IBM Series/1

New Product Announcement

● The 4955 Model D, consisting of a 32K-byte to 128K-byte processor (expandable in increments of 32K) with 7 I/O feature slots in a full-width unit. Purchase price is $7,915.

The new processor models use 32K-byte storage cards rather than the 16K-byte cards available with the previously announced models, thus requiring fewer card slots as well as reducing the price for additional 32K-byte increments of memory. A 32K-byte storage addition for the 4953 Model C and D processors has a purchase price of $2,425, while a 32K-byte addition for the 4955 Model C and D processors is priced at $2,850.

The new 4973 Line Printer is a free-standing impact printer available in two print speeds: 155 lpm (Model 1) and 414 lpm (Model 2) with the 48-character set. Print belts are also available that provide sets of 64 or 96 EBCDIC characters. The 4973 prints 6 or 8 lines per inch at 132 print positions per line, has programmable vertical forms control, and can handle up to 6-part forms. All data transfers to and from the Series/1 system are on a cycle-steal basis. The purchase price of a 4973 Model 1 or Model 2 printer is $8,625 or $12,425, respectively.

The 4978 Display Station is a table-top CRT display with a movable keyboard. The display has a 1920-character screen (24 lines of 80 characters each), using a 7-by-8 dot matrix for each character. The keyboard scan code and display character generator format are user-definable and RAM-loadable from processor storage. Up to 256 different scan codes are recognized. The user can assign a key to be either an interrupting, interrupting/data, data, or local functional key. Two keyboard models are available. All data transfers to and from the system are on a cycle-steal basis. The purchase price of the 4978 Display Station is $1,320.□

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The Series/1 Model 5 system shown here includes a 9.3-million-byte disk subsystem with a built-in 492,000-byte diskette unit. The 120-cps printer and the display station with a 1920-character CRT screen are shown at left.

> The Series/1 is, in IBM's words, a "small computer intended primarily for experienced data processing users." System software is minimal by today's standards and applications software is nil, but a powerful instruction set and the IBM marketing know-how make the company's prediction of selling "thousands" in the first year a realistic goal.

MANAGEMENT SUMMARY

With the introduction of the Series/1 in November 1976, IBM's General Systems Division (GSD) broke a number of marketing traditions:

● It marked the first time GSD had test-marketed a product prior to its announcement.

● It was the first time the company had taken the approach of selling at a component level.

● The Series/1 is offered on a "purchase only" basis.

● System software for the new line is minimal— and applications software is non-existent at this writing.

● The company will sell the Series/1 on an OEM as well as end-user basis, but will continue its policy of not giving volume discounts.

Avoiding the term "minicomputer," IBM calls the Series/1 "a family of small general-purpose processors with data processing I/O, sensor I/O, and communications capabilities." Company literature goes on to state that "Series/1 is specifically designed for users who have the capability to do their own application programming ▷

CHARACTERISTICS

MANUFACTURER: International Business Machines Corporation, General Systems Division, 5775 Glenridge Drive N.E., Atlanta, Georgia 30301.

MODELS: Series/1 Models 3A, 3B, 5A and 5B.

DATA FORMATS

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

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

FLOATING-POINT OPERANDS: 32-bit single-precision operands with a 7-bit exponent and signed 24-bit fraction; and 64-bit double-precision operands with a 7-bit exponent and signed 56-bit fraction. The hardware floating-point capability is available only with the Series/1 Models 5A and 5B.

INSTRUCTIONS: One- or two-word instructions. There are 10 different types of instructions available, categorized as follows: Data Movement, Arithmetic, Branching, Shift, Stack, Compare, Logical, Processor Status, Privileged, and Floating-Point. In all instructions, bits 0 through 4 identify the specific function.

INTERNAL CODE: EBCDIC and binary.

MAIN STORAGE

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

CYCLE TIME: Model 3 processor—800 nanoseconds; Model 5 processor—660 nanoseconds.

CAPACITY: Model 3—16K to 64K bytes in 16K-byte increments; Model 5—16K to 128K bytes in 16K-byte increments.

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

STORAGE PROTECTION: None on Model 3; standard on Model 5.

CENTRAL PROCESSORS

GENERAL: The Series/1 family is available in two processor models, each with an A and B version. Both models are 19-inch rack-mountable processors with optional data processing I/O, sensor I/O, and communications capabilities. An I/O feature attachment card provides the attach- ▶

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▷ and may desire to perform systems integration and develop a tailored control program. Such users are primarily interested in multiple systems deployed to locations performing essentially the same applications."

There are four members of the Series/1 family of 16-bit general-purpose processors. The four minicomputers (or, in IBM's terms, "small computers") are based on two microprocessor-based CPU's, the 4953 (Model 3) and the faster 4955 (Model 5). The 4955 is about three times faster than the 4953, due to more and improved microcoding and faster memory (660 nanoseconds for the 4955 and 800 nanoseconds for the 4953). According to IBM, the average instruction execution time (weighted) is 11.8 microseconds for the 4953 and 3.9 microseconds for the 4955.

Model 3 computers can address up to 64K bytes of memory, while Model 5 computers can support up to 128K bytes through optional mapping hardware. Storage protection is included on the 4955, and optional floating-point hardware is also available. Neither of these features is offered for the Model 3.

The Model 3A is housed in a "half-rack" chassis (one-half the width of a standard rack) and has four slots for either memory modules or I/O interfaces. The Model 3B is housed in a full-width chassis and has 13 slots for either memory modules or I/O interfaces. With 16K bytes of memory, the Model 3A is priced at $4,360 and the Model 3B at $5,190. Additional memory for these two models costs $1,800 per 16K-byte module.

The Model 5A is intended for systems that are not expected to exceed 64K bytes, while the Model 5B is for systems that will require up to 128K bytes of memory. In the Model 5's, unlike the Model 3's, memory and I/O controller modules cannot be intermixed; previously configured slots are required for each type. The Model 5A comes with eight I/O slots and three memory slots, while the Model 5B has only three I/O slots and seven add-on memory slots. The remaining slot in the Model 5B is for the storage address relocation translator (map).

As in the Model 3's, the basic configuration of each Model 5 system includes one 16K-byte memory module. The price for either the basic Model 5A or Model 5B is $6,165, and additional 660-nanosecond, 16K-byte memory modules cost $2,040 each. The map module for addressing above 64K bytes is priced at $805, and the floating-point feature costs $1,190.

Configurations requiring additional I/O slots can be implemented through 14-slot I/O expansion units. On systems delivered prior to March 31, 1977, a maximum of two I/O expansion units can be added to a Model 3, and a maximum of three to a Model 5. All systems delivered after this date will be capable of accepting up to five expansion units, and systems previously delivered will be altered at no charge. ▷

▶ ment between the Series/1 processor and the I/O devices. Multiple feature cards can be used in a system, and each card may address from 1 to 16 I/O devices, depending on the type of card being used.

The Series/1 Model 3A processor is a one-half-width unit with four slots for either I/O feature or memory cards. The Model 3B processor is a full-width unit with 13 slots for either I/O feature or memory cards. The Model 5A and 5B processors are both full-width units and include storage protection as a standard feature. The Model 5A has eight I/O feature slots, and the Model 5B has three. Conversely, the Model 5A has three add-on memory slots, and the Model 5B has seven. All Series/1 processors provide a basic 16K bytes of MOSFET memory, a basic console, power failure detect/auto restart, a self-contained power supply, and four priority interrupt levels.

REGISTERS: Each Series/1 processor has one Interrupt Mask Register (IMR) and one Processor Status Word (PSW). Each of the four priority interrupt levels has eight general-purpose registers, one Instruction Address Register (IAR), and one Level Status Register (LSR). The Model 5 processor also has one Address Key Register (AKR). All of the above are 16-bit registers. Optionally, the Model 5 processor can also have four 64-bit floating-point registers installed per level.

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

INSTRUCTION REPERTOIRE: The Series/1 Model 3 processor has 168 instructions available; the Model 5 has 177 instructions. The floating-point processor option, available on Model 5 only, adds 30 instructions to the basic instruction set to handle single- and double-precision floating-point arithmetic.

INSTRUCTION TIMINGS: The instruction timings shown below are typical execution times. When address modification is used, two words are appended to the instruction and contain a displacement to be added to a base register. Register-to-storage instruction times assume the destination is a register, and no indirect addressing or Storage Address Relocation Translator usage is assumed. Execution times are in microseconds for 16-bit, fixed-point operands.

	Model 3	Model 5
Load/store	5.40	2.42
Add	8.40	2.64
Subtract	9.00	2.64
Multiply	13.20	10.78
Divide	15.60	17.16
Branch on condition	4.20	1.54
Move byte field	5.40+CT*	1.45+CT*

*CT is the count of the last byte moved. For the Model 3 add 8.40 microseconds to each value in this instruction, and for the Model 5 add 1.54. ▶

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▷ Peripherals for the Series/1 systems include 9.3-megabyte, Winchester-type disk storage modules with a 123K-byte fixed-head option; diskette drives; a new 1920-character CRT display station; a 120-cps dot-matrix printer; eight different synchronous or asynchronous communications interfaces; and eight different sensor I/O modules for data logging or process control applications.

The disk units for the Series/1 systems are offered in four models that deserve particular attention. The basic 4962 Model 1 disk subsystem includes a nonremovable 9.3-megabyte disk storage module with heads and medium contained in an integral protected assembly. Model 1F adds 122,880 bytes of fixed-head storage to the basic 9.3-megabyte storage capacity. Model 2 starts with the 9.3-megabyte storage module and also incorporates a diskette (floppy disk) drive in the same cabinet. Model 2F simply adds the 122,880 bytes of fixed-head storage to the Model 2 storage module. Separate attachment modules are required for disk storage modules and diskette units. Each attachment module (controller) can support one unit.

The diskette unit for the Series/1 features a two-sided flexible diskette that can be used to transfer data or to load programs into the system. Depending on the data format used, the diskette has a capacity of 492K, 568K, or 606K bytes. All diskette operations are microprocessor-controlled. Extensive diagnostics, along with cyclic redundancy checking, are standard.

The printer offered with the Series/1 is a table-top unit with a wire-matrix print head. Printing is performed at 120 characters per second, bidirectionally, with a maximum of 132 characters per lines at 10 characters per inch. Using the EBCDIC 63-character set, the Series/1 printer is controlled by a cycle-stealing attachment, and accepts up to 6-part forms.

The Series/1 display station is a table-top unit that serves as a communications link between the user and the system. It provides image display of data transmitted to and from the processor. The display station enables the user to enter, modify, or delete data on the display, and to cause the revised display to be returned to the processor for storage or additional processing. The display screen is a 12-inch CRT with a capacity of 1920 characters arranged in a format of 24 lines of 80 characters each. The display attachment provides a 1920-character buffer. The display station keyboard design is similar to that of a typewriter, and is arranged in four different keygroups: shift/lock keys, graphic alphanumeric, local function, and interrupt request.

Series/1 communications interfaces include asynchronous, binary synchronous (bisync), and SDLC single-line units, asynchronous 4-line and 8-line multiplexers, and synchronous 4-line and 8-line multiplexers.

The Series/1 sensor input/output unit is housed in a "half-width" chassis and contains space for up to eight sensor input/output feature attachment cards. These ▷

▶ INTERRUPTS: Series/1 processors have four pre-emptive priority interrupt levels. Associated with each level is a bank of general registers and status registers. Each bank consists of eight general registers, a Level Status Register (LSR), an Instruction Address Register (IAR), and, for the Model 5 processor only, an Address Key Register (AKR). When switching between levels, the hardware automatically preserves the information contained in the interrupted-from level. Level switching can occur automatically upon acceptance of an I/O interrupt request or under program control.

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

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

PROCESSOR MODES: The Series/1 models recognize either a user mode of program execution or a supervisor mode. The supervisor mode is entered when a Supervisor Call (SVC) instruction is executed, when a console or class interrupt occurs, when an I/O interrupt is accepted, and at IPL time.

PHYSICAL SPECIFICATIONS: The Series/1 processors are housed in 14-inch-high chassis. The Model 3A processor is 8½ inches wide, 20¾ inches deep, and weighs 30 pounds. The Model 3B, 5A, and 5B processors are 19 inches wide, 18¾ inches deep, and weigh 50 pounds. All units require 115 or 230 VAC, ±20 percent, at 47 to 63 Hz, and are usable internationally. Recommended operating environment is 75 degrees F.

INPUT/OUTPUT CONTROL

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

The processor I/O channel directs the flow of information between I/O devices and main storage, and contains the facilities for control of the I/O operations. The I/O channel is an asynchronous multidropped channel that links the processor to its external resources. It consists of address, control, and data lines. Device service through the processor I/O channel can occur as a cycle steal or as a Direct Program Control (DCP) operation.

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

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

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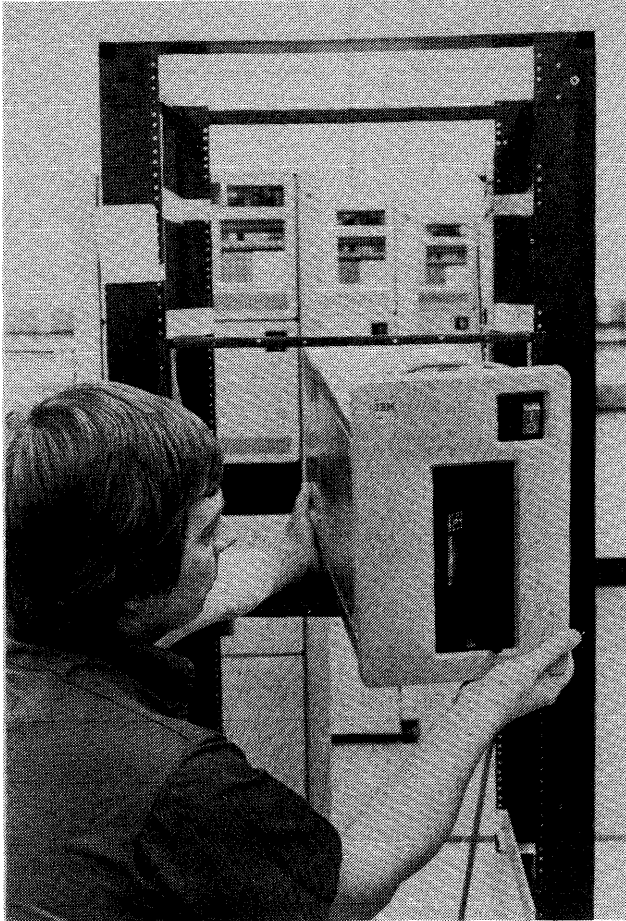
A Series/1 diskette unit, capable of storing up to 606K bytes of data, is fitted into an EIA standard 19-inch rack.

▷ **CONFIGURATION RULES**

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

MASS STORAGE

4962 DISK STORAGE UNIT: Contains a nonremovable disk with a capacity of 9,308,160 bytes. Optionally, eight fixed heads can add 122,880 bytes of storage capacity. Access time averages 40 milliseconds, and average rotational delay is 20.2 milliseconds. Data transfer rate is 889,000 bytes per second. The 4962 operates in a cycle-steal mode and supports multiple-sector transfers. Attachment to the processor is through a 1K-byte buffer.

There are four models of the 4962. All models have a basic storage capacity of 9.3 million bytes under movable read/write heads. Models 1F and 2F have the basic capacity of 9.3 million bytes plus an additional 122,880 bytes under fixed heads. Models 2 and 2F include a diskette drive that employs a removable two-sided diskette having a maximum formatted capacity of 606,208 bytes. The operating characteristics of the diskette drive contained in Models 2 and 2F are identical with those of the 4964 Diskette Unit.

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

INPUT/OUTPUT UNITS

4974 PRINTER: A table-top printer with a wire-matrix print head, the 4974 prints a maximum of 132 characters per line at 10 characters per inch. All printing is performed at 120 characters per second, bidirectionally. The printer connects to the 4974 attachment card, which is located either in the Model 5 processor or in the I/O expansion unit.

The 4974 is controlled by a cycle-stealing attachment, prints six lines per inch, suppresses unprintable characters, and uses an EBCDIC 64-character set. The printer accepts up to six-part cut, multicut, or continuous forms. A forms tractor unit is provided for margin-punched forms.

4979 DISPLAY STATION: A table-top unit that serves as a communications link between the user and the Series/1 system, the 4979 provides CRT displays of data transmitted to and from the processor. The display station keyboard enables the user to enter, modify, or delete data on the display, and to cause the revised display to be returned to the processor for storage or additional processing. Manual operations are performed by keying characters from the keyboard into the display. The screen is used to display all actions.

The 4979 Display Station connects to the 4979 attachment card, which is located either in the Model 3 or Model 5 processor or in the I/O expansion unit.

The 4979 has two basic components: the display screen and keyboard. The display screen is a 12-inch CRT with a ▶

▷ cards can provide a variety of digital and analog input and output capabilities. The sensor unit enables analog input, analog output, digital input/process interrupt, and digital output.

Programming support for the Series/1 consists of the Base Program Preparation Facilities and the Stand-Alone Utilities. The program preparation facilities include a text editor, macro assembler, and linkage editor. The utilities include routines for such functions as diskette and disk initialization, copy, dump, patch, automatic system build, and system verification. In addition, Control Program Support is available to provide supervisory services for program control, selected peripheral support at the read/write level, and IPL loaders for disk and diskette.

All data transfers to and from the Series/1 systems are on a cycle-steal basis. The communications features allow for manual dialing and manual or automatic answering on switched lines. The Binary Synchronous Communications Single-Line Control provides the ability to IPL the processor from a remote system. The Asynchronous Communications Single-Line Control and Asynchronous Communications 4-Line Adapter can be locally attached ▷

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▷ to appropriate asynchronous terminals by means of the appropriate attachment cables.

Other attachment feature cards can be mounted in the I/O slots of the processor or the I/O expansion unit to provide for the attachment of user equipment to the Series/1. These include:

● A teletypewriter adapter that provides the means to attach a serial I/O device such as a Teletype ASR 33/35 or equivalent.

● An integrated digital I/O adapter that contains 32 points of DI/PI and 32 points of DO, with external sync and ready lines for each 16-bit group.

● A timer feature that provides 16-bit timers with selectable internal or external time bases for use as interval timers, pulse counters, or pulse duration counters.

● A customer direct program control adapter that permits attachment of up to 16 customer-supplied input/output devices or subsystems.

As IBM has stated, the target market for the Series/1 computers is sophisticated, large-volume end users who can develop their own software. Industry experts interpret this to mean primarily the growing distributed processing market, toward which a number of large corporations are already moving and which many more are investigating. One recent industry study predicts that the market for distributed computing systems in the U.S. will exceed $5.6 billion by 1980—17 percent of the total quantity of U.S. computer system shipments.

Considering the fact that IBM already has its foot in the door of most of the large corporations, and that most of these large users already have the in-house expertise to design and develop the necessary software, the Series/1 market appears ready-made. Those users who may be somewhat reluctant will be heartened by statements from IBM spokesmen about the company's "total commitment" to the Series/1 program, and the knowledge that IBM "would entertain accommodating an RPQ" to develop user-designed interfaces for special equipment and other manufacturers' mainframes.

IBM has stated that the "Series/1 will be marketed by a special sales force in conjunction with IBM's Data Processing Division and GSD marketing organizations," and that the sales organization will be "working on a referral basis." Keeping in mind that IBM usually does its homework and that the company is basically a retailer, not a wholesaler as are the big minicomputer vendors, we don't look for many serious confrontations between IBM and companies such as DEC, Hewlett-Packard, and Data General at this time. The Series/1 is not a number cruncher, but it has a powerful instruction set designed for data processing and data collection. Couple this with a ready-made customer base and the IBM marketing ▷

▶ capacity of 1920 characters arranged in a format of 24 lines of 80 characters each. The display's attachment provides a buffer for storing data; the capacity of the buffer is the same as the character capacity of the screen. Through programming, all key entries are displayed as they are stored and can be altered as desired before they are sent to main storage. Characters displayed consist of dots generated in a pseudo 7-by-7 dot matrix on a raster CRT-scanned screen.

The 4979 Display Station keyboard design is similar to that of a typewriter. The alphanumeric, punctuation, and special character keys form the main body of the keyboard, with special control keys on each side. The keyboard is arranged in four different keygroups: shift/lock keys, graphic alphanumeric, local function, and interrupt request.

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

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

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

COMMUNICATIONS CONTROL

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

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

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

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

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

> know-how, and it's likely that many of the "small business system" vendors will find that their market has suddenly become a lot tougher.

IBM has elected to play in its own backyard for a while—and it appears big enough to provide ample sales opportunities for the Series/1 until all the facilities are thoroughly checked out. But, like the little guy next door, IBM's minicomputer forces will soon outgrow the swings and seesaws in their own backyard and be ready for shoulder pads and hockey sticks, and eager to mix it up with the big guys who are already established in the minicomputer hardware industry.□

▶ **2090 SYNCHRONOUS DATA LINK CONTROL (SDLC) SINGLE-LINE CONTROL:** Provides circuitry for controlling one half-duplex line, operating at a speed of up to 9600 bits per second. Operates as either a primary or secondary station. The ability to IPL from a host system is not provided.

SOFTWARE

Programming support for the Series/1 consists of the Base Program Preparation Facilities and the Stand-Alone Utilities. The program preparation facilities include a text editor, macro assembler, and linkage editor. The utilities include routines for such functions as diskette and disk initialization, copy, dump, patch, automatic system build, and verification. In addition, Control Program Support is available to provide supervisory services for program control, selected peripheral support at the read/write level, and IPL/loaders for disk and diskette.

BASE PROGRAM PREPARATION FACILITIES: The three BPP facilities are the text editor, macro assembler, and linkage editor. These programs are individually loaded by the user from disk storage. Then, a message is written to the operator station requesting the name or the sector address of the program to be loaded. All IBM-provided programs can be loaded by name or sector address. After the program is loaded, it prompts the operator to supply any necessary input.

The text editor is used to create and modify source statements that can be used as input to the macro assembler. The listing can be directed to either the operator station or the printer.

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

The linkage editor is used to combine and link relocatable object modules into a single, non-relocatable load module with all cross-references resolved. The load module is then placed on disk. All executable programs must be in load module format. The linkage editor does not provide an overlay capability.

STAND-ALONE UTILITIES: The stand-alone utilities allow the user to maintain his program preparation system. The utilities and their functions follow:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

PRICING

The Series/1 is offered on a purchase-only basis, at prices ranging from $10,000 to $100,000 depending on configuration. Purchase prices include installation and a three-month parts and labor warranty. On-site physical planning is separately priced. On-site support for the Stand-Alone Utilities is provided by a GSD CE at no additional charge.

IBM Series/1

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

EQUIPMENT: The Series/1 is not currently available in "packaged" or specially configured systems. Each component is offered on an individually priced basis; thus, the actual price for any particular system is the sum total of every configured unit. The following configurations are offered as guidelines to show a price range, and are not necessarily "typical" systems. Prices below do not include maintenance.

SERIES/1 POWER CONTROL SYSTEM: Includes rack, 4953A processor, 16K bytes of memory, diskette unit, diskette attachment, timers, teletypewriter adapter, and integrated digital input/output and rack mounting fixture. Purchase price is $10,380.

SERIES/1 STORE CONTROLLER/CONCENTRATOR: Includes rack, 4955A processor, 48K bytes of memory, 9.3-million-byte disk unit with fixed heads (122,880 bytes additional capacity) and diskette unit, 4979 Display Station and attachment, 4974 Printer and attachment, asynchronous 8-line control and two 4-line adapters, floating point, communications power, programmer console, and binary synchronous single-line control (high-speed). Purchase price is $34,645.■

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
PROCESSORS/FEATURES			
4953A	Processor; half-width module, 16K bytes of memory, 4 I/O feature or storage slots	$4,360	$80.00
4953B	Processor; full-width module, 16K bytes of memory, 13 I/O feature or storage slots	5,190	78.00
6315	Storage Addition for 4953 Processors; 16,384 bytes	1,800	10.00
4955A	Processor; full-width module, 16K bytes of memory, 8 I/O feature slots	6,165	77.00
4955B	Processor; full-width module, 16K bytes of memory, 3 I/O feature slots	6,165	77.00
6325	Storage Addition for 4955 Processors; 16,384 bytes	2,040	8.00
4959	Input/Output Expansion Unit	2,515	37.00
1590	Customer Access Panel	180	1.00
1593	Customer Access Panel—Integrated DI/DO cable	385	.50
1594	Customer Access Panel—DPC Adapter Cable	270	.50
1560	Integrated Digital I/O, Non-isolated	825	14.00
1565	Channel Repower	520	2.00
1595	Channel Socket Adapter	73	.50
1610	Asynchronous Communications Single-Line Control	1,090	17.00
1999	Battery Backup Unit	1,895	18.00
2000	Communications Indicator Panel	250	3.00
2010	Communications Power	120	3.00
2055	Teletypewriter Cable	52	.50
2056	Asynchronous Local Attachment	47	.50
2057	EIA Dataset Cable	70	.50
2058	BSC/HS Cable	125	.50
2059	Teletypewriter Customer Access Panel Cable	40	.50
2074	BSC Single-Line Control	1,190	19.00
2075	BSC Single-Line Control, High Speed	1,380	21.00
2090	SDLC Single-Line Control	1,420	19.00
2091	Asynchronous 8-Line Control	975	13.00
2092	Asynchronous 4-Line Adapter	1,005	30.00
2093	BSC 8-Line Control	1,215	13.00
2094	BSC 4-Line Adapter	1,245	35.00
3920	Floating Point	1,190	11.00
4540	Rack Mounting Fixture	55	NC
5430	Customer Direct Program Control Adapter	660	11.00
5650	Programmer Console	460	6.00
6335	Storage Address Relocation Translator	805	9.00
7840	Timers	570	4.00
7850	Teletypewriter Adapter	560	11.00
4997	Rack Enclosures:		
	Model 1A	870	2.00
	Model 2A	1,160	5.00
	Model 1B	1,025	2.00
	Model 2B	1,315	5.00

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
PERIPHERAL UNITS/FEATURES			
4962-1	Disk Storage Unit; 9,308,160-byte disk	6,895	44.00
4962-1F	Disk Storage Unit; 9,308,160-byte disk with 8 fixed heads having an additional 122,880-byte capacity	7,760	60.00
4962-2	Disk Storage Unit; 9,308,160-byte disk with 492,544-byte diskette unit identical in function to the 4964 diskette unit	8,575	60.00
4962-2F	Disk Storage Unit; 9,308,160-byte disk with 8 fixed heads having an additional 122,880-byte capacity, plus a 492,544-byte diskette unit identical in function to the 4964 diskette unit	9,440	76.00
3580	4962 Attachment	815	8.00
4964	Diskette Unit; 492,544-byte capacity	2,410	17.00
3581	4964 Attachment	730	8.00
4974	Printer; 120 cps	2,790	34.00
5620	4974 Attachment	930	3.50
4979	Display Station	1,735	25.00
3585	4979 Attachment	955	10.00
4982	Sensor I/O Unit	1,655	11.00
6305	4982 Attachment	650	11.00

SOFTWARE PRICES

	Monthly License Fee (for 24 months)
Control Program Support	$15.50
Base Program Preparation Facilities	$90.00