

## IBM System/3 Model 15



The Model 15 CPU features an operator console with CRT display output and keyboard input. At right are two 5445 Disk Storage Drives, which use interchangeable 2316 Disk Packs and can store 20.48 million bytes each.

### MANAGEMENT SUMMARY

The System/3 Model 15, introduced on July 10, 1973, greatly increases the functional capabilities of IBM's popular small-scale computer line while retaining the proven architecture and software facilities of the earlier System/3 models described in Reports 70C-491-21 and 70C-491-22. Thus, the availability of the Model 15 should ease the minds of thousands of current and prospective System/3 users by eliminating—or at least postponing—the need for a costly, traumatic conversion to a noncompatible system when their needs outgrow the capabilities of their present installations.

The Model 15 represents, in most respects, a bigger, better, and more costly System/3 Model 10. The new model offers up to 131,072 bytes of MOSFET main storage and 91.7 million bytes of disk storage, whereas the Model 10 is limited to a maximum of 49,152 bytes of core storage and 50.8 million bytes of disk storage. The Model 15 systems software is a compatible superset of the Model 10 software, enhanced to support dual-partition multiprogramming, spooling, device-independent data management, expanded communications control, and other throughput-boosting features (but not virtual storage—at least not yet). Moreover, in addition to accommodating most of the Model 10 peripheral devices, the Model 15 uses a new CRT operator console and can support the 80-column 2560 Multi-Function Card Machine and 2501 Card Reader. Thus, the Model 15 offers Model 10 users a natural and highly welcome growth path with minimum conversion effort.

IBM is also promoting the Model 15 as an appropriate growth system for System/360 Model 20 users who have ➤

The Model 15 boosts the throughput potential of IBM's popular System/3 line by adding multiprogramming, spooling, increased main storage and disk storage capacities, and several new peripheral devices. It shapes up as a cost-effective growth system for current System/3 users and an attractive alternative to the smaller System/370 models.

### CHARACTERISTICS

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

**MODEL:** System/3 Model 15.

### 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," and all instructions contain a 1-byte operation code and a 1-byte "Q" code.)

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

### MAIN STORAGE

**STORAGE TYPE:** MOSFET (metal oxide semiconductor field effect transistor) integrated circuits.

**CAPACITY:** Model A17—49,152 bytes; Model A18—65,536 bytes; Model A19—98,304 bytes; Model A20—131,072 bytes.

**CYCLE TIME:** 1.52 microseconds per 1-byte access.

**CHECKING:** An error detection and correction function permits automatic correction of single-bit errors and detection of double-bit errors with no loss of processor time.

**STORAGE PROTECTION:** Write/Fetch Protection, which guards against unauthorized overwriting and/or reading of data in specified 2048-byte segments of storage, is a standard feature of the Model 15.

### CENTRAL PROCESSOR

**ADDRESSING:** A 32-register Address Translation Table (ATT) enables the Model 15 to address up to 131K bytes of main storage. The Supervisor loads the appropriate ➤

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▷ rebelled against the comparatively high cost of even the smallest System/370 configuration. The Model 15 supports the 2560 MFCM, which is the key peripheral device in most 360/20 installations, and a field-developed program is available to aid in converting 360/20 RPG programs into Model 15 RPG II.

Typical Model 15 systems will range from \$3,240 to \$7,127 in monthly rental, with purchase prices ranging from \$136,575 to \$298,480. The basic \$3,240 per month will buy a 49K CPU with CRT display console, a single 4.9-million-byte disk drive, a 465-lpm printer, and a 5424 Multi-Function Card Unit that reads 250 cpm and punches or prints at 60 cpm. Customer shipments of the Model 15 are scheduled to begin in March 1974, with the 131K CPU following in June 1974. The Model 15 was developed at IBM's laboratory in Rochester, Minnesota, and will be manufactured in Boca Raton, Florida, and Vimercate, Italy.

The 5415 Processing Unit, the central component of every Model 15 system, is available with 49K, 65K, 98K, or 131K bytes of main storage. IBM's MOSFET (metal oxide semiconductor field effect transistor) storage technology is used, as in the latest System/370 models, and up to 2048 bits of data are stored on a single chip. Cycle time of the Model 15 memory is the same as that of the Model 10: 1.52 microseconds per byte. Automatic correction of single-bit memory errors is a standard feature. On a cost-per-byte basis, the new MOSFET memory is offered at approximately one-fourth the price of the core memory used in the System/3 Model 10—bad news for the several companies that are currently offering add-on memory units for the System/3.

The 5415 Processing Unit has the same basic architecture, instruction set, and cycle time as its Model 10 counterpart, the 5410. Thus, the Model 15's greater throughput is not derived through an increase in raw CPU power (the System/3 has always boasted surprisingly high internal speed, with a faster add time than the System/360 Model 30), but through its increased storage capacity and more powerful software. To support the improved software, IBM has added a number of new facilities to the 5415 Processing Unit:

- Storage Protection, which prevents users' programs from interfering with one another or with the Supervisor.
- I/O Operation End Interrupt, which facilitates multiprogramming by enabling the Model 15 to operate as an interrupt-driven system.
- Program Check Interrupt, which makes it unnecessary to halt the entire system when an error occurs in one partition.

▶ values into the ATT registers, which are then used to convert the 16-bit addresses in users' programs into the 17-bit addresses required to address 131K bytes.

**INSTRUCTION REPERTOIRE:** 31 instructions, including 2-address 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. In addition to the 28 instructions of the System/3 Model 10, the Model 15 has 3 new instructions—Load CPU, Store CPU, and Command CPU—which are used to implement its multiprogramming capability.

**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

**INTERRUPTS:** There are eight levels of program interrupts, including a new I/O Operation End Interrupt, which facilitates spooling, and a new Program Check Interrupt, which improves throughput by preventing errors in one partition from halting the entire system.

**CONSOLE:** The 3277 Model 1 Display Station, equipped with a 78-key Operator Console Keyboard, is a required component of every Model 15 system. The 3277 displays up to 480 characters, in 12 lines of 40 characters each.

Extra-cost features, called attachments, controls, or channels, must be added to the 5410 Processing Unit to accommodate each of the standard peripheral devices.

### INPUT/OUTPUT CONTROL

**CONFIGURATION RULES:** Every System/3 Model 15 requires one 5415 Processing Unit, one 3277 Model 1 Display Station, one 5444 Model A2 Disk Storage Drive, one 1403 Printer (Model 2, 5, or N1) and 5421 Printer Control Unit, and either a 5424 Multi-Function Card Unit, a 1442 Card Read Punch, or a 2560 Multi-Function Card Machine, together with the necessary prerequisites. If a 1442 or 2560 is selected as the primary card I/O unit, a 5422 Disk Enclosure is also required.

The basic configuration can be expanded by adding any or all of the following peripheral devices: a second 5444 Disk Storage Drive (Model A2 or A3), one to four 5445 Disk Storage Drives, one 3410/3411 Magnetic Tape Subsystem with up to four drives, one 1255 Magnetic Character Reader or one 3881 Optical Mark Reader (connected via the optional Serial I/O Channel), one or two Binary Synchronous Communications Adapters, one Multiple Line Terminal Adapter (an RPQ feature), and one Local Communications Adapter (which takes the place of the First BSCA and permits local attachment of a 3741 Model 2 Data Station, a 3271 Control Unit, or a 3275 Display Station).

I/O CHANNELS: The 5415 Processing Unit acts as a controller for all System/3 I/O operations. All I/O devices ▶

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- ● 2-byte-wide data path for 5444 or 5445 Disk Storage Drives, which reduces the interference with CPU operations imposed by disk input and output.
- Scan/Read for 5445 Disk Storage Drives, which permits a disk index to be scanned and retrieved in a single rotation instead of two.
- An Address Translation Table (ATT), which consists of 32 registers and enables the Model 15 to address up to 131K bytes of storage.

The System/3 Model 15 supports all of the Model 10 peripheral devices except the 5444 Model 1, 2, 3, and A1 Disk Storage Drives, the 5203 Printer, the 5471 Printer-Keyboards, and the 5475 Data Entry Keyboard. The original 5444 Disk Storage Drive models are replaced by the newer 5444 Models A2 and A3, with their faster head positioning mechanisms, and by up to four of the 20.48-million-byte 5445 Disk Storage Drives. The 5203 Printer is replaced by the faster 1403, available in three models with rated speeds of 465, 600, and 1100 lines per minute. The 5471 and 5475 are replaced by the 3277 Display Station, which provides improved communication between the system and its operator. The 1255 Magnetic Character Reader or the 3881 Optical Character Reader can be connected to a Model 15 via the optional Serial I/O Channel, but neither device is supported by the initial Model 15 System Control Programming.

As alternatives to the 5424 Multi-Function Card Unit, which uses IBM's compact new 96-column cards and was at one time the only card I/O device available for the System/3, Model 15 users can elect to use either of two 80-column card units: the 1442 Card Read/Punch or the 2560 Multi-Function Card Machine. In addition, a 2501 Card Reader can be used as an auxiliary 80-column input unit. Support for both the 80-column and 96-column card units is provided by all of the Model 15 systems software facilities announced to date. Thus, IBM's strong initial commitment to the 96-column card as a key feature of the System/3 approach to data processing has now been heavily diluted.

The IBM software support for the Model 15 is a largely upward-compatible and greatly improved version of the Model 10 software. The no-charge System Control Programming (SCP) lets Model 15 users enjoy numerous "big computer" capabilities that were previously unknown to System/3 users, including real dual-partition multiprogramming, disk spooling of unit record input and output data, a task dispatcher, interrupt handlers, and the ability to assign sequential files to specific types of devices at execution time. The Model 15's multiprogramming facility replaces the optional Dual Programming Feature of the Model 10 and offers far more operational flexibility. A Model 15 user can operate his

➤ are connected, via the appropriate attachment features, to an 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. The I/O devices "time-share" the processing unit according to predefined priorities established for each device. The 5415 features a 2-byte-wide data path for both 5444 and 5445 disk I/O, which reduces the number of CPU cycles required to service disk I/O requests.

### MASS STORAGE

**5444 DISK STORAGE DRIVE, MODELS A2 & A3:** Model A2 consists 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 A3 accommodates one removable single-disk cartridge only. A System/3 can include one or two disk drives, housed in sliding drawers beneath the Multi-Function Card Unit. The following combinations of models and resulting capacities are available for use in Model 15 systems:

<u>No. of Drives</u>	<u>Models</u>	<u>Data Capacity</u>
1	A2	4,915,200 bytes
2	A2 + A3	7,372,800 bytes
2	A2 + A2	9,830,400 bytes

Models A2 and A3 have 200 data tracks on each recording surface. Each track is divided into 24 sectors, and each sector can hold one 256-byte record. Average rotational delay is 20 milliseconds, average head movement time is 126 milliseconds, and data transfer rate is 199,000 bytes/second. The removable 5540 Disk Cartridge weighs 6 pounds and is about 15 inches in diameter and 2.5 inches high. It stores 2.45 million bytes when used with the 5444 Model A2 or A3.

**5445 DISK STORAGE DRIVE:** Provides comparatively large-capacity random-access storage on interchangeable, 11-disk 2316 Disk Packs. Each single-spindle drive holds one pack and stores 20.48 million bytes in 256-byte physical records; when IBM software support is used, all data is recorded in this format. If the System/3 format conventions are followed on a System/360 or System/370, data recorded on 2316 Disk Packs can be interchanged between the systems. Average head movement time is 60 milliseconds, average rotational delay is 12.5 milliseconds, and data transfer rate is 312,000 bytes/second. A maximum of four 5445 drives (or 81.92 million bytes of storage) can be connected to a 5415 Processing Unit equipped with the appropriate attachment features. The 5415's Scan/Read feature permits an index in 5445 Disk Storage to be scanned and read during a single revolution of the disk.

### INPUT/OUTPUT UNITS

**3410/3411 MAGNETIC TAPE SUBSYSTEM:** Adds magnetic tape capabilities to the System/3 Model 15. The 3410 is a tape unit only, while the 3411 contains both a tape unit and the subsystem control unit. The compact, waist-high cabinets are cable-connected to one another at the front corners, making it possible to place them side

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▷ system either with two batch partitions or with one batch partition and one communications partition, with concurrent spooling in either case. Each batch partition can occupy from 8K to 49K bytes of main storage.

Predictably, the Model 15 user will pay a fairly high price for this "big computer" software in terms of main storage residence requirements. The Supervisor will normally occupy from 18K to 24K bytes, and spooling will require another 8K to 20K bytes, depending on the options selected by the user. Fortunately, the price of Model 15 main storage is low enough to make these rather lavish software requirements a matter of small concern to most users; another 32K bytes of main storage can be added for a modest \$200 to \$250 per month.

Also available for the Model 15 are improved versions of the following System/3 Program Products: RPG II, COBOL, FORTRAN, Basic Assembler, Disk Sort, Tape Sort, and Card Utilities. All of these products support the new Model 15 peripheral devices, and the RPG II and COBOL compilers offer a number of other worthwhile new facilities.

Two communications-oriented programs that deserve special attention are DATA/3, a new Program Product that generates interactive terminal-control programs for CRT displays used in inquiry or data entry applications, and the Communications Control Program (CCP), an SCP extension that can control the concurrent execution of multiple application programs within a single partition. At the hardware level, the Model 15 offers essentially the same remote communications control facilities as the Model 10. In addition, a new Local Communications Adapter (LCA) permits direct connection of either a 3741 Model 2 Data Station (IBM's new "floppy disk" data entry unit, described in Report 70D-491-41) or a 3270 Information Display System (Report 70D-491-11).

The System/3 Model 15 is generally upward-compatible with the earlier Model 6 and Model 10 systems, but there are a few important caveats. Disk and tape data files and Operation Control Language (OCL) are directly compatible, but all source programs written for a Model 6 or Model 10 must be recompiled before they can be executed under Model 15 SCP. Model 10 programs written in Basic Assembler language may require changes prior to reassembly. In all cases, naturally, the Model 15 system must include an adequate complement of peripheral equipment.

To make the conversion from a Model 10 disk system to a Model 15 even easier, Model 15 users can elect to operate their system under the control of Model 10 software. When this "Model 10 mode" is used, the new features of the Model 15 are ignored and the system operates in the same manner (and, presumably, at about the same speed) as a Model 10. ▷

▷ by side or at any angle up to 90 degrees to one another. Both the 3410 and the 3411 are available in three models, whose principal characteristics are as follows:

	Model 1	Model 2	Model 3
Tape speed, inches/sec	12.5	25	50
Recording density, bpi	1600	1600/800*	1600/800*
Data rate, bytes/sec:			
At 1600 bpi			
(phase encoded)	20,000	40,000	80,000
At 800 bpi (NRZI)	Not avail.	20,000*	40,000*
Inter-block gap, inches	0.6	0.6	0.6
Rewind time, minutes/ 2400' reel	3	3	2

\* Requires Dual Density feature.

All three models use half-inch tape recorded in the standard IBM 9-track formats. A single 3410/3411 subsystem, consisting of a 3411 Magnetic Tape Unit and Control and up to three additional 3410 Magnetic Tape Units, can be connected to a System/3 Model 15. Model 1, 2, and 3 tape units cannot be intermixed in a subsystem. A System/3 Attachment is required on the 3411 and a 3411 Magnetic Tape Attachment is required on the 5415 Processing Unit. In addition, every 3410 and 3411 tape unit must be equipped with either the Single Density (1600 bpi) or Dual Density (1600 or 800 bpi) feature; the Dual Density capability is not available for the Model 1 units.

Features of the 3410/3411 subsystem include single-capstan drive, linear rewind, simplified tape threading, and a push-pull quick-release latch. The tape units are connected to the control unit in radial rather than series fashion to facilitate maintenance. Only digital signals are transmitted across the interface to reduce the sensitivity to noise.

**5424 MULTI-FUNCTION CARD UNIT (MFCU):** Combines the functions of a 96-column card reader/punch, collator, and interpreter in a single unit. Consists of two 2,000-card feed hoppers, a read station, and four 600-card stackers. Cards fed from either or both hoppers can be read, punched, printed, and fed into any of the four stackers under program control. Card sorting is also possible through the use of a multiple-pass sorting technique.

The 5424 is offered in two models, either of which can be used with any System/3 Processing Unit. Cards are read serially at 250 cpm in Model A1 and 500 cpm in Model A2. Punching is performed serially at 60 cpm in Model A1 and 120 cpm in Model A2. Printing occurs at a speed of 60 cpm in Model A1 and 120 cpm in Model A2 when printing in any or all of the first three line positions on each card. There is a fourth line position which, if used, causes the printing speed to drop to 48 cpm for Model A1 and 96 cpm for Model A2. Each of the 4 lines can hold up to 32 printed characters.

**1442 CARD READ PUNCH:** Provides 80-column card input/output capabilities when installed in place of the 96-column 5424 MFCU. Either a 1442 Model 6 or Model 7 Card Read Punch can be connected to the 5415 Processing Unit via a #4130 Card Read Punch Attachment on the 5415 and a #3950 Coupling feature on the 1442. Also required is the 5422 Disk Enclosure, which houses one or two 5444 Disk Storage Drives on a System/3 Model 15 when no 5424 MFCU is installed. The 1442 has ▷

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➤ And what will a System/3 Model 15 user do when he has outgrown the capabilities of his system? At present, he's faced with the same old problem of converting to the System/370 or a competitive computer line. And, despite the availability of upward-compatible System/370 compilers for RPG II, COBOL, and FORTRAN, there are still numerous differences in system control, data management, and operational characteristics which make nearly any System/3-to-370 conversion a costly, time-consuming task. But by the time Model 15 users begin demanding a still bigger and better version of the System/3, the odds are good that IBM will be ready to provide it. System/3 users are making it increasingly clear that they tend to be independent souls who are unwilling to be stampeded into a costly conversion effort to a costly System/370—and there are so many System/3 users that IBM simply must accommodate them. Therefore, the only reasonable solution seems to be continued expansion and development of the System/3 product line. If IBM doesn't do it, others will. □

➤ a 1200-card feed hopper, a single card feed path, and two 1300-card stackers. It can read or punch standard 80-column cards, or read cards and punch additional data into them during the same pass. Model 6 reads at 300 cards per minute and punches at 80 columns per second, while Model 7 reads at 400 cards per minute and punches at 160 columns per second. The rated speed for punching full cards (columns 1 through 80) is 50 cpm for Model 6 and 91 cpm for Model 7.

**2501 CARD READER:** Reads 80-column cards serially by column at either 600 cpm (Model A1) or 1000 cpm (Model A2). Has a 1200-card feed hopper and a single 1300-card stacker. Can be connected to the 5415 Processing Unit via an #8090 Attachment on the 5415 and a #3630 Coupling feature on the 2501. The 2501 cannot serve as the primary card input unit for a System/3 Model 15; it can be used only in addition to a 5424, a 1442, or a 2560.

**2560 MULTI-FUNCTION CARD MACHINE (MFCM):** Combines the functions of an 80-column card reader/punch, collator, and interpreter in a single unit. Consists of two 1,200-card feed hoppers, a solar-cell read station, a punch station, an optional print station, and five 1,300-card stackers. Cards fed from either or both hoppers can be read, punched, printed, and fed into any of the five stackers under program control.

The 2560 is offered in two models, A1 and A2. Cards are read serially by column, at 500 cpm in Model A1 and 310 cpm in Model A2. Punching is at the rate of 160 columns per second in Model A1 and 120 columns per second in Model A2. When all 80 columns of each card are punched, the speed is 91 cpm in Model A1 and 65 cpm in Model A2.

The optional Card Print feature, for the 2560 Model A1 only, provides 2, 4, or 6 printing heads, each adjustable to print in any one of 25 line positions on the cards. Each line can be up to 64 characters long. Printing speed, regardless of the number of lines printed, is 150 print positions per second.

One 2560, Model A1 or A2, can be connected to the 5415 Processing Unit via the #8100 MFCM Attachment.

Also required is the 5422 Disk Enclosure, which houses one or two 5444 Disk Storage Drives on a System/3 Model 15 when no 5424 MFCU is installed.

**1403 PRINTER:** Provides fast, high-quality printed output by means of a horizontal chain or train mechanism. With the standard 48-character set, rated printing speed is 465 lpm for the 1403 Model 5, 600 lpm for the 1403 Model 2, and 1100 lpm for the 1403 Model N1. All three models have 132 print positions. Skipping speed is 33 inches per second on short skips and 75 inches per second on skips of more than 8 lines. Vertical format is controlled by the stored program. The optional Universal Character Set feature (for Model 2 or N1 only) permits the use of operator-changeable chain or train cartridges containing up to 120 different characters. A single 1403 Printer, Model 2, 5, or N1, can be connected to the 5415 Processing Unit via a 5421 Control and attachment.

**1255 MAGNETIC CHARACTER READER:** Reads and sorts MICR-encoded documents from 5.75 to 8.875 inches in length, 2.5 to 4.25 inches in width, and 0.003 to 0.007 inch in thickness. Three models are available. Model 1 reads up to 500 six-inch documents per minute, while Models 2 and 3 read up to 750 six-inch documents per minute. Models 1 and 2 have six horizontal stackers arranged in a single vertical bay and require one and one-half sort passes for each digit position. Model 3 has two horizontal stackers in two vertical bays. The optional Self-Checking Number, 51-Column Card Sorting, and Dash Symbol Transmission features are available for all three models. Model 3 can also be equipped with the High-Order Zero and Blank Selection feature, which reduces off-line sorting times. One 1255 can be connected to a System/3 Model 15 via a Serial I/O Channel on the Processing Unit and a System/3 Adapter (#6303) on the 1255 itself. The 1255, however, is not supported by the Model 15 SCP and must be used in connection with Model 10 programming support. All three models can also be used for off-line sorting.

**3881 OPTICAL MARK READER:** Reads machine-printed and/or hand-marked data from documents ranging from 3 by 3 inches to 9 by 12 inches in size. Model 1 reads data directly into a System/3 Model 10 at a speed of 4000 to 6000 documents per hour, depending upon the document size. Model 2 operates off-line, transferring the data to a 3410 Model 1 Magnetic Tape Unit at a speed of 3700 to 5400 documents per hour. Up to 2480 marking positions are available on each 9-by-12-inch document. Up to six different document formats, loaded from format control sheets, can be stored and read during the same run. An optional BCD Read feature facilitates the processing of turnaround documents, and a Serial Numbering feature prints consecutive numbers on the documents being processed. One 3881 Model 1 can be connected to a System/3 Model 15 via a Serial I/O Channel on the Processing Unit. The 3881, however, is not supported by the Model 15 SCP and must be used in connection with Model 10 programming support.

## 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. ➤

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- A 2770 Data Communications System.
- A 2780 Data Transmission Terminal.
- A 3735 Programmable Buffered Terminal.
- A 3741 Model 2 Data Station.
- A System/7 equipped with the BSCA.

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.

Finally, the BSCA can equip the System/3 to function as the control station for a leased or private multipoint communications line supporting the following IBM BSC terminals:

- 3270 Information Display System terminals in single-station or multi-station configurations at 1200 to 7200 bps.
- 3735 Programmable Buffered Terminals at 1200, 2000, 2400 bps, or 4800 bps.
- 2980 General Banking Terminal System at 600 to 4800 bps.
- System/7 with BSCA.

The BSCA is an optional feature for the 5415 Processing Unit; the Processing Unit Expansion 1 feature 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 EIA Local Attachment permits one 3275 Display Station or one 3271 Display Control Unit to be cable-connected directly to the BSCA without the use of a modem or data communications line.

**SECOND BSCA:** This optional feature enables a System/3 Model 15 to control transmissions simultaneously over two communications lines. Either the first BSCA or the Local Communications Adapter is a prerequisite. The Second BSCA has the same capabilities, options, and limitations as the First BSCA except that its range of transmission speeds is limited to 600 to 7200 bps; no broadband facilities are available for the Second BSCA.

**LOCAL COMMUNICATIONS ADAPTER (LCA):** This optional feature for the 5415 Processing Unit permits direct, local attachment of either one 3741 Model 2 Data Station (Report 70D-491-41), one 3271 Control Unit (Report 70D-491-11), or one 3275 Display Station (Report 70D-491-11). Data is transferred at 2400 bps in non-transparent EBCDIC mode. The LCA requires the Processing Unit Expansion 1 feature on the 5410, and cannot be installed in combination with the First BSCA.

**MULTIPLE LINE TERMINAL ADAPTER (MLTA):** This RPQ feature for the 5415 Processing Unit permits connection of up to eight communications lines, with multiple low-speed terminals on each line. The MLTA accommodates the following IBM start/stop terminals: 1050 Data Communications System, 2740 and 2741 Communications Terminals, Communicating Magnetic Card Selectric Typewriter (CMCST), and System/7 (supported as a 2740 Model 1).

### SOFTWARE

The IBM software for the System/3 Model 15 is a compatible superset of the software for System/3 Model 10 disk systems, as described in Report 70C-491-22. Therefore, the emphasis in the following paragraphs is on the new software facilities and features which are unique to the Model 15. Except where otherwise indicated, all announced Model 15 software facilities are scheduled for availability in March 1974 and are usable on a minimum Model 15 system.

**SYSTEM CONTROL PROGRAMMING:** SCP is IBM's designation for the programs that perform the system control functions which are basic to every installation. These programs are supplied with the system at no additional charge, whereas all other IBM software for the System/3 is separately priced.

The Model 15 System Control Programs are functionally compatible with their Model 10 counterparts, with additions to support two-partition multiprogramming, disk spooling, and the new Model 15 CPU features and peripheral devices. Source programs written for a System/3 Model 6 or Model 10 must be recompiled prior to operation under Model 15 SCP, but data files and OCL (Operation Control Language) are directly compatible. To further ease the transition from a Model 10 to a Model 15, it is possible to operate a Model 15 system under Model 10 software; when this is done, the new features of the Model 15 are not used and the system operates in the same manner as a Model 10.

The most significant new feature of the Model 15 SCP is its capability to support multiprogramming in any of three environments: single batch with spooling, dual batch with spooling, or batch, communications, and spooling. The Supervisor controls the allocation of CPU time, giving Partition 2 (communications) priority over Partition 1 (batch). When an interrupt occurs, the Supervisor seizes control, processes the interrupt, and transfers control to the highest-priority program that is in a ready state. A high-priority program gives up control whenever it encounters a condition that prevents further processing. The processing of a low-priority program is suspended upon completion of an event (e.g., an I/O operation) for which a higher-priority program is waiting.

When the Communications Control Program (CCP) is used, the communications partition can be further divided into smaller subpartitions ranging from 2K to 32K bytes

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in size. Multiple communications-oriented application programs can be executed concurrently in these subpartitions under CCP control. A detailed description of the CCP is presented below.

Spooling is another important new feature of the Model 15 SCP. Spooling can increase system throughput by reducing the amount of time the CPU must spend awaiting the completion of card and printer I/O operations. Moreover, it enables a single input or output device to serve both partitions. When spooling is employed, each job's normal card input (including OCL) is read by the card reader and stored in an input queue on a 5445 Disk Storage Drive, where it can be accessed at disk I/O speed when the job is processed. Similarly, the job's output is stored in a disk output queue and then printed and/or punched at a later time. Spooling on the Model 15 requires a 5445 Disk Storage Drive and from 8K to 20K bytes of main storage, depending on the options selected.

Other new or improved facilities of the Model 15 SCP include: (1) device-independent data management, which allows a sequential file to be assigned at execution time to any one of numerous I/O devices; (2) system-assigned halt defaults, which reduce the need for operator intervention when errors are encountered; (3) reduced system overhead through improved transient handling, reduced interpartition interlock time, and faster operator communication via the CRT console; and (4) additional OCL statements and options, which define program processing in the multiprogramming and spooling environments.

The Model 15 SCP supports all the peripheral devices available for the system except the 1255 Magnetic Character Reader and the 3881 Optical Mark Reader; these devices are supported only by Model 10 programming. The SCP also supports the following new features of the Model 15 CPU: I/O Operation End Interrupt, Program Check Interrupt, Storage Protection, console CRT display, and expanded main storage capacities to 131K bytes.

The following software facilities which were optional for the Model 10 are standard features of the Model 15 SCP: Magnetic Tape and 5445 Disk Storage Support, Macros, Overlay Linkage Editor, Checkpoint/Restart, and BSCA Multiline/Multipoint. The Macros facility permits the use of user-coded macro-instructions to control nonstandard data management and I/O functions. The Overlay Linkage Editor creates loadable programs from multiple relocatable modules. The Checkpoint/Restart facility aids users in writing checkpoint records and in restarting interrupted programs from the last checkpoint rather than from the beginning. The BSCA Multiline/Multipoint facility provides communications support for a point-to-point switched, point-to-point nonswitched, or multipoint configuration with the System/3 as a multidropped terminal or control station; it can support two BSCA's with different configurations.

The Model 15 SCP can be used on the minimum Model 15 system, as defined in the "Configuration Rules" paragraph of this report. Spooling, however, requires the addition of a 5445 Disk Storage Drive. The minimum main storage requirement for the Supervisor is 18K bytes, and this can expand to as much as 24K bytes when a variety of peripheral devices must be supported. Spooling adds another 8K to 20K bytes to the residence requirement, depending on the options selected. Batch partitions can range from 8K to 49K bytes in size. The Model 15 SCP is scheduled for availability in March 1974.

**COMMUNICATIONS CONTROL PROGRAM (CCP):** This optional SCP component provides control facilities for

multi-terminal communications systems connected to a System/3 via either the BSCA or the MLTA (see "Communication Control," above). The System/3, in turn, can operate as a tributary terminal to a host System/360 or 370 computer. The CCP: (1) permits programs coded in COBOL, FORTRAN, or RPG II to access the terminals; (2) handles resource management to reduce contention between programs accessing the same files; (3) monitors the terminals and responds to their commands; and (4) controls the concurrent execution of multiple application programs within the CCP partition. The CCP can occupy a partition larger than the normal 49K-byte maximum size, but individual programs running under CCP control are limited to 32K bytes. When used with a BSCA-equipped System/3, the CCP supports the following IBM terminals: other System/3's (in a point-to-point switched or non-switched arrangement), 3270 Information Display Systems (in a multipoint non-switched arrangement), or 3735 Programmable Buffered Terminals (in any of the above arrangements). The CCP is scheduled to become available to Model 15 users in September 1974.

**RPG II (REPORT PROGRAM GENERATOR):** This is the principal programming system for the IBM System/3. The 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 transcribed into punched cards and fed into the system. The RPG processor then generates a machine-language object program to perform the specified functions.

The RPG II language is an extended version of earlier IBM RPG languages. It provides the facilities of System/360 RPG plus at least 20 useful extensions, including the ability to define and execute closed subroutines, to use dual input/output areas, and to debug programs at the source-language level.

Model 15 RPG II provides all the facilities of Model 10 Disk RPG II (Report 70C-491-22), plus device-independent data management, variable-length magnetic tape records, support of the 2501 Card Reader, 2560 MFCM, and 3277 Display Station, and several other new facilities. In addition, four features which are separately priced options for the Model 10 are included in the price of Model 15 RPG II: Telecommunications, Auto Report, Magnetic Tape support, and 5445 Disk Storage support.

**COBOL:** The System/3 Subset ANS COBOL Compiler supports these six modules of the American National Standard COBOL language: Nucleus (Level 1), Sequential Access (Level 1), Random Access (Level 1), Table Handling (Level 2), Segmentation (Level 1), and Library (Level 1). The compiler also supports certain elements of higher-level ANS COBOL modules and some IBM extensions. The ANS Sort and Report Writer modules, however, are not implemented. System/3 COBOL is upward compatible with the ANS COBOL compilers for the System/360 and 370, and is a superset of IBM 1130 COBOL. The Model 15 COBOL compiler provides all the facilities of System/3 Model 10 COBOL, plus the ability to use the SCP Roll-out/Roll-in routines, support of multi-volume indexed disk files, and support of the 2501 Card Reader, 2560 MFCM, and 3277 Display Station.

**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

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► 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 sub-routines which perform essentially the same functions as the IBM 1130 Commercial Subroutine Package. The Model 15 FORTRAN compiler provides all the facilities of System/3 Model 6 and Model 10 FORTRAN, and also supports the new I/O devices available for the Model 15.

**BASIC ASSEMBLER:** Converts programs coded in a symbolic assembly language into executable object programs. Creates stand-alone programs that have no defined interfaces with the other System/3 software support. May be used to assemble relocatable subroutines for use with Card or Disk RPG II programs. The Model 15 Basic Assembler provides all the facilities of the Model 10 Basic Assembler, plus mnemonic operation codes to support the new Model 15 instructions and several other minor improvements.

**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 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 Model 15 Disk Sort program is functionally identical to the Model 10 Disk Sort with the 5445 Disk Storage Drive feature. Up to four 5445 drives are supported for use as input, output, or work files.

**TAPE SORT:** Sorts fixed-length records on magnetic tape files, in either blocked or unblocked format and EBCDIC or ASCII data code. The Model 15 Tape Sort program is functionally identical to the Model 10 Disk-Resident Magnetic Tape Sort program.

**CARD UTILITIES:** A set of four disk-resident programs designed to handle a variety of punched card utility functions. The Sort/Collate Program supports either the 5424 MFCU or the 2560 MFCM and performs numerous sorting, merging, matching, selecting, and sequence-checking functions. The Card List Program lists 80-column or 96-column cards on the printer without reformatting. The Reproduce/Interpret Program handles the reproduction and/or interpretation of 80-column or 96-column cards, with or without reformatting. The Gangpunch Program (new for the Model 15) handles interspersed master card gangpunching, count-controlled gangpunching, and punching based on matching control fields in master and detail cards. Three of the Model 10 Card Utilities programs are not included in the Model 15 Card Utilities: Data Recording, Data Verification, and 80-96 Conversion.

**DATA/3:** This new System/3 Program Product, introduced along with the Model 15, generates terminal control programs for the following types of applications: inquiry, inquiry with update, data entry, and data entry with master file input. The programmer fills out two RPG-like forms: a data description form and a program

definition form. DATA/3 uses this information to generate RPG II source programs, which are subsequently compiled and executed. Programs generated by DATA/3 support the 3270 Information Display System and both the 5444 and 5445 Disk Storage Drives. DATA/3 can be used on either a System/3 Model 10 or Model 15, in connection with either the Multiline/Multipoint software or the Communications Control Program. The planned availability dates are March 1974 for the Model 10 and May 1974 for the Model 15.

**APPLICATION PROGRAMS:** The following IBM Program Products, developed for earlier models of the System/3 and described in Report 70E-491-21, can also be used on the Model 15:

Bill of Material Processor  
Health, Welfare, and Pension Funds (supported in Model 10 mode only)  
Inventory and Requirements Planning  
Property and Liability Agency Accounting System  
System for Television and Radio  
System/3 Shop Loading and Control

### PRICING

**MINIMUM SYSTEM:** The basic configuration required to utilize the Model 15 programming support consists of a 5415 Model A17 Processing Unit (49K bytes), 3277 Model 1 Display Station, 1403 Model 5 Printer, 5425 Model A1 MFCU, and one 5444 Model A2 Disk Storage Drive, plus all necessary attachments and control units. Monthly rental (including maintenance), \$3,240. Purchase price, \$136,575.

**EXPANDED SYSTEM:** A typical large Model 15 disk system consists of a 5415 Model A20 Processing Unit (131K bytes), 3277 Model 1 Display Station, 1403 Model N1 Printer, 2560 Model A1 MFCM, 2501 Model A2 Card Reader, one 5444 Model A2 Disk Storage Drive, and four 5445 Disk Storage Drives, plus all necessary attachments and control units. Monthly rental (including maintenance), \$6,900. Purchase price, \$289,330.

**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 rate 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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		Purchase Price	Monthly Maint.	Rental (short-term lease)*
<b>PROCESSOR AND MAIN STORAGE</b>				
5415	Processing Unit:			
	Model A17; 49,152 bytes	63,000	210	1,510
	Model A18; 65,536 bytes	67,000	215	1,610
	Model A19; 98,304 bytes	78,000	220	1,860
	Model A20; 131,072 bytes	86,000	230	2,060
5501	Power Supply Expansion	2,250	1.00	50
5733	Processing Unit Expansion 1	800	0.50	20
5734	Processing Unit Expansion 2 (5733 is prerequisite)	2,200	1.00	55
5735	Processing Unit Expansion 3 (5734 is prerequisite)	800	1.00	20
	Note: The above four features provide additional CPU power supply and connections; they are required for certain combinations of peripheral, communications, and/or RPQ equipment.			
<b>CONSOLE</b>				
3277	Display Station, Model 1 (required)	3,400	7	75
4632	78-Key Operator Console Keyboard (required on 3277)	1,400	11	35
<b>MASS STORAGE</b>				
5444	Disk Storage Drive:			
	Mod. A2; 4.92 million bytes	10,075	65	300
	Mod. A3; 2.46 million bytes	8,450	65	200
5440	Disk Cartridge (for 5444 drives)	175	Time & Mat'l.	Purchase Only
6378	Second Disk Attachment (required on 5415 for a 5444 Mod. A3 or a 2nd 5444 Mod. A2)	3,495	6	67
5445	Disk Storage Drive:			
	Mod. 1; 20.48 million bytes	15,750	85	350
	Mod. 2; 20.48 million bytes	15,075	80	335
3901	First 5445 Attachment (required on 5415 for first 5445 Mod. 1)	20,000	33	500
3903	Second 5445 Attachment (required on 5415 for second 5445 Mod. 1)	3,000	1	75
<b>INPUT/OUTPUT UNITS</b>				
3410	Magnetic Tape Unit:			
	Model 1; 20 KB	7,700	45	185 (2)
	Model 2; 40/20 KB	10,300	50	245 (2)
	Model 3; 80/40 KB	12,800	55	305 (2)
3411	Magnetic Tape Unit and Control:			
	Model 1; 20 KB	17,000	70	405 (2)
	Model 2; 40/20 KB	21,600	75	515 (2)
	Model 3; 80/40 KB	26,300	80	625 (2)
3211	Single Density Feature (for 3410 & 3411)	2,500	7.50	55 (2)
3221	Dual Density Feature (for 3410 & 3411, Models 2 & 3 only)	3,600	27	80 (2)
7003	System/3 Attachment (required on 3411)	3,150	3	75 (2)
7951	3411 Magnetic Tape Attachment (required on 5410 Processing Unit)	4,800	10	160
5424	Multi-Function Card Unit:			
	Mod. A1; reads 250 cpm, punches and prints 60 cpm	10,010	140	286
	Mod. A2; reads 500 cpm, punches and prints 120 cpm	13,320	200	429
4100	MFCU Attachment (required on 5415 for 5424 Mod. A1)	4,450	14	84
4101	MFCU Attachment (required on 5415 for 5424 Mod. A2; 4100 is prerequisite)	900	2	16
1442	Card Read Punch			
	Model 6; reads 300 cpm, punches 80 cols/sec	14,140	51	257
	Model 7; reads 400 cpm, punches 160 cols/sec	15,255	61	370
3950	5415 Coupling (required on 1442)	1,475	1	30
4130	1442 Attachment (required on 5415)	9,310	15	190
2501	Card Reader:			
	Model A1; 600 cpm	11,010	35	195
	Model A2; 1000 cpm	11,240	49	255
3630	2501 Coupling (required on 2501)	150	No charge	5
8090	2501 Attachment (required on 5415)	6,700	7.50	150
2560	Multi-Function Card Machine:			
	Model A1; reads 500 cpm, punches 160 col/sec	27,055	97	615
	Model A2; reads 310 cpm, punches 120 col/sec	19,885	97	480
8100	2560 MFCM Attachment (required on 5415)	6,300	16	150
1580	Card Print Control (for 5415)	1,250	3	25
	Card Print Feature for 2560 Model A1:			
1575	First Two Lines (requires 1580 on 5415)	5,880	16	135
1576	Second Two Lines	5,880	16	135
1577	Third Two Lines	5,880	16	135
5422	Disk Enclosure (required for attachment of 5444 Disk Storage Drives when 5424 MFCU is not used)	4,900	12	100

\*Rental prices include equipment maintenance.

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		Purchase Price	Monthly Maint.	Rental (short-term lease)*
<b>INPUT/OUTPUT UNITS (continued)</b>				
1403	Printer:			
	Model 2; 600 lpm, 132 positions	28,030	159	750 (2)
	Model 5; 465 lpm, 132 positions	26,800	NA	580 (2)
	Model N1; 1100 lpm, 132 positions	33,970	183	875 (2)
1416	Interchangeable Train Cartridge (for 1403 Mod. N1)	2,910	Time & Mat'l.	97
1376	Auxiliary Ribbon Feeding (for 1403 Mod. 2 or 5)	2,540	14.75	73 (2)
4740	Interchangeable Chain Cartridge Adapter (for 1403 Mod. 2 or 5)	2,580	No Charge	73 (2)
8640	Universal Character Set Feature (for 1403 Mod. N1)	380	1.75	10 (2)
8641	Universal Character Set Feature (for 1403 Mod. 2)	380	1.75	10 (2)
5421	Printer Control Unit (required for 1403 Mod. 2, 5, or N1)	12,740	26	260
4135	1403 Model 5 Printer Attachment (for 5415)	4,700	21	110
4140	1403 Model 2 Printer Attachment (for 5415)	5,150	21	120
4150	1403 Model N1 Printer Attachment (for 5415)	5,650	21	175
1255	Magnetic Character Reader			
	Mod. 1; 500 dpm, 6 stackers	38,645	210	805
	Mod. 2; 750 dpm, 6 stackers	44,260	335	980
	Mod. 3; 750 dpm, 12 stackers	60,240	440	1,300
3215	Dash Symbol Transmission (for 1255)	35	No Charge	50 (1)
4380	51-Column Card Sorting (for 1255)	720	No Charge	15
4520	High-Order Zero & Blank Selection (for 1255 Mod. 3 only)	1,440	5	30
7060	Self-Checking Numbers (for 1255)	2,330	2.50	49
6303	System/3 Adapter (required on 1255)	5,820	4	121
7081	Serial I/O Channel (required on 5415 for connection of 1255 or 3881)	7,790	6	159
3881	Optical Mark Reader			
	Model 1; for on-line use	56,000	140	1,150 (3)
	Model 2; for off-line use	51,000	110	1,050 (3)
1471	BCD Read (for 3881)	2,350	1.50	56 (3)
3450	Document Counters (for 3881)	930	2	22 (3)
3550	Dual Density (for 3881 Model 2 only)	5,900	0.50	141 (3)
3801	Expanded Storage (for 3881)	2,350	0.50	56 (3)
6451	Serial Numbering (for 3881)	6,900	25	165 (3)
<b>COMMUNICATIONS EQUIPMENT</b>				
2074	Binary Synchronous Communications Adapter (requires #5733 on 5415 Processing Unit)	12,300	65	280
1315	Auto Call Feature (for #2074)	2,075	1	42
3601	EIA Local Attachment (for 2074)	1,000	1	25
4703	Internal Clock Feature (for #2074)	1,295	1	26
7477	Station Selection Feature (for #2074)	1,035	1	21
7850	Text Transparency Feature (for #2074)	1,035	1	21
2084	Binary Synchronous Communications Adapter, Second (#2074 is a prerequisite)	12,300	65	280
1325	Auto Call Feature (for #2084)	2,075	1	42
3602	EIA Local Attachment (for #2084)	1,000	1	25
4723	Internal Clock (for #2084)	1,295	1	26
7487	Station Selection Feature (for #2084)	1,035	1	21
7851	Text Transparency Feature (for #2084)	1,035	1	21
4765	Local Communications Adapter (permits local attachment of a 3741 Model 2 Data Station, a 3271 Control Unit, or a 3275 Display Station)	6,500	28	150

\*Rental prices include equipment maintenance.

(1) One-time charge.

(2) A discount of 8% or 16% from these rental prices is available under a 12-month or 24-month Fixed-Term Lease, respectively.

(3) A discount of 15% from these rental prices is available under a 24-month Extended-Term Lease.

SOFTWARE PRICES

Program Products – Systems

ANS COBOL Subset Compiler (5704-CB1)	75
Basic Assembler (5704-AS1)	75
Card Utilities (5704-UT1)	15
Disk Sort (5704-SM1)	40
FORTTRAN IV (5704-FO1)	100
Magnetic Tape Sort (5704-SM2)	70
RPG II (5704-RG1)	75

Monthly License Fee

Program Products – Applications

Bill of Material Processor (5702-M41)	50
DATA/3	120
Health, Welfare and Pension Funds (5703-N11)	175
Inventory and Requirements Planning (5702-M52)	75
Property and Liability Agency Accounting System (5701-N21)	65
System for Television and Radio (5702-K11)	375

Monthly License Fee