IBM Series/1

MANAGEMENT SUMMARY

UPDATE: *IBM has renewed its commitment to the Series/1 in the past year and has enhanced it to the point that it is calling it the new Series/1. The many enhancements include two entry-level processor models, the 4950 and the 5170; the 4971 printer; and the Series/1-Personal Computer Interconnect. IBM has also enhanced the two existing operating systems, as well as added a Unix-based operating system. Other software announcements include the Transaction Processing System, the Input/Output Executive, and the Manufacturing Automation Protocol Communications Server program. IBM also withdrew two models from the market, the 4954C and 4956C processors.*

The new entry-level Series/1 4950 is a specially designed Series/1 integrated with a PC XT. It is available in two models, with each consisting of a Series/1 microprocessor with 256KB of memory, which can be increased to a maximum of 512K bytes in 128K-byte increments; a PC XT microprocessor with 256K bytes of memory; a PC keyboard; and an RS-422 host/terminal attachment card that supports up to four display stations. The Series/1 microprocessor executes the Series/1 programs, and the PC XT microprocessor controls the input/output functions. The 4950 Model A includes a 10M-byte fixed disk plus a 320K-byte diskette drive, while Model B includes only the 320K-byte diskette drive. If additional storage or optional attachments are required, the appropriate IBM 5161 expansion unit must be attached.

The 5170 Model 475 consists of a Series/1 integrated with an IBM PC AT. According to IBM, performance of the 5170 is two to three times better than that of the 4950. The 5170 includes a Series/1 microprocessor with 256K bytes of storage expandable to 512KB in 128KB increments, and a PC AT processor with 512KB of memory. Also included with the system is a 20MB fixed disk, a 1MB diskette, a

The IBM Series/1 is an intelligent communications processing system offering open-ended architecture. Communicating with host systems as well as Personal Computers, the Series/1 systems are designed to handle general-purpose, commercial, and sensor-based applications in a multiprogramming environment. Applications areas include retail, financial, industrial, transportation, government, insurance, and telephone management.

MODELS: 4950, Models A and B; 5170, Model 495; 4954, Models B, 30D, and 60D; 4956, Models B, E, 30D, 60D, and 60E.
MAIN MEMORY: 64KB to 2MB.
DISK CAPACITY: Up to 800MB per disk subsystem.
WORKSTATIONS: Up to 256.
PRICE: $5,750 to $22,500 per processor.

CHARACTERISTICS

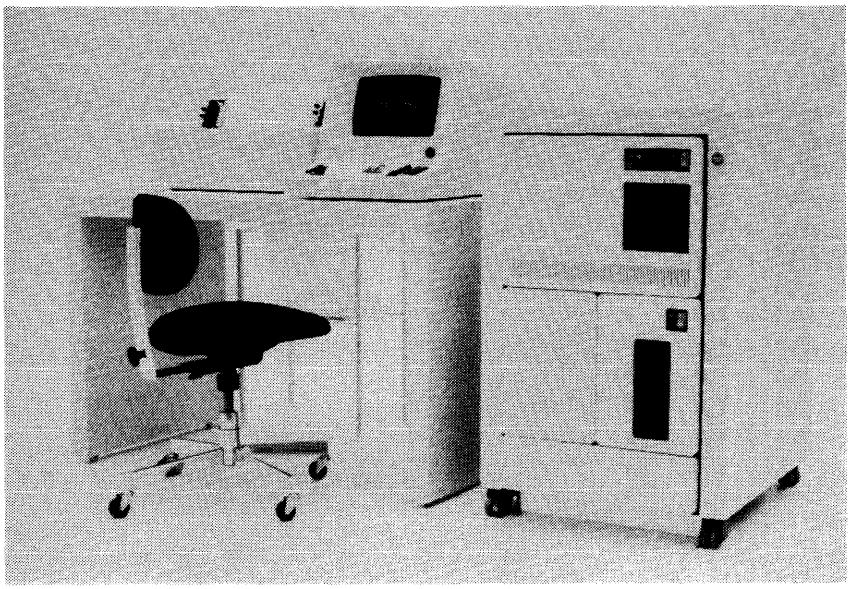
MANUFACTURER: International Business Machines Corporation (IBM), Old Orchard Road, Armonk, NY 10504. Contact your local IBM representative.

CANADIAN ADDRESS: IBM Canada Limited, Markham, 3500 Steeles Avenue East, Markham, Ontario, L3R 2Z1 Canada. Contact your local IBM representative.

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.



The Series/1 as shown, includes a low-boy rack enclosure housing the processor and a 4964 diskette unit. The tabletop, 120-cps 4974 printer is shown at left. The 1,920-character 4979 display station is also shown.

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CHART A. SYSTEM COMPARISON

MODEL	4950 Models A&B	5170 Model 495	4954 Models B&C	4954 Model 30D	4954 Model 60D
SYSTEM CHARACTERISTICS					
Date of introduction	March 1985	March 1985	February 1982	—	July 1984
Date of first delivery	July 1985	November 1985	—	—	September 1984
Operating system	EDX; RPS	EDX; RPS	EDX; RPS	EDX; RPS	EDX; RPS
Upgradable from	Not applicable	Not applicable	4952	—	4954
Upgradable to	Not upgradable	Not upgradable	4956	4954-60D	4956-60E
MIPS	—	—	—	—	—
Relative performance (based on a rating of the 4954 at 1.0)	—	—	1.0	1.0	2.0
MEMORY					
Minimum capacity, bytes	256	256	64K	64K	256K
Maximum capacity, bytes	512K Series/1; 256K PC AT	512K Series/1; 512 PC AT	256K	256K	1024K
Type	MOSFET; SAMOS: NMOS	MOSFET; SAMOS; NMOS	MOSFET; SAMOS; NMOS	MOSFET; SAMOS; NMOS	MOSFET; SAMOS; NMOS
Cache memory	None	None	None	64K	64K
Cycle time, nanoseconds	210 (PC mode)	—	1.4 ms	1.4 ms	—
Bytes fetched per cycle	—	—	—	—	—
INPUT/OUTPUT CONTROL					
Number of channels	—	—	—	—	—
High-speed buses	—	—	—	—	—
Low-speed buses	—	—	—	—	—
MINIMUM DISK STORAGE	320KB (Model A) 10MB (Model B)	20MB Fixed; 1MB diskette	9.3MB	30MB	60MB
MAXIMUM DISK STORAGE	20MB (Model A) 30MB (Model B)	40MB	800MB	800MB	800MB
NUMBER OF WORKSTATIONS	4	8	256	256	256
COMMUNICATIONS PROTOCOLS	Async; BSC; SDLC	Async; BSC; SDLC	SDLC; BSC; ACC; Sync	SDLC; BSC; ACC; Sync	SDLC; BSC; ACC; Sync

A dash (—) in a column indicates that the information is unavailable from the vendor.

Personal Computer keyboard, a serial/parallel adapter, and a six-port host/terminal attachment card allowing attachment of four RS-422-attached terminals and providing two RS-232-C asynchronous ports. The PC microprocessor operates as an I/O controller. A second six-port host/terminal attachment card is available for the 5170 processor, providing support for a maximum of 8 terminals.

Three feature slots are available on both the 4950 and 5170 systems for additional functions. Both systems can also operate either as a Series/1 or as a Personal Computer, but not simultaneously. In fact, because the XT and AT processors function as I/O controllers when in Series/1 mode, the systems must be rebooted to operate as a PC unit. Performance is dependent on the number and type of devices attached, the operating characteristics selected for those devices, and the types of applications programs being used. The 4950 and 5170 systems can perform Series/1 floating point instructions, but at a reduced speed. A 5151 Monochrome Display, or equivalent, is required for both the 4950 and 5170 systems; the display and keyboard serve as the system console. Both systems support up to two printers of which one must be a 4971; the second can be either a 4791 or 5152. Asynchronous, BSC, or SDLC communications lines are also supported. The systems operate under the Realtime Programming System (RPS) V.7 or Event Driven Executive (EDX) V.5. in Series/1 mode, and under DOS R.2.1 (XT) or 3.0 (AT) in PC mode.

The Series/1-PC models are designed for OEM, VAR, and other turnkey-type applications where the basic program development is done on a full-blown Series/1 minicomputer. The PC version is designed for production system use only. Therefore, there are no compilers supported in Series/1 mode, and only Basic is supported in PC mode.

FLOATING-POINT OPERANDS: 32-bit single-precision operands with a 7-bit exponent and signed 24-bit fraction; and 64-bit double-precision operands with a 7-bit exponent and signed 56-bit fraction. The hardware floating-point capability is optional. It provides single (32-bit) and double (64-bit) precision arithmetic plus conversion between binary and floating-point data. Floating-point instructions are performed at reduced speeds on the Series/1-PC models.

INSTRUCTIONS: Microcoded set of over 160 individual instructions (additional 30 floating-point instructions are optional). 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. Series/1 instructions use 11 possible combinations of addressing modes; a maximum of four can be implemented for any one instruction.

INTERNAL CODE: EBCDIC and binary.

MAIN STORAGE

TYPE: MOSFET (Metal Oxide Semiconductor Field Effect Transistor); SAMOS (Silicon and Aluminum Metal Oxide Semiconductor); and NMOS (N-Channel Metal Oxide Semiconductor).

CYCLE TIME: 210 nanoseconds for the 4950 in the PC mode, 1.4 microseconds for the 4954, and 0.55 microseconds for the 4956. The cycle time for the 5170 Series/1-PC models is not available from the vendor.

CAPACITY: Main memory on the Series/1 ranges from 64K bytes to 2 megabytes. See Chart A for memory sizes for particular models.

CHECKING: Parity checking on main storage and the channel data bus is available on the Series/1 systems. Error checking and correction (ECC), correcting single bit errors, and detecting double bit errors, is also available on the 4956 models.

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CHART A. SYSTEM COMPARISON (Continued)

MODEL	4956 Models B&C	4956 Model E	5956 Model 30D	4956 Model 60D	4956 Model 60E
SYSTEM CHARACTERISTICS					
Date of introduction	—	October 1984	—	July 1984	October 1984
Date of first delivery	—	December 1984	—	September 1984	December 1984
Operating system	EDX; RPS	EDX; RPS	EDX; RPS	EDX; RPS	EDX; RPS
Upgradable from	1954	4954	—	4954-60D	4954-30D and 60D
Upgradable to	4956-E	—	60D	4956-60E	—
MIPS	—	—	—	—	—
Relative performance (based on a rating of the 4954 at 1.0)	2.0	4.0	—	2.0	4.0
MEMORY					
Minimum capacity, bytes	256K	512K	256K	256K	512K
Maximum capacity, bytes	1024K	2MB	1MB	1024K	2MB
Type	MOSFET; SAMOS; NMOS	MOSFET; SAMOS; NMOS	MOSFET; SAMOS; NMOS	MOSFET; SAMOS; NMOS	MOSFET; SAMOS; NMOS
Cache memory	None	None	64K	64K	64K
Cycle time, nanoseconds	550 ns	—	—	—	—
Bytes fetched per cycle	—	—	—	—	—
INPUT/OUTPUT CONTROL					
Number of channels	—	—	—	—	—
High-speed buses	—	—	—	—	—
Low-speed buses	—	—	—	—	—
MINIMUM DISK STORAGE	9.3MB	9.3MB	30MB	60MB	60MB
MAXIMUM DISK STORAGE	800MB	800MB	800MB	800MB	800MB
NUMBER OF WORKSTATIONS	256	256	256	256	256
COMMUNICATIONS PROTOCOLS	SDLC; BSC; ACC; Sync	SDLC; BSC; ACC; Sync	SDLC; BSC; ACC; Sync	SDLC; BSC; ACC; Sync	SDLC; BSC; ACC; Sync

A dash (—) in a column indicates that the information is unavailable from the vendor.

The IBM 4971 Printer is a serial printer that attaches to the Series/1-PC models (4950 and 5170) only. It offers bidirectional printing at up to 120 characters per second.

In its efforts to link PCs to its larger systems, IBM announced the IBM Series/1-Personal Computer Interconnect, which includes both the hardware, known as the Series/1-PC Channel Attachment feature, and the software, the Series/1-PC Connect Program. This offering allows Personal Computers to utilize the Series/1 resources and to communicate with IBM host systems and local area networks at a data transfer speed of 400K bits per second (bps). The Series/1-PC Interconnect feature is presently supported by RPS Version 7.1; it will reportedly be available under EDX in the near future.

The Personal Computer Channel Attachment offers a single cycle-stealing Series/1 microprocessor-controlled feature card and a Personal Computer channel interface card. It also offers power-on diagnostics and RAM-loaded facilities.

The Series/1-PC Connect Program complements the IBM PC Network Program, giving IBM PC Network users access to Series/1 disks and printers. It also allows PC Network users to communicate with other users and programs outside their own local area network. In addition, it provides PC Network SNA 3270 emulation program support through Series/1 communications to the host System/370-based system or Series/1.

The RPS and EDX operating systems have both been enhanced to support the new Series/1 system models.

In addition, IBM has introduced a new Series/1 operating system, the Interactive Executive (IX), which is supported by the 4956 processer only, and is based on Unix System V.

STORAGE PROTECTION: None on the Series/1-PC and the 4954 models; standard on the 4956.

RESERVED STORAGE: Information not available from vendor.

CACHE MEMORY: The IBM Series/1 Model 30D, 60D, and 60E can include an optional microprocessor-controlled 64KB cache. Cache functions are transparent to application and systems programming. During a write operation, data is first placed in the cache, or updated if already existing in the cache. Data is then written to disk from cache.

CENTRAL PROCESSOR

GENERAL: The Series/1-PC processors include the 4950 with Models A and B and the 5170 Model 495. The other Series/1 processors include the 4954 with Models B, 30D, and 60D, and the 4956 with Models B, E, 30D, 60D, and 60E.

The 4950 system unit is an IBM Series/1 integrated with a specially designed IBM Personal Computer XT. Both models (A and B) contain a Series/1 microprocessor and a PC XT microprocessor implemented on a chip (the PC XT processor is based on the Intel 8088 microprocessor). The Series/1 processor provides 256KB of memory that can be increased to 512KB in 128KB increments, and uses either the Realtime Programming System (RPS) or Event Driven Executive (EDX) operating system. The PC XT processor offers 256KB of memory, and functions as an I/O controller running under the Input/Output Executive software program (the Input/Output Executive includes a software-based disk cache). The standard system includes a PC keyboard, a host/terminal attachment card, a 10MB fixed disk (Model A only), a 320KB diskette drive, and three feature slots for additional functions.

The 5170 Model 495 is a Series/1 processor integrated with a PC AT microprocessor (the PC AT processor is an Intel 80286 microprocessor). The Series/1 processor offers 256KB of memory that can be expanded to 512KB in 128KB increments. The PC AT offers 512KB of memory, and, like the 4950, the PC AT functions as an I/O controller running under the Input/Output Executive system. The 5170 in-

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CHART B. MASS STORAGE

MODEL	4962	4963	4964	4965
Type	fixed	fixed	diskette	diskette
Controller model	4962 unit attachment	4963 disk attachment	4959 I/O unit, 4965 I/O unit	diskette attachment card
Drives per subsystem/controller	2	4	1	2
Formatted capacity per drive, megabytes	9.3/13.9	23/29/58/64	606KB	246KB to 1.2MB
Number of usable surfaces	—	—	2	2
Number of sectors or tracks per surface	60 sectors/track	—	77 tracks	77 tracks
Bytes per sector or track	256/sector	256/sector	—	256, 512, or 1024
Average seek time	29.9 ms	27 ms	40 ms	40 ms
Average rotational/relay time	10.1 ms	9.6 ms	83.4 ms	83.4 ms
Average access time	40 ms	36.6 ms	123.4 ms	123.4 ms
Data transfer rate	889KB/sec.	1MB/sec.	31KB/sec.	62.5KB/sec.
Supported by system models	all models	all models	all models	all models
Comments	Models 2, 2F, and 4 include 0.5MB diskette. Models 1F and 2F have additional 122.8MB of fixed storage.			

A dash (—) in a column indicates that the information is unavailable from the vendor.

CHART B. MASS STORAGE (Continued)

MODEL	4966	4967	5161/2500
Type	diskette magazine	fixed	fixed
Controller model	4966 diskette magazine attachment	4967 high-performance disk subsystem attachment	5161
Drives per subsystem/controller	23	4	2
Formatted capacity per drive, megabytes	1.2	200	10M
Number of usable surfaces	2 per diskette	—	4
Number of sectors or tracks per surface	77 tracks	—	306 tracks
Bytes per sector or track	—	256/sector	512/sectors
Average seek time	40 ms	25 ms	—
Average rotational/relay time	41.6 ms	10.1 ms	—
Average access time	81.6 ms	35.1 ms	90ms
Data transfer rate	125K bps	1.5MB/sec.	50M bit/sec
Supported by system models	all models	all models	4950; 5170
Comments		Includes disk coding feature.	

A dash (—) in a column indicates that the information is unavailable from the vendor.

IX supports application areas that include timesharing, batch processing, program development, and document preparation. Features include a simple command language, device-independent input/output, hierarchical file system, program development tools, and a mechanism that enables a user to perform complex operations by connecting a number of program modules.

The Transaction Processing System (TPS) is supported by the RPS or EDX operating system. The system is an application development tool that provides support for developing and managing transaction-oriented user application programs. It allows the user to develop applications without knowing the operating system or programming languages.

The Series/1 Input/Output Executive program executes on the IBM Series/1 4950 and 5170 Personal Computer processors to provide support for the Series/1 4950 input/output devices to the Series/1 operating systems (EDX or RPS).

The new Manufacturing Automation Protocol (MAP) Communications Server program allows Series/1s to com-

cludes a six-port host/terminal attachment card, a 20MB fixed disk, a 1MB diskette, a personal computer keyboard, and a serial/parallel adapter. Three feature slots are available for additional functions. A second six-port host/terminal attachment card is available, providing support for a maximum of 8 terminals.

The 4954 models are standard 19-inch rack-mountable models offering 64K bytes of basic storage, expandable to 256K bytes in 64K-byte increments by adding storage addition modules. The 4954 Model B has 13 card slots available for data channel features. The 4954 30D has six card slots, a 30MB disk, an optional 1.2MB diskette drive, and a 64KB cache. The 4954 60D provides a 60MB disk, an optional 1.2MB diskette drive, and a 64KB cache.

The 4956 models are also standard 19-inch rack-mountable, and offer either 256KB or 512KB of basic storage with error checking and correcting (ECC). Models B, 30D, and 60D are expandable to 1024KB. Models E and 60E are expandable to 2MB, in 256KB or 512KB increments with 512KB directly addressable. The storage address translator, communications power, and a clock/comparator are standard features. The 4956 Model B has up to 13 card slots available for data channel features, depending on storage size. The 4956 30D provides a 30MB disk with six card slots; the 4956 60D and the 4956 E provide a 60MB disk, with an optional 1.2MB diskette drive and 64KB cache. The 4956 E offers 13 card slots; the 4956 60E offers six card slots.

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municate and cooperate with other systems in a manufacturing network. The system supports a subset of Manufacturing Automation Protocol at the 2.1 level of function; the IEEE Standard 802.4 (token bus local area network) and IEEE 802.2 (logical link control); and the International Standards Organization (ISO) protocols.

IBM continues to maintain the previous 4954 and 4956 models of the Series/1 family. The 4954 is offered in three models featuring a CPU, 64K bytes of main memory, a storage address translation function, a basic console, a clock/comparator, and a power supply that includes communications power. Memory is expandable to 256K bytes in 64K-byte increments. The number of I/O attachments varies; the Model B supports 13 feature positions, and the Model 30D or 60D processor supports six I/O feature positions. 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 Models 30D and 60D provide a capacity of 30MB and 60MB, respectively, of disk storage.

The 4956 processor is designed for mounting on support rails (fixed) in an IBM 4997 or EIA standard 19-inch rack enclosure. Error checking and correcting (ECC) memory is standard. Other features of the 4956 include full program compatibility, storage address translation for up to eight address spaces, and pluggable floating point with both single- and double-precision arithmetic.

The 4956 Model B reportedly provides twice the internal speed of the 4954 through a channel speed of 2.4MB per second. Maximum storage is one megabyte. Directly addressable storage is 512KB. Storage over 512KB is available for use as high-performance secondary storage. An optional full-function console with lock and segmentation register display/store is also offered.

The Series/1 4956 Model E is an extension of the 4956 Model B and reportedly offers internal performance approximately 50 percent greater than the 4956 B model. The basic 4956 Model E processing unit contains the processor; 512K bytes basic storage, plus optional 256K-byte and 512K-byte additional storage cards for a maximum of 2MB storage; 13 I/O slots; error checking and correcting; enclosure; and power. The 4956 Model E is field-upgradable from the 4956 Model B.

The Model 30D is an integrated package, which includes either of the two processors (the 4954 or 4956) and one expansion unit (the 4965 Storage and I/O Expansion Unit). It includes a 30MB disk, an optional 1.2MB diskette, and an optional 64KB cache. The Model 30D also features extensive error recovery procedures, self-diagnostics, and pluggable high-frequency power supply. Any attachment card or feature that can be plugged into the 4954 or 4956 processor, or the 4959 or 4965 expansion units, can also be plugged into the Model 30D. Main storage capacity is 512KB to 1024KB.

CONTROL STORAGE: Information not available from vendor.

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 IMR is used for control interrupts, while the PSW reports the specific condition that caused an exception interrupt. The IAR contains the left-most byte of the next instruction to be executed, and the LSR contains information about the status of an interrupt level. The Address Key Register (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 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. The 4956 features a storage address translation for up to 16 address spaces.

INTERRUPTS: Series/1 processors have four priority interrupt levels. Associated with each level is a bank of hardware registers (16 bits each), an instruction address register, an address key register, and a level status register that includes a set of result indicators. If floating point is installed, there are also four 64-bit floating-point registers per level. 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.

OPERATING ENVIRONMENT: The Series/1 4954 and 4956 processors can be either rack-mounted or housed in a standalone enclosure. Most units are designed for mounting on support rails (fixed) in an IBM 4997 or EIA standard 19-inch rack enclosure. If a system requires space for modular units beyond the capacity of a single rack, multiple racks can be bolted together to form a multibay enclosure.

The 4950 and 5170 Series/1-PC processors are desktop models.

The 4954 and 4956 models are 14 inches high, 19 inches wide, and weigh from 50 to 126 pounds. The 4950 models are 6 inches high, 20 inches wide, 16 inches in depth, and weigh 32 pounds. The 5170 model is 6.38 inches high, 21.25 inches wide, 17.28 inches in depth, and weighs 42.9 pounds.

INPUT/OUTPUT CONTROL

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 processor and the type of card being used.

With the Series/1-PC models, the PC microprocessor functions as an I/O controller.

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CHART C. WORKSTATIONS

MODEL	3101	4978	4979	4980	5251-011
DISPLAY PARAMETERS					
Max. chars./screen	1,920	1,920	1,920	1,920	1,920
Buffer capacity	—	—	—	—	—
Screen size (lines x chars.)	24 x 80	24 x 80	24 x 80	24 x 80	24 x 80
Tilt/swivel screen	No	No	No	Yes	Yes
Symbol formation	—	4 x 6 dot matrix	4 x 6 dot matrix	—	dot matrix
Character phosphor	Green on black or black on green	—	—	—	Green on black
Total colors/no. simult. displayed	None	None	None	None	None
KEYBOARD PARAMETERS					
Style	Typewriter	Typewriter	Typewriter	Typewriter	Typewriter
Character/code set	EBCDIC	EBCDIC	EBCDIC	EBCDIC	EBCDIC
Detachable	Yes	Yes	No	Yes	Yes
Program function keys	—	35	—	24	24
TERMINAL INTERFACE	RS-232-C; RS-422-A	—	Integrated	—	—

A dash (—) in a column indicates that the information is unavailable from the vendor.

The 4954 and 4956 Model 60D processors and the 4965 storage and I/O unit incorporates two major auxiliary devices, one 60MB disk, and an optional 1.2MB diskette drive. An optional 64KB microprocessor-driven cache is also available, which, according to IBM, has disk throughput acceleration potential of 50 to 200 percent, depending upon the application. Model 60D also features error detecting and correcting capabilities.

The 4956 Model 60E is an integrated package containing the processor and storage provided in the Model E; it is reportedly 50 percent faster than the 4956 Models 30D and 60D. The 60E is an extension of the Model 60D and offers a 60MB integrated disk, maximum storage of 2MB (1MB is directly addressable and 1MB is secondary), six I/O slots, an optional 1.2MB diskette, and an optional 64KB microprocessor-controlled cache for the disk. The 4956 Model 60E is field-upgradable from the 4956 30D or 60D.

The 4954 and 4956 Series/1s are considered a modular "mix and match" system with the user determining the modules required—equipment, programming, and service. The units can either fit into an IBM 4997 rack enclosure or EIA standard 19-inch rack, or be mounted in standalone enclosures, depending on the model. I/O device attachment is supported by means of I/O feature cards installed in available slots either in the processor or an I/O expansion unit. Up to 256 individual devices, both standard and custom built, may be addressed by the Series/1 4954 and 4956 processors.

Up to 16 processors can be connected on a high-speed ring. In addition to local ring-connected processors, many of the Series/1 capabilities can be provided to geographically distributed Series/1s by using communication lines. Series/1 capabilities provide the ability to utilize packet switched networks. Communications features are contained in feature cards that plug into the processor I/O channel or the 4987 programmable communication unit. The communications attachment feature cards include a synchronous (SDLC adapter), binary synchronous (BSC) adapter, Asynchronous (ACC) adapter, X.25 network communications adapter, and feature-programmable communications adapter. The Series/1 also supports three local area networks: the Industrial Network, the PC Network, and the Token Ring Network.

On the 4954 and 4956 models, 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, multi-dropped channel that links the processor to its external resources. It consists of address, 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.

Direct program control input/output operations involve a separate I/O command from the processor for each data item transferred across the channel. The data can consist of one byte or one word. The operation may or may not terminate in an interrupt.

CONFIGURATION RULES

GENERAL: Attachment feature cards provide for the attachment of input/output devices to a Series/1 processor. The feature cards mount in the I/O feature locations of a Series/1 processor, 5161 Expansion Unit, 4959 I/O Expansion Unit, or 4965 Diskette Drive and I/O Expansion Unit. Series/1 I/O devices are attached to the processor through the processor I/O channel. 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 4950 and 5170 processors occupy one slot. The 4954 and 4956 processors occupy three slots. And the floating-point and storage relocation transfer features occupy one I/O slot each.

The *5161 Expansion Unit* provides additional configuration flexibility for the 5950 and 5170 processors. It contains one 10MB fixed disk drive and eight option expansion slots.

The *4959 I/O Expansion Unit* provides a maximum of 14 I/O features. 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, a maximum of five Channel Repower units (feature 1565) may be added. This feature repowers the I/O channel along a chain of I/O expansion units. The 1565 must be installed on the 4954 and 4956 processors for any 4959 Expansion Units attached, and on all 4959 units when another 4959 follows.

The *4965 Diskette Drive and I/O Expansion Unit* provides one or two diskettes and four available I/O channel feature positions.

The *1310 Multifunction Attachment Feature* is a single-card unit that provides four independent attachment addresses.

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The Series/1 offers two operating systems, in addition to the Interactive Executive Unix-based system mentioned above: the Realtime Programming System (RPS), and the Event Driven Executive (EDX).

RPS provides for development of applications and mixes of applications with moderate-to-high complexity. It also contains many system management features generally associated with operating systems on larger processors. RPS can support numerous separately packaged, supplemental programs offering program development tools, languages, commercial communications, and sensor input/output support. RPS also supports a broad range of applications, including commercial use (distributed or standalone), communications applications (such as network management), and sensor-based functions (such as process control).

The EDX operating system is adaptable to entry-level, diskette-based production systems as well as larger, disk-based development or production systems of moderate complexity. In keeping with the Series/1 modular concept, the functions of EDX are available through a number of individually licensed programs, which allow users to select from these offerings to provide for the support of a particular installation. EDX is an interactive, interpretive, response-oriented system appropriate for distributed processing and standalone environments in both business and industrial applications, which include data entry and remote job entry, as well as sensor-based functions such as data acquisition, material and component testing, machine and process control, and shop floor control. Language capabilities include Cobol, PL/1, Pascal, Assembler, Fortran IV, and Event-Driven Language.

In addition to the operating systems, standalone program support is available for those who wish to develop an application without using any of the Series/1 operating systems. This alternative is most often used to create a highly tailored and specialized solution where the application and system control functions are integrated by the programmer. Included are a set of standalone utilities, a base program preparation facility, and a group of separately packaged programming modules, known as Control Program Support.

Series/1 software provides a wide range of communications support, including X.21, X.25, SNA, and RJE. The software allows the system to act, variously, as a network node, a communications controller, a distributed processing system, or a standalone system.

Applications available for the Series/1 include retail, manufacturing, energy management, telephone listing management, automated office management, remote job entry, batch entry, and more. Applications are available from IBM and from third-party vendors.

COMPETITIVE POSITION

The Series/1 continues to be one of IBM's best-sellers with an installed base of nearly 60,000. The system sales accelerated from a 6 percent growth rate in 1982/1983 to close to a

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 and the 4975 Printer (local). For remote devices, asynchronous or bi-synchronous communications can be selected through device initialization software in the operating system, and a single communications line is made available to the applications programs.

The *4982 Sensor I/O Unit* consists of a power supply, terminator card, and slots for eight sensor I/O feature cards. The 4982 attaches sensor user processes to the IBM Series/1 computers via the 4982 attachment feature.

The *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.

The *1200 System/370 Channel Attachment* provides memory-to-memory communications between a Series/1 processor and any System/370-based processor. An optional feature allows the host system to IPL an attached Series/1 processor.

The *7400 Two-Channel Switch* is a feature for the 4959 I/O Expansion Unit that provides the capability for switching a set of common I/O devices between two Series/1 processors.

The *7777 Programmable Two-Channel Switch* provides the Series/1 with the capability of bidirectionally switching the 4959 and/or 4965 Model 1 I/O expansion units and their attached devices between processors.

The *5200 Series Printer Attachment* plugs into a Series/1 processor or I/O expansion unit. Up to eight printers can be connected to the attachment.

WORKSTATIONS: Up to four are supported on the 4950 processors, and up to eight are supported on the 5170 processor. A 5151 Monochrome Display, or equivalent, is required for both the 4950 and 5170 systems; the display and keyboard serve as the system console.

The 4954 and 4956 processors support one to eight workstations per I/O attachment. Additional workstations can be added to the 4954 and 4956 processors through the various I/O expansion devices.

DISK STORAGE: Additional disk storage can be added to the 4950 and 5170 systems through the 5161 Expansion Unit. The 5161 Expansion Unit can provide up to two 10MB fixed disk drives and eight option slots (two of which are populated).

Additional disk storage units can be attached to the 4954 and 4956 systems, which include the following:

The 4962 Disk Storage Unit requires the 4962 disk storage unit attachment feature to attach to the Series/1. The models with a diskette unit require both the 4962 attachment and the 4964 diskette unit attachment feature, which can be plugged into either a processor unit or an I/O expansion unit.

The 4963 disk subsystem is attached to the Series/1 through one disk subsystem attachment (feature 3590) installed in a

IBM Series/1

CHART D. PRINTERS

MODEL	4973	4974	4975	5219
Type	Impact	Wire-matrix	Wire-matrix	Impact
Speed	155 or 414 lpm	to 120 cps	40/80/160 cps	40/60 cps
Bidirectional printing	No	Yes	Yes	Yes
Paper size	Up to 15 inches	Up to 14.5 inches	Up to 14.5 inches	Up to 14.5 inches
Character formation	—	Dot matrix	Dot matrix	—
Horizontal character spacing (char./inch)	10	10	10 or 15	10/12/15
Vertical line spacing (char./inch)	6 or 8	6 or 8	6 or 8	varies
Character set	48/64/96 EBCDIC	64 EBCDIC	—	96
Controller/Interface	4973 line printer attachment	4974 line printer attachment	RS-232-C	5200 series printer attachment
No. of printers per controller/interface	one	—	—	—
Printer dimensions, in. (h x w x d)	42.5 x 27 x 28.9	12 x 22.25 x 25.5	8.7 x 20.8 x 16.5	7.9 x 26 x 23
Graphics capability	No	No	No	No
Comments				

A dash (—) in a column indicates that the information is unavailable from the vendor.

40 percent growth rate in 1984/1985. In fact, 1985 was the biggest year in the life of the Series/1.

The Series/1 has progressed in technology from using six processor boards to using a half-inch silicon chip on the Series/1-PC models. Presently, 64K-bit memory is being used, but IBM is in the process of testing 256K-bit technology for use in the near future.

One can see the Series/1 actually competing with its sister system, the IBM Series/36. Both systems overlap, featuring many of the same capabilities, and both systems offer integrated PC models. However, the System/36 is more of an office system and offers more general business packages; whereas the Series/1, seen as a communications and networking system, offers more communications capabilities, such as its support of three types of local area networks.

The Series/1, however, is not lacking in competition from other manufacturers. Since its strengths spread across several marketing areas, including distributed processing, manufacturing, and sales/distribution, as well as communications, competing systems include the Honeywell DPS 6 systems, the Texas Instruments Business Systems, the low end of the Wang VS Series, and the Hewlett-Packard 3000.

In comparing the Series/1 with low-end and mid-range Honeywell DPS 6 systems, some common factors are noted: both are 16-bit systems; both have introduced a Unix-based operating system, allowing users to take advantage of the range of third party software available for the Unix system; both have introduced microcomputer low-end entry-level systems; and both possess effective communications capabilities. One major advantage the DPS 6 family has over the Series/1 is that the three mid-range systems can be upgraded to the two high-end systems, which are 32-bit systems, providing an increase in processing throughput.

In doing a one-on-one system comparison between the most closely related systems, one finds that the Series/1 4956 E and the DPS 6/75 compare equally in maximum memory offered (2MB). However, the 4956 E excels in terminal connectivity supporting 256 workstations versus

processor feature location space, a 4959 I/O expansion unit, or 4965 storage and I/O expansion unit. Each subsystem has one primary drive and may have up to three expansion drives. Multiple subsystems may be attached.

The 4964 is a diskette unit that can be attached directly to either a processor unit or an I/O expansion unit.

The 4965 storage and I/O expansion unit provides either diskette storage or disk storage, depending on the model. A 1565 attachment feature is required for attaching to a 4954 or 4956 Series/1.

The 4967 disk subsystem requires the microprocessor-based 4967 disk subsystem attachment (3595), and one 4967 Model 2CA primary disk unit, and can have up to three 2CB expansion units.

MAGNETIC TAPE UNITS: Up to eight tape systems per I/O attachment can be attached to the 4954 and 4956 processors. The 4968 autoload streaming magnetic tape unit and the 4969 magnetic tape subsystem are available for the Series/1. The 4968 attaches to the Series/1 through a tape attachment feature (feature 1220), which can be plugged into either a processor or an I/O expansion unit. The 4969 subsystem attaches to the Series/1 through a microprocessor-based 4969 magnetic tape subsystem attachment feature, which can be plugged into either the processor or an I/O expansion unit. One attachment feature, which allows for cycle-steal tape read/write operations, is required for each subsystem.

PRINTERS: Up to two printers can be attached to the 4950 and 5170 processors, which include the 4971 printer and 5152 Graphics Printer. One of the attached printers must be a 4971; the second can be either a 4791 or 5152. The 5152 is not supported in the Series/1 mode.

The 4954 and 4956 processors support up to eight printers per I/O attachment. Additional printers can be added through various I/O expansion devices such as the 5200 Series Printer Attachment, the 4959 I/O Expansion Unit, the 4965 Diskette Drive and I/O Expansion Unit, the 1310 Multifunction Attachment Feature, the 4982 Sensor I/O unit, and the 5252 Information Display System Attachment.

MASS STORAGE

Please refer to the Chart B for disk storage devices.

INPUT/OUTPUT UNITS

See Chart C for workstations, Chart D for printers, and Chart E for tape devices.

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CHART D. PRINTERS (Continued)

MODEL	5224	5225	5256	4971
Type	Wire-matrix	Wire-matrix	Impact matrix	Impact
Speed	140/240 lpm	280/400/490/560	Up to 120 cps	60/120 cps
Bidirectional printing	Yes	Yes	Yes	Yes
Paper size	Up to 17.7 inches	Up to 17.7 inches	—	
Character formation	Dot matrix	Dot matrix	Dot matrix	Dot matrix
Horizontal character spacing (char./inch)	10 or 15	10 or 15	10	—
Vertical line spacing (char./inch)	6 or 8	6 or 8	6 or 8	—
Character set	—	—	96/187 char. set	—
Controller/Interface	5200 series printer attachment	5200 series printer attachment	5250 attachment	4900/5200 adapters
No. of printers per controller/interface	—	—	8	1
Printer dimensions, in. (h x w x d)	11 x 28 x 23	39.5 x 43.75 x 29.5	—	—
Graphics capability	No	No	—	—
Comments				

A dash (—) in a column indicates that the information is unavailable from the vendor.

the 96 supported by the DPS 6/75. But then looking at the maximum disk storage supported, we note that the DPS 6/75 tops the 4956 E with support of 2GB, versus 800MB on the 4956 E. The DPS 6/75 also offers an 8K cache memory. Both systems offer an upgrade path through two larger models.

The Series/1 cost factor is a crucial issue; IBM has recently reduced processor costs, and rivals will be hard-pressed to match the resulting price/performance ratio.

ADVANTAGES AND RESTRICTIONS

The many enhancements made in the past year expand the dimensions of the Series/1 systems. A broader range of processors, communications features, and software is now available. IBM sees the Series/1 as an intelligent communications processor rather than as a distributed processor or departmental system. This is not to say that it cannot be used as such, but that communications capabilities are the Series/1's strength. An example of the system's versatility in communications is its support of three local area networks—the Industrial Network, the PC Network, and the Token Ring Network. The Series/1 also offers both PC and host affinity and operates as a natural gateway between the two.

The new entry-level desktop Series/1-PC models offer users a low-cost, entry-level solution, and because it can be operated as either a Series/1 or a PC (not simultaneously), an overwhelming amount of software is available. The drawback is that the small amount of memory available on the Series/1-PC models restricts the applications software to a 512KB limitation. Another disadvantage is that the Series/1-PC models cannot be hardware upgraded to the high-end models; however, there is software portability. Also, because the PC controls the I/O functions of the system, only PC peripherals can be attached to the Series/1-PC models. In addition, the PC models cannot be used as LAN servers.

IBM has again decreased the price of four models: the 4956 B, 4956 30D, 4956 60D, and the 4956 60E. The lower cost, flexibility, reliability, and the modularity of the Series/1 are all system advantages. Another advantage is that

COMMUNICATIONS

GENERAL: The following communications devices are available for the Series/1.

The *1400 Local Communications Controller* provides a high-speed, local interconnection of up to 16 Series/1 4954 and 4956 processors, resulting in the configuration of a Distributed Data Processing (DDP) system. 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.

The *1610 Asynchronous Single-Line Control* provides circuitry for controlling one half-duplex line operating at a speed of up to 9600 bits per second (bps). It can be used as either a primary station or a secondary station. The 1610 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.

The *2091/2092 Asynchronous 8-Line Control and 4-Line Adapter* can control a maximum of eight lines operating in half-duplex mode. Each of these lines can operate at up to 2400 bits per second. No IPL capability is provided.

The *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. It 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.

The *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. It 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.

The *2090 Synchronous Data Line Control (SDLC) Single-Line Control* provides circuitry for controlling one half-duplex line, operating at a speed of up to 9600 bits per second. It operates as either a primary or secondary station. The ability to IPL from a host system is not provided.

The *2093/2094 Binary Synchronous 8-Line Control and 4-Line Adapter* 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.

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CHART E. MAGNETIC TAPE EQUIPMENT

MODEL	4968	4969
TYPE	Streaming	
FORMAT		
Number of tracks	9	9
Recording density, bits per inch	1600/3200	800/1600
Recording mode	IBM/ANSI	NRZI/PE
CHARACTERISTICS		
Controller model	1200	1215
Drives per controller	One	One
Storage capacity, bytes	Up to 80M	—
Tape speed, inches per second	50/100	45/75
Data transfer rate, units per second	—	36-120K
Streaming technology	Yes	No
Start/stop mode; speed	25 ips	—
Switch selectable	—	Yes

A dash (—) in a column indicates that the information is unavailable from the vendor.

while not considered a fault tolerant system, dual Series/1 processors can be connected in a ring to provide for fault tolerant processing.

The new Unix-based operating system, Interactive Executive, is also a plus for the Series/1 4956 systems. This provides for a wider range of third-party applications and many users, such as the government, are looking for systems that offer Unix.

Although the Series/1-PC models cannot be upgraded, a good growth path is provided throughout the Series/1 4954 and 4956 models. However, to expand out of the family would entail not only the expense of all new hardware, but also the expense of software reconfiguration, for the Series/1 software is not compatible with any of the other systems offered by IBM.

IBM's future direction for the Series/1 includes additional cost reductions, increased memory to 1MB on the PC models, and increased memory as well as faster processor speeds at the high-end of the Series/1 systems.

USER REACTION

When Datapro conducted its 1985 User Survey, 11 users of the Series/1 responded. The systems had an average life of 13.6 months. Seven of the respondents polled were first-time computer users, four converted from other manufacturers' systems.

The types of industries represented in the survey include manufacturing (two responses), education (two responses), and one response each for retail/wholesale, engineering, insurance, service bureau, and utilities. The principal applications performed on the systems were accounting/billing (six users), payroll/personnel (five users), sales distribution (two users), manufacturing (two users), order processing (two users), and one response each for education, engineering, mathematics/statistics, insurance, purchasing, and process control. The main source of applications programs were in-house personnel (eight users), followed by independent suppliers (four users), and contract programming (three users).

The *2095/2096 8-Line Controller/4-Line Adapter* are also available. The 2095 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 1200 bps, or 300 bps to 19,200 bps. Choice of synchronous or asynchronous operation is provided. 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.

The *4987 Programmable Communications Subsystem* consists of the subsystem unit, up to two controller features, and device attachment features. It 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 nonstandard protocols. A special communications-oriented instruction set allows many communications functions to be performed outside the Series/1 processor.

The *Series/1 to Personal Computer Channel Attachment Feature* provides a high-speed (400K bits per second) data path between IBM Personal Computers and the Series/1, enabling users to utilize Series/1 resources and to communicate with IBM host systems and local area networks through the Series/1.

***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 the 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: All models of the Series/1 support two operating systems: the Event Driven Executive (EDX) and the Realtime Programming System (RPS). A third operating system, the Interactive Executive (IX) is supported by the 5956 processors only. A standalone program support option is also available. For the Series/1-PC

IBM Series/1

When asked how many local workstations are supported by their Series/1, three users answered between 1 and 5, and eight answered between 6 and 15. With regard to remote workstation/terminals supported, two answered 1 to 5, two answered 6 to 15, and one answered 31 to 60. Only four of the respondents use a data base management system, five don't plan to add a data base management at all, and one plans to add one in the near future. Only one of the users is presently using integrated office automation functions; the other 10 don't plan to add such functions in the near future. The most frequently employed programming languages used on the systems were Cobol (two users), Assembler (one user), Fortran (one user), and the balance of respondents used other languages. Only four of the users plan to acquire expansions to their present hardware in 1985, and four plan to add data communications facilities.

When asked if the system did what they expected it to do, nine answered yes and one was undecided. Nine of the users also said they would recommend the system to other users, one said they would not, and one was undecided.

The 11 users polled rated the Series/1 as follows:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	5	4	2	0	3.3
Reliability of mainframe	6	5	0	0	3.6
Reliability of peripherals	5	5	0	0	3.6
Maintenance service:					
Responsiveness	6	3	2	0	3.4
Effectiveness	6	5	0	0	3.6
Technical support:					
Troubleshooting	3	4	2	0	3.1
Education	2	5	2	1	2.8
Documentation	3	5	1	1	3.0
Manufacturers software:					
Operating system	4	5	0	0	3.4
Compiler & assemblers	1	8	0	0	3.1
Application programs	1	5	0	0	3.2
Ease of programming	2	4	3	0	2.9
Ease of conversion	0	3	1	2	2.2
Overall satisfaction	2	6	1	0	3.1

*Weighted Average based on a scale of 4.0 for Excellent.

To further evaluate the performance of the Series/1, we conducted the following telephone interviews with four survey respondents in November 1985.

The first user we talked to represented an insurance firm in the Northeast. His company's Series/1 4955 is used for accounting and insurance applications, and supports 10 local workstations, six remote workstations, and 384KB of memory. Prior to purchasing the system, the user looked at several systems, which included Wang and Hewlett-Packard, but chose the Series/1 because of IBM's reputation and the availability of software better suited for his needs. The user is happy with the system, listing the system advantages as ease of use, high reliability, and exceptional hardware support from IBM (the software was third-party supplied). He feels the system's disadvantage is that the processing speed is slow.

The user's company is planning to expand its data communications facilities by adding more remote units, and by models operating in the PC mode, the Disk Operating System (DOS) is supported.

The *Event Driven Executive (EDX)* supports multiple, independent, time-dependent, and/or event driven applications with a minimum of interaction. The EDX supervisor overhead can range from 15KB of storage for small production systems to over 64K bytes for a complex interactive communications system. The system supports multiple programming language options, including Series/1 Assembler, Cobol, Fortran, and PL/1. EDX also provides online utilities to support production operations and assist program development, such as text editors, debugging aids, screen format builders, remote management, and remote job entry facilities. Highlights of the system include the following:

- **Initiation of application programs from a user terminal, by another program, or by outside events, such as IPL or a sensor-input interrupt.**
- **Execution of job streams of applications in a batch-like manner.**
- **Concurrent use of programs.**
- **Spooling.**
- **Application program use of any available main storage area at the time of invocation.**
- **Management of storage in eight partitions with crosspartition services, providing for information transfer.**
- **X.21 Circuit Switched support.**

The *Realtime Programming System (RPS)* provides a full-function operating system to users who wish to develop applications and mixes of applications with moderate to high complexity. It provides operating system functions to support realtime operations concurrently with the execution of other batch and online programs. RPS also supports multiple processors and provides a multiprocessing feature system that consists of multiple (2 to 16) Series/1 processors connected by the local communications controller. Highlights include the following:

- **Storage management and task set management**
- **Data management**
- **Timer services**
- **Interrupt handler**
- **Event services**
- **Queuing services**
- **Command language processor**
- **Device management**
- **Communications support**
- **SNA support**
- **X.25 SNA support**

***Interactive Executive (IX)* is a multiuser, timesharing operating system based on Unix System V. It is supported by the 5956 processors only. IX includes a command language, device-independent I/O hierarchical file system, program development tools, and a mechanism that allows performance of complex operations by connecting a number of program modules. The optimizing C language compiler**

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going from 4-channel to 8-channel multiplexers. Expansion from the 4955 to the 4956 E is also being considered.

The second user contacted represented a service bureau in the Midwest using the Series/1 Model 4956 E for applications that include accounts receivable, payroll, inventory, order entry, general ledger, and income tax processing. The system supports seven local workstations and 768KB of memory. The original Series/1 system was selected back in 1979 over the IBM System/34 because of its open-ended architecture. The open-ended architecture, along with reliability (very little downtime), was about the only advantage this user could mention. He stated, "The installation of any hardware changes is very difficult, and the operating system is atrocious, with bad documentation." The user was happy with the technical support "when he could get it." However, support was not always available to him because he had purchased the 4956 E from a third-party dealer. This transaction was handled in this manner because the user stated he could not get satisfactory service from the IBM representative when attempting to upgrade to the 4956 E, and did not realize that a purchase from a third party would affect his support from IBM. (The third-party dealer has since gone out of business.) The user has since purchased software and a memory upgrade directly from IBM, but said even that did not help his support situation. Because of the third-party system purchase, the user said he could not get any 800-line support, and that a broken code problem was the only time he was able to call IBM support at Boca Raton, FL. When he did get through to Boca Raton, he said the support was excellent. He stated that IBM's solution to his problems was to switch to a System/36 or /38, but that since the software is not compatible, his present investment is too great and the cost to convert is to expensive. The user feels the Series/1 is a technical machine and that it must have a technically competent person to operate it.

When asked if he plans to expand the system in the future, the user stated that he would upgrade when a new high-end processor was introduced. Expansion plans for the near future included adding modems and terminals at remote sites, more memory, and more peripherals.

The third user was with an engineering/scientific firm also located in the Midwest. This company's Series/1 4955 is used strictly for mathematical and statistical applications. When asked why his firm purchased the Series/1 for engineering applications, the user said that he bought prior to the micro/engineering workstation age, and that at the time, he wanted a system that was capable of supporting both accounting and engineering applications (he has since dropped the accounting applications). He said his firm also chose the system because of good local support, and because it could be used on a timesharing basis providing a remote link, using Fortran, to engineering packages located on a mainframe. His other reason was that the Series/1 is a multitasking system capable of running several jobs at a time. The user credited the system as being reliable with limited problems over the five-to-six-year span the system has been in-house. When asked if he was happy with the support, he said, "Yes, especially the hardware support; the

allows for migration of Unix-based applications to the Series/1. The kernel is the basic resident operating system that executes system calls, maintains the file system, and manages system resources. It contains device drivers, I/O buffers, and processor and memory scheduling components, and gathers accounting and device error information.

The *Disk Operating System (DOS)* provides support for the Series/1-PC processors while operating in the PC mode only. The 4950 processor is supported by DOS Version 2.1, and the 5170 is supported by DOS Version 3.0. DOS is a general-purpose diskette operating system that supports single-user interactive and batch processing.

A *Standalone Program Support* program is also offered for users who wish to develop an application without using either of the two Series/1 operating systems. This provides the option of creating a highly tailored and specialized solution where the application and system control functions are integrated by the program. A base program preparation facility allows a programmer to translate Assembler language source statements into Series/1 object code. A group of control program support packages provides components from which a tailored operating system and application environment can be built.

DATA BASE MANAGEMENT SYSTEMS: None is provided by the manufacturer for the Series/1.

LANGUAGES: The Series/1 provides a choice of multiple high-level languages for use with both the EDX and RPS operating systems, including Cobol, PL/1, Pascal, and Fortran. Cobol and Basic compilers developed using Control Program Support modules are also available as standalone systems. An EDX Macro Assembler package is also available.

COMMUNICATIONS: The following communications support programs are provided by IBM and are supported by either the RPS or EDS operation systems:

***EDX X.25/HDLC Communications Support* extends the IBM Series/1 EDX to provide read/write level X.25/HDLC support for the DLC adapter, SDLC single-line control, and the synchronous communications single-line control/high-speed. Typical functions of user applications based on the EDX X.25/HDLC Communications Support are protocol conversion (to enable nonpacket-mode terminals on a Series/1 to communicate with a packet switched data network) and networking (where X.25 or HDLC is being used as the communication protocol between Series/1s).**

The *EDX Communications Controller for System/38* is a resident program that allows a System/38 to communicate to a variety of systems and devices through a Series/1. Functions include SDLC link from System/38 to Series/1; BSC links from Series/1 to other devices and systems; and support for System/38 to communicate with other systems.

***EDX Communication Facility:* Manages the flow of information throughout a configuration that may include one or many Series/1, Personal Computers, and host computers, plus terminals and printers. It can be used for communication between Series/1 terminal operators and host programs to which the Series/1 appears as an IBM 3270 Information Display System. It also supports the Series/1-PC connection providing PCs with access to Series/1 disks and printers and to Series/370-based applications. It includes aids for the development of application programs, which can communicate with terminal operators or host programs, or supply other functions required in an installation. Communication with a host may be over a leased or switched BSC line operating in multipoint mode; an SNA connection; or a channel attachment. Communications between Series/1s may be over a leased or switched BSC line operating in**

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software support is just so-so." He feels the major problem with the system is the memory limitation.

The fourth user worked for a Northeast manufacturing firm that used the Series/1 4955 for accounting, order processing and inventory, payroll and personnel, sales and distribution, and data entry. The system supports four local workstations, several remote workstations, and 384KB of memory. The user, like most other users, feels the Series/1 hardware is very reliable. His only complaint with the software is that there is a discrepancy between two of their software packages, (IDES II and Yale ASCII). Each software system, operating alone, works well with the Series/1 and the operating system, but will not work in conjunction with each other. He also felt that hardware and software growth could only be within the Series/1 family, because there is no relation to any other IBM product, and that major conversion will be required when his company outgrows the product. □

point-to-point or multipoint mode, or over a local communications controller.

System/370 Channel Attach Program is provided for both the RPS and EDX operation systems. This program provides the Series/1 user with the ability to communicate with any System/370-based 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.

EDX Systems Network Architecture (SNA) executes as a separate program within the EDX operating system and coordinates all user application program requests for SNA/SDLC communications. The basic operations of the systems network architecture (SNA) support involves establishing communications with the host subsystem, including message recovery/resynchronization assistance; transmitting messages to and receiving messages from the host subsystem; and terminating communications with the host subsystem.

The *EDX Systems Network Architecture Remote Job Entry (RJE)* program is 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.

The *EDX Advanced Remote Job Entry* program supports both BSC and SNA/SDLC host connections, and allows the Series/1 installation to conform to the protocol required by the host system. The BSC option provides a multileaving RJE (MRJE) workstation over a point-to-point (switched or nonswitched) connection. The SDLC option provides an SNA RJE workstation over a point-to-point (switched or nonswitched) or multipoint connection.

The *Programmable Communications Subsystem Preparation Facility* is a macro library 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 or her subsystem. Facilities are provided for implementing communications applications, using communications macroinstructions and communications definition macros.

The *Programmable Communications Subsystem 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.

The *Remote Manager* program is available for both the EDX and RPS operating systems, and allows the Series/1 networks to be managed and operated through the Communications and Systems Management programs available on IBM host processors (System 30XX and 43XX). The Remote Manager on each Series/1 in the network is designed to support centralized control and problem determination using the following host Communications and System Management programs: Network Communications Control Facility (NCCF); Network Problem Determination Application (NPDA); Host Command Facility (HCF); and Distributed Systems Executive (DSX).

The *RPS Communications Manager* supports line concentration, message routing, terminal control, and distributed processing. One or more Series/1s using the program can be installed to manage the flow of information through the network. The Communications Manager supports a variety of terminals and other I/O devices. Support for non-IBM devices can be incorporated through the use of the 4987 programmable communications subsystem. The Communications Manager also allows users to add applications of their own to the network control base support.

RPS Advanced Remote Job Entry (ARJE) 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 nonswitched) connection. The SDLC option features the Series/1 as an SNA RJE workstation over a point-to-point or multipoint connection.

The *RPS Remote Management Utility* consists of two programs, the RPS Remote Management Utility (BSC protocol) and the RPS SNA Remote Management Utility (SDLC protocol); these programs facilitate the operation of a remote Series/1 in a distributed data processing system.

The *5259 Information Display System Attachment Support* program provides definition and execution time facilities to assist the user in the control of 5250 information display system units. Functions provided are attachment initialization, verification test facilities, screen formatting macros, and utility functions.

The *Series/1-PC Connect* is a Series/1 program that runs on an IBM Personal Computer, IBM Personal Computer XT, or IBM Personal Computer AT. It supports the Series/1 PC Channel Attachment feature. The Series/1-PC Connect provides IBM Personal Computers on the IBM PC Network with access to Series/1 disks and printers, as well as access to System/370-based applications from the IBM PC Network. Series/1-PC Connect is supported by RPS Version 7.1.

The *Manufacturing Automation Protocol Communication Server* allows the Series/1 to communicate and cooperate with other systems in a MAP (Manufacturing Automation Protocol) network. The program supports a subset of MAP

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at the 2.1 level, IEEE Standard 802.4 and 802.2, and International Standards Organization (ISO) protocols.

UTILITIES: A variety of utility programs are supported by both the EDX and RPS operating systems.

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 online.

The *EDX Macro Library/Host* is a set of libraries and procedures that resides on a System/370 and includes a macro library containing Series/1 instructions and a data set containing sample Job Control Language (JCL). This package provides the capability to assemble application programs written in the Event Driven Language and/or the Series/1 instruction set on a host System/370.

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-based system using the System/370 Program Preparation Facilities for Series/1 FDP. Communications with the host System/370-based system are supported by either the Host Communications Facility IUP or the Remote Job Entry capability of the EDX utilities.

The *Series/1 Data Collection Interactive* provides additional functions for EDX; it 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, online test initialization, audible alarm initiation, error handling, and data routing to storage or to disk/diskette.

The *RPS Native Application Load Facility* provides a means of transmitting programs to and from the System/370-based system for host preparation. Key features include commands to initiate and control data transfer; a transparent data scheme to permit the transfer of load modules and data from a System/370-based system to Series/1; and error features for detecting machine check, communication failure, and program check interrupts.

The *RPS Host Preparation Facility* provides the following support for the Series/1: translation of Series/1 source programs written in Assembler language into machine language instructions, producing Series/1 object modules; printed output, including program listing, symbol dictionaries, cross-reference, and diagnostic messages; an application builder that prepares object modules for execution by building load modules or task sets that can execute on the Series/1; a host application load facility that can be invoked through TSO to transmit Series/1 object code from the System/370-based system to the Series/1 for execution across BSC lines.

The *RPS Program Preparation Subsystem* provides a group of components that assists in developing and executing user programs. The components include a text editor, a macro assembler, an application builder, a macro preprocessor, a job stream processor, a command language facility, and a system facility that provides the ability to generate a customized operating system.

The *Job Stream Processor* is provided for those who require only the Job Stream Processor portion of the Program Preparation Subsystem. This program invokes programs and supplies control information to the system in production job streams.

The *RPS Query* program provides interactive access to data stored in Series/1 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 can 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.

EDX Query provides interactive 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 RPS Query.

The *EDX Multiple Terminal Manager* provides a set of high-level functions designed to simplify development (design and implementation) of transaction-oriented applications.

The *EDX* and *RPS Sort/Merge* programs handle the 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 *EDX* and *RPS Indexed Access Method* provide keyed access to user data to support applications ranging from batch processing to multiuser, interactive applications. The data file organization is designed to provide random and sequential processing of files. The access method design supports files which have high add/delete activity, minimizing performance degradation.

The *System Control Program* is a set of standalone facilities to provide the programmer with the most commonly used facilities in a standalone environment. The characteristics of the program include an operator station for interactive utility operation and utilities loaded from diskette by name; unrecoverable errors return control to operator. Separate utilities functions within the SCP program provide disk and diskette IPL bootstraps, disk and diskette initialization, disk and diskette printer dumps, disk and diskette copy programs, disk and diskette patch programs, storage dumps to diskette or printer, automatic system build and verification utilities, and error logging facilities.

The *3101 Full Screen Support* program provides programming support for the IBM 3101 Models 20, 22, and 23 display stations.

The *Base Program Preparation Facilities* provide the programmer with the tools needed to create, enter, edit, compile, and link-edit application programs. The package consists of three subsystems: a text editor, macro assembler, and linkage editor.

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The *Control Program Support* provides task management and input/output support for application programs. It also includes facilities for timer support, error logging, and installing the disk bootstrap and loader program.

The *Address Relocation Translator* provides users with the capability to address storage above 64KB. It also provides multiple address space management support and program debugging support for systems using the storage address relocation feature.

The *Commercial Arithmetic* program consists of a set of macros that perform add, subtract, multiply, divide, and compare operations for up to 15 packed decimal digits per operand.

The *Binary Synchronous Communications Control Program Support* extends Control Program Support to provide read/write support for the IBM 2074, 2075, and 2093 communications features.

The *Sort/Merge* routine can create a sorted tag-along output file from key fields contained in from one to seven input files on disk or diskette. Sorting on EBCDIC, signed binary, or single-precision, floating-point key fields is provided.

The *EDX* and *RPS Transaction Processing System (TPS)* offers support for developing and managing transaction-oriented user application programs. It provides the use of system functions without the complexity of an operating system interface. TPS provides support for file management, program management, storage management, error management, terminal management, multitasking, multiple address space support, and security sign-on and access. As a transparent interface to the Communications Facility, TPS will support 3270 pass-through and emulation.

Input/Output Executive executes on the 4950 System Unit's Personal Computer Processor to provide support for the 4950 I/O devices to the Series/1 operating systems.

OFFICE AUTOMATION: A variety of office systems programs are available for the Series/1, including the following:

The *Department Office Control System* is an EDX program designed to enhance an environment of multiple IBM Personal Computers. This program offers a range of automated office functions, similar to the Professional Office System (PROFS), including electronic mail, note and document management, personal scheduling/calendaring, personal computer file archiving/sharing, document printing, access to 3270 host-based applications (optional), and batch file transfer to/from host (optional).

The *Subscript* word processing program, under the EDX operating system, is designed for the preparation of letters, documents, manuals, and other text material on a Series/1 using an upward-compatible subset of the Script/VS IBM program product.

The *Audio Distribution System* is a voice store-and-forward message system, providing direct support for a network of business professionals in their daily communications activities, supporting up to 3,000 subscribers and up to 16 telephone ports.

Letter Writer executes in conjunction with the RPS Multiple Terminal Manager. The system uses a full-screen display terminal to provide word processing capability. Letter Writer provides the basis for word processing applications that execute with data processing applications.

Text Routing System is a standalone program that allows the Series/1 to act as a communications controller for a local or a remote office systems network. This field-developed program allows the sharing of non-Series/1 devices in an office systems environment; provides for additional online storage of information for an office system workstation; allows high-speed transfer of data to a Series/1 for rapid availability by a receiving station; and provides an interface to a Telex network.

APPLICATIONS: For users interested in minimizing their development effort, IBM offers Series/1 applications software that addresses a range of uses including, but not limited to, the following:

- Energy management
- Pharmacy systems
- Videotex
- Text entry and editing
- Telephone listing management
- X-Ray analysis
- Audio distribution
- Data collection
- Data entry
- Automobile dealer/heavy equipment management
- Remote job entry
- Batch entry
- Word processing
- Publishing
- Insurance
- Manufacturing
- Sales and distribution
- Accounting

With the standalone program support programs, users can also develop their own software to meet their individual needs (see the Utilities portion of the Software section for more information).

In addition to the IBM-developed and individually developed programs, a large array of applications software is available for the Series/1 through third-party vendors.

PRICING

POLICY: The Series/1 is offered on a purchase-only basis, at prices ranging from approximately $5,750 to over $100,000, depending on the 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 customer engineer at no additional charge.

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

Quantity of Eligible Machines	Volume Purchase Discount Percent
20-49	12%
50-149	16%
250-499	24%
500-999	27%
1,000 or more	30%

The discount schedule for Series/1 4954 and 4956 processors is as follows:

Quantity of Eligible Machines	Volume Purchase Discount Percent
5-9	7%
10-19	10%
20-34	17%
35-49	22%
50 or more	28%

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The majority of Series/1 programs are offered with an option of a continuous monthly charge or a onetime charge with future payments waived. Under either payment option, the licensed program remains the property of IBM and is subject to the provision of the Agreement for IBM Licensed Programs. For most Series/1 software offerings, there is a onetime process charge to cover the cost of distribution of basic machine-readable material, including service updates.

SUPPORT: The Series/1 4954 and 4956 models are supported nationwide by trained IBM customer service representatives who will install the Series/1 and perform extensive tests and diagnostics. The customer service representatives are backed by a countrywide parts distribution network, and are equipped with a variety of portable diagnostic tools to pinpoint trouble areas. Customer service representatives are available 24 hours a day, 7 days a week to help solve any problems that may occur during or after installation.

Support for the Series/1-PC models is provided by the IBM Personal Computing Assistance Center Support to a location designated by the customer as their Technical Support Location. IBM allows up to three members of the customers Technical Support Location staff to be trained to assist in the installation, testing, and use of both the hardware and software of the Series/1-PC models. Customer Carry-In Repair (CCR) is provided during the three-month warranty period. A warranty option is also available which provides for IBM On-site Repair (IOR). Maintenance service providing IOR and CCR is also available.

Programming support and advice and assistance in the development and writing of tailored operating systems and applications programs are available under a systems engineering contract.

TRAINING: IBM offers a variety of self-study and classroom training courses on the operation of the Series/1 system. The courses are geared for different levels of personnel, including systems support, programming, and operations staff.

TYPICAL CONFIGURATIONS:

Series/1—Personal Computer AT:

5170	Model 495 Series/1-PC/AT Processors, 256K bytes memory	$8,895
0205	20MB Fixed Disk Drive	1,595
0206	Diskette Drive, high capacity	650
0215	Serial/Parallel Adapter	150
3101	2 Model 13 Display Terminals	2,860
0217	Serial Adapter Cable	65
0242	Serial Adapter Connector	35
0401	3101 Display Cable 15m	100
4971	Matrix Printer	700
TOTAL PURCHASE PRICE		$15,050

Series/1 4954:

4954	Model B Processor 64K bytes of memory	$ 8,500
6307	3 Storage Additions 192K bytes of storage	1,875
5655	Programmer Console	820
1310	2 Multifunction Attachments	4,080
5770	6 Multifunction Local Attachment Cables	612
2057	EIA Dataset Cable	87
3101	6 Model 23 Display Terminals	7,580
4963	Model 64A Disk Subsystem (64MB)	13,340
3590	4963 Disk Subsystem Attachment	1,630
4966	Diskette Magazine Unit	6,160
1205	4966 Diskette Magazine Unit Attachment	2,520
4973	4973 Model 2 Printer (400 lpm)	14,910
5630	4973 Line Printer Attachment	1,125
4997	Model 2B Rack Enclosure	1,715
TOTAL PURCHASE PRICE		$64,954

Series/1 4956:

4956	Model E Processor 512K bytes of memory	$16,500
6330	Memory Addition 256K bytes of memory	1,595
1310	Multifunction Attachment	2,040
4980	8 Display Stations	23,800
5770	2 Multifunction Cables	204
2074	Binary Synchronous Communication Single-Line Control	1,265
2057	EIA Dataset Cable Terminals	87
4967	Model 2CA Disk Subsystem (200MB)	24,000
3595	4967 Disk Subsystem Attachment	6,000
4966	Diskette Magazine Unit	6,160
1205	4966 Diskette Magazine Unit Attachment	2,520
5225	Model 4 Printer (560 lpm)	16,940
5640	Printer Attachment—5200 Series	3,035
4997	Model 2B Rack Enclosure	1,715
TOTAL PURCHASE PRICE		$105,861

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint. ($)
PROCESSORS AND MAIN STORAGE			
5170	Model 495 Series/1-PC/AT System Unit/Keyboard	8,895	—
4950	Model A Series/1-PC/XT System Unit/Keyboard	5,750	—
	Model B Series/1-PC/XT System Unit/Keyboard	7,605	—
4954B	Processor; full-width module, 64K bytes basic memory, 13 I/O feature slots	8,500	45.00

NC—No Charge.

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		Purchase Price ($)	Monthly Maint. ($)
495430D	4954 Model 30D, full-width module, 32KB basic memory, 6 I/O feature slots, disk	17,800	79.00
485460D	4954 Model 60D	19,800	98.00
4956B	Processor; full-width module, 256KB basic memory, and 13 I/O feature slots	12,500	37.00
4956C	Processor; full-width module, diskette drive, 256KB basic memory, and 3 I/O feature slots	16,855	57.00
4956E	Processor, full-width module, 512KB basic memory, 13 I/O slots	16,500	59.00
495630D	4956 Model 30D, full-width module, 256KB of memory, 6 I/O slots, disk	21,700	75.00
495660D	4956 Model 60D	18,500	102.00
495660E	4956 Model 60E, 512KB of memory, 6 I/O feature slots	22,500	126.00
6307	64KB Storage Addition Card for the 4954 processor	625	2.50
6330	256KB Storage Addition Card for the 4956 processor	1,595	16.00
6331	512KB Storage Addition Card for Model 30D	3,190	48.00
6332	512KB Basic Storage Expansion for Model 30D	1,595	32.00
6333	512KB Storage Addition Card for the 4956 processor	3,750	48.00
PROCESSOR FEATURES			
0205	20MB Fixed Disk Drive for 5170 Model 495	1,595	—
0206	Diskette Drive for 5170 Model 495	650	—
0207	Diskette Drive, dual sided for 5170 Model 495	425	—
3810	5¼" Double-Sided Disk Drive	428	—
4100	Second Diskette Drive for 4954 and 5956 processors	1,465	10.00
4959	Input/Output expansion unit	3,290	36.00
4965	Model 1 Diskette Drive and I/O Expansion Unit	6,635	38.00
4965	Model 30D Storage and I/O Expansion Unit	14,100	58.00
4965	Model 60D Storage and I/O Expansion Unit	16,100	88.00
5161	Model 002 Expansion Unit for 4950 Models A and B Processors	2,290	—
	Model 003 Expansion Unit for 4950 Models A and B Processors	4,145	—
3629	Additional Six-port Terminal/Host Attachment Card; 5170 Processor	750	—
6400	Cache option	2,305	14.00
3925	Floating-point; 4954 and 4956 processor	700	38.00
3926	Floating-point; 4956 processor	700	38.00
1590	Customer access panel	225	1.50
1593	Customer access panel—integrated digital I/O output cable	484	1.00
1594	Customer access panel—customer direct program control adapter cable	339	1.00
1595	Channel socket adapter	90	1.00
4520	Standalone Enclosure	371	—
4540	Rack mounting fixture	68	NC
4997-1A	Rack enclosure, Model 1A	1,130	2.00
4997-1B	Rack enclosure, Model 1B	1,335	2.00
4997-2A	Rack enclosure, Model 2A	1,510	5.00
4997-2B	Rack enclosure, Model 2B	1,715	5.00
5655	Programmer console; 4954 and 4956 processors	820	3.00
7777	Programmable Two-Channel Switch	6,775	9.00
7840	Timers	790	4.00
7900	Two-channel switch; plugs into 4959 and 4965 expansion units	3,330	8.00
MAGNETIC TAPE EQUIPMENT			
1215	4969 Magnetic Tape Subsystem attachment	1,640	4.00
4968-1AS	Automatic Stream Magnetic Tape Unit	8,800	23.00
1220	Attachment feature for 4968	2,600	10.00
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 7P, 75 ips, PE	16,170	108.00
	Magnetic Tape Subsystem; Model 7D, 75 ips, dual density	16,960	111.00
MASS STORAGE			
4962-1	Disk Storage Unit; 9-megabyte capacity, nonremovable disk	9,025	53.50
4962-2	Disk Storage Unit; combination disk/diskette unit, 9-megabyte capacity on nonremovable disk, 606K-byte capacity on removable diskettes	11,230	72.50
4962-2F	Disk Storage Unit; combination disk/diskette unit, 9-megabyte capacity on nonremovable disk, 123K-byte capacity on fixed-head disk, 606K-byte capacity on removable diskettes	12,360	92.50
4963-58A	Disk Storage Subsystem; primary disk unit with 58-megabyte capacity on nonremovable disk and an additional 131K bytes under fixed heads; up to three 4963-58B or 4963-64B disk units can be attached	14,120	66.00
4963-64A	Disk Storage Subsystem; primary disk unit 64-megabyte capacity on nonremovable disk; up to three 4963-58B or 4963-64B disk units can be attached	13,340	51.00
4963-64B	Disk Storage Subsystem; expansion drive, same characteristics as 4963-64A	11,170	48.00
4964	Diskette Unit; 606K-byte capacity on removable, 2-sided diskettes	3,005	17.00

NC—No Charge.

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		Purchase Price ($)	Monthly Maint. ($)
4965	Diskette Unit and I/O Expansion Unit; 1.2M-byte capacity on removable 2-sided diskettes; 4 additional feature locations	6,635	36.00
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
4967-2CB	High-performance disk subsystem	19,900	61.00
3595	Attachment Feature for the 4967	6,000	26.00
1205	4966 Diskette Magazine Attachment	2,520	4.00
3580	4962 Disk Storage Unit Attachment	1,025	7.00
3581	4964 Diskette Unit Attachment	795	6.00
3590	4963 Disk Subsystem Attachment	1,630	4.00
4100	4965 Second Diskette Drive	1,830	10.00
PRINTERS			
4973-2	Line Printer; 132 columns, 48-, 64-, or 96-character set; 400 lpm	14,910	143.00
4974	Printer; wire-matrix print head, 132 columns, EBCDIC 64-character set; 120 cps	3,470	44.00
4975-01L	Printer (local); 80 cps, 184-character set, 6 or 8 lpi, 10 or 15 cpi	2,860	31.00
4975-02L	Printer (local); 160 cps (draft), 40 cps (letter), 184-character set, 6 or 8 lpi	4,175	38.00
4975-01R	Printer (remote); 80 cps, 184-character set, 6 or 8 lpi, 10 or 15 cpi	2,860	38.00
4975-02R	Printer (remote); 160 cps (draft), 40 cps (letter), 184-character set, 6 or 8 lpi	4,175	46.00
4971	Model 1 Matrix Printer for Series/1 4950 and 5170/495 Systems; 120 cps	700	—
5219	Model B1 Impact Printer; 40 cps	5,265	42.00
	Model B2 Impact Printer; 60 cps	5,680	46.50
	Model D1 Impact Printer; 40 cps	5,420	54.00
	Model D2 Impact Printer; 60 cps	5,835	58.50
5224	Model 1 Line Printer; 95/140 lpm	6,395	48.00
	Model 2 Line Printer; 170/240 lpm	7,280	57.00
5225	Model 1 Line Printer; 195/280 lpm	12,075	109.00
	Model 2 Line Printer; 290/400 lpm	13,945	152.00
	Model 3 Line Printer; 35/490 lpm	15,495	188.00
	Model 4 Line Printer; 420/560 lpm	16,940	224.00
5256	Model 1 Impact Printer; 40 cps	3,110	49.00
	Model 2 Impact Printer; 80 cps	3,255	53.00
	Model 3 Impact Printer; 120 cps	3,400	60.00
5620	4974 Printer Attachment	1,110	3.50
5630	4973 Line Printer Attachment	1,125	5.00
5640	5200 Series Printer Attachment	3,035	9.00
TERMINALS			
3101	Display Terminal; 1,920-character display	1,430	—
4704	Display Terminal	1,034	12.00
4978	Display Station; 80 characters by 24 lines, cycle-steal operations and buffered microprocessor control	1,570	17.00
D02038	4978 Display Station Attachment	1,665	14.00
D02056	4978 Keyboard; typamatic mode keys (cursor, space, and all other than fixed-function keys); extended	1,030	11.00
D02057	4978 Keyboard; typamatic space key; basic	1,000	11.00
4980	Display Station; 80 characters by 24 lines; 1,920-character display	2,985	260.00
5251	Model 11 Display Station; 1,920-character display	2,135	18.50
5151	Monochrome Display	275	—
COMMUNICATIONS			
1204	Binary Synchronous Communications Adapter	240	—
1205	SDLC Communications Adapter	240	—
1300	Programmable communications subsystem controller	2,495	26.00
1400	Local communications controller	3,365	14.50
1610	Asynchronous communications single-line control	1,360	9.50
2000	Communications indicator panel	250	3.00
2010	Communications power; 4955 only	150	3.00
2074	BSC single-line control	1,265	11.50
2075	BSC single-line control/High speed	1,385	11.50
2080	Synchronous Single Line Control/High speed	3,310	25.00
2090	SDLC single-line control	1,290	11.50
2091	Asynchronous communications 8-line control	1,220	9.50
2092	Asynchronous communications 4-line adapter	1,260	19.50
2093	BSC 8-line control	1,360	9.50
2094	BSC 4-line adapter	1,250	24.50
2095	Feature-programmable multiline communications; 8-line control	1,300	7.00
2096	Feature-programmable multiline communications; 4-line adapter	1,225	20.00
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	2.00

NC—No Charge.

IBM Series/1

		Purchase Price ($)	Monthly Maint. ($)
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, read relay	850	12.00
4950	Multiplexer, solidstate	934	7.00
4987	Programmable communications subsystem, Model 1	5,205	45.00
4990	Communications console, Model 1	975	2.00
7850	Teletypewriter adapter	705	6.00
USER ATTACHMENT FEATURES			
0215	Serial/Parallel Adapter	150	—
0217	Serial Adapter Cable	65	—
1060	Analog input control	1,045	4.50
1065	Analog output	687	5.00
1070	Amplifier, multirange	1,190	5.00
1200	System/370 channel attachment	2,355	10.50
1205	Monochrome Display and Printer Adapter	250	—
1310	Multifunction Attachment; for 4 device attachments (local or remote) for 3101 Display Terminal or 4975 Printer	2,040	9.00
1560	Integrated digital I/O, nonisolated	1,035	11.50
1565	Channel repower	525	2.50
3525	Digital input/process interrupt, nonisolated	535	4.00
3532	Digital input/process interrupt, isolated	908	3.00
3535	Digital output, nonisolated	462	4.00
4000	Series/1 to Personal Computer Channel Attachment Feature	3,265	196
4001	Series/1 to Personal Computer Attachment Cable	435	26
4900	Monochrome Display and Printer Adapter	250	—
4982	Sensor I/O unit	2,155	11.00
4993	Series/1-System/370 termination enclosure, Model 1	3,290	23.50
6305	4982 Sensor I/O attachment	818	6.50

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SOFTWARE PRICES

		Monthly Charge ($)	Onetime Charge ($)
LICENSED PROGRAMS			
5719-PC5	Realtime Programming System, Version 5, with Command Language Facility	175	4,940
5719-PC6	Version 6, with Command Language Facility	476	7,500
	Version 6 without Command Language Facility	304	5,000
5719-AM2	RPS Indexed Access Method, Version 2	52	1,150
5719-AM4	EDX Indexed Access Method, Version 2	52	1,150
5719-AS5	Program Preparation Subsystem, Version 5	166	4,675
5719-AS6	Version 6	256	5,265
5719-AS7	Version 7	472	6,600
5719-ASA	EDX Macro Assembler	21	888
5719-CA1	System/370 Channel Attachment	33	1,305
5719-CB5	EDX Cobol Compiler and Resident Library, Version 2	163	4,710
5719-CB6	EDX Cobol Transient Library, Version 2	20	601
5719-CB7	RPS Cobol Compiler and Resident Library, Version 2	163	4,710
5719-CB8	RPS Cobol Transient Library, Version 2	20	601
5719-CF1	EDX Communications Facility	63	2,200
5719-CF2	Series/1 EDX Communications Facility, Version 2	167	2,500
5719-CM1	Communications Monitor for Series/1	174	5,515
5719-CM2	Communications Manager	386	5,550
5719-CN1	Series/1-PC Connect, Version 1	—	400
5719-CS0	Program Communications Subsystems Preparation Facility	12	523
5719-CS2	Program Communications Subsystem Extended Execution Support	32	1,200
5719-CX1	EDX System/370 Channel Attachment	105	2,820

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IBM Series/1

SOFTWARE PRICES

		Monthly Charge ($)	Onetime Charge ($)
5719-EM1	Input/Output Executive, Version 1	—	650
5719-FO2	Fortran IV Compiler and Object Library	21	950
5719-FO4	Fortran IV Realtime Subroutine Library, Version 2	9	351
5719-HD1	Series 1/Realtime X.25/HDLC Communication Support	148	2,500
5719-HD2	EDX X.25/HDLC Communications Support	139	2,500
5719-LM2	Math and Functional Subroutine	12	502
5719-LM3	EDX Math and Functional Subroutine Library	12	502
5719-LM7	EDX Macro Library, Version 3	85	2,665
5719-LM8	Version 4	216	3,635
5719-LM9	Series 1 EDX Macro Library	286	4,000
5719-MS2	Version 2	27	727
5719-MT1	Realtime Programming System Multiple Terminal Manager, Version 3	34	750
5719-PA1	Base Program Preparation Faciltiy	135	2,375
5719-PC5	RPS Realtime Programming Language, Version 5, with Command Language Facility	175	4,940
5719-PC6	Version 6	476	7,500
5719-PC7	Version 7	500	7,000
5719-PJ7	Realtime Programming System, Version 7 (for the Series/1 4950)	—	2,800
5719-PL2	PL/1 Compiler and Resident Library, Version 2	189	7,425
5719-PL4	Version 2	35	1,370
5719-PL5	PL/1 EDX Compiler and Resident Library	189	7,425
5719-PL6	PL/1 EDX Transient Library	35	1,370
5719-RJ1	EDX Advanced Remote Job Entry	62	1,050
5719-RJ6	RPS Advanced Remote Job Entry	34	1,050
5719-RM1	EDX Remote Manager	133	2,000
5719-RM6	RPS Remote Manager	125	2,000
5719-SC2	Standalone Disk Utilities	NC	NC
5719-SM1	Sort/Merge	10	315
5719-SM2	EDX Sort/Merge	12	360
5719-SN1	RPS Version 5 SNA Extended Support	103	2,905
5719-SX1	EDX System Network Architect (SNA)	71	2,005
5719-SX2	System Network Architect (SNA) RJE	32	1,000
5719-TA1	5250 Info Display System Attachment Support	33	1,290
5719-TA4	4969 Magnetic Tape Subsystem Support	32	1,220
5719-TR1	EDX Transaction Processing System, Version 1.1	—	2,950
5719-UN1	Interactive Executive (IX)	—	6,500
5719-UT3	EDX Utilities, Version 1	19	792
5719-UT4	Version 2	22	1,135
5719-UT5	Version 3	38	1,165
5719-U11	FC/PM 1	196	6,515
5719-U12	FC/PM 2	283	9,430
5719-U13	FC/PM 4	390	12,980
5719-U14	FC/PM 2M	139	4,610
5719-U15	FC/PM 4M	172	5,765
5719-U20	IBM Audio Distribution System	449	12,700
5719-U21	Audio Distribution System, Version 2	950	15,200
5719-XJ5	EDX Version 5 for Series 1 4950 System	—	750
5719-XR1	Event Driven Executive Query	27	792
5719-XR2	Realtime Programming System Query	27	792
5719-XS1	EDX Supervisor and Emulator, Version 1	26	1,055
5719-XS3	Version 3 (Basic)	47	1,440
5719-XS4	Version 4	132	1,900
5719-XS5	Series/1 EDX Basic Supervisor and Emulator	158	2,200
5719-XT1	EDX Manufacturing Automation Protocol Application Server	321	4,500
5719-XT2	RPS Manufacturing Automation Protocol Communications Server	679	9,500
5719-XX2	EDX Program Preparation Facilities, Version 1	25	990
5719-XX4	Version 3	46	1,410
5719-XX5	EDX Preparation	174	2,925
5719-XX6	Series/1 EDX Program Preparation Facility	229	3,200
5740-LM4	EDX Macro Library/Host, Version 3	226	2,268
5740-LM5	Version 4	357	5,010
5740-LM6	Version 5	393	5,500
5796-NPW	Virtual Cobol Computer	356	—
5796-REE	PXS-V3 Development Support	85	—
5796-REF	PXS-V3 Operational/Application Support	85	—
5798-DQG	Department Office Control System	—	1,800

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IBM Series/1

SOFTWARE PRICES

		Monthly Charge ($)	Onetime Charge ($)
5798-NLG	Intelligent Terminal Subsystem	126	—
5798-NPY	Intelligent Data Entry System	63	—
5798-NPZ	Remote Job Entry for Controller Program Support	29	—
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-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-RBQ	Specialized Terminal Interactive Processor	120	—
5798-RBY	Virtual Basic Supervisor	29	—
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-RFC	Communicating Job Stream Processor	—	650
5798-RFF	3101 Full Screen Control Program Support	—	282
5798-RHB	Laboratory Automation Software	300	3,600
5798-RRD	Programming Services for Multimedia Industrial Terminals	—	1,800
5798-ZZB	Virtual Cobol Control Program Support	58	—
5798-ZZC	EDX Communication Facility	40	—
5798-ZZF	Series/1 Communication Controller for System/38	250	—
5799-AXL	Intelligent Remote Station Support	114	—
5799-BEW	ACS Series/1 Support	1,660	—
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 1	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	72
5799-TBA	CPS Format/Print	3	72
5799-TBB	CPS Operator Station/Debug Package	10	240
5799-TBC	CPS Auto-Call Interface	6	144
5799-TBD	CPS Commercial Arithmetic	2	48
5799-TBE	CPS 4978/4979 Display Map	5	120
5799-TBQ	CPS Extended Function	3	83
5799-TBT	CPS Address Translator Support	7	144
5799-TCZ	CPS 4963 Subsystem	15	312
5799-TDE	Data Collect Interactive	29	1,425
5799-TDH	RPS Remote Management Utility	7	420
5799-TDK	CPS 4963/4966 Save/Restore	15	358
5799-TDR	Site Universal Billing	84	1,875
5799-TDT	Host Universal Billing	205	4,580
5799-TDW	CPS 4969 Magnetic Tape Subsystem	56	1,350
5799-TEC	RPS Job Stream Processor	13	535
5799-TEF	SNA Remote Management Utility	9	220
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-TER	Pascal Compiler and Object Library	195	3,900
5799-TEY	Series/1 Letter Writer, Version 2	107	1,200
5799-TFY	Telephone Message Management System, Version 1.2	171	19,800

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