as used by System/3.

Physical Characteristics



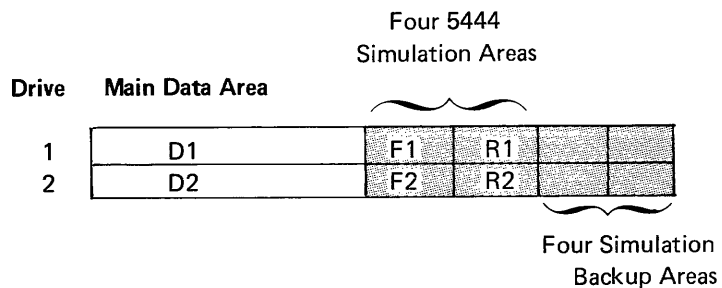
Height — 8 inches
 Width — 16 inches
 Maximum length — 18 inches
 Shipping weight — 23 pounds

Storage Characteristics

Figure 9 shows the relative storage characteristics of the 5444 and the 5445 disk storage drives and the 3340 for the System/3 Model 12.

5444 SIMULATION AREAS AND MAIN DATA AREA

Each 3348 Data Module is divided into a main data area and four simulation areas. Following is a graphic representation of these areas of a 3340 subsystem:



Simulation Areas

Each 3340 data module used on System/3 contains four 5444 simulation and simulation backup areas. The system uses the 5444 simulation areas in the same way it would use the 5444 disk storage drive. That is, all libraries (user programs, system programs, procedures, etc) are contained in the 5444 simulation areas.

There are four 5444 simulation and simulation backup areas for each drive (a total of 8 for two drives). Four of these 8 areas are available for general system use:

- F1 = Simulation of fixed disk on 5444 drive 1
- R1 = Simulation of removable disk on 5444 drive 1
- F2 = Simulation of fixed disk on 5444 drive 2
- R2 = Simulation of removable disk on 5444 drive 2

The location of these four 5444 simulation areas is fixed. F1 and R1 are always on 3340 drive 1; F2 and R2 are always on 3340 drive 2.

The remaining four simulation backup areas are accessible only by a simulation area program, \$SCOPY.

The main data area of each module provides 40.8 megabytes of data storage. These areas are referred to as:

- D1 = Main data area on 3340 drive 1
- D2 = Main data area on 3340 drive 2

	5444 (high speed)	5445	3340
Minimum access time	28 ms	25 ms	10 ms
Average access time	126 ms	60 ms	25 ms
Maximum access time	255 ms	130 ms	50 ms
Data transfer rate	199,000 bytes/second	312,000 bytes/second	885,000 bytes/second
Rotational speed	1500 rpm	2400 rpm	2900 rpm (approximate)
Nominal rotation time	40 ms	25 ms	20.2 ms
Average rotational delay	20 ms	12.5 ms	10.1 ms

Figure 8. Access Times for the 5444 and 5445 Disk Storage Drives and the 3340

	5444	5445	3340
Bytes per record	256	256	256
Records per track	24	20	48
Bytes per track	6,144	5,120	12,288
Tracks per cylinder	2	20	20
Bytes per cylinder	12,288	102,400	245,760
Cylinders per disk pack/data module ¹	100/200	200	207
Bytes per disk pack/data module ¹	1,228,800/ 2,457,600	20,480,000	50,872,320
Tracks per disk pack/data module ¹	200/400	4,000	4,140
Records per disk pack/data module ¹	4,800/9,600	80,000	198,720
Maximum number of disk files per pack/module	50	1,000	1,000
Maximum number of drives	2	4	2

¹ Excluding alternate tracks and CE tracks

Figure 9. Characteristics of Disk Storage Drives for the System/3 Model 12

Glossary

This glossary contains terms used in this manual, other System/3 terms, and general data processing terms. If you do not find the term you are looking for, refer to the *IBM Data Processing Glossary*, GC20-1699.

IBM is grateful to the American National Standards Institute (ANSI) for permission to reprint its definitions from the *American National Standard Vocabulary for Information Processing* (Copyright 1970 by American National Standards Institute, Incorporated), which was prepared by Subcommittee X3K5 on Terminology and Glossary of American National Standards Committee X3.

ANSI definitions are identified by an asterisk. An asterisk to the right of the term indicates that the entire entry is reprinted from the *American National Standard Vocabulary for Information Processing*; where definitions from other sources are included in the entry, ANSI definitions are identified by an asterisk to the right of the item number.

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

access time: * (1) The time interval between the instant at which data is called for from a storage device and the instant delivery begins. (2) The time interval between the instant at which data is requested to be stored and the instant at which storage is started.

alternate track: On a direct access device (disk drive), a track designated to contain data in place of a defective primary track.

American National Standards Institute: An organization sponsored by the Business Equipment Manufacturers Association (BEMA) for the purpose of establishing voluntary industry standards. Abbreviated ANSI.

APAR: Authorized program analysis report. A request for correction of a problem caused by a defect in a current unaltered release of a program.

application program: A program written for or by a user that applies to his own work.

ASCII (American National Standard Code for Information Interchange, X3.4-1968): * The standard code, using a coded character set consisting of 7-bit coded characters (8 bits including parity check), used for information interchange among data processing systems, communications systems, and associated equipment. The ASCII set consists of control characters and graphic characters. Synonymous with USASCII.

assemble: * To prepare a machine language program from a symbolic language program by substituting absolute operation codes for symbolic operation codes and absolute or relocatable addresses for symbolic addresses.

assembler: * A computer program that assembles.

assembler language: A source language that includes symbolic machine language statements in which there is a one-to-one correspondence with the instruction formats and data formats of the computer.

asynchronous transmission: Transmission in which each information character is individually synchronized (usually by the use of start bits and stop bits).

auxiliary storage: (1) Data storage other than main storage; for example, storage on magnetic tape or direct access devices. Synonymous with external storage, secondary storage. (2) * A storage that supplements another storage. Contrast with *main storage*.

backup copy: A copy of a file that is kept for reference in case the original file is destroyed.

batch processing: (1) Pertaining to the technique of executing a set of computer programs such that each is completed before the next program of the set is started. (2) Pertaining to the sequential input of computer programs or data. (3) See also *stacked job processing*.

binary digit: * In binary notation, either of the characters 0 or 1. Abbreviated bit.

binary synchronous communication: Communication using binary synchronous transmission. Abbreviated BSC.

binary synchronous transmission: Data transmission in which synchronization of characters is controlled by timing signals generated at the sending and receiving stations. Contrast with *asynchronous transmission*.

block: (1) * A collection of contiguous records recorded as a unit. Blocks are separated by block gaps and each block may contain one or more records. (2) * A group of contiguous characters recorded as a unit. (3) To record data in a block. (4) In System/3, blocks of logical data on a direct access storage device are not separated by gaps.

blocking: Combining two or more records into one block.

blocking factor: The number of logical records combined into one physical record or block.

bps: Bits per second.

BCSA: Binary synchronous communications adapter. A device used for *binary synchronous communication*.

buffer: An area of storage that is temporarily reserved for use in performing an input/output operation, into which data is read or from which data is written. Synonymous with I/O area.

byte: (1) The representation of a character. (2) In System/3, a sequence of eight adjacent binary digits that are operated upon as a unit and that constitute the smallest addressable unit in the system.

cataloged procedure: A set of operation control language statements that has been placed in a library called the source library, and can be retrieved as required by calling it by name. Control statements for some System/3 programs may also be included in a cataloged procedure.

cathode ray tube: An electronic vacuum tube, such as a television picture tube, that can be used to display graphic images. Normally, displays codes or words to convey information to an operator. Abbreviated CRT.

CCITT: Consultative Committee International Telegraph and Telephone.

CCP: Communications control program. A function of System/3 SCP that provides the control program services needed to operate a communications-based information processing system.

channel: A hardware device that connects the CPU and main storage with the I/O control units.

character: * A letter, digit, or other symbol that is used as part of the organization, control, or representation of data.

character set: (1) * A set of unique representations called characters. (2) The System/3 64-character set includes 26 alphabetic, 10 numeric, and 28 special characters including a blank character. It is a subset of the EBCDIC character set which contains 256 characters.

checkpoint: (1) * A place in a routine where a check, or a recording of data for restart purposes, is performed. (2) A point at which information about the status of a job and the system can be recorded so that the job step can be later restarted. (3) To record such information.

checkpoint/restart facility: A facility for restarting execution of a program at some point other than at the beginning, after the program was terminated due to a program or system failure. A restart begins at a checkpoint of a job step, and uses checkpoint records to reinitialize the system.

COBOL: * Common business-oriented language. A business data processing language.

code: * (1) A set of unambiguous rules specifying the way in which data may be represented; for example, the set of correspondences in the standard code for information interchange. Synonymous with coding scheme. (2) In telecommunications, a system of rules and conventions according to which the signals representing data can be formed, transmitted, received, and processed. (3) In data processing, to represent data or a computer program in a symbolic form that can be accepted by a data processor. (4) To write a routine.

collating sequence: Any logical sequence used to order items of data.

compile: * To prepare a machine language program from a computer program written in another programming language by making use of the overall logic structure of the program, or generating more than one machine instruction for each symbolic statement, or both, as well as performing the function of an assembler.

compiler: * A program that compiles.

computer: * A data processor that can perform substantial computation including numerous arithmetic or logic operations, without intervention by a human operator during the run.

computing system RPQ: A customer request for a price quotation on alterations or additions to the functional capabilities of the computing system. The RPQ may be used in conjunction with programming RPQs to solve unique data processing problems. See also *programming RPQ*, *RPQ*.

configuration: The group of machines, devices, and programs that make up a data processing system.

consecutive processing: The treatment of data with respect to its location in external storage, and in a sequence governed by the physical order of the data in the file. Contrast with *sequential processing*, *random processing*.

console: * That part of a computer used for communication between the operator or maintenance engineer and the computer.

contention: (1) A condition on a communication channel when two or more locations try to transmit at the same time. (2) Unregulated bidding for a resource by multiple users.

control field: In sorting or merging records, a group of bytes in a record used in determining sequence.

control program: A program that is designed to schedule and supervise the performance of data processing work by a computing system.

conversion: (1) The process of changing from one method of data processing to another or from one data processing system to another. (2) The process of changing from one form of representation to another, for example, to change from decimal representation to binary representation.

copy: * To reproduce data in a new location or other destination, leaving the source data unchanged, although the physical form of the result may differ from that of the source.

cps: Character per second.

CPU: * Processing unit.

CRT: Cathode ray tube. A display device on which images are produced on a cathode ray tube.

cursor: A movable spot of light on the cathode ray tube of a console or display unit that indicates where the next character will be entered.

cylinder: The tracks of a disk storage device that can be accessed without repositioning the access mechanism.

data: * A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or automatic means.

data file: A collection of related data records organized in a specific manner. For example, a payroll file (one record for each employee, showing his rate of pay, deductions, etc) or an inventory file (one record for each inventory item, showing the cost, selling price, number in stock, etc).

data management: A major function of the SCP that involves organizing, locating, storing, retrieving, and maintaining data.

data module: A sealed cartridge that contains disks, spindle, read/write heads, and access arms. The 3348 Data Module (or equivalent) is used on the 3340.

data set: (1) The major unit of data storage and retrieval in the operating system, consisting of a collection of data in one of several prescribed arrangements and described by control information to which the system has access. (2) A device that performs the modulation/demodulation and control functions necessary to provide compatibility between business machines and communications facilities. Abbreviated DS.

deblocking: The action of making the first and each subsequent logical record of a block available for processing, one record at a time.

debug: * To detect, locate, and remove mistakes from a routine, or malfunctions from a computer. Synonymous with troubleshoot.

default value: The choice among exclusive alternatives made by the system when no explicit choice is specified by the user.

direct access storage device: A device in which the access time is effectively independent of the location of the data.

direct organization: A file organization in which, for purposes of storage and retrieval, there is a relationship between the contents of the records and their positions in the file. Contrast with *indexed organization*, *sequential organization*.

directory: An index that is used by a control program to locate one or more blocks of data that are stored in separate areas of a direct access storage device.

disk: Loosely, a disk storage device.

diskette: The square plastic container and its enclosed disk.

disk pack: A removable direct access storage volume containing magnetic disks on which data is stored. Disk packs are mounted on a disk storage drive. (Disk cartridges, also removable direct access storage volumes, are used on the IBM 5444 Disk Storage Drive.)

dump: * (1) To copy the contents of all or part of a storage, usually from an internal storage into an external storage. (2) A process as in (1). (3) The data resulting from the process in (1).

EBCDIC: Extended binary coded decimal interchange code. A set of 256 characters, each represented by eight bits.

EIA: Electronics Industries Association.

error recovery procedures: Procedures designed to help isolate and, where possible, to recover from errors in equipment. The procedures are often used in conjunction with programs that record the statistics of machine malfunctions. Abbreviated ERP.

execute: To carry out an instruction or group of instructions, as in a program.

FDP: See *field developed program*.

FET: See MOSFET.

field developed program: A licensed program that performs a function for the user. It may interact with program products and/or system control programming, or it may be a stand-alone program. Field developed programs are normally developed by IBM branch office personnel to perform end-use or transitional functions for the user, contain logic directly related to the user's data, and are usable or adaptable to meet specific functional requirements. Abbreviated FDP.

file: * A collection of related records treated as a unit.

file maintenance: * The activity of keeping a file up to date by adding, changing, or deleting data.

fixed-length record: A record having the same length as all other records with which it is logically or physically associated. Contrast with *variable-length record*.

FORTRAN: * Formula translating system. A language primarily used to express computer programs by arithmetic formulas.

hard copy: A printed copy of machine output in a visually readable form; for example, printed reports, listings, documents, and summaries.

hardware: * Physical equipment, as opposed to the computer program or method of use; for example, mechanical, magnetic, electrical or electronic devices. Contrast with *software*.

hex: Hexadecimal.

hexadecimal: Pertaining to a number system with a base of 16; valid digits range from 0 through F, where F represents the highest units position (15).

host computer: The primary or controlling computer in a teleprocessing environment.

ICA: Integrated communications adapter.

index: (1) * An ordered reference list of the contents of a file or document, together with keys or reference notations for identification or location of those contents. (2) A table used to locate the records of an indexed file.

indexed organization: A file organization in which records are arranged in logical sequence by key. Indexes to these keys permit random processing of individual records. Contrast with *direct organization, sequential organization*.

initial program load: The initialization procedure that causes an operating system to commence operation. Abbreviated IPL.

initial program loader: * The procedure that causes the initial part of an operating system or other program to be loaded such that the program can then proceed under its own control. Abbreviated IPL.

input: * (1) Pertaining to a device, process, or channel involved in the insertion of data or states, or to the data or states involved. (2) Same as input device. (3) Same as input data.

input/output: (1) * Pertaining to either input or output, or both. (2) A general term for the equipment used to communicate with a computer, commonly called I/O. (3) The data involved in such communication. (4) The media carrying the data for input/output.

inquiry: A request for information from storage; for example, a request for the available quantity of an item of inventory.

installation: A particular computing system, in terms of the work it does and the people who manage it, operate it, apply it to problems, service it, and use the results it produces.

installed user program: A licensed program that performs a function for the user. It may interact with program products and/or system control programming, or it may be a stand-alone program. Installed user programs are produced by or for an individual user, contain logic directly related to the user's data, and are usable or adaptable to meet specific functional requirements. Abbreviated IUP.

interrupt: * To stop a process in such a way that it can be resumed.

I/O: See *input/output*.

I/O area: Same as *buffer*.

IOCS: Input/output control system. A group of routines for handling the transfer of data between main storage and I/O devices.

IPL: (1) * *initial program loader*. (2) *initial program load*.

IUP: See *installed user program*.

job: A program to be executed that usually includes all necessary computer programs, linkages, files, and instructions to the operating system.

job step: A unit of work associated with one processing program or one catalogued procedure and related data. A job consists of one or more job steps.

job stream: The sequence of operation control statements and data submitted to an operating system or an input unit especially activated for this purpose by the operator.

K: 1024 bytes; used in referring to storage capacity.

key: * One or more characters within an item of data that are used to identify it or control its use.

keyword: (1) A symbol that identifies a parameter. (2) A part of a statement that consists of a specific character string (such as NAME-).

keyword parameter: A parameter that consists of a keyword, followed by one or more values.

label: An identification record for a tape or disk file.

language: * A set of representations, conventions, and rules used to convey information.

language translator: A general term for any assembler, compiler, or other routine that accepts statements in one language and produces equivalent statements in another language.

leased line: A communication service used exclusively by one particular customer. Referred to as private line service.

librarian: The set of programs that maintains, services, and organizes the source and object libraries.

library: A set of programs, procedures, routines, etc, on a direct access storage device. See *source library, object library*.

linkage editor: A program that prepares the output of language translators for execution. It combines separately produced object modules; resolves symbolic cross references among them; generates overlay structures on request; and produces executable code (a load module) that is ready to be loaded into main storage.

listing: A printout, usually prepared by a language translator, that lists the source language statements and contents of a program.

load: To enter data or programs into storage.

log device: A device used to record system activity.

main storage: * The general purpose storage of a computer. Contrast with *auxiliary storage*.

merge: (1) * To combine items from two or more similarly ordered sets into one set that is arranged in the same order. (2) A program or routine that performs this function.

microsecond: One-millionth of a second.

millisecond: One-thousandth of a second.

ML/MP: Multiline/multipoint. A communications facility of System/3 SCP.

MLTA: Multiple line terminal adapter.

modem: (1) * (Modulator-demodulator) A device that modulates and demodulates signals transmitted over communication facilities. (2) See also *data set* (2).

MOSFET: Metal oxide semiconductor field effect transistor. Type of main storage used in computers. Also referred to as FET (field effect transistor).

multitasking: The concurrent execution of one main task and one or more subtasks in the same partition.

multi-volume file: A file that requires more than one volume of a storage medium.

network: In teleprocessing, a number of communication lines connecting a computer with remote terminals.

object code: * Output from a compiler or assembler which is itself executable machine code or is suitable for processing to produce executable machine code.

object library: An area on a direct access storage device used to store object programs and routines.

object module: * A module that is the output of an assembler or compiler and is input to a linkage editor.

object program: * A fully compiled or assembled program that is ready to be loaded into the computer. Contrast with *source program*.

OCL: Operation control language.

offline: * Pertaining to equipment or devices not under control of the central processing unit.

online: * (1) Pertaining to equipment or devices under control of the central processing unit. (2) Pertaining to a user's ability to interact with a computer.

operating system: * Software which controls the execution, of computer programs and which may provide scheduling debugging, input/output control, accounting, compilation, storage assignment, data management, and related services.

operation control language: A programming language used to code operation control statements. Abbreviated OCL.

operation control statement: A statement in a job or job step that is used in identifying the job or describing its requirements to the operating system.

operator message: A message from the operating system or a user program directing the operator to perform a specific function, such as mounting a disk pack or informing him of specific conditions within the system, such as an error condition.

output: * (1) Pertaining to a device, process or channel involved in an output process, or to the data or states involved. (2) Same as output device. (3) Same as output data.

overlay linkage editor: See *linkage editor*.

overlay program: A program in which certain sections can use the same storage locations at different times during execution.

pack: (1) * To compress data in a storage medium by taking advantage of known characteristics of the data, in such a way that the original data can be recovered; for example, to compress data in a storage medium by making use of bit or byte locations that would otherwise go unused. (2) See *disk pack*.

parameter: (1) * A variable that is given a constant value for a specific purpose or process. (2) See *keyword parameter*.

partition: A subdivision of main storage.

permanent file: A disk file that is normally created for continuing use. Contrast with *scratch file*, *temporary file*.

point-to-point line: A line that connects a single remote station to the computer; it may be either switched or non-switched.

point-to-point transmission: Transmission of data directly between two points without the use of any intermediate terminal or computer.

PP: Program product.

primary track: On a direct access device, the original track on which data is stored. See also *alternate track*.

procedure: (1) * The course of action taken for the solution of a problem. (2) A set of job definitions, including operation control statements, stored in a source library.

processing unit: * A unit of a computer that includes the circuits controlling the interpretation and execution of instructions. Synonymous with main frame. Abbreviated CPU.

program level: A subdivision of main storage.

program library: * A collection of available computer programs and routines.

programming language: * A language used to prepare computer programs.

programming RPO: A customer request for a price quotation on alterations or additions to the functional capabilities of system control programming or program products. The RPO may be used in conjunction with *computing system RPO's* to solve unique data processing problems. Abbreviated PRPO.

program product: A licensed program that performs a function for the user and usually interacts with and relies upon system control programming. A program product contains logic related to the user's data and is usable or adaptable to meet his specific requirements.

random processing: The treatment of data with respect to its location in external storage, and in an arbitrary sequence governed by the input against which it is to be processed. Contrast with *consecutive processing, sequential processing*.

record: * A collection of related items of data, treated as a unit; for example, one line of an invoice may form a record; a complete set of such records may form a file.

remote job entry: Submission of job control statements and data from a remote terminal, causing the jobs described to be scheduled and executed as though encountered in the input stream. Abbreviated RJE.

restart: The process of resuming a job at a checkpoint within the job step that caused abnormal termination. See *checkpoint/restart facility*.

rollin/rollout: Same as rollout/rollin.

rollout/rollin: An optional feature of the operating system that allows the temporary reassignment of a main storage partition from one program to another.

routine: * An ordered set of instructions that may have some general or frequent use.

RPG II: Report program generator, version 2. A business-oriented data processing language.

RPQ: Request for price quotation. See *computing system RPQ, programming RPQ*.

scheduler: The part of a control program that reads and interprets job definitions, schedules the jobs for processing, and initiates and terminates the processing of job steps.

scratch file: A disk file that is normally created and deleted in the same job step. Contrast with *permanent file, temporary file*.

secondary storage: Same as *auxiliary storage*.

sector: The smallest addressable part of a disk storage device.

seek: To position the access mechanism of a direct access device at a specified location.

sequence: (1) * An arrangement of items according to a specified set of rules. (2) In sorting, a group of records whose control fields are in ascending or descending order, according to the collating sequence.

sequential organization: A file organization in which records are arranged in a physical sequence. The records are not necessarily in logical sequence. Contrast with *direct organization, indexed organization*.

sequential processing: A treatment of data with respect to its location in external storage, and in a sequence governed by the logical order of the data in the file. Contrast with *consecutive processing, random processing*.

simulation areas: Fixed data areas on the 3340 disk drives that simulate the 5444 disk areas.

SIOC: Serial input/output channel.

software: * A set of programs, procedures, and possibly associated documentation, concerned with the operation of a data processing system. Contrast with *hardware*.

source language: (1) * The language from which a statement is translated. (2) Used to code source statements.

source library: An area on a direct access storage device used to store source programs and procedures.

source module: The source statements that constitute the input to a language translator for a particular translation.

source program: * A computer program written in source language. Contrast with *object program*.

source statement: A statement written in symbols of a programming language.

stacked job processing: A technique that permits multiple job definitions to be grouped (stacked) for presentation to the system, which automatically recognizes the jobs, one after the other.

stand-alone program: A program that can be executed independently of an operating system.

statement: (1) * In computer programming, a meaningful expression or generalized instruction in a source language. (2) See *operation control statement*.

storage: * (1) Pertaining to a device into which data can be entered, in which they can be held, and from which they can be retrieved at a later time. (2) Loosely, any device that can store data. (3) Synonymous with memory.

supervisor: The part of a control program that coordinates the use of resources and maintains the flow of CPU operations.

switched line: A communication line in which the connection between the computer and a remote station is established by dialing. Synonymous with dial line.

SYSGEN: System generation.

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.

system generation: The process of tailoring the system control programming to suit a user's requirements and of including the desired program products.

system input device: A device specified as a source of input.

system log device: See *log device*.

system output device: A device assigned to record output data.

task: A unit of work for the central processing unit; therefore, the basic multiprogramming unit under the control program.

teleprocessing: The processing of data that is received from or sent to remote locations by way of telecommunication lines.

temporary file: A disk file that is normally created and deleted in the same job. Contrast with *permanent file*, *scratch file*.

track: The portion of a moving storage medium, such as a tape or disk, that is accessible to a given reading head position.

unit record devices: Card readers, card punches, and printers.

universal character set: A printer feature that permits the use of a variety of character arrays. Abbreviated UCS.

utility program: A program designed to perform an everyday task, such as copying data from one storage device to another.

variable-length record: (1) A record having a length independent of the length of other records with which it is logically or physically associated. Contrast with *fixed-length record*. (2) * Pertaining to a file in which the records are not uniform in length.

volume: (1) That portion of a single unit of storage which is accessible to a single read/write mechanism, such as a disk pack. (2) A recording medium that is mounted and demounted as a unit; for example, a reel of magnetic tape or a disk pack.

volume table of contents: A table on a disk volume that describes each file on the volume. Abbreviated VTOC.

VTOC: Volume table of contents.

work file: (1) In sorting, an intermediate file used for temporary storage of data between phases. (2) A temporary or scratch file generally used for the duration of one job or job step.

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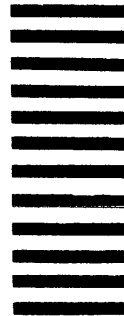
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