IBM System/3
Model 15
Introduction

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Model 15
Introduction

Sixth Edition (December 1978)

This is a major revision of, and obsoletes, GC21-5094-4. The manual has been extensively revised and should be reviewed in its entirety.

This edition applies to version 7, modification 00 of IBM System/3 Model 15 System Control Program 5704-SC1; to version 3, modification 00 of IBM System/3 Model 15 System Control Program 5704-SC2; and to all subsequent versions and modifications unless otherwise indicated in new editions or technical newsletters. Changes are periodically made to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest *IBM System/3 Bibliography,* GC20-8080, for the editions that are applicable and current.

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The purpose of this publication is to introduce the IBM System/3 Model 15 to new users of System/3 and to present users of other System/3 models.

For new users:

- Chapter 1, *System Summary*, briefly describes the devices available for System/3 Model 15, including a photograph of each device. Appendix A, *Configurations,* summarizes the various configuration options supported for the Model 15 and offers more detailed characteristics of the available devices.

- Chapter 2, in its first three sections (*Disk System Management, System Control and Service Programs,* and *Additional System Control Programming Functions*) describes the functions and capabilities of the system control programs supporting the Model 15.

- Chapter 3 summarizes the program products that are optionally available to System/3 Model 15 users.

  Note: In this publication, licensed programs are referred to as program products.

- Chapter 4 describes the role of the operator in controlling the operation of the system.

- Appendix B is a bibliography of publications that give more detailed information about devices and programs highlighted in this manual.

For users of other System/3 models, in addition to the preceding information:

- Chapter 2's *Controlling Program Processing* and *Controlling System Resources* sections discuss the major system control program functions that improve system throughput.

- Chapter 5 highlights the features of the Model 15 that distinguish it from other System/3 models.

- Chapter 6 discusses the compatibility between the Model 15 and other System/3 models with regard to system, operation, programs, and files.

The reader is expected to have a basic knowledge of data processing and fundamental System/3 concepts; the *Glossary* contains definitions of terms applicable to the System/3 Model 15.

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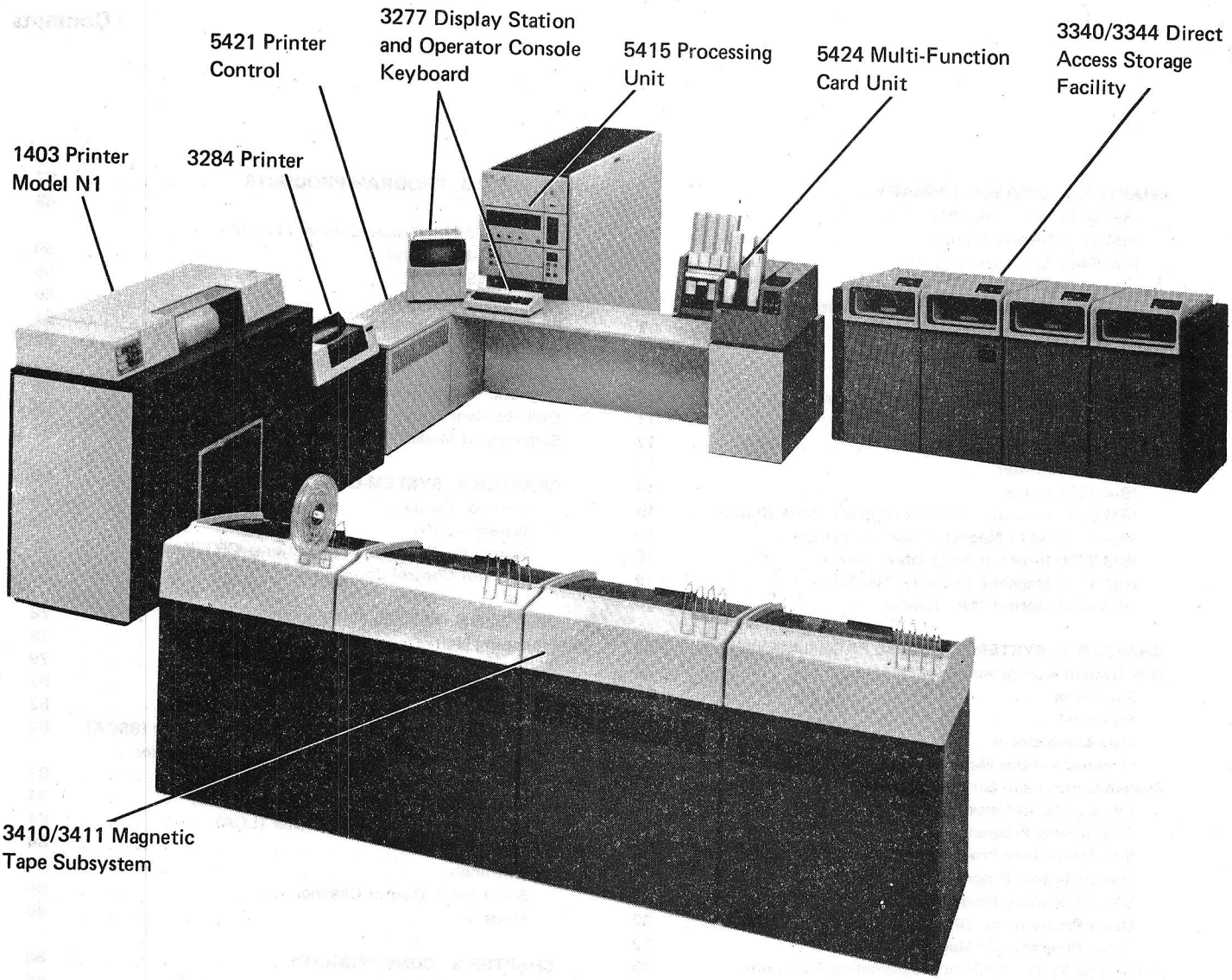


IBM System/3 Model 15

Chapter 1. System Summary

The IBM System/3 Model 15 is a disk-oriented general-purpose computer that offers a wide variety of I/O options and large storage capacities. This chapter highlights the devices available for the Model 15; see Appendix A, *Configurations,* for more detailed characteristics of the various devices and a summary of optional system configurations.

IBM 5415 Processing Unit

The IBM 5415 Processing Unit is available with these storage capacities:

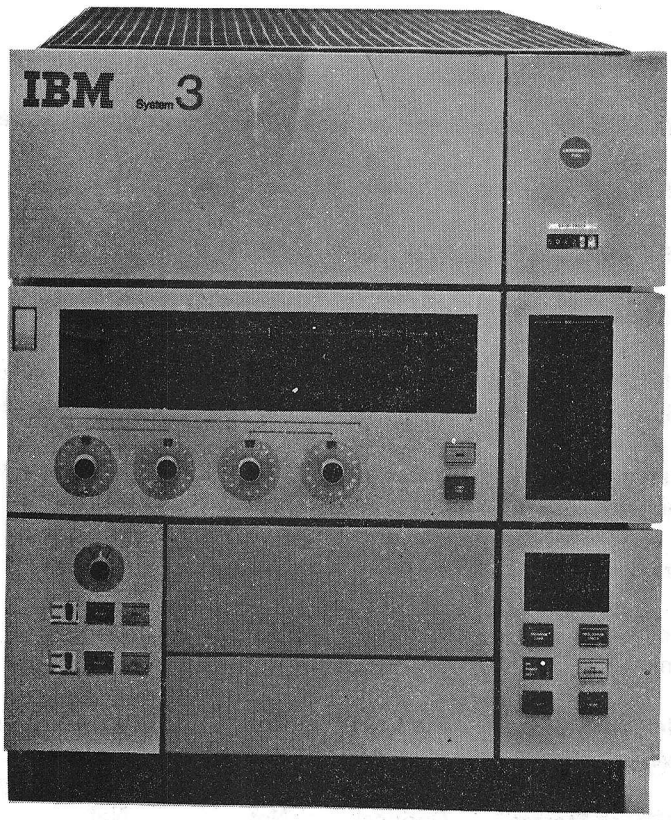
- 5415 A and B Models: 48K, 64K, 96K, or 128K
- 5415 C Models: 160K, 192K, 224K, or 256K
- 5415 D Models: 96K, 128K, 160K, 192K, 224K, 256K, 384K, or 512K

The IBM System/3 Model 15 has the same basic instruction set and access time as other System/3 models. For System/3 Model 15 features, see Chapter 5.

A minimum system is determined primarily by the main storage and disk storage requirements:

Storage	A Model	B Model	C Model	D Model
Main Storage (minimum)	48K	48K	160K	96K
5444 Disk Storage Drive	Required	Not applicable	Not applicable	Not applicable
5445 Disk Storage	Optional	Not applicable	Not applicable	Not applicable
3340 Direct Access Storage Facility	Not applicable	Required	Required	Required
3344 Direct Access Storage	Not applicable	Not applicable	Not applicable	Optional

For each of these models, a minimum system also includes a CRT/Keyboard, a 1403 Printer, and one of the following: 5424 MFCU, 2560 MFCM, 1442 Card Read Punch, directly attached 3741 Data Station, or directly attached 3741 Programmable Work Station.



IBM 5415 Processing Unit

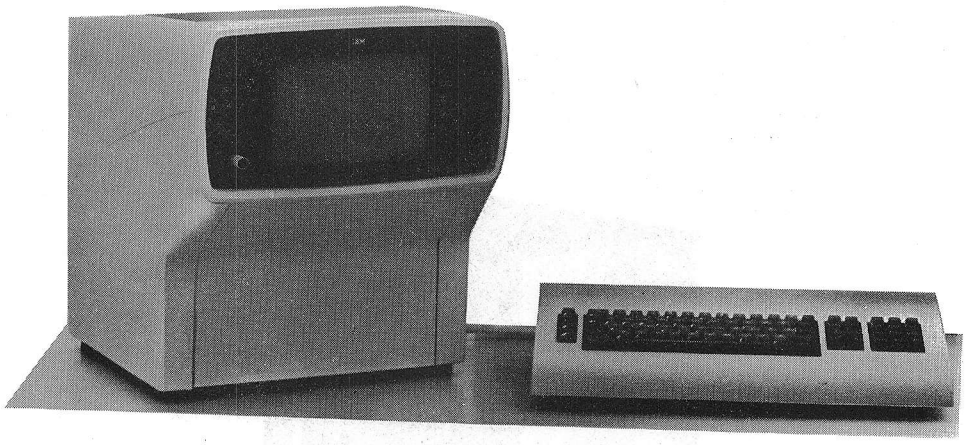
IBM 3277 Display Station

The System/3 Model 15 CRT/Keyboard is comprised of:

- An IBM 3277 Display Station Model 1 – A CRT (cathode-ray tube) screen
- Feature 4632 – A 78-key Operator Console Keyboard

The CRT/Keyboard is the operator/system communication device for Model 15 and is required on every system. It is attached directly to the processing unit and is located on the system table top. The CRT/Keyboard can be used for inquiry, secondary output, limited key entry of data, and operator/program interaction.

The CRT can display 480 characters—12 lines of 40 characters each. It supports a 64-character set (36 alphameric characters, 27 special characters, and a blank). The movable keyboard has a 78-key EBCDIC keyboard that includes 45 alphameric keys, 21 control keys, and 12 program function keys. As each character is keyed, it is displayed on the CRT.



IBM 3277 Display Station (CRT/Keyboard)

IBM 5444 Disk Storage Drive

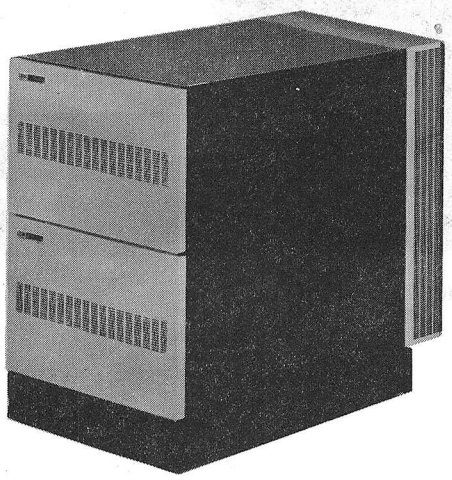
The IBM 5444 Disk Storage Drive provides System/3 Model 15 with direct access storage having capacities ranging from approximately 5 million to 10 million bytes.

The 5444 Model A2 has one permanent and one removable disk, while Model A3 has one removable disk. The 5444 uses the removable 5440 Disk Cartridges to provide essentially unlimited storage. Cartridges are interchangeable between Models A2 and A3.

Models A2 and A3 are the same high-speed access disk drives that are available on the System/3 Model 8 or 10.

5444 Disk Storage Drives can be attached to the 5415 Processing Unit (A Model only) to give data capacities as follows:

4.9 million bytes	One 5444 Model A2
7.35 million bytes	One 5444 Model A2 and one 5444 Model A3
9.8 million bytes	Two 5444 Model A2s



IBM 5444 Disk Storage Drive

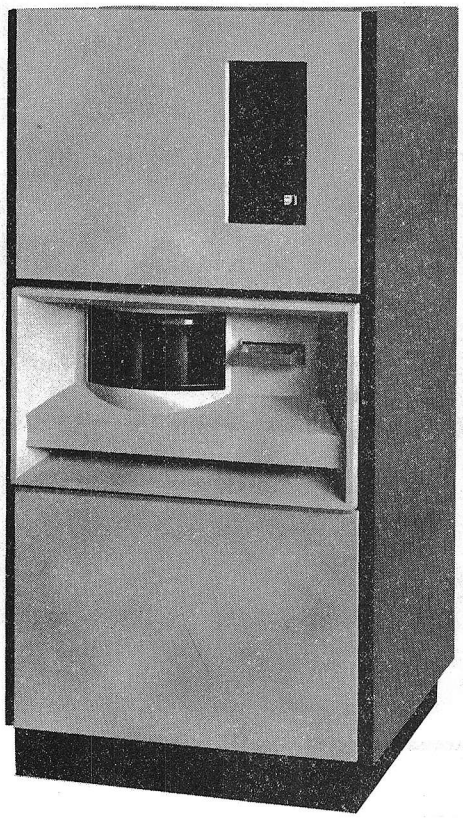
IBM 5445 Disk Storage

The IBM 5445 Disk Storage provides large capacity, high speed, direct access storage capacity for System/3 Model 15. The removable IBM 2316 Disk Pack is used on the 5445 to provide an online data capacity of 20.48 million bytes.

The 5445 Disk Storage is available in three models. The Model 1 contains the necessary controls for both the Model 1 and the Model 2. The Model 2 can be attached only to systems using a Model 1. The Model 3 resembles two Model 1's (side by side) and allows two disk packs to be online simultaneously.

5445 Disk Storage can be attached to the 5415 Processing Unit (A Model only) to give data capacities as follows:

20.48 million bytes	One 5445 Model 1
40.96 million bytes	One 5445 Model 1 and one 5445 Model 2, or One 5445 Model 3
61.44 million bytes	Two 5445 Model 1's and one 5445 Model 2, or One 5445 Model 1 and one 5445 Model 3
81.92 million bytes	Two 5445 Model 1's and two 5445 Model 2's, Two 5445 Model 3's, or One 5445 Model 1, one 5445 Model 2, and one 5445 Model 3



IBM 5445 Disk Storage Model 1

IBM 3340 Direct Access Storage Facility

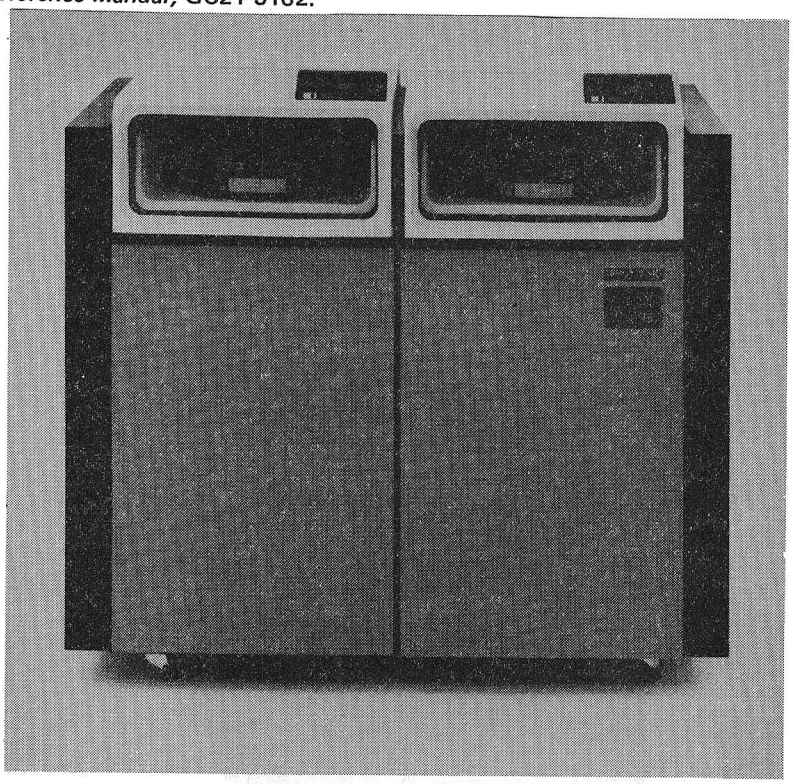
The 3340 Direct Access Storage Facility uses a removable IBM 3348 Model 70 Data Module and provides an online data capacity of 40.8 million bytes (excluding program storage and backup areas). The 3340 is available for all 5415 Processing Units Models B, C, and D.

When the 3340 Direct Access Storage Facility is used, one 3340 Model A2 is required; in addition, one 3340 Model B1 or B2 can be used.

The 3340 Direct Access Storage Facility can be attached as follows:

3340 Models	User Data Storage[1]	Programs, Backup, and Reserved Areas[1]
Model A2	81.6	21.3
Model A2 with Model B1	122.4	32.0[2]
Model A2 with Model B2	163.2	42.6[2]

For more information about disk storage facilities, refer to Chapter 5 in this manual. For the models 15B and 15C also refer to the *IBM System/3 Model 15 3340 Direct Access Storage Facility Reference Manual,* GC21-5111. For the Model 15D also refer to the *IBM System/3 Model 15 System Control Programming Concepts and Reference Manual,* GC21-5162.



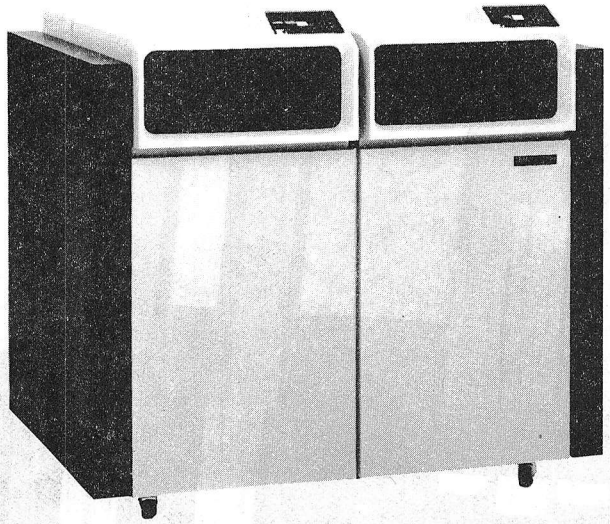
IBM 3340 Direct Access Storage Facility Model A2

[1] In millions of bytes.
[2] A data module used on Model B1 or B2 on System/3 Model 15D has less capacity.

IBM 3344 Direct Access Storage

The 3344 Direct Access Storage Model B2 is a two-drive unit that attaches to the 3340 Direct Access Storage Facility Model A2 on a 5415 Processing Unit Model D. The 3344 storage medium is permanently mounted and sealed within the drive as an integral component. The disk surfaces and read/write heads are incorporated into the drive; the density of recorded data is substantially increased; and important environmental stability is added.

The two drives of a 3344 provide approximately 365.7 million bytes of user data storage and 47.2 million bytes for programs, backup, and reserved areas.



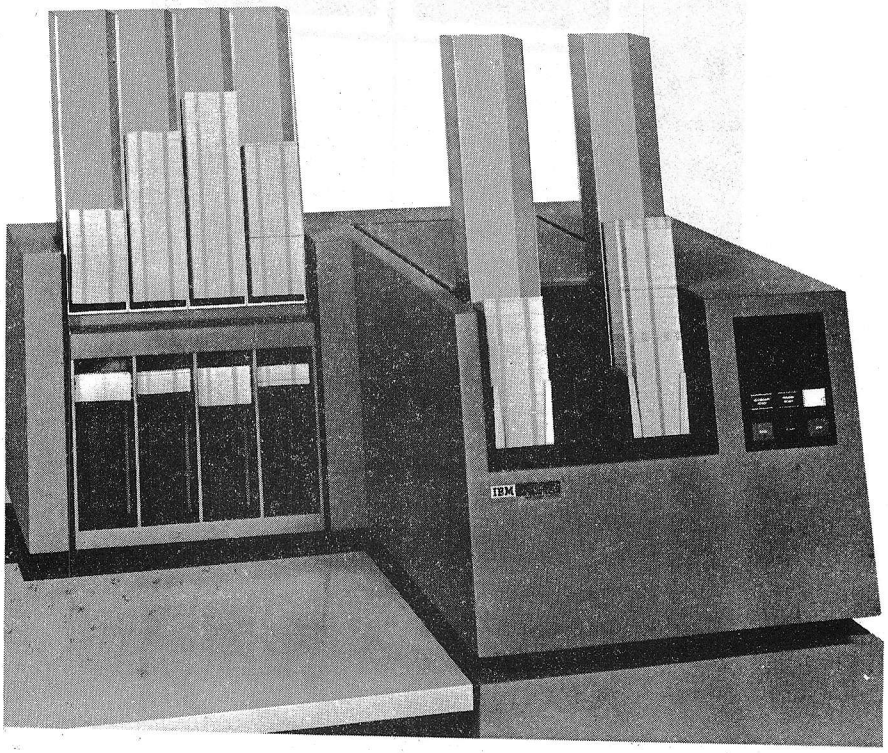
IBM 3344 Direct Access Storage Model B2

IBM 5424 Multi-Function Card Unit

The IBM 5424 Multi-Function Card Unit (MFCU) is a 96-column card device that performs the following functions:

- Reads or feeds cards from either of two hoppers. Model A1 reads 250 cards per minute; Model A2 reads 500 cards per minute.
- Punches cards at a rated speed of 60 cards per minute (Model A1) or 120 cards per minute (Model A2).
- Prints on cards at 60 cards per minute (Model A1) or 120 cards per minute (Model A2).
- Stacks cards in any of four stackers.

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



IBM 5424 Multi-Function Card Unit

IBM 1442 Card Read Punch

An IBM 1442 Card Read Punch Model 6 or Model 7 can be attached to the System/3 Model 15 to provide 80-column card reading and punching. Model 6 reads at 300 cards per minute and punches at 80 columns per second; Model 7 reads at 400 cards per minute and punches at 160 columns per second.

The following operations can be performed on the 1442:

- Read
- Punch with no feed
- Punch and feed
- Stack cards in either of two stackers
- Read column binary (card image)—supported only by the Basic Assembler

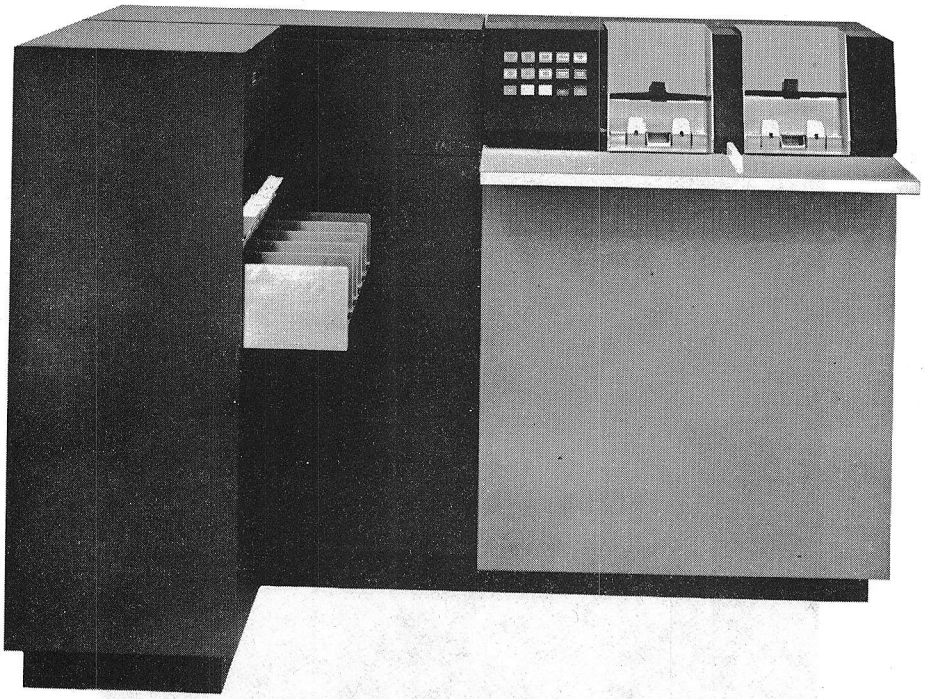
IBM 1442 Card Read Punch

IBM 2560 Multi-Function Card Machine

The IBM 2560 Multi-Function Card Machine (MFCM) is an 80-column card device available in two models, Model A1 and Model A2. The MFCM can:

- Read cards from either of two hoppers. Model A1 reads 500 cards per minute; Model A2 reads 310 cards per minute.
- Punch cards at a rated speed of 160 columns per second (Model A1) or 120 columns per second (Model A2).
- Print on cards (Model A1 with optional print feature) at 140 positions per second.
- Stack cards in any of five stackers (Model A1) or four stackers (Model A2).

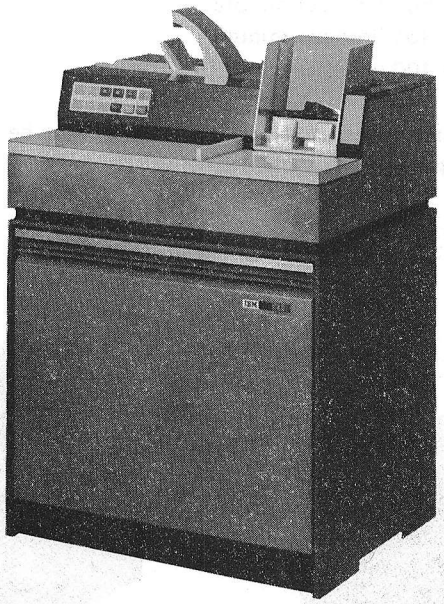
The MFCM can be used to match records within two files, merge two files, select records, or sort card files.



IBM 2560 Multi-Function Card Machine

IBM 2501 Card Reader

System/3 Model 15 supports two models (A1 and A2) of the IBM 2501 Card Reader. Models A1 and A2 read 80-column cards at a maximum rate of 600 and 1,000 cards per minute, respectively. The card image mode is supported only by the Basic Assembler.



IBM 2501 Card Reader

IBM 1403 Printer

The IBM 1403 Printer Model 2, 5, or N1 is required on every System/3 Model 15. It is attached via an IBM 5421 Printer Control Unit. Each model produces a print line with 132 print positions. The Universal Character Set special feature can be used to expand the basic set of 48 characters to as many as 120 characters.

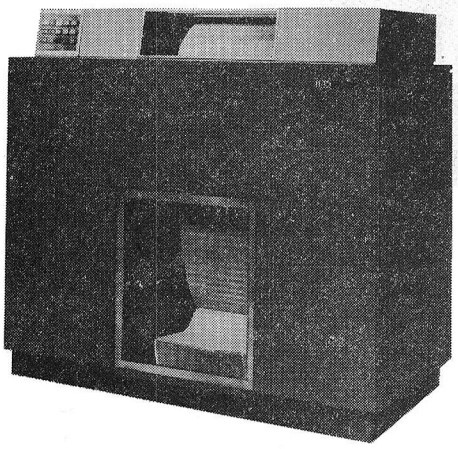
Note: Model 2 or 5 requires an Interchangeable Chain Cartridge Adapter special feature for installation of the Universal Character Set.

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

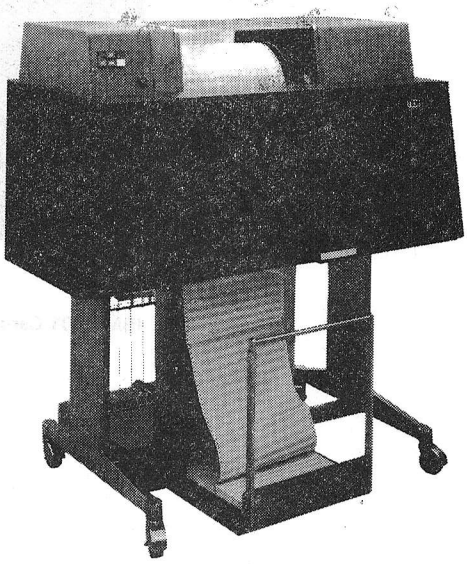
The 1403 printers use a type cartridge with 240 characters. The standard set of graphics, repeated five times on the cartridge, permits the rated throughput of the standard models. Rated throughput, based on a 48-character set with single-line spacing, is:

Model 2	600 lines per minute
Model 5	465 lines per minute
Model N1	1,100 lines per minute

A second 1403 printer, supported only by spooling, may be attached to a System/3 Model 15D; such attachment requires an RPQ.



IBM 1403 Printer Model N1



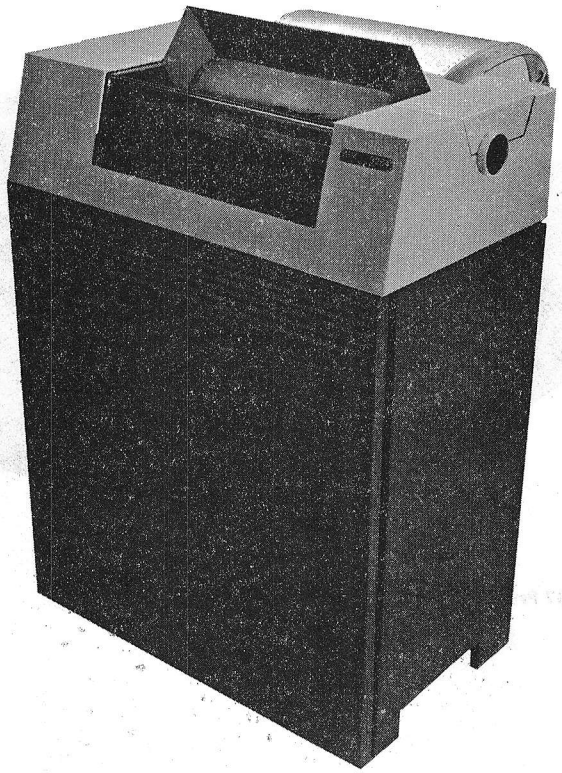
IBM 1403 Printer Model 2 and Model 5

IBM 3284 Printer

The 3284 Printer Model 1 can be attached to System/3 Model 15 as an auxiliary printer.

The primary use of the 3284 is to obtain hard copy output of system messages that appear on the CRT. The 3284 can also be used for low volume output of other programs.

The 3284 Printer uses a matrix print head and pin feed platen and has a rated speed of 40 characters per second. It uses a character set of 64 EBCDIC characters and can produce print lines of 120, 126, or 132 print positions.



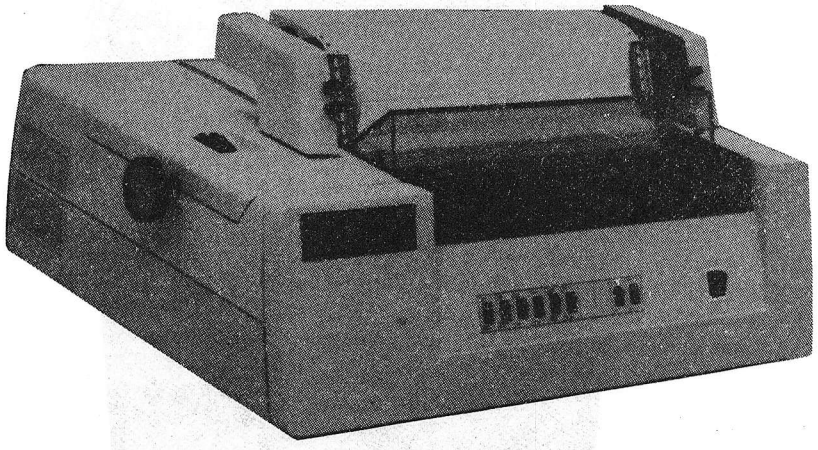
IBM 3284 Printer

IBM 3287 Printer

The 3287 Printer Model 1 or 2 can be attached to the System/3 Model 15 as an auxiliary printer.

The primary use of the 3287 is to obtain hard copy output of system messages that appear on the CRT. The 3287 can also be used for low volume output of other programs.

The 3287 Model 1 has a rated print speed of 80 characters per second; the 3287 Model 2 has a rated print speed of 120 characters per second. Each model features a desktop design for convenient placement, and provides improved forms handling, dual case printing, print option of 6 or 8 lines per inch, and print lines of 132 print positions.



IBM 3287 Printer

IBM 3741 Data Station/Programmable Work Station

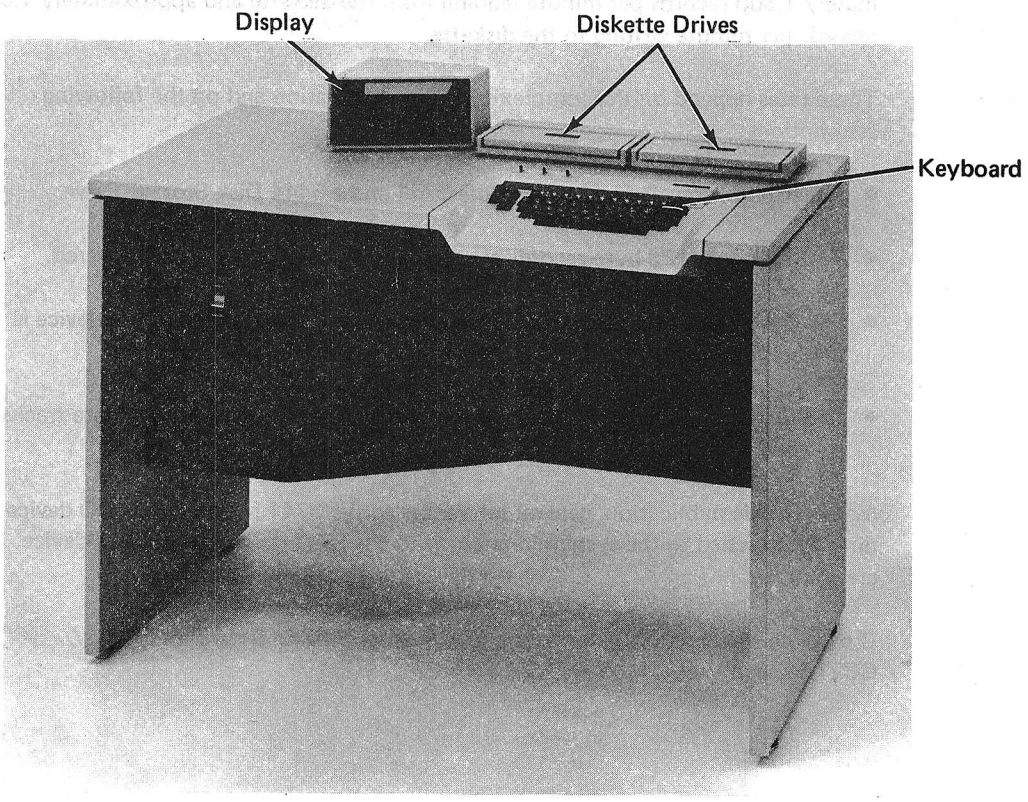
The 3741 can be used as:

- An offline data entry device (as part of the IBM 3740 Data Entry System)
- An online input/output device attached directly to the Model 15
- A terminal device in a communications environment

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

The 3741 Programmable Work Station, Model 3 or 4, provides additional functions beyond the scope of the 3741 Data Station. It has the capability to operate under the control of an application program written in Application Control Language (ACL). System/3 does not support this language; however, ACL can be used for offline applications.

One 3741 (Model 1, 2, 3, or 4) can be attached directly to the System/3 Model 15 to provide, in addition to the input or output of data, necessary system input and output functions, such as entering Operation Control Language. The Model 2 or 4 can also be used with System/3 Model 15 via its BSCA, BSCC, or LCA attachments for the input or output of data only.



IBM 3741 Data Station/Programmable Work Station

Characteristics of the four models of the 3741 are as follows:

Model 1 Data Station
A single data entry station; record size 1-128 characters; 10 program levels standard; 240-character (6 rows of 40 characters) CRT display; operator guidance.

Model 2 Data Station with BSC
Same functional characteristics as Model 1. Also includes a binary synchronous communications adapter; switched or nonswitched, point-to-point, or nonswitched multipoint; auto-answer, EBCDIC transparency standard (except when transmitting or receiving blocked data). Can be used as a remote terminal at 1,200, 2,000 or 2,400 bps over appropriate communications facilities.

Model 3 Programmable Work Station
Executes programs written in Application Control Language. Optionally can create object programs from source programs. Can operate with the same functional characteristics as a Model 1 when not under ACL program control.

Model 4 Programmable Work Station with BSC
Same functional characteristics as Model 3. Adds 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 directly attached to System/3 provides input/output rates of approximately 1,500 records per minute reading from the diskette and approximately 1,000 records per minute writing to the diskette.

These rates depend on the complexity of the application and on the following assumptions:

- Records are transferred between the 3741 and a 5444 Disk Storage Drive.
- For the 3741, 128-byte records are used and the device is double buffered.
- For the 5444, block size is 1,024 bytes (8 records per block) and the device is double buffered.
- The system is dedicated and the operation is error-free with no alternate tracks assigned on the disk.

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

(For more information, refer to the *IBM System/3 3741 Reference Manual,* GC21-5113.)

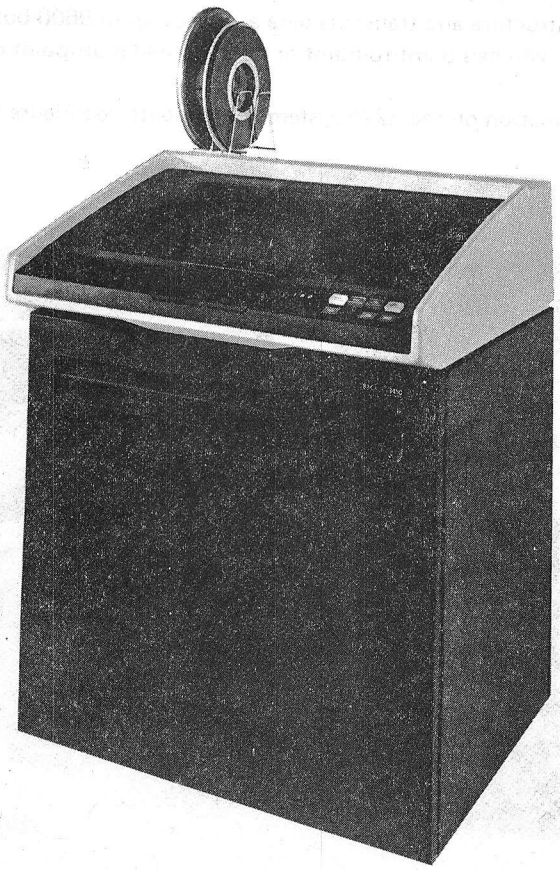
IBM 3410/3411 Magnetic Tape Subsystem

The 3410/3411 Magnetic Tape Units read from and write to half-inch magnetic tape. The 3410 is a tape unit only; the 3411 is a tape unit and a control unit in the same frame. From one to four tape units can be attached to System/3 Model 15.

The 3410/3411 Models 1, 2, and 3 have data rates of 20, 40, and 80 kilobytes per second, respectively. All units in a magnetic tape system must be the same model. Recording density can be 800 or 1,600 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 tape reels mounted horizontally rather than vertically. 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 subsystem.



IBM 3410 Magnetic Tape Unit

IBM 3270 Information Display System

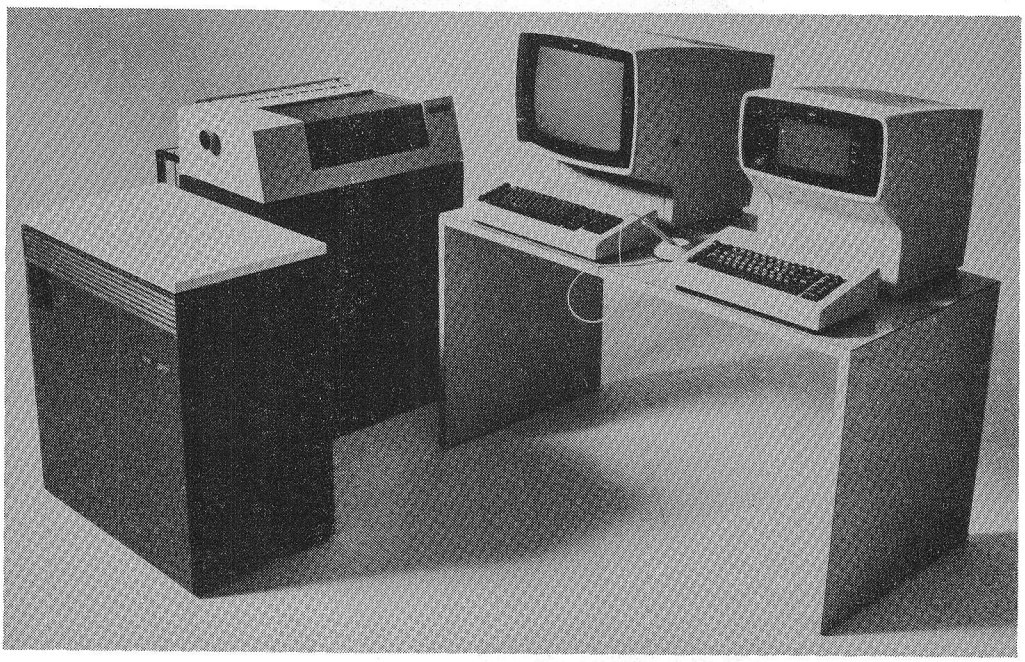
The 3270 Information Display System consists of display stations (screen and keyboard), printers, and control units. The system offers a choice of display sizes (480 or 1,920 characters), keyboards, and printer speeds (40 to 120 characters per second, 120 to 300 lines per minute, assuming a 64-character set).

The components of the 3270 are designed for many different data communication system configurations. The System/3 Model 15 supports the following:

3271 Control Unit
3274 Control Unit
3275 Display Station
3276 Control Unit Display Station
3277 Display Station
3278 Display Station
3284 Printer
3286 Printer
3287 Printer
3288 Line Printer
3289 Line Printer

The 3270 uses binary synchronous communications with either the ASCII or the EBCDIC code structure and transmits data at speeds up to 9600 bps. The 3270 can be used on switched point-to-point or nonswitched multipoint channels.

For more information on the 3270 system components, see Figure 21 in Appendix A.



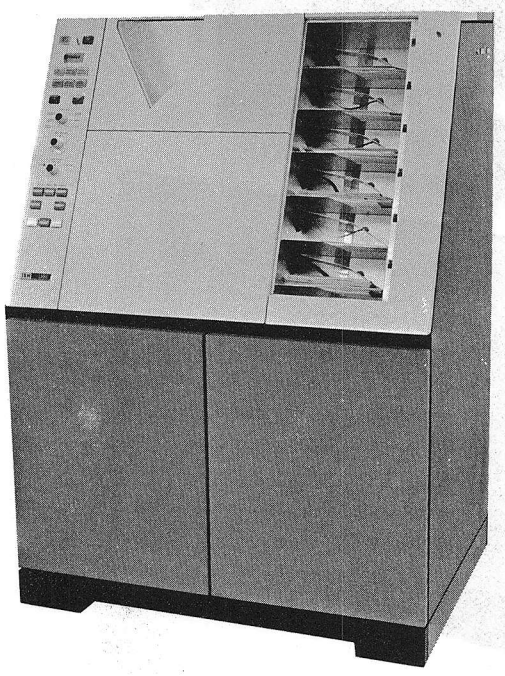
IBM 3270 Information Display System

IBM 1255 Magnetic Character Reader

The 1255 Magnetic Character Reader, available in three models, reads magnetically inscribed data from cards and paper documents. The 1255 has the following characteristics:

- Checks the readability of each magnetic character and special symbol
- Checks fixed-length fields to ensure that all numeric digits have been printed
- Processes intermixed paper and card documents
- Reads and/or sorts at the following rates:
  - Model 1: up to 500 6-inch documents per minute into six stackers
  - Model 2: up to 750 6-inch documents per minute into six stackers
  - Model 3: up to 750 6-inch documents per minute into twelve stackers

  Note: Actual sorting and processing speeds of all three models depend on length of document and complexity of system program.



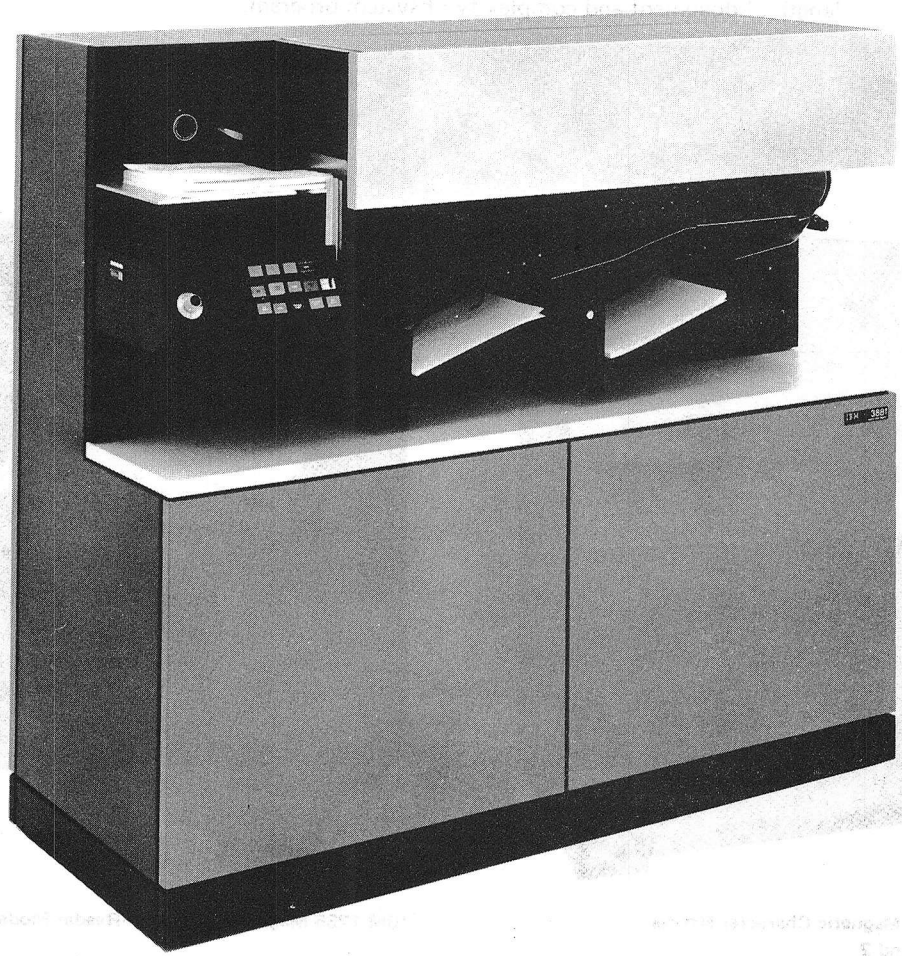
IBM 1255 Magnetic Character Reader Models 1 and 2

IBM 1255 Magnetic Character Reader Model 3

IBM 3881 Optical Mark Reader

The 3881 Optical Mark Reader Model 1 reads machine-printed and/or hand-marked data and has the following characteristics:

- Reads up to 6,000 documents per hour under control of the system control program.
- Reads data placed on data sheets with an ordinary number 2 pencil or by various IBM printers.
- Uses a format control sheet to load format control information into the 3881.
- Directs data sheets without errors to the main stacker. Data sheets with errors are directed to a separate stacker. Stacker selection is under control of the user program.



IBM 3881 Optical Mark Reader Model 1

Chapter 2. System Control Programming

The System/3 Model 15 System Control Program (SCP) consists of programs fundamental to the operation and maintenance of the system: disk system management programs and system control and service programs. These programs are stored in a library on disk and loaded into main storage for execution as required, as shown in Figure 1. Library storage can be on a 5444 Disk Storage Drive or in a 5444 simulation area on a 3340 Direct Access Storage Facility or 3344 Direct Access Storage.

An *object library* contains the system programs and program products; a *source library* contains source programs and operation procedures. These libraries can be on the same or different disks and can reside on a disk with data files.

System control programming for System/3 Model 15 is available as follows:

Program	Program/Feature Numbers	
	Models 15A, 15B, 15C	**Model 15D**
System Control Program	5704-SC1	5704-SC2
Communications Control Program	Feature 6033/6070 of 5704-SC1	Feature 6011 of 5704-SC2
MULTI-LEAVING Remote Job Entry Work Station Program	Feature 6001/6002 of 5704-SC1	Included in 5704-SC2

All Model 15 I/O units are supported by both SCPs, except:

5704-SC1 does not support 3344 Direct Access Storage

5704-SC2 does not support 5444 Disk Storage Drive or 5445 Disk Storage

DISK SYSTEM MANAGEMENT

For operation and support of the system and for execution of user programs, the disk system management consists of a supervisor, a scheduler, and data management facilities.

Supervisor

The supervisor is loaded into storage by the initial program loader, starting operation of the system. The supervisor controls overall system operations and provides the general functions required by the scheduler and all processing programs. The supervisor resides in the lowest area of storage throughout system operation, while the file share area (5704-SC2 only) always resides in the highest area of storage.

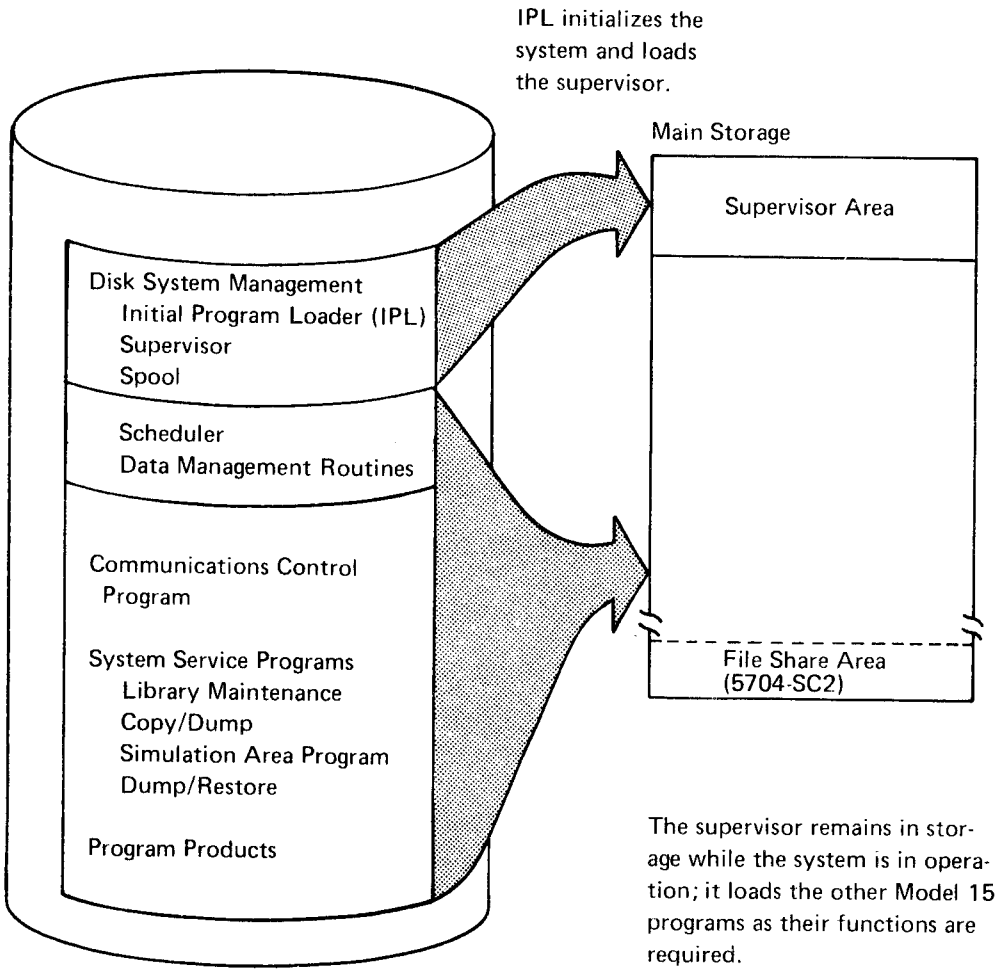


Figure 1. Storage of System/3 Model 15 Programs

Scheduler

The scheduler is loaded by the supervisor to initiate the execution of each new program and to establish which system facilities are to be evoked while that program is running.

Data Management

Data management routines provide an interface between the user program and the required data files. They can be included in problem programs to relieve the programmer of the detailed programming associated with the transfer of data between programs and auxiliary storage. SCP data management services are provided for disk, tape, card, diskette, printer, communication, and CRT files; in addition, a device-independent access method is available.

Disk Data Management

Sequential, indexed, or direct disk file organizations are supported for the 5444, 5445, 3340, and 3344 units; these files can be processed consecutively or randomly. The maximum number of files that can be stored is:

5444	50 per disk cartridge
5445	50 or 1,000 per disk pack
3340 and 3344	1,000 per main data area; 50 per simulation area

Indexed files are not allowed in simulation areas.

The following are supported by SCP disk data management routines:

- Records that span physical disk boundaries (sectors, tracks, cylinders). The user does not need to be aware of the physical boundaries when he writes programs to access the data.
- Record sizes from 1 byte to 32K bytes (a particular program, such as RPG II, can restrict the maximum size).
- Fixed-length records.
- Blocked or unblocked records.
- Blocking factor that can vary from program to program.
- Multivolume files (sequential or indexed multivolume files may be either online or offline, but direct multivolume files must be online).
- External buffers (5704-SC2 only)—Disk I/O buffers can be outside the object program but within the partition.
- File sharing—A single-volume disk file can be shared for certain access methods between partitions. By using 5704-SC2, a multivolume disk file can also be shared between partitions.

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 are supported by SCP tape data management:

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

Card I/O Data Management

The following are supported by SCP card data management for the respective I/O devices:

	Card I/O Device			
Function	**5424**	**2560[1]**	**1442**	**2501**
Reading				
Columns read per card	96	1-80	80	1-80
Unique EBCDIC characters	64	256	256	256
Punching				
Columns punched per card	96	1-80	1-80	–
Unique EBCDIC characters	64	256	256	–
Card printing				
Print positions per line	1-32	1-64	–	–
Print lines per card	4	25	–	–
Lines per print operation	0, 1, 2, 3, 4	0, 2, 4, 6	–	–
Unique EBCDIC characters	64	64	–	–
Deferred punch or print	Yes	Yes	–	–
Card image (column binary)	–	–	Yes	Yes
Feed	Yes	Yes	Yes	–
Stacker select	Yes	Yes	Yes	–
Single or double buffering	Yes	Yes	Yes	Yes
Combined file processing	Yes	Yes	Yes	–

[1]System/3 Model 15 support for the MFCM is compatible with System/360 Model 20 support except for certain stacker-select situations and read card image.

Diskette Data Management

The following are supported by SCP diskette data management:

Reading 1-128 positions
Writing 1-128 positions
Single or double buffering
Reading or writing, but not simultaneously
Reading or writing 256 EBCDIC characters
Reading or writing fixed-length records only
Processing only consecutive records

Printer Data Management

The following are supported by SCP printer data management:

	Printer		
Characteristic	**1403**	**3284**	**3287**
Print line positions	132	120, 126, or 132	132
Skip to line number before or after print	Yes	Yes	Yes
Space before print	0, 1, 2, or 3	0, 1, 2, or 3	0, 1, 2, or 3
Space after print	0, 1, 2, or 3	1, 2, or 3	1, 2, or 3
Page overflow detection	Yes	Yes	Yes
Unique EBCDIC characters	64	64	64
Printable graphics	No limit[1]	64	64
Universal character set	Optional	No	No

CRT/Keyboard Data Management

The 3277 Display Station Model 1 is supported by data management for output records and, in conjunction with the 78-key Operator Console Keyboard, for input and update records. The top seven lines (40 positions each) of the CRT screen are used. Because the last position is reserved for system use, a maximum area of 279 positions is available. Data can be displayed with any of the 64 EBCDIC characters allowed by the 3277 Display Station Model 1.

[1] Depends on print train or chain used.

Device-Independent Data Management

A sequential file that uses device-independent data management can be assigned at program execution time to one of the following devices: 1403 Printer, 3284 Printer, 3287 Printer, 5424 MFCU, 2560 MFCM, 1442 Card Read Punch, 2501 Card Reader, 3741 Data Station or Programmable Work Station, 5444 and 5445 Disk Storage (5704-SC1 only), 3340 Direct Access Storage Facility, 3344 Direct Access Storage (5704-SC2 only), or 3410/3411 Magnetic Tape Subsystem.

For device-independent data management, the following are supported:

Double buffering
MFCU or MFCM card print
Fixed-length record processing
EBCDIC data format
Multivolume tape file processing

The following are not supported:

Stacker select
Forms control
Updating records
Adding records
Combined file processing
Multivolume disk file processing
Variable length record processing
Deferred open of tape files
ASCII data format

Communications Management

Five communications interfaces are provided (refer to Figure 20 for the terminals supported by these interfaces; also see *Communications* in Chapter 5).

- RPG II Telecommunications (BSCA) – A function of the RPG II program product
- RPG II 3270 Display Control Feature – A separately orderable feature for the RPG II program product 5704-RG1
- BSCA Multiline/Multipoint (ML/MP) – A function of SCP
- Multiple Line Terminal Adapter (MLTA) IOCS – Programming support for a hardware RPQ
- Communications Control Program (CCP) – A function of SCP

SYSTEM CONTROL AND SERVICE PROGRAMS

The SCP provides system control and service programs to enable the user to prepare and maintain system libraries and data files and to perform basic functions necessary for the operation of the system and the maintenance of application programs. These system control and service programs can be executed in a multiprogramming environment, although resource contention may prevent some functions from being executed.

The programs distributed with SCP 5704-SC1 (applicable to System/3 Model 15A, 15B, or 15C) are designed to be used only with that SCP. Programs distributed with 5704-SC2 (applicable to Model 15D) are designed to be used only with that SCP.

System control and service programs and their minimum main storage requirements are as follows:

Program	Main Storage Required
Library maintenance	10K
Copy/dump	10K
Simulation area program	10K
Dump/restore	8K
Disk service programs:	
Alternate track assignment	8K
Alternate track rebuild	8K
Disk initialization	8K
File and volume label display	
50-file VTOC	8K
1,000-file VTOC	10K-18K
File compress	10K
File delete	8K
Reassign alternate track	8K
Recover index	10K
Spool file copy (5704-SC2 only)	10K-14K
System history area display	8K
1,000-file VTOC conversion	8K
5445 data interchange (5704-SC1 only)	8K
Configuration record program (5704-SC2 only)	8K
Chain cleaning	8K
Tape service programs:	
Tape error summary	8K
Tape initialization	8K
Overlay linkage editor	10K
Macro processor	12K
Checkpoint/restart	8K

In addition to the preceding programs, a certain number of CE (customer engineering) diagnostics may be included in your object library. The concurrent CE diagnostics run under control of the SCP on the Models 15B, 15C, and 15D; they can be executed in a batch partition while other jobs are running in another partition. These programs are used to perform selected tests on I/O devices without requiring a dedicated system. Main storage requirements are 10K to 14K, depending on the function selected.

Library Maintenance Program

The library maintenance program allows the user to produce, maintain, and service the system disk and the source and object program libraries. The principal functions of the library maintenance program are to:

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

The library maintenance program supports the 5444 Disk Storage Drive, 5444 simulation area of a 3340 Direct Access Storage Facility or 3344 Direct Access Storage, printer, card I/O, diskette I/O, and CRT/Keyboard. 5445 Disk Storage or 3340/3344 main data area can be used for the library-to-file or file-to-library copy functions or for work area for the allocate function.

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 on disk, tape, card, diskette, or printer.
- Provide a method of moving files from one location to another on disk, allowing both file limit modification and reorganization.
- Support one input and one output per execution.
- Support sequential, indexed, or direct disk files as input.
- Support copy of a sequential file to an indexed file or a direct file.

- Support tape files and card files for input and output.
- Support a diskette file for either input or output.
- Allow printer output in addition to tape, disk, card, or diskette output.
- Support the deletion of records from files through the specification of a deletion code and position within each record. The deleted records can be printed.
- Allow output record length different from input record length.
- Allow an input file to be specified using cylinder/head address, rather than file name, as an aid in file recovery.

The volume-to-volume routines allow the user to copy an entire volume to another volume for backup. The following combinations are supported:
- 5444 to 5444
- 5445 to 5445
- 3340 main data area to 3340 main data area
- 3340 main data area to 3344 main data area
- 3344 main data area to 3344 main data area
- 3344 main data area to 3340 main data area (if there are no files beyond cylinder 166 on the 3344)
- 5444 simulation area to 5444 simulation area (F1, R1, F2, R2 only)

Simulation Area Program

The simulation area program is used to support the 5444 simulation areas of a 3340 or 3344. The following functions can be performed:

- Copy the entire contents of one simulation area to another simulation area.
- Move the entire contents of one simulation area to another simulation area, clearing the area from which the contents were moved.
- Clear all data from a simulation area.
- Change the name of a simulation area.
- Print and/or display the name of each online simulation area and main data area.
- Copy IPL records from one volume to another volume.

Dump/Restore Program

The dump/restore program copies (dumps) a disk volume to magnetic tape and, if necessary, restores a disk from a tape previously created by this program. In addition, a 5444 or 5444 simulation area can be dumped to or restored from diskettes on a 3741. One execution of the dump/restore program can dump one of the following:

From	To
5444 Disk Storage Drive	Tape or diskette
5445 Disk Storage	Tape
3340 Direct Access Storage Facility	
– Main data area	Tape
– 5444 simulation area (F1, R1, F2, R2)	Tape or diskette
3344 Direct Access Storage	
– Main data area	Tape
– 5444 simulation area (F1, R1, F2, R2)	Tape or diskette

One execution of the dump/restore program can restore one of the following:

Backup Dumped From	Can Be Restored To
5444	5444 or 5444 simulation area (F1, R1, F2, R2) on 3340 or 3344
5444 simulation area	5444 or 5444 simulation area (F1, R1, F2, R2) on 3340 or 3344
5445	5445
3340 main data area	3340 or 3344 main data area
3344 main data area	3344 main data area or 3340 main data area (if there are not files beyond cylinder 166)

Spool File Copy Program (5704-SC2 only)

The spool file copy program is used to access the spool queues from a program partition—either a batch partition or a CCP partition. With this program, the user can perform the following functions:

- Copy the $SPOOL file to disk or tape
- Copy jobs into the reader queue from a file, terminal, or the system input device
- Copy print steps to a file
- Copy punch steps to a file
- Copy reader queue jobs to a file
- Restore print or punch file to a physical device or to the spool queue
- Copy the spool queue status display to a file or terminal

Other Programs for Disk Storage Devices

- Alternate Track Assignment – Assigns an alternate track in place of a defective one and prints the data content of the area in error.
- Alternate Track Rebuild – Corrects data on the assigned alternate track.
- Disk Initialization – Performs surface analysis on the user's disk and formats the disk according to disk system management requirements.
- File and Volume Label Display – Prints the entire volume table of contents (VTOC) of a disk or the information pertaining to a single file.
- File Compress – Moves files on a main data area, or to another main data area, such that the gaps between the files are collected into one contiguous space.
- File Delete – Deletes temporary or permanent data files from a disk.
- Reassign Alternate Track – Allows a 3340 data module to be initialized and used on System/370.
- Recover Index – Updates the VTOC entry of an indexed file to reflect added records in case of abnormal program termination.
- System History Area Display – Permits the user to copy the contents of the system history area to a printer or to a device supported by device-independent data management.
- 1,000-File VTOC Conversion – Converts the capacity of a 5445 VTOC from 50 to 1,000 or from 1,000 to 50 for use of the disk pack on both Model 10 and Model 15. Also compresses the entries in a 1,000-file VTOC on a 5445, 3340, or 3344.
- 5445 Data Interchange Utility (5704-SC1 only) – Allows 2316 Disk Packs to be interchanged between System/3 and System/360 or System/370.
- Configuration Record Program (5704-SC2 only) – Allows certain changes to be made to the configuration record on disk without the need to perform another system generation. Also sets some default values that are not set during system generation.
- Chain Cleaning – Exercises the 1403 printer for the purpose of cleaning the print chain or train.

Other Programs for Magnetic Tape

- Tape Error Summary – Prints tape error statistics that have been accumulated during processing.
- Tape Initialization – Creates or deletes standard tape volume labels, checks for unexpired files, and displays existing volume and data file labels.
- Transaction Logging – Writes user-specified data records to the tape as an audit trail of system activities.

ADDITIONAL SYSTEM CONTROL PROGRAMMING FUNCTIONS

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 punched into cards or written to a diskette. Overlay structures can be created automatically or as designated by the user. The overlay linkage editor is used by the RPG II, COBOL, and FORTRAN IV compilers, the Basic Assembler, the system generation procedures, the CCP format generation routines, and the CCP/Disk Sort program.

Memory-resident overlays, an optional function of the overlay linkage editor, allow the user to increase the performance of programs using overlays. When compiling programs or when executing the overlay linkage editor, the user can select this option to allow certain overlay segments to remain in main storage after the first reference. Subsequent requests for the overlay segments are to main storage rather than to disk storage. If an overlay is not used by the program, it will not occupy main storage space.

System Generation

When installing a system, the user performs a system generation (sysgen) to create a supervisor and data management support for his particular configuration, and to include the program products he has ordered. During system generation, the source library, object library, and system history area are established. The characteristics of the required spooling support are also defined.

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, as well as support for general I/O; CRT/keyboard; and unit record, disk, and tape devices.

Support of Rollout/Rollin Capability (5704-SC1 Only)

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

- Supported in program partition 1 only.
- Supported by RPG II, COBOL, and FORTRAN IV.
- Available to Basic Assembler users.
- Not supported for sorts, utilities, or system control and service programs.

Support of 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 partition 1 only, by COBOL and Basic Assembler object programs. (The Tape Sort program uses its own checkpoint/restart facilities rather than those provided by the SCP.)

Checkpoint/restart cannot be used in programs for which input or output is being spooled or in programs being executed under control of CCP. With 5704-SC2, checkpoint/restart cannot be used in programs with external disk I/O buffers or in programs greater than 48K. Also, a checkpoint request is ignored if a disk file is open with file sharing specified.

System Input Device

The system input device, or READER, is used to read:

- OCL statements
- Control statements for system control and service programs
- Source statements for the macro processor and program products
- Relocatable input and control statements for the overlay linkage editor
- Specifications for program products
- Object programs under control of the SCP by means of the LOAD * statement
- Input for the modify and reader-to-library functions of the library maintenance program

One of the following devices can be assigned as the reader:

3277 Display Station (CRT/Keyboard used as system console)
5424 MFCU (primary or secondary hopper)
2560 MFCM (primary or secondary hopper)
1442 Card Read Punch
2501 Card Reader
3741 Data Station (directly attached)
3741 Programmable Work Station (directly attached)

System Punch Device

The system punch device, or PUNCH, is used to provide:

- Optional output from the overlay linkage editor
- Output from the library-to-punch function of the library maintenance program

One of the following devices can be assigned as the punch:

5424 MFCU (primary or secondary hopper)
2560 MFCM (primary or secondary hopper)
1442 Card Read Punch
3741 Data Station (directly attached)
3741 Programmable Work Station (directly attached)

MAIN STORAGE REQUIREMENTS

Supervisor Requirements for 5704-SC1 (Model 15A, 15B, 15C)

For SCP 5704-SC1, the minimum main storage requirement for the supervisor is 18K bytes, which supports multiprogramming and:

All available main storage sizes
One or two 5444 disk drives (Model 15A only)
One to four 5445 disk units (Model 15A only)
One 1403 printer
One CRT/Keyboard
One 5424 MFCU or 2560 MFCM
One 2501 Card Reader
One 1442 Card Read Punch

Spooling support adds from 7K to 18K bytes to this requirement, depending on the devices and partitions selected for spooling. For example, with 7K spooling support, printer output from one partition can be spooled. Thus, with 7K of spooling, the minimum supervisor size is 25K bytes.

Additional supervisor main storage is required to support:

3340 Direct Access Storage Facility (Model 15B or 15C only)
3410/3411 Magnetic Tape Subsystem
3284 or 3287 Printer
3741 Data Station or Programmable Work Station, directly attached
Communications
Memory-resident overlays
Interval timer
Unit record restart
I/O storage protection
Serial I/O channel

Additional information regarding storage requirements is in the *IBM System/3 Model 15 System Generation Reference Manual,* GC21-7616.

Supervisor Requirements for 5704-SC2 (Model 15D)

For 5704-SC2, the minimum main storage requirement for the supervisor is 22K bytes, which supports three-partition multiprogramming and:

All available main storage sizes
Two, three, or four drives of the 3340 Direct Access Storage Facility
Two drives of the 3344 Direct Access Storage
One 1403 printer
One CRT/Keyboard

The requirement for spooling depends on the devices and partitions selected for spooling. For example, approximately 7K is required to support spooling of printer output from one partition. Approximately 21K is required for maximum spool support.

Additional supervisor main storage is required to support:

5424 MFCU or 2560 MFCM
2501 Card Reader
1442 Card Read Punch
3410/3411 Magnetic Tape Subsystem
3284 or 3287 Printer
Second 1403 Printer
3741 Data Station or Programmable Work Station, directly attached
Communications
Memory-resident overlays
Interval timer
Unit record/extended restart
I/O storage protection
Serial I/O channel

In addition to the resident supervisor requirements listed above, a resident file share common area is also required. This area is a minimum of 2K and resides at the upper limit of main storage.

User Program Requirements

The minimum usable partition size is 8K, with no upper limit, except as determined by the size of the system and supervisor. (If partition 2 or 3 is not used, its size may be set to 0.) Programs to be executed in a non-CCP partition can be up to 48K using 5704-SC1; they can be up to 56K using 5704-SC2 depending on supervisor requirements selected during system generation. Tasks running under control of CCP can range from 4K to 32K

Several techniques allow effective use of available resources:

- Overlays: If a compiled RPG II program cannot fit into the specified storage size, the SCP automatically attempts to generate overlays. The COBOL and FORTRAN user can segment large programs.

- Memory-resident overlays: This compiler option to the overlay linkage editor allows overlays to reside in main storage outside the object program but within the partition. (See *Overlay Linkage Editor* in this chapter.)

- External buffers: This compiler option allows disk I/O buffers to reside outside the object program but within the partition.

CONTROLLING PROGRAM PROCESSING

Operation Control Language

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. Operation control language statements specify:

- System information and options

- Assignment of system devices

- Whether programs are to be compiled, link-edited, and/or executed

- The library or device from which the user or system program is to be loaded

- The files to be processed and the locations of these files

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

A LOAD, CALL, or INCLUDE statement can be conditioned such that the related program or procedure is executed or bypassed, depending on the setting of external program switches (5704-SC2 only).

Figure 2 illustrates the variety of options that the user can specify in OCL on the Model 15.

Statement Identifier	Keyword	Explanation
// ASSIGN		Reassigns simulation areas F1, R1, F2, R2 (5704-SC2 only).
// BSCA	LINE	Allows change of BSCA line to 1 or 2.
// CALL		Identifies an OCL procedure.
// COMPILE		Specifies, for program compilations:
	ATTR	Type of memory-resident overlay program
	LINKADD	Link-edit start address of compiled program
	OBJECT	Location of object program
	SOURCE	Name of source program
	UNIT	Location of source program
// DATE		Sets system or partition date.
// FILE		Describes data files to be used in program:
	ASCII	Recording mode for tape
	BLKL	Tape block length
	CONVERT	Tape data conversion
	DATE	Date of file
	DEFER	Deferred mount of tape files
	DENSITY	Density of tape
	END	End of job tape option
	HIKEY	Used for multivolume indexed files
	LABEL	Name of file on disk or tape
	LOCATION	Location of file on disk
	NAME	Name of file in program
	PACK	Name of disk pack
	PARITY	Tape parity
	PRINT	Card print option
	RECFM	Tape record format
	RECL	Tape or diskette record length
	RECORDS	Number of records in disk file
	REEL	Labeled or unlabeled tapes (reel name)
	RETAIN	Retention code
	SEQNUM	Relative position of tape file
	SHARE	Share file between partitions (5704-SC2 only)
	SPLIT	Split cylinder files on 5445
	TRACKS	Number of tracks in disk file
	TRANSLATE	Tape data translation
	UNIT	Unit containing file
	VERIFY	Write verify option for 3340/3344

Figure 2 (Part 1 of 3). System/3 Model 15 OCL Options

Statement Identifier	Keyword	Explanation
// HALT		Specifies halt on system errors or end of program.
// IMAGE		Changes printer chain image.
// INCLUDE		Identifies source library member containing OCL to merge into job stream (5704-SC2 only).
// JOB		Specifies, in first statement of a job:
	CORE	Amount of main storage required
	PARTITION	Which partition is to be used
	PRIORITY	Priority of the job
	SPOOL	Whether job is to be spooled
// LOAD		Identifies program to be executed:
		Object program is in system input device (LOAD *).
		Object program is in object library (LOAD name).
		Object program is in a disk file (LOAD *,name) (5704-SC2 only).
// LOG		Changes system logging device: CONSOLE, EJECT, NOEJECT, 1403, 3284
// NOHALT		Specifies no halt at end of program:
	SEVERITY	Specifies severity level of default overrides.
// PAUSE		Causes halt and wait for operator.
// PRINTER		Describes system print device:
	ALIGN	Forms alignment
	COPIES	Number of copies
	DEFER	Begin printing at end of program
	DEVICE	Type of printer
	FORMSNO	Identifies forms type
	LINES	Number of lines per page
	PRIORITY	Priority of job step on print queue
	CLOSE	Prevents closing spool step at end of step (5704-SC2 only)
	QCOPY	Prevents $QCOPY from accessing step (5704-SC2 only)

Figure 2 (Part 2 of 3). System/3 Model 15 OCL Options

Statement Identifier	Keyword	Explanation
// PUNCH		Describes system punch device:
	CARDNO	Card type
	COPIES	Number of copies
	DEFER	Begin punching at end of program
	DEVICE	Changes system punch device: MFCM, MFCU, 1442, 3741
	PRIORITY	Priority of job step on punch queue
	QCOPY	Prevents $QCOPY from accessing step (5704-SC2 only)
// READER		Changes system input device: CONSOLE, MFCM, MFCU, 1442, 2501, 3741
// RUN		Indicates end of OCL for a program.
// SWITCH		Sets user program switches.
/.		Acts as job stream delimiter.
/&		Acts as job step delimiter.
/*		Indicates end of input data file.
*		Indicates comments.

Figure 2 (Part 3 of 3). System/3 Model 15 OCL Options

Step Mode and Job Mode

System/3 Model 15 provides the user with two program processing modes: step mode and job mode.

A *step* is a specific program to be executed and the description of the resources required by that program.

A *job* is a group of related programs (steps) to be executed in a sequential manner.

Note: On other System/3 models, the execution of a single program is often called a *job.*

Defining a series of related steps as a single job may sometimes be required or it may otherwise provide specific advantages. For instance, multiple steps within a single job would be preferred when execution of a later step is directly dependent upon successful completion of an earlier step. If a step terminates abnormally, the remaining steps in the job are bypassed.

The beginning of a job is always indicated by a JOB statement. A succession of jobs presented to a computer is a job stream. Within each job, one or more programs (steps) may be executed. These steps can be programs supplied by IBM, such as a compiler that translates a source program into object code, or an application program that is already in executable format and processes data files.

Step mode processing is indicated by the absence of JOB statements. This is the mode of processing used on other System/3 models.

Figure 3 shows an example of executing programs in job mode. The sample job stream is composed of two jobs, one with four steps and the other with three.

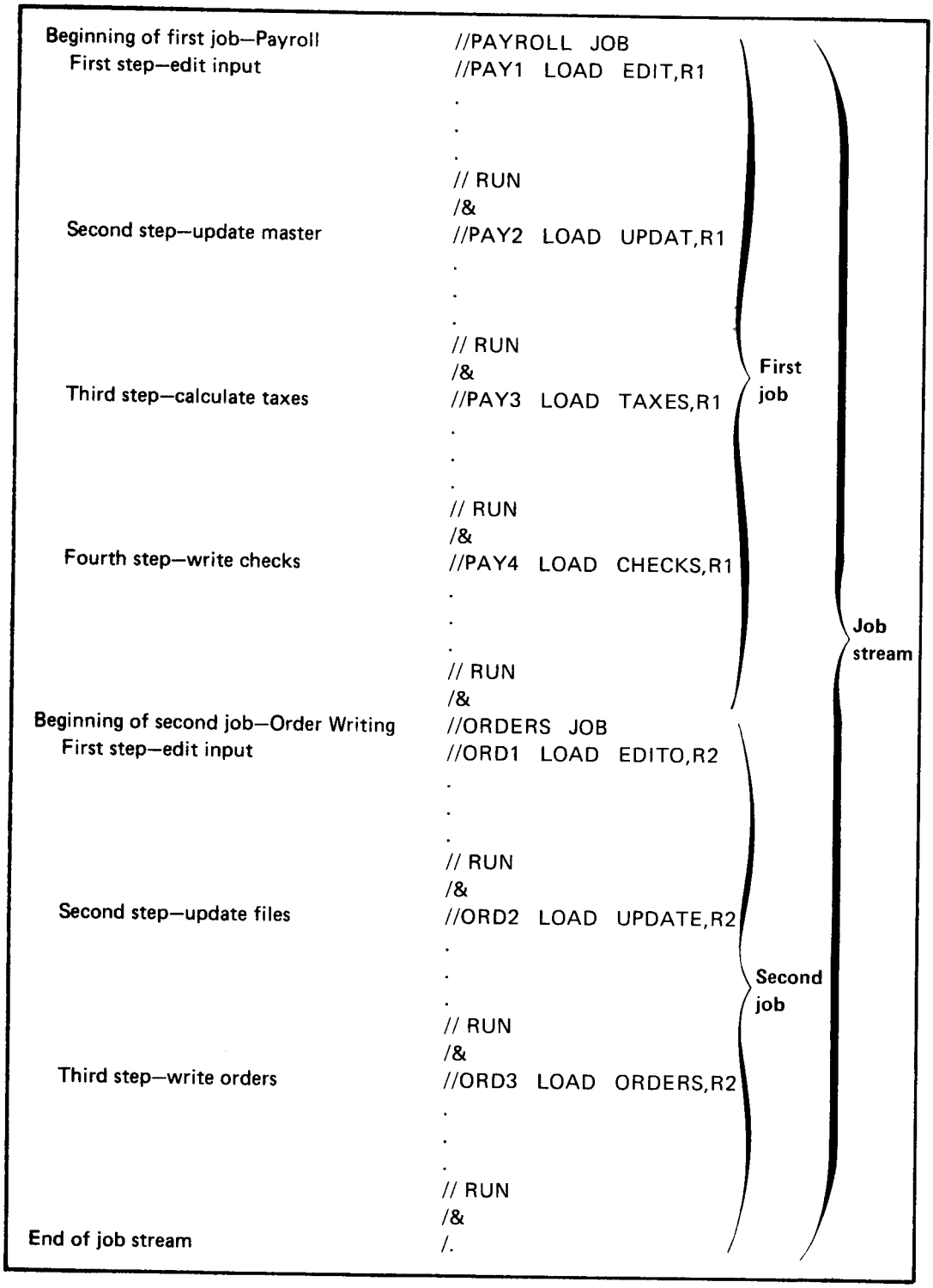


Figure 3. Example of Executing Programs in Job Mode

Messages, Defaults, and Severity Levels

System/3 Model 15 uses the CRT to display halt codes or messages. These messages indicate incorrect program operation, machine errors, or, in some cases, information or instructions. When a message requires operator action, the operator enters the necessary response by means of the keyboard. The response is displayed on the CRT, and the message and its response are stored in the system history area on disk.

When the system is initially loaded (IPL), nohalt mode is assumed. Through the use of HALT and NOHALT OCL statements, this mode can be altered. The HALT statement causes the system to halt (displaying EJ or ES on the CRT) when a program ends, and the operator can restart when ready. The NOHALT statement causes the system to continue without stopping when a program ends normally.

There may be more than one option to choose from, or there may be no options at all. The following options may be present:

Option	Meaning
0	Continue with the program.
1	Retry the operation and continue with the program. (This can mean to reread a card or repeat the operation.)
2	Controlled cancel: Control is given back to the program, which closes the files, performs other end-of-job functions, and cancels the program.
3	Immediate cancel: Control is given to the supervisor, which cancels the program.

When a controlled cancel (option 2) or immediate cancel (option 3) is selected for a message while the system is in step mode, only the current step is canceled. In job mode, the cancel options cause all remaining steps in that job to be canceled.

Some messages have a default response, so that the program is not required to stop. Those conditions that have a default response option are further identified as to their severity. A SEVERITY parameter for the NOHALT statement allows the user to indicate the level of severity for which the system is allowed to select default options. If the parameter is not specified, the operator is required to respond to error conditions. Each message that has a predetermined default option also has one of four severity codes.

A message that has a default value may or may not cause the system or partition to stop, depending on the severity level selected by the operator. Figure 4 illustrates this concept; it shows what happens when a halt (message) occurs in the six modes that can be selected by the user with the following OCL statements:

```
// HALT
// NOHALT
// NOHALT SEVERITY-1
// NOHALT SEVERITY-2
// NOHALT SEVERITY-4
// NOHALT SEVERITY-8
```

Notice that the EJ code is an exception. A NOHALT statement without a SEVERITY parameter affects *only* the EJ and ES (end of step) codes. Also notice that the default value and the severity code for a particular message are not necessarily related.

Generally, the user selects HALT mode when testing a new job or application. When the job is debugged, NOHALT mode with a low severity level may be selected until the user feels the severity level can be increased.

Message Characteristics				Result[2] Depending on User OCL Statement					
Message Code[1]	Options	Default	Severity	HALT	NOHALT	NOHALT SEVERITY			
						1	2	4	8
18	3	3	2	H	H	H	NH	NH	NH
19	0,3	0	2	H	H	H	NH	NH	NH
6E	0,2,3	2	4	H	H	H	H	NH	NH
EJ	None	None	None	H	NH	NH	NH	NH	NH
LL	0,2,3	0	2	H	H	H	NH	NH	NH
LY	1,2,3	2	4	H	H	H	H	NH	NH
P3	1,2,3	None	None	H	H	H	H	H	H

[1] Meaning of message codes:
- 18 Serious errors were found during RPG II compilation.
- 19 Warning diagnostics were issued during RPG II compilation.
- 6E Attempt was made to replace an existing library entry (library maintenance program).
- EJ End of job occurred.
- LL Attempt was made to overlay an existing temporary file.
- LY Sufficient disk space is not available.
- P3 Forms are jammed on the printer.

[2] Meaning of result:
- H — Program halts; operator action is required.
- NH — Program does not halt; default is assumed and processing continues.

In both cases, the message and response are logged in the system history area.

Figure 4. Message Characteristics and Results

CONTROLLING SYSTEM RESOURCES

One of the main measures of a system's efficiency is the throughput; that is, the amount of work handled in a certain period of time. The major factors that influence system throughput are (1) processing time and its use and (2) I/O devices and their efficiency.

System/3 Model 15 offers features that improve system throughput by allowing efficient utilization of system resources:

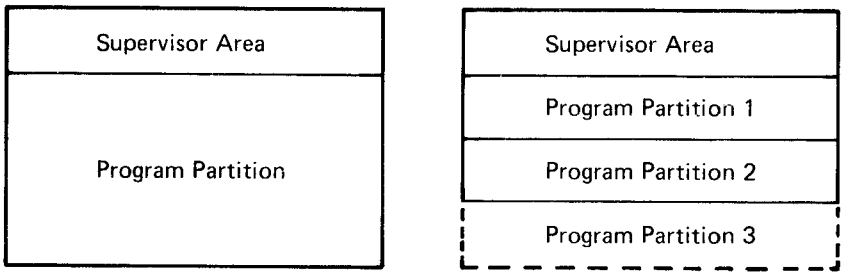
- *Multiprogramming* allows more efficient use of processing unit time by allowing different programs to be executed in each partition.
- *Communications Control Program* allows concurrent execution of programs within one partition.
- *Spooling* reduces the dependence of processing unit time on the relatively slow speeds of unit record equipment.

Multiprogramming

A multiprogramming system has advantages, in both storage organization and processing unit usage, over a single-partition system.

Storage Organization

SCP 5704-SC1 supports two program partitions; SCP 5704-SC2 supports three. However, when the size of the second (and third) partition is set to zero, the result is a single-partition system.



Single-Partition System **Multiprogramming System**

A single-partition system represents the simplest type of storage organization. The lower storage area contains the supervisor, which remains resident throughout system operation. The remaining area is where all other programs, both IBM-supplied and user application, are executed. (In addition, when using SCP 5704-SC2, a portion of the high end of storage is used for file sharing information.)

In a multiprogramming system, each program partition can contain a separate program. Each program is logically independent, but shares the processing unit facilities with the other program(s), thus reducing the unproductive wait state time of the system.

The sizes of the program partitions that best meet the needs of an installation depend upon such factors as total amount of storage available; size and structural characteristics of the processing programs and their balance among job streams; and the operating environment. The size of each program partition is specified during system generation, but it can be modified between jobs or job steps by means of an operator control command. The minimum partition size that can be used is 8K (see *Main Storage Requirements* in this chapter).

Processing Unit Usage

In a single-partition system, only one program is normally in storage at a time. If the program needs input or output, it issues an I/O request to the supervisor. The supervisor then passes this request to an I/O supervisor routine, which executes the I/O operation. During most of this time, the processing unit itself remains idle or in a wait state. As shown in Figure 5 (gray areas), the processing unit spends a significant amount of time in an inactive state, waiting.

In a multiprogramming system, the supervisor controls priority of processing. Program partition priority can be changed by operator control command. All programs operate with interrupts enabled; when an interrupt occurs, the supervisor gains control, processes the interrupt, and gives control to the highest priority partition that is available. Control is given up by a higher priority partition when it encounters a condition that prevents further processing. Control is taken away from a lower priority partition at the completion of a function for which a higher priority partition is waiting.

Figure 6, based on a multiprogramming system with two active partitions, shows that processing unit time is more usefully employed when two programs call upon the processing unit resources. The *processing unit time* line, when compared to that in Figure 5, shows a noticeable reduction in the amount of time that the processing unit spends in an inactive state.

The following paragraphs explain the points referenced on the bottom line of Figure 6.

Points 1, 3, and 9: A program partition (2, 1, 2 respectively) issues an I/O request and enters the wait state pending its completion. The supervisor takes over to start the I/O operation and to determine whether the other program partition can start (or resume) processing.

Points 2 and 10: Program partition 1 gains control because it is waiting with no I/O requests pending.

Point 4: The supervisor is unable to find a program partition waiting with no I/O requests pending. The system enters the inactive state, waiting for an I/O interrupt.

Points 5 and 7: An I/O interrupt occurs, signaling the completion of the I/O operation for program partitions 1 and 2, respectively.

Point 6: Program partition 1 gains control because program partition 2 is still waiting.

Point 8: Program partition 2 resumes processing, because it is the higher priority program partition waiting with no pending I/O request.

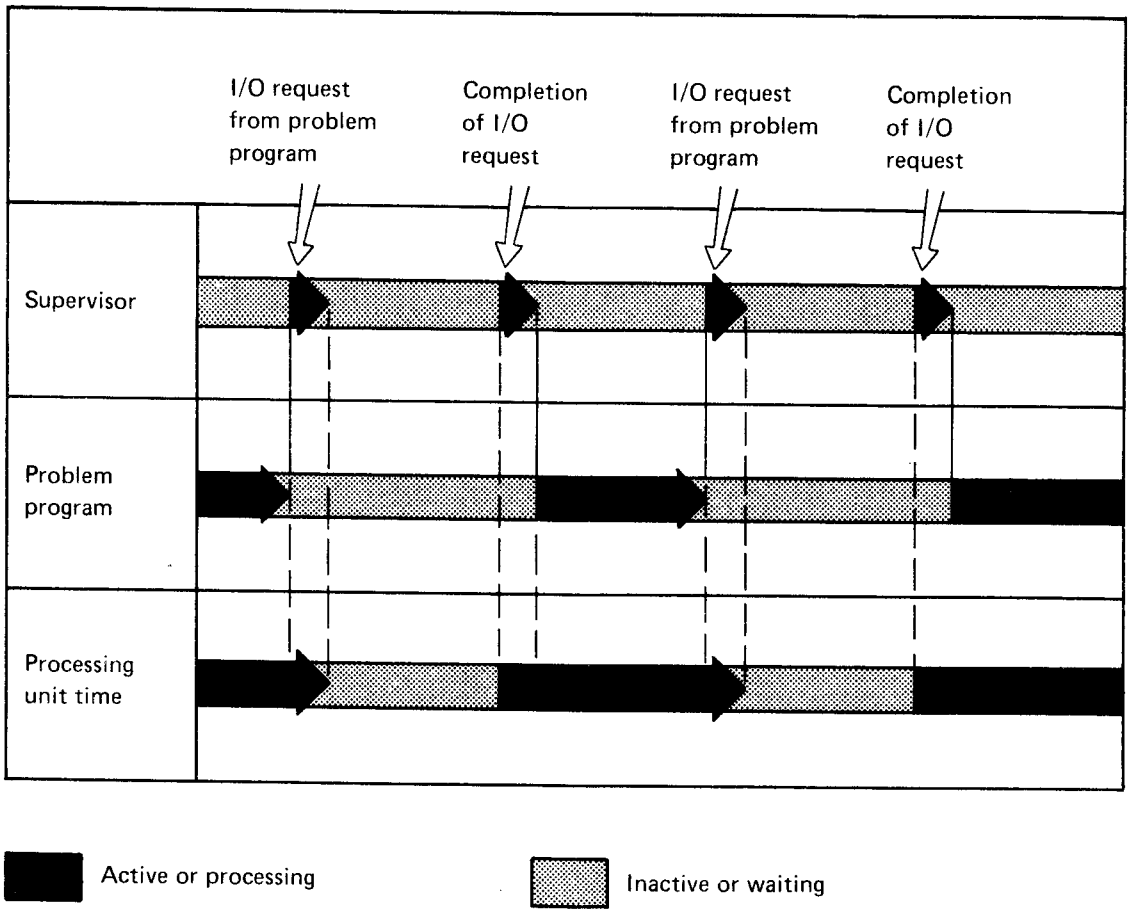


Figure 5. Processing Unit Usage in a Single-Partition System

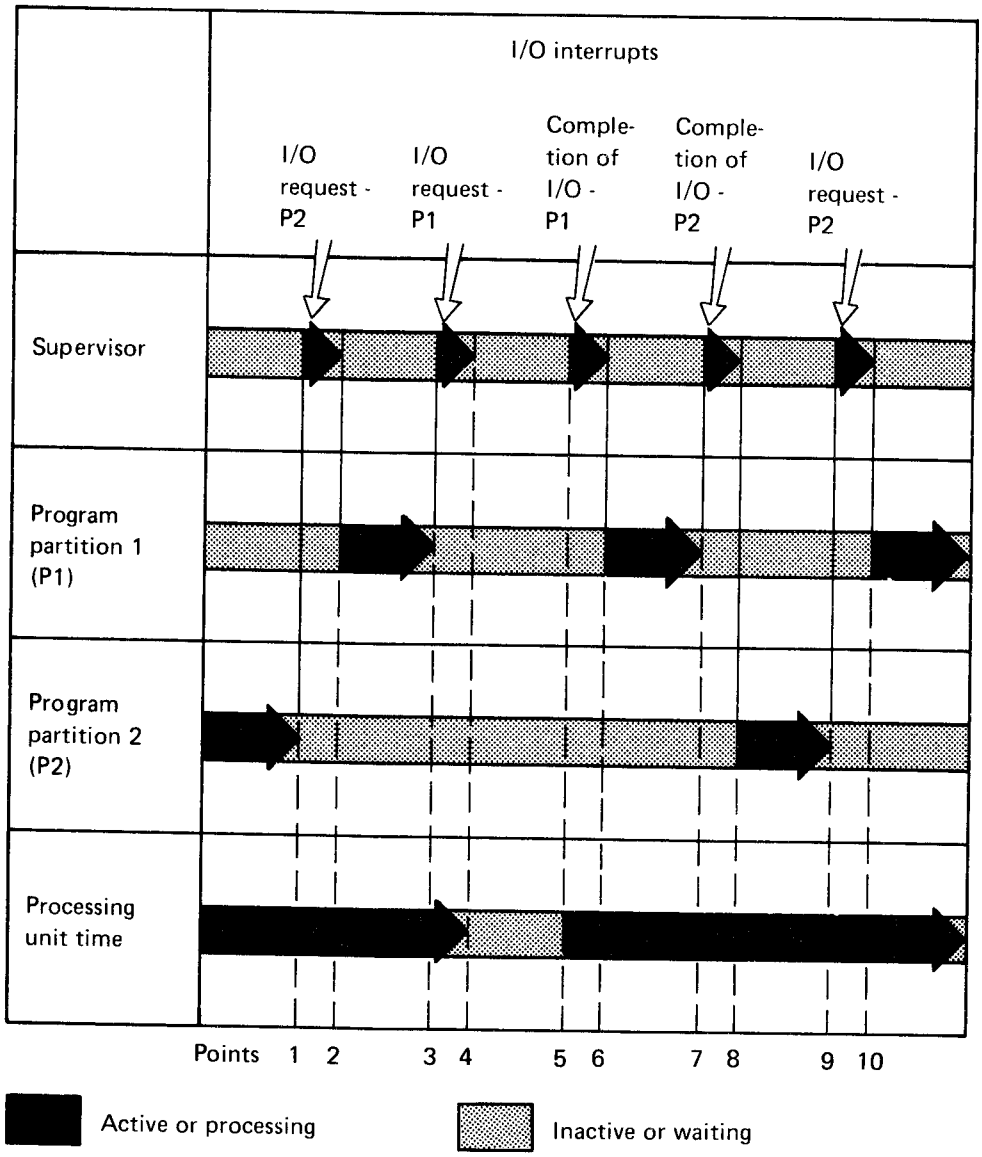


Figure 6. Processing Unit Usage in a Multiprogramming System

Communications Control Program

The Communications Control Program (CCP) is a system control programming feature that controls concurrent execution of several application programs within a partition, thereby providing System/3 Model 15 with multitasking.

Multitasking

Multitasking is a special form of multiprogramming where two or more programs, called tasks, execute concurrently within a single partition. The purpose of multitasking is again to make more efficient use of processing unit time.

Main Tasks and Subtasks

In multitasking, one main program (main task) attaches one or more subprograms (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 partition.

In System/3 Model 15, CCP is the main task permitting several application programs (the subtasks) to execute concurrently, though independently of one another. 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 – Several user application programs, initiated independently, can be executing concurrently 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 concurrently execute application programs.
- File management – CCP manages access by user programs to user data files.
- Display format facility for the 3270.

The following are some of the programs distributed as part of CCP that, if used, must be run in batch mode either before CCP startup or after CCP shutdown:

- Assignment build program — Creates, deletes, replaces, or modifies assignment sets.
- Assignment list program — Lists the contents of assignment sets, assignment file directory, CCP configuration, or program request counts.
- Initialize assignment file program — Creates the CCP assignment file during CCP installation.
- Display format generation routine — Generates display formats and places them in an object library for use with the 3270 display format facility during CCP operation.

  Note: Under 5704-SC2, this routine can be used while CCP is active.
- Display format test routine — Allows 3270 display formats to be tested without starting CCP.
- Printer format generation routine — Generates printer formats and places them in an object library for use with the 3270 display format facility during CCP operation.

  Note: Under 5704-SC2, this routine can be used while CCP is active.

Programming Facilities

Programs that run under CCP can be written in the following languages:

- RPG II — The EXIT/RLABL operation or a SPECIAL file is used for terminal input/output.
- COBOL and FORTRAN IV — The CALL statement is used for terminal input/output.
- Basic Assembler — A macro instruction can be used for terminal input/output.

Figure 7 shows CCP (the main task) controlling three user application programs (the subtasks).

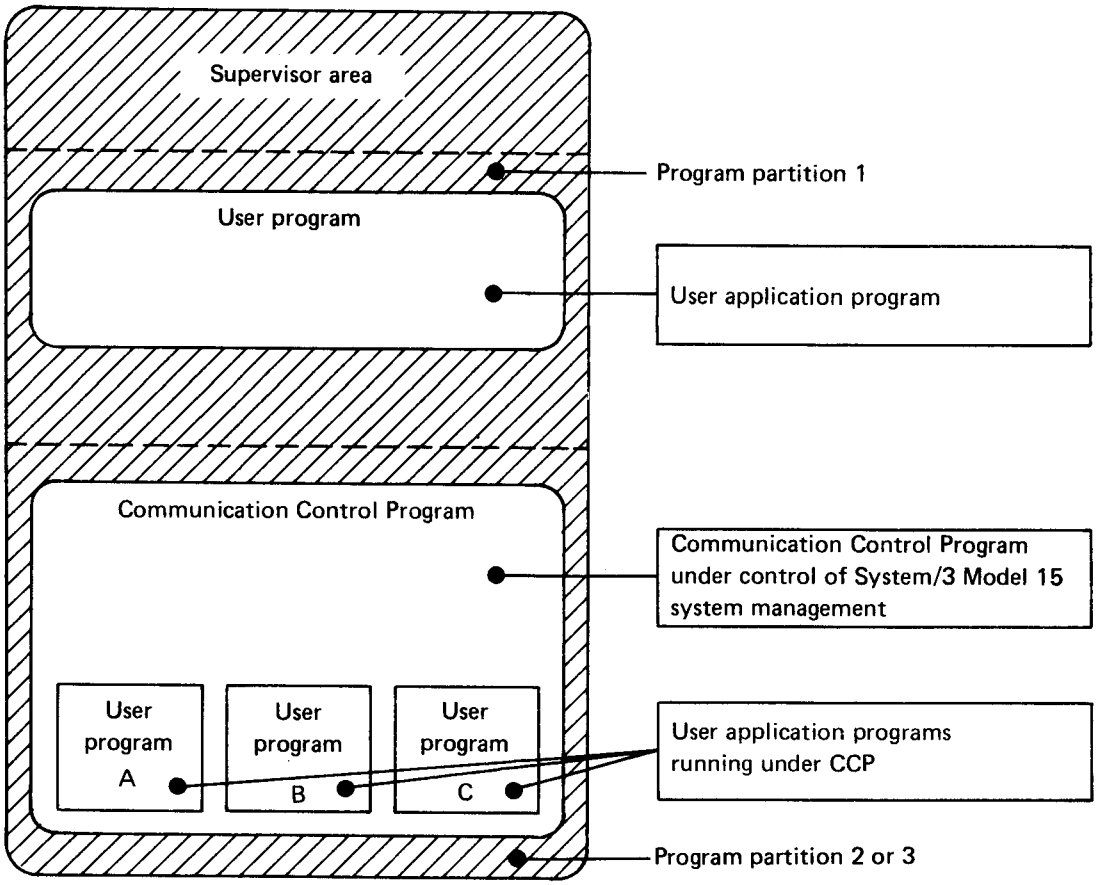


Figure 7. Communications Control Program (CCP)

Spooling

In any computing system, there is a large discrepancy between the electronic speed of the processing unit and the relatively slow (mechanical) speeds of card readers, card punches, and printers.

Spooling is a system control function designed to decrease the execution time of unit record I/O-bound jobs by servicing I/O requests addressed to such devices at disk I/O speed. Spooling increases throughput by doing unit record I/O in parallel during the execution of other jobs.

Without spooling, the throughput of a program is often determined by the speed of the slowest device, and therefore other devices may not be operating at full speed. With spooling, card punching and printing can occur at near the maximum speed of each device.

Another advantage of spooling is that it allows the user to run programs in more than one partition without the need for separate unit record devices for each partition. The printer, for example, can be used by another partition if they are being serviced by the spooling function.

Processing with the spooling function on Model 15 is as follows:

- The job streams (operation control statements, programs, and data cards) for the individual partitions are read and stored in input areas (called queues) on disk. The routine that accomplishes this is called the spooled reader, and the disk space used is called the reader queue.

- From disk, the jobs are transferred to the partitions, as required, for execution.

- Unit record (printer and punch) output is stored in queues on disk before it is finally printed and/or punched. The routines that accomplish this are called output writers, and the disk space used is called the punch queue or print queue.

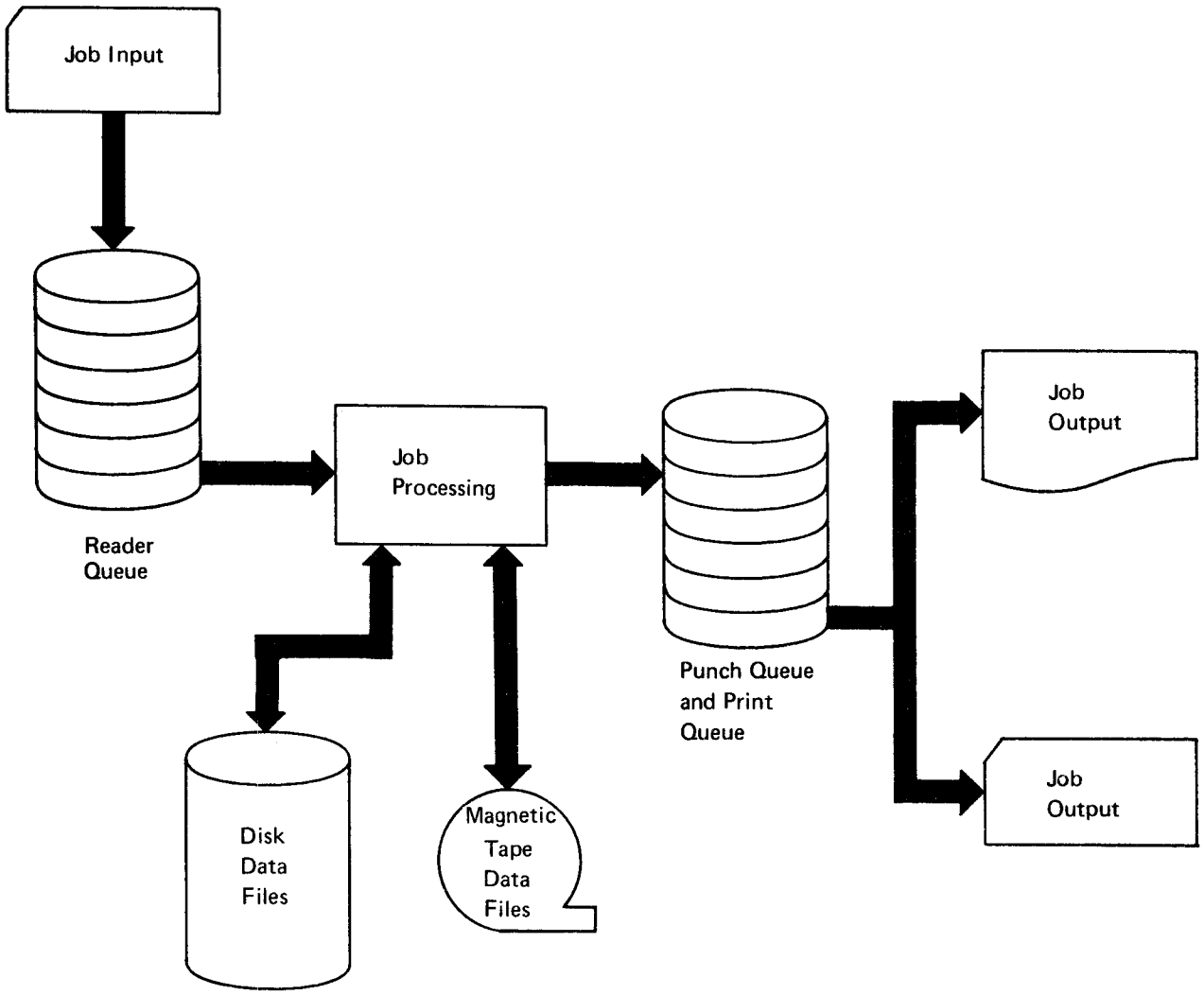
In Figure 8, a job's normal input is read from the spooled reader and queued on disk before the job is started. Similarly, a job's output is stored on disk in the punch queue and print queue; punching and printing occur later. (The device used for the spool queues can be a 5445, 3340, or 3344.)

Execution of the spooling function can be controlled by the operator, who can start and stop the spooled reader and output writers independently of program execution by entering operator control commands through the keyboard.

Job input can be held in the reader queue for execution at a later time. This allows the user to hold jobs that need, for example, two hours of execution time until the system is less occupied.

Job output can be either held in the punch and print queues until convenient to process it, or processing can be started while the job step is still executing.

Whenever a spooled reader, card punch, or printer becomes inoperative, the system can continue processing with those jobs already in the reader queue on disk and store the output in the punch and print queues. When the I/O unit becomes available again, reading, punching, or printing can continue.



User files on disk and magnetic tape are not handled by the spooling function.

Figure 8. Processing with Spooling

Performance with Spooling

An example of System/3 Model 15 performance with spooling is shown in Figure 9. The upper part shows the processing of a System/3 Model 15 job stream in a partition without the spooling facilities. Note that the first job, which needs a great deal of printing time, slows down throughput. The lower part of the figure shows the processing times of the same job stream with spooling. Here, the total time is divided into processing unit time, queue time (the time the output of the job is in the print queue, ready for printing), and printing time. (Input spooling and multiprogramming are not considered in this example.)

When the system is spooling, the improvement in system performance achieved by output queuing is shown by the difference in time between points 2 and 3. (Printing can begin prior to the completion of the program.)

Although the time elapsed between the reading of a job and the completion of its output increases 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 have finished processing. In addition, the processing unit is available for processing, because between points 1 and 2 the only activity is the printing of the output queues, which requires little processing unit time.

This example of spooling performance in a single batch environment is theoretical. The actual increase in throughput achieved depends, for example, on the I/O orientation of each program, the sequence of the particular jobs, and the speed and number of unit-record devices.

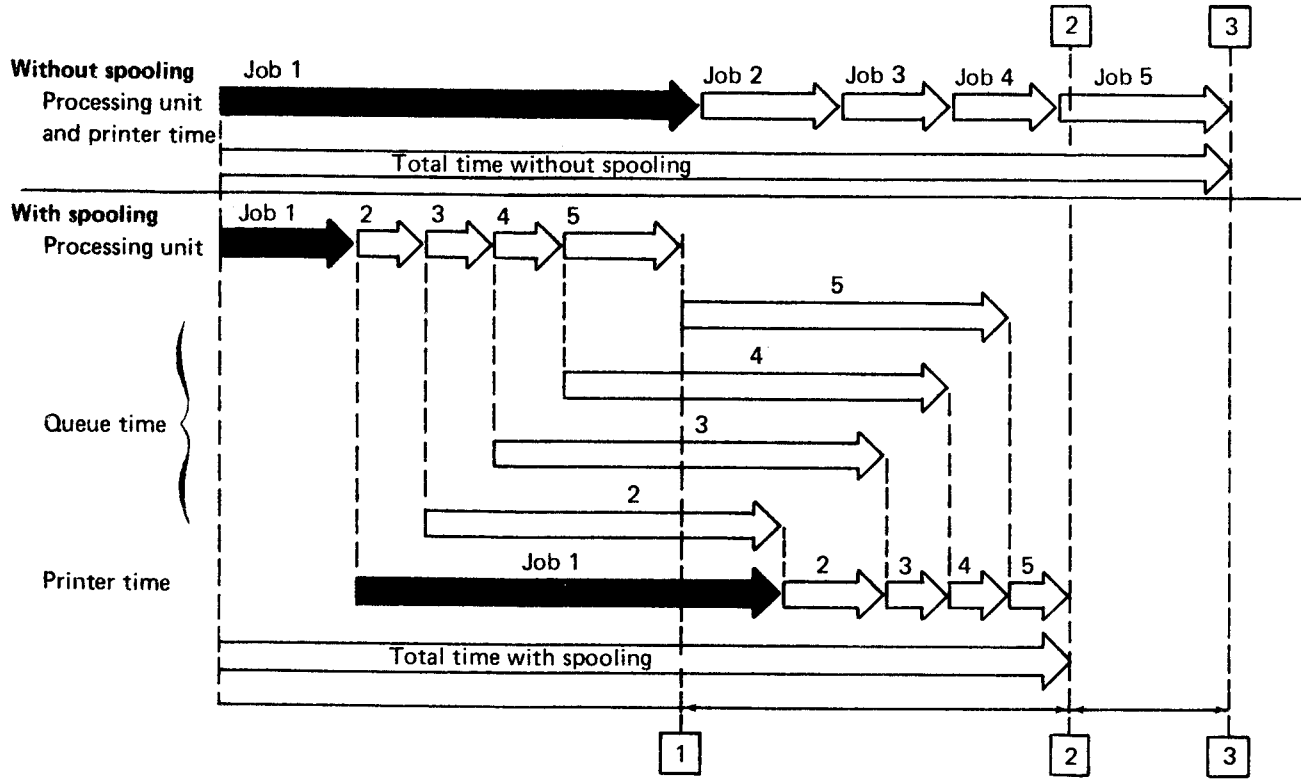


Figure 9. Processing Five Jobs with and without Spooling

Considerations for Using Spooling

The spooling function is distributed as a set of modules from which the user can build his own version according to his needs.

The following levels of spooling support are selected by the user during system generation:

- Print spooling
- Print and punch spooling
- Input and print spooling
- Input, print, and punch spooling

  Note: The spooled reader and the punch writer cannot execute concurrently. The operator controls starting and stopping of the reader and writer.

In addition to choosing the level of spooling support, the user must also specify:

- The 5445 Disk Storage, the 3340 Direct Access Storage Facility, or the 3344 Direct Access Storage for spooled records.
- A description of the disk space used by spooling.
- The unit-record devices to be spooled. The following devices can be spooled: 5424 MFCU, 2560 MFCM, 1442 Card Read Punch, 2501 Card Reader, 3741 Data Station or Programmable Work Station (input only), or 1403 Printer(s).
- The program partitions that are to be supported by spooling.

During system generation, the user can specify that one or more of the spooling functions be started automatically upon completion of IPL, rather than under operator control.

MULTI-LEAVING Remote Job Entry Work Station Program

The MULTI-LEAVING Remote Job Entry Work Station (MRJE/WS) program permits a System/3 Model 15 with EBCDIC to communicate over a point-to-point (switched or nonswitched) line to a System/370 operating under control of one of the following:

- HASP II (version 3.1 or 4.0)
- ASP (version 2.6 or 3.1)
- Remote Entry Services (RES) of JES under OS/VS1
- MULTI-LEAVING Work Station facilities of JES2/JES3 under OS/VS2
- Remote Spooling Communication Subsystem (RSCS) of VM/370

Any job that can be entered into the central system from locally attached, similarly functioned I/O devices can be entered from the System/3 Model 15 work station.

MRJE/WS input can be read from one or a combination of the following devices:

5424 MFCU
2560 MFCM
1442 Card Read Punch
2501 Card Reader
Directly attached 3741 Data Station or 3741 Programmable Work Station
5444 or 5445 Disk Storage
3340 or 3344 Direct Access Storage
3410/3411 Magnetic Tape Subsystem

Output data sets can be directed to:

1403 Printer
5424 MFCU
2560 MFCM
1442 Card Read Punch
Directly attached 3741 Data Station or 3741 Programmable Work Station
5444 or 5445 Disk Storage
3340 or 3344 Direct Access Storage
3410/3411 Magnetic Tape Subsystem

Output can be returned to the submitting work station, routed to another work station, or directed to local central system I/O devices.

Operator messages are directed to the Model 15 CRT/Keyboard; they can also be logged on the system logging device.

When the MRJE/WS program is used, the following restrictions apply:

- Column binary is not supported.
- Reading and punching of OS object decks requires the BSCA Text Transparency feature and either a 2560 MFCM or 1442 Card Read Punch; OS object decks can be read from the 2501 Card Reader.
- Only the first 80 bytes of the input records are processed by the MRJE/WS program.
- Input record length can be only 80 or 96 bytes.
- Print records that exceed the line length of the System/3 printer are truncated.

Program products are licensed programs that are used to satisfy specific application requirements. They operate under control of the System/3 Model 15 System Control Program (SCP), and are disk-resident on a 5444 Disk Storage Drive or on a simulation area on a 3340 Direct Access Storage Facility or 3344 Direct Access Storage.

The following program products are available:

Program Product	Program Number	
	System/3 Models 15A, 15B, 15C	System/3 Model 15D
RPG II	5704-RG1	5704-RG2
RPG II 3270 Display Control Feature	5704-RG1 Feature 6005/6006	Not available
Subset ANS COBOL	5704-CB1	5704-CB2
FORTRAN IV	5704-FO1	5704-FO2
Basic Assembler	5704-AS1	5704-AS2
Disk Sort	5704-SM1	5704-SM9
CCP/Disk Sort	5799-ATH	5704-SM7
Tape Sort	5704-SM2	5704-SM8
Card Utilities	5704-UT1	5704-UT3

Figure 10 at the end of this chapter summarizes device support for System/3 Model 15 program products.

RPG II

Model 15 RPG II requires, as input, an RPG II source language program and produces, as output, a System/3 Model 15 machine language object program that is cataloged in an object library, punched into 80- or 96-column cards, or written on a diskette. A source program listing, diagnostic messages, and a main storage map can be requested.

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 before the source statements are entered in the system. The titles of the specification sheets are: Auto Report, Control Card and File Description, Extension and Line Counter, Telecommunications, Input, Calculation, and Output.

Source programs can be read from the system input device (card reader, 3741, or 3277 Keyboard) or from a source library. Work files for the compiler can be on 5444, 5445, 3340, or 3344 disk storage devices.

The overlay linkage editor is invoked by the compiler to generate overlays and an executable object program.

Model 15 RPG II includes support that is offered as extra features in RPG II for other System/3 models:

- 5445 Disk Storage support
- 3410/3411 Magnetic Tape support
- Auto Report (enhances the RPG II language by providing functions that eliminate much of the preparation and coding usually required)
- Telecommunications facilities (support BSCA files as input, output, combined, or demand files in RPG II)

Model 15 RPG II supports:

- Device-independent data management
- Additional index space
- The TIME operation code to obtain the date and time of day from the supervisor

All disk I/O buffers can be placed outside the object program but within the partition by a control card option of 5704-RG2, thus allowing more code to reside within the limits of the object program.

B-type inquiry programs are supported only by 5704-RG1.

RPG II 3270 Display Control Feature (5704-RG1 only)

The 3270 Display Control Feature provides an interface to an RPG II program for up to 18 local or remote 3270 devices on a single communications interface. This telecommunications facility can be used without the need for CCP, ML/MP, Basic Assembler, or RPG II Telecommunications (BSCA) support.

The feature offers screen formatting through a user interface that is designed to be easy to use. A SPECIAL file is defined in the RPG II source program. Then, with a user-supplied array and with READ and EXCPT operation codes, the application program communicates with the terminals.

SUBSET ANS COBOL

Model 15 COBOL requires, as input, a COBOL source language program. The COBOL compiler produces as output, by means of the system's overlay linkage editor, a System/3 Model 15 machine language object program that is cataloged in an object library, punched into 80- or 96-column cards, or written on a diskette. A source program listing, diagnostic messages, and a main storage map can be requested.

Source programs can be read from the system input device (card reader, 3741, or 3277 Keyboard) or from a source library. Work files for the compiler can be on 5444, 5445, 3340, or 3344 disk storage devices.

The user can interface with the rollout/rollin routines through use of a CALL statement in the source program. (Rollout/rollin is not supported in SCP 5704-SC2.)

The date and time of day can be obtained from the supervisor through the use of a supplied subroutine and a CALL statement in the COBOL source program.

With 5704-CB2, a directly attached 3741 can be specified as a data input or output device. 5704-CB2 also allows all disk I/O buffers to be placed outside the object program but within the partition.

The following functional processing modules of the American National Standards Institute (ANSI) standard COBOL are included in the System/3 Model 15 compiler.

The first digit in the list represents the level of the modules included in the compiler; the second digit represents the lowest level in the American National Standards Institute standard (0 implies that the module may be completely missing from the standard compilers); the third digit represents the highest level of the ANSI standard.

- 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

The international standard for COBOL is ISO Recommendation number 1989, which was approved by ISO (International Organization for Standardization) in 1972. System/3 Model 15 COBOL bears the same relation to the ISO standard as to the ANSI standard, inasmuch as the two standards are identical in technical content.

FORTRAN IV

Model 15 FORTRAN IV requires, as input, a FORTRAN IV source language program and produces as output, by means of the system's overlay linkage editor, a System/3 machine language object program that is cataloged in an object library, punched into 80- or 96-column cards, or written on a diskette. A source program listing, diagnostic messages, and main storage map can be requested.

Source programs can be read from the system input device (card reader, 3741, or 3277 keyboard) or from a source library. Work files for the compiler can be on 5444, 5445, 3340, or 3344 disk storage devices.

Model 15 FORTRAN IV language contains those features defined in American National Standard Basic FORTRAN, X3.10-1966 and additional language features previously available only with full FORTRAN IV Compilers.

The user can interface with the rollout/rollin routines through use of a CALL statement in the FORTRAN IV source program. (Rollout/rollin is not supported by SCP 5704-SC2.)

The date and time of day can be obtained from the supervisor through use of a supplied subroutine and a CALL statement in the FORTRAN source program.

With 5704-FO2, a directly attached 3741 can be specified as a data input or output device. 5704-FO2 also allows all disk I/O buffers for direct access files to be placed outside the object program but within the partition.

The Model 15 FORTRAN IV Library contains:

- Mathematical subroutines to perform arithmetic operations
- Service subroutines to perform input/output conversion and control
- A commercial subroutine package to perform functions equivalent to the 1130 Commercial Subroutine Package, insofar as they are meaningful to System/3.

BASIC ASSEMBLER PROGRAM

The Model 15 Basic Assembler program is a program product that processes source programs written in the Basic Assembler Language and produces executable object programs.

The Basic Assembler Language is a symbolic programming language. Some of the features provided are:

Mnemonic operation codes
Symbolic referencing of storage addresses
Automatic storage assignment
Address displacement calculation
Convenient data representation
Operand field expressions
Source identification-sequence fields
Assembler instructions
Source program listings
Cross reference listing
Error checking and diagnostic messages

LCP (load CPU), SCP (store CPU), and CCP (command CPU) are mnemonic operation codes not supported on other System/3 models. The extended mnemonic code SVC (supervisor call) is also supported.

Work files for the assembler can be on 5444, 5445, 3340, or 3344 disk storage devices.

The Basic Assembler can be used for assembly of relocatable subroutines for use with Model 15 RPG II, COBOL, or FORTRAN IV. These subroutines are coded by the user and assembled separately. The process of program linking is accomplished during compilation of the RPG II, COBOL, or FORTRAN IV source program by means of the overlay linkage editor.

Source programs can be read from the system input device (card reader, 3741, or 3277 keyboard), a source library, or a source file generated by the macro processor.

The Basic Assembler can be used to create a standalone program. The object program is punched into cards, and program loading is performed with an initial program loader through the alternate IPL device (MFCU, MFCM, or 1442). Standalone programs are coded entirely by the user with no dependence on other programming support.

DISK SORT PROGRAM

The Model 15 Disk Sort program sorts a file into ascending or descending sequence. Specifications are described on a simple, RPG-like coding sheet; then, with the use of the system input device, they can be entered into the system or stored in the source library on disk. Disk Sort diagnostics and messages can be printed on the system logging device (1403, 3284, or 3287 printer). Disk Sort requires an input file, a work file, and an output file; these files can be on:

	File		
Device	**Input**	**Work**	**Output**
1442 Card Read Punch	X		
2501 Card Reader	X		
2560 MFCM	X		
3340 Direct Access Storage Facility	X	X	X
3344 Direct Access Storage	X	X	X
3410/3411 Magnetic Tape Subsystem	X		X
3741 Data Station (directly attached)	X		
3741 Programmable Work Station (directly attached)	X		
5424 MFCU	X		
5444 Disk Storage Drive	X	X	X
5445 Disk Storage	X	X	X

Input File: Up to eight input files can be specified in any combination of the devices. A disk input file can be sequential, indexed, or direct organization. A tape input file can have:

Minimum record or block length of 18 bytes
Maximum record length of 9,999 bytes
Maximum block length of 9,999 bytes
Fixed length records (variable length records are not supported)
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: Work space can be specified by the user or automatically allocated by the program.

Output File: A disk output file can have only sequential organization. Tape output files have the same characteristics as tape input files, except that the maximum output record size is 4,096 bytes. Output of the program is in one of three formats: tags, tag along, or summary tag along.

CCP/DISK SORT PROGRAM

The CCP/Disk Sort program performs the same functions as the Model 15 Disk Sort program. However, the CCP/Disk Sort program provides the capability of executing sort jobs under CCP control. (A sort program can also be generated to run in a batch partition.)

Two steps are necessary to use this program:

- *Generation.* This program uses information from OCL FILE statements (for the input, work, and output files) and sort specifications to generate an object module that is cataloged in an object library by the overlay linkage editor program. This step is executed in a non-CCP partition.

- *Execution.* Calling the generated object program is similar to calling any other program that is to be executed under CCP control. The CCP system or terminal operator calls the generated object program by entering its name.

  A CCP assignment run is required to define the input, work, and output files for each sort program to be executed by CCP. For 5799-ATH, these files can be on the 5444 Disk Storage Drive or 5445 Disk Storage. For 5704-SM7, these files can be on 3344 Direct Access Storage. For both programs, these files can be on the 3340 Direct Access Storage Facility.

  A maximum of eight disk input files can be specified. The organization of a disk input file can be sequential, indexed, or direct. Work space must be specified by the user; it cannot be automatically allocated by the system. Organization of the output file is sequential. Output of the CCP/Disk Sort program is in one of three formats: tags, tag along, or summary tag along.

MAGNETIC TAPE SORT PROGRAM

The Model 15 Magnetic 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. Specifications are described on a simple, RPG-like coding sheet; then, by use of the system input device, they can be entered into the system or stored in the source or procedure library on disk. Sort diagnostics and messages can be printed on the system logging device (1403, 3284, or 3287 Printer). 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 can have:

Minimum record or block length of 18 bytes
Maximum record or block length of 9,999 bytes
Fixed-length records (variable-length records are not supported)
Blocked or unblocked records
EBCDIC or ASCII format
Single or multiple volumes
9-track (800/1,600 bpi) or 7-track (200/556/800 bpi)

Work Files: Three work tapes are required; a fourth can be utilized, 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 sort control fields and/or the data fields the user has specified. (The tag or summary tag along sort capabilities of the Disk Sort are not supported in the Tape Sort.)

DISK RESIDENT CARD UTILITIES

The Disk Resident Card Utilities program product provides the following programs that support 80- or 96-column card files.

Sort/Collate Program: This program sorts or collates files of cards into the specified sequence. It uses the 5424 MFCU or the 2560 MFCM.

Card List Program: This program is used to list cards on the printer. It accepts input from the 5424 MFCU, 2560 MFCM, 1442 Card Read Punch, or 2501 Card Reader. Printed output is on the 1403, 3284, or 3287 Printer.

Reproduce/Interpret Program: This program is used to reproduce cards with reformatting options, or to interpret cards. When reproducing, the program supports one of the following:
- MFCU1 input and MFCU2 output
- MFCM1 input and MFCM2 output
- 2501 input and 1442 output

Gangpunch Program: This program provides the following capabilities:

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

The gangpunch program supports one of the following:

- For count-controlled and match fields processing:
  - MFCU2 input and MFCU1 output
  - MFCM2 input and MFCM1 output
  - 2501 input and 1442 output
- For interspersed processing:
  - MFCU1 input and output
  - MFCM1 input and output
  - 1442 input and output

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SUMMARY OF MODEL 15 PROGRAM PRODUCT DEVICE SUPPORT

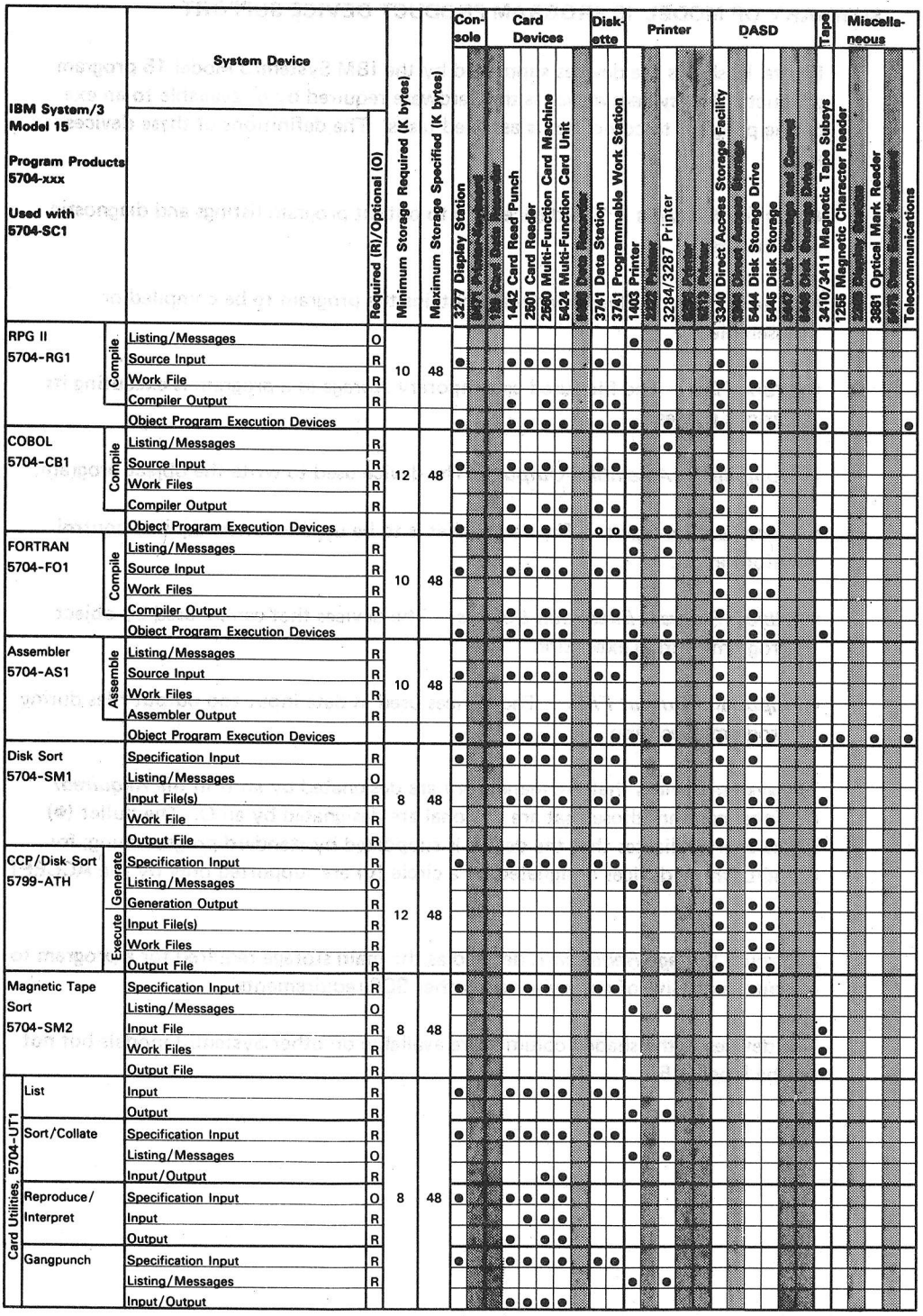
Figure 10 shows the devices supported by the IBM System/3 Model 15 program products. The *system device* is the hardware required by or available to an executing program to complete its assigned tasks. The definitions of these devices are:

- *Listing/Messages* — The device used to output program listings and diagnostic messages.
- *Source Input* — The device that contains the program to be compiled or assembled.
- *Work Files* — The files used as temporary storage as a program is executing its various phases.
- *Compiler* or *Assembler Output* — The device used to write the object program.
- *Specification Input* — The device that is to be used to enter required control information.
- *Object Program Execution Devices* — The devices that can be used by object programs during execution.
- *Input* and *Output Files* — The devices used as data input and output files during program execution.

The system devices that are mandatory are designated by an R in the *Required/Optional* column; those that are optional are designated by an O. The bullet (●) in the chart indicates that the device is supported by standard programming; for COBOL, those devices designated by a circle (o) are supported only by the ACCEPT verb.

Minimum Storage Required is defined as the main storage required for a program to execute, exclusive of supervisor and other SCP requirements.

The devices in the shaded columns are available on other System/3 models but not on the Model 15.



IBM System/3 Model 15 Program Products 5704-xxx Used with 5704-SC1		System Device	Required (R)/Optional (O)	Minimum Storage Required (K bytes)	Maximum Storage Specified (K bytes)	Console: 3277 Display Station	Card Devices: 1442 Card Read Punch	2501 Card Reader	2560 Multi-Function Card Machine	5424 Multi-Function Card Unit	Diskette: 3741 Data Station	3741 Programmable Work Station	Printer: 1403 Printer	3284/3287 Printer	DASD: 3340 Direct Access Storage Facility	5444 Disk Storage Drive	5445 Disk Storage	Tape: 3410/3411 Magnetic Tape Subsys	Miscellaneous: 1255 Magnetic Character Reader	3881 Optical Mark Reader	Telecommunications
RPG II 5704-RG1	Compile	Listing/Messages	O	10	48								●	●							
		Source Input	R			●	●	●	●	●	●	●			●	●					
		Work File	R												●	●	●				
		Compiler Output	R				●		●	●	●	●			●	●					
		Object Program Execution Devices				●	●	●	●	●	●	●	●	●	●	●	●	●			●
COBOL 5704-CB1	Compile	Listing/Messages	R	12	48								●	●							
		Source Input	R			●	●	●	●	●	●	●			●	●					
		Work Files	R												●	●	●				
		Compiler Output	R				●		●	●	●	●			●	●					
		Object Program Execution Devices				●	●	●	●	●	o	o	●	●	●	●	●	●			
FORTRAN 5704-FO1	Compile	Listing/Messages	R	10	48								●	●							
		Source Input	R			●	●	●	●	●	●	●			●	●					
		Work Files	R												●	●	●				
		Compiler Output	R				●		●	●	●	●			●	●					
		Object Program Execution Devices				●	●	●	●	●			●	●	●	●	●	●			
Assembler 5704-AS1	Assemble	Listing/Messages	R	10	48								●	●							
		Source Input	R			●	●	●	●	●	●	●			●	●					
		Work Files	R												●	●	●				
		Assembler Output	R				●		●	●					●	●					
		Object Program Execution Devices				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Disk Sort 5704-SM1		Specification Input	R	8	48	●	●	●	●	●	●	●			●	●					
		Listing/Messages	O										●	●							
		Input File(s)	R				●	●	●	●	●	●			●	●	●	●			
		Work File	R												●	●	●				
		Output File	R												●	●	●	●			
CCP/Disk Sort 5799-ATH	Generate	Specification Input	R	12	48	●	●	●	●	●	●	●			●	●					
		Listing/Messages	O										●	●							
		Generation Output	R												●	●	●				
	Execute	Input File(s)	R												●	●	●				
		Work Files	R												●	●	●				
		Output File	R												●	●	●				
Magnetic Tape Sort 5704-SM2		Specification Input	R	8	48	●	●	●	●	●	●	●			●	●					
		Listing/Messages	O										●	●							
		Input File	R															●			
		Work Files	R															●			
		Output File	R															●			
Card Utilities, 5704-UT1	List	Input	R	8	48	●	●	●	●	●	●	●									
		Output	R										●	●							
	Sort/Collate	Specification Input	R			●	●	●	●	●	●	●									
		Listing/Messages	O										●	●							
		Input/Output	R						●	●											
	Reproduce/ Interpret	Specification Input	O			●	●	●	●	●											
		Input	R					●	●	●											
		Output	R				●		●	●											
	Gangpunch	Specification Input	R			●	●	●	●	●	●	●									
		Listing/Messages	R										●	●							
		Input/Output					●	●	●	●											

Figure 10 (Part 1 of 2). System/3 Model 15 Program Product Device Support

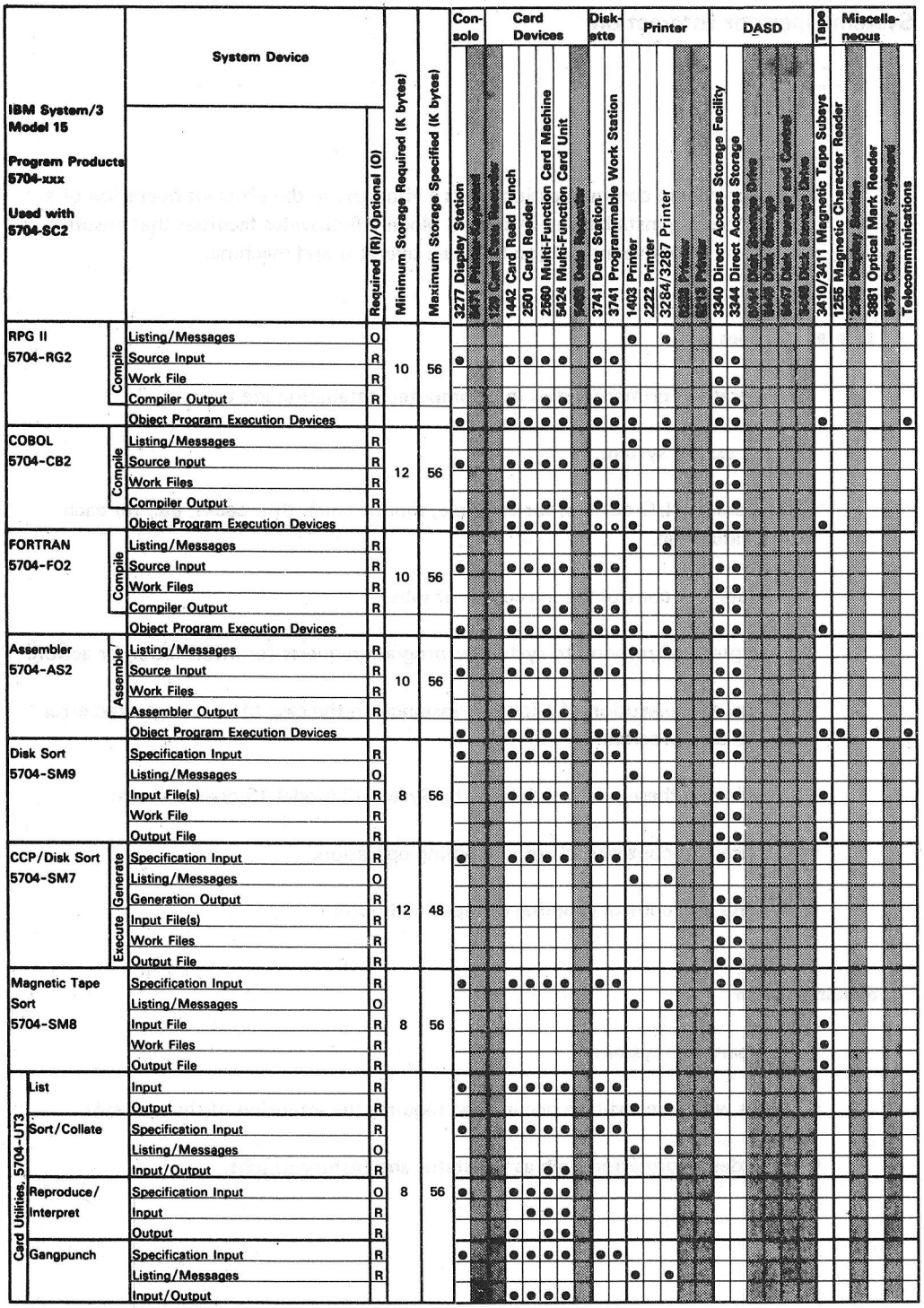


Figure 10 (Part 2 of 2). System/3 Model 15 Program Product Device Support

Chapter 4. System-Operator Interaction

Operator-system communication plays a vital part in the efficient operation of a data processing installation. System/3 Model 15 provides facilities that ensure timely and effective interaction between operator and machine.

Operator Duties

The operator's primary duties in a computer installation are to:

- Start up the system.
- Prepare the I/O devices; for example, mount tapes, disk packs, etc, for each individual job.
- Initiate and control the execution of jobs.
- Interpret and respond to system or program requests for information or action.
- Cancel the execution of a job; for instance, in the case of an unexpected error in the user program.

In addition to these primary duties, the System/3 Model 15 operator can:

- Initiate and control multiprogramming operation.
- Initiate and control spooling of input and output.

System Action

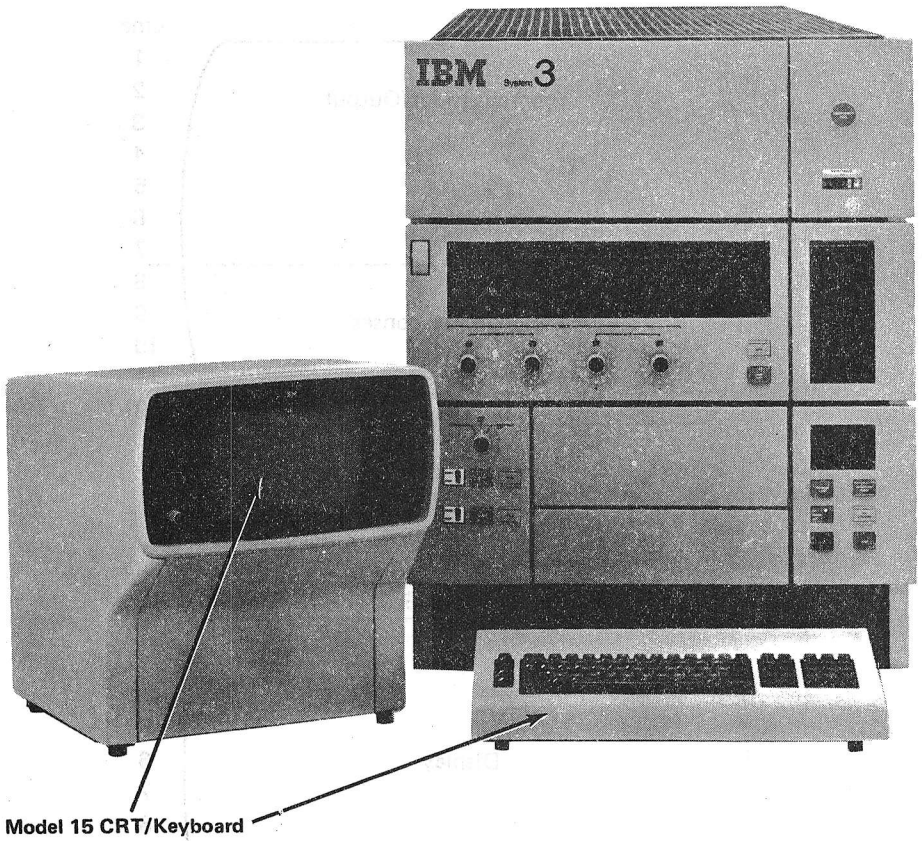
For its part, the system:

- Stops when a condition occurs that requires the attention of the operator.
- Provides information such as the status and history of jobs.

System-Operator Communications — CRT/Keyboard

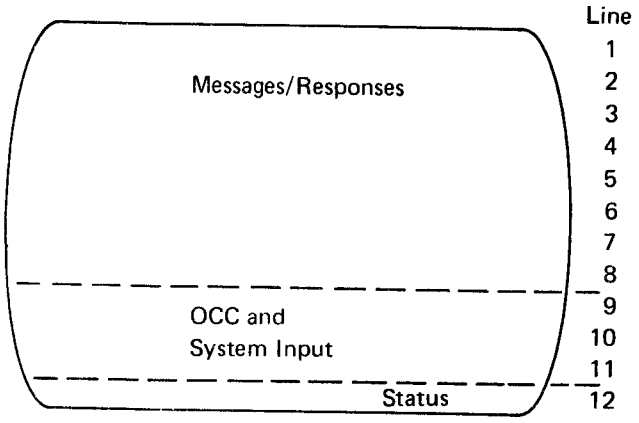
System/3 Model 15 allows system-operator communication through the Model 15 CRT/Keyboard. The following basic functions are supported:

- Logging messages that require operator action.
- Accepting operator responses to messages.
- Accepting operator control commands (OCC) or OCL and utility specifications.
- Displaying the system status, such as active job and resources in use.
- Displaying the system history area.
- Supporting local inquiry or other low-volume I/O requirements.

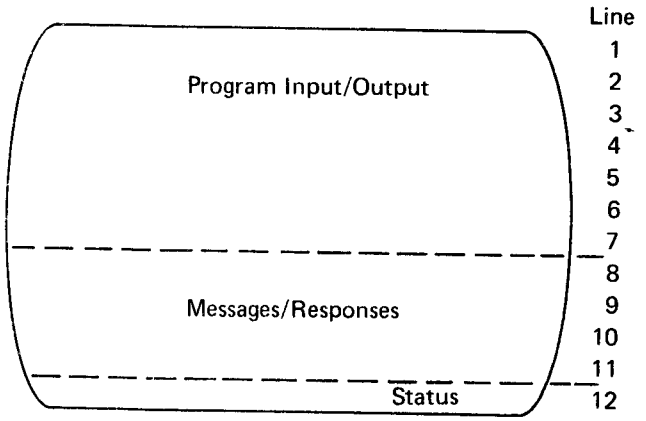


Information appears on the CRT screen in one of three formats:

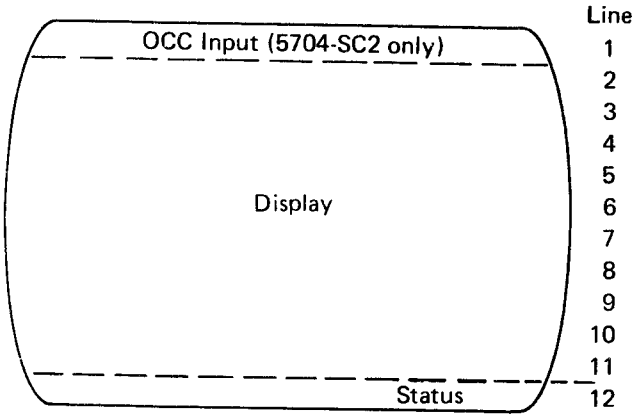
- System format—for system use, such as for OCC or system input:



- Data management format—for user programs, such as RPG II object programs:



- Display format—for displaying system information:



Status

In all formats, the bottom line of the screen is used for status and contains the following information:

```
xxxxxxxxxxxxxxxxxxxxx  MSG  NOT  RSP  nn
```

where the x's prompt the operator as to what is expected next as keyed input. nn refers to the number of messages not responded to.

The following prompts are given:

ENTER COMMAND	Displayed when the operator has pressed program function key 10 to indicate that an operator control command (OCC) is to be entered.
ENTER DATA {P1 / P2 / P3}	Indicates that CRT data management is waiting for input.
ENTER READER DATA {P1 / P2 / P3}	Indicates that READER (the system input device) is waiting for input for partition 1 (P1), 2 (P2), or 3 (P3).
ENTER RESPONSE	Displayed when the operator has pressed program function key 12 to indicate that the operator wants to respond to a message.
READY	Indicates that there is no pending operator action.
WAITING FOR REQUEST {P1 / P2 / P3}	Indicates that CRT data management has asked for input on request.
ENTER DISPLAY REQUEST	Indicates that a DISPLAY OCC is in progress.

Messages/Responses

The messages/responses portion of the CRT display is used for messages requiring operator action, such as system and program messages.

Program Input/Output

The program input/output portion of the CRT display is supported by data management and is used by RPG II or assembler object programs to display information on the CRT and, in conjunction with the keyboard, to accept input from the operator.

Display

The display format is used with the DISPLAY operator control command for displaying specified system information.

System History Area

The system history area is a space on the system disk that contains a log or audit trail of the following information:

Messages
Responses taken to messages
OCL statements and diagnostics
OCC commands, comments, and diagnostics
Utility control statements
Program product messages
Display screen images
Automatic responses taken to messages

Operator Control Commands

Operator control commands (OCCs) are entered from the Model 15 CRT/Keyboard to provide operator communication with the system.

The following OCCs are available:

CANCEL	Cancels program execution in a partition; a 2 or 3 following the P1, P2, or P3 indicates the option of the cancel.
DATE	Sets the system date.
DISPLAY	Displays system status or system history area on the CRT.
DUMP	Causes a dump of the specified partition or of the entire main storage.
HALT	Causes the system to halt at EJ or ES messages or when unprinted system history area entries are about to be overlaid.
IDELETE	Automatically deletes information messages (I-type) not responded to.
NOHALT	Changes the processing mode of a partition from halt to nohalt.

NOIDELETE	Cancels the effect of the IDELETE command.
PTY	Establishes the relative order of priority for the system tasks: spooling (reader, print writer, punch writer), partition 1, partition 2, and partition 3.
READER	Changes system input device for a partition.
ROLLOUT	Interrupts an inquiry-evoking program to allow another program to be loaded and executed (5704-SC1 only).
SET	Overrides the partition size or (5704-SC2 only) file-share size specified during system generation.
SIMULATE	Enables or disables the 5444 simulation area on the 3340 drive 2 (5704-SC1 only).
START	Restarts program execution in a partition (5704-SC2 only).
STOP	Stops program execution in a partition (5704-SC2 only).
TIME	Sets the system time of day.
TLOG	Activates or deactivates the currently loaded transaction logging routine (5704-SC2 only).
TRACE	Enables or disables the system trace routine.

Operator Control Commands Used with Spooling

Operator control commands are available for monitoring, controlling, and communicating with the spooling function. The following commands can be entered via the Model 15 CRT/Keyboard in a spooling environment:

CANCEL	Cancels spooling support (at IPL only); or cancels a job, step[1], or entire queue.
CHANGE	Changes the main storage requirement, number of copies of output, card type, forms type, partition assignment, or priority of a job or a step[1] on a queue.
DISPLAY	Enables the operator to determine the contents of the spooling queues.

[1] The user cannot hold, release, change, keep, or cancel a step on the input (reader) queue.

HOLD	Prevents a job, step[1], or queue from being scheduled for input or output.
KEEP	Keeps printed, punched, or executed jobs and/or job steps on the queue (5704-SC2 only).
RELEASE	Releases a job, step[1], or entire queue from the hold state.
RESTART	Restarts the step's printed or punched output from the beginning; or restarts the step's printed output at the beginning of any page.
REUSE	Makes printed or punched track groups available for other use (5704-SC2 only).
START	Initiates spooling support (at IPL only); starts spooling for the designated partition if it had previously been stopped; or starts the reader, print writer, or punch writer.
STOP	Terminates spooling in the designated partition; or stops the reader, print writer, or punch writer.

Operator Control Commands Used with CCP

The terminal operator uses commands to communicate with CCP. Some of these are listed below:

/FILE	Associates files.
/MSG	Sends a message to the system operator.
/NAME	Changes the name of the terminal.
/NOQ	Indicates unwillingness to wait for a program that cannot be started immediately.
/OFF	Ends current work session using installation default.
/OFF DROP	Ends current work session and disconnects the terminal from CCP.
/OFF HOLD	Ends current work session and returns the terminal to sign-on status.
/ON	Starts a terminal session, with optional password.
/Q	Indicates willingness to wait for a program that cannot be started immediately.
program-name	Requests an application program, with optional data.

[1]The user cannot hold, release, change, keep, or cancel a step on the input (reader) queue.

The system operator uses commands to control and monitor CCP and to communicate with the terminal operator. Some of these are listed below:

$CCPCL	Closes a disk file.
$CCPOP	Reopens a disk file.
ASSIGN	Assigns a name to a terminal.
AUTOERP	Activates or deactivates the automatic error recovery retry functions.
CANCEL	Cancels a program or cancels CCP.
DISPLAY TERMID	Displays terminal assignment.
DISPLAY TERMINALS	Displays terminal status.
DISPLAY USERS	Displays user program area status.
ERP	Recovers from a terminal's error.
MSG	Sends a message to a terminal.
POLTIME	Changes interval polling time.
RESUME	Restarts program execution and allows terminal commands to be accepted.
SHUTDOWN	Shuts down CCP.
SUSPEND	Stops program execution and prevents terminal commands from being accepted.
TEST	Performs an online test.
TRACE	Enables or disables the CCP/system trace function.
VARY	Changes the status of a terminal.

Chapter 5. Model 15 Features

This section highlights the features of System/3 Model 15 that distinguish it from some of the other models of System/3.

PROCESSING UNIT

- The 5415 Processing Unit, with its associated programming support, makes the System/3 Model 15 suitable for a multiprogramming environment, without the need for a hardware dual programming feature.
- MOSFET (metal oxide semiconductor field effect transistor) monolithic storage with error correction and checking (ECC) for processing unit main storage.
- 48K, 64K, 96K, 128K, 160K, 192K, 224K, 256K, 384K, and 512K bytes of main storage.
- Write/fetch storage protection (for processing unit cycles only) in 2K byte segments. This feature is used by the supervisor to keep user programs from interfering with each other or with the supervisor.
- Load CPU, store CPU, and command CPU—additional instructions to control the Model 15 program facilities, particularly multiprogramming.
- Memory address translation capability to address main storage above 64K.
- Four additional interrupt levels.
- Operation end interrupts for all input/output devices. Prioritized task-switching, an important factor in multiprogramming environment, is facilitated by operation end interrupts.
- Provisions to mask off (inhibit) all interrupts except program check.
- Privileged mode of operation. Privileged instructions are intended to be executed only by system control programming.
- Program check interrupt to prevent a *hard stop* for the following kinds of errors: invalid storage or device address, invalid operation code, storage protection violation, and privileged mode operation error.
- Complete overlap of all input/output operations without data overrun errors.

- Two-byte disk data channel to reduce processing unit burden (I/O cycle steals) during data transfer.

- An interval timer to provide time-of-day services.

- A disk scan/read feature that allows the scanning and reading of data in one revolution of the disk; this feature is used on 5445 Disk Storage, 3340 Direct Access Storage Facility, and 3344 Direct Access Storage.

- Main cycle time (for an instruction cycle or an execution cycle) is 1.52 microseconds. However, on Model 15D, the instruction cycle time for certain non-I/O instructions is faster, in order to complement the requirements of the programming support.

- On Model 15D, IPL can occur from drive 1 (3340) or drive 3 (3344).

3340 AND 3344 DIRECT ACCESS STORAGE

System/3 Model 15B or Model 15C uses the 3340 Direct Access Storage Facility; two 3340 drives are required in each configuration, which may include a total of three or four 3340 drives. System/3 Model 15D uses the 3340 and, optionally, the 3344 Direct Access Storage; two 3340 drives are required, and optional configurations may include three 3340 drives, four 3340 drives, or two 3340 drives and two 3344 drives. Thus, possible combinations are as follows:

	Drive 1 (req'd)	**Drive 2 (req'd)**	**Drive 3 (opt)**	**Drive 4 (opt)**
Model 15B, 15C, 15D	3340	3340		
Model 15B, 15C, 15D	3340	3340	3340	
Model 15B, 15C, 15D	3340	3340	3340	3340
Model 15D	3340	3340	3344	3344

The 3340 uses a 3348 Model 70 Data Module. Each data module is divided into a main data area and four 5444 simulation areas. The main data area of each module provides 40.8 megabytes of data storage. Each simulation area provides 2.5 megabytes of storage. The system uses the simulation areas in the same way it would use the 5444 Disk Storage Drive; that is, all libraries (user programs, system programs, and procedures) are contained in the 5444 simulation areas.

The 3344 Model B2 includes two drives of fixed media storage and attaches to a 3340 Model A2. The 3344 storage medium is permanently mounted and sealed within the drive as an integral component. Each 3344 drive is supported as though it were four individual volumes, each containing a main data area and two simulation areas.

On both the 3340 and 3344, the main data areas and simulation areas are referenced by codes. The following are graphic representations of these areas and their associated codes:

On System/3 Model 15B or 15C (3340)

Drive	Main Data Areas	5444 Simulation Areas			
1 3340	D1	D1A	D1B	D1C	D1D
2 3340	D2	D2A	D2B	D2C	D2D
3 3340	D3	D3A	D3B	D3C	D3D
4 3340	D4	D4A	D4B	D4C	D4D

On System/3 Model 15D (3340)

Drive	Main Data Areas	5444 Simulation Areas			
1 3340	D1	D1A	D1B	D1C	D1D
2 3340	D2	D2A	D2B	D2C	D2D
3 3340	D3 or D31	See note		D3E	D3A
4 3340	D4 or D41			D4E	D4A

Note: The data module always has four simulation areas, but when it is used on drive 3 or 4, only two of the areas are addressable. Drives 3 and 4 are supported as though they were fixed 3344 drives with one volume; as a result, the data modules used on these devices cannot be used for offline, multivolume files.

On System/3 Model 15D (3340/3344)

Drive	Main Data Areas	5444 Simulation Areas			
1 3340	D1	D1A	D1B	D1C	D1D
2 3340	D2	D2A	D2B	D2C	D2D
3 3344	D31 or D3			D3E	D3A
4 3344	D41 or D4			D4E	D4A
	D32			D3F	D3B
	D42			D4F	D4B
	D33			D3G	D3C
	D43			D4G	D4C
	D34			D3H	D3D
	D44			D4H	D4D

Shaded area represents one volume.

Simulation Area Usage

With few exceptions, the simulation areas are referenced by 5444 unit codes F1, R1, F2, R2. On the Model 15B or 15C, these four codes are assigned to specific simulation areas and cannot be changed:

F1 is assigned to D1A
R1 is assigned to D1B
F2 is assigned to D2A
R2 is assigned to D2B

To access the other simulation areas, an SCP program is used to copy the desired area into one of the four accessible areas.

On the Model 15D, the user can assign these four unit codes to different simulation areas for each partition, with these considerations:

- On a system with 3340 only, IPL is performed from either D1A (F1) or D1B (R1) on drive 1. On a system with 3340 and 3344, IPL can be performed from drive 1 or drive 3; either D1A or D3A can be used as F1, and either D1B or D3B can be used as R1.

- The IPL area is common for all partitions. The other three unit codes can be assigned to different areas for each partition, but within a single partition, unit code assignments must be unique.

Thus, on Model 15B or 15C, four simulation areas are directly accessible at any one time; and on Model 15D, no more than ten simulation areas are directly accessible at any one time:

Model 15D

Partition 1	3 areas
Partition 2	3 areas
Partition 3	3 areas
IPL area	1 area
	10 areas maximum

COMMUNICATIONS

Binary Synchronous Communications Adapter (BSCA)

The BSCA is a communications I/O feature for System/3 that is housed in the processing unit. It operates in an overlap mode with other system I/O devices and processing. One or two BSCAs can be installed per system.

BSCA provides a single channel for synchronous half-duplex data transmission and reception. Characters are transmitted serially by bit and serially by character.

BSCA is capable of communicating at the following nominal transmission rates (bits per second) on a point-to-point (nonswitched) data link:

600 bps
1,200 bps
2,000 bps
2,400 bps
4,800 bps
7,200 bps
9,600 bps
19,200 bps
40,800 bps
50,000 bps

BSCA will also operate on a switched network communications line at 600, 1,200, 2,000, 2,400, 3,600, or 4,800 bps. Transmission code can be selected. Automatic answering is provided for incoming calls on switched communications facilities.

Special Features

- Station Selection – Allows BSCA to function as a remote or a tributary station on a multipoint communications line as a compatible member of the IBM family of BSC terminals in conjunction with a System/360 or System/370 control station (that is, Model 25 and up) at transmission rates of 1,200, 2,000, 2,400, 4,800, 7,200, or 9,600 bps.

- Internal Clock – Provides the clocking pulses for bit synchronization at speeds of 600, 1,200, or 2,000 bps, or at 2,400 bps when clocking is not provided by the modem.

- Automatic Call – Permits calls on a switched network to be originated under control of the user program in conjunction with a common carrier automatic calling unit.

- Text Transparency – Allows any combination of 8 bits to be used in text data (256 combinations) with EBCDIC transmission codes.

- EIA Local – Permits direct attachment of a 3270 Information Display System or System/7 via the external modem cable of the attached device. Data transfer rates up to 8,000 bps are available.

Binary Synchronous Communications Controller (BSCC) – Model 15D Only

The BSCC is a communications feature for System/3 Model 15D that is housed in the processing unit. One or two lines can be attached to a BSCC. These lines are optimized for leased-line, multipoint control station operations. They operate at speeds up to 9,600 bps in half duplex mode using either 2-wire or 4-wire facilities.

The BSCC can handle polling functions outboard of the Model 15D processing unit.

The BSCC can be installed with one or two BSCA lines, a Display Adapter, or an LCA, but none of these features is a prerequisite for BSCC. The BSCC is mutually exclusive with MLTA.

Special Features

- Internal Clock – Provides business machine clocking at 1,200 bps for the external or integrated modem operating at that line speed.
- EIA Interface – Provides an interface and cable for attachment of an external modem meeting EIA RS 232C characteristics.
- 1,200 BPS Integrated Modem – Transmits data at 1,200 bps over nonswitched 2- or 4-wire facilities. Attachment to the communications facility is via an IBM-provided cable directly to the common carrier type 3002 channel or equivalent. All devices communicating with System/3 must be equipped with a compatible 1,200 bps integrated modem/line adapter.
- DDS Adapter – Interfaces to an AT&T nonswitched Digital Data Service Adapter (DDS) channel service unit at the customer site termination of the DDS network. Line speeds of 2,400 bps, 4,800 bps, and 9,600 bps are available.
- EIA Local – Permits local attachment of one IBM BSC device to the processing unit without the use of communications line or modem. The external modem cable of the attached device connects directly to the processing unit when this feature is installed. Data clocking for transfer rates of 2,400 bps, 4,800 bps, 7,200 bps, and 9,600 bps is provided by this feature for both the processing unit and the attached device. The device must be capable of functioning as a multi-point tributary station at the transfer rate provided by this feature.

Multiple Line Terminal Adapter (MLTA)

The MLTA provides for the attachment of one or multiple start-stop terminals of the same type to one line; up to eight start-stop lines can be attached to the System/3. (The MLTA requires a special order.)

Local Communications Adapter (LCA)

The LCA provides direct local attachment of the 3741 Model 2 or 4, 3271 Control Unit, 3275 Display Station, or System/7 on the System/3. The attached 3741 Model 2 or 4 can be used offline as a data entry station and/or through the LCA as an IBM diskette input/output data device. The local attachment of the 3271 or 3275 provides the capability for display applications in which a data transfer rate of 2,400 bps is satisfactory.

The LCA is mutually exclusive with the first BSCA.

Display Adapter

The Display Adapter provides for local attachment (up to 2,000 cable feet) to the processing unit of up to thirty 3270 devices (3277 Model 1 or 2, 3284 Model 1 or 2, 3286 Model 1 or 2, 3287 Model 1 or 2, or 3288 Model 2) in any combination. This feature eliminates the need for a 3271 Control Unit and a BSCA or LCA feature on the processing unit. The Display Adapter and the second BSCA are mutually exclusive.

Terminals

The System/3 Model 15 can be:

- Host to a terminal network
- Subhost, hosting a network of terminals yet subordinate to a System/360 or System/370, or
- A processor terminal

Serial Input/Output Channel

Two System/3 Model 15Ds can be connected together to share the workload. Each System/3 Model 15 will require a Serial Input/Output Channel (SIOC) and a Request for Price Quotation (RPQ) feature. The channel connected systems allows a user to balance the application workload between the two systems.

Terminals or devices supported are listed below. See Figure 20 in Appendix A for other characteristics of terminal support.

- Via Binary Synchronous Communications:
  - 2770 Data Communications System
  - 2780 Data Transmission Terminal
  - 2972/2980 General Banking Terminal System (RPQ required)
  - 3270 Information Display System
  - 3600 Finance Communication System (RPQ required)
  - 3735 Programmable Buffered Terminal
  - 3741 Model 2 Data Station
  - 3741 Model 4 Programmable Work Station
  - 5110 Computing System
  - 5230 Data Collection System
  - Office System/6 (RPQ required)
  - Series/1
  - System/3
  - System/7
  - System/360 (as host only)
  - System/370 (as host only)
  - System/32
  - System/34

- Via LCA:
  - 3741 Model 2 Data Station
  - 3741 Model 4 Programmable Work Station
  - 3270 Information Display System
  - 3600 Finance Communication System (RPQ required)
  - System/7

- Via MLTA:
  - 1050 Data Communications System
  - 2740 Models 1 and 2 Communication Terminal
  - 2741 Communication Terminal
  - 3767 Communication Terminal (supported as a 2740 Model 1 or 2 or as a 2741)
  - 5100 Portable Computer (supported as a 2741)
  - 5110 Computing System
  - Series/1
  - CMCST (Communicating Magnetic Card SELECTRIC® Typewriter)
  - System/7 (supported as a 2740 Model 1)

Modems

IBM modems can be attached to the processor, one per BSCA or BSCC line:

3872 Modem (2,400 bps)
3875 Modem (7,200 bps)
4872 Modem (4,800 bps)

A 1,200-bps integrated modem is also available on each BSCA and BSCC line.

Chapter 6. Compatibility

The System/3 Model 15 is supported by a system control program and program products designed to take advantage of the Model 15 features. This chapter discusses the compatibility of the Model 15 with other System/3 models in the areas of system, operation, programs, program products, and data files.

SYSTEM COMPATIBILITY

Although Model 15 SCP is different from Model 10 SCP, conversion from a Model 10 to Model 15A is made easier by the capability to use Model 10 programming on System/3 Model 15A. However, when this is done, the unique Model 15 features described in this publication are not used, and the Model 15 operates similarly to a Model 10. (Model 10 mode also refers to the Model 8.)

The mode of operation—Model 15 mode or Model 10 mode—is determined by the type of supervisor loaded during IPL (initial program load). In Model 15 mode, IPL occurs from a 5444 that contains a Model 15 supervisor and other Model 15 SCP programs. In Model 10 mode, IPL occurs from a 5444 disk that contains a Model 10 supervisor and other Model 10 SCP programs. To operate in Model 10 mode, the options (including number of devices and special features) selected during the Model 10 system generation must match, or be equivalent to, the Model 15 devices. (Programming support for RPQs on the Model 10 may not execute properly on the Model 15.)

The following Model 8 or 10 devices and features are not available on the Model 15:

- Dual Program Feature (DPF)—no equivalent
- 5475 Data Entry Keyboard—no equivalent
- 5471 Printer Keyboard—no equivalent
- 5203 Printer Models 1, 2, and 3—equivalent to 1403 Printer
- 5203 Printer Dual Feed Carriage Feature—no equivalent
- 5444 Disk Storage Drive Models 1, 2, 3, and A1—equivalent to 5444 Disk Storage Drive Models A2 and A3

Model 15 Programming Differences

SCP 5704-SC1 supports System/3 Models 15A, 15B, and 15C; SCP 5704-SC2 supports System/3 Model 15D. Some of the facilities in 5704-SC2 are not available in 5704-SC1; major differences are described in the following paragraphs:

Third Partition: SCP 5704-SC2 supports three programming partitions; SCP 5704-SC1 supports two.

Enhanced File Sharing: SCP 5704-SC1 has only limited file-sharing capabilities between partitions, although its CCP feature allows extensive sharing of a disk file. SCP 5704-SC2, rather than its CCP, contains file-sharing capabilities for both SCP and CCP. Thus, with few exceptions, a disk file can be shared between batch partitions, between a CCP partition and batch partition(s), and between CCP tasks. Some of the exceptions are:

- A file opened for output cannot be shared, except for CCP direct files.
- A file opened for consecutive additions cannot be shared with another program in which the file is also opened for consecutive additions.
- A scratch file cannot be shared.
- Double buffering (two I/O areas) cannot be used with a shared file.

More Files per Partition: SCP 5704-SC2 supports up to 192 active disk files per partition at any given time (SCP 5704-SC1 supports a maximum of 40). This capability is most useful to the CCP user.

More Online Library Capacity: Users of SCP 5704-SC1 have a maximum of 10 megabytes of online (directly accessible) library storage on four simulation areas for both partitions. With 5704-SC2, *each* partition can access three unique simulation areas while sharing a fourth (IPL) area. Thus, with SCP 5704-SC2, 25 megabytes are directly accessible for library storage. (Using 5704-SC2, simulation areas can be reassigned by the user with OCL.)

CCP Task Chaining Technique: The user of CCP under 5704-SC2 can chain together a series of programs to be run without operator intervention.

Cataloging into an Active Library: Using SCP 5704-SC2, the library maintenance program or overlay linkage editor can, with few restrictions, catalog entries into a library on a program pack used by another partition. Thus, a CCP program (or display format) can be cataloged into an active CCP library from a batch partition and, assuming its characteristics were defined prior to CCP startup, that program can then be executed under control of CCP. The level of program pack protection is selected during system generation.

External Buffers: As a user option in program compilation, all disk I/O areas can be stored outside the object program but within the partition. As a result, object programs can make better use of available main storage, and larger user programs can be compiled within the maximum program size.

Multivolume Files: For some access methods, a multivolume disk file can be shared between partitions or between tasks under CCP.

Transaction Logging: As a system task, user-selected records can be logged to a tape drive for audit trail purposes under CCP and/or batch.

CCP Resident Options: The user can specify certain CCP routines to be resident, rather than transient, in order to improve performance. Options include: termination, DFF format index, open/close/allocate, and program request.

Spool File Copy Program: This program, $QCOPY, can be used in a batch partition or under CCP to put jobs on the spool reader queue and to copy steps from the print and punch queues to a file. With $QCOPY, a user can develop a remote job initiation application from terminals attached to the system.

Program Load from File: An object program can be stored in a disk file in the main data area and subsequently loaded for execution from that area. Since the VTOC of the main data area can accommodate 1000 entries, space not required for files can be used for infrequently used programs, thus freeing up library space in the simulation areas.

OPERATION COMPATIBILITY

The OCL used with the Model 15 SCP 5704-SC1 is upwardly compatible with that of the Model 15 SCP 5704-SC2. 5704-SC2 supports:

- A SHARE parameter on the FILE statement.
- Optional ASSIGN and INCLUDE statements.
- Optional CLOSE and QCOPY parameters on the PRINTER statement.
- An optional QCOPY parameter on the PUNCH statement.
- QCOPY parameter on the JOB statement.
- Conditional OCL.
- Program load (LOAD*) from file.

The OCL from other System/3 models is compatible with Model 15 OCL. The OCL in a Model 8, 10, or 12 job stream can run without change on the Model 15 except in following instances:

- The RETAIN-A parameter in the FILE statement is not permitted.
- After IPL, the system is in NOHALT mode rather than HALT mode.
- The FORMS statement is not used, but it is accepted as a PRINTER statement.
- The LOG ON, LOG OFF, LOCKOUT, and PARTITION statements are not supported and are ignored on the Model 15.

The Model 15 uses the CRT for displaying messages instead of using the display lights on the processing unit to display halt codes. The Model 15 messages generally have the same meaning as other System/3 models except that subhalts are not used. Some messages have default responses so that an operator is not required to be present to take action.

Model 15 SCP 5704-SC1 operator control commands (OCC) are upwardly compatible with those of Model 15 SCP 5704-SC2 except that 5704-SC2 does not support the ROLLOUT and SIMULATE commands. 5704-SC2 supports:

- REUSE command.
- PR1 and PR2 operands on START, RESTART, and STOP commands.
- Commands to START and STOP by partition.
- Specifying equal priority tasks with a PTY command.
- DISK operand on DUMP command.
- KEEP command.

PROGRAM COMPATIBILITY

Programs that are compiled or assembled to be executed under control of Model 15 SCP 5704-SC1 must be recompiled or reassembled to be executed under control of Model 15 SCP 5704-SC2. Similarly, programs that are compiled or assembled to be executed under control of Model 15 SCP 5704-SC2 must be recompiled or reassembled to be executed under control of Model 15 SCP 5704-SC1.

Programs compiled on other System/3 models do not operate with System/3 Model 15 SCP; likewise, programs used with the Model 15 SCP cannot be used on other System/3 models.

Source programs must be recompiled before other System/3 model programs can operate with the Model 15 SCP. To facilitate recompilation, the Model 15 SCP can access the source and procedure libraries on a disk created by another System/3 model.

PROGRAM PRODUCT COMPATIBILITY

When changing from a Model 15A, 15B, or 15C to a Model 15D, the user must recompile source programs using the compilers applicable for the Model 15D. Changes to source programs are not required unless unique Model 15D functions are needed.

The 5444 indexed files and 5444 multivolume files are not supported in the simulation areas of a 3340 or 3344. As a result, some source program modifications may be required when systems are changed.

RPG II

System/3 Model 15 RPG II is source-language compatible with RPG II on other System/3 models. A RPG II source program can be recompiled by Model 15 RPG II compiler without changes to the source program (assuming the same I/O devices are referenced). The resulting object program can be executed under control of Model 15 SCP and will produce output identical to that on the previous system (assuming equivalent I/O devices and data), except that rollout/rollin is not supported for SCP 5704-SC2.

The inline inquiry subroutine (SUBR95) is not supported by Model 15 RPG II. A different subroutine, SUBR89, supports program function keys 1-9 on the keyboard.

COBOL

System/3 Model 15 COBOL is source-language compatible with COBOL on other System/3 models. A COBOL source program from a Model 10 can be recompiled by a Model 15 COBOL compiler without changes to the source program (assuming the same I/O devices are referenced). The resulting object program can be executed under control of Model 15 SCP and will produce output identical to that on the previous system (assuming equivalent I/O devices and data), except that rollout/rollin is not supported for SCP 5704-SC2.

FORTRAN IV

System/3 Model 15 FORTRAN IV is source-language compatible with FORTRAN IV on other System/3 models. A FORTRAN IV source program can be recompiled by a Model 15 FORTRAN IV compiler without changes to the source program (assuming the same I/O devices are referenced). The resulting object program can be executed under control of Model 15 SCP and produces output identical to that on the previous system (assuming equivalent I/O devices and data).

Basic Assembler

System/3 Model 15 Basic Assembler is functionally equivalent to the Basic Assembler on other System/3 models. When converting from another System/3 model, the user should review assembler programs for possible changes in macro statements.

Disk Sort

The System/3 Model 15 Disk Sort program is compatible with the Disk Sort programs used on other System/3 models.

CCP/Disk Sort

The Model 15 CCP/Disk Sort program is compatible with the CCP/Disk Sort program used on other System/3 models.

Tape Sort

The System/3 Model 15 Tape Sort program is compatible with Tape Sort programs on other System/3 models.

Card Utilities

The System/3 Model 15 Disk Resident Card Utilities (that have equivalents on other System/3 models) are functionally equivalent to the versions on the other System/3 models. Operation of the programs is different due to the Model 15 system/operator interface.

DATA FILE COMPATIBILITY

Disk Files

Any of the disk data files created by any System/3 program using disk system management (for example; RPG II, COBOL, Disk Sort) can be processed by any System/3 program that uses disk system management to access the files. Scratch files (RETAIN-S) created on other System/3 models are not accessible on the Model 15.

Tape Files

Tape data files are interchangeable between System/3 models except that multifile tapes are supported only on the Model 15.

Figures 11 through 23 show the device configurations supported by System/3 Model 15. Figure 24 compares the more common configuration options for the IBM System/3.

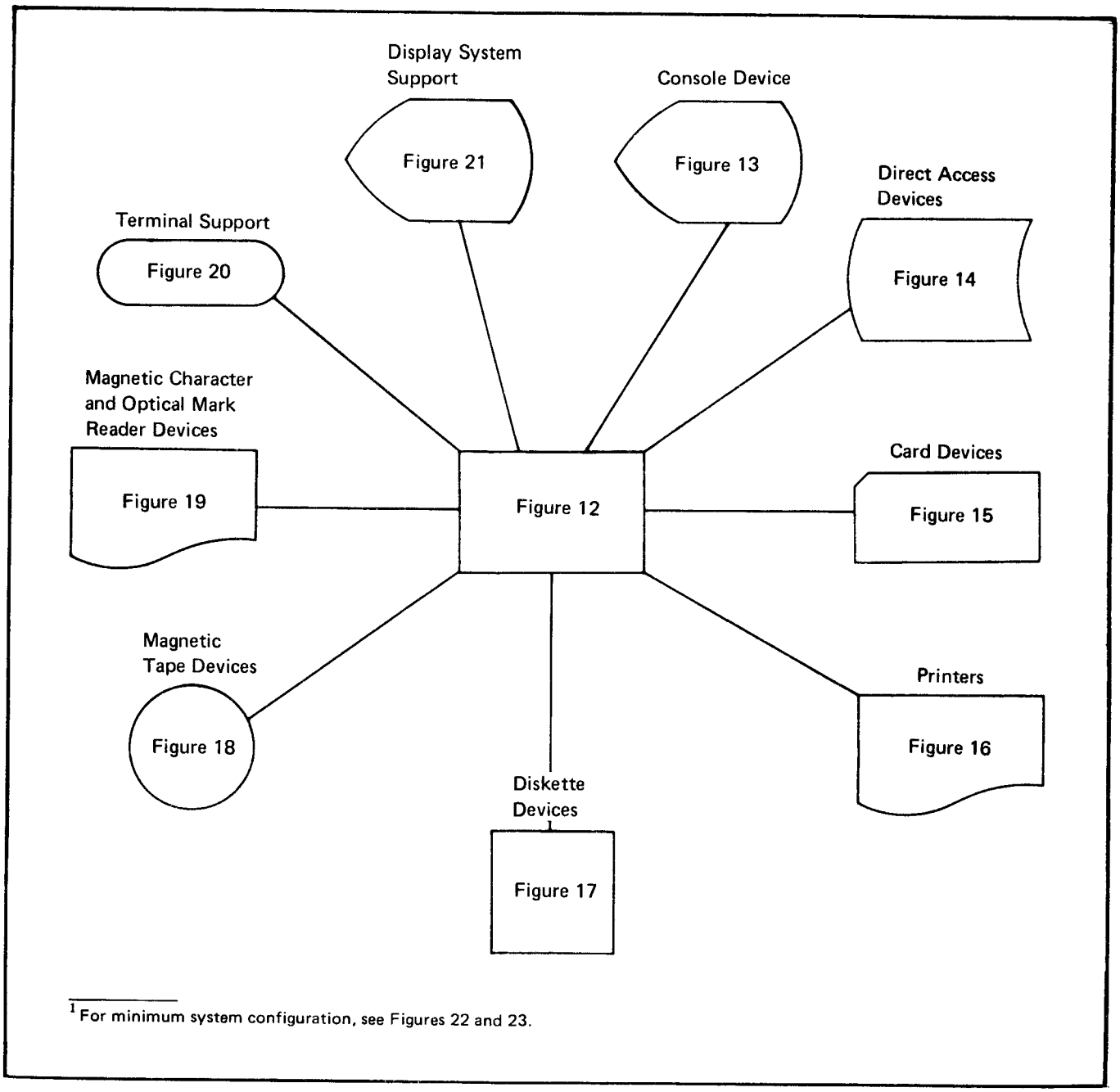


Figure 11. Configurations Supported by System/3 Model 15

Model	Storage Size in Bytes	Approximate Storage Size
A17/B17	49,152	48K
A18/B18	65,536	64K
A19/B19/D19	98,304	96K
A20/B20/D20	131,072	128K
C21/D21	163,840	160K
C22/D22	196,608	192K
C23/D23	229,376	224K
C24/D24	262,144	256K
D25	393,216	384K
D26	524,288	512K

Figure 12. Processing Units

Device and Feature	Characteristics
3277 Display Station Model 1	A cathode-ray tube screen: Displays 480 characters—12 lines of 40 characters Supports a 64-character set—36 alphameric characters, 27 special characters, and a blank
Feature 4632	A 78-key Operator Console Keyboard: 45 alphameric, 21 control, and 12 program function keys

Figure 13. Console Device—CRT/Keyboard

Storage Characteristics	5444 Disk Storage Drive	5445 Disk Storage	3340 Direct Access Storage Facility	3344 Direct Access Storage
Timing:				
Minimum access time (ms)	28	25	10	10
Average access time (ms)	126	60	25	25
Maximum access time (ms)	255	130	50	50
Data transfer rate (bytes/second)	199,000	312,000	885,000	885,000
Nominal rotational speed (rpm)	1,500	2,400	2,900 (approx)	2,964
Capacity:				
Bytes per record (sector)	256	256	256	256
Records (sectors) per track	24	20	48	48
Bytes per track	6,144	5,120	12,288	12,288
Tracks per cylinder	2	20	20	20
Bytes per cylinder	12,288	120,400	245,760	245,760
Cylinders per disk medium	200	200	207	828
Bytes per disk medium (see Part 2)	2,457,600	20,480,000	50,872,320	203,489,280
Tracks per disk medium	400	4,000	4,140	16,560
Records (sectors) per disk medium	9,600	80,000	198,720	794,880

Figure 14 (Part 1 of 4). Direct Access Devices—Storage Characteristics

DISK CAPACITY IN BYTES	5440 Disk Cartridge (5444)	2316 Disk Pack (5445)	3348 Data Module (3340)	3344 Direct Access Storage (1 vol)	3344 Direct Access Storage (4 vols, 1 dr)
User data area	2,445,312	20,377,600	40,796,160	45,711,360	182,845,440
Simulation area	N/A	N/A	9,830,400[1]	4,915,200	19,660,800
Subtotal	2,445,312	20,377,600	50,626,560	50,626,560	202,506,240
Cylinder 0 (reserved)	12,288	102,400	245,760	245,760	983,040
Subtotal	2,457,600	20,480,000	50,872,320	50,872,320	203,489,280
Alternate tracks (reserved)	36,864	307,200	491,520	491,520	1,966,080
Other use (reserved)	12,288	N/A	98,304	245,760	983,040
Total physical capacity	2,506,152	20,787,200	51,462,144	51,609,600	206,438,400

[1] When a data module is mounted on 3340 drive 3 or 4 on Model 15D, only 4,915,200 bytes of simulation area are addressable.

Figure 14 (Part 2 of 4). Direct Access Devices—Disk Capacity in Bytes

	System Use		User Data Area		Simulation Areas		Other Use		
	Cylinder	Million Bytes	Cylinder	Million Bytes	Cylinder	Million Bytes	Cylinder	Million Bytes	Total
5440 Disk Cartridge	0	0.01	4-202	2.45	N/A		1-3 203	0.04 0.01	2.51
2316 Disk Pack	0	0.10	1-199	20.38	N/A		200-202	0.31	20.79
3348 Data Module	0	0.25	1-166	40.80	169-208[1] (4)	9.83[1]	167-168 209	0.49 0.10	51.47[1]
3344 Direct Access Storage									
Each volume	0	0.25	1-186	45.71	189-208 (2)	4.91	187-188 209	0.49 0.25	51.61
4 volumes	—	0.98	—	182.85	—	19.66	—	2.95	206.44

[1] On the Model 15D, if the data module is mounted on drive 3 or drive 4, only two simulation areas are accessible. The starting cylinder number is 189 and the capacity is 4.91M bytes. Total capacity is 46.56M bytes.

Figure 14 (Part 3 of 4). Direct Access Devices—Disk Capacity in Bytes

Configurations	Storage in Millions of Bytes
5444	
One Model A2	4.9
One Model A2 and one Model A3	7.35
Two Model A2s	9.8
5445	
One Model 1	20.48
One Model 1 and one Model 2	40.96
One Model 3	40.96
Two Model 1s and one Model 2	61.44
One Model 1 and one Model 3	61.44
Two Model 1s and two Model 2s	81.92
Two Model 3s	81.92
One Model 1, one Model 2, and one Model 3	81.92
3340[1]	
One Model A2	81.6
One Model A2 and one Model B1	122.4
One Model A2 and one Model B2	163.2
3340/3344[1]	
One 3340 Model A2 and one 3344 Model B2	447.2

[1] Storage size is for main data areas only and does not include 5444 simulation areas or reserved areas.

Figure 14 (Part 4 of 4). Direct Access Devices—Configurations

Device	Maximum Speed			Card Columns	Stackers		Hoppers	
	Reading (cards per minute)	Punching	Printing		Number	Capacity (cards)	Number	Capacity (cards)
5424 Multi-Function Card Unit								
Model A1	250	60 cds/m	60 cds/m	96	4	600	2	2,000
Model A2	500	120 cds/m	120 cds/m	96	4	600	2	2,000
2560 Multi-Function Card Machine								
Model A1	500	160 col/s	140 pos/s	80	5	1,300	2	1,200
Model A2	310	120 col/s	—	80	4	1,300	2	1,200
1442 Card Read Punch								
Model 6	300	80 col/s	—	80	2	1,300	1	1,200
Model 7	400	160 col/s	—	80	2	1,300	1	1,200
2501 Card Reader								
Model A1	600	—	—	80	1	1,300	1	1,200
Model A2	1,000	—	—	80	1	1,300	1	1,200

Valid card device combinations:
- None
- 5424
- 2560
- 1442
- 2501
- 5424 and 2501
- 2560 and 2501
- 1442 and 2501
- 5424 and 1442 (RPQ)

Notes:

1. If no card device is attached, a 5415 Model B, C, or D requires a directly attached 3741 Data Station or Programmable Work Station.
2. If the 5424 is not installed, a 5415 Model A requires a 5422 Disk Enclosure.

Figure 15. Card Devices

Device	Maximum Print Speed	Print Positions
1403 Printer[1]		
Model 5	465 lines per minute	132
Model 2	600 lines per minute	132
Model N1	1,100 lines per minute	132
3284 Printer		
Model 1	40 characters per second	120, 126, or 132
3287 Printer		
Model 1	80 characters per second	132
Model 2	120 characters per second	132

[1] A 5421 Printer Control Unit is required to attach a 1403 Printer.

Figure 16. Printer Devices

3741 Diskette Storage Characteristics	
Bytes per record	1-128
Records per track	26
Tracks per diskette	73
Data sets per diskette	1-19
Records per diskette	1,898

Figure 17. Diskette Devices

Characteristics	3410/3411 Magnetic Tape Unit and Control[1]		
	Model 1	Model 2	Model 3
Data rate (kilobytes/sec)			
at 1,600 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	0.6	0.6	0.6
for 7-track	0.75	0.75	0.75
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

[1] Maximum configuration: One 3411 and three 3410s.

Figure 18. Magnetic Tape Devices

Characteristics	1255 Magnetic Character Reader			1419 Magnetic Character Reader[1]	3881 Optical Mark Reader
	Model 1	Model 2	Model 3	Model 1	Model 1
Maximum throughput	500 dpm	750 dpm		1,600 dpm	6,000 dph[2]
Number of fields	5				Not applicable
Maximum number characters	45 plus 8 special symbols				2,480 per page
Document width	2.5 to 4.25 inches (63.5 to 108 mm)			2.75 to 3.66 inches (70.0 to 93.9 mm)	3 to 9 inches (76.2 to 228.6 mm)
Document length	5.75 to 8.88 inches (146.0 to 225.6 mm)			6.00 to 8.75 inches (152.4 to 222.3 mm)	3 to 12 inches (76.2 to 304.8 mm)
Document thickness	0.003 to 0.007 inch (0.08 to 0.18 mm)				0.0035 to 0.0070 inch (0.089 to 0.18 mm)
Number of stackers	6		12	13	2
Capacity of stackers	2.5 inches (63.5 mm)			4.0 inches (101.6 mm)	4.0 inches (101.6 mm)
Number of hoppers	1				
Capacity of hoppers	5.5 inches (139.7 mm)			12.0 inches (304.8 mm)	600 forms
Required font	E13B				Not applicable

[1] Requires an RPQ on the 1419 to attach to System/3.
[2] Four thousand 8.5 x 11 inch (215.9 x 279.4 mm) pages per hour.

Figure 19. Magnetic Character Reader and Optical Mark Reader Devices

Terminals Operating with System/3 Model 15	Type of Communication	Programming Support				Communication Code					Communication Network			
						EBCDIC		ASCII			Point-to-point		Multipoint	
		RPG II	MLMP	MLTA	CCP	Normal	Transparency	Normal	Transparency	PTTC	Switched	Non-switched	Tributary	Control Station
CMCST	SS	–	–	X	X	–	–	–	–	X	X	–	–	–
S/7 ACC	SS	–	–	X	X	–	–	–	–	X	X	X	–	X
1050 System	SS	–	–	X	X	–	–	–	–	X	X	X	–	X
2740-1	SS	–	–	X	X	–	–	–	–	X	X	X	–	X
2740-2	SS	–	–	X	X	–	–	–	–	X	–	X	–	X
2741	SS	–	–	X	X	–	–	–	–	X	X	X	–	–
3767	SS	–	–	X	X	–	–	–	–	X	X	X	–	X
5100/5110	SS	–	–	X	X	–	–	–	–	X	X	X	–	–
S/3	BSC	X	X	–	X	X	X	X	–	–	X	X	X	X[1]
S/7	BSC	X	X	–	X	X	X	X	–	–	X	X	–	X[1]
S/32 & S/34	BSC	X	X	–	X	X	X	X	–	–	X	X	–	X[1]
S/360-20	BSC	X	X	–	X	X	X	X	–	–	X	X	–	–
S/360 & S/370	BSC	X	X	–	X	X	X	X	–	–	X	X	X	–
1130 System	BSC	X	X	–	–	X	X	–	–	–	X	X	–	–
2770	BSC	X	X	–	–	X	X	X	–	–	X	X	–	–
2780	BSC	X	X	–	–	X	X	X	–	–	X	X	–	–
2972-8, -11	BSC	–	X	–	–	X	–	–	–	–	–	–	–	X
3270	BSC	X[3]	X	–	X	X	–	X	–	–	–	–	–	X
3600	BSC	–	X	–	X	X	X	–	–	–	–	X	–	X
3741-2, -4	BSC	X	X	–	X	X	X	–	–	–	X	X	–	X[2]
3735	BSC	–	X	–	X	X	–	X	–	–	X	X	–	X
5110	BSC	X	X	–	X	X	X	–	–	–	X	X	–	X[2]
5230	BSC	X	X	–	X	X	X	–	–	–	X	X	–	X[2]

Legend:
CMCST = Communicating Magnetic Card SELECTRIC® Typewriter
ACC = Asynchronous Communications Control
SS = Start/Stop
BSC = Binary Synchronous Communication
X = Supported
– = Not Supported
PTTC = Perforated Tape and Transmissio[illegible]de

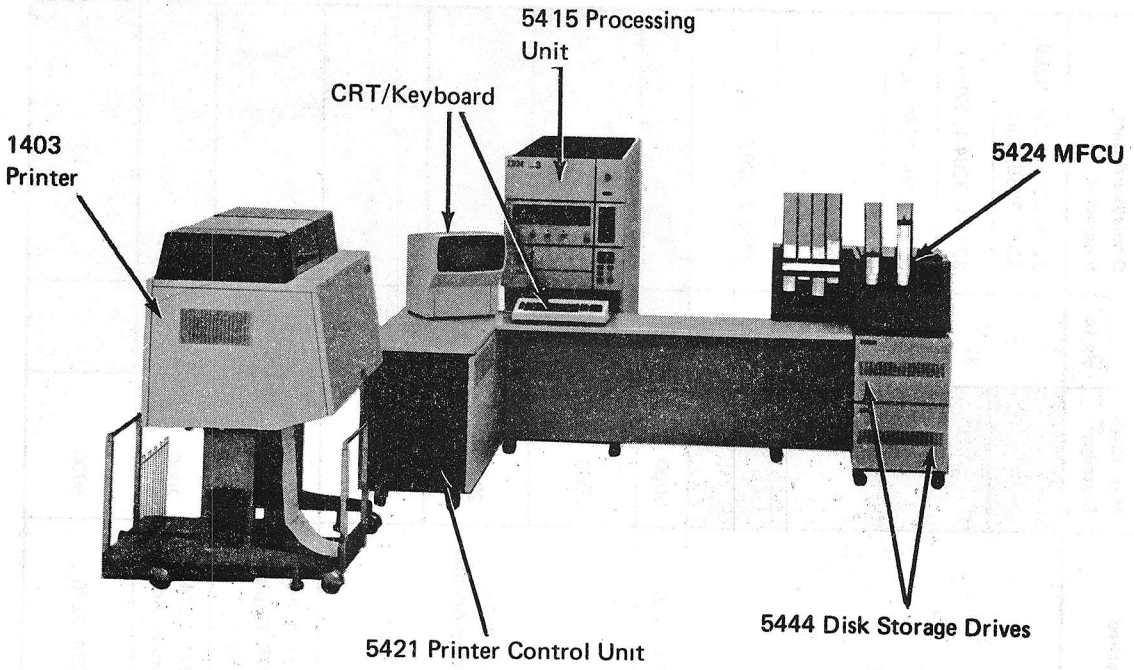
[1] Not supported by RPG II.
[2] Multipoint tributary to CCP and MLMP only.
[3] RPG II display control feature only.

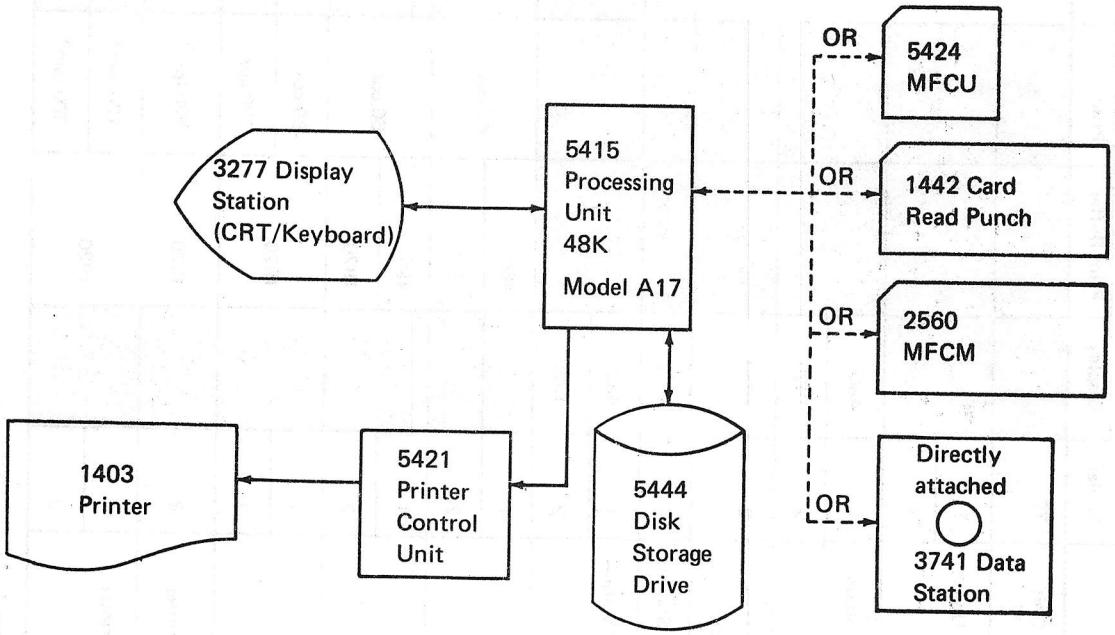
Figure 20. Terminal Support

Device	Model	Character Capacity		Maximum Speed		Attached via	Max. Cable Distance[2]	Displays/Printers	
		Display	Print Buffer	Print	Transmit[1]			Up to	Supported
3274 Control Unit	1C				9600 bps	BSC		32	3277, 3278, 3284, 3286, 3287, 3288, 3289
3271 Control Unit	1				7200 bps				3277-1, 3284-1, 3286-1
	2								3277, 3284, 3286, 3288
3275 Display Station	1	480						1	3284-3
	2	1920							
3276 Control Unit Display Station	2	1920						7	3278-2, 3287, 3289
3278 Display Station	2	1920				3274, 3276	5000		
3277 Display Station	1	480				3271, 3274, Display Adapter	2000		
	2	1920							
3284 Printer	1		480	40 cps			2000		
	2		1920						
3286 Printer	1		480	66 cps			2000		
	2		1920						
3287 Printer	1		1920	80 cps		3271, 3274, 3276, Display Adapter	5000/ 2000		
	2			120 cps					
3288 Line Printer	2		1920	120 lpm[3]		3271, 3274, Display Adapter	2000		
3289 Line Printer	1		1920	120 lpm[3]		3274, 3276	5000		
	2			300 lpm[3]					

[1] Nonswitched. 3275 can also transmit at 1200 bps switched.
[2] In feet from control unit
[3] With 64-character set

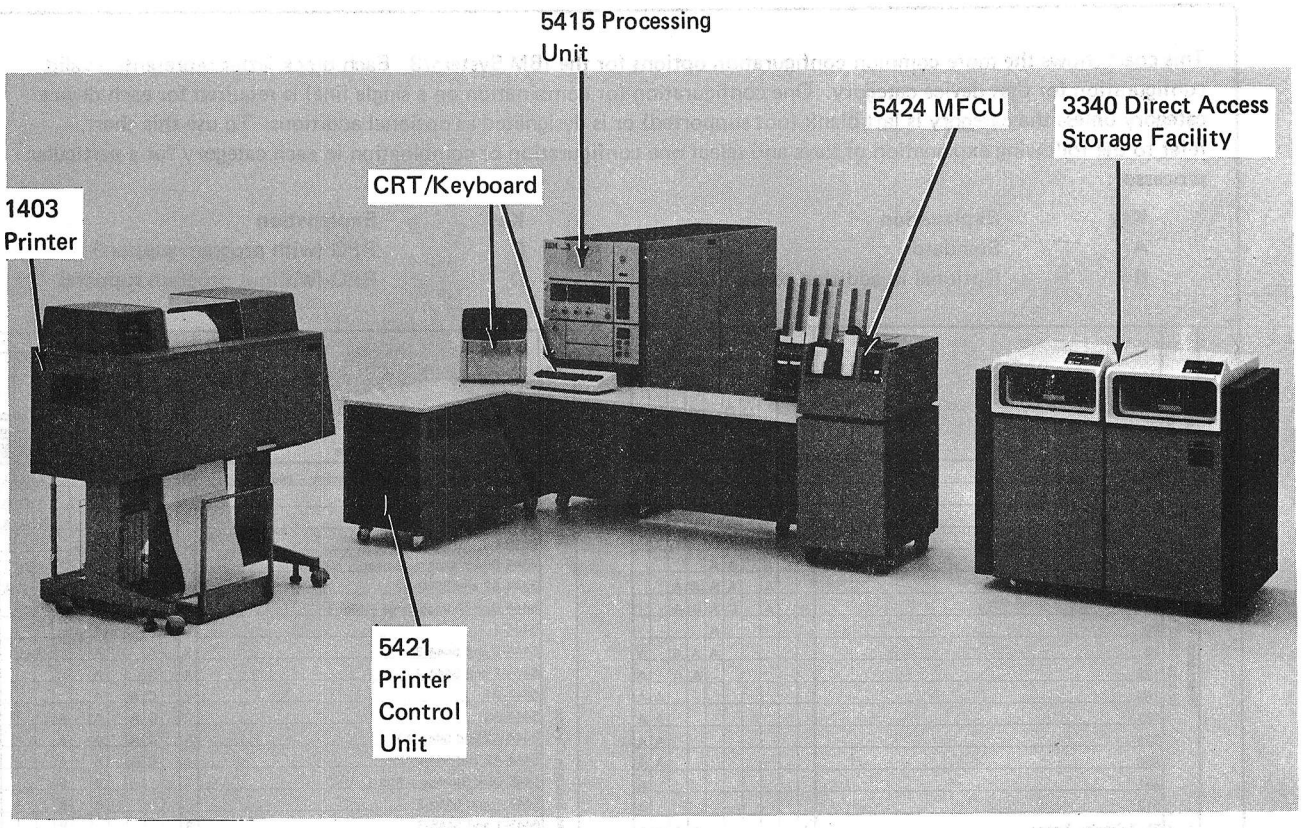
Figure 21. 3270 Information Display System Support

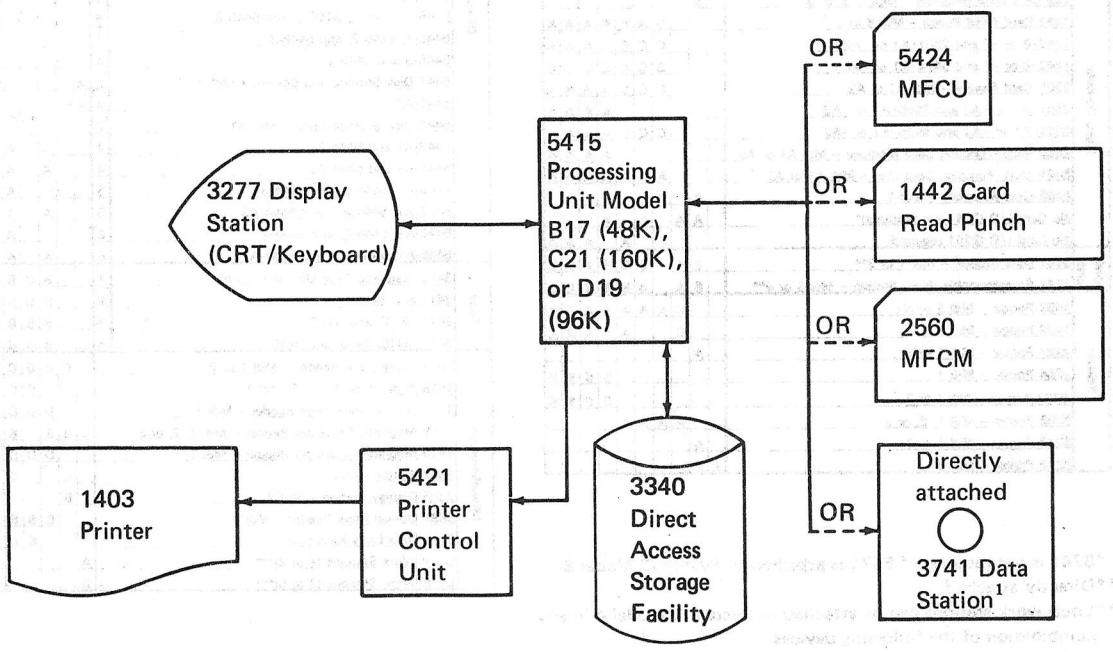




Dashed lines (- - - -) indicate a system configuration with card I/O devices.

Figure 22. System/3 Model 15—Minimum System Configuration





Dashed lines (----) indicate a system configuration with card I/O devices.

[1] Required if system does not have any card I/O.

Figure 23. System/3 Models 15B, 15C, and 15D—Minimum System Configuration

This chart shows the more common configuration options for the IBM System/3. Each block letter represents a valid configuration for that device category. One configuration (or combination on a single line) is required for each device category unless the category is left blank (not supported) or is designated as optional additions. To use this chart, refer to the following explanation of keys and select one configuration or combination in each category for a particular processor:

Key	Explanation
A	Standard
B	Optional in addition to the standard
C	RPQ (with program support)
D	RPQ (without program support)

Device Category	Device	5404	5406	5408	5410 C	5410 D	5412	5415 A	5415 B	5415 C	5415 D
Processor Storage (Minus 1024 bytes)	8		A		A						
	12		A		A	A					
	16		A	A	A	A					
	24		C			A					
	32		C	A		A	A				
	48			A		A	A	A	A		
	64	A		A		C	A	A	A		
	80						A				
	96							A	A	A	A
	128								A	A	A
	160										A
	192										A
	224										A
	256										A
	384										A
	512										A
Console	3277 Display Station	A						A	A	A	A
	5471 Printer-Keyboard			A		B	B				
Card Devices	129 Card Data Recorder – Mdl 1, 2, or 3		B								
	1442 Card Read Punch – Mdl 6 or 7				D	A	A	A	A	A	A
	1442-6 or -7 and 2501-A1 or -A2				C	C	C	A	A	A	A
	1442-6 or -7 and 5424-A1 or -A2				C	C	C	C	C	C	C
	2501 Card Reader – Mdl A1 or A2				C	C	C	A	A	A	A
	2501-A1 or -A2 and 2560-A1 or -A2							A	A	A	A
	2501-A1 or -A2 and 5424-A1 or -A2				C	C	C	A	A	A	A
	2560 Multi-Function Card Machine – Mdl A1 or A2							A	A	A	A
	5424 Multi-Function Card Unit – Mdl A1 or A2				A	A	A	A	A	A	A
	5496 Data Recorder – Mdl 1		B								
	No Card I/O (3741 not required)*		A	A		C		A			
	No Card I/O (3741 required)							A		A	A
Diskette	3741 Data Station – Mdl 1 or 2**		B	A		B	B	B	B	B	B
	3741 Programmable Work Station – Mdl 3 or 4**		B	A		B	B	B	B	B	B
Printer	1403 Printer – Mdl 2 or N1			C	A	A	A	A	A	A	A
	1403 Printer – Mdl 5			C			A	A	A	A	A
	2222 Printer – Mdl 1 or 2	A									
	3284 Printer – Mdl 1								B	B	B
	3287 Printer – Mdl 1 or 2								B	B	B
	5203 Printer – Mdl 1, 2, or 3			A	A	A	A				
	5213 Printer – Mdl 1 or 2		A								
	5213 Printer – Mdl 3	A	A								

Device Category	Device	No. of Drives	5404	5406	5408	5410 C	5410 D	5412	5415 A	5415 B	5415 C	5415 D
Direct Access Storage Device	3340 Direct Access Storage Facility – Mdl A2	2								A	A	A
	3340-A2 and 3340-B1	3								A	A	A
	3340-A2 and 3340-B2	4								A	A	A
	3340-C2	2						A				
	3344 Direct Access Storage – Mdl B2	2										
	3344-B2 and 3340-A2	4										A
	5444 Disk Storage Drive – Mdl 1	2		A			A					
	5444-2	2		A			A					
	5444-2 and 5444-3	3		A			A					
	5444-2 and 5444-2	4		A			A					
	5444-A1	2		C	A		A					
	5444-A2	2		C	A		A		A			
	5444-A2 and 5444-A3	3		C	A		A		A			
	5444-A2 and 5444-A2	4		C	A		A		A			
	5445 Disk Storage – Mdl 1	1					B		B			
	5445-1 and 5445-2	2					B		B			
	5445-1 and 5445-3	3							B			
	5445-3	2					B		B			
	5445-1, 5445-1, and 5445-2	3							B			
	5445-1, 5445-1, 5445-2, and 5445-2	4							B			
	5445-1, 5445-2, and 5445-3	4							B			
	5445-3 and 5445-3	4							B			
	5447 Disk Storage and Control – Mdl A1	2	A									
	5447-A2	4	A									
	5448 Disk Storage Drive – Mdl A1	2										
	5448-A1 and 5444-2	4				A						
	5448-A1 and 5444-A2	4		A		A						
	5448-A1, 5444-2, and 5444-3	5				A						
	5448-A1, 5444-A2, and 5444-A3	5		A		A						
	5448-A1, 5444-2, and 5444-2	6				A						
	5448-A1, 5444-A2, and 5444-A2	6		A		A						
Tape	3411 Magnetic Tape Unit and Control	1			B	B	B	B	B	B	B	B
	3411 and 3410	2			B	B	B	B	B	B	B	B
	3411, 3410, and 3410	3			B	B	B	B	B	B	B	B
	3411, 3410, 3410, and 3410	4			B	B	B	B	B	B	B	B
Miscellaneous	1017 Paper Tape Reader – Mdl 1 or 2			C	C	C	C	C	C	C	C	C
	1018 Paper Tape Punch – Mdl 1					C	C	C	C	C	C	C
	1231 Optical Mark Page Reader – Mdl 1				D	D	D	D	D	D	D	D
	1255 Magnetic Character Reader – Mdl 1, 2, or 3		C	B	B		B	B	B	B	B	B
	1419 Magnetic Character Reader – Mdl 1				D	D	D	D	C	C	C	C
	1627 Plotter – Mdl 1			C			C					
	2265 Display Station – Mdl 2			B								
	3881 Optical Mark Reader – Mdl 1				B	B	B	B	B	B	B	B
	5475 Data Entry Keyboard					B	B					
	Local Work Stations (1 or 2)***		A									
	Local Work Stations (3 to 5)***		B									

*3741 is not required if 5471 is attached to System/3 Model 8.

**Directly attached.

***Local work stations can be attached to System/3 Model 4 in any combination of the following devices:

3277 Mdl 1 or 2	3286 Mdl 1 or 2
3284 Mdl 1 or 2	3288 Mdl 2

Note: RPQs (requests for price quotation) are special features. Contact your marketing representative for more information.

Figure 24. IBM System/3 Configuration Summary

Appendix B. Bibliography

SYSTEM CONTROL PROGRAM

IBM System/3 Model 15 Operator's Guide	GC21-5075
IBM System/3 Model 15 System Control Programming Reference Manual, 5704-SC1	GC21-5077
IBM System/3 Model 15 System Control Programming Concepts and Reference Manual, 5704-SC2	GC21-5162
IBM System/3 Model 15 System Generation Reference Manual	GC21-7616
IBM System/3 Model 15 System Messages	GC21-5076
IBM System/3 Model 15 User's Guide to Spooling	GC21-7632

Communications

IBM Data Communications Concepts	GC21-5169
IBM System/3 Communications Control Program General Information Manual	GC21-7578
IBM System/3 Communications Control Program Messages	GC21-5170
IBM System/3 Communications Control Program Programmer's Reference	GC21-7579
IBM System/3 Communications Control Program System Design Guide	GC21-5165
IBM System/3 Communications Control Program Terminal Operator's Guide	GC21-7580
IBM System/3 Model 15 Communications Control Program System Operator's Guide	GC21-7619
IBM System/3 Model 15 Communications Control Program System Reference Manual	GC21-7620
IBM System/3 Model 15 MULTI-LEAVING Remote Job Entry Work Station Support Reference Manual	GC21-5115
IBM System/3 Multiline/Multipoint Binary Synchronous Communications Reference Manual	GC21-7573

PROGRAM PRODUCTS

RPG II

Introduction to RPG II	GC21-7514
IBM System/3 RPG II Reference Manual	GC21-7504
IBM System/3 RPG II Auto Report Feature General Information Manual	GC21-7563
IBM System/3 RPG II Auto Report Feature Reference Manual	SC21-5057
IBM RPG II 3270 Display Control Feature Reference and Logic Manual	SC21-5161
IBM System/3 RPG II Telecommunications Programming Reference Manual	SC21-7507

Other Programming Languages

IBM System/3 Basic Assembler Reference Manual	SC21-7509
IBM System/3 Subset American National Standard COBOL Reference Manual	GC28-6452
IBM System/3 FORTRAN IV Reference Manual	SC28-6874

Sorts

IBM System/3 Disk Sort Reference Manual	SC21-7522
IBM System/3 Tape Sort Reference Manual	SC21-7572

Card Utilities

IBM System/3 Sort/Collate and Card Utilities Reference Manual	SC21-7529

OTHER REFERENCE

An Introduction to the IBM 3270 Information Display System	GA27-2739
IBM System/3 Disk Concepts and Planning Guide	GC21-7571
IBM System/3 Magnetic Tape Program Planning Manual	GC21-5040
IBM System/3 Models 8, 10, 12, and 15 Components Reference Manual	GA21-9236
IBM System/3 Model 15 1255/1419 Magnetic Character Reader Reference and Program Logic Manual	GC21-5132
IBM System/3 Model 15 3340 Direct Access Storage Facility Reference Manual	GC21-5111
IBM System/3 3741 Reference Manual	GC21-5113
IBM System/3 3881 Optical Mark Reader Model 1 Program Reference and Logic Manual	GC21-5103
IBM 3270 Information Display System Component Description	GA27-2749
IBM 3270 Information Display System Reference Summary	GX20-1878
IBM System/3 Model 15D Channel-Connected Systems Reference and Logic Manual	GC21-5199
IBM System/3 Model 15D System Measurement Facility Reference and Logic Manual	GC21-5207

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 the Terminology and Glossary of the American National Standards Committee X3.

An asterisk (*) preceding a definition in the following list indicates an American National Standard definition.

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.

active program: Any program that is loaded and ready to be executed or is executing.

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

American National Standard labels: Magnetic tape labels that conform to the conventions established by the American National Standards Institute. Synonymous with ASCII label.

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

ANS: American National Standard

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.

ASCII label: Same as *American National Standard label.*

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.

bpi: Bits per inch.

bps: Bits per second.

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

BSCC: Binary synchronous communications controller. 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.

card image: (1) A one-to-one representation of the hole patterns of a punched card; for example, a matrix in which a 1 represents a punch and a 0 represents the absence of a punch. (2) See *column binary.*

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.

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 processing unit 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.

CMCST: Communicating Magnetic Card SELECTRIC® Typewriter.

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.

cold start: Same as *initial program load.*

collate: *To combine items from two or more ordered sets into one set having a specified order not necessarily the same as any of the original sets. Contrast with *merge.*

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

column binary: (1) *Pertaining to the binary representation of data on cards in which the significances of punch positions are assigned along card columns. (2) For example, in System/3 each column in a 12-row card may be used to represent 2 consecutive bytes. (3) See *card image.*

combined file: A file of cards upon which both input and output operations are performed. All cards in the file are read, but not all cards in the file are punched, interpreted and/or stacker selected.

communications control program: See *CCP.*

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 card: A punched card containing input data or parameters for initializing or modifying a program.

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; that is, 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: Characters 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 the 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 system control program 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 data module is used on the IBM 3340 Direct Access Storage Facility.

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 diskettes 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.

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, such as the IBM 5445 Disk Storage Drive. (Disk cartridges, also removable direct access storage volumes, are used on the IBM 5444 Disk Storage Drive.)

dph: Documents per hour.

dpm: Documents per minute.

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).

duplex: *In communications, pertaining to a simultaneous two-way independent transmission in both directions. Contrast with *half duplex.* Synonymous with full duplex.

EBCDIC: Extended binary coded decimal interchange code. A set of 256 characters, each represented by 8 bits.

error recovery procedure: Procedures designed to help isolate and, where possible, to recover from errors in equipment. The procedures 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 the system control program, or it may be a standalone 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 in which it is logically or physically associated. Contrast with *variable-length record.*

gangpunch: To punch all or part of the information from one punched card into succeeding cards.

half duplex: *In communications, pertaining to an alternate, one way at a time, independent transmission. Contrast with *duplex.*

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.*

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.

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.

input queue: A queue (waiting list) of job definitions in direct access storage arranged in order of assigned priority.

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 the system control program, or it may be a standalone 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.

interpret: (1) To print on cards. (2) To translate.

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: (1) *A specified group of tasks prescribed as a unit of work for a computer. By extension, a job usually includes all necessary computer programs, linkages, files, and instructions to the operating system. (2) A collection of related problem programs, identified in the job stream by a JOB statement.

job step: A unit of work associated with one processing program or one cataloged 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 on an input unit especially activated for this purpose by the operator.

K: 1,024 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.

magnetic tape: *A tape with a magnetic surface on which data can be stored by selective polarization of portions of the surface.

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

Mdl: Abbreviation for model.

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

MFCM: Multi-function card machine. Same as IBM 2560 Multi-Function Card Machine.

MFCU: Multi-function card unit. Same as IBM 5424 Multi-Function Card Unit.

microsecond: One-millionth of a second. Abbreviated μs.

millisecond: One-thousandth of a second. Abbreviated ms.

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

MLTA: Multiple line terminal adapter.

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

multiprogramming: *Pertaining to the concurrent execution of two or more programs by a computer.

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

multivolume 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.

nonstandard labels: Labels that do not conform to American National Standard or IBM Standard label conventions.

object code: *Output from a compiler or assembler that 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. Contast with *source program.*

OCC: Operator control command.

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 that controls the execution of computer programs and that 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 control command: A statement to the supervisor issued via the console device that causes the supervisor to provide requested information, alter normal operations, initiate new operations, or terminate existing operations. Abbreviated OCC.

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 the operator 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.

output queue: A queue of control information describing system output that specifies to an output writer the location and disposition of system output.

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.*

priority: A rank assigned to a job that determines its precedence in receiving system resources.

privileged instruction: An instruction that is intended to be executed only by the system control program.

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 check interruption: An interruption caused by unusual conditions encountered in a program, such as incorrect instructions.

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

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

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

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 specific requirements.

prompting: A function that helps a user by requesting information necessary to continue processing.

queue: (1) A waiting line or list formed by items in a system waiting for service; for example, jobs to be performed. (2) To arrange in, or form, a queue. See *input queue, output queue.*

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.

reel: (1) Mounting for a roll of tape. (2) A volume of magnetic tape.

reproduce: To prepare a duplicate of stored information, especially for punched cards.

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

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 jobs and job steps.

scratch file: A disk file that is 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.*

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.

spooling: The reading and writing of input and output streams on disk concurrently with job execution, in a format convenient for later processing or output operations.

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.

standalone program: A program that can be executed independently of an operating system.

start-stop transmission: See *asynchronous transmission.*

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

step: (1) *One operation in a computer routine. (2) See *job step.*

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.

storage protection: *An arrangement for preventing access to storage for either reading, or writing, or both. Synonymous with memory protection.

supervisor: The part of a control program that coordinates the use of resources and maintains the flow of system 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 program: 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 program 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 history area: A space on a direct access storage device in which information relating to system activity is stored.

system log device: See *log device.*

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

tape: See *magnetic tape.*

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 read 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 that 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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