IBM System/3 Model 6

The wide-carriage 2222 Printer equips this System/3 Model 6 for ledger card processing. Cards up to 11 by 14 inches can be inserted into the feed slot (center).

The operator-centered design of this low-priced model of the System/3 gives it great appeal to most current users of accounting machines or time-sharing terminals, but also severely limits its potential throughput. Programs can be written in RPG II, FORTRAN, or conversational BASIC.

MANAGEMENT SUMMARY

The IBM System/3 Model 6, introduced in October 1970, is a small-scale computer that is strikingly different in its peripheral equipment, software, and applications orientation from the original System/3 (now called Model 10) that IBM unveiled in July 1969.

The System/3 Model 6 announcement stressed that this single computer system can be used in two radically different ways. As "the office computer," IBM introduced the Model 6 as a low-cost stored-program computer, using disk drives for on-line file storage and featuring an Operator Keyboard Console for both data entry and system control. Ledger card processing is also offered as an option. All programming of standard business applications is normally done in the RPG II language.

As "the problem solver," IBM introduced the System/3 Model 6 as a fast arithmetic processor designed to permit engineers, scientists, and other technicians to utilize the system at the keyboard via the conversational BASIC ➢

CHARACTERISTICS

MANUFACTURER: International Business Machines Corporation 1133 Westchester Avenue, White Plains, New York 10604.

MODEL: System/3 Model 6.

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 1 BCD digit, or 8 binary bits.

FIXED-POINT OPERANDS: Can range from 1 to 16 digits for source fields and from 1 to 31 digits for result fields. Logical operands can range from 1 to 256 bytes.

FLOATING-POINT OPERANDS: No hardware facilities for floating-point arithmetic are provided.

INSTRUCTIONS: 4, 5, or 6 bytes long in 2-address format; 3 or 4 bytes long in 1-address format; 3 bytes long in command format. (Each address can be represented by either a 2-byte direct address or a 1-byte "displacement.")

INTERNAL CODE: EBCDIC (Extended Binary-Coded Decimal Interchange Code).

MAIN STORAGE

STORAGE TYPE: Magnetic core.

CAPACITY: 8,192, 12,288, or 16,384 bytes.

CYCLE TIME: 1.52 microseconds per 1-byte access.

CHECKING: Parity bit with each byte is generated during writing and checked during reading.

STORAGE PROTECTION: None.

CENTRAL PROCESSOR

INDEX REGISTERS: None for use by programmer. Sixteen local storage registers are provided for use in base-displacement addressing, instruction execution, program control, and I/O control.

INDIRECT ADDRESSING: None.

INSTRUCTION REPERTOIRE: 28 instructions, including addition and subtraction of unpacked (1 digit per byte) decimal operands, but no multiply or divide. Also included are an edit instruction and addition, subtraction, and comparison of logical characters. ➤

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language. An optional CRT display unit is offered for quick display of the results of calculations. The Model 6 also offers features to permit its use as a simple desk calculator.

The original System/3 Model 10, described in Report 70C-491-22, features batch-mode punched card and/or disk processing and has been enthusiastically accepted by thousands of first-time computer users. Yet many other prospective users have shied away from the Model 10 because its tab-oriented processing techniques differ so radically from their present methods of processing data via manual techniques or electronic accounting machines. The System/3 Model 6 has been designed as a keyboard-oriented system that these prospective users will be able to understand and use with comparative ease.

The Model 6 offers full operator control of the system via the Operator Keyboard Console. Input data is directly entered at the keyboard, and printing can take place on conventional (non-magnetic) ledger cards. This equipment will seem familiar and comfortable to most small businessmen, as will the design approach used in setting up the applications.

Another reason for the introduction of the Model 6 is IBM's recognition of the fact that many small scientific and engineering firms have been spending their processing dollars with time-sharing firms. By providing the System/3 with a conversational BASIC compiler and an 85-cps serial printer, IBM is attempting to exploit the computational power of its System/3 by luring small companies away from the somewhat tarnished world of time-sharing and into the IBM fold for the first time.

The basic System/3 Model 6 configuration consists of a processing unit (with 8K, 12K, or 16K bytes of core storage), an Operator Keyboard Console, an 85-cps serial printer (available in unique bidirectional-printing models), and a disk storage subsystem of 2.45 to 9.83 million bytes. The processing unit, main memory, and disk storage units are the same as those offered with the original System/3 Model 10 (see Report 70C-491-22). The Operator Console is new, but the wire matrix print mechanism of the serial printers is the same as that used with the System/370's 3215 Console Printer-Keyboard. The basic System/3 Model 6 configuration requires only about 120 square feet of floor space.

System/3 Model 6 configurations can be expanded by adding a 5496 Data Recorder (for reading, punching, and printing of 96-column cards at 22 cards per minute) or a 129 Card Data Recorder (for reading, punching, and printing of 80-column cards at 12 to 50 cards per minute), a 2265 Display Station, and a 1255 Magnetic Character Reader. Also, a Binary Synchronous Communications Adapter can be added to permit the system to serve as a programmable remote terminal (to another System/3 or to any larger computer in IBM's current product line).

INSTRUCTION TIMES: The following times, in microseconds, assume the use of direct (2-byte) operand addresses.

Decimal add (5 digits):	24.4
Decimal subtract (5 digits):	24.4
Binary (logical) add (5 bytes):	24.4
Binary (logical) subtract (5 bytes):	24.4
Move (5 bytes):	24.4
Compare (5 bytes):	24.4
Edit (5 digits):	24.4
Load or store register (2 bytes):	9.1
Add to register (2 bytes):	9.1
Jump on condition:	4.56

OPTIONAL FEATURE: The Command Keys feature provides an additional set of eight keys which can be programmed to perform specific arithmetic operations in the Desk Calculator mode. (Eight Command Keys are standard equipment.)

Extra-cost features, called attachments, controls, or channels, must be added to the 5406 Processing Unit to accommodate each of the standard peripheral devices.

INPUT-OUTPUT CONTROL

CONFIGURATION RULES: Every System/3 Model 6 requires one 5406 Processing Unit, one 5444 Disk Storage Drive, and one Printer (either Model 5213 or Model 2222). A maximum of two 5444 Disk Storage Drives can be connected. In addition, one 5496 Data Recorder (96-column) or 129 Card Data Recorder (80-column), one 1255 Magnetic Character Reader, one 2265 Display Station, and one Binary Synchronous Communications Adapter can be connected. The 2265 Display Station and the 2222 Printer cannot be used in the same system.

I/O CHANNELS: The 5406 Processing Unit acts as a controller for all System/3 I/O operations. All I/O devices are connected, via the appropriate attachment features, to a single I/O attachment interface called the Input/Output Channel. The channel includes logic to establish the "cycle-stealing" and interrupt priorities and to perform code translations between the punched card and internal EBCDIC codes.

SIMULTANEOUS I/O OPERATIONS: Input/Output operations are overlapped with computing through a memory "cycle-stealing" technique.

MASS STORAGE

5444 DISK STORAGE DRIVE, MODELS 1, 2, & 3: Models 1 and 2 each consist of one removable single-disk cartridge and one fixed disk on a single drive, served by a single access mechanism with four vertically-aligned heads. Model 3 accommodates one removable single-disk cartridge only. A System/3 Model 6 can include one or two disk drives, housed in sliding drawers beneath the operator's work table. The following combinations of models and resulting capacities are available:

Drives	Models	Data Capacity
1	1	2,457,600 bytes
1	2	4,915,200 bytes
2	2 + 3	7,372,800 bytes
2	2 + 2	9,830,400 bytes

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The Model 6 offers disk-based processing at lower entry costs than the original Model 10 system. The Model 6 has been deliberately restricted in size and I/O device flexibility in order to eventually force users with growing needs to upgrade to punched card processing and the larger configurations possible with the Model 10.

The System/3 Model 6 lacks the following features and capabilities of the System/3 Model 10:

- No line printer.
- No high-speed card processing.
- No expansion of core storage beyond 16K bytes.
- No large-capacity disk drives.
- No magnetic tape I/O.
- No optical mark reader.
- No COBOL compiler.
- No assembler.

But the Model 6 offers some significant features of its own:

- Low-cost serial printers with rated speeds of 85 cps.
- Ledger card processing, with optical reading of the ledger card identification number and last-line mark.
- 2265 Display Station.
- Conversational BASIC language.
- RPG II, FORTRAN, and BASIC capabilities on the same system.
- Low-cost disk entry system beginning at $1,044 per month, including business-oriented software.

And finally, the principal overall limitations of the System/3 Model 6 can be summed up as follows:

- In those business-oriented installations that do not include a card Data Recorder, all data files stored on the relatively extensive disk files (up to 9.8 million characters) must be laboriously entered a character at a time via the keyboard. (Even using the optional Data Recorder, data input time is still relatively slow.)
- Line printing speeds are restricted to about 40 to 70 lines per minute, depending on the number of characters printed per line and on the printer model used.

Model 1 has 100 data tracks on each recording surface, while Models 2 and 3 have 200 data tracks per surface. Each track consists of 24 sectors, and each sector can hold a 256-byte record.

For all models, average rotational delay is 20 milliseconds and data transfer rate is 199,000 bytes/second. Average head movement time is 153 milliseconds in Model 1 and 269 milliseconds in Models 2 and 3. A seek operation on one drive can be overlapped with a seek on another drive, but not with another read or write operation.

The removable 5440 Disk Cartridge weighs 6 pounds and is about 15 inches in diameter and 2.5 inches high. It stores 1.22 million bytes when used with the 5444 Model 1 Drive and 2.45 million bytes when used with the 5444 Model 2 or 3. Disk Cartridges are physically interchangeable between the System/3 Model 6 and the original System/3 Model 10.

INPUT-OUTPUT UNITS

OPERATOR KEYBOARD CONSOLE: An integrated input device that forms part of every System/3 Model 6 configuration. This device is the primary means of operator control over the system and, in basic systems that do not include the optional 5496 Data Recorder or 1255 Magnetic Character Reader, the Keyboard Console is the only means of entering programs and data.

Data is entered at the keyboard through three groups of keys: a typewriter-style alphanumeric keyboard, an adding-machine style 10-key numeric keyboard, and an 8-or 16-key command keyboard. Several other operator control keys are provided.

The eight standard Command Keys are pre-programmed to perform (in Desk Calculator Mode) such functions as add, subtract, multiply, divide, square root, and exponentiation. Eight additional Command Keys are optionally available and can be programmed as desired. The Command Keys have 20 registers associated with them for storing and accumulating Calculator operands and results.

The Operator Keyboard Console also contains a Switch Panel and an Indicator Panel. The Switch Panel is used for operator control of the entire system. The Indicator Panel not only provides normal system status indicators, but can also provide programmable indicators to guide the operator in performing fixed sequences of operations.

5213 PRINTER: An 85-character-per-second serial printer capable of printing a 64-character set across 132 print positions. The print mechanism is a 7-by-7 wire matrix similar to that used in the 3215 Console Printer of the IBM System/370. Characters are printed at 10 characters per inch, 6 lines per inch.

There are three models of the 5213 Printer: Model 1 moves its forms by a pin-feed platen, with single or double spacing controlled by the operator; Model 2 employs a tapeless vertical forms control carriage and has a high-speed skip feature; Model 3 is similar to Model 2, but adds the capability of bidirectional printing, eliminating non-productive "carriage-return" operations. The fact that the printing element can print while moving in either direction can lead to higher throughput speeds than with the uni-directional models. The optional Enhanced Print Rate Attachment for the 5406 Processing Unit drives the 5213 Model 3 Printer at a nominal print rate of 115 characters per second, a 35 percent increase over the basic 85-cps speed. Throughputs for the various models of the 5213,

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The optional 2265 Display Station complements the basic 5213 Printer by serving as a high-speed output device for the System/3 Model 6.

Overall system throughput, restricted by the operator's keying action on input and the serial printer on output, will be correspondingly low in most commercial installations.

- Commercial, RPG II-oriented users must learn a fairly involved system control language called OCL (Operation Control Language) for directing the execution of every program. Those users who also utilize the BASIC programming language must learn an entirely different control language to direct the preparation and execution of BASIC programs.

- RPG II and BASIC programs generate and use mutually incompatible disk-based data files. Also, BASIC data files cannot be sorted by the Disk Sort program unless they are first converted to the appropriate format.

With regard to compatibility, the System/3 Model 6 uses basically the same RPG II, FORTRAN, and Disk Sort programs as the System/3 Model 10. The only differences between the two RPG compilers are those based on the unique I/O devices used in each system. Disk cartridge files prepared by the RPG II or Sort programs of one system can be processed with no difficulty by the other. The 5440 Disk Cartridges used in both models of the System/3, however, are incompatible with IBM's larger computer systems and virtually all competitive systems.

Applications such as billing, inventory control, accounts receivable, and sales analysis are the "bread and butter" uses of the Model 6 in the RPG II-based, business-oriented environment. Under BASIC, IBM divides the typical application areas into engineering/scientific, financial (such as

measured in terms of lines per minute, can span the range from under 20 to over 100 lpm, but will typically fall between 40 and 70 lpm.

The 5213 Model 1 handles continuous, marginally-punched forms 13-7/8 inches in width, while Models 2 and 3 can handle continuous forms ranging from 3 to 14-7/8 inches in width. All models can accommodate forms ranging from 3 to 14 inches in width and having up to 6 parts.

2222 PRINTER: Uses the same basic print mechanism as the Model 5213 Printer and prints in serial mode at 85 characters per second. The Model 2222 features an extra-wide carriage (220 character positions per line) and a dual, pin-feed tractor (with vertical forms control on the primary tractor only). The Model 2222 has been especially designed to feed, identify, and print on large ledger cards (6 to 14 inches wide, 8 to 11 inches long).

Each ledger card is manually fed, optically identified by a binary-coded identification number printed along the right-hand margin, aligned to the next available print line by an optical sensing device, printed on (using print positions 80 to 220), and ejected for manual stacking. This cycle typically takes about 4 seconds.

The ledger card's identification number is used to locate the corresponding disk-stored data record. This technique is much more flexible than that of storing a restricted amount of information on a magnetic stripe on the reverse side of a ledger card itself.There are two models of the 2222 Printer: Model 1 uses a uni-directional printing technique, and Model 2 uses a bidirectional technique to achieve higher effective speeds.

5496 DATA RECORDER: Serves as either an on-line reader of 96-column cards or an on-line card punch and print device. In either input or output mode, rated throughput is 22 cards per minute. Only data that is being punched can also be printed on the cards. The 5496 is an option in System/3 Model 6 configurations.

This device is the same Data Recorder that was announced with the original System/3 Model 10 as an off-line keypunch for 96-column card preparation; please see Report 70D-491-22 for a detailed description. When connected to a System/3 Model 6, the 5496 Data Recorder can also be used in off-line mode as a buffered keypunch by setting a switch on the console.

129 CARD DATA RECORDER: A buffered keypunch-verifier for standard 80-column cards; see Report 70D-491-21 for a detailed description. Any model of the 129 can be connected to the 5406 Processing Unit via a #3210 Data Recorder Attachment on the 5406 and a #7503 Card Input/Output Attachment and #3610 Expansion Feature on the 129. The 129 and the 96-column 5496 Data Recorder cannot be used in the same system.

When used on-line, the 129 can read up to 50 cards per minute and can punch (or punch and print on Models 2 and 3) from 12 to 50 cards per minute, depending on the number of columns punched in each card. Conversions between the 80-column card code and the System/3 code are performed automatically. When switched to the off-line mode, the 129 operates as a conventional buffered keypunch and/or verifier. All optional features for the 129 are compatible with the Card Input/Output Attachment except the Self-Checking Number feature. However, the Accumulate, Direct Punch Control, Verify Read Control, and

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bond analysis, lease analysis, rate of return calculations, etc.), and general business (sales forecasting, cash flow analysis, overhead distribution, etc.). For installations using both RPG II and BASIC, almost any application is suitable for the System/3 Model 6, provided it does not require large data files and/or high-speed input/output.

When the Model 6 was introduced in October 1970, applications software was notably absent from the IBM product offering. Since then, IBM has developed three different approaches to the application programming problem. First, there is a limited but steadily expanding complement of packaged application programs in three categories: IBM Program Products, Field Developed Programs, and Installed User Programs. Second, IBM offers the Application Customizer Service to aid Model 6 users in developing their own programs for Order Writing and Invoicing, Accounts Receivable, Inventory Accounting and Management, and Sales Analysis. Third, in response to criticism that its Application Customizer Service left the hardest parts of the job (the coding and testing) undone, IBM now offers a complete Application Programming Service for the same four applications at fixed prices.

IBM introduced the System/3 Model 6 on October 28, 1970, and demonstrated it in 40 locations across the country on the same day. Customer deliveries of BASIC-oriented systems began in December 1970, and the first RPG-based systems were delivered in March 1971. By April 1972, IBM announced that the total number of System/3 installations had passed the 10,000 mark. Although the great majority of these installations involve the batch-oriented Model 10, the Model 6 is also gaining widespread acceptance. An unusually high percentage of System/3 users express general satisfaction with the system's reliability, effectiveness, and simplicity of operation.

The Model 6, like all current IBM computer systems, is marketed on an "unbundled" basis, meaning that most of the software, educational courses, and technical support are separately priced. When comparing the Model 6 with competitive equipment, prospective users should carefully consider the amounts of these "extras" they will need and the associated costs.

In summary, the System/3 Model 6 is well designed to appeal to first-time computer users–particularly those who are unfamiliar with tab-oriented data processing techniques. The availability of RPG II, BASIC, and FORTRAN helps to make the Model 6 an unusually flexible system that can handle both the business and scientific computational needs of many small companies. The throughput capabilities of the Model 6 in most applications, however, are significantly lower than those of IBM's own System/3 Model 10 and many batch-oriented competitive systems. □

Production Statistics features are all inoperative in the on-line mode.

2265 MODEL 2 DISPLAY STATION: Serves as an optional rapid output device, displaying up to 15 lines of 64 characters per line on the face of a CRT display screen. Solid-line characters are displayed in green on a gray background. A character brightness control is provided. This unit is basically the same as the single-station Model 2265 unit used with the System/360 and System/370 computers.

The 2265 Display Station cannot be used in the same system with a 2222 Printer. As supported by BASIC, the 2265 requires the Command Keys option on the Processing Unit. As supported by RPG II, the 2265 requires a 12K- or 16K-byte Processing Unit.

1255 MAGNETIC CHARACTER READER: Performs online reading of MICR-encoded documents at either 500 or 750 documents per minute, and sorts them into 6 or 12 stackers, depending on model. Connects to a System/3 via the optional Serial I/O Channel. The 1255 requires use of a Processing Unit with at least 12K bytes of core storage. It is not supported by RPG II or BASIC, but functions only with a stand-alone, separately priced utility routine which gathers the MICR input data on disk and records it on the printer.

There are three models: Model 1 reads and sorts up to 500 documents per minute into 6 stackers; Models 2 and 3 read and sort up to 750 documents per minute, and Model 3 provides 6 additional stackers. Document size can range from 2.5 to 4.25 inches in width, 5.75 to 8.875 inches in length, and 0.003 to 0.007 inches in thickness. The 1255 is also usable for off-line sorting.

COMMUNICATION CONTROL

BINARY SYNCHRONOUS COMMUNICATIONS ADAPTER (BSCA): Enables a System/3 to function as a processor terminal communicating with any of the following IBM devices:

- Another similarly equipped System/3.
- Any System/360 or System/370 computer equipped with appropriate communications control facilities.
- A 2770 Data Communications System.
- A 2780 Data Transmission Terminal.

Transmission is in half-duplex binary synchronous mode over a switched, leased, or private line. Either ASCII or EBCDIC transmission code can be used. Transmission over a non-switched data link can occur at 600, 1200, 2000, 2400, 3600, 4800, 7200, 19,200, 40,800 or 50,000 bits per second. When switched lines are used, transmission speed is limited to 600, 1200, 2000, 2400, or 3600 bits per second. BSCA operations are overlapped with computing and other I/O operations.

The BSCA alternatively enables a System/3 to operate as a tributary station on a multipoint leased or private line in conjunction with a central System/360 or 370 computer using either OS TCAM or OS or DOS BTAM. In this case the System/3 operates as a compatible member of the IBM family of BSC terminals at transmission rates of 1200 to 7200 bps.

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The BSCA is an optional feature for the 5406 Processing Unit; the Processing Unit Expansion feature (#5732) is a prerequisite.

Several optional features, in turn, are available to enhance the capabilities of the BSCA. The Text Transparency feature permits transmission and reception of data in 8-bit binary image form as well as in EBCDIC code. The Station Selection feature enables the BSCA-equipped System/3 to operate as one of a number of IBM BSC terminals on a multipoint line. The Internal Clock feature generates timing signals for use with modems that lack a clocking facility. The Auto Call feature enables the System/3 to dial and initiate a call to a remote BSC terminal under program control.

The System/3 BSCA is supported by the separately-priced RPG II Telecommunications software.

SOFTWARE

SYSTEM CONTROL PROGRAMMING (SCP): These programs perform the system control functions that are basic to an RPG II-oriented System/3 Model 6 installation. They are supplied with the system at no additional charge. (All other System/3 software components are separately priced.)

All of the basic SCP programs can function with the minimum System/3 Model 6 configuration: 5406 Processing Unit with 8K bytes of core storage, one 5444 Disk Storage Drive, and one printer. All other standard I/O units are also supported.

It should be noted that every program executed on a System/3 Model 6 requires a set of Operation Control Language (OCL) statements to provide the system with information about the job to be run (such as what program to load, what files to use, what date to use, etc.). OCL for the System/3 Model 6 is called conversational OCL because the operator keys in the control statements one at a time in response to queries (in the form of "keywords") from the system. (It is also possible to enter OCL statements via the optional Data Recorder.)

There are three sequences of OCL statements to be learned by the System/3 Model 6 operators: LOAD, for running a job whose OCL statements are not catalogued; BUILD, for cataloging OCL statements into a library; and CALL, for running a job whose OCL statements have been previously catalogued. Both the LOAD and the BUILD sequences contain a string of 20 keywords which must be individually responded to by the operator. The CALL sequence contains only four queries requiring operator response.

There are four categories of basic SCP routines:

SYSTEM MANAGEMENT PROGRAMS: Generate and maintain a disk-resident system capable of compiling, generating, and executing user programs. These SCP programs consist of a supervisor and a scheduler which provide the user with selective program loading from disk, program roll-in/roll-out capability, I/O control, and execution of programs from catalogued OCL procedures. The operator must intervene at the end of each job to re-initiate the next job for execution.

LIBRARY MAINTENANCE PROGRAM: Permits the user to generate, maintain, and service the system disk and the source and object program libraries. The libraries can reside on any drive, but the system disk must reside on either the fixed or removable disk of Drive 1. Functions include library add, delete, display, and copy.

COPY/DUMP PROGRAM: Provides the user with the capability of copying his disk files onto another disk drive or printing them on the printer. Printing can be specified to occur between certain limits, and any portions of the original file can be deleted.

UTILITY PROGRAMS: Permit the user to prepare and maintain his disk files. The programs provided include Disk Initialization, Alternate Track Assignment, Alternate Track Rebuild, File and Volume Display, and File Delete.

The Overlay Linkage Editor Feature is an optional extension of the basic System Control Programming that creates loadable programs from multiple relocatable modules. Overlay structures can be created automatically or as designated by the user. Output from the Overlay Linkage Editor can be cataloged in the Object Library on disk and/or punched into cards. The feature requires a 12K 5406 Processing Unit, one 5444 Disk Storage Drive, and a printer.

RPG II (REPORT PROGRAM GENERATOR): This is the only programming language provided for business-oriented users of the System/3 Model 6. (The BASIC and FORTRAN languages are strongly oriented toward engineering and other mathematical applications.)

The RPG II programmer, using five different types of preprinted specification sheets, prepares a set of specifications that describe the form of the input data, the calculations to be performed, and the format of the desired output. These specifications are then keyed into the system and compiled by the RPG compiler, producing a machine-language program ready for execution.

The RPG II language is an extended version of earlier IBM RPG languages. It provides the facilities of System/360 RPG plus about 30 useful extensions, including automatic overlay, AND/OR relationships, square root operation code, indexing, array manipulation, and three types of file organization: sequential, indexed, and direct. All three types of files can be processed either sequentially or randomly.

The RPG II compiler operates under control of the System Control Programming (SCP) software. Minimum system size for compilation and execution includes one 5406 Processing Unit with 8K bytes of core storage, a 5444 Model 1 Disk Storage Drive, and a 5213 or 2222 Printer. RPG II programs will also support the 5496 Data Recorder or the 129 Card Data Recorder, and object programs will support the 2265 Display Station. The 1255 Magnetic Character Reader is not supported.

System/3 Model 6 RPG II is source-language-compatible with Disk RPG II for the original System/3 Model 10 except for differences originating from different I/O devices. Data files are similarly compatible. Conversely, data files created by RPG II and BASIC programs are not compatible and cannot be interchanged.

IBM has supplied the following sample RPG II compilation time, using the minimum system described above (with the 5213 Model 3 Printer): to compile 100 source statements, including 300 lines of listing and no object program overlays—11 minutes.

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RPG II AUTO REPORT FEATURE: This optional enhancement of RPG II is a precompiler that reduces the coding effort required to prepare report programs. A single Auto Report output field specification written by the programmer can result in the generation of RPG II statements to indicate printing with editing, insert column headings, control spacing and horizontal alignment of the data, define total fields, accumulate totals by control levels, and flag total lines with asterisks. The Auto Report functions may be specified for only one printer file in any RPG II program. Auto Report also provides a COPY statement that permits RPG II source statements to be copied from a disk library into source programs that are about to be compiled.

RPG II TELECOMMUNICATIONS FEATURE: Provides the capability to compile programs for sending or receiving data via the Binary Synchronous Communications Adapter (BSCA) over a data communications network. A sixth RPG specification sheet is used to define the data transmission aspect of the RPG program. This feature operates under control of the System Control Programming (SCP) software. It requires the minimum-sized System/3 Model 6 configuration, plus the RPG II Program Product. The functions and specifications of the System/3 Model 6 Telecommunications Feature are identical to those for the System/3 Model 10.

BASIC: System/3 BASIC is a conversational, stand-alone computing system designed for mathematical problem solving. The System/3 BASIC programming language is fully compatible with the BASIC language co-developed by GE and Dartmouth College and currently used with most time-sharing systems..

Programs and data files are created at the keyboard in a conversational mode. (The 5496 or 129 Card Data Recorder can also be used to load source programs into the system.) There are four types of lines that can be entered: BASIC source program statements, data-file lines, comment lines, and system commands. All statements are checked for proper syntax as they are entered.

The system commands specify an immediate system action, such as saving a program or data file, executing a program, modifying a work file, etc. These system commands constitute a control language that is entirely different from the OCL statements used to control the System/3 when operating under the System Control Programming software.

Debugging aids are provided to assist in checking programs at execution time. Also, a number of utility functions are provided to perform such support functions as system generation, disk initialization, disk copy, etc.

BASIC also provides another mode of service, called the Desk Calculator mode, utilizing the console's Command Keys rather than any detailed programming language. Operating in this mode, the user can add, subtract, multiply, divide, compute powers and roots, and use built-in logarithmic and trigonometric functions.

BASIC is a stand-alone computing system. However, it can co-reside on the same system disk cartridge as the SCP software. In such co-residence situations, control can be easily transferred back and forth between the two operating systems.

Data and program files are prepared in a manner unique to the BASIC system. Thus, an RPG-prepared object program cannot use the data files prepared by a BASIC program, and vice versa. These incompatible disk files can be made compatible by converting them with the Data Interchange Utility (DIU), one of the optionally available "Conversational Utilities."

The minimum System/3 Model 6 configuration will support the use of BASIC. Fully expanded configurations can also be used to advantage. Both the 5213 and 2222 Printers are supported, as well as the 5496 Data Recorder, the 129 Card Data Recorder, and the 2265 Display Station.

Source Programs, data files, and systems programs are all stored on disk for direct accessibility. The system uses a 64K-byte "virtual memory", implemented through software paging, to permit the compilation and execution of large programs that otherwise would not fit into main memory. A 500-statement BASIC program can be compiled from disk in about 30 to 35 seconds, once all the statements have been entered and verified. BASIC programs can be listed at the rate of about 60 statements per minute on a 5213 Model 1 Printer.

FORTRAN: The System/3 Disk FORTRAN IV compiler accepts source programs written in the IBM System/360 Basic FORTRAN IV language, which encompasses American National Standard Basic FORTRAN. It also accepts programs written in IBM 1130 Basic FORTRAN IV with minor modifications. Language extensions beyond the Basic FORTRAN level include the DEBUG facility, the IMPLICIT statement, the relational IF statement, and explicit length specification for the INTEGER and REAL Type statements. Also included are commercial subroutines which perform essentially the same functions as the IBM 1130 Commercial Subroutine Package.

The Disk FORTRAN IV compiler operates in batch (i.e., non-conversational) mode. It runs on either a System/3 Model 6 or Model 10 disk system, providing full FORTRAN compatibility between the two models except for changes that may be necessitated by differences in their I/O equipment. Compilation requires a 12K 5406 Processing Unit, one 5444 Disk Storage Drive, and a printer. The 5496 Data Recorder is also supported. A program of approximately 150 source cards can be compiled and executed on a 12K system. Announced in November 1971, the Disk FORTRAN IV compiler for the Model 6 is scheduled for delivery in December 1972.

CONVERSATIONAL UTILITY PROGRAMS: There are three optionally available disk-resident utility programs for use under the SCP software: Keyboard Data Entry, Keyboard Source Entry, and Data Interchange Utility.

Keyboard Data Entry allows the operator to use the System/3 console keyboard as a key-to-disk data entry station. Data files can be prepared and organized for direct usage by RPG II and Disk Sort programs. Ten batch and ten final totals can be utilized.

Keyboard Source Entry enables the user to key RPG II source statements or other procedures directly into the source program library on disk. Compilation can then take place from disk.

Data Interchange Utility permits the user to convert RPG-produced data files into BASIC data files, and vice versa.

DISK SORT: Sorts disk files into either ascending or descending sequence. Accepts files organized in sequential, indexed, or direct fashion. Can perform a full-record sort, a

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tag sort (yielding a file of 3-byte record addresses arranged in the desired sequence), or a "tagalong" sort (yielding a sequenced file of records containing only the key fields and data fields specified by the user).

The functions and syntax of specification sheets for the System/3 Model 6 Disk Sort program are identical to those used with the System/3 Model 10 Disk Sort. Output data files created by the Model 6 Disk Sort can be processed by the Model 10 Disk Sort, and vice versa.

The Disk Sort Functions under control of the SCP software. It requires the minimum 8K-byte System/3 Processing Unit, one 5444 Disk Storage Drive, and one printer.

1255 MAGNETIC CHARACTER READER UTILITY: Controls the reading and sorting of MICR-encoded documents, accumulates appropriate totals, and places selected data from the documents on disk and/or printer files. It requires a 12K-byte System/3 Processing Unit and functions under control of the SCP software.

APPLICATION CUSTOMIZER SERVICE: As an alternative to the usual "packaged" application programs, IBM is offering a new service called the Application Customizer, which is designed to assist users in preparing programs to handle four common data processing applications: Order Writing and Invoicing, Accounts Receivable, Inventory Accounting and Management, and Sales Analysis.

The user defines his requirements by completing application-oriented questionnaires and report specification sheets. These are keypunched and fed into a computer at an IBM Basic Systems Center. The resulting output consists of detailed application documentation, from which the user's own programmer writes the necessary System/3 programs (usually in the RPG II language).

Documentation produced by the Application Customizer includes a data dictionary, a listing of the contents and format of each record, an application flowchart, an RPG-oriented description of each program, and a sample of each report.

Customized Source Code is now available as an optional additional output from the Application Customizer Service. The user who elects this option receives raw, machine-generated RPG II source code on a 5440 Disk Cartridge; he must then add various constants and indicators, compile the programs, and test and debug them in the usual fashion.

APPLICATION PROGRAMMING SERVICE: This IBM service, introduced in September 1971, enables System/3 Model 6 users to have their basic business application programs designed, generated, tested, and documented by IBM Systems Engineers at fixed prices. The service currently covers four applications: Order Writing and Invoicing, Accounts Receivable, Inventory Accounting and Management, and Sales Analysis.

The Application Programming Service consists of four main steps. First, the user and an IBM representative fill out questionnaires defining the application and the formats of the required reports. Second, IBM processes the information at its Application Customizing Center to generate the required programs. Third, IBM tests the programs to make sure they produce the agreed-upon results, using test data and machine time provided by the user. Fourth, IBM turns over the tested application programs and associated documentation to the user.

APPLICATION PROGRAMS: In addition to the two services described above, IBM offers a limited number of packaged programs for specific applications. The current Application Program Products, which receive centralized IBM support, are listed in the price list at the end of this report. Also available are a variety of Field Developed Programs (FDP's) and Installed User Programs (IUP's). Support for the FDP's and IUP's is limited to pertinent error-correction information during the first six months after initial availability of each program.

Other sources of programs, technical information, and education are the System/3 user groups. Two IBM-affiliated user groups, COMMON and Guidance International, are open to System/3 users. Moreover, at least two independent organizations, Group 3 and the National Association of IBM System/3 Users, have been formed specifically to aid System/3 users.

PRICING

MINIMUM SYSTEM: Consists of 8K Processing Unit, 5213 Model 1 Printer, and 5444 Model 1 Disk Storage Drive (2.45 million bytes). Monthly rental, $984. Purchase price, $46,925. Adding RPG II, Conversational Utilities, and Disk Sort would raise the monthly rental by $60 for the commercial user. Adding BASIC for mathematical processing raises the monthly rental by $110. Using the 5213 Model 2 Printer with vertical forms control increases the monthly rental by $40 and the purchase price by $1,800.

MINIMUM LEDGER CARD SYSTEM: Consists of 8K Processing Unit, 2222 Model 1 Printer, and 5444 Model 1 Disk Storage Drive. Monthly rental, $1,174. Purchase price, $57,225.

TYPICAL COMMERCIAL CARD SYSTEM: Consists of 12K Processing Unit, 5496 Data Recorder, 5213 Model 3 Printer, and 5444 Model 2 Disk Storage Drive (4.90 million bytes). Monthly rental, $1,535. Purchase price, $68,220. Substitution of a 16K-byte Processing Unit in this configuration raises the monthly rental by $115 and the purchase price by $700.

SOFTWARE: System/3 users receive the basic System Control Programs at no additional cost. All other IBM software, including compilers and utility routines, is separately priced. Prices of the current IBM Program Products are listed at the end of this report.

SUPPORT: IBM Systems Engineering assistance is available to System/3 users at a basic charge of $23.75 per hour.

EDUCATION: Two-day introductory courses are offered at no charge. Various other System/3 courses are available at costs averaging about $40 per student per day.

CONTRACT TERMS: The standard IBM rental contract includes equipment maintenance and entitles the customer to up to 176 hours of billable time per month. Time used in excess of that amount is billed, for most System/3 components, at an extra-use of 10% of the basic hourly rate (i.e., 10% of 1/176 of the monthly rental for each hour of extra use). ■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-year lease)*
PROCESSOR AND MAIN STORAGE				
5406	Processing Unit			
	Model B2; 8,192 bytes	28,745	125	590
	Model B3; 12,288 bytes	34,545	130	705
	Model B4; 16,384 bytes	35,245	130	820
1550	Command Keys (9-16)	980	0.50	20
5732	Processing Unit Expansion	1,725	6	35
PERIPHERAL EQUIPMENT				
5444	Disk Storage Drive			
	Model 1; 2.46 million bytes	8,550	47	164
	Model 2; 4.92 million bytes	10,280	47	270
	Model 3; 2.46 million bytes	8,550	47	164
5440	Disk Cartridge	175	Time & Mat'l.	Purchase Only
6378	Second Disk Attachment (required on 5406 for a 5444 Mod. 3 or a second 5444 Mod. 2)	2,375	5	45
5213	Printer			
	Model 1; pin-feed platen	6,200	48	160
	Model 2; vertical forms control	8,000	65	200
	Model 3; vertical forms control, bidirectional printing	8,200	75	250
3901	Printer Attachment (required on 5406 for 5213 Mod. 1)	3,430	19	70
3902	Printer Attachment (required on 5406 for 5213 Mod. 2)	3,430	19	70
3903	Printer Attachment (required on 5406 for 5213 Mod. 3)	3,430	19	70
3960	Enhanced Print Rate Attachment (required on 5406 for printing at 115 cps with 5213 Mod. 3; replaces 3903 Attachment)	4,800	21	120
2222	Printer (with ledger card device)			
	Model 1; unidirectional printing	16,500	105	350
	Model 2; bidirectional printing	16,700	115	385
7951	Printer Attachment (required on 5406 for 2222 Mod. 1)	3,430	19	70
7952	Printer Attachment (required on 5406 for 2222 Mod. 2)	3,430	19	70
5496	Data Recorder	7,600	54	155
3210	Data Recorder Attachment (required on 5406)	1,960	2	40
7501	System/3 Attachment (required on 5496)	2,205	11	45
129	Card Data Recorder			
	Model 1; Punch-Verifier (non-print)	6,125	38	125
	Model 2; Printing Punch (non-verifier)	6,860	42	140
	Model 3; Printing Punch-Verifier	7,350	43	150
7503	Card I/O Attachment (required on 129)	2,625	11	75
3610	Expansion Feature (required on 129)	490	10	NC
3210	Data Recorder Attachment (required on 5406)	1,960	2	40
2265	Display Station	5,430	40	170
7960	Display Station Attachment (required on 5406)	3,675	1.50	75
1255	Magnetic Character Reader (requires #5732 on 5406 Processing Unit)			
	Model 1; 500 dpm, 6 stackers	38,645	210	805
	Model 2; 750 dpm, 6 stackers	44,260	335	980
	Model 3; 750 dpm, 12 stackers	60,240	440	1,300
6303	System/3 Adapter (required on 1255)	5,820	4	121
7081	Serial I/O Channel (required on 5406 for connection of 1255)	7,350	5	150
3215	Dash Symbol Transmission Feature (for 1255)	35	NC	50(1)
4380	51-Column Card Sorting Feature (for 1255)	720	NC	15
7060	Self-Checking Number Feature (for 1255)	2,330	2.50	49
COMMUNICATIONS EQUIPMENT				
2074	Binary Synchronous Communications Adapter (requires #5732 on 5406 Processing Unit)	12,985	65	265
1315	Auto Call Feature (for #2074)	1,960	1	40
4703	Internal Clock Feature (for #2074)	1,225	1	25
7477	Station Selection Feature (for #2074)	980	1	20
7850	Text Transparency Feature (for #2074)	980	1	20

* Rental prices include equipment maintenance.

(1) One-time charge.

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SOFTWARE PRICES

Program Products—Systems	Monthly License Fee
BASIC	110
Disk FORTRAN IV	100
RPG II	35
Auto Report Feature (for RPG II)	15
Telecommunications Feature (for RPG II)	35
Conversational Utilities	15
Disk Sort	10
1255 Magnetic Character Reader Utility	80

Program Products—Applications	Monthly License Fee
Business Analysis/BASIC	50
MATH/BASIC	45
STAT/BASIC	35

Application Customizer Service (Without Customized Source Code)	Single Use Charge
Order Writing and Invoicing	665
Inventory Accounting and Management	665
Accounts Receivable	665
Sales Analysis	665

Application Customizer Service (With Customized Source Code)	Single Use Charge
Order Writing and Invoicing	765
Inventory Accounting and Management	765
Accounts Receivable	765
Sales Analysis	765

Application Programming Service	Single Use Charge
Order Writing and Invoicing	**
Inventory Accounting and Management	**
Accounts Receivable	**
Sales Analysis	**

** Price is $1,350 for any one application, $2,600 for any two, $3,650 for any three, or $4,600 for all four.