IBM Series/1

MANAGEMENT SUMMARY

The IBM Series/1 is a family of small general-purpose computers that can be used for a variety of data processing applications. The Series/1 represents a departure from tradition for IBM in that it is offered unbundled, is available on a purchase-only basis, and is offered on an OEM as well as an end-user basis. Initially offered with a minimal amount of system software, IBM has since been making licensed programs, programming RPQs, field-developed programs, and installed user programs available. Currently, the Series/1 is supported by a very respectable array of software products from IBM in addition to a raft of packages from software houses across the country.

Currently, there are 12 members of the Series/1 family of 16-bit general-purpose processors. The 12 minicomputers (or in IBM's terms "small computers") are based on three microprocessor-based CPUs: the 4952 (Models A, B, and C), the recently introduced 4954 (Models A, B, and C), and the 4955 (Models A, B, C, D, E, and F). Cycle time for the 4952 is 2.1 microseconds; 1.4 microseconds for the 4954; and for the faster 4955, 600 nanoseconds.

Each processor also contains a power supply, basic storage, and space for storage additions, processor features, and I/O attachment features. A basic console is standard with either processor, and a programmer's console is available as an optional feature.

The 4952 processor, introduced in February 1979, includes 32K bytes of main memory, expandable to 128K bytes, eight general-purpose registers for each of four priority interrupt levels, and up to 256 I/O devices that can be directly addressed. Model A is a half-width unit with five ▷

The IBM Series/1 minicomputer systems are offered as unbundled system components on a purchase-only basis. There are currently three processors and a total of 12 models in the Series/1 family.

MAIN MEMORY: 16K to 512K bytes.
DISK CAPACITY: Up to 256M bytes per I/O attachment.
WORKSTATIONS: Up to eight per I/O attachment.
PRINTERS: 160 cps; 80 to 414 lpm.
OTHER I/O: Magnetic tape, sensor, data collection.

CHARACTERISTICS

MANUFACTURER

International Business Machines Corporation, Information Systems Group, 1133 Westchester Avenue, White Plains, New York 10604. Telephone (914) 686-2363.

MODELS: Series/1 4952, Models A, B, and C; 4954, Models A, B, and C; 4955, Models A, B, C, D, E, and F.
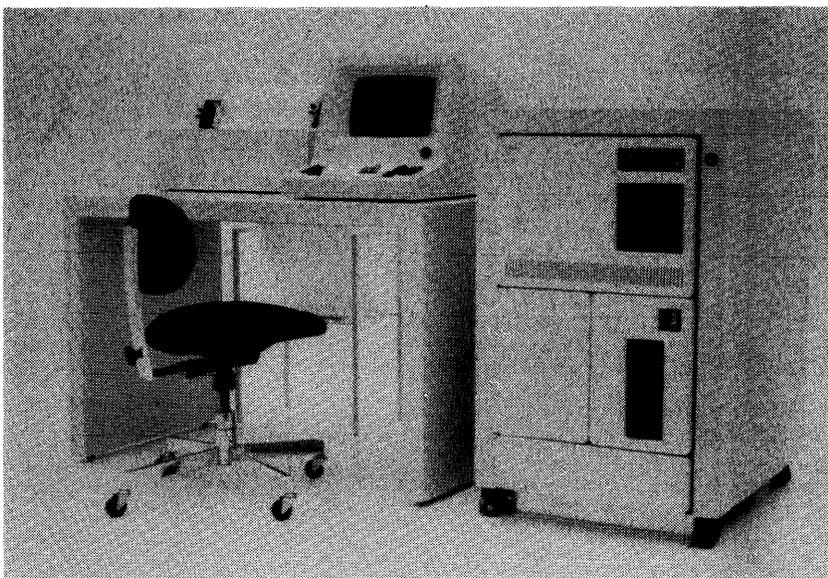
DATE ANNOUNCED: 4955, November 1976; 4952, February 1979; 4954, February 1982.

DATA FORMATS

BASIC UNIT: 16-bit word or 8-bit byte.

FIXED-POINT OPERANDS: 16-bit words can be interpreted as signed or unsigned binary numbers, logical words, memory addresses, or portions of decimal character strings.

FLOATING-POINT OPERANDS: 32-bit single-precision operands with a 7-bit exponent and signed 24-bit fraction; ▶

This small Series/1 configuration includes a low-boy rack enclosure housing the processor and a 4964 diskette unit. The table-top, 120 cps 4974 printer is shown at left. The display station in the photo is the 4979, one of two 1920-character display units offered with the Series/1.

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▷ I/O feature locations. Model B is a full-width processor with 14 I/O feature locations. Model C is a half-width module with four I/O slots and an integrated diskette drive (a second drive is optional).

The 4954 processor, introduced in February 1982, is essentially the replacement for the 4953 processor which was discontinued by the vendor last year. The new processor provides twice the internal performance of the 4952 processor and features a main memory capacity of 256K bytes. The 4954 is available in three models: Model A, a half-rack unit with four I/O feature slots; Model B, a full-rack unit with 13 I/O feature slots; and Model C, a full-rack unit with an integrated floppy disk drive and three I/O feature slots. All models feature a CPU, 64K bytes of main memory, a storage address translation function (eight 64K-byte address spaces), a basic console, a clock/comparator, and a power supply that includes communications power. Storage is expandable to 256K bytes in 64K-byte increments. Optional features include a plug-in Floating-Point capability and a Programmer Console which is mounted in the front of the unit to provide data entry/display functions to the programmer.

The 4954 Model C offers an integrated 1.2M-byte floppy disk drive; a second drive is optional. The Model C is also available as a standalone unit designed for use only with peripheral devices that interface to the Series/1 (printers, display terminals, etc.) via external cabling.

In the 4955 processors, memory and I/O controller modules cannot be intermixed; previously configured slots are required for each type. The Model A comes with eight I/O slots and three memory slots, while the Model B has only three I/O slots and seven add-on memory slots. The remaining slot in the Model B is for the storage address relocation translator (map). The Model C comes with 10 I/O feature slots. Models D, E, and F each come with seven I/O feature slots.

The 4955 computers can support up to 512K bytes (Model F) through optional mapping hardware. Storage protection is included on the 4955, and optional floating-point hardware is also available.

Configurations requiring additional I/O slots can be implemented through 14-slot I/O expansion units. On systems delivered after March 31, 1977, five I/O expansion units can be accepted. Systems previously delivered can be altered at no charge.

Programming support for the Series/1 consists of the Realtime Programming System, the Event Driven Executive, Base Program Preparation Facilities, Structured Programming Facility, System/370 Channel Attach Program, Fortran IV compiler and Realtime Subroutine Library, PL/1 compiler, and Cobol compiler. The Realtime Programming System is designed to give the user flexibility and control over system and applications programs, and is offered in five versions. The Base ▷

▶ and 64-bit double-precision operands with a 7-bit exponent and signed 56-bit fraction. The hardware floating-point capability is optional on the 4954 and 4955 processors. It provides single (32-bit) and double (64-bit) precision arithmetic plus conversion between binary and floating-point data.

INSTRUCTIONS: Microcoded set of over 160 individual instructions (additional 30 floating-point instructions are optional on the 4954 and 4955 processors). Series/1 instructions operate on bit, byte, word, doubleword, and variable field length byte operands. Most instructions are one word in their basic format; expanded address modes use two or three words, as required. Using a maximum of four from the possible 11 combinations of addressing modes can be implemented for any one instruction.

INTERNAL CODE: EBCDIC and binary.

MAIN STORAGE

TYPE: MOSFET (Metal Oxide Semiconductor Field Effect Transistor).

CYCLE TIME: 2.1 microseconds for the 4952, 600 nanoseconds on the 4955; and 1.4 microseconds for the 4954. The 4954 has an internal performance approximately twice that of the 4952.

CAPACITY: For the 4952 Models A, B, and C, 32K to 128K bytes in 32K-byte increments; for the 4954 Models A, B, and C, 64K bytes to 256K bytes in 64K-byte increments; for the 4955 Model A, 16K to 64K bytes in 16K-byte increments, Model B, 16K to 128K bytes in 16K-byte increments, Model C, 32K to 64K bytes in a 32K-byte increment, Model D, 32K to 128K bytes in 32K-byte increments, Model E, 64K to 256K bytes in 64K-byte increments, and Model F, 128K to 512K bytes in 128K-byte increments.

CHECKING: Parity checking on main storage and channel data bus.

STORAGE PROTECTION: None on the 4952 and 4954; standard on the 4955.

CENTRAL PROCESSORS

GENERAL: The Series/1 family is available in three processor models: the 4952 with Models A, B, and C; the 4954 with Models A, B, and C; and the 4955 with Models A, B, C, D, E, and F. All versions are 19-inch rack-mountable processors with optional data processing I/O, sensor I/O, and communications capabilities. An I/O feature attachment card provides the attachment between the Series/1 processors and the I/O devices. Multiple feature cards can be used in a system, and each card may address from one to 16 I/O devices, depending on the type of card being used.

The Series/1 4952 processor Models A and C are half-width units with 5 and 4 feature locations, respectively, while the Model B is a full-width unit with 141 I/O feature locations. The Model C also features an integrated floppy disk drive (a second drive is optional) for a storage capacity of 2.4 megabytes. The 4954 Model A is a half-width unit with 4 feature slots; the 4954 Model B, a full rack unit with 13 I/O feature slots; and the 4954 Model C, a full rack integrated processor/diskette unit with 3 I/O feature slots.

The 4955 processors are all full-width units which vary in main memory capacities and the number of I/O feature locations. Models A, B, and C have 8, 3, and 10 I/O feature locations or slots, respectively, while the Models D, E, and F each provide 7 feature locations. Also, the Models C and D can include one 16K-byte storage card; the Model E, one 32K-byte card; and the Model F, one 128K-byte storage card. ▶

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION & SPEED
TERMINALS	
4978 Model 1	CRT Display Station; 1920 characters, 24 lines by 80 characters, 4 x 6 dot matrix, local editing, detached keyboard
4979	CRT Display Station; 1920 characters, 24 lines by 80 characters, 4 x 6 dot matrix, local editing, integrated keyboard
MAGNETIC TAPE	
4969 Model 4N	Magnetic tape drive; 45 ips; 800 nrzi; 36,000 bps
4969 Model 4P	Magnetic tape drive; 45 ips; 1600 pe; 72,000 bps
4969 Model 4D	Magnetic tape drive; 45 ips; 800 nrzi or 1600 pe; 36,000 or 72,000 bps; dual density
4969 Model 7N	Magnetic tape drive; 75 ips; 800 nrzi; 60,000 bps
4969 Model 7P	Magnetic tape drive; 75 ips; 1600 pe; 120,000 bps
4969 Model 7D	Magnetic tape drive; 75 ips; 800 nrzi or 1600 pe; 60,000 or 120,000 bps; dual density
PRINTERS	
4973 Model 1	Line Printer; 132 columns; 48-, 64-, or 94-character set; 80 to 155 lpm
4973 Model 2	Line Printer; 132 columns; 48-, 64-, or 94-character set; forms stand; 235 to 414 lpm
4974	Serial Printer; 132 columns, 64- or 94-character set; 120 cps
4975 Model 01L	Serial Printer (local); 184-character set; 80 cps; 6 or 8 lpi; 10 or 15 cpi
4975 Model 02L	Serial Printer (local); 184-character set; 160 cps (draft), 40 cps (letter); 6 or 8 lpi
4975 Model 01R	Serial Printer (remote); 184-character set; 80 cps; 6 or 8 lpi; 10 or 15 cpi
4975 Model 02R	Serial Printer (remote); 184-character set; 160 cps (draft), 40 cps (letter); 6 or 8 lpi

▷ Program Preparation Facilities include a text editor, macro assembler, application builder, and job stream processor, and feature routines for such functions as disk and diskette initialization, copy, dump, patch, automatic system build, and system verification. The Structured Programming Facility provides a programming editor in a Series/1 that communicates with a companion MVS/VTAM or MVS/TCAM application program in a System/370 computer. The System/370 Channel Attach Program, running under the Realtime Programming System, allows user communication with any System/370 through a selector or block multiplexer channel. The Realtime Subroutine Library provides real-time support for Fortran IV programs. PL/1 support consists of a PL/1 compiler and resident library, and a transient library. Series/1 PL/1 is a subset of ANS PL/1 X3.53-1976 plus additional extensions. Cobol programs are compiled, built, and executed under two licensed program libraries, the resident and the transient, which greatly enhance the functions supported by Series/1 Cobol. In addition, Control Program Support is available to provide supervisory services for program control, as well as selected peripheral support at the read/write level.

The Event Driven Executive (EDX), upgraded from a Field Developed Program to a licensed program in January 1979, is designed as a performance-oriented system for business, industrial, and laboratory uses. EDX supports EDX System Network Architecture (SNA), EDX Systems Network Architecture Remote Job Entry (RJE) Program, EDX Sort/Merge, EDX Macro Assembler, EDX Indexed Access Method, EDX Mathematical and Functional Subroutine Library, EDX Multiple Terminal Manager, and EDX Query. ▷

▶ Optional features for the 4952 processor include a programmer console, 32K-byte storage addition modules, and a standalone enclosure (Model C). For the 4954 processor, optional features include floating-point which is plugged to the processor card, and a programmer console which is mounted in the front of the unit to provide data entry/display functions to the programmer.

The 4955 processor's optional features package includes storage address relocation translator (Models B and D only), floating-point, programmer console, and storage addition unit in 16K-byte (Models A, B, C, and D), 32K-byte (Models, C, D, and E), 64K-byte (Model E only), or 128K-byte (Model F only) increments. All processors include a basic console, power failure detect/auto restart, self-contained power supply, and four priority interrupt levels.

REGISTERS: Each Series/1 processor has one Interrupt Mask Register (IMR) and one Processor Status Word (PSW). Each of the four priority interrupt levels has eight general-purpose registers, one Instruction Address Register (IAR), and one Level Status Register (LSR). The 4955 processor also has one Address Key Register (AKR). All of the above are 16-bit registers. Optionally, the 4955 processor can also have four 64-bit floating-point registers installed per level.

The IMR is used for control of interrupts, while the PSW reports the specific condition that caused an exception interrupt. The IAR contains the leftmost byte of the next instruction to be executed, and the LSR contains information about the status of an interrupt level. The AKR contains three address keys and an address key control bit associated with address space management and the storage protection mechanism. Separate 3-bit fields contain an address key for the instruction address space, the operand 1 address space, and the operand 2 address space.

ADDRESSING: All storage addresses are 16-bit, unsigned, binary integers. The direct address range of the system is 64K bytes. The addressable unit of main storage is the byte, and all ▶

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USER REACTION

Forty-five users representing 57 IBM Series/1 computers responded to Datapro's 1982 User Survey. The life of the systems averaged approximately 22.9 months. Thirty-eight of the respondents purchased their systems while two rented or leased from the manufacturer and five leased from a third party; furthermore, 26 of those surveyed were first-time computer users. The types of industries represented most in the survey were Manufacturing (16 users) and Retail/Wholesale (nine users). The principal applications performed on the Series/1 were Accounting/Billing (46 percent), Order Processing/Inventory Control (40 percent), Payroll/Personnel (37 percent), and Purchasing (31 percent). The primary source of applications programs came from in-house personnel (73 percent).

The number of local workstations/terminals employed on-site ranged from none to up to 60 terminals. Of the 27 percent that employed remote workstation/terminals, the numbers ranged from one to up to 30 in use. Memory capacities ranged from 32K bytes to as high as 4096K bytes. Total disk storage, on the other hand, ranged from 256K bytes to a high of 600 megabytes. Of the 28 percent using a data base management system, 10 users employed an outside vendor package, and two used their own home-grown system.

Only 28 percent used integrated word processing functions. The programming language used most was Assembler followed by Cobol and RPG. Sixty percent of the users planned expansions to their present hardware in 1982 with 46 percent planning expansions to their data communications facilities. When asked if they planned to replace their system in 1982, all 45 users said no. The users rated their Series/1 computers as shown in the chart below.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	19	23	2	1	3.3
Reliability of mainframe	36	9	0	0	3.8
Reliability of peripherals	27	15	3	0	3.5
Maintenance service:					
Responsiveness	23	19	1	2	3.4
Effectiveness	20	23	1	1	3.3
Technical support:					
Trouble-shooting	8	19	9	5	2.7
Education	4	11	19	6	2.3
Documentation	6	14	16	6	2.4
Manufacturer's software:					
Operating system	9	24	8	3	2.8
Compilers and assemblers	9	20	7	2	2.9
Applications programs	4	16	6	2	2.7
Ease of programming	6	21	9	6	2.6
Ease of conversion	2	13	11	5	2.3
Overall satisfaction	7	30	6	1	2.9

*Weighted Average on a scale of 4.0 for Excellent.

When asked to state the significant advantages of their systems, 64 percent said the system is easy to expand/reconfigure, 53 percent stated they were happy with response times, 35 percent stated that the system is power/energy

references to storage locations are byte addresses. Instructions refer to bits, bytes, words, doublewords, or fields as data types. Addressing modes include direct, indirect, indexed, and indirect indexed.

INSTRUCTION REPERTOIRE: The Series/1 4952 processor has 179 instructions available; and the Model 4955 has 177 instructions. All instructions are implemented in microcode. The floating-point processor option, available on the 4955 and 4954, adds 30 instructions to the basic instruction set to handle single- and double-precision floating-point arithmetic.

INTERRUPTS: Series/1 processors have four priority interrupt levels. Associated with each level is a bank of general registers and status registers. Each bank consists of eight general registers, a Level Status Register (LSR), an Instruction Address Register (IAR), and, for the Model 4955 processor only, an Address Key Register (AKR). When switching between levels, the hardware automatically preserves the information contained in the interrupted-from level. Level switching can occur automatically upon acceptance of an I/O interrupt request or under program control.

The processor uses the device address to find the service routine for a given device; thus, there are 256 direct interrupt entry points. The I/O instruction assigns an interrupt level to an I/O device.

The processor enters the supervisor state when it has accepted all priority interrupts. When the processor accepts an interrupt on a given level, that level remains active until a level exit instruction is executed. If a higher-priority interrupt is accepted before the level exit instruction is executed, the processor switches to the higher level, completes execution at that level, and automatically returns to the interrupted-from level, provided no higher-priority interrupts are pending. If an interrupt is pending on the currently active level, it is not accepted until the level exit instruction has been executed. When no levels are active and no interrupts are pending, the processor enters the wait state.

PROCESSOR MODES: The Series/1 models recognize either a user mode of program execution or a supervisor mode. The supervisor mode is entered when a Supervisor Call (SVC) instruction is executed, when a console or class interrupt occurs, when an I/O interrupt is accepted, and at IPL time.
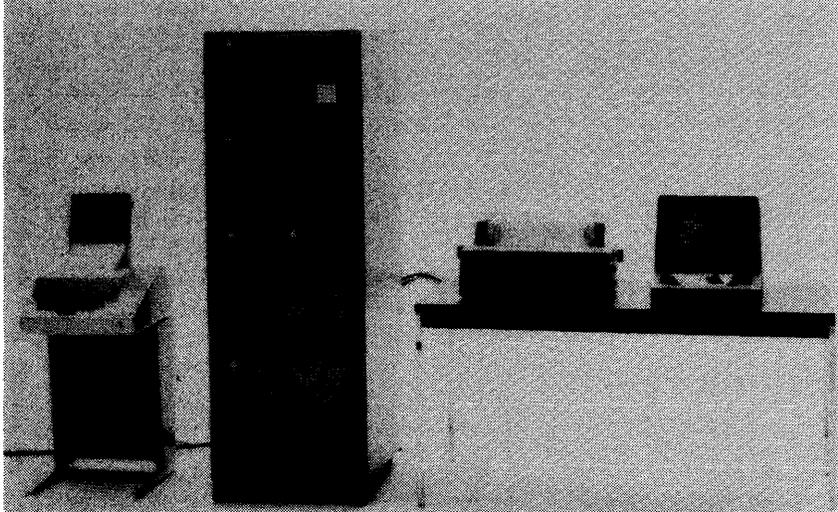
PHYSICAL SPECIFICATIONS: The Series/1 processors are housed in a 14-inch high chassis. The 4952 processor Models A and C are 8.5 inches wide, 22.5 inches deep, and weigh 52.9 pounds; the Model B measures 19 inches wide by 18.75 inches deep, and weighs 50 pounds. The 4952 processor Models A and B are designed for mounting in a 4997 or EIA standard 19-inch rack enclosure. Model C is designed for mounting in a 4997 or EIA standard 19-inch rack or standalone enclosure. All models of the 4955 processor are 19 inches wide, 18.75 inches deep, and weigh 50 pounds.

INPUT/OUTPUT CONTROL

INPUT/OUTPUT CHANNELS: The Series/1 I/O devices are attached to the processor through the processor I/O channel. The I/O channel accommodates a maximum of 256 I/O devices, with each device having a unique address. Four pre-emptive priority interrupt levels can be used to facilitate device service.

The processor I/O channel directs the flow of information between I/O devices and main storage, and contains the facilities for control of the I/O operations. The I/O channel is an asynchronous, multidropped channel that links the processor to its external resources. It consists of address,

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This Series/1 configuration includes a 4997 rack enclosure with a 4955 processor mounted at the top and a 4959 input/output expansion unit below. The bottom half of the enclosure houses a 4962 disk storage unit, with a 4982 sensor I/O unit above and to the left, and a 4964 diskette unit to the right of the sensor unit. Also shown are the 4974 printer, 4979 display station, and a teletypewriter.

▷ efficient, and 24 percent said that system costs were less than expected. On the negative side, 24 percent said that delivery of required software was late and 15 percent stated that system costs (for hardware, vendor-supplied software, support) exceeded the expected total and that the vendor did not provide all the promised software or support. When asked if the computer did what it was expected to do, 39 users said yes, two said no, and four were undecided. Similarly, when asked if they would recommend the system to another user, 38 said yes, two said no, and five were undecided.□

▶ control, and data lines. Device service through the processor I/O channel can occur as a cycle steal or as a Direct Program Control (DCP) operation.

In the cycle steal mode, each Operate I/O instruction can initiate multiple data transfers (maximum of 65,535 bytes). I/O operations are overlapped with processing operations. The I/O device must be able to operate in the cycle steal mode, and always interrupts upon termination of a cycle steal operation.

Under DCP, an immediate data transfer is made to, or from, the device for each Operate I/O instruction. The data can consist of one byte or one word. The operation may or may not terminate with an interrupt.

CONFIGURATION RULES

The Series/1 I/O channel accommodates up to 256 devices, with each device having a unique address. The actual number of devices that can be attached to a processor depends on the available number of slots in the basic chassis and the number of I/O expansion units employed. The Series/1 processors occupy three slots, and the floating-point and storage relocation transfer features occupy one I/O slot each. (See the Central Processor section for additional configuration details.)

WORKSTATIONS: One to eight per I/O attachment.

DISK STORAGE: Up to 256MB per I/O attachment.

MAGNETIC TAPE UNITS: Up to eight per I/O attachment.

PRINTERS: Up to eight per I/O attachment.

MASS STORAGE

4962 DISK STORAGE UNIT: There are six models of the 4962. Models 1, 1F, 2, and 2F all have a basic storage capacity of 9.3 million bytes under movable read/write heads. Model 1 has this basic capacity alone, on a fixed disk, accessed by two movable heads. Model 2 consists of a Model 1 plus a removable diskette with a maximum formatted storage capacity of 606,208 bytes; the diskette is accessed by two movable heads. Model 1F contains a fixed disk that is accessed by two movable heads and eight fixed heads; the maximum formatted storage capacity is 9.3 million bytes for the movable heads and 122,880 bytes for the fixed heads. Model 2F adds to the Model 1F a removable diskette with a maximum formatted storage capacity of 606,208 bytes, accessed by two movable heads.

The 4962 Model 3 contains a fixed disk with a maximum formatted storage capacity of 13,962,240 bytes, accessed by three movable heads. Model 4 is a combination disk and diskette unit, containing both a fixed disk with the Model 3 characteristics plus a removable diskette with a maximum formatted storage capacity of 606,208 bytes; the diskette is accessed by two movable heads.

Disk units in all models of the 4962 are functionally identical. Disk access time is 10 milliseconds (cylinder to cylinder). The data transfer rate is 889,000 bytes per second. The 4962 operates in a cycle-steal mode and supports multiple-sector transfers. The diskette unit in Models 2, 2F, and 4 is functionally identical to the 4964 Diskette Unit.

4963 DISK SUBSYSTEM: There are eight models of the 4963 Disk Subsystem, providing the Series/1 with 23 to 256 megabytes per subsystem. These subsystems include various combinations of 4963 disk storage units—a primary drive is requisite, to which a maximum of three expansion units may be attached. The primary unit contains a disk and control unit. The control unit provides control and attachment facilities for up to three other disk units in the subsystem. Disk storage units are full-width modular units designed for rack mounting. All models of the 4963 make use of multiple, non-removable magnetic disk with movable heads for recovering and retrieving data. Four models are primary units; four are expansion units. ▶

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4963 Model	Disk Capacity (bytes) Movable Heads	Fixed Heads
23A	23,461,888	131,072
23B	23,461,888	131,072
29A	29,327,360	
29B	29,327,360	
58A	58,654,720	131,072
58B	58,654,720	131,072
64A	64,520,192	
64B	64,520,192	

XXA = Primary unit
XXB = Expansion unit

The subsystem attaches to the Series/1 through a microprocessor-based disk subsystem attachment feature. The attachment feature offers high-speed cycle-steal access to the subsystem. Models 23 (A and B) and 58 (A and B) provide 131,072 bytes of additional storage that is accessed by fixed heads. These heads have 256 bytes per record capacity which equals the movable-head storage capacity. The data transfer rate is 1,030,000 bytes per second, and average seek time is 27.0 milliseconds.

4964 DISKETTE UNIT: Features a removable, two-sided, flexible diskette that can be used to transfer data or to load programs into the system. The 4964 uses dual-head recording and has a capacity of 492K, 568K, or 606K bytes, depending on the data format used. Track-to-track access time is 40 milliseconds, and data transfer rate is 31,250 bytes per second. The 4964 operates in a cycle-steal mode and supports multiple-sector transfers. All operations are controlled by an I/O microprocessor. Extensive diagnostics, along with the cyclic redundancy checking, are standard on this half-width modular unit.

4965 DISKETTE DRIVE AND I/O EXPANSION UNIT: Accommodates one (standard) or two drives for single- or double-density, one- or two-sided diskettes. The storage capacity of a dual-drive 4965 is 2.4 megabytes, and the average data transfer rate is 62,500 bytes per second for double-density diskettes and 31,250 bytes per second for single-density diskettes. The I/O microprocessor-controlled unit operates in a cycle-steal mode and supports multiple-sector transfers. Diskette data tracks contain 128-, 256-, 512-, or 1024-byte sectors. The 4965 supports the same diskette media used by the 4964 Diskette Unit and the 4966 Diskette Magazine Unit. (See INPUT/OUTPUT UNITS for I/O Expansion Unit details.)

4966 DISKETTE MAGAZINE UNIT: Provides access to data recorded on up to 23 diskettes, using either the two-sided IBM Diskette-2 or Diskette-2D, or the one-sided IBM Diskette-1. Diskette type 1 or 2 may be initialized for a maximum of 512-byte sectors, while type 2D may be initialized for a maximum of 1024-byte sectors. The 4966 features a 5-slot carriage assembly, with three slots storing individual diskettes and two containing magazines storing 10 diskettes each. Diskettes can be inserted in or removed from the magazines by the operator, and will typically be processed in sequential fashion. The 4966 provides a maximum on-line storage capacity of 27.8 megabytes, with a maximum data transfer rate of 125,000 bytes per second. Diskette-to-adjacent-diskette access time is under three seconds, and the maximum access time to any diskette is five seconds. All diskettes on the 4966 are compatible with existing IBM diskette drives. The 4966 attaches to a Series/1 channel via the Diskette Magazine Attachment, feature 1205.

INPUT/OUTPUT UNITS

4959 I/O EXPANSION UNIT: The 4959 provides additional I/O capability to supplement the I/O feature locations provided within the Series/1 processors. A maximum of 14 I/O feature locations are contained in the 4959. Any user attachment features, integrated communications features, data processing I/O attachment features, and the sensor I/O unit attachment feature may be installed in each 4959 I/O Expansion Unit.

Optionally, Channel Repower (feature 1565) may be added; this feature repowers the I/O channel along a chain of I/O expansion units. A maximum of five channel repower features can be installed. The 1565 *must* be installed: 1) on 4953 Processors for any 4959 Expansion Units attached; 2) on all 4959 units when another 4959 follows; and 3) on 4955 Processors with both a 4959 unit and a 4999 Battery Backup Unit installed, and for the second and following 4959 units attached.

The 4959 is a full-width module. I/O cables, for the processor I/O channel, are used to attach the 4959 to the processor.

4965 DISKETTE DRIVE AND I/O EXPANSION UNIT: In addition to being a diskette drive, the 4965 contains four additional I/O feature locations which allow for the connection of other I/O devices to a Series/1 processor.

1310 MULTIFUNCTION ATTACHMENT FEATURE: The Multifunction Attachment is a single-card unit that provides four independent attachment addresses. The first port can be used for both local and remote attachments, while the remaining three ports are designed for local attachments only. Both local and remote interfaces allow data rates of up to 9600 bits per second.

The 1310 provides interfaces for the 3101 Display Terminal Models 13 or 23, and the 4975 Printer Models 01L or 02L (local). For remote devices, asynchronous or bisynchronous communications can be selected through device initialization software in the operating system, and a single communications line is made available to the applications programs.

4982 SENSOR I/O UNIT: Consists of a power supply, terminator card, and slots for eight sensor I/O feature cards. Any of the following cards can be used:

Digital input/processor interrupt non-isolated
Digital input/processor interrupt isolated
Digital output non-isolated
Analog input control
Amplifier multirange
Multiplexer—reed relay
Multiplexer—solid state
Analog output

The 4982 attaches sensor user processes to the IBM Series/1 computers via the 4982 attachment feature, which may be either in the Model 3 or Model 5 processor or in the I/O expansion unit. Together, the sensor I/O unit and the attachment feature provide a broad base for general digital and analog I/O applications.

5250 INFORMATION DISPLAY SYSTEM ATTACHMENT: Consists of two cards that plug into a Series/1 processor or I/O expansion unit. The attachment provides four ports to which 5250 units are attached by means of twinax or coax cabling. The maximum length of the twinax cable is 5,000 feet; for the coax cable, 2,000 feet. A maximum of seven printer units, in any combination can be attached to any single port. The maximum number of 5250 units that may be connected to the attachment feature is eight; each 5251 and 5256 counts as one, the 5252 counts as two.

1200 SYSTEM/370 CHANNEL ATTACHMENT: Provides memory-to-memory communications between a Series/1 processor and any System/370 processor, Model 135 and above, including the 303X processors. Up to eight attachments can be connected to any selector or block ▶

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▶ multiplexer channel except the 2780 channel used on 370/168 systems. An optional feature allows the host system to IPL an attached Series/1 processor.

7400 TWO-CHANNEL SWITCH: This feature for the 4959 I/O Expansion Unit provides the capability for switching a set of common I/O devices between two Series/1 processors. The 7900 feature card is plugged into the 4959 and is connected by cable to the I/O channels of two Series/1 processors. Upon failure of the primary processor, the secondary or backup processor receives an interrupt and can be programmed to switch the common I/O. Manual intervention is required when switching back to the primary processor. Manual switching in either direction can be done by the operator.

The Two-Channel Switch console, located on the front panel of the 4959 I/O Expansion Unit, is provided as part of this feature, and provides indicator lights, switches, and keys that allow unit power on/off, manual or backup selection, manual processor selection, manual processor interrupt, channel reset, manual error recovery, and unit status. As a unit, the 7900 is field-installable.

See the Peripherals/Terminals table for additional Series/1 I/O devices.

COMMUNICATIONS CONTROL

1400 LOCAL COMMUNICATIONS CONTROLLER: Provides a high-speed, local interconnection of up to 16 Series/1 processors (all models), resulting in the configuration of a Distributed Data Processing (DDP) system. Each unit of the cluster or "ring" is capable of directing messages at 2,000,000 bits per second to any other unit within the interconnected configuration without the need of a master controlling station. A microcontroller and associated circuitry provide for cycle stealing, control buffers, and error handling. The "peer-to-peer" full-duplex protocol is transmitted via twinaxial cable, connecting processors at a maximum distance of 5,000 feet.

1610 ASYNCHRONOUS SINGLE-LINE CONTROL: Provides circuitry for controlling one half-duplex line, operating at a speed of up to 9600 bits per second. Can be used as either a primary station or a secondary station. Makes no provision for station-address recognition; therefore, when used as a secondary station on a multipoint network, the software must provide the ability to recognize station addresses. No IPL capability is provided.

2091/2092 ASYNCHRONOUS 8-LINE CONTROL AND 4-LINE ADAPTER: A maximum of eight lines operating in half-duplex mode can be controlled by these features. Each of these lines can operate at up to 2400 bits per second. No IPL capability is provided.

2074 BINARY SYNCHRONOUS SINGLE-LINE CONTROL (MEDIUM-SPEED): Provides circuitry for controlling one half-duplex line, operating at a speed of up to 9600 bits per second. Can be used as either a primary (control) or a secondary (tributary) station, and has the ability to IPL the processor from a host system.

2075 BINARY SYNCHRONOUS SINGLE-LINE CONTROL (HIGH-SPEED): Provides circuitry for controlling one half-duplex line, operating at a speed of up to 56,000 bits per second. Can be used as either a primary or secondary station, and has the ability to IPL the processor from a host system. This feature is for use in leased-line applications only.

2090 SYNCHRONOUS DATA LINKE CONTROL (SDLC) SINGLE-LINE CONTROL: Provides circuitry for controlling one half-duplex line, operating at a speed of up to 9600 bits per second. Operates as either a primary or

secondary station. The ability to IPL from a host system is not provided.

2093/2094 BINARY SYNCHRONOUS 8-LINE CONTROL AND 4-LINE ADAPTER: These features control up to eight half-duplex lines. The maximum aggregate bit rate is achieved by running two lines at 9600 bits per second and six lines at 2400 bits per second. The ability to IPL from a host system is not provided.

2095/2096 8-LINE CONTROLLER/4-LINE ADAPTER: The 2095 feature provides the control circuitry for up to two 4-line communications. This 8-line control includes point to point or multipoint operations which are supported with an aggregate controller throughput of 64,000 bytes per second. The 2096 feature is a 4-line adapter and provides speeds of 37.5 bytes per second (BPS) to 1,200 bps, or 300 bps to 19,200 bps. Choice of synchronous or asynchronous operation. Included are Echo-plex operation; choice of 5, 6, 7, or 8 bits per character; odd, even, or no parity checking/generation; stop-bit length of 1 or 2; and change-of-direction (COD) character recognition.

4987 PROGRAMMABLE COMMUNICATIONS SUBSYSTEM: Consists of the subsystem unit, up to two controller features, and device attachment features. Accommodates up to 32 lines per subsystem at data rates of 45 to 9600 bps. The 4987 supports point-to-point leased and switched lines or multipoint lines and handles the communications requirements for standard IBM protocols and non-standard protocols. A special communications-oriented instruction set allows many communications functions to be performed outside the Series/1 processor.

The NETWORK ROUTING FACILITY is designed to provide users of Advanced Communication Function/ Network Control Program (ACF/NCP/VS) with a 3705 based message routing facility. The Network Routing Facility resides in an IBM 3705 Communication Controller with ACF/NCP/VS and routes messages between supported devices without the use of host processor resources. The Network Routing Facility features support for 3650 Data Communications Terminal; multiple message routing options selectable by the user; user exits allowing customized routing, editing, and error processing; continuation of terminal routing in the event of a host failure; and detection of abnormal conditions with reporting to the host ACF/ VTAM.

SOFTWARE

OPERATING SYSTEMS

THE REALTIME PROGRAMMING SYSTEM

The *Realtime Programming System (RPS)* is a control system through which a user can install, operate, and maintain system programs, application programs, and data. RPS is multiprogramming, multitasking, event-driven, and disk-based. It allows multiple concurrent task operations in the same or different partitions with synchronization and communication between them. Re-entrant programs can be used by more than one task. Announced in April 1977, RPS manages all physical resources—processor, storage, and devices. Its supervisor and data management services provide a controlled interface between application programs and Series/1 hardware.

RPS Version 2 provides all the facilities of Version 1 plus system support for the IBM Disk Storage Unit Models 3 and 4 with a capacity of 13,926,240 bytes. This permits more program and data storage for users with large program libraries and/or data files. RPS Version 2 also provides storage support beyond 64K bytes using storage overlays, automatic device backup for printers and a teletypewriter, ▶

▶ IPL and dumping of a remote Series/1 by a host Series/1 using BSC communications, and use of the basic level for communications operations.

Version 3 further enhances RPS capabilities. This licensed program provides all the facilities of Versions 1 and 2 operating in a multiple address space environment. In addition, it provides support for up to 256K bytes of strage, up to 15 user partitions, relocatable task sets, support for instructions/data split in the supervisor which allows maximum size to exceed 64K bytes, and dynamic partitions that are created on demand.

Programs that run on RPS Versions 1 and 2 may require source modifications to enable Version 3 to compile and execute. Program Preparation Subsystem Version 3 is required on RPS Version 3.

Version 4 of RPS provides all facilities found on Versions 1, 2, and 3, and in addition support the following: attachment of a Series/1 as a cluster controller in a System/370 systems network architecture (SNA) network; additional binary synchronous and asynchronous terminals on multipoint lines; 4963 Disk Subsystem; 4966 Diskette Magazine Unit; single or multiple address space environment; dynamic transient pool management, the Command Language Facility; and ease-of-use features including simplified systems and installation, dynamic control block allocations, and dynamic device configuration.

The Realtime Programming System SNA support controls the management of sessions and the flow of data in an SNA network between a System/370 user program or IMS/VS and a Series/1 user program. This support provides for system definition services, network attachment activation/deactivation services, session activation/deactivation and message exchange, and activation of a Series/1 task set from the host.

RPS provides a data flow control level interface for support, as a multiple logical unit cluster controller, on an SNA network controlled by a System/370 using OS/VS2 (SVS or MVS) and ACF/VTAM or ACF/TCAM. This allows multiple user program to be in session with multiple System/370 user programs.

Through a simplified interface to RPS based services, the Command Language Facility provides on line programming development and production system support to multi-programming users. Commands are processed in realtime by an interpretive compiler that establishes the necessary execution environment prior to invoking requested services, such as the IBM Series/1 text editor, application builder, or PL/1 compiler.

As defined by systems network architecture, the Realtime Programming System SNA support provides SNA physical unit type 2 support, SNA function management profile 3 and 4 support, SNA transmission subsystem profile 3 and 4 support, and SDLC secondary station support.

Programs run on RPS Version 1, 2, or 3 may require source modifications to compile and execute on RPS Version 4. Program Preparation Subsystem Versions 3 or 4 is required to prepare programs to execute on RPS Version 4.

Version 5 of the Realtime Programming System provides all of the functions featured in the previous four versions (excluding single address space management), plus the following features: support for the 4955 Model F processor, support for the 4952 Model C processor, improved SYSGEN and installation, and improved system usability and application productivity, including SNA enhancements.

Version 5 is designed to effectively support the larger 4955 Model F processor. This larger processor provides a maximum of 512K bytes of main memory, allowing for more programs and data, multiple Shared Task Sets, larger and more applications, and increased number of Command Language Facility users in logically expanded Supervisor Data Space (D-Space). D-Space has been expanded beyond its current 64K-byte limit to provide a greatr capacity for more devices and task sets. with the introduction of a new facility called "Secondary Storage Services," a partition size can be extended beyond 64K bytes by requesting that a pool of additional processor storage be allocated at Task Set load time. With Version 5, more than one shared task set can be active at a time, allowing for each shared task set to be tailored to the requirements of the applications which share it, resulting in more address space for the applications program.

As a result of several enhancements, Version 5 more effectively supports the 4952 Model C processor with a main memory capacity of 128K bytes. These enhancements include full support of the integraded clock/comparator, better storage utilization via enhanced SYSGEN capabilities, and a loadable Binary Synchronous/Asynchronous communications support. With Version 5's diskette-based system option, it is now possible to SYSGEN a diskette-based system, enabling the use of the operating system in configurations without a disk unit.

Several packages have been integrated into Version 5 for improved SYSGEN and installation. The Spool and Transient Activity Tool support, previously offered as separately licensed programs, has been fully integrated into Version 5. In addition, to fully provide what is needed for application development, the User Macro Library, SYSGEN programs, and the Command Language Facility are now packaged in Version 5 of the Program Preparation Subsystem. To reduce the need to SYSGEN, a standard (prebuilt) system is available. Capable of supporting a number of development configurations and uses, the minimum processor storage required by the standard system is 192K bytes. An installation system can also be used to install a customized system on a processor with 128K bytes or greater of main memory. If the need exists to generate a customized system, various improvements to SYSGEN are inlcuded in Version 5. A more accurate and faster SYSGEN, through reduced number of questions, automatic answer verification, and fewer assemblies, is now available.

Segmentation of messages is provided in Version 5's SNA support. To provide increased connectivity to System/370 facilities, Unbind/Hold and Full-Duplex are also provided. In addition, the SNA buffer pool has been removed from D-Space to reduce the SNA demands on this limited resource and to support more Logical Units (LUs). Other features of Version 5 for improved system usability and application productivity include new operator commands, a common terminal controller, interpartition communications, Command Language Facility enhancements, improved documentation, a new On-line Error Log Report facility, and spooling enhancements.

Complete compatibility with files supported by the IBM Series/1 RPS Versions 1 through 5 is provided. Any data file written using any of these systems is directly usable by the other. Problem state programs of Version 1 or 2 require reassembly and rebuilding for execution on Version 5. Versions 3 and 4, however, with the exception of those programs using the BSC IPL bootstrap facilities, require no reassembly. In some cases, VCBA Space may need to be increased. The Series/1 Program Preparation Subsystem Version 5 is required to prepare programs for the RPS Version 5.

RPS has debugging aids to help users to find and correct errors in problem and supervisory programs. Through the ▶

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▶ interactive debug package, users can display and modify registers, processor storage, disk, and diskette contents, as well as set address tops to monitor the status of executing programs.

RPS SUPPORT SOFTWARE: *RPS Communications Monitor:* The Series/1 Communications monitor, which runs under RPS Version 5, provides an extensive set of facilities that manages the flow of messages between Series/1 systems, other computer systems, terminals, printers, and other I/O devices. It handles user-directed message prioritization and queuing from local or remote Series/1 systems via a point-to-point Binary Synchronous Communications (BSC) non-switched line, the Series/1 Local Communications Controller, or a point-to-point High-level Data Link Control (HDLC) non-switched line. The program directs communications between a Series/1 and a host computer (e.g., System/370) through a BSC non-switched line, the Series/1-System/370 Channel Attachment feature, or an SDLC/SNA non-switched line. The SDLC/SNA line provides the capability to tie the Series/1 into an SNA network communicating with IMS/VS and CICS/VS. Any data set or program can be transmitted over these lines.

RPS Version 5 SNA Extended Support: This licensed program enhances the overall usability of the base operating system's SNA support. The basic operation of the SNA Extended Support involves establishing communications with the host subsystem, including message recovery/re-synchronization assistance; sending messages to and receiving messages from the host computer while handling the required SNA formats and protocols; and terminating communications with the host system. The use of the SNA Extended Support is selectable for any Logical Unit (LU) by the application programmer. Multiple LUs can be supported in the same physical unit. The extended icense program only requires an SDLC single-line control, assuming all hardware requirements for the particular base RPS SNA configurations have been satisfied.

RPS Query: Provides interactive user-friendly access to data stored in an Indexed Access Method or sequential file. This program is for use with the Realtime Programming System Multiple Terminal manager and can also be used in a batch processing mode by a user application program. Query permits users to access their data in the form of tables consisting of rows (representing records) and columns (representing data fields). Users create table descriptions which describe how information from a user file is presented. These table descriptions are then used by Query to allow information retrieval from Indexed Access Method or sequential files. Record update, delete and insert, and request journaling are also available using an Indexed Access Method file.

Using the Query interactive interface, users can specify adhoc queries or executive predefined queries. The results of a query can be displayed at a terminal, printed, or written to an output file for subsequent processing. A menu-driven Query utility interface is provided to define the physical layout of fields in user files, create table descriptions, predefine queries, and assign passwords. This interface utilizes prompt-response menu screens. Maintenance routines are provided to perform copy, update, delete, and rename functions for file descriptions, table descriptions, and predefined queries.

RPS Remote Management Utility: Two programs, the RPS Remote Management Utility (BSC protocol) and the RPS SNA Remote Management Utility (SDLC protocol), facilitate the operation of a remote Series/1 in a distributed data processing system. As a network management tool, the programs can access a Series/1 from a System/370 or another Series/1 and issue RPS operator commands, including transmit, receive, create, reset, or delete a data set on the remote Series/1; schedule programs on a Series/1 for

execution, including utilities, storage dumps, and other remote management environment diagnostic aids; and includes a Virtual Telecommunications Access Method (VTAM) application program to provide the controlling code on a System/370.

RPS Indexed Access Method: The Index Access Method PRPQ for RPS users provides keyed access to user data to support a wide variety of applications ranging from batch processing to multi-user, interactive applications. The data file organization is designed to provide efficient random and sequential processing of files. The access method design supports files which have high add/delete activity, minimizing performance degradation. This is accomplished by distributing free space for additions throughout the file, by updating and inserting additions in place, and by dynamically reclaiming space after deletions. The Indexed Access Method also supports multiple tasks sharing the same data files. In a shared environment, data integrity is maintained by record level locking, preventing multiple concurrent updates of the same record.

The Indexed Access Method Licensed Program includes all Indexed Access Method PRPQ features, plus the following functions: required DSD name referencing, generating a free pool area for reserved blocks, key modification verification, selectable write/verify option, automatic index file closing and freeing of access method resources, a macro for obtaining information about a file, and a utility program for creating an indexed file. Version 2 of the RPS Indexed Access Method supports all the preceding features plus a multiple secondary index support feature, a data paging function which utilizes unmapped storage, and a set of enhanced utilities which have simplified procedures in file definition/creation, file load/unload, and file organization.

RPS Multiple Terminal Manager: The Multiple Terminal Manager provides facilities for the management and control of user-written programs that execute from multiple IBM 4978, 4979 Display Units or Teletype's Model ASR 33/35, or equivalent devices. It provides users with a productivity enhancement for the implementation of transaction applications written in Assembler, Fortran, PL/1, or Cobol. The Multiple Terminal Manager also provides management of buffer allocation and I/O support, a high-level language interface for accessing random and keyed direct files, menu-invoked transaction application programs, among others. Version 2 of the Multiple Terminal Manager operates under RPS Version 4 or 5 and, in addition to the facilities offered in Version 1, includes IBM 3270 emulation, IBM 3101 Display Terminal support, IBM 3270 Information Display System support, additional disk file support (FILEIO), and new utility functions.

RPS Sort/Merge: The Sort/Merge program handles sorting and merging of records from eight input data sets into one output data set in either ascending or descending order. The user specifies one or more control fields in the records to be sorted; the program then compares the control fields to determine the relative sequence of the records.

The Sort/Merge Program executes under the RPS Version 3 or 4, or under the Program Preparation Subsystem Version 3. It can execute either as a batch job under the job stream processor or in a foreground partition under the Realtime Programming System.

RPS Advanced Remote Job Entry (ARJE): Licensed program provides the Series/1 user with RJE support in an SNA/SDLC or BSC environment. The program allows the Series/1 to conform to the protocol required by the host system. The BSC option features the Series/1 as a multitasking RJE (MRJE) workstation over a point-to-point (switched or non-switched) connection. The SDLC option features the Series/1 as an SNA RJE workstation over a ▶

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► point-to-point or multipoint connection. Users can place advanced RJE commands in a direct access data set, and the program will read the commands as if they were entered via a display terminal. The ARJE also allows Series/1 users to query the host system as to the status of the previously submitted jobs. Configuration requirements for the ARJE program include either a 4954 or 4955 processor with 192KB of main storage, a Series/1 direct access device, a 4978, 4979 or 3101 display, an SDLC or BSC communications feature, and Version 5.2 of RPS.

EVENT DRIVEN EXECUTIVE (EDX)

The *Event Driven Executive (EDX)* consists of five licensed programs that together provide a flexible operating system for the Series/1. These licensed programs include the EDX Basic Supervisor and Emulator, EDX Utilities, EDX Program Preparation Facility, EDX Macro Library, and EDX Macro Library/Host. EDX can apply to a broad range of applications such as data entry, remote job entry, distributed processing, and other commercial applications, as well as typical sensor-based functions such as data acquisition, material and component testing, machine and process control, and shop floor control.

EDX is a multiprogramming, multitasking supervisor that offers a high-level, user-oriented instruction set; direct access, multiple terminal, and sensor input/output support; a flexible operating environment-storage resident only, disk- or diskette-based; high-level programming languages, including Fortran IV and Cobol; on-line utilities including source entry and editing interactive debugging aids, screen format builder, remote job entry; on-line program preparation facility, system generation, and application development; and a session manager that provides a menu of functions with automatic allocation of user work files.

The EDX Basic Supervisor and Emulator is a multi-programming system supervisor controlled by a user-oriented instruction set. This supervisor supports multiple, in-dependent, time dependent, and/or event-driven applications with minimum interaction. This support includes:

* The ability to initiate an application program from a terminal or another application program and to pass parameters to the new program;

* Multiple copies of the same program can run concurrently;

* Multiple independent applications can run concurrently;

* Multitasking within each application program, with preemptive task switch;

* Multiple terminal support so terminals may be dynamically assigned to each application as required; and

* A relocating loader so an application program may use any available main storage area at the time of invocation.

Typical supervisor size is from 10K to 30K bytes and application instructions typically average from 6 to 8 bytes of storage.

The Basic Supervisor and Emulator also provides an operating environment for other licensed programs, including Fortran IV and Cobol, the Indexed Access Method and Sort/Merge, the Multiple Terminal Manager, and the Event Driven Executive Macro Assembler.

The EDX Utilities are a set of programs that provide productivity aids for Series/1 program development, program maintenance, and distributed processing functions to a host System/360/370. These programs are independent program load modules capable of running concurrently with

other application programs on a Series/1 having the Basic Supervisor and Emulator. The utilities are:

* Data Set Management;

* Distributed Processing/Communications Control;

* Source Program Entry and Editing;

* Interactive Program Debugging;

* Program Library Update;

* Sensor I/O Test Functions;

* Graphics Display Processor;

* A full screen editor for source program entry and editing;

* The Screen Format Builder utility for use in designing formatted screen images for the 4978 and 4979 Display Stations;

* The Job Stream Processor utility, a batch job processing facility that can be invoked concurrently with other programs. Allows user to execute a series of programs that are defined in disk/diskette procedure data sets without operator intervention;

* Remote Job Entry (2780- and 3870-like work station) utilities for interface with System/370 HASP, JES2, JES3 remote job entry;

* Terminal Configuration utility for modifying an Event Driven Executive terminal configuration after IPL;

* Binary Synchronous Communications Trace to provide a means of tracing the I/O activity on a given BSC line;

* Message Routing Utility to provide a simple means of sending messages to any terminal on the system;

* A Copy utility that dynamically allocates and copies data set members in single or multiple copy mode; and

* An on-line disk/diskette initialization facility to provide sector formatting, labelling, and alternate sector identification.

The EDX Program Preparation Facility allows the user to compile and link edit application programs (using EDX language macros) concurrently with the execution of other programs (including other program preparation partitions). The user can also reconfigure, compile, and link edit custom supervisors on-line.

The EDX compiler can provide productivity improvements through the availability of all EDX supervisor functions, symbolic file addressing, selection of any terminal device for listing output, and greater compilation speeds than the EDX Macro Assembler. The compiler can operate on a disk- or diskette-based system.

The EDX Macro Library, in conjunction with the EDX Macro Assembler, can be used to build a basic supervisor and emulator or to assemble application programs written in the EDX instruction set and/or the Series/1 instruction set.

This licensed program is a set of libraries and procedures that provide the capability to assemble application programs written in the EDX instruction set and/or Series/1 instructions on a host System/370 using the System/370 Program Preparation Facilities for Series/1 FDP. Communications with the host System/370 is supported by either the System/370 EDX Host Communications Facility IUP or the Remote Job Entry capability of the EDX utilities. ►

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▶ The Series/1 Data Collection Interactive is an individually licensed PRPQ that provides additional function for the EDX and consists of a set of functional modules that interface with, and require, the EDX. It supports the attachment of up to thirty-one 5234 Time Entry Stations and 5235 and/or 5236 Data Entry Stations in any combination. The 5235 and 5236 Data Entry Stations may also have the 5239 Value Read Module attached. Some of the functional capabilities are: personalization prompting on the Series/1 console, configuration modification, program selectable time of day option, on-line test initialization, audible alarm initiation, error handling, and data routing to storage or to disk/diskette. Some potential applications could include time and attendance, data base inquiry, shop floor control, and inventory updating.

EDX was initially released as a field-developed program. This FDP is available in three versions. The licensed programs available under Version 1 are: Event Driven Executive Basic Supervisor and Emulator, Event Driven Executive Utilities, and Event Driven Executive Macro Library.

Version 2 of the EDX FDP consists of the four following programs: EDX Basic Supervisor and Emulator Version 2, EDX Utilities Version 2, EDX Program Preparation Facility, and EDX Macro Library/Host.

Version 3 of the EDX FDP features three new programs, including EDX Support for Systems Network Architecture (SNA), EDX Systems Network Architecture Remote Job Entry (RJE) Program, and EDX Indexed Access Method Version 2. The following programs have ben enhanced to reflect the contents of EDX Version 3.1: EDX Basic Supervisor and Emulator Version 3, EDX Utilities Version 3, EDX Program Preparation Facility Version 3, EDX Macro Library Version 3, and EDX Macro Library/Host Version 3.

EDX SUPPORT SOFTWARE: *EDX Systems Network Architecture (SNA):* A single copy of the SNA program will execute and coordinate all SNA/SDLC requests from user application programs. With the SNA program, EDX users are capable of interfacing to existing SNA host system networks, allowing for communications with existing host application subsystems such as the Customer Information Control System (CICS/VS) and the Information Management System (IMS/VS). The Series/1 is connected to the host application as a Secondary Logical Unit (IMS/VS) or as a full-function Logical Unit (CICS/VS).

The SNA support controls the communications path between the Series/1 and the host computer (System/370, 303X, 43XX), and handles the required SNA format and protocols. It provides an SNA presentation services level user an interface to program-to-program communications with the host data base/data communications subsystem in an SNA network. This support allows the Series/1 to be defined as a cluster controller on an SNA/SDLC network controlled by a host computer using OS/VS1, OS/VS2 or DOS/VSE, and ACF/VTAM or ACF/TCAM via an IBM 3705 Communications Controller using the Network Control Program.

EDX Systems Network Architecture Remote Job Entry (RJE) Program: A licensed program that provides a workstation program for the Series/1 in an SNA network environment. The program enables the user, who has created a job stream via the EDX edit features, to transmit that job stream to a host system for processing. Upon completion, the output from the job stream is normally sent back to the workstation for printing and/or punching. The workstation program also allows the user to query the host computer for system status reports.

EDX Mathematical and Functional Subroutine Library: A library of common-usage subroutines for mathematical and data conversion functions. It runs under the control of the EDX Basic Supervisor and Emulator and depends upon this operating system to be its complete and only interface to hardware. Some of the features are mathematical functions including sine, cosine, logarithms and exponentiation functions, maximum and minimum functions, modular arithmetic and others; a commercial subroutine package containing a library of subroutines that will meet most requirements for decimal data handling. These subroutines, similar to those offered on other IBM systems, provide comprehensive facilities for editing, decimal arithmetic, and data compaction, and conversion subroutines for data manipulation. Subroutine library services allow Assembler language users to initialize and release a library work area and to specify an abnormal termination processing routine that returns control to the user on program interrupts or abnormal execution of system macro instructions. MFSL routines are modular in design and can be easily replaced by user-written routines; error-checking routines detecting error conditions during processing of mathematical and conversion routines, including checking of illegal arguments and invalid conversion data inputs, testing floating-point divide exceptions, and testing floating-point overflow and underflow conditions, are also included.

EDX Query: Provides interactive, user-friendly access to data stored in an Indexed Access Method or sequential file. This program is for use with the Event Driven Executive Multiple Terminal Manager and can also be used in background mode by a user application program. EDX Query offers the same functions as Query (refer to the RPS Software section).

EDX Sort/Merge: Handles the sorting and merging of records from up to eight input data sets into one output data set in either ascending or descending order. The user specifies one or more control fields in the record to be sroted. EDX Sort/Merge accepts fixed length or variable-length records in unblocked or blocked formats (variable-length records are only supported by the Series/1 EDX Cobol Compiler and associated libraries); initiates program execution either as a batch job or from a user routine written in Series/1 Assembler language, Series/1 Cobol, or EDX language; permits user-written exit routines to handle I/O errors and process records during Sort/Merge execution; permits deviation from the standard EBCDIC or ASCII collating sequence at program execution; allows multiple sorts to be invoked from the same application; and routes messages to the operator workstation or printer. Output from the EDX Sort/Merge program is limited only by output data set size and can be one of our types: address sort, record sort, record summary sort, or merge.

EDX Indexed Access Method: A licensed program that provides data management facilities supporting indexed file operations for the Series/1 EDX. It allows the user to build, access, and maintain user-defined records in indexed data sets via a predetermined field called a key. The Indexed Access Method builds an index of keys that provides fast access to records in a data set. The access method supports a high degree of insert/delete activity, providing both direct and sequential access to the data from multiple programs concurrently accessing the same or different indexed data sets. A single copy of the Indexed Access Method supports multiple programs and tasks sharing the same data files. In a shared environment, data integrity is maintained by record and block level locking to prevent access to an indexed or data record while the record is being modified.

Version 2 of the EDX Indexed Access Method supports all the functions of the previous version, plus the following functions:

● Multiple Secondary Index Support—allows keys other than the primary key to access, retrieve, and manipulate a specific record. ▶

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► • Data Paging—keeps the most frequently used indexed file pages in storage, thereby reducing the number of file input/output accesses.

• Enhanced Indexed Access Method Utilities—provide a simplified interface and less complex procedures for file definition/creation, and improvements in load/unload and file reorganization processing.

Applications that use the Indexed Access Method support can be programmed in the EDX language or Cobol. It is also supported by the Series/1 EDX Sort/Merge licensed program, which will accept Indexed Access Method data sets as input files.

EDX Multiple Terminal Manager: A licensed program that provides a set of high-level functions designed to simplify development (design and implementation) of transaction-oriented applications. High-level language programs (Cobol, Fortran IV, or Event Driven Executive language) can execute in an interactive environment where one or more applications run concurrently using one or more display devices. User-written transaction programs using predetermined screen formats could be used for order entry, inventory file update, and inquiry-type applications. Full screen support for the IBM 4978 and 4979 display stations includes write variable data (scatter write), read unprotected data from screen, set tone alarm, and PF key support.

Screens designed using an EDX Utility can then be used with Multiple Terminal Manager transaction applications written in Cobol, Fortran IV, or the EDX language.

EDX Macro Assembler: A licensed program that allows the user to assemble application programs or program modules concurrent with the execution of other programs operating under the control of the EDX Basic Supervisor and Emulator.

The Macro Assembler converts text data sets containing machine and macro instructions into object modules to be processed by the supplied linkage editor. In conjunction with the EDX Macro Library, applications coded in the Serie/1 EDX language can also be processed by the Macro Assembler, including the reconfiguring or customizing of the EDX supervisor. User-generated macros for commonly used routines can be incorporated into the macro library.

The Assembler also provides the user with the facility for generating device support modules or specific routines in support of user exits or customized supervisory functions. These routines can be link edited with user applications generated in the EDX language, Fortran IV, and/or Cobol.

LANGUAGES

Cobol: Series/1 Cobol is offered as two licensed programs: the Compiler and Resident Library for compilation and building of user programs, and the Transient Library for execution of user programs. Series/1 Cobol executes under Version 3 or Version 4 of RPS and Version 3 or Version 4 of the Program Preparation Subsystem. Cobol applications can execute under RPS or the Program Preparation Subsystem batch environment.

Series/1 Cobol is a compatible subset of IBM's OS/VS Cobol compiler and library, release 2. Programs can be developed on larger systems for use on Series/1 provided they do not use any language or hardware features the Series/1 product does not use. For compilation, a minimum 34K-byte partition is required. For execution, a minimum 8K-byte partition is required for the Cobol library routines, while the actual partition size is a function of the Cobol source program.

The Cobol Resident Library consists of commonly used re-entrant subroutines which are combined with a user's program through the Application Builder to form a task set for subsequent execution on the Series/1.

The Transient Library is used in conjunction with the execution of Cobol user programs. Transient Library routines are loaded only when needed, allowing for more efficient utilization of primary storage. These routines are re-entrant and can be executed from a shared task set.

The RPS Cobol Compiler Version 2, executing under Version 5 of RPS, includes logical operators and support for handling special forms and blocking of relative files. It features facilities for easier accessing of files, enhanced data interchange with other systems via a packed decimal format, and increased utilization of IBM hardware (4975 Printer). Series/1 Cobol Version 2 also provides an improved level of source statement compatibility with IBM Cobol compilers offered on the IBM System/370, System/34, and System/38.

EDX Cobol: Offered as two licensed programs, the EDX Cobol Compiler and Resident Library for compiling and building user programs and the EDX Cobol Transient Library for executing user programs. EDX Cobol is designed according to specification for the ANS Cobol X3.23-1974 as understood and interpreted by IBM as of March 1979, with the exception of the RERUN clause. Some of the features above the low intermediate level include support of merge and various extensions of the nucleus features.

The EDX Cobol Compiler operates in the environment of the EDX Basic Supervisor and Emulator. The Cobol-generated object code is combined with library routines by the EDX linkage editor and can run as a program under the control of the EDX system. The EDX utilities provide powerful program editing and source program management capabilities for the Cobol development process.

EDX Cobol Compiler Version 2 executes in the operating environment provided by the IBN EDX Basic Supervisor and Emulator Version 3 and requires the EDX Utilities Version 3. For compilation, a minimum 32K-byte partition is required. For execution, a minimum partition size of 8K to 10K bytes is required. Version 2 supports additional source statements, special forms, blocking of relative files, and provides facilities for easier file accessing.

Fortran IV: A licensed program that includes the compiler and object support library, Series/1 Fortran IV is a subset of ANS Fortran X3.9-1966 and includes ANS Basic Fortran X3.10-1966, with the exception of object-time formats, adjustable dimensions, COMPLEX data type, G-format specifications, and two-level FORMAT parentheses. In addition to the basic subset, IBM extensions are also provided.

A separate licensed program, the Fortran IV Realtime Subroutine Library (RSL), provides additional extensions to facilitate real-time systems support. These subroutines conform to the Instrument Society of America (ISA) standard S61.1-1976. They are available to the user via the CALL statement.

The Mathematical and Functional Subroutine Library is a prerequisite to the Fortran IV compiler.

Series/1 Fortran IV permits input and output of both formatted and unformatted data and, through the Fortran IV RSL, permits byte manipulation. In addition to the basic Fortran IV branching capabilities, Series/1 Fortran also offers logical and relative operations that can be used for program control. ►

▶ Three Fortran IV statements (Program, Invoke, and Global) permit optimal use of the interrupt scheme. These three statements help the programmer to model his programming modules according to the interrupt configurations and allow the system to pass information and control between various program elements as conditions warrant. Series/1 Fortran IV statements may be written so that assignment of physical devices to many data sets can be deferred until execution time. These assignments can be changed as required for subsequent use without recoding and recompiling the program.

Fortran IV Realtime Subroutine Library: Offers two versions designed to work with the RPS and the Fortran IV compiler to provide real-time system support. The five basic functional areas these subroutines are grouped into are executive functions with ability to start, stop, or delay execution; process I/O subroutines that access analog and digital points for input and output; system service interface subroutines that make services available to the problem programmer; time subroutine; and date subroutine. Version 2 includes all functions of Version 1 plus ISA subroutines and use of additional IBM Series/1 RPS interface services.

EDX Fortran IV Compiler and Object Support Library: Executes under the EDX Basic Supervisor and Emulator and used in conjection with the EDX Program Preparation Facility. EDX Fortran IV produces relocatable object code that is suitable for subsequent execution under EDX. With the prerequisite EDX Mathematical and Functional Subroutine Library this program conforms to the ANS Fortran X3.10-1966 with some extensions from ANS Fortran X3.9-1966.

PL/1: Consists of two licensed programs: the PL/1 Compiler and Resident Library, and the PL/1 Transient Library. Series/1 PL/1 is a subset of ANS PL/1 X3.53-1976 plus additional language functions to support the coding of real-time applications. A program written in PL/1 is processed under control of Series/1 RPS and the Program Preparation Subsystem (PPS). Input to the PL/1 compiler can be prepared conversationally, using the text editor of the Program Preparation Subsystem.

The PL/1 compiler operates in the batch environment of the PPS under RPS. The PL/1-generated object code, after processing by the Application Builder, runs either in a batch environment or directly under RPS. When the floating-point feature is not installed and floating-point operations are required, the PL/1-generated object code uses the floating-point emulator of RPS.

PL/1 does not directly support any Series/1 hardware. It will run under the complete control of RPS and the PPS, and depends upon RPS to be its complete and only interface to the hardware.

The PL/1 Resident Library contains frequently used routines that are included in the user's task set during execution of the Application Builder. As a result, performance of a user's application is significantly enhanced by eliminating loading of these functions during execution time.

The PL/1 Transient Library contains infrequently used routines, such as I/O transmission, error handling, and low-usage conversion routines. These functions are dynamically loaded into a user's shared task set at execution time, thus permitting storage savings in a user's partition with minimal impact on performance.

PL/1 Version 2 is compatible with Version 1 at the source program level and is a subset of ANS PL/1 with real-time language extensions. Version 2 allows users to develop application programs that can be modified and maintained. Highlights of Version 2 include full screen supports, extended coverage of ANS PL/1, code optimization, new device

support (IBM 4969 Magnetic Tape Subsystem and IBM 5250 Information Display System), real-time language extensions, I/O capability, communications support, indexed access method support, multiple data types and organizations, data manipulation features, additional language features, and sort/merge support. Series/1 PL/1 Version 2 compiler and applications programs execute under Version 3 or Version 4 of the Realtime Programming System and Version 3 or Version 4 of the Program Preparation Subsystem.

EDX PL/1: A subset of ANSI PL/1 as understood and interpreted by IBM as of July 1979, plus additional language functions to support coding multitasking applications. PL/1 allows many functions of the EDX operating system to be expressed in "natural" syntax. As a result, the applications programs are easier to read, debug, maintain, and modify.

With EDX PL/1, the user can write applications programs in a high-level language that provides interactive terminal handling facilities, communications via binary synchronous or START/STOP disciplines to other processors and terminals, and indexed files for data base management. Along with the EDX Multiple Terminal Manager, PL/1 programs can execute in an interactive environment where one or more applications can run concurrently. EDX PL/1 is a compatible subset of PL/1 Version 2 running on the Realtime Programming System.

APPLICATIONS DEVELOPMENT SOFTWARE

CONTROL PROGRAM SUPPORT (CPS): Provides a basic control package and separate compatible functional extensions. CPS and its extensions provide facilities for task and data management, device support, and services. The CPS modules are programming RPQs, and all use the Series/1 Base Program Preparation Facilities (described below).

PROGRAM PREPARATION SUBSYSTEM (PPS): Provides a general-purpose batch environment and software tools for developing the application programs that run under RPS. The PPS licensed program consists of a Job Stream Processor, Text Editor, Macro Assembler, and Application Builder. These programs execute in the batch partition as task sets under control of RPS.

The *Job Stream Processor* provides the Series/1 user with a batch processing facility. This program executes in the batch partition and is a convenient and easily modified method of invoking programs, communicating with these programs, and defining or creating the data sets the programs will use. The facilities of this program are used to run the other three PPS programs.

The *Text Editor* provides the capability for creating and editing text modules. These text modules can be source programs for input to the Macro Assembler, the Fortran IV compiler, or the PL/1 compiler. Job streams for batch processing or data sets for user-written programs can also be created and edited in this fashion.

The *Macro Assembler* processes the user's source statements consisting of machine, assembler, and macro instructions coded in the Series/1 Assembler language. This Assembler program produces a machine-language object module that requires link editing prior to use. The Assembler program accepts input from either the job stream or a predefined data set and compiles it into one or more object modules that are stored on disk. These modules will later be processed by the Application Builder into executable code.

The *Application Builder* converts one or more object modules to either an executable load module or a task set. The executable load module is intended for use with a user-provided operating system. The task set is intended for execution under control of RPS and contains the various ▶

tables and control blocks required for this specific environment. In addition to these user task sets, the Application Builder can also be used to create a special module (shared task set) consisting of programs and data areas that are shared by several user task sets.

Version 2 of PPS provides all the facilities of Version 1 plus system support for the IBM 4962 Disk Storage Unit Models 3 and 4, program preparation for storage overlay capability, new Job Stream Processor functions (display jobs, cancel jobs, restart jobs), and eight additional Text Editor commands.

Version 2 can prepare applications to execute under the Realtime Programming System (RPS) Versions 1 and 2.

Version 3 of PPS provides all the facilities of Version 1 and Version 2 plus support for multiple address space management environments. Version 3 contains the ability to preare applications for the RPS Versions 1, 2, 3, and 4.

Version 4 of PPS is a licensed program containing of facilities of Versions 1, 2, and 3 plus a new macro preprocessor to improve Assembler performance, support for 4952 processor instructions assembler, and usability enhancements. The Version 4 can compare to the RPS Versions 1, 2, 3, and 4.

Version 5 of PPS, which prepares applications for RPS Version 5, provides all preceding facilities, plus a new text editor offering full screen support, application builder extensions to accommodate the secondary storage pool facility offered with RPS Version 5, Job Stream Processor extensions to accommodate new spooling parameters in the base operating system, and improved packaging for program development and generating a customized system.

BASE PROGRAM PREPARATION FACILITIES: A set of standalone programs designed to facilitate the preparation and coding of Series/1 programs. The four BPP facilities are the Text Editor, Macro Assembler, Application Builder, and Job Stream Processor.

The *Text Editor* enables the user to create, modify, list, and save text modules. These modules can consist of job input streams, source statements, or input data to a batch program. The Text Editor can be used in an interactive mode to enter text and commands from an operator station, or in a batch mode.

The *Macro Assembler* is used to translate symbolic source statements into a relocatable object module and program listing. The Assembler source input is read from the diskette (except for user-defined macros, which can reside in a macro source file on the disk). The object module produced by the Assembler is placed on disk at the location specified by the user.

The *Application Builder* combines object modules produced by language translators with system and application information to produce task sets for execution by the Realtime Programming System. The three-step application building process enables the user to meet application needs.

The *Job Stream Processor* offers control statements through which the user specifies all batch executions and data sets, reads these statements, and through them controls the processing of batch jobs.

SORT/MERGE: The Series/1 Sort/Merge program executes with the Realtime Programming System, Version 3

or 4, as either a batch job under the Job Stream Processor or in a foreground partition under the Realtime Programming System. The program product handles the sorting and merging of records from up to eight input data sets whose members have random or consecutive organization into one output data set in either ascending or descending order. Data sets with other organizations, such as indexed, can be processed through user exit routines. The user specifies one or more control fields in the records to be sorted, and the program then compares the relative sequence of the records.

STRUCTURED PROGRAMMING FACILITY (SPF): A program operating with the System/370 Time-Sharing Option (TSO), SPF is designed to provide off-loading of TSO/SPF work to one or more Series/1's. The Series/1 communicates with the System/370 via a binary synchronous link using IBM 3271 protocol. The Series/1 SPF editing facilities are very similar in function to the editing facilities of the System/370 SPF.

SYSTEM/370 CHANNEL ATTACH PROGRAM: A licensed program which runs under control of the Realtime Programming System (RPS) Version 3 or 4, this program provides the Series/1 user with the ability to communicate with a System/370 (Models 135 through 168) or 303X processor over a selector or block multiplexer channel, when used in conjunction with the 4933 Model 1 Series/1-System/370 Termination Enclosure and the Series/1-System/370 Channel Attachment Feature 1200. The program provides the Series/1 user with the ability to transfer data, under joint consent, between user application programs in the Series/1 and the System/370.

INTELLIGENT DATA ENTRY SYSTEM AND REMOTE JOB ENTRY FOR CPS: These field-developed programs support data entry and transmission in distributed data processing environments. The systems' supervisory functions of file management, storage management, and system integrity provide control for data entry while co-residing with other business and communications applications.

The main focus of the Intelligent Data Entry System is enhanced operator productivity. Operators can key at higher speeds because data is captured stroke by stroke, with logical and sytactical data checking and editing performed on the fly.

The Remote Job Entry for CPS program provides transmission to and from host processors via a subset of IBM 3780 BSC line protocol. Emulating a 3780, the Series/1 operates point-to-point on either switched or leased lines.

INTELLIGENT TERMINAL SUBSYSTEM: Provides a productivity tool to assist the user in establishing distributed processing systems. This field-developed program aids users by supplying programming for the first step: the connection to host processors through binary synchronous communications lines. The Intelligent Terminal Subsystem is designed to provide increased accessibility to multiple applications using IBM 3270 protocol to communicate with one or more host processors.

When installed on the Series/1, this program allows the Series/1 to have the appearance of one or more 3270 subsystems to host processors. Through this programmed emulation, the Series/1 can communicate concurrently with multiple host processors, each with its own BSC line.

In addition, the Intelligent Terminal Subsystem, using IBM 4978 and 4979 Display Stations, emulates most of the functions of an IBM 3277 Display Station. This feature allows an operator to use the 4978 and 4979 in a manner similar to that of a 3277, with the added capability to select the host processor connection directly from the display station and keyboard. The user can, optionally, establish connections to ▶

IBM Series/1

▶ multiple host system concurrently with any or all terminals. This allows access to multiple data base systems for inquiry and updating from a single terminal.

PROGRAMMABLE COMMUNICATIONS SUB-SYSTEM PREPARATION FACILITY: A macro library that is used to support the generation of controller storage image programs for the Series/1 Programmable Communications Subsystem. This macro library is used with either the Base Program Preparation Facility or the Program Preparation Subsystem. It provides the user with the capability of defining and customizing the total protocol for his subsystem. Facilities are provided for implementing communications applications, using communications macro instructions and communications definition macros.

PROGRAMMABLE COMMUNICATIONS SUB-SYSTEM EXECUTION SUPPORT: Runs under control of RPS and provides the user with an interface to the 4987 Programmable Communications Subsystem. The support consists of execution support macros and a loader utility to load the controller storage image program into controller storage.

MATHEMATICAL AND FUNCTIONAL SUB-ROUTINE LIBRARY (MFSL): A licensed program library of common-usage subroutines for mathematical and data conversion functions. Version 1 of MFSL provides mathematical functions for the application programmer, including sine, cosine, logarithms, and exponentiation functions, maximum and minimum functions, modular arithmetic, and other; conversion routines to convert numerical data between EBCDIC format and Series/1 internal format; error-checking routines to detect error conditions during processing of mathematical and conversion routines, including checking of illegal arguments and invalid conversion of data inputs, testing floating-point divide exceptions, and testing floating-point overflow and underflow conditions; and subroutine library services that allow assembler-language users to initialize and release a library work area and to specify an abnormal termination processing routine which allows a user to receive control on program interrupts or abnormal executions of system macro instructions.

MFSL routines are re-entrant, which can result in more efficient storage utilization. Through the application build process, users can link MFSL routines into the auto-call area of a user's task set or into a shared task set, making a single copy of the routines accessible to multiple programs or partitions.

MFSL Version 2 provides all the facilities described above plus a commercial subroutine package that offers Series/1 users a library of subroutines designed to meet most requirements for decimal data handling. The commercial subroutine package provides comprehensive facilities for editing, decimal arithmetic, data compaction, and conversion subroutines for data manipulation. These subroutines are similar to the commercial subroutine packages offered on other IBM computer systems.

STANDALONE UTILITIES: The standalone utilites allow the user to maintain his program preparation system. The utilities and their functions follow:

● Diskette IPL Bootstrap—loads a program, which is one diskette track in length, into the high end of main storage.

● IPL Bootstrap/Loader Disk—loads programs from the disk into main storage.

● Diskette Initialization—initializes the diskette, writing ID records and checking for defective sectors. This utility formats each track into 128-byte sectors and assigns alternate cylinders if it detects a defective sector.

● Disk Initialization—initializes the disk, verifying sector ID's and checking for defective sectors. This utility assigns alternates for defective sectors and also lets the user assign them.

● Diskette to Disk Copy—copies data from a specified diskette file to a specified disk file.

● Disk to Diskette Copy—copies data from a specified disk file to a specified diskette file.

● Diskette to Printer Dump—dumps the contents of a specified location on the diskette to the printer.

● Disk to Printer Dump—dumps the contents of a specified location on the disk to the printer.

● Diskette Patch—applies a patch entered at the operator station to a specified location on the diskette.

● Disk Patch—applies a patch entered at the operator station to a specified location on the disk.

● Create Diskette HDR1—takes information supplied by the user and creates a header (HDR1) record for a diskette data file.

● Delete Diskette HDR1—deletes a header (HDR1) record for a diskette data file.

● Storage to Diskette Dump—dumps the contents of main storage to the diskette. The dump begins at storage address 256 and continues until all storage has been dumped.

● Storage to Printer Dump—dumps the contents of main storage to the printer. The dump begins at storage address 256 and continues until all storage has been dumped. If a programmer console is available, start and stop dump address can be specified.

● Automatic System Build—copies to disk the diskette(s) the user receives from IBM. (The program product requires two diskettes and the SCP requires one.) A copy of this program resides on each diskette. Each build program loads the contents of its diskette, in succession, to a predefined area of the disk. Multiple diskettes can be loaded in any sequence.

● System Verification—ensures that the system is built properly by cross-checking each module on the initial-program-loaded system disk against a table containing expected module names. If a module is missing a message is printed to indicate which program is not at its expected disk address. If the system is correct, a system map containing header record data for each load module is printed on the printer and a message verifying that the system was built correctly is printed at the operator station.

PRICING

The Series/1 is offered on a purchase-only basis, at prices ranging from approximately $9,500 to $100,000 depending on configuration. Purchase prices include installation and a three-month parts and labor warranty. On-site physical planning is separately priced. On-site support for the Standalone Utilities is provided by a GSD CE at no additional charge. IBM recently announced the capability for monthly-charge users to convert to a one-charge basis. After August 31, 1982, only those licensed programs initially obtained on a one-time charge will be eligible for a volume discount. ▶

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▶ The discount schedule for Series/1 processors is as follows:

20 to 49 units, 5%
50 to 99 units, 10%
100 or more units, 15%

Program products for the Series/1 are available on a 24-month paid-up license basis. The program product license fee includes central APAR processing for 24 months from the date of first customer availability. For the Base Program Preparation Facilities, central APAR processing is available through December 31, 1978. One month of program test allowance is included.

EQUIPMENT: The Series/1 is not currently available in "packaged" or specially configured systems. Each component is offered on an individually priced basis; thus, the actual price for any particular system is the sum total of every configured unit.

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
PROCESSORS AND MAIN STORAGE			
4952A	Processor; half-width module, 32K bytes of memory, 5 I/O features or storage slots	$ 5,260	$ 29.00
4952B	Processor; full-width module, 32K bytes of memory, 14 I/O features or storage slots	7,035	64
4952C	Processor; 32K bytes of memory, 4 I/O features, diskette drive	9,720	70.50
4954A	Processor; half-width module, 256K bytes of memory, 4 I/O feature slots	8,810	41
4954B	Processor; full-width module, 256K bytes of memory, 13 I/O feature slots	10,105	45
4954C	Processor; diskette drive, 256K bytes of memory, 3 I/O feature slots	12,845	65
4955A	Processor; full-width module, 16K bytes of memory, 8 I/O feature slots	7,760	76.50
4955B	Processor; full-width module, 16K bytes of memory, 3 I/O feature slots	7,760	76.50
4955C	Processor; full-width module, 32K bytes of memory, 10 I/O feature slots	9,325	87
4955D	Processor; full-width module; 32K bytes of memory, 7 I/O feature slots	9,325	87
4955E	Processor; full-width module, 64K bytes of memory, 7 I/O feature slots	10,550	133
4955F	Processor; full-width module, 128K bytes of memory, 7 I/O feature slots	13,200	127
6306	Storage addition, 4952 processor; 32,768 bytes	514	2
6307	Storage addition, 4954 processor; 65,536 bytes	1,095	2.50
6325	Storage addition, 4955 processor; 16,384 bytes	1,160	6.50
6326	Storage addition, 4955 Model C and D processors only; 32,768 bytes	1,725	13.50
6327	Storage addition, 4955 Model E processor only; 65,536 bytes	2,785	41
6328	Storage addition, 4955 Model F processor only; 131,072 bytes	3,520	42
PROCESSOR FEATURES			
3925	Floating-point; 4954 processor	635	2
1590	Customer access panel	225	1.50
1593	Customer access panel—integrated digital I/O output cable	484	1
1594	Customer access panel—customer direct program control adapter cable	339	1
1595	Channel socket adapter	90	1
3920	Floating-point; 4955 processor	1,490	8.50
4540	Rack mounting fixture	68	NC
4959A	Input/output expansion unit	3,290	39
5655	Programmer's console; 4954 processor	820	3
4997-1A	Rack enclosure, Model 1A	1,130	2
4997-1B	Rack enclosure, Model 1B	1,335	2
4997-2A	Rack enclosure, Model 2A	1,510	5
4997-2B	Rack enclosure, Model 2B	1,715	5
4999-1	Battery backup, Model 1	2,470	15
4999-2	Battery backup, Model 2	2,440	16
4704	Display terminal	940	—
5430	Customer direct program control adapter	830	9.50
5650	Programmer console; 4952 and 4955 processors	579	3.50
6335	Storage address relocation translator; 4955 only	1,010	8.50
7840	Timers	716	4.50
7900	Two-channel switch; plugs into 4959 and 4965 expansion units	3,330	8.50
4100	Second diskette drive	1,830	10
MAGNETIC TAPE EQUIPMENT			
1215	4969 Magnetic Tape Subsystem attachment	1,640	3.50
1540	4969 Magnetic Tape Subsystem Controller, 800 bpi	5,165	50.50
1545	4969 Magnetic Tape Subsystem Controller, 1600 bpi	5,690	53.50
1550	4969 Magnetic Tape Subsystem Controller, dual density	5,955	60.50
4969	Magnetic Tape Subsystem; Model 4N, 45 ips, NRZI	11,720	83.50
	Magnetic Tape Subsystem; Model 4P, 45 ips, PE	12,250	83.50
	Magnetic Tape Subsystem; Model 4D, 45 ips, dual	13,020	83.50
	Magnetic Tape Subsystem; Model 7N, 75 ips, NRZI	15,640	108
	Magnetic Tape Subsystem; Model 7P, 75 ips, PE	16,170	108
	Magnetic Tape Subsystem; Model 7D, 75 ips, dual	16,960	111

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
► MASS STORAGE			
4962-1	Disk Storage Unit; 9-megabyte capacity, non-removable disk	9,025	53.50
4962-1F	Disk Storage Unit; 9-megabyte capacity on non-removable disk, 123K additional bytes on fixed-head disk	10,160	72.50
4962-2	Disk Storage Unit; combination disk/diskette unit, 9-megabyte capacity on non-removable disk, 606K-byte capacity on removable diskettes	11,230	72.50
4962-2F	Disk Storage Unit; combination disk/diskette unit, 9-megabyte capacity on non-removable disk, 123K-byte capacity on fixed-head disk, 606K-byte capacity on removable diskettes	12,360	92.50
4962-3	Disk Storage Unit; 14-megabyte capacity, non-removable disk	11,250	75.50
4962-4	Disk Storage Unit; combination disk/diskette unit, 14-megabyte capacity on non-removable disk, 606K-byte capacity on removable diskettes	13,450	103
4963-23A	Disk Storage Subsystem; primary disk unit with 23-megabyte capacity on non-removable disk and an additional 131K bytes under fixed heads	12,560	56
.4963-23B	Disk Storage Subsystem; expansion drive, same characteristics as 4963-23A	10,390	53
4963-29A	Disk Storage Subsystem; primary disk unit with 29-megabyte capacity on non-removable disks	11,780	41
4963-29B	Disk Storage Subsystem; expansion drive, same characteristics as 4963-29A	9,610	38
4963-58A	Disk Storage Subsystem; primary disk unit with 58-megabyte capacity on non-removable disk and an additional 131K bytes under fixed heads; up to three 4963-58B or 4963-64B disk units can be attached	14,120	66
4963-58B	Disk Storage Subsystem; expansion drive, same characteristics as 4963-58A	11,950	63
4963-64A	Disk Storage Subsystem; primary disk unit with 64-megabyte capacity on non-removable disk; up to three 4963-58B or 4963-64B disk units can be attached	13,340	51
4963-64B	Disk Storage Subsystem; expansion drive, same characteristics as 4963-64A	11,170	48
4964	Diskette Unit; 606K-byte capacity on removable, 2-sided diskettes	3,005	17
4965	Diskette Unit and I/O Expansion Unit; 1.2M-byte capacity on removable 2-sided diskettes; 4 additional feature locations	6,635	36
4966	Diskette Magazine Unit; provides random access to 23 diskettes contained in two 10-diskette removable magazines and three individual diskettes; up to 27.8-megabyte capacity	6,160	76.50
1205	4966 Diskette Magazine Attachment	2,520	4.50
3580	4962 Disk Storage Unit Attachment	1,025	7.50
3581	4964 Diskette Unit Attachment	875	6.50
3590	4963 Disk Subsystem Attachment	1,920	4.50
4100	4965 Second Diskette Drive	1,830	10
PRINTERS			
4973-1	Line Printer; 132 columns; 48-, 64-, or 96-character set; 150 lpm	10,350	85
4973-2	Line Printer; 132 columns, 48-, 64-, or 96-character set; 400 lpm	14,910	143
4974	Printer; wire-matrix print head, 132 columns, EBCDIC 64-character set; 120 cps	3,470	38.50
4975-01L	Printer (local); 80 cps, 184-character set, 6 or 8 lpi, 10 or 15 cpi	2,860	26
4975-02L	Printer (local); 160 cps (draft), 40 cps (letter), 184-character set, 6 or 8 lpi	4,175	32
4975-01R	Printer (remote); 80 cps, 184-character set, 6 or 8 lpi, 10 or 15 cpi	2,860	32
4975-02R	Printer (remote); 160 cps (draft), 40 cps (letter), 184-character set, 6 or 8 lpi	4,175	39
5620	4974 Printer Attachment	1,110	4
5630	4973 Line Printer Attachment	1,125	5.50
TERMINALS			
4978	Display Station; 80 characters by 24 lines, cycle-steal operations and buffered microprocessor control	1,425	17
DO2038	4978 Display Station Attachment	1,665	14
DO2056	4978 Keyboard; typamatic mode keys (cursor, space, and all other than fixed-function keys); extended	1,030	11.00
DO2057	4978 Keyboard; typamatic space key; basic	1,000	11.00
4979	Display Station; 80 characters by 24 lines, integrated keyboard, cycle-steal operations and buffered microprocessor control	2,265	19.50
3585	4979 Display Station Attachment	1,200	7.50
COMMUNICATIONS			
1300	Programmable communications subsystem controller	3,565	28.50
1400	Local communications controller	4,370	16
1610	Asynchronous communications single-line control	1,360	10.50
2000	Communications indicator panel	314	3.50
2010	Communications power; 4955 only	150	3.50
2074	BSC single-line control	1,490	12.50
2075	BSC single-line control/high-speed	1,730	12.50
2090	SDLC single-line control	1,780	12.50
2091	Asynchronous communications 8-line control	1,220	10.50
2092	Asynchronous communications 4-line adapter	1,260	21

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EQUIPMENT PRICES

► **COMMUNICATIONS (Continued)**

		Purchase Price	Monthly Maint.
2093	BSC 8-line control	1,520	10.50
2094	BSC 4-line adapter	1,565	26.50
2095	Feature-programmable multiline communications; 8-line control	1,730	7.50
2096	Feature-programmable multiline communications; 4-line adapter	1,970	22
4730	Half-duplex DCE attachment	426	2.50
4731	Full-duplex DCE attachment	419	2.50
4734	TTY-current attachment	700	4.00
4736	Data-Phone digital service adapter	1,132	4.50
4739	Asynchronous local attachment	467	1.50
4740	Synchronous local attachment	492	2
4743	Autocall attachment	432	2.50
4746	1200 bps asynchronous modem, switched network	1,200	7.50
4747	1200 bps asynchronous modem, leased line SNBU	1,330	8.00
4748	1200 bps asynchronous modem, leased line	1,205	7.50
4751	1200 bps synchronous modem with clock, switched network	1,235	7.50
4752	1200 bps synchronous modem with clock, leased line SNBU	1,370	8.00
4753	1200 bps synchronous modem with clock, leased line	1,240	7.50
4940	Multiplexer, reed relay	850	12
4950	Mutliplexer, solid state	934	7
4987	Programmable communications subsystem, Model 1	5,205	45
4990	Communications console, Model 1	975	2
7850	Teletypewriter adapter	705	6.50

USER ATTACHMENT FEATURES

1060	Analog input control	1,045	4.50
1065	Analog output	687	5
1070	Amplifier, multirange	1,190	5
1200	System/370 channel attachment	2,730	11.50
1210	5250 Information Display System Attachment	3,750	10.50
1310	Multifunction Attachment; for 4 device attachments (local or remote) for 3101 Display Terminal or 4975 Printer	2,400	10
1560	Integrated digital I/O, non-isolated	1,035	12.50
1565	Channel repower	655	2.50
3525	Digital input/process interrupt, non-isolated	535	4
3532	Digital input/process interrupt, isolated	908	3
3535	Digital output, non-isolated	462	4
4982	Sensor I/O unit	2,155	11
4993	Series/1-System/370 termination enclosure, Model 1	3,435	23.50
6305	4982 Sensor I/O attachment	818	6.50

SOFTWARE PRICES

		Monthly Charge	One-Time Charge
LICENSED PROGRAMS			
5719-AM1	RPS Indexed Access Method, Version 1	$ 20	$ 990
5719-AM2	Version 2	38	1,580
5719-AM3	EDX Indexed Access Method, Version 1	22	1,135
5719-AM4	Version 2	38	1,580
5719-AS1	Program Preparation Subsystem, Version 1	23	1,210
5719-AS2	Version 2	25	1,325
5719-AS3	Version 3	28	1,450
5719-AS4	Version 4	30	1,580
5719-AS5	Version 5	120	5,015
5719-ASA	EDX Macro Assembler	25	924
5719-CA1	System/370 Channel Attachment	26	1,375
5719-CB1	Cobol Compiler and Resident Library	90	4,680
5719-CB2	Cobol Transient Library	8	379
5719-CB3	EDX Cobol Compiler and Resident Library	90	4,680
5719-CB4	EDX Cobol Transient Library	8	379
5719-CB5	EDX Cobol Compiler and Resident Library, Version 2	118	4,960
5719-CB6	EDX Cobol Transient Library, Version 2	15	633
5719-CB7	RPS Cobol Compiler and Resident Library, Version 2	118	4,960
5719-CB8	RPS Cobol Transient Library, Version 2	15	633
5719-CF1	EDX Communications Facility	55	2,200
5719-CM1	Communications Monitor for Series/1	139	5,805
5719-CR1	Structured Program Facility MVS/VTAM	265	—
5719-CR2	Structured Program Facility MVS/TCAM	265	— ►

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SOFTWARE PRICES

		Monthly Charge	One-Time Charge
➤ **LICENSED PROGRAMS (Continued)**			
5719-CS0	Program Communications Subsystems Preparation Facility	10	550
5719-CS1	Program Communications Subsystem Execution Support	8	369
5719-CS2	Program Communications Subsystem Extended Execution Support	25	1,265
5719-CX1	EDX System/370 Channel Attachment	76	2,970
5719-ED1	Structured Programming Facility	265	1,320
5719-FO1	Fortran IV Compiler and Object Support Library	17	950
5719-FO2	Fortran IV Compiler and Object Library	17	950
5719-FO3	Fortran IV Realtime Subroutine Library, Version 1	7	316
5719-FO4	Version 2	8	369
5719-LM1	Math and Functional Subroutine Library (MFSL)	9	448
5719-LM2	Math and Functional Subroutine	10	528
5719-LM3	EDX Math and Functional Subroutine Library	10	528
5719-LM5	EDX Macro Library, Version 1	37	1,910
5719-LM6	Version 2	49	2,575
5719-LM7	Version 3	67	2,805
5719-MS1	EDX Multiple Terminal Manager, Version 1	20	986
5719-MS2	Version 2	22	1,035
5719-MT1	Realtime Programming System Multiple Terminal Manager, Version 3	30	1,050
5719-PA1	Base Program Preparation Facility	113	2,375
5719-PC1	Realtime Programming System, Version 1	25	1,320
5719-PC2	Version 2	32	1,650
5719-PC3	Version 3	40	2,090
5719-PC4	Version 4, with Command Language Facility	62	3,230
5719-PC5	Version 5, with Command Language Facility	126	5,200
5719-PL1	PL/1 Compiler and Resident Library, Version 1	59	3,060
5719-PL2	Version 2	148	7,815
5719-PL3	PL/1 Transient Library, Version 1	7	316
5719-PL4	Version 2	28	1,440
5719-PL5	PL/1 EDX Compiler and Resident Library	148	7,815
5719-PL6	PL/1 EDX Transient Library	28	1,440
5719-SC2	Standalone Disk Utilities	—	—
5719-SF1	RPS Screen Format Design Aid Utility	17	910
5719-SF2	RPS Screen Format Presentation Support	25	1,285
5719-SM1	Sort/Merge	9	440
5719-SM2	EDX Sort/Merge	9	440
5719-SN1	RPS Version 5 SNA Extended Support	74	3,060
5719-SX1	EDX System Network Architect (SNA)	51	2,110
5719-SX2	System Network Architect (SNA) RJE	25	1,055
5719-TA1	5250 Info Display System Attachment Support	26	1,360
5719-TA4	4969 Mag Tape Subsystem Support	25	1,285
5719-UT3	EDX Utilities, Version 1	15	792
5719-UT4	Version 2	22	1,135
5719-UT5	Version 3	30	1,225
5719-U11	FC/PM 1	164	6,860
5719-U12	FC/PM 2	236	9,925
5719-U13	FC/PM 4	325	13,660
5719-U14	FC/PM 2M	116	4,855
5719-U15	FC/PM 4M	144	6,070
5719-U20	IBM Audio Distribution System	350	12,700
5719-XR1	Event Driven Executive Query	22	792
5719-XR2	Realtime Programming System Query	22	792
5719-XS1	EDX Supervisor and Emulator, Version 1	21	1,055
5719-XS2	Version 2	28	1,440
5719-XS3	Version 3 (Basic)	37	1,515
5719-XX2	EDX Program Preparation Facilities, Version 1	20	990
5719-XX3	Version 2	26	1,360
5719-XX4	Version 3	36	1,485
5740-LM2	EDX Macro Library/Host, Version 1	111	—
5740-LM3	Version 2	151	—
5740-LM4	Version 4	189	—
5796-NPP	Series/1 Debugging Aid	—	189
5796-NPW	Virtual Cobol Compiler	356	—
5796-NQC	Supermarket Energy Management	90	—
5796-NQE	Waterloo Interactive Direct Job Entry Terminal System	166	—
5796-NRD	Distributed Processing System	195	—
5796-NTP	Program Executive System Preparation Support	52	—
5796-NTQ	Program Executive System Execution Support	52	—
5796-NTY	Multileaving Remote Job Entry System	143	— ➤

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SOFTWARE PRICES

		Monthly Charge	One-Time Charge
LICENSED PROGRAMS (Continued)			
5796-NWL	Waterloo Basic Compiler and Runtime Monitor	110	—
5796-NWZ	Heavy Equipment Dealer Parts Order Entry and Inventory Support System	575	—
5796-NZT	EDX Retail Pharmacy System	195	—
5796-RAL	Waterloo Virtual Basic	98	—
5796-RBB	Expansion Skeleton System/Implementation with Software Hooks	345	—
5796-REE	PXS-V3 Development Support	85	—
5796-REF	PXS-V3 Operational/Application Support	85	—
5798-NLG	Intelligent Terminal Subsystem	126	—
5798-NNB	EDX Macro Library	28	1,635
5798-NNC	EDX Utilities	10	575
5798-NND	EDX Basic Supervisor and Emulator	13	747
5798-NNQ	S/370 Programmer Preparation Facilities for Series/1	598	—
5798-NPY	Intelligent Data Entry System	63	—
5798-NPZ	Remote Job Entry for Controller Program Support	29	—
5798-NQJ	Controlled Access System I	166	—
5798-NRP	EDX Program Preparation Facility	14	862
5798-NRQ	EDX Utilities, Version 2	12	690
5798-NRR	EDX Basic Supervisor and Emulator, Version 2	16	920
5798-NTF	Cobol Subsystem Runtime Monitor	46	—
5798-NTH	EDX Supermarket Energy Management	115	—
5798-NWB	Facility Control Multiplexer Subsystem	138	—
5798-NXD	Intelligent Terminal Subsystem Print Spool	92	—
5798-NXQ	Intelligent Data Entry System II	109	—
5798-NXX	Audio Support for Touch-Tone Telephone	201	—
5798-NYA	Point-of-Sale Data Collection Distribution System	258	—
5798-NYG	Central Toll Data Collection	185	—
5798-NYH	Remote Toll Data Collection	100	—
5798-NYJ	Automated Instrument Control	15	—
5798-NYK	X-Ray Fluorescense Analysis	150	—
5798-NYL	X-Ray Polycrystalline Diffraction	120	—
5798-NZG	Text Routing System	373	—
5798-NZJ	Host PL/1 for the Series/1 RPS System	960	—
5798-NZK	Host PL/1 for the Series/1 EDX System	960	—
5798-NZZ	Telephone Listing Management System	180	—
5798-RAB	EDX Energy Conservation System	149	—
5798-RAR	Text Entry and Edit Facility	276	—
5798-RBL	EDX File Create and Maintenance Utility	46	—
5798-RBR	Series/1 Native Application Load Facility	172	—
5798-RBY	Virtual Basic Supervisor	29	—
5798-RBQ	Specialized Terminal Interactive Processor	120	—
5798-RCG	X-Ray Search/Math	460	—
5798-RCX	Series/1 Data Collection Interactive Edit and Transmit	138	1,656
5798-RCZ	Series/1 General Purpose Automation Executive	250	6,000
5798-RDT	EDX Communications Facility II	55	—
5798-RDQ	Series/1 Air Quality Monitoring System	560	—
5798-RFC	Communicating Job Stream Processor	—	650
5798-RFF	3101 Full Screen Control Program Support	—	282
5798-RHB	Laboratory Automation Software	300	—
5798-ZZB	Virtual Cobol Control Program Support	58	—
5798-ZZC	EDX Communication Facility	40	—
5798-ZZD	Series/1 3101/3275 Display Manager Subsystem	—	5,750
5798-ZZF	Series/1 Communication Controller for System/38	250	—
5799-TAA	Control Program Support	20	480
5799-TAE	Display Station CPS	2	48
5799-TAF	BSC Control Program Support	5	120
5799-TAH	Indexed Access Method CPS	6	144
5799-TAJ	4991-201 M/S Card Reader CPS	14	336
5799-TAK	4978/4979 Display Station CPS	7	168
5799-TAL	CPS Extension I	2	55
5799-TAQ	CPS Extension II	2	55
5799-TAT	CPS Sort/Merge	6	138
5799-TAW	CPS Disk Table of Contents	1	28
5799-TAY	CPS Disk Spooling	3	83
5799-TBA	CPS Format/Print	3	83
5799-TBB	CPS Operator Station/Debug Package	10	240
5799-TBC	CPS Auto-Call Interface	6	144
5799-TBD	CPS Commercial Arithmetic	2	55
5799-TBE	CPS 4978/4979 Display Map	5	120
5799-TBK	Remote Job Entry	38	2,280
5799-TBL	RPS Disk Spooling, Version 1	3	207
5799-TBM	4978 Display Support, Version 1	3	207
5799-TBN	Indexed Access Method, Version 1	7	420

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		Monthly Charge	One-Time Charge
LICENSED PROGRAMS (Continued)			
5799-TBP	Basic Sort	2	138
5799-TBQ	CPS Extended Function	3	83
5799-TBT	CPS Address Translator Support	7	165
5799-TBX	RPS Address Translator Support, Version 2	3	180
5799-TBY	RPS Address Translator Support, Version 3	3	180
5799-TCA	Indexed Access Method, Version 2	7	420
5799-TCB	Indexed Access Method, Version 3	7	420
5799-TCD	RPS 4978 Display Support, Version 2	3	207
5799-TCE	RPS 4978 Display Support, Version 3	3	207
5799-TCG	RPS Disk Spooling, Version 2	3	207
5799-TCH	RPS Disk Spooling, Version 3	3	207
5799-TCX	Communication Monitor for Series/1	100	5,220
5799-TCY	RPS Multiple Terminal Manager	921	11,052
5799-TCZ	CPS 4963 Subsystem	15	358
5799-TDE	Data Collect Interactive	29	1,500
5799-TDG	RPS Transient Activity Tool, Version 1	6	300
5799-TDH	RPS Remote Management Utility	7	420
5799-TDK	CPS 4963/4966 Save/Restore	15	358
5799-TDR	Site Universal Billing	78	1,875
5799-TDT	Host Universal Billing	190	4,580
5799-TDW	CPS 4969 Mag Tape Subsystem	56	1,350
5799-TDX	RPS Multiple Terminal Manager, Version 2	1,550	18,630
5799-TEC	RPS Job Stream Processor	12	535
5799-TEF	SNA Remote Management Utility	9	220
5799-TEH	Series/1 Letter Writer, Version 1	80	960
5799-TEK	CPS 4965 Support	42	1,000
5799-TEL	370 Host Cobol for Series/1 EDX	1,435	—
5799-TEP	370 Host Cobol for Series/1 RPS	1,435	—
5799-TEY	Series/1 Letter Writer, Version 2	100	1,200