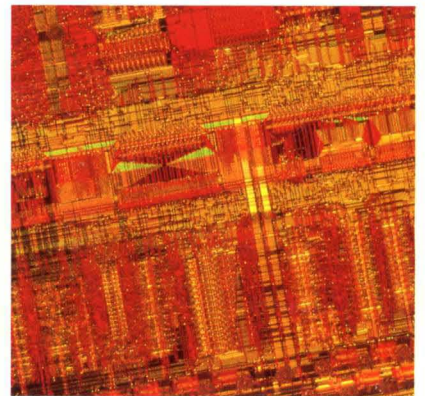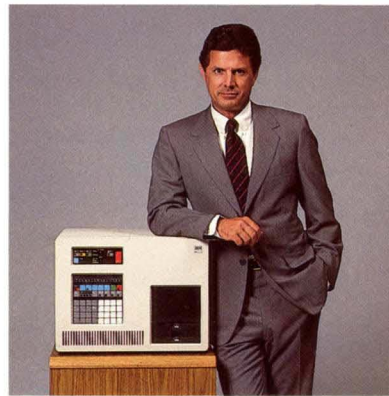# Series/1
Digest

Series/1
Digest

Twelfth Edition (March 1987)

This is a major revision of, and obsoletes, G360-0061-10. Information for Series/1 products and services is included as of January 1987. Prices for these products are in the IBM *Series/1 Pocket Digest*, GX34-0104. Changes will be periodically made to the information herein; any such changes will be reported in subsequent revisions or supplements.

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The term network has at least two meanings. A *public network* is a network established and operated by common carriers or telecommunications administrations for the specific purpose of providing circuit-switched, packet-switched, and nonswitched-circuit services to the public. A *user application network* is a configuration of data processing products (such as processing units or work stations) established and operated by users for the purpose of data processing or information exchange; such a network may use transport services offered by common carriers or telecommunications administrations. *Network*, as used in this publication, refers to a user application network.

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1 Executive overview

Chapter 1. Executive overview

This publication presents a comprehensive view of the Series/1 computing family, its programming, and support services.

This overview introduces you to the Series/1 features and functions, and summarizes the information that is detailed in subsequent chapters.

Introduction
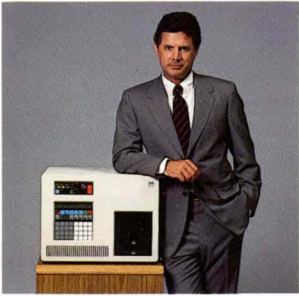
The IBM Series/1 is a family of low-cost, high-performance, small computers widely known for their price/performance, configuration flexibility, and communications capabilities. These computers are designed to handle general-purpose, commercial, and sensor-based applications in a multiprogramming environment.

Series/1 offers a modular approach to computing—an approach you can tailor to match your needs for equipment, programs, and services.

The Series/1 hardware menu offers a variety of standard rack-mounted and free-standing processing units, fixed and removable storage media, fast and efficient input/output attachments, plus attachment features that allow you to attach a wide range of non-IBM terminals and equipment.

With its powerful architecture, Series/1 can handle a variety of applications efficiently and effectively. This architecture includes:

- An efficient cycle-steal channel for servicing input/output devices

- Microprocessor device control for reducing the channel burden for most I/O units

- A comprehensive interrupt structure for high response and minimum overhead

- An extensive instruction set that provides flexibility for a variety of applications.

Series/1 I/O architecture contains a system interface of high functional content and integrity. Up to 256 individually addressable I/O devices (both standard and custom-built) may be attached to a Series/1 system.

Series/1 software offers an extensive choice of systems programs and productivity tools. Programmers can select and implement only those functions needed to meet their application needs.

You can choose from two primary full-function operating systems: the Realtime Programming System (RPS) or the Event Driven Executive (EDX). In addition, Control Program support is available for those who wish to develop applications with a tailored control program.

A wealth of application programs from both IBM and non-IBM sources is available to address many of your specific operational requirements. High-level languages can support diverse application requirements, such as transaction processing, commercial jobs, and sensor-based data handling.

Series/1 hardware and software are available to meet a broad range of requirements for communications with host systems, other Series/1's, printers, and terminals (including the IBM Personal Computer). A number of specific program tools are available for unique system requirements.
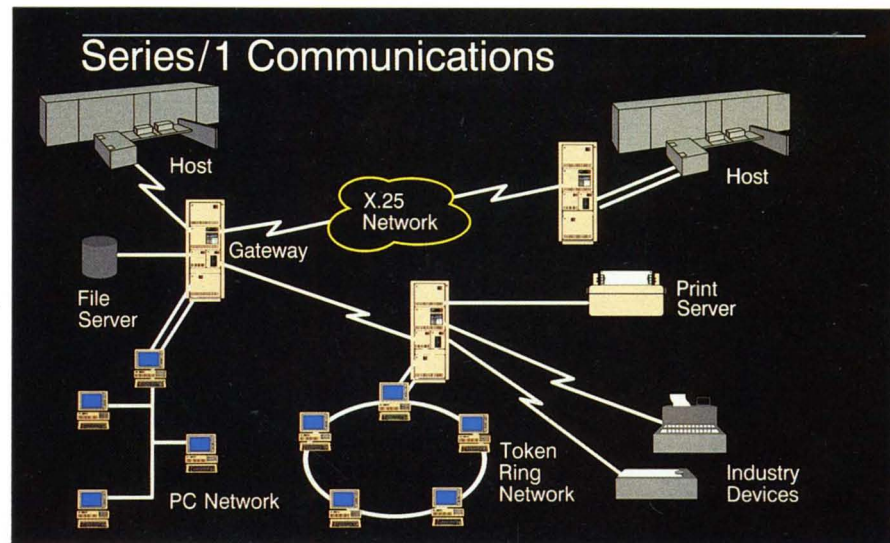
Whenever you acquire a Series/1 computer, you gain an added value—dependable, efficient service when and as you need it.

This service capability rests on IBM's commitment to reliability, availability, and serviceability. IBM service starts with the designer at the drawing board, and includes strict quality control procedures in product development and manufacture, plus a variety of training and diagnostic tools. In the event of a problem, skilled IBM Customer Engineer can provide service around the clock from a nationwide network of service support locations.

Series/1 architecture
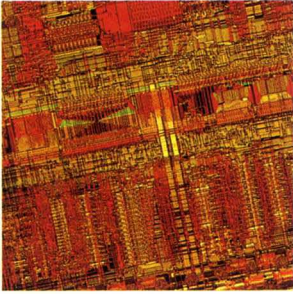
Series/1 hardware and internal architecture have been designed to meet the performance and reliability levels necessary for demanding realtime and sensor-based operations.

Bipolar LSI[1] and CMOS[5] logic circuitry are used extensively in the Series/1. They consume little power and are fast, reliable, and compact. SAMOS[2], NMOS[3], or MOSFET[4] N-channel storage provides fast access and processing power comparable to much larger computers.

The 16-bit processor architecture provides a comprehensive range of instructions, multiple addressing modes, efficient use of storage and a powerful priority interrupt structure.

Series/1 logic cards offer considerable flexibility in the choice of terminal devices, and digital and analog connections to initiate and control activities and processes. The attachment cards plug into the data channel, allowing ease of change and servicing.

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[1]   Large-scale integration.

[2]   Silicon aluminum metal-oxide semiconductor.

[3]   N-channel metal-oxide silicon.

[4]   Metal-oxide semiconductor field-effect transistor.

[5]   Complementary metal-oxide semiconductor.

Series/1 processors and features

A choice of compatible processors, available in several models, allows for nondisruptive expansion of your computing facilities, and they are flexible enough to accommodate your requirements now and in the future.

All processors have a basic operator console (the Series/1 System Units use a *soft* console via the keyboard), an optional programmer's panel, power failure/restart, base power, four priority interrupt levels, and a powerful instruction set. Using new technologies, the processor, storage, address relocation translator function, and clock/comparator are combined on a single processor card.

The 4956 processors are upward compatible with the 4954, with enhancements to support more demanding computing requirements. Additional processor features include *read-only* storage protection and floating-point (with 30 instructions and four 64-bit registers per level). The 4956 also provides single-bit correction and double-bit detection for storage errors (ECC).

The processors offer a choice of storage size and attachment possibilities. Standard processor storage is available from a minimum of 64 kilobytes (1 kilobyte = 1024 bytes) to 2048 kilobytes. Processor average instruction times range from approximately 7.4 microseconds to 1.53 microseconds.

Processor selection depends on individual job requirements. For example, the more powerful and internally faster 4956 processor might be used to handle program development or complex operations when more than one program is active, or for fast data transfer operations. A desk-top Series/1 System Unit, on the other hand, might be used for remote computer installations in a distributed data processing environment, or where the emphasis is on batch or single application use.

I/O devices are attached through I/O feature cards installed in the processor or optional I/O expansion unit. Up to 256 individual devices, both standard and custom-built, may be addressed by the Series/1. With the exception of printers, display stations, and System Units, all Series/1 units fit into an IBM 4997 Rack Enclosure or EIA[6] standard 19-inch rack.

An optional customer access panel provides quick-disconnect for a timer, a teletypewriter, and connectors for four integrated digital input/digital output or customer direct program control features.

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6   Electronics Industries Association.

Series/1 offers a choice of communication capabilities to allow wide flexibility. Communication features are contained in feature cards that plug into the processor data channel or the 4987—a programmable communications unit. Three line disciplines may be used—binary synchronous communications (BSC), asynchronous communications control (ACC), and synchronous data link control (SDLC). In addition, a high-speed Local Communications Controller allows multiple Series/1's to be attached on a ring in a peer-to-peer relationship.

SDLC and BSC communication can support sophisticated communications links, including system-to-system and system-to-host-computer, with the Series/1 acting as a terminal or device network controller. BSC single line also allows the user to perform an initial program load (IPL) of the Series/1 from a remote host. ASCII communication is supported for connection of inexpensive terminals like the IBM 3161 or 3163 ASCII Display Stations.

Ring-connected processors offer the basis for a variety of applications including distribution of functions and sharing of data among autonomous applications.

These communication capabilities can be used independently or simultaneously to enable the user to choose the processors, connection method, and devices best suited to a particular application.

Series/1 I/O and system support units

Series/1 I/O devices include disk and diskette units, magnetic tape units, line and matrix printers, and display stations. Many of the attachment features for these devices are equipped with cycle-stealing microprocessor controllers that permit device overlapping and reduce processor workload.

The versatility of your 4956 configuration may be expanded through I/O feature locations in the 4959 Input/Output Expansion Unit and/or the 4965 Storage and I/O Expansion Unit. (The Series/1 System Units contain integrated disks and diskettes.)

Two types of direct access storage are available with Series/1: high-speed, large-capacity, fixed-disk storage and inexpensive, removable-diskette storage.

The 4963 Disk Subsystem and the 4967 High Performance Disk Subsystem offer storage capacity ranging from 58 million bytes up to 358 million bytes per unit. A cache feature offers the potential of significant disk throughput improvement. Cache is standard on the 4967, 4965 Model E00, and 4956 Models G10, H10, and J00; it is optional on the integrated disks of the 4965 Model 60D and 4956 Models 31D, 61D, and E70. A cache function is provided by the software for the Series/1 System Units.

With the 4964 Diskette Unit and the 4965 Storage and I/O Expansion Unit, you have an easily usable and flexible means of storing and distributing data and programs.

The 4968 Autoload Streaming Magnetic Tape Unit is a high-performance, large-capacity, full-function streaming magnetic tape unit. The 4968 provides for fast, convenient save/restore of data on medium-to-large disks. A 200-megabyte disk can be saved on three reels of tape in approximately 30 minutes. The autoload function makes tape handling easy even for an inexperienced operator.

The 5225 and 5262 printers are line-impact printers that are especially suited for heavy duty printing requirements, such as the production of lengthy report listings, daily work status printouts, and batch listings of daily transactions.

The 4224, 4975, and 5224 are tabletop matrix printers capable of producing high-quality printouts and accepting multipart paper. The 4224 and 4975 offer an option of printing correspondence-quality output including proportional spacing. You can define the character sets you need for particular jobs. Typical uses might include printed reports on the status of an operation, messages from a remote terminal, invoices, packing lists, and letters.

The 5219 is a tabletop serial-impact printer that provides letter-quality printing, extensive type-style selection, and a choice of continuous forms or cut-sheet paper feeding.

The 4201 Proprinter and the 4202 Proprinter XL are available for use with the Series/1 System Unit. In addition, they can be used as low-cost system printers for the Event Driven Executive Operating System.

Display station options underline the versatility of Series/1. The 316X ASCII Display Stations provide low-cost ASCII devices suitable for many applications requiring local or remote terminals. Custom graphics and a choice of keyboards distinguish the 4978 Display Station. All are tabletop units, accommodating a maximum of 1920 characters on the display screen.

The 5230 Data Collection units record data, which can vary from time recording to a comprehensive system for cost and work status accounting.

With the 4982 Sensor Input/Output Unit, Series/1 can control a wide range of sensor-based or event-driven applications, such as machine status reporting or alarm/contact sensing (digital signal), and temperature and voltage measurements (analog signal).

The 4987 Programmable Communications Subsystem provides power and control facilities for expanded communications versatility in the Series/1. The subsystem has the capacity for multiple line disciplines in a single communications unit and can provide a cost alternative for the user of large numbers of communications lines.

The 4993 Series/1-System/370 Termination Enclosure and its companion channel attachment feature allow a Series/1 to be channel-attached to IBM System/370 for high-speed data transfer. The Series/1-to-Personal Computer Channel Attachment feature allows Series/1 to be an effective gateway and server system in an IBM Personal Computer network. Series/1 modular units may be mounted in the IBM 4997 Rack Enclosure or EIA standard 19-inch rack. IBM offers four models of rack enclosures, in two sizes, with either plain or decorative filler covers. A primary power-distribution system is included.

Until now, we've looked only at hardware—its power, modularity, and sophistication. But Series/1 hardware is complemented by programming support and high-level languages that emphasize efficient and productive use of your Series/1.

IBM Series/1 programming support

Programming that offers a wide range of support is available for the Series/1:

- Operating systems that support batch, transaction driven, communications, and realtime applications

- Programs for preparing application programs to execute under control of an IBM operating system or under a specialized operating system

- BASIC, COBOL, FORTRAN, Pascal, and PL/I high-level language support

- Modules that provide I/O device support and other supervisory control functions for building an operating system and applications

- Programming packages for such needs as energy management, intelligent data entry, and text entry.

IBM Series/1 support services

The IBM commitment to your equipment and programming does not end with a parts and labor warranty—it is just beginning.

You can choose one of several maintenance plans, matching your selection to your requirements and your budget.

Skilled IBM customer service representatives are backed by a country-wide parts distribution network that locates the nearest parts and gets them to you quickly. Customer engineers are equipped with a variety of portable diagnostic tools to help pinpoint faults rapidly. Programming support advice and assistance in development and writing of tailored operating systems and application programs are provided, as available under a systems engineering contract. IBM education and training courses are available if you need them, to help you get the most from your Series/1 with the least delay. There are courses for different levels of personnel, including systems support, programming, and operation staff. A range of training courses includes classroom teaching and self-study, a method by which a student works at his or her own pace.

Series/1 is a "mix and match" system. You determine the modules you require — equipment, programming, and service. The combinations are practically unlimited.

Note: Additional information about the Series/1 product line is in the *IBM Series/1 Pocket Digest*, GX34-0104. The Pocket Digest contains the Series/1 prices and examples of Series/1 configurations, which were formerly published in this Digest.

2 Series/1 architecture
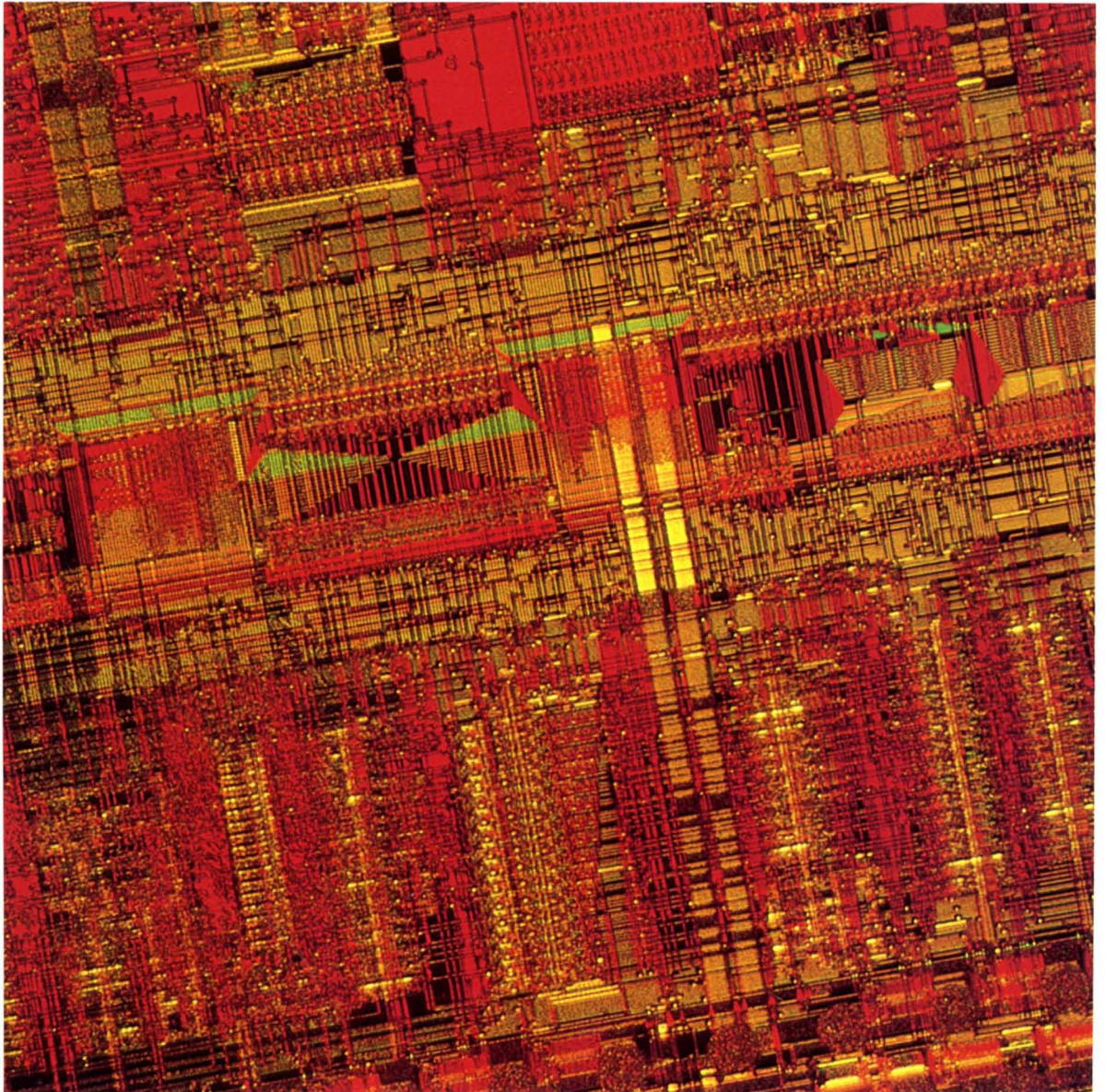
Chapter 2. Series/1 architecture

The 16-bit processor architecture of the Series/1 provides a comprehensive range of instructions, multiple addressing modes, efficient use of storage, and a powerful priority interrupt structure.

With the Series/1, you have considerable flexibility in systems building, because the architecture is open-ended and not tied to any particular task, job, or device.

And the structural and logical stability enables you to adapt a system more easily to your changing requirements.

Note: The architecture of the Series/1 System Unit is similar to the architecture of the 4956, although there are minor differences. This chapter refers to the 4956 architecture.

Series/1 architecture

The Series/1 architecture supports either small or complex systems requirements. A modular computing system, it is a flexible base on which to build your system and achieve:

- High performance and rich function at an attractive price

- A high standard of reliability and serviceability through the use of proven technology.

System design overview

The Series/1 offers a variety of data processing I/O devices and attachment capabilities that include:

- Sensor I/O equipment

- Communication lines

- Customer devices.

High reliability is designed into the Series/1 through the use of proven technology such as bipolar LSI technology in the processor and MOSFET, SAMOS, and NMOS logic in main storage.

Suitable for applications ranging from conventional data processing to sensor-based applications like energy management, the Series/1 is a comprehensive computer—meeting the needs of installations requiring either a single computer or multiple small computers.

To achieve this flexibility, the Series/1 design is modular and compact—most units fit into an IBM 4997 Rack Enclosure or an EIA standard 19-inch rack. Series/1 components occupy either the full width or a half width in a rack enclosure. And 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. Included in an IBM 4997 Rack Enclosure is a primary power panel for distributing ac power to the individual units installed in the enclosure.

Another option available is a stand-alone unit. Instead of being rack-mounted, the 4956 processors with integrated disk units can be housed in a tabletop Stand-Alone Enclosure (feature number 4520 or 4521).

For greater flexibility, individual I/O attachment features, processor features, and some storage additions are constructed on multilayer printed-circuit cards. These circuit cards can be selectively plugged into sockets on the back panel of certain modular units. By selecting the desired units, and functions, you can tailor a system to your needs.

The processor unit contains the processor card, data channel, processor storage, basic console, a power supply, and card sockets for plugging in processor features, storage additions, and I/O attachment feature cards. When greater I/O capacity is needed, I/O expansion units are available. These units contain both a power supply and card sockets for additional data channel feature cards, and some models include additional disk and diskette capacity.

Expanding the capability of the Series/1 are various input/output devices and attachment features. Attachment feature cards allow attachment of:

- Data processing I/O devices
- Communications lines
- User I/O devices and instruments
- Sensor I/O units.

I/O attachment feature cards and integrated communications feature cards plug into the processor or input/output expansion unit. Attachment features are not necessarily limited to a single function. Some features offer multiple attachment combinations. A programmable communications subsystem also provides for attachment of communications features. Sensor I/O feature cards plug into the sensor I/O unit. In this way, individual devices are attached to the processor and main storage via the data channel, with the channel directing the flow of information.

The following figures are block diagrams of a Series/1 system:

Series/1 System Unit

Series/1 processor

Processor data channel

Series/1 rack-mounted units

I/O devices

Multifunction attachment feature

Communications attachment features

Programmable communications controller feature

Series/1-System 370 channel attachment

System/370

Sensor I/O attachment feature

Series/1-to-PC channel attachment

Channel repower

PCs

Additional data channel features
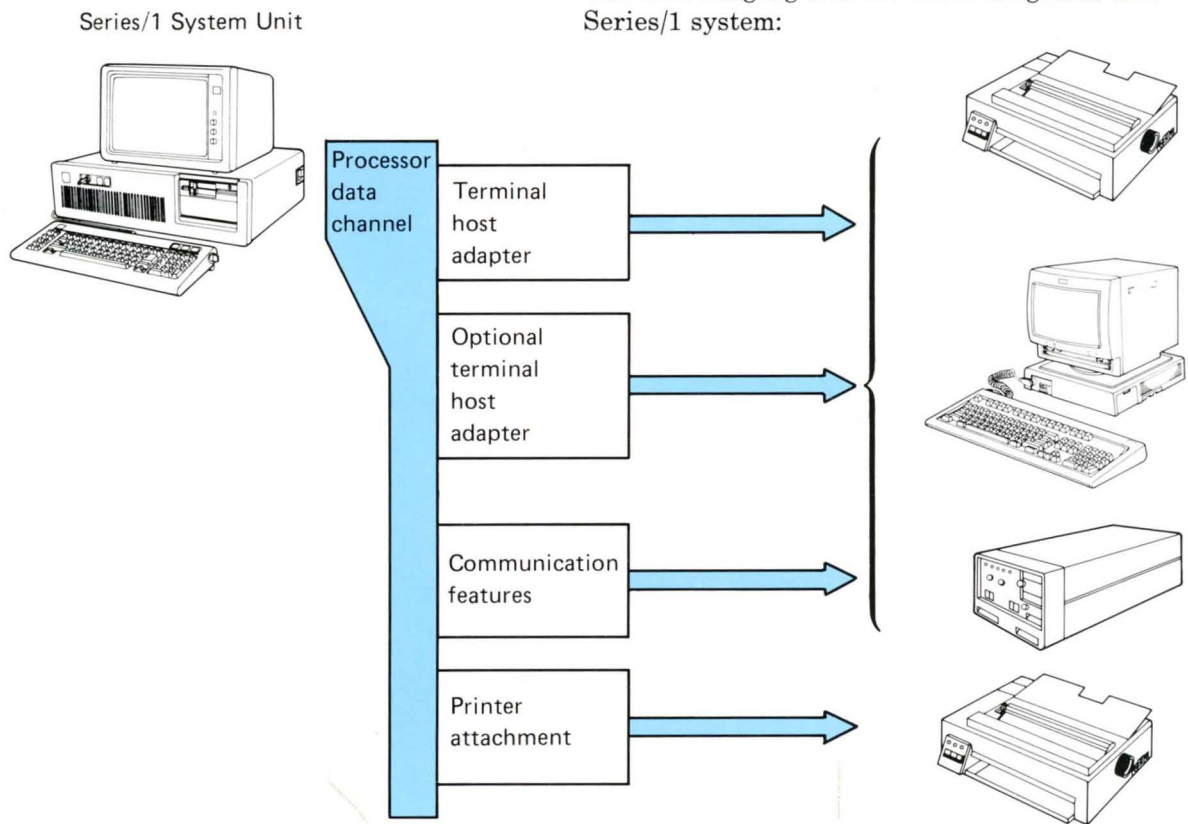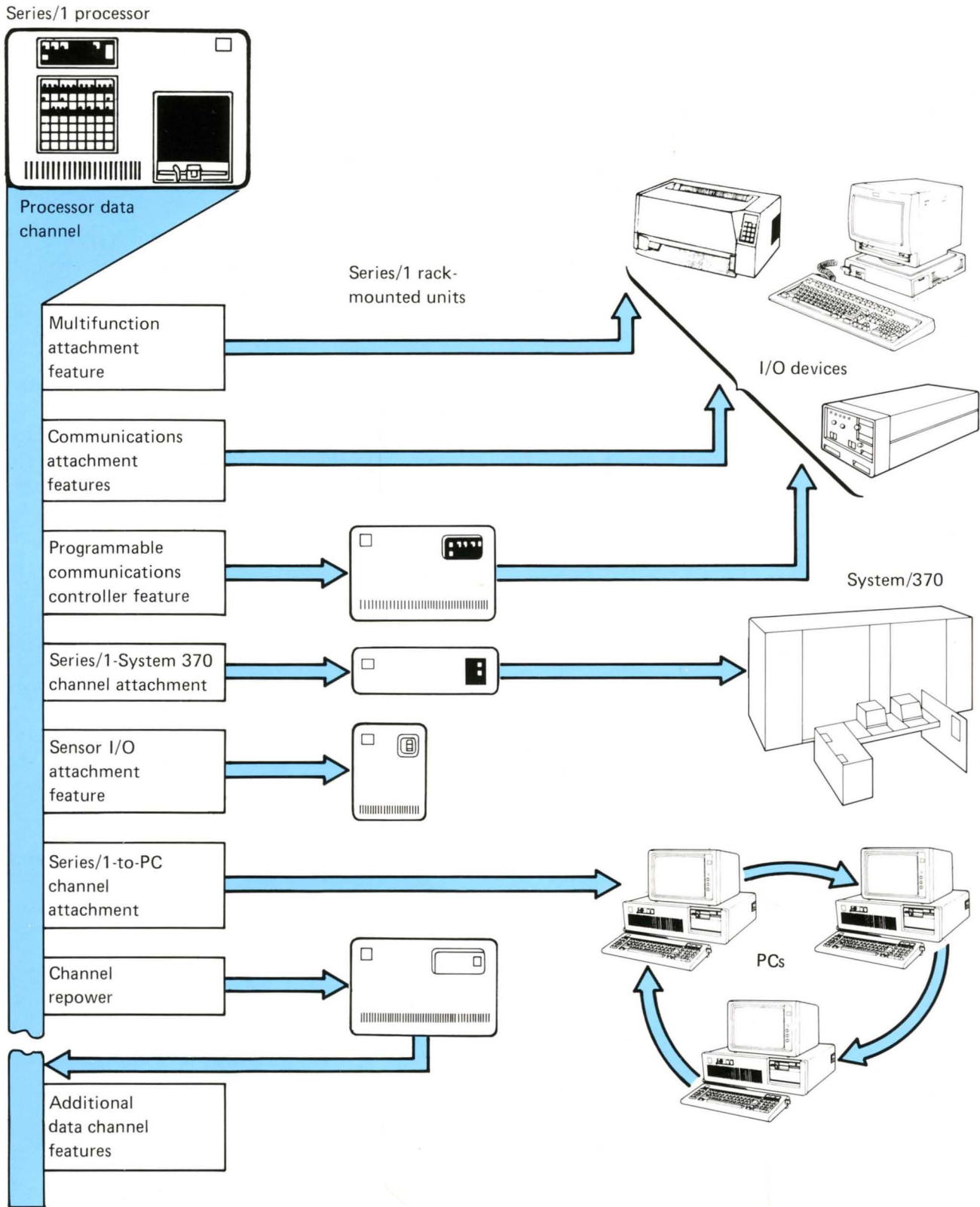
Processor structure

Main storage

Main storage holds the data and instructions for applications to be processed on the Series/1. The basic unit of information is the byte (eight binary data bits plus an associated parity bit).

The 4956 has error checking and correcting storage; single-bit errors are corrected, and double-bit errors are detected.

On other processors, odd parity by byte is maintained throughout storage. On reads from storage, an even parity causes a machine check error. The Series/1 instruction set addresses bytes either separately or grouped together. Instructions can refer to bits, bytes, byte strings, words, or doublewords as data operands to allow efficient, flexible use of storage.

Addressing main storage: Each byte location in main storage is directly addressable. Byte locations in storage are numbered consecutively, starting with location 0; each number is considered to be the address of the corresponding byte. Storage addresses are 16-bit unsigned binary numbers, which give a direct addressing range of 0 to 65,535 bytes. The storage address relocation translator function is required to address storage above 65,536 bytes. With the translator function, a portion of the 16-bit address and an address key are used as a logical address to generate either a 19-bit, 20-bit, or 21-bit physical address.

Storage protection: When the translator is enabled, a *read-only* bit can be assigned to any given block of storage. This protection is from any problem state program. Supervisor state can write to any location in storage.

Storage mapping: In a multiprogramming system the storage address relocation translator function can provide the means to assign separate storage pages to individual programs and data and to prevent unauthorized access to this storage. Data or program sharing among separate tasks can also be accommodated, using the facilities of the translator. For example, users can share reentrant code or establish

intertask communications. This allows the translator to support a flexible multiprogramming environment, while providing safeguards to prevent accidental or intentional destruction of application or system programs.

The relocation translator function permits addressing main storage locations beyond 64 kilobytes (KB) and facilitates dynamic storage relocation on a 2KB-block basis. When the translator function is enabled, the read-only protection is under control of the translator.

Using the translator function, tasks on each of the four Series/1 priority levels can address three separate storage maps through three address keys. For each priority level, one of these keys can be used to address a map for fetching instructions, a second key can be used to address a map for all data not defined by the first key, and a third key can address a map for source operands in storage-to-storage operations. In addition, each I/O device has an address key used in cycle-stealing operations that enables the user to directly assign a storage map to a given I/O device.

The three address keys point to stacks of hardware translator segmentation registers. On the 4956, eight stacks of segmentation registers are provided (16 on the 4956 E, H, J, and K models), each stack containing 32 segmentation registers, for a total of 256 and 512. Each of these segmentation registers defines a 2KB segment of storage. Once loaded, each stack of segmentation registers can contain a complete map of up to 64KB scattered in 2KB physical segments. Privileged supervisor instructions set or change the address space keys and the contents of the segmentation registers.

This arrangement allows programs to be scattered throughout storage. It also allows users to access common data or programs by loading more than one segmentation register with the same 2KB segment address. In a multitasking environment, the existence of a separate stack of segmentation registers for each address key value removes the need to save and restore the storage map and allows fast task switching.

The 4956 E, H, J, and K models also have eight stacks of *I/O* segmentation registers.

Instruction set

The Series/1 family of processors has microcode that permits a rich instruction set of up to 182 individual instructions. Additionally, 30 floating-point instructions are available with the optional floating-point feature of the 4956 Processors (a reduced speed version is standard on the Series/1 System Units). Series/1 instructions operate on bit, byte, word, doubleword, and variable field-length byte operands. Many of the instructions operate in multiple operand types.

Instruction formats: Series/1 instruction formats allow the following types of address arguments, operand locations, and data types. These formats are intended to show function only and not assembler coding.

Address arguments:

R	The effective address is the register R.
(R)	The effective address is the contents of the register R.
(R)+	The effective address is the contents of the register R. After an instruction uses it, the contents of the register are increased by the number of bytes addressed by the instruction.
A	An address value.
A+(R)	The effective address is the contents of the register R added to the address A.
(R)*	The effective address is the contents of storage at the address defined by the contents of register R.
(A+(R))*	The effective address is the contents of storage at the address defined by the contents of register R added to the address A.
A*	The effective address is the contents of storage at the address defined by A.
D+(R)*	The effective address is the contents of storage at the address defined by the contents of R added to the value of the displacement D.

(D+(R))*	The effective address is the contents of storage at the address obtained by adding the contents of R to the value of the displacement D.
D2+(D1 +(R))*	The effective address is calculated as follows: the contents of the register R are added to the value of the displacement D1 to form an address. The contents of that storage location are added to the value of D2 to form the effective address.

Operand locations:

Register-immediate (R-I)
Storage-immediate (S-I)
Register-register (R-R)
Storage-register (S-R)
Register-storage (R-S)
Storage-storage (S-S).

Data types:

Bit
Byte
Byte field
Word
Doubleword

Function examples:

Move
Add
Subtract
Multiply
Divide
Test
Compare
AND
OR
Exclusive OR

Most instructions in their basic format are one word; 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.

The instruction set offers the programmer a wide choice of powerful instructions. For example, with variable field length instructions,

up to 64KB of storage can be moved with one instruction.

Supervisor state: Series/1 instructions are executed in either supervisor state or problem state. This facility gives the Series/1 user another built-in feature to protect critical system functions. For example, privileged or supervisor state instructions are those that control input/output, interrupt level processing, storage protection, address space management, and other system resources and functions. Only when the processor enters the supervisor state as a result of an interrupt or immediately after initial program load can these sensitive types of instructions be run.

Registers: Series/1 has eight general-purpose registers for each of the four priority interrupt levels. These registers have no predefined or preassigned function and can be assigned dynamically by the programmer.* Any general-purpose register can be used as an accumulator, index pointer, or index register. In addition, the optional floating-point feature has four registers.

Stacking: The Series/1 stacking mechanism provides two types of stacking facilities—data stacking and linkage stacking. There is no restriction, except storage size, on the number of stacks the programmer can define. An interrupt condition signals a full or an empty stack, protecting the programmer against errors in managing stacks.

The *data stacking* facility provides an efficient and simple way to handle last-in/first-out stacks of data items, and/or parameters in main storage. The data items, or parameters, are stack elements. For a given queue or stack, each element is one, two, or four bytes wide. Instructions for each element size—byte, word, or doubleword—are provided to push an element into a stack (register to storage) and pop an element from a stack (storage to register).

Linkage stacking provides an easy method for linking subroutines to a calling program. A stack one word wide, is used for saving and restoring the status of general registers and for allocating dynamic work areas. The Store Multiple instruction stores the contents of the registers into the stack and reserves a designated number of bytes in the stack as a work area. The Load Multiple and Branch instruction reloads the registers, releases the stack element, and causes a branch back to the calling program.

Instruction set summary: For arithmetic operations the Series/1 includes hardware multiply/divide with byte, word, or doubleword operations. The floating-point feature (optional on the 4956), includes separate instructions to perform single-precision (32 bit) and double-precision (64-bit) operations. A summary at the end of this section highlights the completeness of the Series/1 instruction set, which provides the programming flexibility usually found only in larger systems.

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* Registers one and seven have special usages with certain instructions; consult the *IBM Series/1 Principles of Operation*, GA34-0152.

Instruction set

Number of instructions	Function	I-R Byte	I-R Word	I-S Word	R-R Word	S-R/R-S Byte	S-R/R-S Word	S-R/R-S Double-word	S-S Byte	S-S Word	S-S Double-word
99	*Arithmetic, logical, data move*										
	Add	X	X	X	X	X	X	X		X	X
	Subtract		X	X	X	X	X	X		X	X
	Multiply					X^1	X^1	X^1			
	Divide					X^1	X^1	X^1			
	Add w/carry				X						
	Subtract w/carry				X						
	Add carry				X						
	Subtract carry				X						
	Reset bits (NAND.)		X	X	X	X	X	X	X	X	X
	Set bits (OR)		X	X	X	X	X	X	X	X	X
	XOR		X		X	X	X	X			
	Test under mask		X	X							
	Compare	X	X	X	X	X^1	X^1	X^1	X	X	X
	Complement				X						
	AND		X								
	Move	X		X	X	X	X	X	X	X	X
	Load		X								
	Store			X							
	Load address						X				
	Load and zero					X^1	X^1	X^1			
	Interchange				X						
	Push/pop					X	X	X			
3	*Variable-field length*										
	Move					X^2			X		
	Compare equal					X^2			X		
	Compare not equal					X^2			X		

18	Shift	Single-word	Double-word	Computed Single-word	Computed Double-word
	Left circular	X	X	X	X
	Left logical	X	X	X	X
	Right logical	X	X	X	X
	Right arithmetic	X	X	X	X
	Left logical-count			X	X

23	System data	R-R Set	R-R Copy	R-S Set	R-S Copy
	Current level		X		
	Indicators	X	X		
	Mask			X	X
	Segment registers			X	X
	Storage key			X	X
	Level status block			X	X
	In process flags				X
	PSW				X
	Address key	X		X	X
	Console data lights	X			
	Console data buffer		X		
	Clock	X	X		
	Comparator	X	X		

[1] S-R only.
[2] R-S only.

Instruction set (continued)

Number of instructions	Function	Single-precision (32-bit)	Double-precision (64-bit)
4	*Bit manipulation*		
	Test		
	Test and set		
	Test and reset		
	Test and invert		
2	*Multiple register*		
	Load multiple and branch		
	Store multiple		
7	*Control*		
	Supervisor call		
	Level exit		
	Enable		
	Disable		
	Stop		
	Diagnose		
	Interchange operand keys		
1	*I/O*		
	Operate I/O		
15	*Branch/jump*		
	Branch/jump unconditional		
	Branch/jump and link		
	Branch and link short		
	Branch/jump on (not) condition		
	Branch on (not) condition code		
	Branch on (not) overflow		
	Branch indexed short		
	Jump on count		
	Address resolution with indirect branch		
30	*Floating-point*		
	Load	X	X
	Store	X	X
	Add	X	X
	Subtract	X	X
	Multiply	X	X
	Divide	X	X
	Add register	X	X
	Subtract register	X	X
	Multiply register	X	X
	Divide register	X	X
	Move register	X	X
	Compare register	X	X
	Load integer[3]	X	X
	Store integer[3]	X	X
	Load level block		
	Store level block		

[3] Single-precision is 16 bits.
Double-precision is 32 bits.

Series/1 architecture

Interrupt structure

Efficient operation of a processor depends on prompt response to both internal and external events. Series/1 recognizes two general types of interrupts, those from external events—input/output interrupts—and those from internal events—class interrupts.

Priority interrupts: Series/1 architecture allows 16 preemptive priority interrupt levels. However, four priority interrupt levels are provided on the Series/1 processors. 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. This is the level status block. If floating-point is installed, there are also four 64-bit floating-point registers per level.

When switching between levels occurs, the information contained in the "interrupted-from" hardware level status block is automatically preserved; as a result, it is not necessary to store the status indicators and general-purpose registers in main storage. Automatic vectoring to the service routine for a given device is accomplished by the eight-bit device addresses, providing 256 direct interrupt entry points.

No program polling of devices is required to accept the interrupt or identify the device. Assignment of a given device to an interrupt level is under program control and can be dynamically reassigned in response to system conditions. Masking and acceptance of priority interrupts by the processor are under program control on the basis of all four levels, one or more individual levels, or one or more individual devices.

The Series/1 interrupt structure, with its separate register stacks and unique double-vectored interrupt addressing, greatly facilitates efficient interrupt handling. The preemptive interrupt structure, and particularly the replication of registers on a per-level basis, is a significant asset in applications requiring multitask structures.

Class interrupts: Class interrupts provide a means of alerting the system to the occurrence of certain classes of errors or exception conditions. Class interrupts may occur on any of the four priority interrupt levels; the class interrupts preempt operation of the system on the appropriate priority level until the class interrupt condition has been reset.

There are eight types of class interrupts:

- Machine check

- Program check

- Power/thermal warning

- Supervisor call

- Soft exception trap

- Trace

- Console

- Clock.

Only the power/thermal warning, console, and the clock class interrupts can be disabled under program control. Identification and status information about the exception or error is provided in the processor status word. With this information, the program may be able to recover in a manner that allows normal processing to continue with minimum disruption.

The trace class interrupt provides an instruction trace mechanism to ease program debugging. Instruction tracing may occur on any priority interrupt level. When trace is turned on, a unique class interrupt occurs prior to each instruction. Upon exit from the trace routine, the next instruction is run and the process repeats until the trace is turned off.

Special supervisor state instructions are available to control interrupt processing.

Data channel

Series/1 provides a data channel interface for all input/output devices; up to 256 devices can be addressed.

The data channel is asynchronous and multidropped, allowing the attachment of devices with various speeds and technologies. All Series/1 data channel signal lines are TTL (transistor-transistor logic) level compatible.

The processor data channel supports direct program control operations, cycle-steal operations, and interrupt servicing.

Direct program control operations: 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 might or might not terminate in an interrupt. Direct program control is an easy way to transfer data. It also allows the programmer to maintain data transfer in line with the program, for example, for conversational or slower speed operations.

Cycle-steal operations: Cycle-stealing, in contrast to direct program control, once initiated, involves no interaction on the part of the processor during the transfer of a block of information between main storage and a device. During a cycle-steal operation, the data channel and the I/O device handle many of the functions performed by the processor during a direct program-controlled operation. An Operate I/O instruction can initiate cycle-stealing data transfers of up to 65,535 bytes between main storage and a device. Cycle-steal operations are overlapped with processing operations. Word or byte transfers, command and data chaining, burst mode, and program-controlled interrupts can be supported. All cycle-steal operations terminate with an interrupt.

Burst mode involves the dedication of the channel for the entire time of the data transfer. In this case, all other devices are locked out of the channel,

permitting high-speed data transfer at the maximum rate the main storage and the channel can accommodate.

Command chaining allows the programmer to sequence an I/O device through a set of operations. A processor interrupt occurs after the successful execution of the last operation or on an exception condition.

Cycle-steal devices include the disk, diskette, magnetic tape, display stations or terminals, printers, communications features and subsystem, System/370 channel attachment feature, and Series/1-to-Personal Computer channel attachment feature.

Interrupt servicing: Interrupt requests from the devices, along with cycle-steal requests, are presented and polled on the interface concurrently with data transfers.

The initial program load interrupt from a processor device or a binary synchronous communications line from a remote host computer is also supported.

The channel provides comprehensive error checking, including time-outs, sequence checking, and parity checking. It consists of the following major line groups:

- Address bus — A bidirectional bus used for device selection and for passing commands to devices during Operate I/O instructions. The address bus is also used for passing main storage addresses from the devices to the channel during cycle-steal data transfers.

- Data bus — A bidirectional bus used for passing data and control information to or from devices during Operate I/O instructions. The data bus is also used for passing device addresses and an interrupt information byte to the processor during interrupt acceptance.

- Control lines — Unidirectional lines and buses used for (1) interrupt and cycle-steal requests, (2) condition code and status reporting, (3) resets, and (4) basic control of sequences.

Series/1 architecture

In the Series/1, the data channel acts in a primary-secondary relationship with attached I/O devices; the data channel is always the primary. This significant characteristic gives the Series/1 positive control during I/O operations. The data channel verifies device attachment and the status of the device relative to the channel function to be performed. It ensures that the addressed device is installed and is capable of processing a command. The channel validates the device command and initiates the data transfer.

During data transfer, the channel checks data parity, both incoming and outgoing. Storage protection (if applicable), address translation (if applicable), and address validity checking are also operative during data transfer.

The parallel operation of the address bus, the data bus, and control lines allows polling concurrent with data transfer.

4956 Processor with a 4959 Input/Output Expansion Unit

Series/1 reliability, availability, and serviceability

Reliability, availability, and serviceability (RAS) are primary design objectives of IBM products and are part of the IBM development cycle from the earliest stages of product development. In the Series/1, IBM has used proven technology with known performance and serviceability characteristics.

In addition to using state-of-the-art technology, extensive checking circuits and microcode are built into the system to detect machine malfunctions. Microprocessors are employed in the processor and in each cycle-steal I/O adapter, except the 4962 disk attachment and the System 370 channel attachment. These small, stored program processors not only provide the logical control and coordination between the device and the processor but also provide a diagnostic capability to the system. Microdiagnostic routines have been built into the microprocessors to check the operational integrity of the processor, channel, and I/O adapters that contain the microprocessors.

The microdiagnostic routines operate automatically when the system is powered on. Various tests are activated, depending on which action invoked the test.

The microdiagnostic routines:

1. Validate integrity of processor data flow.
2. Write in and then read back a specified bit pattern in all of main storage.

   Note: The Realtime Programming System's (RPS) bootstrap loader validates the integrity of all installed primary storage (up to 64KB). Those versions of RPS that support storage above 64KB verify the presence of the storage address relocation translator function and validate secondary storage integrity (above 64KB).

3. Validate the integrity of the device controller by running through all the microinstructions in the microcontroller and then comparing an accumulated check digit to a pre-programmed check digit.

4. Validate the integrity of the data channel.

If an error is detected in the processor or data channel, the operator is alerted before an attempt is made to use the system. If a problem is detected in an I/O attachment feature, an error condition is presented to the user the first time the device is addressed.

Provided connections between modules pass this self-diagnostic test, the system link to IPL (initial program load) takes place. Self-diagnosis then passes from the hardware level to the program level where the operating system may monitor operations, detect errors and retry the operation, and log all detected errors to disk or diskette for later examination by maintenance personnel.

During system operation, an important reliability consideration is the integrity of data within the system. Parity checking of storage and channel, addressing-boundary restrictions, storage protection and a privileged instruction set help to ensure accurate processing of data. In addition, the Series/1 utilizes error checking and correcting storage (corrects all single-bit errors and detects all double-bit errors) on the 4956. If system errors or exception conditions do occur, a class interrupt could result.

The 4956 processors contain an error log that provides a history of the 64 most current errors that have occurred since the power was switched on. This information is available to the customer engineer through the programmer's console or the Diagnose instruction and is useful in isolating the cause of a particular problem. At power-on, all 64 entries in the error log are cleared.

At the input/output level of the system, IBM has incorporated capabilities into the attachment features and into the devices themselves to help ensure reliability of the hardware and the data. The following are examples of checks that are built into the attachment features:

- Condition codes — Each time an Operate I/O instruction is issued, the device, controller, or channel immediately reports to the processor a condition code pertaining to processing of the I/O command.

  On devices that present interrupts, condition codes are again presented with the I/O interrupt to further define the exact status of the I/O operation.

- Interrupt status byte (ISB) — If an error condition exists after an I/O operation (for example, a channel parity check), detailed information on the nature of the error is presented in the ISB.

  Further residual parameters from the device are also available in the device status words, which can be brought into storage by doing a Start Cycle Steal Status operation.

- Redundancy checking — Vertical redundancy checking (VRC), longitudinal redundancy checking (LRC), and cyclic redundancy checking (CRC), as applicable, are done by the various I/O adapters. For example, the disk and diskette units both generate CRC characters by sector for both the sector ID fields and data fields.

  The ACC control features provide LRC and VRC checking on receive data—the BSC features offer CRC with EBCDIC and LRC/VRC with ASCII. The 4987 Programmable Communications Subsystem can provide VRC, LRC, or CRC.

The Series/1 processors contain circuitry to provide continuous power verification (that is, circuitry to monitor the source voltage and the output voltage of the power supply).

If the source voltage drops, a power/thermal warning class interrupt occurs, and if the voltage drops below a certain point (approximately 80 Vac or 160 Vac), the system shuts off. Upon restoration of the mainline voltage, the system automatically switches power back on and, if the IPL switch is set to auto-IPL, the system automatically performs another IPL. The IPL bootstrap program can be coded to reload a selected program and processing resumes. This automatic restart feature makes the system particularly viable for use in a remote or unattended location.

If the error occurs as a result of a failure in the power supply or its load, or as a result of a thermal condition, the system shuts off and remains off until it is manually restored.

3 Series/1 processors and features

Chapter 3. Series/1 processors and features

Series/1 offers many compatible processors—the 4956 processors and the entry-level desk-top Series/1 System Units, which are available in several models. The processors differ mainly in storage size and speed, with the 4956 J and K models offering 2 megabytes of onboard storage and the greatest internal speed. Processor models also differ in the number of I/O features that may be attached.

Features that enhance reliability and performance include power fail detect/auto restart, storage protection for complex application environments and program development, error checking and correcting storage, and optional floating-point feature for mathematical and scientific calculations.

Adding one or more 4959 Input/Output Expansion Units or 4965 Storage and Input/Output Expansion Units to your 4956 provides I/O attachment capacity beyond that in the Series/1 processor.

Attachment features provide a wide range of device and system attachment to the Series/1. Specifically covered in this chapter are features for attaching 5200 Series printers, multiple work stations, and non-IBM devices. The Multifunction Attachment and various communications features are also covered.

Note: Programming support refers to the latest version and release level that was announced at the time this document was printed. Programming support is available under separate license.

4956 Processor specifications (Model B10)

Operating characteristics

Storage cycle time	550 nanoseconds
Average instruction time (weighted)	2.3 microseconds
Storage read/write access time (typical)	400 nanoseconds
Maximum aggregate data rate for multiple cycle-stealing devices	2.42 megabytes per second

Physical characteristics

Height	356 millimeters (14 in.)
Width	483 millimeters (19 in.)
Depth	476 millimeters (18.75 in.)
Weight	22.7 kg (50 lb)
Shipping weight	42.2 kg (93 lb)

Environmental conditions

Heat output/hour	500 watts (2157 BTU)
Cooling	Forced air
Operating temperature	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Power requirements (at full load)

115 volts	6.0 amperes
120 volts	5.8 amperes
208 volts	3.3 amperes
230 volts	3.0 amperes
240 volts	2.9 amperes
Frequency	60 ± 0.5 Hz
kVA	0.70
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

None required.

Standard features

- High-performance Series/1 processor
- 1024 kilobytes (KB) main storage
- Up to 512KB of main storage directly addressable
- Instruction set (179 instructions) implemented in microcode
- Four priority interrupt levels
- Eight general-purpose registers per level
- Byte-addressable storage
- Error checking and correcting storage
- Storage address relocation transfer function
- Clock/comparator
- Error log
- Self-contained power supply that includes communications power
- Power failure detect/auto restart
- Eight address spaces available to software
- Data channel
  - Up to 256 I/O devices directly addressable
  - Direct program control or cycle-steal operation
  - Data transfer on byte or word basis
  - All data checked for parity on a byte basis
  - Data transfer at 2.42 megabytes per second (maximum aggregate).

The processor is a full-width unit with 13 I/O feature locations. It is a modular unit that mounts in a 4997 Rack Enclosure or an EIA standard 19-inch rack.

When an I/O expansion unit is added to the system, the required repower card uses one of the processor I/O feature locations.

Note: The Model B has been replaced by the Model B10, and can no longer be ordered.

Optional features

- Floating-point (feature 3925) — Both single- and double-precision arithmetics are available using 30 additional instructions and four 64-bit registers per priority interrupt level. It does not use a feature location and can be field-installed.

- Programmer Console (feature 5655) — Provides indicators and controls for operator-oriented systems where programs are tested or entered and run.

- Storage Addition (feature 6330) — Provides additional processor storage in 256KB increments (Model B only, maximum of three).

- Storage Addition (feature 6331) — Provides an additional 512KB of processor storage (Model B only, maximum of one).

- Basic Storage Expansion (feature 6332) — Provides 512KB of base main storage instead of 256KB. It does not require a feature location and is not field-installable (Model B only, maximum of one).

Model upgrade

A field-installed model upgrade is available to convert a Model B to a Model B10, E10 or K00. The Model B10 can also be converted to a Model E10 or K00. See your IBM representative for further information.

Operating characteristics

Storage cycle time	550 nanoseconds
Average instruction time (weighted)	2.3 microseconds
Storage read/write access time (typical)	400 nanoseconds
Maximum aggregate data rate for multiple cycle-stealing devices	2.42 megabytes per second

Disk operating characteristics

Rotational speed	3151 ± 3% RPM
Average latency (nominal)	9.52 milliseconds
Instantaneous data rate	1.25 megabytes per second
Access times	
Cylinder to cylinder	9 milliseconds
Average seek	35 milliseconds
Total usable storage	61.7 megabytes
Cylinders	888 (2 reserved)
Tracks per cylinder	4
Sectors per track	70 (68 usable)
Bytes per sector	256

Physical characteristics

Height	356 millimeters (14 in.)
Width	483 millimeters (19 in.)
Depth	546 millimeters (21.5 in.)
Weight	50.4 kg (111 lb)
Shipping weight	72.6 kg (160 lb)

Environmental conditions

Heat output/hour	650 watts (2220 BTU)
Cooling	Forced air
Operating temperature	
	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Power requirements (at full load)

115 volts	7.0 amperes
120 volts	6.7 amperes
208 volts	3.9 amperes
230 volts	3.5 amperes
240 volts	3.4 amperes
Frequency	60 ± 0.5 Hz
kVA	0.81
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

None required.

Standard features

- High-performance Series/1 processor
- 1024KB of main storage
- Up to 512KB of mapped main storage
- Instruction set (179 instructions) implemented in microcode
- Four priority interrupt levels
- Eight general-purpose registers per level
- Byte-addressable storage
- Error checking and correcting storage
- Storage address relocation transfer function
- Clock/comparator
- Error log
- Self-contained power supply that includes communications power
- Power failure detect/auto restart
- Eight address spaces available to software
- Data channel
  - Up to 256 I/O devices directly addressable
  - Direct program control or cycle-steal operation
  - Data transfer on byte or word basis
  - All data checked for parity on a byte basis
  - Data transfer at 2.42 megabytes per second (maximum aggregate).
- Integrated 60-megabyte disk.

The processor is a full-width modular unit that mounts in a 4997 Rack Enclosure, a stand-alone enclosure, or an EIA standard 19-inch rack. It contains six I/O feature locations and includes an integrated 60-megabyte disk, with optional Cache. When an I/O expansion unit is added to the system, the required repower card uses one of the processor I/O feature locations.

Model upgrades

The following field-installed model upgrades are available for the 4956 processors:

- Model 30D to Models 31D, 61D, E70
- Model 31D to Models 61D, E70
- Model 60D to Models 61D, E70
- Model 61D to Model E70.

See your IBM representative for further information.

Optional features

- Floating-point (feature 3925) — Both single- and double-precision arithmetics are available using 30 additional instructions and four 64-bit registers per priority interrupt level. It does not use a feature location and can be field-installed.
- Diskette Drive (feature 4100) — Provides a diskette drive with 1.2 megabytes of diskette storage.
- Stand-Alone Enclosure (feature 4520) — Provides a tabletop enclosure that allows the processor to be installed without a rack. Can be field-installed. If more than one enclosure is used, the external-shielded Stand-Alone Enclosure Cable (feature 4525) is needed.
- Programmer Console (feature 5655) — Provides indicators and controls for operator-oriented systems where programs are tested or entered and run.
- Cache (feature 6400) — Provides a 64KB cache that is microprocessor-controlled and can significantly improve system performance. Test cases of typical applications have shown improvements in disk throughput ranging from 50% to more than 200%. Cache functions are transparent to programming. The Cache option does not require a feature position and is not field-installable.

Note: The Model 60D has been replaced by the Model 61D. Models 30D and 60D can no longer be ordered. Model 31D can be ordered as an upgrade only.

4956 Processor specifications (Model E10)

Operating characteristics

Storage cycle time	550 nanoseconds
Average instruction time (weighted)	1.53 microseconds
Storage read/write access time (typical)	400 nanoseconds
Maximum aggregate data rate for multiple cycle-stealing devices	2.42 megabytes per second

Physical characteristics

Height	356 millimeters (14 in.)
Width	483 millimeters (19 in.)
Depth	476 millimeters (18.75 in.)
Weight	22.7 kg (50 lb)
Shipping weight	42.2 kg (93 lb)

Environmental conditions

Heat output/hour	500 watts (1705 BTU)
Cooling	Forced air
Operating temperature	$10-40.6°C$ $(50-105°F)$
Operating humidity	$8-80\%$

Power requirements (at full load)

115 volts	6.0 amperes
120 volts	5.8 amperes
208 volts	3.3 amperes
230 volts	3.0 amperes
240 volts	2.9 amperes
Frequency	60 ± 0.5 Hz
kVA	0.70
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

None required.

Standard features

- High-performance Series/1 processor
- 1024KB of main storage (expandable to 2048K)
- Up to 1024KB of mapped main storage
- Instruction set (182 instructions) implemented in microcode
- Four priority interrupt levels
- Eight general-purpose registers per level
- Byte-addressable storage
- Error checking and correcting storage
- Storage address relocation transfer function
- Clock/comparator
- Error log
- Self-contained power supply that includes communications power
- Power failure detect/auto restart
- Sixteen address spaces available to software
- Eight address spaces available to I/O
- Data channel
  - Up to 256 I/O devices directly addressable
  - Direct program control or cycle-steal operation
  - Data transfer on byte or word basis
  - All data checked for parity on a byte basis
  - Data transfer at 2.42 megabytes per second (maximum aggregate).
- Address Resolution and Indirect Branch (ARIB) instructions provide Event Driven Language (EDL) Acceleration capability.

The processor is a full-width unit with 13 I/O feature locations. It is a modular unit that mounts in a 4997 Rack Enclosure or an EIA standard 19-inch rack.

When an I/O expansion unit is added to the system, the required repower card uses one of the processor I/O feature locations.

Note: The Model E has been replaced by the Model E10, and can no longer be ordered.

Optional features

- Floating-point (feature 3926) — Both single- and double-precision arithmetics are available using 30 additional instructions and four 64-bit registers per priority interrupt level. Does not use a feature location. Can be field-installed.

- Programmer Console (feature 5655) — Provides indicators and controls for operator-oriented systems where programs are tested or entered and run.

- Storage Addition (feature 6330) — Provides additional processor storage in 256KB increments (maximum of three).

- Storage Addition (feature 6331) — Provides an additional 512KB of processor storage (maximum of two).

- Storage Addition (feature 6334) — Provides an additional 1024KB of processor storage (maximum of one).

Model upgrade

A field-installed model upgrade is available to convert a 4956 Model E to a Model E10 or K00, and convert a Model E10 to a Model K00. See your IBM representative for further information.

Operating characteristics

Storage cycle time	550 nanoseconds
Average instruction time (weighted)	1.53 microseconds
Storage read/write access time (typical)	400 nanoseconds
Maximum aggregate data rate for multiple cycle-stealing devices	2.42 megabytes per second

Disk operating characteristics

Rotational speed	3151 ± 3% RPM
Average latency (nominal)	9.6 milliseconds
Instantaneous data rate	1.25 megabytes per second
Access times	
Cylinder to cylinder	5.4 milliseconds
Average seek	35 milliseconds
Total usable storage	61.7 megabytes
Cylinders	888 (2 reserved)
Tracks per cylinder	4
Sectors per track	70 (68 usable)
Bytes per sector	256

Physical characteristics

Height	346 millimeters (13.75 in.)
Width	483 millimeters (19 in.)
Depth	578 millimeters (22.75 in.)
Weight	50.4 kg (111 lb)
Shipping weight	72.6 kg (160 lb)

Environmental conditions

Heat output/hour	650 watts (2220 BTU)
Cooling	Forced air
Operating temperature	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Power requirements (at full load)

115 volts	7.0 amperes
120 volts	6.7 amperes
208 volts	3.9 amperes
230 volts	3.5 amperes
240 volts	3.4 amperes
Frequency	60 ± 0.5 Hz
kVA	0.81
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

None required.

Standard features

- High-performance Series/1 processor
- 1024KB of main storage (expandable to 2048K)
- Up to 1024KB of mapped main storage
- Instruction set (182 instructions) implemented in microcode
- Four priority interrupt levels
- Eight general-purpose registers per level
- Byte-addressable storage
- Error checking and correcting storage
- Storage address relocation transfer function
- Clock/comparator
- Error log
- Self-contained power supply that includes communications power
- Power failure detect/auto restart
- Sixteen address spaces available to software
- Eight address spaces available to I/O
- Data channel
  - Up to 256 I/O devices directly addressable
  - Direct program control or cycle-steal operation
  - Data transfer on byte or word basis
  - All data checked for parity on a byte basis
  - Data transfer at 2.42 megabytes per second (maximum aggregate).
- Integrated 60-megabyte disk
- Address Resolution and Indirect Branch (ARIB) instructions provide EDL Acceleration capability.

The processor is a modular unit that mounts in a 4997 Rack Enclosure, a stand-alone enclosure, or an EIA standard 19-inch rack. The processor is a full-width unit with six I/O feature locations.

When an I/O expansion unit is added to the system, the required repower card uses one of the processor I/O feature locations.

Note: The Model 60E has been replaced by the Model E70, and can no longer be ordered.

Optional features

- Floating-point (feature 3926) — Both single- and double-precision arithmetics are available using 30 additional instructions and four 64-bit registers per priority interrupt level. Does not use a feature location. Can be field-installed.
- Diskette Drive (feature 4100) — Provides a diskette drive with 1.2 megabytes of diskette storage.
- Stand-Alone Enclosure (feature 4520) — Provides a tabletop enclosure that allows the processor to be installed without a rack. Can be field-installed. If more than one enclosure is used, the external-shielded Stand-Alone Enclosure Cable (feature 4525) is needed to connect them together.
- Programmer Console (feature 5655) — Provides indicators and controls for operator-oriented systems where programs are tested or run.
- Storage Addition (feature 6330) — Provides additional processor storage in 256KB increments (maximum of three).
- Storage Addition (feature 6331) — Provides an additional 512KB of processor storage (maximum of two).
- Storage Addition (feature 6334) — Provides an additional 1024KB of processor storage (maximum of one).
- Cache (feature 6400) — Provides a 64KB cache that is microprocessor controlled and can significantly improve system performance. Test cases of typical applications have shown improvements in disk throughput ranging from 50% to more than 200%. Cache functions are transparent to programming. The Cache option does not require a feature position and is not field-installable.

Operating characteristics

Storage cycle time	550 nanoseconds
Average instruction time (weighted)	
Model G10	2.3 microseconds
Model H10	1.53 microseconds
Storage read/write access time (typical)	400 nanoseconds
Maximum aggregate data rate for multiple cycle-stealing devices	2.42 megabytes per second

Disk operating characteristics

Rotational speed	3600 RPM
Average latency (nominal)	8.3 milliseconds
Instantaneous data rate	625 kilobytes per second
Access times	
Cylinder to cylinder	8 milliseconds
Average seek	40 milliseconds
Total usable storage	40 megabytes
Cylinders	733
Tracks per cylinder	7
Sectors per track	32
Bytes per sector	256

Physical characteristics

Height	346 millimeters (13.75 in.)
Width	483 millimeters (19 in.)
Depth	576 millimeters (22.75 in.)
Weight	55 kg (121 lb)
Shipping weight	72.6 kg (160 lb)

Environmental conditions

Heat output/hour	600 watts (2040 BTU)
Cooling	Forced air
Operating temperature	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Power requirements (at full load)

115 volts	7.0 amperes
120 volts	6.7 amperes
208 volts	3.9 amperes
230 volts	3.5 amperes
240 volts	3.4 amperes
Frequency	50/60 ± 3.0 Hz
kVA	0.81
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

None required.

Standard features

- High-performance Series/1 processor
- 1024KB of main storage (expandable to 2048KB in the Model H10)
- Model G10 has up to 512KB of mapped main storage, and implements 179 instructions in microcode
- Model H10 has up to 1024KB of mapped main storage, and implements 182 instructions in microcode
- Cache storage (400KB)
- One high-capacity (1.2 megabyte) 5.25-inch diskette drive
- One 40-megabyte fixed-disk drive
- Four priority interrupt levels
- Eight general-purpose registers per level
- Byte-addressable storage
- Error checking and correcting storage
- Storage address relocation transfer function
- Clock/comparator
- Error log
- Self-contained power supply that includes communications power
- Power failure detect/auto restart
- Eight (Model G10) or sixteen (Model H10) address spaces available to software
- Eight address spaces available to I/0 (Model H10)
- Data channel
  - Up to 256 I/O devices directly addressable
  - Direct program control or cycle-steal operation
  - Data transfer on byte or word basis
  - All data checked for parity on a byte basis
  - Data transfer at 2.42 megabytes per second (maximum aggregate).
- Address Resolution and Indirect Branch (ARIB) instructions provide EDL Acceleration capability.

The 4956 Models G10 and H10 are full-width units with 6 I/O feature locations. They are modular units that mount in a 4997 Rack Enclosure, a stand-alone enclosure, or an EIA standard 19-inch rack.

When an I/O expansion unit is added to the system, the required repower card uses one of the processor I/O feature locations.

Optional features

- Floating-point for the Model G10 (feature 3925) and the Model H10 (feature 3926) — Both single- and double-precision arithmetics are available using 30 additional instructions and four 64-bit registers per priority interrupt level. Does not use a feature location. Can be field-installed.
- Programmer Console (feature 5655) — Provides indicators and controls for operator-oriented systems where programs are tested or entered and run.
- Storage Addition (feature 6334) — Provides an additional 1024KB of processor storage for the Model H10 only (maximum of one).
- Second Diskette Drive (feature 4110) — Provides a second high-capacity (1.2 megabyte) 5.25-inch diskette drive.
- Second Disk Drive (feature 4115) — Provides a second 40-megabyte fixed-disk drive.
- Third Disk Drive (feature 4116) — Provides a third 40-megabyte fixed-disk drive.
- Stand-Alone Enclosure (feature 4521) — Provides a tabletop enclosure that allows the processor to be installed without a rack.

Model upgrade

A field-installed model upgrade is available to convert a 4956 Model G10 to a Model H10 or J00, and convert a Model H10 to a Model J00. See your IBM representative for further information.

Operating characteristics

Storage cycle time	360 nanoseconds
Average instruction time (weighted)	1.0 microsecond
Storage read/write access time (typical)	320 nanoseconds
Maximum aggregate data rate for multiple cycle-stealing devices	2.74 megabytes per second

Disk operating characteristics

Rotational speed	3600 RPM
Average latency (nominal)	8.3 milliseconds
Instantaneous data rate	625 kilobytes per second
Access times	
Cylinder to cylinder	8 milliseconds
Average seek	40 milliseconds
Total usable storage	40 megabytes
Cylinders	733
Tracks per cylinder	7
Sectors per track	32
Bytes per sector	256

Physical characteristics

Height	346 millimeters (13.75 in.)
Width	483 millimeters (19 in.)
Depth	576 millimeters (22.75 in.)
Weight	55 kg (121 lb)
Shipping weight	72.6 kg (160 lb)

Environmental conditions

Heat output/hour	600 watts (2040 BTU)
Cooling	Forced air
Operating temperature	
	$10-40.6°C$ ($50-105°F$)
Operating humidity	$8-80\%$

Power requirements (at full load)

115 volts	7.0 amperes
120 volts	6.7 amperes
208 volts	3.9 amperes
230 volts	3.5 amperes
240 volts	3.4 amperes
Frequency	$50/60 \pm 3.0$ Hz
kVA	0.81
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

None required.

Standard features

- High-performance Series/1 processor
- 2048KB of main storage
- Floating-point
- Cache storage (400KB)
- One high-capacity (1.2 megabyte) 5.25-inch diskette drive
- One 40-megabyte fixed-disk drive
- Four priority interrupt levels
- Eight general-purpose registers per level
- Byte-addressable storage
- Error checking and correcting storage
- Storage address relocation transfer function
- Clock/comparator
- Self-contained power supply that includes communications power
- Power failure detect/auto restart
- Sixteen address spaces available to software
- Eight address spaces available to I/O
- Data channel
  - Up to 256 I/O devices directly addressable
  - Direct program control or cycle-steal operation
  - Data transfer on byte or word basis
  - ECC (single-error correction, double-error detection) done on a byte-basis
  - Data transfer at 2.74 megabytes per second (maximum aggregate).
- Address Resolution and Indirect Branch (ARIB) instructions provide EDL Acceleration capability.

The processor is a full-width unit with 7 I/O feature locations. They are modular units that mount in a 4997 Rack Enclosure, a stand-alone enclosure, or an EIA standard 19-inch rack.

When an I/O expansion unit is added to the system, the required repower card uses one of the processor I/O feature locations.

Optional features

- Programmer Console (feature 5655) — Provides indicators and controls for operator-oriented systems where programs are tested or entered and run.
- Second Diskette Drive (feature 4110) — Provides a second high-capacity (1.2 megabyte) 5.25-inch diskette drive.
- Second Disk Drive (feature 4115) — Provides a second 40-megabyte fixed-disk drive.
- Third Disk Drive (feature 4116) — Provides a third 40-megabyte fixed-disk drive.
- Stand-Alone Enclosure (feature 4521) — Provides a tabletop enclosure that allows the processor to be installed without a rack.

4956 Processor specifications (Model K00)

Operating characteristics

Storage cycle time	360 nanoseconds
Average instruction time (weighted)	1.0 microsecond
Storage read/write access time (typical)	320 nanoseconds
Maximum aggregate data rate for multiple cycle-stealing devices	2.74 megabytes per second

Physical characteristics

Height	356 millimeters (14 in.)
Width	483 millimeters (19 in.)
Depth	476 millimeters (18.75 in.)
Weight	23 kg (50 lb)
Shipping weight	40.6 kg (89 lb)

Environmental conditions

Heat output/hour	500 watts (1705 BTU)
Cooling	Forced air
Operating temperature	$10-40.6°C$ ($50-105°F$)
Operating humidity	$8-80\%$

Power requirements (at full load)

110 volts	6.3 amperes
115 volts	6.0 amperes
208 volts	3.3 amperes
230 volts	3.0 amperes
235 volts	2.9 amperes
Frequency	$50/60 \pm 3.0$ Hz
kVA	0.7
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

None required.

Standard features

- High-performance Series/1 processor
- 2048KB of main storage
- Floating-point
- Four priority interrupt levels
- Eight general-purpose registers per level
- Byte-addressable storage
- Error checking and correcting storage
- Storage address relocation transfer function
- Clock/comparator
- Self-contained power supply that includes communications power
- Power failure detect/auto restart
- Sixteen address spaces available to software
- Eight address spaces available to I/O
- Data channel
  - Up to 256 I/O devices directly addressable
  - Direct program control or cycle-steal operation
  - Data transfer on byte or word basis
  - ECC (single-error correction, double-error detection) done on a byte-basis
  - Data transfer at 2.74 megabytes per second (maximum aggregate).
- Address Resolution and Indirect Branch (ARIB) instructions provide EDL Acceleration capability.

The processor is a full-width unit with 14 I/O feature locations. It is a modular unit that mounts in a 4997 Rack Enclosure or an EIA standard 19-inch rack.

When an I/O expansion unit is added to the system, the required repower card uses one of the processor I/O feature locations.

Optional features

Programmer Console (feature 5655) — Provides indicators and controls for operator-oriented systems where programs are tested or entered and run.
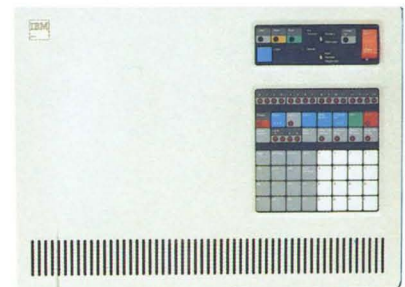
5170 System Unit specifications (Model 496)

Operating characteristics

Storage cycle time	945 nanoseconds
Average instruction time (weighted)	7.4 microseconds
Storage read/write access time (typical)	280 nanoseconds

Disk operating characteristics

Rotational speed	3600 ± .5% RPM
Average latency (nominal)	8.3 milliseconds
Instantaneous data rate	625 kilobytes per second
Access times	
Cylinder to cylinder	8 milliseconds
Average seek	40 milliseconds
Total usable storage	30 megabytes
Cylinders	733
Tracks per cylinder	5
Sectors per track	17
Bytes per sector	512

Diskette operating characteristics

Rotational speed	360 RPM
Instantaneous data rate	
high-capacity	62.5 kilobytes per second
dual-sided	31.3 kilobytes per second
Access time	
track to track	3 milliseconds
Total usable storage	
high-capacity	1.2 megabytes
dual-sided	360 kilobytes

Environmental conditions

Heat output/hour	360 watts (1229 BTU)
Cooling	Convection
Operating temperature	
	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Physical characteristics

System Unit

Height	162 millimeters (6.8 in.)
Width	540 millimeters (21.3 in.)
Depth	439 millimeters (17.3 in.)
Weight	20 kg (44 lb)

Display

Diagonal measurement	11.5 inches
Character capacity	2000
Format	25 rows with 80 characters
Weight	7 kg (44 lb)

Keyboard

Height	225 millimeters (9 in.)
Width	540 millimeters (21.6 in.)
Depth	100 millimeters (3.9 in.)
Weight	2.8 kg (6.2 lb)

Power requirements (at full load)

100 volts	5.0 amperes
240 volts	3.0 amperes
Frequency	60 ± 0.5 Hz
kVA	0.45
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System
- Input/Output Executive.

Prerequisites

- Monochrome display and adapter, *or*
- Color Display and adapter.

Cables

Printer cable (feature 5612) is available for connecting to the Monochrome display and printer adapter.

Standard features

The IBM Series/1 System Unit 5170, Model 496 is a desk-top entry-level Series/1 computer. Highlights are:

- Series/1 microprocessor runs Series/1 programs
- 1024K storage
- IBM Personal Computer AT microprocessor (8 megahertz) controls I/O devices
- 30-megabyte fixed-disk drive
- IBM Personal Computer enhanced keyboard
- One high-capacity diskette drive
- Six-port Terminal/Host Attachment card:
  - Four RS-422-A (local) ports
  - Two RS-232-C asynchronous ports (one port may be used for bisynchronous).
- Three I/O feature slots available
- Performs Series/1 floating-point instructions (reduced speed)
- Serial/Parallel adapter
- Supports ASCII Display Stations
- Designed for customer setup
- One or two 4201 printers may be attached
- Can operate as a stand-alone IBM Personal Computer AT.

Optional features

- Second Six-Port Terminal/Host Attachment card (feature 3629) — Provides attachment for up to four additional RS-422-A (local) and two additional RS-232-C ports. One RS-232-C port made be used for bisynchronous connection.
- 30-Megabyte Fixed-Disk Drive (feature 0210) — Provides a second fixed-disk drive.
- High-capacity Diskette Drive (feature 0206) — Provides a second diskette drive.
- Dual-sided Diskette Drive (feature 0207) — Permits the exchange of 320/360KB diskette media between the IBM PC, IBM Portable

PC, IBM Personal Computer AT, and IBM Personal Computer XT.

- Serial/Parallel Adapter (feature 0215) — Provides a serial port and a parallel port. The serial portion is fully programmable and supports asynchronous communications from 300 to 9600 baud. The parallel portion provides the ability to attach various devices that accept eight bits of parallel data. This adapter does not support current-loop operation. Maximum of two.
- Binary Synchronous Communications Adapter (feature 1204) — Provides an EIA RS-232-C interface. It is compatible with the IBM PC, IBM Portable PC, and IBM Personal Computer XT. A maximum of two; one, if SDLC Adapter is installed.
- SDLC Communications Adapter (feature 1205) — Provides an EIA RS-232-C interface. It is compatible with the IBM PC, the IBM Portable PC, and the IBM Personal Computer XT. Maximum of one.
- Monochrome Display and Printer Adapter (feature 4900) — Required for the attachment of the 5151 Monochrome Display and one 4201 Proprinter. Needs a full feature-expansion slot.

Note: The Binary Synchronous and SDLC communications adapters operate mutually exclusive of each other.

Attachment features specifications

Programming support

Event Driven Executive and Realtime Programming System support:

- Integrated Digital/Output Non-Isolated feature
- Timers feature
- Teletypewriter adapter feature.

Event Driven Executive also supports the GPIB adapter feature.

Prerequisites

- Series/1 processor
- The appropriate attachment devices.

Cables

- Teletypewriter Adapter Cable (feature 2055) for the Teletypewriter Adapter feature.
- Teletypewriter Adapter Cable with EIA male connector (feature 2064) for the teletypewriter adapter feature.
- Teletypewriter Adapter cable with EIA female connector (feature 2065) for the teletypewriter adapter feature.
- GPIB adapter cable (RPQ D02119) provides a special 4-meter (13 foot) adapter cable that connects the GPIB adapter to a standard IEEE 488/IEC 66.22 device.

Attachment feature cards provide for the attachment of user equipment and input/output devices to a Series/1 processor. The feature cards mount in the I/O feature locations of a Series/1 processor, 4959 I/O Expansion Unit, or 4965 Diskette Drive and I/O Expansion Unit. Attachment cards for devices described in Chapter 4 are not included here.

Integrated Digital Input/Output Non-Isolated

The Integrated Digital Input/Output Non-Isolated (feature 1560) allows small numbers of digital sensor I/O devices to be attached in situations where the 4982 Sensor Input/Output Unit is not required. The feature contains 32 points (two 16-point groups) of non-isolated digital input/process interrupt (DI/PI) and 32 points (two 16-point groups) of digital output (DO). Each group of 16 points is separately addressable and has a 'ready' line and a 'sync' line for synchronizing its operation with attached devices.

Timers

The Timers (feature 7840) provides two 16-bit timers that are packaged on one printed-circuit card. Each timer can be used as an interval timer, pulse counter, or pulse duration counter with end-interrupt. The timers are separately addressable and are independently started, stopped, read, or set to any value under program control. The timers can be read without disturbing their operation; however, to set a timer's value or mode, it must be stopped.

Teletypewriter Adapter

In addition to providing one of the attachment options for the 316X ASCII Display Stations, the Teletypewriter Adapter (feature 7850) provides for the attachment of any of several I/O devices. The adapter operates in duplex mode at speeds up to 9600 bits per second (bps)

and supports initial program load. DC current loop, TTL, and EIA interface options are offered.

GPIB Adapter

The General Purpose Interface Bus (GPIB) Adapter (RPQ D02118) provides Series/1 attachment capability for original equipment manufacturers' (OEM) devices, instrumentation, and subsystems that conform to the IEEE Standard 488, 1975. The adapter is microprocessor-controlled and cycle-stealing. It provides for attachment of up to 14 addressable devices per adapter. Maximum adapter speed is 65KB per second.

Programmable Cycle-Stealing Digital Input/Digital Output Attachment

The Programmable Cycle-Stealing DI/DO Attachment (RPQ D02288) provides a general-purpose, high-speed, digital input/output interface for the attachment to Series/1 of non-IBM devices, such as printers, plotters, graphics terminals, scientific instrumentation, and sensor input/output front ends.

The attachment runs in programmable mode or cycle-steal mode. In programmable mode, the microprocessor, located in the attachment, controls the interface and can run smaller applications based on stored control logic loaded from the Series/1. In cycle-steal mode, the microprocessor is bypassed; this allows higher data rates of up to 800KB per second.

Multifunction Attachment

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

Communications power (feature 2010) is required when installed in a 4955 Model C or D processor or an input/output expansion unit.

Cables

- The Multifunction local attachment cable (feature 5770) is available as a 15.4 meter (50 foot) cable for RS-422-A attachment.
- The Asynchronous local attachment cable (feature 2056) and EIA dataset cable (feature 2057) are available as 6.1-meter (20-foot) cables for RS-232-C attachment.

Highlights are:

- Provides four independent local attachments or, optionally, three local attachments and one remote attachment
- Allows local attachment of devices to be located up to 1219 meters (4000 feet) from a Series/1
- Has capabilities similar to other Series/1 remote attachment features.

The Multifunction Attachment (feature 1310) provides for the local or remote attachment of the many types of terminals and printers. The feature card also provides for the remote attachment to Series/1 of binary synchronous communications (BSC) input/output devices and BSC systems. The card mounts in an input/output feature location of a Series/1 processor, 4959 Input/Output Expansion Unit, or 4965 Storage and I/O Expansion Unit.

The card has four attachment ports. All four ports can provide asynchronous communications by means of the EIA RS-422-A (local) interface. Or, one port can be used for the remote attachment of a device through a modem by means of the EIA RS-232-C interface and the other three ports can be used for the local attachment of devices. Both interfaces allow data rates up to 9600 bits per second. However, allowable data rates are configuration sensitive.

The RS-422-A interface allows local attachment of terminals and printers up to 1219 meters (4000 feet) from a Series/1. The Multifunction Attachment provides for local attachment of the 3101 Model 13 or 23 Display Terminal, 316X Model 12 ASCII Display Station, 4201 Proprinter, 4202 Proprinter XL, 4224 (all Models), and the 4975 Model 01L or 02L Printer.

When a remote device is attached to a Series/1 through the RS-232-C interface, binary synchronous communications or asynchronous communications can be selected through device initialization software in the operating system.

For binary synchronous communications, the functions of the BSC Single-Line Control (feature 2074) are provided to the application program.

For asynchronous communications, a half-duplex single line is available to the application program. The line is equivalent to that of the Feature-Programmable Multiline 8-Line Communications Control (feature 2095) and the Feature-Programmable Multiline 4-Line Communications Adapter (feature 2096). Specifically, all models of the 3101 Display Terminal and 316X ASCII Display Stations are supported, and the 4975 Model 01R or 02R Printer is supported (the start/stop protocol used to communicate with these remote printers is unique). Also, any non-IBM device that meets the interface standards of the feature-programmable adapter can be remotely attached.
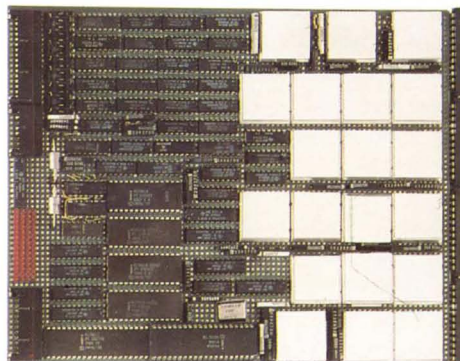
Multidrop Work Station Attachment

Programming support

Event Driven Executive.

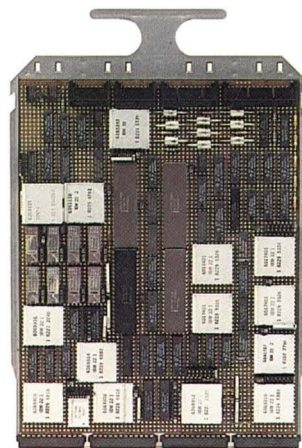**Prerequisites**

None required.

Cables

- Feature 5780, 6.1 meters (20 feet) in length, or customer-supplied cable.
- Twinaxial cable-to-cable connector (part 7362203) may be used to connect feature 5780 to twinaxial cable assembly (part 7362267).
- A Berg connector (part 6095524) may be used with customer-provided twinaxial cables to attach directly to the Multidrop Work Station Attachment.

The IBM Multidrop Work Station Attachment (feature 1250) plugs into a Series/1 processor or I/O expansion unit, and provides four cable ports for multidrop of up to eight 4980 displays. Each port provides interfaces for up to a maximum total cable distance of 1219 meters (4000 feet). Speeds vary according to distance as follows:

- 100 kilobits per second to 1219 meters (4000 feet)

- 250 kilobits per second to 844 meters (1600 feet)

- 500 kilobits per second to 422 meters (800 feet).

The attachment responds to eight device addresses (one for each display). The attachment can transfer data to and from Series/1 storage using cycle-steal and Direct Program Control (DPC).

The maximum number of Multidrop Work Station Attachments installed in a Series/1 is determined by the number of available feature positions in the processor or I/O expansion unit.

Attachment features

Printer Attachment - 5200 Series

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

None required.

Cables

Feature 5780, 6.1 meters (20 feet) in length, or customer-supplied cable.

The Series/1 Printer Attachment — 5200 Series (feature 5640) plugs into a Series/1 processor or I/O expansion unit. The attachment has two ports that physically connect and logically adapt the 5219 (Model D01 and D02), 5224 (Model 1 and 2), 5225 (Model 1, 2, 3, and 4), or 5262 Printer to the processor data channel.

Data can be transmitted and received up to a distance of 1524 meters (5000 feet). The attachment supports the transfer of data in data stream mode or 4975 emulation mode. The printer is connected to the attachment by a twinaxial cable.

Up to a maximum of eight printers can be connected to the attachment (no more than seven on one port).

Configurations

When all printers are the same type, the five possible configurations are:

- Up to eight 5219s

- Up to eight 5224s

- Up to four 5225s

- Up to two 5262s.

The following configurations illustrate the mix of printer types that can be connected:

- Any mix of up to eight 5219s or 5224s
- One 5225 and any mix of up to seven 5219s or 5224s
- Two 5225s and any mix of up to five 5219s or 5224s
- Three 5225s and any mix of up to three 5219s or 5224s
- Four 5225s and either one 5219 or one 5224
- One 5262 and up to five 5219s
- Two 5262s and up to three 5219s.

Note: When any mix of 5219, 5224, or 5225 printers are connected, only printers of the same type can be physically located within 30.5 meters (100 feet) of the attachment (feature 5640).
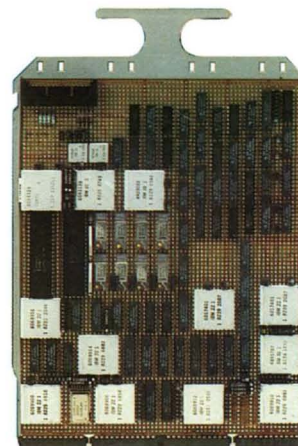
Series/1-to-Personal Computer Channel Attachment

Programming support

- Realtime Programming System

- Series/1-PC Connect.

Prerequisites

None required.

Cables

Feature 4001, or customer-supplied cable.

The Series/1-to-Personal Computer Channel Attachment provides a high-speed data transfer between systems to allow the Series/1 to be an effective gateway and server system in an IBM Personal Computer network.

Note: The Series/1-to-Personal Computer channel Attachment can be used with the IBM PC, IBM PC XT, and IBM PC AT (except the IBM PC XT Model 286).

Highlights include:

- The attachment card contains a 64KB storage that is mapped as part of the IBM Personal Computer storage; 48KB of this shared storage is used to transfer data between the Series/1 and the Personal Computer. The data can then be transferred at the cycle-stealing rate of the Series/1 channel.

- Series/1 feature 4000 provides the attachment card and an IBM Personal Computer channel interface card.

- Series/1 feature 4001 provides the cable to connect the attachment card to the IBM Personal Computer.
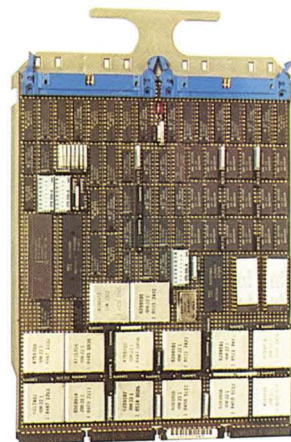
Programming support

Event Driven Executive

- Support is provided in the base operating system for:
  - BSC features
  - ACC features
  - Series/1-to-Series/1 attachment
- Specific device support has been validated for communications with the following:
  - Series/1
  - System/370 (BSC, SDLC, and Channel attachment)
  - 2741 Communication Terminal
  - 3101/316X displays
  - 5100 Portable computer
  - 5110 Computer
  - Teletype[1] Model ASR 33/35 or equivalent
  - Tektronix[2] Model 4013 graphics terminal or equivalent.
- Support is available in other Event Driven Executive based licensed programs for:
  - SDLC through the Support for Systems Network Architecture
  - System/370 Channel Attach through the System/370 Channel Attachment program

Realtime Programming System

- Support is provided in the base operating system for:
  - BSC features
  - SDLC features
  - ACC features
- Specific device support has been validated for communications with the following:
  - Series/1
  - System/3
  - System/32
  - System/34
  - System/370 (BSC, SDLC, and Channel attachment)
  - 2740/2741 Communication Terminal
  - 3101/316X displays
  - 3271/3274/3275/3276 Control Unit (BSC)
  - 3684 Point-of-Sale Controller Unit
  - 5260 Retail System
  - 6670 Information Distributor
  - Teletype Model ASR 33/35 or equivalent
- Support is available in other Realtime Programming System based licensed programs for:
  - System/370 Channel Attach through the System/370 Channel Attachment program
  - Data Link Control Adapter through the Packet Network Support.

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[1]   Trademark of the Teletype Corp.

[2]   Trademark of Tektronix, Inc.

Prerequisites

- Communications power (feature 2010) is required on the 4955 Models C and D processor and the 4959 input/output expansion unit (below serial number 22499, domestic):
  - Binary Synchronous Communications Single-line Control
  - Binary Synchronous Communications 4-line Adapter
  - Synchronous Data Link Control Single-line Control
  - Asynchronous Communications 4-line Adapter
  - Synchronous Communications Single-line Control/High speed
- Binary Synchronous Communications 8-line Control (feature 2093) is required for the Binary Synchronous Communications 4-line Adapter feature.
- Asynchronous Communications 8-line Control (feature 2091) is required for the Asynchronous Communications 4-line Adapter feature.
- Feature-Programmable Communications 8-line Control (feature 2095) is required for the Feature-Programmable Communications 4-line Adapter feature.
- 4993 Series/1-System/370 Termination Enclosure is required for each Series/1-System/370 Channel Attachment feature.

Cables

- Feature 2056, the Asynchronous Local Attachment Communications cable, can be used with features 1310, 1610, 2092, and 2096.

- Feature 2057, the EIA dataset cable, can be used with features 1310, 1610, 2074, 2090, 2092, 2094, and 2096.
- Feature 2058, the BSC/High Speed cable (for Western Electric 303[3] interface), can be used with feature 2075.
- Feature 2060, the BSC V.35/High Speed DDN cable (for EIA/CCITT V.35 interface), can be used with features 2075 and 2080.
- Feature 2061, the Feature-Programmable Multiline Current Loop cable, can be used with feature 2096.
- Feature 2062, the EIA Duplex cable for pair of SDLC adapters, can be used with feature 2090.
- Feature 2067, the X.21 cable, can be used with feature 2080.
- Feature 2944, the Shielded EIA cable, can be used with features 1310, 1610, 2074, 2090, 2092, 2094, and 2096.
- Feature D02014, the Auto-call Originate Attachment cable, can be used with feature D02013.
- Feature D02352, the Series/1-3101 cable, can be used with feature D02350.
- Features D02246 and D02268, the Series/1-Series/1 cable and increment/replace cable, can be used with feature D02242.

Limitations

- No more than 24 communications lines, of any combination, can terminate in any processor or input/output expansion unit.
- No more than eight Binary Synchronous Communications Single-Line Control/High Speed features (feature 2075) can be installed in any processor or input/output expansion unit.

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[3] Product of Western Electric Company

Communications features

Series/1 communications features provide a variety of communications options. Two types of communications features are available: features that plug into the processor data channel (discussed in this chapter) and features that plug into the 4987 Programmable Communications Subsystem (discussed in Chapter 4).

Five types of attachment features provide communication with remote terminals and systems:

- Binary synchronous communications (BSC)

- Synchronous data link control (SDLC)

- Asynchronous communications control (ACC)

- Feature-programmable

- Synchronous Communications Single-Line Control/High Speed (SCSLC).

These features provide a choice of several single- and multiple-line data communications capabilities. In addition, there is a choice of line speeds, line configurations, clocking sources, and data codes. All communications features (except binary synchronous/high speed) are capable of automatic answering on switched lines.

Other features enhance the versatility of the Series/1 communications capabilities. For example, the Local Communications Controller feature provides access to other Series/1 processors connected on a high-speed ring. Also, the Series/1-System/370 Channel Attachment feature allows the Series/1 to be channel attached to a System/370.

Attributes	Feature programmable	SDLC	BSC (1)	ACC	SCSLC (2)
Point-to-point nonswitched	X	X	X	X	X
Point-to-point switched	X	X	X (3)	X	X
Multipoint	X (4)	X	X	X (4)	X
Primary station	X	X	X	X	X
Secondary station	X (4)	X	X	X (4)	X
Manual call/answer	X	X	X (3)	-	X
IPL (host initiated)	-	-	X (5)	-	X
Modem clocking	X	X	X	-	X
Business machine clocking	X	X	X	X	X
Error recovery facilities	X	X	X	X	X

Notes:

1. *Also applies to the remote capabilities of the Multifunction Attachment (feature 1310).*
2. *Supports V.35 and X.21 interfaces (no RS-232-C capability).*
3. *Not available on BSC high-speed.*
4. *No provision for recognition of station addresses. If used as a secondary station in a multipoint network, station address recognition must be provided by programming.*
5. *Single-line only.*

Binary synchronous (BSC) features

- Binary Synchronous Communications Single-Line Control (feature 2074) — This feature provides circuitry for one half-duplex line at data rates up to 9,600 bps on a switched or nonswitched basis. It also provides the ability to perform an initial program load (IPL) on the processor from a host system and can be used as either a primary or secondary station.

- Binary Synchronous Communications Single-Line Control/High speed (feature 2075) — This feature provides circuitry for one half-duplex line at speeds up to 56,000 bps on a nonswitched basis only. It also provides the ability to perform an initial program load (IPL) on the processor from a host system and can be used as either a primary or secondary station.

- Binary Synchronous Communications 8-Line Control (feature 2093) — This feature provides control circuitry for up to two BSC 4-line adapters. Data rates are 9600 bps for lines 1 and 2 and up to 2400 bps on lines 3 through 8 when two adapters are used. When a single 4-line adapter is used, the data rates for each line can be up to 4800 bps. The 8-line control can be used as either a primary or secondary station.

- Binary Synchronous Communications 4-Line Adapter (feature 2094) — This feature provides circuitry for up to four half-duplex lines. Data rates are dependent on the number of lines and the line speeds used. Control circuitry is provided by the prerequisite BSC 8-line control feature.

Synchronous (SDLC) feature

The Synchronous Data Link Control Single-Line Control (feature 2090) controls the serial transfer of data to and from remote terminals or host systems by using modems and communication line facilities. The following communication characteristics apply to the SDLC feature:

- Communicates using EBCDIC or ASCII (or any other 8-bit) code

- Single-line, medium-speed, half-duplexed device that can operate on switched or nonswitched lines

- Operates in a duplex environment by installing two cards (one as a transmitter and one as a receiver) in adjacent feature locations

- Data rates up to 19,200 bps with external clocking

- Operates as a primary or secondary station

- Internal clocking is available with bit rates of 600 bps or 1,200 bps

- Nonreturn-to-zero-inverted (NRZI) and nonreturn-to-zero (NRZ) coding

- Provides answer-tone by installing a jumper.

Asynchronous (ACC) features

- Asynchronous Communications Single-Line Control (feature 1610) — This feature provides circuitry for one half-duplex line at data rates up to 9600 bps on a switched or nonswitched basis. It can be used as either a primary station or secondary station. This feature does not provide for recognition of station addresses. If the feature is to be used as a secondary station in a multipoint network, station address recognition must be provided by programming.

- Asynchronous Communications 8-Line Control (feature 2091) — This feature provides the control circuitry for up to two ACC 4-line adapters. It can be used as a primary or secondary station.

- Asynchronous Communications 4-Line Adapter (feature 2092) — This feature provides circuitry for up to four half-duplex lines. Each of these lines can operate at data rates up to 2400 bps. Control circuitry is provided by the ACC 8-line control.

Feature-programmable multiline communications features

- Feature-Programmable Multiline 8-Line Communications Control (feature 2095) — This feature provides the control circuitry for up to two programmable 4-line communications adapters. Point-to-point or multipoint operations are supported with an aggregate controller throughput of 64,000 bits per second (based on a 12-bit character).

- Feature-Programmable Multiline 4-Line Communications Adapter (feature 2096) — This feature provides the circuitry to support up to four communications lines. Each line can be programmed to select:

    - Speed — 37.5 bps to 1200 bps, or 300 bps to 19,200 bps
    - Synchronous or asynchronous operation
    - 5, 6, 7, or 8 bits per character
    - Odd, even, or no parity checking/generation
    - Stop-bit length of 1 or 2
    - Synchronization character specification
    - Change-of-direction (COD) character recognition
    - Echo-plex operation
    - Break operation recognition/generation
    - Block check character reception (for 1 character).

Each line can also be jumpered for:

- EIA RS-232-C or current loop interface
- Modem controls for direct connect, switched line, and nonswitched line.

Synchronous Communications Single-Line Control/High Speed

Highlights are:

- BSC or SDLC/HDLC protocol
- Up to 56,000 bps line speed
- CCITT V.35 interface (leased)
- CCITT X.21 interface (switched or leased)
- Full or half duplex operation with SDLC/HDLC
- Remote initial program load (IPL) capability.

The Series/1 Synchronous Communications Single-Line Control/High Speed (feature 2080) provides the function required to attach the Series/1 to network interfaces conforming to the Consultative Committee International Telephone and Telegraph (CCITT) recommendation V.35 or X.21.

The hardware can operate with either of two protocols:

- Binary synchronous communications (BSC): Half duplex communications at speeds up to 56,000 bits per second (bps) by using V.35 interfaces (leased) or up to 48,000 bps using an X.21 interface (switched or leased). A local BSC connection supports speeds up to 48,000 bps.
- Synchronous data link control (SDLC): SDLC or high level data link control (HDLC) can operate in full-duplex mode with the same interfaces and speeds mentioned above. A local connection is available at speeds of 48,000 or 9,600 bps.

  Note: BSC and SDLC software support for X.21 interface is available at speeds of 19,200 or 9600 bps.

The hardware supports multipoint operation.

The feature consists of a single card, which mounts in a Series/1 processor or I/O expansion unit. It allows the connection of a Series/1 on a switched or nonswitched line to telecommunications networks requiring an X.21 standard interface.

Programming support

Nonswitched support:

- BSC X.21 is supported by:
  - Event Driven Executive Version 3.1
  - Realtime Programming System
- SDLC X.21 is supported by:
  - Event Driven Executive Support of Systems Network Architecture (5719-SX1)
  - Realtime Programming System
- HDLC is supported by:
  - X.25/HDLC Realtime Programming System Communications Support (5719-HD1).

Switched X.21 support:

- BSC is supported by Realtime Programming System and Event Driven Executive.
- SDLC is supported by Realtime Programming System and Event Driven Executive.

Prerequisites

When the V.35 interface is used, Communications Power (feature 2010) is required on the 4955 Model C or D processor or the I/O expansion unit.

Cables

For attachment to a data communications equipment (DCE) arrangement conforming to CCITT recommendation V.35, the BSC V.35/High Speed DDN cable (feature 2060) is available. The cable is 6.1 meters (20 feet) long.

For attachment to a DCE arrangement conforming to CCITT X.21, the X.21 cable (feature 2067) is available.

Local connection cables are a customer responsibility.

Telephone Communications Controller and Adapter

Highlights are:

- Automatically answers and originates calls

- Generates and detects standard pushbutton signals

- Digitally encodes and decodes voice signals

- Transfers data to and from the processor.

The IBM Series/1 Telephone Communications Controller (feature 7880) and IBM Series/1 Telephone Communications Adapter (feature 7881) combine to provide an attachment capability for public or private switched telephone lines. Each Controller provides the control and data transfer function for one to four Adapters. Each Adapter allows the attachment of one line.

These features interface the Series/1 to a customer installed telephone service connecting arrangement. The features allow telephone calls to come in and out of the Series/1 for processing by Series/1 application software.

The Adapter answers and originates calls, generates and detects standard pushbutton phone signals, and digitally encodes and decodes voice signals.

Programming support

The Telephone Communications Controller and Adapter are supported on the Series/1 only by the Audio Distribution System (5719-U20). The licensed program requires a dedicated system.

Prerequisites

Telephone Communications Adapter requires a Telephone Communications Controller (feature 7880). Both features can be installed in any Series/1 processor or expansion unit. The available software, however, requires a 4955 Model F processor configuration.

Cables

- The Telephone Communications Adapter cable - DAA (feature 2070) provides for connection to a data access arrangement (DAA).

- The Telephone Communications Adapter cable - VCA (feature 2071) provides for connection to a voice connecting arrangement (VCA).

Other communications features

- Series/1-System/370 channel Attachment (feature 1200) provides a high-speed data transfer capability (300,000 bytes per second) between a Series/1 and any of the following IBM processors:

  - System/370 (Models 135 through 168)

  - 3031, 3032, 3033, 3081

  - 4331, 4341.

  The feature occupies 32 device addresses on the System/370 channel and a single device address on the Series/1. IPL capability is provided. The feature requires 32 contiguous device addresses on the System/370 channel and a single device address on the Series/1 channel. IPL of the Series/1 from the host System/370 is supported.

  Communications between the Series/1 and the System/370 is accomplished by the cooperative processing of programs in each processor. The S/370 programs use a subset of the 3272 command set to access the feature. The Series/1 programs use the Series/1 Operate I/O instruction along with IDCB and DCB command codes and formats defined specifically for the feature.

- Local Communication Controller (feature 1400) is intended for high-speed serial data communications between two or more processors. The feature card allows multiple processors to be attached together by way of a ring data link without the need of a primary station. This type of configuration accommodates high-speed, storage-to-storage data transfer between two processors.

  The controller is clocked at 2 million bits per second. A built-in modem provides bit synchronization. The maximum distance allowed between any two active processors is 1524 meters (5000 feet) for twinaxial cables or 610 meters (2000 feet) for coaxial cables. Cable assemblies, bulk cables, and connector kits can be ordered from IBM to provide the link between processors. Up to 16 Series/1 processors can be interconnected on a ring.

- Auto-Call Originate Attachment Card (RPQ D02013) provides 12 input lines and 12 output lines for controlling up to two auto-call modems under direct program control (EIA RS-366 interface). It also provides 16 digital input/process interrupt points and 16 digital output non-isolated points under direct program control.

- Series/1-to-Series/1 Attachment (RPQs D02241 and D02242) permit the direct coupling of two Series/1 processors at distances of up to 21 meters (65 feet). Communication is in cycle-steal mode and operates at instantaneous data rates of up to 55,000 bytes per second. The Series/1s operate in a peer-to-peer relationship, except that the processor with RPQ D02241 installed prevails during data transfer contention.

- Direct BSC Attach (RPQ D02349) provides a half-duplex, single-line interface for connecting one Series/1 to another Series/1 up to 1219.2 meters (4000 feet) away. The interface conforms to EIA RS-422-A interface standards and transmits data at 38,000 bits per second. This attachment must be installed on both Series/1 processors.

- Asynchronous Direct 8-Line RS-422-A Adapter (RPQ D02350) provides eight RS-422-A interfaces for local attachment of RS-422-A devices such as the 316X Display Terminals. It is used with the Feature-Programmable 8-Line Communications Control (feature 2095) in place of the Feature-Programmable Multiline 4-Line Communications Adapter (feature 2096). Data rates of up to 19,200 bits per second are allowed with an aggregate controller throughput of 64K bps (based on a 12-bit character). Attached devices can be placed up to 1219.2 meters (4000 feet) from the Series/1.

Communications support features

- Communications Indicator Panel (feature 2000) is available as an option to the communications features on the data channel of a 4959 or a full-width processor. It mounts under the front cover and provides a means of displaying various states and conditions of lines and also a means of manually controlling certain modem functions. The panel can be used with any of the communications features, one at a time.

- Communications Power (feature 2010) provides the additional ± 12-volt regulated power required for attachment of one or more communications feature cards to the processor I/O channel. It is required in the processor or the I/O expansion unit where communications features are installed. It is required on a 4955 Model C or D Processor or a 4959 Input/Output Expansion Unit below serial number 22499 (domestic only).

4 Series/1 input/output and system support units

Chapter 4. Series/1 input/output and system support units

Series/1 input/output devices are designed to contribute to efficient system performance. Many devices are equipped with cycle-stealing microprocessor controllers that permit device overlapping and reduce processor workload.

Series/1 I/O units include disk, diskette, magnetic tape, printers, and display stations.

The 4982 Sensor I/O Unit provides control for a number of sensor digital and analog feature cards, and offers a flexible, modular approach for attaching the user's process I/O applications to the Series/1.

The 4987 Programmable Communications Subsystem expands the Series/1 communications versatility. It can support a large number of lines and multiple line disciplines in a single communications unit.

Storage-to-storage communication between Series/1 and System/370 processors is provided by the 4993 Series/1–System/370 Termination Enclosure and its companion channel attachment feature.

Note: Programming support refers to the latest version and release level that was announced at the time this document was printed. Programming support is available under separate license.

Physical characteristics

Height	356 millimeters (14 in.)
Width	483 millimeters (19 in.)
Depth	476 millimeters (18.75 in.)
Weight	22.7 kg (50 lb)
Shipping weight	37.5 kg (87 lb)

Environmental conditions

Heat output/hour	500 watts (1705 BTU)
Cooling	Forced air
Operating temperature	
	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Power requirements (at full load)

100 volts	7.0 amperes
115 volts	6.1 amperes
200 volts	3.5 amperes
208 volts	3.4 amperes
230 volts	3.2 amperes
Frequency	60 ± 0.5 Hz
kVA	0.7
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

- Series/1 processor
- Channel repower (feature 1565) is required:

    - In processors for the first expansion unit attached
    - In all expansion units, when more than one expansion unit is attached.

Cables

Input/output cables for the processor data channel are used to attach the 4959 to a Series/1 processor.

Standard features

- Fourteen input/output feature locations for attachment of devices to a Series/1

- Designed for mounting in a 4997 Rack Enclosure or an EIA standard 19-inch rack enclosure.

The 4959 provides additional I/O attachment capability to supplement the I/O feature locations provided within the Series/1 processors. A maximum of 14 I/O feature locations are contained in a 4959. Attachment features, data processing I/O attachment features, the Programmable Two-Channel Switch feature, and the sensor I/O unit attachment feature can be installed in any 4959 I/O Expansion Unit.

The Programmable Two-Channel Switch or Two-Channel Switch console is located on the front panel of the 4959 unit, and is a part of the optional feature. The console contains indicator lights and switches for determining the status of the feature and to allow for manual switching. Upon failure of the primary processor, the secondary or backup processor receives an interrupt and can be programmed to switch the common I/O. Manual intervention is required with the Two-Channel Switch feature when switching back to the primary processor, not with the Programmable Two-Channel Switch feature.

Note: The characteristics of the 4959 generally apply to the expansion unit capabilities of the 4965 Storage and I/O Expansion Units.

Optional features

- Channel Repower (feature 1565) — This feature repowers the data channel along a chain of I/O expansion units. The feature is always installed in the preceding unit and provides channel repower for the subsequent unit. A maximum of five Channel Repower features can be installed in a Series/1 configuration. The limit is three for any processor configuration with the Two-Channel Switch or Programmable Two-Channel Switch.

- Programmable Two-Channel Switch (feature 7777) — This feature electronically switches common I/O devices between two Series/1 processors. The unit also allows direct communication between the two Series/1 processors. At all times, the unit logically connects the common channel features to the I/O interface of one Series/1 processor while listening to the interface of both processors.

- Two-Channel Switch (feature 7900) — This feature provides the capability for switching the Series/1 channel between two processors. Features located in either the 4959 or 4965 in which the Two-Channel Switch feature is located, and in expansion units following in the chain, can be switched between processors.
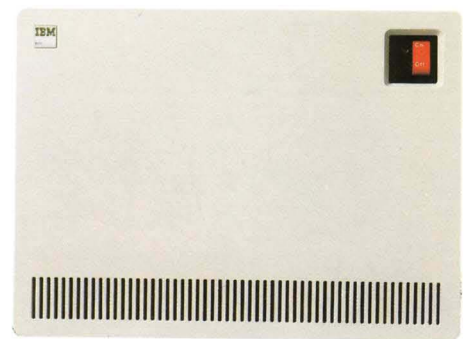
Operating characteristics

Rotational speed	3125 RPM
Average latency (nominal)	9.6 milliseconds
Instantaneous data rate	1.03 megabytes per second
Access times	
Cylinder to cylinder	9 milliseconds
Average seek	27 milliseconds
Maximum seek	45 milliseconds
Total usable storage	
Model 58A	58.8 megabytes
Models 64A, 64B	64.5 megabytes
Cylinders	360
Tracks per cylinder	4 (minimum)
	11 (maximum)
Sectors per track	64
Bytes per sector	256
Fixed-head storage (Model 58A)	
Total usable storage	131 kilobytes
Heads	8
Sectors per track	64
Bytes per sector	256

Physical characteristics

Height	356 millimeters (14 in.)
Width	483 millimeters (19 in.)
Depth	584 millimeters (23 in.)
Weight	54.4 kg (120 lb)
Shipping weight	67.9 kg (150 lb)

Environmental conditions

Heat output/hour	242 watts (827 BTU)
Cooling	Forced air
Operating temperature	
	$10-40.6°C$ ($50-105°F$)
Operating humidity	$8-80\%$

Power requirements (at full load)

100 volts	5.0 amperes
200 volts	2.5 amperes
208 volts	2.5 amperes
230 volts	2.5 amperes
Frequency	60 ± 0.5 Hz
kVA	0.50
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

The 4963 Disk Subsystem Attachment (feature 3590) is required for each 4963 Model 58A or 64A.

Highlights include:

- Mid-range disk subsystem with up to 256 megabyte capacity

- Microprocessor control to optimize disk performance

- One to four disks per subsystem — models may be mixed

- Multiple subsystems may be attached

- 27-millisecond average access time

- 10.1-millisecond latency

- 1.03-megabyte-per-second data rate.

This high-performance disk subsystem features multiple microprocessors to off-load the Series/1 processor and optimize disk performance. Each subsystem has one primary drive and may have up to three expansion drives (models may be intermixed). Multiple subsystems may be attached. Each subsystem attaches to the Series/1 through one Disk Subsystem Attachment (feature 3590) installed in a feature location space in a processor, 4959 I/O Expansion Unit, or 4965 Storage and I/O Expansion Unit.

Automatic retries on soft errors, automatic seek to alternate sector (one alternate sector per track plus use of spare sectors on tracks in same or adjacent cylinder eliminates seeks to alternate track), automatic seek overlap with read or write, and automatic error handling are all under subsystem microprocessor control. The microprocessor executes self-test diagnostics on power up, reset, and during quiescent periods. A three-sector speed matching buffer reduces extra revolutions often encountered on multiple sector read or write operations.

| 4963 model | Disk capacity (bytes) | |
	Movable heads	Fixed heads
64A	64,520,192	—
64B	64,520,192	—
58A	58,654,720	131,072
A = Primary unit		
B = Expansion unit		

The 4963 is a full-width unit that mounts in a 4997 Rack Enclosure or an EIA standard 19-inch rack.
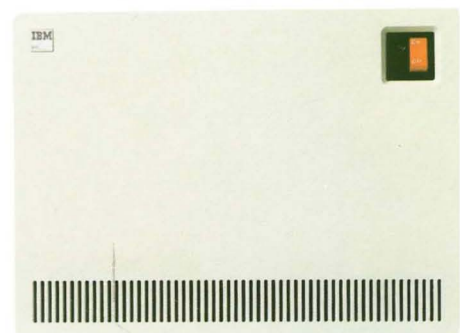
4964 Diskette Unit specifications

Operating characteristics

Rotational speed	360 RPM
Average latency (nominal)	83.4 milliseconds
Instantaneous data rate	31.3 kilobytes per second
Access times	
Track to track	5 milliseconds
Average seek	40 milliseconds
Total usable storage by type/sector size	
1/128	246 kilobytes
1/256	284 kilobytes
1/512	303 kilobytes
2/128	493 kilobytes
2/256	568 kilobytes
2/512	606 kilobytes
Tracks per diskette surface	77 (74 data)

Physical characteristics

Height	356 millimeters (14 in.)
Width	216 millimeters (8.5 in.)
Depth	590 millimeters (23.25 in.)
Weight	18.1 kg (40 lb)
Shipping weight	20 kg (44 lb)

Environmental conditions

Heat output/hour	230 watts (785 BTU)
Cooling	Forced air
Operating temperature	$10-40.6°C$ $(50-105°F)$
Operating humidity	$8-80\%$

Power requirements (at full load)

115 volts	2.2 amperes
208 volts	1.2 amperes
230 volts	1.1 amperes
Frequency	60 ± 0.5 Hz
kVA	0.25
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

The 4964 Diskette Unit Attachment (feature 3581) is required.

Rack mounting fixture (feature 4540) is required if mounting in an IBM 4997 Rack Enclosure or an EIA standard 19-inch rack enclosure.

Highlights include:

- Removable storage on two-sided diskette; each side has 74 data tracks

- Average data rate of 31,250 bytes per second

- Track-to-track access time of 40 milliseconds

- Selectable IPL capability.

The 4964 Diskette Unit mounts in half the width of a 19-inch rack enclosure. It is a direct-access storage device that retrieves and records data on a single, removable magnetic diskette and combines the small batch data storage properties with many of the features of magnetic tape. The diskette has the added advantage of providing direct access to a specified group of records filed either sequentially or randomly. Diskette data tracks contain 128-, 256-, or 512-byte sectors. One-or two-sided diskettes can be used. A two-sided diskette provides maximum storage capacity, using the 512-byte sector format. A one- sided diskette recorded in 128-byte sector format can be used to exchange data with other IBM devices.

The 4964 can be designated as either the primary or alternate system IPL device. It attaches to the Series/1 by means of the 4964 Diskette Unit Attachment feature, which can be plugged into either a processor unit or an I/O expansion unit. A microprocessor located in the diskette unit attachment feature controls cycle-steal read/write operations and supports multiple sector transfers. Extensive microdiagnostics along with cyclic redundancy checking are standard.

Diskette operating characteristics

Rotational speed	360 RPM
Average latency (nominal)	83.4 milliseconds
Instantaneous data rate	62.5 kilobytes per second
Access times	
Track to track	5 milliseconds
Average seek	40 milliseconds
Total usable storage by type/sector size	
1/128	246 kilobytes
1/256	284 kilobytes
1/512	303 kilobytes
2/128	493 kilobytes
2/256	568 kilobytes
2/512	606 kilobytes
2D/256	985 kilobytes
2D/512	1.1 megabytes
2D/1024	1.2 megabytes
Tracks per diskette surface	77 (74 data)

Physical characteristics

Height	356 millimeters (14 in.)
Width	483 millimeters (19 in.)
Depth	552 millimeters (21.75 in.)
Weight	38.5 kg (85 lb)
Shipping weight	43 kg (95 lb)

Environmental conditions

Heat output/hour	433 watts (1480 BTU)
Cooling	Forced air
Operating temperature	$10-40.6°C$ ($50-105°F$)
Operating humidity	$8-80\%$

Power requirements (at full load)

100 volts	7.0 amperes
200 volts	3.5 amperes
Frequency	60 ± 0.5 Hz
kVA	0.7
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

Channel Repower (feature 1565) is required when attaching a 4965 to a processor or another expansion unit.

Standard features

- Double-density, two-sided or one-sided diskette with a capacity of up to 1.2 megabytes

- Integrated diskette attachment card

- Available space and power for an optional second diskette drive

- Four additional feature locations for attachment of I/O features

- Selectable initial program load (IPL) capacity.

The 4965 Storage and I/O Expansion Unit, Model 001, is a direct-access storage device that retrieves and records data on removable magnetic diskette. One diskette drive is standard. A second diskette drive (feature 4100) is optional.

In addition to being a diskette device, the 4965 contains additional input/output feature locations, which allow for the connection of other Series/1 devices through the 4965 to a Series/1 processor. The attachment for the diskette is integrated as part of the 4965. The 4965 provides four I/O feature locations.

Optional features

- Diskette Drive (feature 4100) — Provides a second diskette drive with 1.2 megabytes of diskette storage.

- Stand-Alone Enclosure (feature 4520) — Provides a tabletop enclosure that allows the 4965 to be installed without a rack.

- Two-Channel Switch (feature 7900) — Provides the capability for switching the Series/1 channel between two processors. Features located in the 4965 in which the switch is located, and in expansion units following in the chain, can be switched between processors.
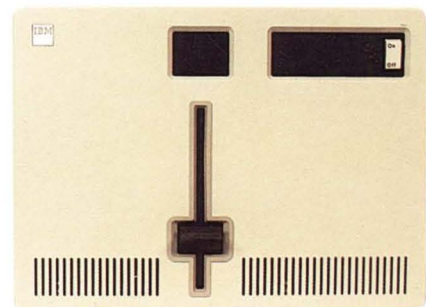
The 4965 can be designated as either the primary or alternate system IPL device. A microprocessor located in the integrated attachment card controls cycle-steal read/write operations and supports multiple diskette transfers. Extensive microdiagnostics along with cyclic redundancy checks are standard.

Double-density, two-sided, or one-sided diskettes can be used. The diskette provides direct access to a specified group of records filed either sequentially or randomly. Diskette data tracks contain 128-, 256-, 512-, or 1024-byte sectors. A double-density diskette provides maximum storage capacity when it is formatted with 1024-byte sectors. A one-sided diskette recorded in 128-byte sector format can be used to exchange data with other IBM systems.

The 4965 is a modular unit that mounts in a 4997 Rack Enclosure, a stand-alone enclosure, or an EIA standard 19-inch rack enclosure.
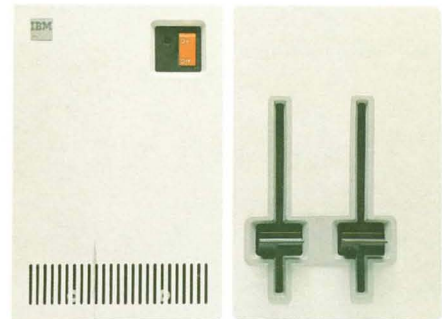
Disk operating characteristics

Rotational speed	3151 ± 3% RPM
Average latency (nominal)	9.5 milliseconds
Instantaneous data rate	1.25 megabytes per second
Access times	
Cylinder to cylinder	5.4 milliseconds
Average seek	35 milliseconds
Total usable storage	61.7 megabytes
Cylinders	888 (2 reserved)
Tracks per cylinder	4
Sectors per track	70 (68 usable)
Bytes per sector	256

For operating characteristics of the diskette drive, see "4965 Storage and I/O Expansion Unit (Model 1)."

Physical characteristics

Height	346 millimeters (13.75 in.)
Width	483 millimeters (19 in.)
Depth	576 millimeters (22.75 in.)
Weight	50.4 kg (111 lb)
Shipping weight	72.2 kg (160 lb)

Environmental conditions

Heat output/hour	650 watts (2220 BTU)
Cooling	Forced air
Operating temperature	
	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Power requirements (at full load)

115 volts	7.0 amperes
120 volts	6.7 amperes
208 volts	3.9 amperes
230 volts	3.5 amperes
240 volts	3.4 amperes
Frequency	60 ± 0.5 Hz
kVA	0.81
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

Channel Repower (feature 1565) is required when attaching a 4965 to a processor or another expansion unit.

Standard features

- 60-megabyte disk storage

- Integrated attachment card

- Instantaneous data rate of 1.25 megabytes per second

- Average access time less than 40 milliseconds

- Seven I/O feature locations

- Selectable IPL capability.

The 4965 Model 60D is a modular unit with seven I/O feature locations and includes an integrated 60-megabyte disk with optional Cache. The unit mounts in a 4997 Rack Enclosure, a stand-alone enclosure, or an EIA standard 19-inch rack enclosure.

Optional features

- Diskette Drive (feature 4100) — Provides an optional diskette drive with 1.2 megabytes of diskette storage.

- Stand-Alone Enclosure (feature 4520) — Provides a tabletop enclosure that allows the 4965 to be installed without a rack. Can be field-installed. If more than on enclosure is used, the external-shielded Stand-Alone Enclosure Cable (feature 4525) is needed to connect them together.

- Cache (feature 6400) — Provides the Model 30D and 60D with a 64K-byte cache that pre-fetches and stores the most-used data sectors. Test cases have shown improvements in disk throughput ranging from 50% to more than 200%. However, performance improvements are application dependent. Cache does not require a feature position and is not field-installable.

- Two-Channel Switch (feature 7900) — Provides the capability for switching the Series/1 channel between two processors. Features located in the 4965 in which the switch is located, and in expansion units following in the chain, can be switched between processors.

The 4965 can be designated as either the primary or alternate system IPL device. A microprocessor located on the integrated attachment card controls cycle-steal read/write operations and supports multiple diskette transfers. Extensive microdiagnostics along with cyclic redundancy checks are standard.

Double-density, two-sided, or one-sided diskettes can be used. The diskette provides direct access to a specified group of records filed either sequentially or randomly. Diskette data tracks contain 128-, 256-, 512-, or 1024-byte sectors. A double-density diskette provides maximum storage capacity when it is formatted with 1024-byte sectors. A one-sided diskette recorded in 128-byte sector format can be used to exchange data with other IBM systems.

Disk operating characteristics

Rotational speed	3600 RPM
Average latency (nominal)	8.3 milliseconds
Instantaneous data rate	625 kilobytes per second
Access times	
Cylinder to cylinder	8 milliseconds
Average seek	40 milliseconds
Total usable storage	40 megabytes
Cylinders	733
Tracks per cylinder	7
Sectors per track	32
Bytes per sector	512

Physical characteristics

Height	346 millimeters (13.75 in.)
Width	480 millimeters (19 in.)
Depth	576 millimeters (22.75 in.)
Weight	55 kg (120 lb)
Shipping weight	72.6 kg (160 lb)

Environmental conditions

Heat output/hour	600 watts (2040 BTU)
Cooling	Forced air
Operating temperature	
	$10-40.6°C$ $(50-105°F)$
Operating humidity	$8-80\%$

Power requirements (at full load)

115 volts	7.0 amperes
120 volts	6.7 amperes
208 volts	3.9 amperes
230 volts	3.5 amperes
240 volts	3.4 amperes
Frequency	$50/60 \pm 3.0$ Hz
kVA	0.81
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

Channel Repower (feature 1565) is required when attaching a 4965 to a processor or another expansion unit.

Standard features

- One 40-megabyte fixed-disk drive

- Cache storage (400KB)

- Instantaneous data rate of 625 kilobytes per second

- Average access time less than 40 milliseconds

- Seven I/O feature locations

- Selectable IPL capability.

The 4965 Model E00 is a modular unit with seven I/O feature locations and includes an integrated 40-megabyte disk with 400KB Cache standard. The unit mounts in a 4997 Rack Enclosure or an EIA standard 19-inch rack enclosure.

The 4965 can be designated as either the primary or alternate system IPL device. A microprocessor located on the integrated attachment card controls cycle-steal read/write operations and supports multiple diskette transfers. Extensive microdiagnostics along with cyclic redundancy checks are standard.

Optional features

- Channel Repower (feature 1565) — Repowers the data channel along a chain of I/O expansion units. The feature is always installed in the preceding unit and provides channel repower for the subsequent unit. Up to five Channel Repower features can be installed in a Series/1 configuration (up to three for any processor configuration with the Two-Channel Switch or Programmable Two-Channel Switch).

- Diskette Drive (feature 4117) — Provides an optional high-capacity 5.25-inch diskette drive with 1.2 megabytes of diskette storage.

- Second Disk Drive (feature 4115) — Provides a second 40-megabyte fixed-disk drive.

- Third Disk Drive (feature 4116) — Provides a third 40-megabyte fixed-disk drive.

- Programmable Two-Channel Switch (feature 7777) — Electronically switches common I/O devices between two Series/1 processors. The unit also allows direct communication between the two Series/1 processors. The unit logically connects the common channel features to the I/O interface of one Series/1 processor while listening to the interface of both processors.

- Two-Channel Switch (feature 7900) — Provides the capability for switching the Series/1 channel between two processors. Features located in either the 4959 or 4965 in which the Two-Channel Switch feature is located, and in expansion units following in the chain, can be switched between processors.
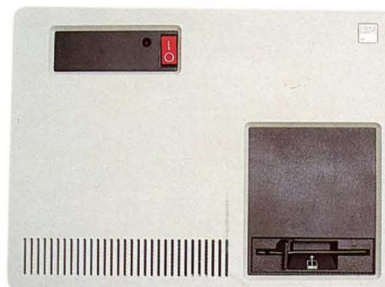
4967 High-Performance Disk Subsystem specifications

Operating characteristics

Rotational speed	2964 RPM (nominal)
Average latency (nominal)	10.1 milliseconds
Instantaneous data rate	1.5 megabytes per second
Access times	
Cylinder to cylinder	9 milliseconds
Average seek	25 milliseconds
Total usable storage	
Model 2CA/2CB	200 megabytes
Model 3CA/3CB	359 megabytes
Cylinders	
Model 2CA/2CB	570
Model 3CA/3CB	1022
Tracks per cylinder	14
Sectors per track	50 (1 reserved)
Records per sector	2
Bytes per record	256

Physical characteristics

Height	356 millimeters (14 in.)
Width	483 millimeters (19 in.)
Depth	635 millimeters (25 in.)
Weight	68.1 kg (150 lb)
Shipping weight	90.9 kg (200 lb)

Environmental conditions

Heat output/hour	
Model 2CA/3CA	500 watts (1730 BTU)
Model 2CB/3CB	400 watts (1365 BTU)
Cooling	Forced air
Operating temperature	10−40.6°C (50−105°F)
Operating humidity	8−80%

Power requirements (at full load)

Model 2CA/3CA

110 volts	7.4 amperes
115 volts	7.4 amperes
120 volts	7.4 amperes
208 volts	3.7 amperes
220 volts	3.7 amperes
240 volts	3.7 amperes

Model 2CB/3CB

110 volts	7.0 amperes
115 volts	7.0 amperes
120 volts	7.0 amperes
208 volts	3.5 amperes
220 volts	3.5 amperes
240 volts	3.5 amperes

Frequency	60±0.5 Hz
kVA	1.25
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

The 4967 high-performance Disk Subsystem Attachment is required for each subsystem in a processor unit or expansion unit (feature 3595 for 2CA and feature 3596 for 3CA).

Highlights include:

- Storage capacity of 200 to 1432 megabytes per subsystem (1 – 4 disk units)
- Cache storage of 384KB per subsystem
- Instantaneous data rate of 1.5 megabytes per second
- Average access time of 25 milliseconds
- Extensive error checking and recovery procedures
- Selectable as IPL device.

The 4967 High Performance Disk Subsystem provides the Series/1 with direct access storage capacities up to 1432 megabytes per subsystem. Multiple subsystems may be attached to a Series/1. The 4967 is a full-width unit designed for mounting in the 4997 Rack Enclosure or EIA standard 19-inch rack.

There are four models of the 4967 disk unit:

- Model 2CA is a primary disk unit that contains 200 megabytes of storage.
- Model 2CB is an expansion unit that contains 200 megabytes of storage.
- Model 3CA is a primary disk unit that contains 358 megabytes of storage.
- Model 3CB is an expansion unit that contains 358 megabytes of storage.

The Model 2CA primary disk unit requires the 4967 Attachment (feature #3595), and can have up to three 2CB expansion units. The Model 3CA primary disk unit requires the 4967 Attachment (feature #3596), and can have up to three 3CB expansion units.

The 384K-byte cache is microprocessor-controlled and has the potential to significantly improve system performance. Selected data sectors, determined by the cache control algorithm to be probable candidates for system read requests, are pre-fetched and stored in cache. Cache functions are transparent to programming.

Performance improvements are application dependent—test cases from a variety of applications thought to be typical have shown improvements in disk throughput ranging from 50% to above 200%. No guarantee of results can be made, however. The microprocessor monitors its own "hit ratio" and adjusts to optimize performance. A least-recently-used algorithm eliminates inactive data from cache as space for new data is required. This allows the 4967 to dynamically adapt to changes in the job stream. Applications that are truly random (test cases found none) or that are heavily write-oriented may experience little or no improvement from the cache function. Cache functions are transparent to programming. In such cases, the standard performance parameters of 25 milliseconds average access time and 10.1 milliseconds latency are seen. During a write operation, data is placed in cache only after being written to the disk.

Further 4967 features include automatic retries on soft error, automatic seek to alternate sector (always on same cylinder; eliminates seek to alternate track), automatic seek overlap with read or write. Error correction code (ECC) mechanism correct the most common form of disk read errors and detect all uncorrectable forms.
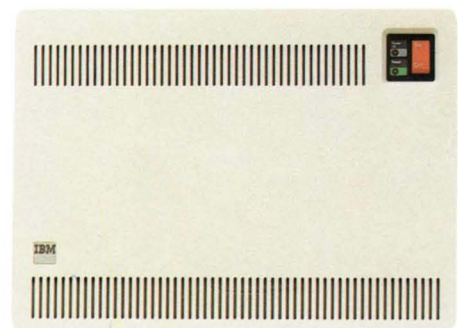
4968 Autoload Streaming Magnetic Tape Unit specifications

Operating characteristics

Normal tape speed	635 millimeters (25 in.) per second
	1270 millimeters (50 in.) per second
	2540 millimeters (100 in.) per second
Normal rewind time	2.6 minutes (2400 foot reel)
Recording mode	IBM/ANSI compatible
Head type	Duel gap
Number of tracks	9

Physical characteristics

Height	222 millimeters (8.75 in.)
Width	483 millimeters (19 in.)
Depth	559 millimeters (22 in.)
Weight	36 kg (80 lb)
Shipping weight	38.6 kg (85 lb)

Environmental conditions

Heat output/hour	180 watts (614 BTU)
Cooling	Forced air
Operating temperature	16 − 32.6°C (60 − 90°F)
Operating humidity	20 − 85%

Power requirements (at full load)

115 volts	1.7 amperes
208 volts	1 ampere
220 volts	0.9 ampere
240 volts	0.8 ampere
Frequency	60 ± 0.5 Hz
kVA	0.2
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Magnetic tape

IBM Multi-system tape.

Prerequisites

The 4968 Autoload Streaming Magnetic Tape Unit attachment (feature 1220) is required for each tape unit.

Highlights include:

- Fast, convenient, save/restore for medium-to-large Series/1 disk products.

- Autoload convenience for standard tape reels.

- Fast, streaming operation of 160KB per second at 100 inches per second (1600 bpi ANSI standard) or 50 inches per second (3200 bpi).

- Reel capacity of 2400-foot reel is up to 80 megabytes at 3200 bpi.

- Start/stop at up to 25 ips (1600 bpi) for limited applications.

- Dual density.

The 4968 Autoload Streaming Magnetic Tape Units are designed for mounting in the 4997 Rack Enclosure Model 2 or EIA standard 19-inch rack. The unit is slide-mounted to facilitate moving the unit into the service position or into position for customer tape path cleaning.

The tape unit 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 primary purpose of the 4968 Autoload Streaming Magnetic Tape Unit is to provide fast, convenient, save/restore functions for IBM Series/1 disk products.

The 4968 has the following key parameters of save/restore:

Speed

In streaming mode at 50 or 100 ips, the data rate is 160K bytes per second. The 4968 saves 80 megabytes in approximately 10 minutes; 200 megabytes in approximately 30 minutes. Software is designed to ensure streaming on a quiescent system in a save operation.

Capacity

In the 3200 bpi mode, each 2400 foot tape reel has a capacity of approximately 80 megabytes. A full 200 megabytes can be saved on three reels. At 1600 bpi, tape capacity is approximately 40 megabytes.

Convenience

Autoloading eliminates tape threading by the operator. Autoloading, plus large per reel tape capacity, make operator convenience a key 4968 highlight. The autoload mechanism features self-seating, self-locking tape hub and tape reel upside-down detect. Software support for save/restore operations minimize operator intervention on single or multi-reel operations.
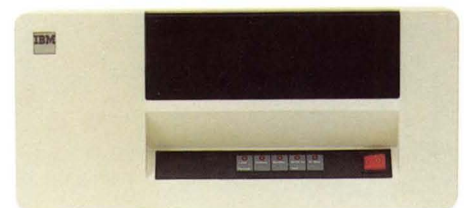
4201 Proprinter specifications

Operating characteristics

Print speeds

DP quality	200 characters per second
Text quality	100 characters per second
Correspondence quality	40 characters per second
Horizontal spacing	5, 6, 8.5, 10, 12 and 17 characters per inch
Vertical line spacing	1/6, 1/8, N/144 inch (converts N/216 to N/144 where applicable)
Print line length	203 millimeters (8 in.)

Forms specifications

Thickness	0.003 – 0.014 inch
Width	
Continuous	3 – 10 inches
Cut forms	3 – 10 inches
Length (minimum)	3 inches
Number of copies	Original plus 3

Physical characteristics

Height	134 millimeters (5.25 in.)
Width	406 millimeters (16 in.)
Depth	343 millimeters (13.5 in.)
Weight	7.94 kg (17.5 lb)

Environmental conditions

Heat output/hour	60 watts (205 BTU)
Cooling	Convection
Operating temperature	
	10 – 40.6°C (50 – 105°F)
Operating humidity	8 – 80%

Power requirements (at full load)

100 volts	1.8 amperes
120 volts	1.5 amperes
240 volts	0.75 ampere
Frequency	60 ± 0.5 Hz
kVA	0.18
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System (for the Series/1 System Unit only).

Print Ribbon

Print cartridge P/N 6328829 or equivalent.

Prerequisites

For the Series/1 System Unit (Note 1):

- Monochrome Display and Printer Adapter (feature 4900), *or*
- Serial/Parallel Adapter (feature 0215).

For the 4956 (Note 2):

- Serial Interface Card (feature 3000)
- Multifunction Attachment (feature 1310), *or*

- Feature Programmable Multiline Controller (features 2095 and 2096).

Cables

For the Series/1 System Unit:

Parallel Printer cable (feature 5612, P/N 1525612).

For the 4956:

- Communications Adapter cable (feature 2056), *and*
- Communications cable (P/N 5640736).

Notes:

1. *The Proprinter can be connected to the Terminal/Host Attachment card as an asynchronous device. The Serial Printer cable (feature 6031, P/N 8509386) and the Serial Interface Card (feature 3000, P/N 6493187) are required.*

2. *Xon/Xoff pacing must be used. For feature 1310, only baud rates up to 4800 bps may be used.*

Highlights include:

- Compact, lightweight, tabletop printer

- Bidirectional printing at a maximum of 200 characters per second

- Choice of three print qualities:

  - DP printing at 200 characters per second
  - Text (double-dotted) printing at a maximum of 100 characters per second
  - Correspondence (double-struck) printing at 40 characters per second

- IBM Personal Computer character sets 1 and 2

- Printing at 5, 6, 8.5, 10, 12, and 17 characters per inch

- Single-sheet or fanfold paper may be used

- An original plus three carbons can be made

- 80 characters per line in normal mode

- 137 characters per line in compressed mode.

The 4201 is a compact, tabletop, bidirectional, matrix printer. This serial printer provides data processing (DP) printing, text printing, and correspondence quality printing.

The 4201 Proprinter is a customer-setup unit that allows the user to install or relocate the printer.

A 5KB print buffer (feature 4000) and a Serial Interface Card (feature 3000) are optional features available on the 4201.

For attachment to the Series/1 System Unit, a 1.8 meter (6 foot) Communications Adapter Cable (feature 5612) is available for attachment to the Monochrome Display and Printer Adapter (feature 4900). A second 4201 may be attached to the Serial/Parallel Adapter Card (feature 0215).

For attachment to an IBM 4956, the Serial Interface Card (feature 3000) must be ordered. Also, a Communications Adapter Cable (feature 2056) is is used with Communications Cable (P/N 5640736) to attach to the Multifunction Attachment (feature 1310) or to the Feature Programmable Multiline Controller (features 2095 and 2096).

4202 Proprinter XL specifications

Operating characteristics

Print speeds

DP quality	200 characters per second
Text quality	100 characters per second
Correspondence quality	40 characters per second
Horizontal spacing	5, 6, 8.5, 10, 12 and 17 characters per inch
Vertical line spacing	1/6, 1/8, N/144 inch (converts N/216 to N/144 where applicable)
Print line length	335 millimeters (13.6 in.)

Forms specifications

Thickness	0.003 − 0.014 inch
Width	
Continuous	3 − 15 inches
Cut forms	3 − 16.5 inches
Length (minimum)	3 inches
Number of copies	Original plus 3

Physical characteristics

Height	140 millimeters (5.5 in.)
Width	574 millimeters (22.6 in.)
Depth	368 millimeters (14.5 in.)
Weight	10.9 kg (24 lb)

Environmental conditions

Heat output/hour	60 watts (205 BTU)
Cooling	Convection
Operating temperature	
	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Power requirements (at full load)

100 volts	1.8 amperes
120 volts	1.5 amperes
240 volts	0.75 ampere
Frequency	60 ± 0.5 Hz
kVA	0.18
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System (for the Series/1 System Unit only).

Print Ribbon

Print cartridge P/N 1040150 or equivalent.

Prerequisites

For the Series/1 System Unit (Note 1):

- Serial Interface Card (feature 3000)
- Monochrome Display and Printer Adapter (feature 4900), *or*
- Serial/Parallel Adapter (feature 0215).

For the 4956 (Note 2):

- Multifunction Attachment (feature 1310), *or*

- Feature Programmable Multiline Controller (features 2095 and 2096).

Cables

For the Series/1 System Unit:

Parallel Printer cable (feature 5612, P/N 1525612).

For the 4956:

- Communications Adapter cable (feature 2056), *and*
- Communications cable (P/N 5640736).

Notes:

1. The Proprinter XL can be connected to the Terminal/Host Attachment card as an asynchronous device. The Serial Printer cable (feature 6031, P/N 8509386) and the Serial Interface Card (feature 3000, P/N 6493187) are required.

2. Xon/Xoff pacing must be used. For feature 1310, only baud rates up to 4800 bps may be used.

Highlights include:

- Compact, lightweight, tabletop printer

- Wide-carriage (13.6 inch print line)

- 132 characters per line in normal mode

- 214 characters per line in compressed mode

- 4KB print buffer standard

- 8KB print buffer option

- Bidirectional printing at a maximum of 200 characters per second

- Easy to use operator panel with expanded function

- Increased character set size for downloadable fonts

- "Quiet" mode

- Power-assisted paper loading

- Choice of three print qualities:

    - DP printing at 200 characters per second
    - Text (double-dotted) printing at a maximum of 100 characters per second
    - Correspondence (double-struck) printing at 40 characters per second

- IBM Personal Computer character sets 1 and 2

- Printing at 5, 6, 8.5, 10, 12, and 17 characters per inch

- Single-sheet or fanfold paper may be used

- An original plus three carbons can be made

- Proportional character spacing

- Software-selectable margins.

The 4202 is a wide-carriage bidirectional dot-matrix printer. This serial printer provides data processing (DP) printing, text printing, and correspondence quality printing.

The 4202 Proprinter is a customer-setup unit that allows the user to install or relocate the printer.

An 8KB print buffer (feature 4000) and a Serial Interface Card (feature 3000) are optional features available on the 4202.

For attachment to an IBM Series/1 System Unit, a 1.8 meter (6 foot) Communications Adapter Cable (feature 5612) is available for attachment to the Monochrome Display and Printer Adapter (feature 4900). A second 4202 may be attached to the Serial/Parallel Adapter Card (feature 0215).

For attachment to an IBM 4956, the Serial Interface Card (feature 3000) must be ordered. Also, a Communications Adapter Cable (feature 2056) is is used with Communications Cable (P/N 5640736) to attach to the Multifunction Attachment (feature 1310) or to the Feature Programmable Multiline Controller (features 2095 and 2096).

4224 Printer specifications

Operating characteristics

Print speeds

Model 301	200 characters per second
Model 302	400 characters per second
Model 3C2	400 characters per second
Horizontal spacing	10, 12 or 15 characters per inch
Vertical line spacing	6 or 8 lines per inch

Characters per print line

10 characters per inch 132 characters
12 characters per inch 158 characters
15 characters per inch 198 characters

Forms specifications

Type of forms	Continuous
Thickness	0.003 – 0.025 inch
Width	3 – 15 inches
Length	3 – 14 inches
Number of copies	Original plus 5

Physical characteristics

Height	280 millimeters (11 in.)
Width	710 millimeters (28 in.)
Depth	580 millimeters (23 in.)
Weight	68 kg (149 lb)

Environmental conditions

Heat output/hour	330 watts (1130 BTU)
Cooling	Forced air
Operating temperature	
	10 – 40.6°C (50 – 105°F)
Operating humidity	8 – 80%

Power requirements (at full load)

110 volts	3 amperes
220 volts	1.5 amperes
Frequency	60 ± 0.5 Hz
kVA	0.33
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System (RS-422-A only).

Print Ribbon

Models 301 and 302	
B/W	P/N 6091649
Model 3C2	
B/W	P/N 6115549
4 color	P/N 6115555
8 color	P/N 6115554

Prerequisites (see note)

- Multifunction Attachment (feature 1310), *or*

- Feature Programmable Multiline Controller (features 2095 and 2096).

Cables

- Feature 5770, *or*
- Feature 5790, *or*
- Communications Adapter cable (feature 2056), *and* Communications cable (P/N 5640736).

Note: Xon/Xoff pacing must be used.

Highlights include:

- Printing up to six-part forms

- Vertical spacing at 6 to 8 lines per inch

- Local attachment via RS-232-C or RS-422-A interface.

- Local attachment up to 1219 meters (4000 feet)

- Three models with a maximum speed of up to 400 characters per second

- Printing at 10 characters per inch (132 characters per line) ,12 characters per inch (158 characters per line), or 15 characters per inch (198 characters per line)

- Bidirectional printing for optimized throughput

- Prints in Data Processing (DP), Data Processing Text (DPT), or Near Letter Quality (NLQ) modes

- Choice of four-color or eight-color ribbons on Model 3C2.

The 4224 is a tabletop wire-matrix printer that produces characters printed by a pattern of dots, and provides medium-speed output for the Series/1.

The printer meets the needs for a system printer or a work station printer. The 4224 is a customer-setup unit, which allows the user to easily install or relocate the printer.

The 4224 attaches to the Series/1 by either Feature 1310 or Features 2095 and 2096.

The printer accepts single-part continuous forms or multipart continuous forms.

Operating characteristics

Print speeds
 Near letter quality   120 Lines per minute
 Data processing print 300 lines per minute
 Draft print   410 lines per minute
 Horizontal spacing   10 or 15 characters per
                      inch
 Vertical line spacing 3, 4, 6, or 8 lines per inch
 Characters per print
 line

                      132 characters at 10 cpi
                      198 characters at 15 cpi

Forms specifications

Thickness
 Single-part   0 − 0.009 inch
 Multipart   0 − 0.02 inch
Width   3.5 − 16 inches
Length   3 − 14 inches
Number of copies   Original plus 5

Physical characteristics

Height   958 millimeters (37.8 in.)
Width   660 millimeters (26 in.)
Depth   765 millimeters (30.3 in.)
Weight   68.1 kg (150 lb)

Environmental conditions

Heat output/hour   700 watts (2387 BTU)
Cooling   Forced air
Operating temperature
                      10 − 40.6°C (50 − 105°F)
Operating humidity   8 − 80%

Power requirements (at full load)

100-110 volts   9.0 amperes
120-127 volts   7.5 amperes
200-220 volts   4.5 amperes

Frequency   50/60 ± 0.5 Hz
kVA   0.9
Phase   1
Branch circuit   15 amperes

Programming support

Event Driven Executive (must be defined as a 5225).

Print Ribbon

P/N 6295158

Prerequisites

Printer attachment—5200 Series (feature 5640) is required.

Cables

Feature 5780, 6.1 meters (20 feet).

The 4234 is a heavy-duty impact-matrix line printer that provides medium-speed output and uses dot-print band technology.

Highlights include:

- A selection of three dot sizes

- selection of three densities of print and print speeds

- 300 lines per minute (nominal)

- Horizontal spacing of 10 and 15 characters per inch

- Vertical spacing of 3, 4, 6, and 8 lines per inch

- Prints up to 6-part forms

- Forms eject and restore for tearing off forms and continuing

- Operator-selectable character sets

- End-of-forms detection

- Variable-width form feed tractors

- Horizontal and vertical vernier-adjustments

- Power-assist when loading forms

- Audible alarm

- Alphameric Status display

- Printer stand

- Low noise level (approximately 57 dB)

- Forms stacker.

The printer meets the needs for a system printer or a work station printer. The 4234 is a customer-setup unit, which allows the user to easily install or relocate the printer.

The 4234 attaches to the Series/1 by means of the IBM Printer Attachment-5200 Series (feature 5640), which can be plugged into either the processor or the I/O expansion unit. Print operations, controlled by a microprocessor located in the attachment feature, are buffered and operate in cycle-steal mode.

The printer accepts single-part continuous forms or multipart continuous forms. Integrated operator controls move and adjust the forms.

4975 Printer specifications

Operating characteristics

Print speeds
Models 01A, 01L, 01R 80 characters per second
Models 02L, 02R 40 or 160 characters per second
Horizontal spacing 10 or 15 characters per inch
Vertical line spacing 6 or 8 lines per inch
Characters per print line
10 characters per inch 132 characters
15 characters per inch 198 characters

Forms specifications

Thickness
Single-part 0.003 − 0.0075 inch
Multipart 0.003 − 0.018 inch
Width 3 − 14.5 inches
Length 3 − 14 inches
Number of copies Original plus 3

Physical characteristics

Height 221 millimeters (8.7 in.)
Width 580 millimeters (20.8 in.)
Depth 420 millimeters (16.5 in.)
Weight
Models 01A, 01L, 01R
26.3 kg (58 lb)
Models 02L, 02R 29.9 kg (66 lb)

Environmental conditions

Heat output/hour
Models 01A, 01L, 01R 125 watts (426 BTU)
Models 02L, 02R 175 watts (597 BTU)
Cooling Convection
Operating temperature 10 − 40.6°C (50 − 105°F)
Operating humidity 8 − 80%

Power requirements (at full load)

Models 01A, 01L, 01R
115 volts 0.61 ampere
208 volts 0.34 ampere
230 volts 0.3 ampere

Models 02L, 02R
115 volts 0.67 ampere
208 volts 0.37 ampere
230 volts 0.34 ampere

Frequency 60 ± 0.5 Hz
kVA
Models 01A, 01L, 01R 0.07
Models 02L, 02R 0.08
Phase 1
Branch circuit 15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Print Ribbon

Models 01A, 01L, 01R P/N 7034535 or equivalent
Models 02L, 02R P/N 7032555 or equivalent

Prerequisites

Multifunction Attachment (feature 1310)

Cables

Each printer comes equipped with a 2.8-meter (9-foot) power cable with nonlocking plug.

To connect Models 01L and 02L to the Multifunction Attachment RS-422-A ports, the Multifunction Attachment cable (feature 5770) is available as a 15.4-meter (50-foot) cable with appropriate connectors.

To connect Models 01A, 01R, and 02R, the Asynchronous Local Attachment cable (feature 2056) or the EIA dataset cable (feature 2057) is available. Both cables are 6.1 meters (20 feet) long.

Highlights include:

- Allows either local attachment up to 1219.2 meters (4000 feet) from a Series/1 processor, remote attachment to Series/1, or as an auxiliary ASCII printer attached to the asynchronous port of a Display Terminal.
- Requires no additional programming for remote attachment
- Models 01L, 01R and 01A:
  - Operate at 80 characters per second
  - Print in draft mode
- Models 02L and 02R:
  - Operate at 40 and 160 characters per second (cps)
  - Print in quality mode (40 cps) and draft mode (160 cps)
- Provides bidirectional printing
- Either prints 10 characters per inch, up to 132 characters per line, or 15 characters per inch, up to 198 characters per line
- Prints six or eight lines per inch under program control
- Prints up to four-part forms.

The 4975 Printer is a tabletop, serial-impact, wire-matrix printer that produces characters printed by a pattern of dots, and provides low-speed output for the Series/1. The printer meets the system needs for a small system printer, a work station printer, or a remote printer. The 4975 is a customer-setup unit, which allows the user to easily install or relocate the printer.

All models print in draft mode. Models 02L and 02R print in quality mode. Quality printing is best suited for cut forms. Software controls the printing of correspondence quality documents. The software instructs the printer to perform additional functions such as proportional spacing and multiple pass printing of each line, which results in higher quality printed output suitable for letters.

The 4975 attaches to the Series/1 by means of the Multifunction Attachment (feature 1310), which can be plugged into either the processor or input/output expansion unit. Print operations, controlled by a microprocessor located in the attachment feature, are buffered and operate in cycle-steal mode.

Two interfaces are available. The RS-422-A interface, for Models 01L and 02L, allows local use; the maximum local distance allowed is 1219.2 meters (4000 feet) from a Series/1 processor. The RS-232-C interface, for Models 01R and 02R, allows remote use; no additional programming is required for remote attachment. Model 01A uses the RS-232-C interface.

The printer accepts single-part continuous forms, multipart continuous forms, and cut forms. A forms tractor, with chain-drive paper feed, is provided for printing on margin-punched continuous forms.

Integrated operator controls move and adjust the paper or forms. An optional Rear Document Insertion Device (feature 6100) allows the user to conveniently feed cut sheets and cut forms. For optimum handling of continuous forms, the Forms Stand (feature 4450) is recommended.

Special printing cartridge

This optional feature on the 4975 Model 2 provides a computer-based system that offers the versatility of bar code, OCR, and large character label printing. Applications include retail sales, stock inventory, manufacturing parts and assembly checking, plus miscellaneous identification needs in other industries or information systems.

The Special printing cartridge is operator-insertable and replaces the standard printing cartridge. Feature 1601 provides a cartridge for already-installed 4975 Model 2 printers. Feature 1610 provides a factory-installed Special Printing Cartridge (no standard cartridge is provided).
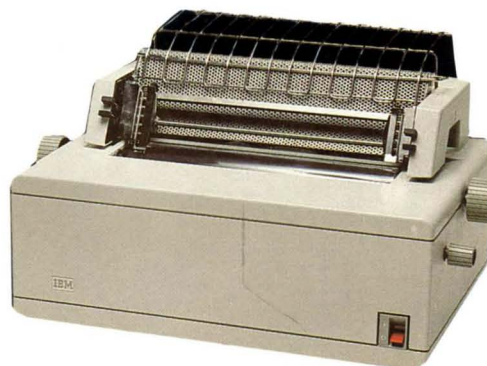
Operating characteristics

Print speeds
Model D01	40 characters per second
Model D02	60 characters per second
Horizontal spacing	10, 12, or 15 characters per inch or proportional spacing
Vertical line spacing	4, 5.3, 6, 8, 9.6, or 12 lines per inch
Print line length	335 millimeters (13.25 in.)

Forms specifications

Thickness
Single-part	0.003 − 0.0075 inch
Multipart	0.003 − 0.018 inch
Width	3 − 14.5 inches
Length	3 − 14 inches
Number of copies	Original plus 5

Physical characteristics

Printer only
Height	200 millimeters (7.9 in.)
Width	660 millimeters (26 in.)
Depth	583 millimeters (23 in.)
Weight	31 kg (68.2 lb)

Printer with sheet feed option
Height	484 millimeters (19 in.)
Width	660 millimeters (26 in.)
Depth	725 millimeters (28.5 in.)
Weight	43 kg (94.6 lb)

Environmental conditions

Heat output/hour	100 watts (341 BTU)
Cooling	Forced air
Operating temperature	15.6 − 32.2°C (60 − 90°F)
Operating humidity	8 − 80%

Power requirements (at full load)

110 volts	5.0 amperes
208 volts	2.6 amperes
240 volts	2.3 amperes

Frequency	60 ± 0.5 Hz
kVA	0.55
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Print Ribbon

IBM Tech III or equivalent

Prerequisites

Printer attachment—5200 Series (feature 5640) is required.

Cables

Feature 5780, 6.1 meters (20 feet).

Highlights include:

- Operates in data stream or 4975 emulation mode

- In data stream mode:

  - 10, 12, 15-pitch, or proportional spacing
  - 4, 5.3, 6, 8, 9.6, or 12 lines-per-inch

- In 4975 emulation mode:

  - 10 or 15-pitch
  - 6 or 8 lines-per-inch

- From single to triple line spacing

- Reverse indexing

- Connects to system with twinaxial cable up to 1524 meters (5000 feet).

- Control panel displays that communicate to operator

- Control panel pushbuttons that allow operator control and communication.

- Semi-automatic paper insertion and alignment

- Economy ribbon saver used for draft quality printing

- Cable-thru feature provides for multidrop of up to eight 5219s

- Interchangeable 96-character printwheels that allow type font changes

- Print ribbon cartridges for easy replacement

- Uses cut sheet feed (feature 7860) or continuous forms feed (feature 7850)

- Paper stand (feature 4450) available for use with tractor feed.

The 5219 is a tabletop printer that provides word processing print quality. There are two models that differ only in speed.

	Model D01	Model D02
Burst speed	40cps	60cps
Net speed	26cps	38cps
Tab speed	150 mm/sec	600 mm/sec
Maximum paper width	392 mm	392 mm
Writing line width	335 mm	335 mm

The 5219 is a customer-setup unit, which allows the user to easily install or relocate the printer. The 5219 attaches to the Series/1 by means of the Printer Attachment-5200 Series (feature 5640), which can be plugged into the processor or an I/O expansion unit. Print operations, controlled by a microprocessor located in the attachment feature, are buffered and operate in cycle-steal mode.
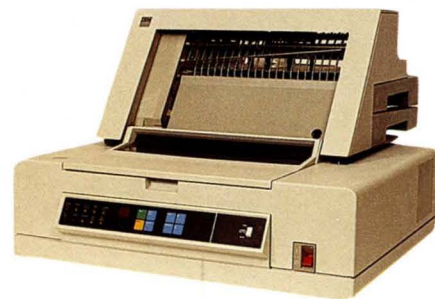
5224 Printer specifications

Operating characteristics

Print speeds (based on a 7.4-inch nominal line)
Model 1 (10 cpi)	140 lines per minute
Model 1 (15 cpi)	95 lines per minute
Model 2 (10 cpi)	240 lines per minute
Model 2 (15 cpi)	175 lines per minute
Horizontal spacing	10 or 15 characters per inch

Vertical line spacing   6 or 8 lines per inch
Characters per print line
10 characters per inch 132 characters
15 characters per inch 198 characters

Forms specifications

Thickness	
Single-part	0.003 − 0.0075 inch
Multipart	0.0025 − 0.018 inch
Width	3 − 17.7 inches
Length	3 − 12.5 inches
Number of copies	Original plus 3

Physical characteristics

Height	280 millimeters (11 in.)
Width	710 millimeters (28 in.)
Depth	580 millimeters (23 in.)
Weight	68 kg (149 lb)

Environmental conditions

Heat output/hour
Model 1	550 watts (1880 BTU)
Model 2	600 watts (2050 BTU)
Cooling	Forced air

Operating temperature
              10 − 40.6°C (50 − 105°F)
Operating humidity   8 − 80%

Power requirements (at full load)

120 volts	2.6 amperes
208 volts	1.5 amperes
240 volts	1.2 amperes

Frequency	60 ± 0.5 Hz
kVA	0.3
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Print Ribbon

P/N 6845100 or equivalent

Prerequisites

Printer attachment—5200 Series (feature 5640) is required.

Cables

Feature 5780, 6.1 meters (20 feet).

The 5224 is a tabletop line-impact wire-matrix printer that produces characters printed by a pattern of dots, and provides medium-speed output for the Series/1.
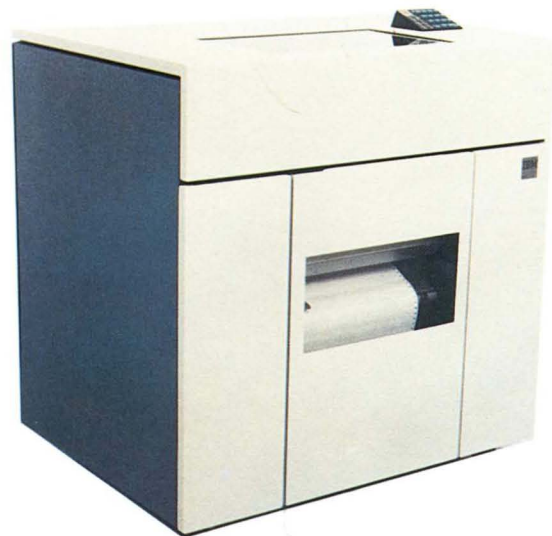
The 5224 Line Printer provides:

- Printing up to four-part forms

- Vertical spacing at 6 to 8 lines per inch

- Local attachment up to 1524 meters (5000 feet)

- Two models with a maximum speed of 140 or 240 lines per minute

- Printing at 10 characters per inch (132 characters per line) or 15 characters per inch (198 characters per line)

- Bidirectional printing for optimized throughput.

The printer meets the needs for a system printer or a work station printer. The 5224 is a customer-setup unit, which allows the user to easily install or relocate the printer.

The 5224 attaches to the Series/1 by means of the Printer Attachment-5200 Series (feature 5640), which can be plugged into either the processor or the I/O expansion unit. Print operations, controlled by a microprocessor located in the attachment feature, are buffered and operate in cycle-steal mode.

The printer accepts single-part continuous forms or multipart continuous forms. Integrated operator controls move and adjust the forms.

5225 Printer specifications

Operating characteristics

Print speeds (based on a 7.4-inch nominal line)

Model 1 (10 cpi)	280 lines per minute
Model 1 (15 cpi)	195 lines per minute
Model 2 (10 cpi)	400 lines per minute
Model 2 (15 cpi)	290 lines per minute
Model 3 (10 cpi)	490 lines per minute
Model 3 (15 cpi)	355 lines per minute
Model 4 (10 cpi)	560 lines per minute
Model 4 (15 cpi)	420 lines per minute
Horizontal spacing	10 or 15 characters per inch
Vertical line spacing	6 or 8 lines per inch

Characters per print line

10 characters per inch	132 characters
15 characters per inch	198 characters

Forms specifications

Thickness	
Single-part	0.003 – 0.0075 inch
Multipart	0.0025 – 0.018 inch
Width	3 – 17.7 inches
Length	3 – 12.5 inches
Number of copies	Original plus 3

Physical characteristics

Height	1000 millimeters (39.5 in.)
Width	1110 millimeters (43.75 in.)
Depth	750 millimeters (29.5 in.)
Weight	250 kg (550 lb)

Environmental conditions

Heat output/hour	
Model 1	750 watts (2562 BTU)
Model 2	800 watts (2733 BTU)
Model 3	900 watts (3074 BTU)
Model 4	1000 watts (3416 BTU)
Cooling	Forced air
Operating temperature	10 – 40.6°C (50 – 105°F)
Operating humidity	8 – 80%

Power requirements (at full load)

Model 1	
110 volts	5.3 amperes
208 volts	2.8 amperes
240 volts	2.5 amperes
Model 2	
110 volts	6.4 amperes
208 volts	3.5 amperes
240 volts	3.0 amperes
Model 3	
110 volts	6.8 amperes
208 volts	3.6 amperes
240 volts	3.1 amperes
Model 4	
110 volts	8.2 amperes
208 volts	4.3 amperes
240 volts	3.8 amperes
Frequency	60 ± 0.5 Hz
kVA	
Model 1	0.6
Model 2	0.72
Model 3	0.75
Model 4	0.9
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Print Ribbon

P/N 4412372 or equivalent

Prerequisites

Printer attachment—5200 Series (feature 5640) is required.

Cables

Feature 5780, 6.1 meters (20 feet).

The 5225 printer is a line-impact wire-matrix printer that produces characters printed by a pattern of dots, and provides high-speed output for the Series/1.

The 5225 Line Printer:

- Prints up to four-part forms

- Vertical spacing at 6 or 8 lines per inch

- Local attachment up to 1525 meters (5000 feet)

- Four models with a maximum speed of 280 to 560 lines per minute

- Prints 10 characters per inch (132 characters per line) or 15 characters per inch (198 characters per line)

- Bidirectional printing for optimized throughput.

The printer meets the needs for a system printer or a work station printer. The 5225 is a customer-setup unit, which allows the user to easily install or relocate the printer.

The 5225 attaches to the Series/1 by means of the IBM Printer Attachment-5200 Series (feature 5640), which can be plugged into either the processor or the I/O expansion unit. Print operations, controlled by a microprocessor located in the attachment feature, are buffered and operate in cycle-steal mode.

The printer accepts single-part continuous forms or multipart continuous forms. Integrated operator controls move and adjust the forms.

Operating characteristics

Print speed	650 lines per minute with 48 character set
Horizontal spacing	10 characters per inch
Vertical line spacing	6 or 8 lines per inch
Characters per print line	132 characters at 10 cpi

Forms specifications

Thickness	
Single-part	0 − 0.009 inch
Multipart	0 − 0.02 inch
Width	3.5 − 16 inches
Length	6 − 14 inches
Number of copies	Original plus 5

Physical characteristics

Height	1000 millimeters (39.5 in.)
Width	965 millimeters (38 in.)
Depth	750 millimeters (29.5 in.)
Weight	246 kg (540 lb)

Environmental conditions

Heat output/hour	1100 watts (3750 BTU)
Cooling	Forced air
Operating temperature	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Power requirements (at full load)

100 volts	1.2 amperes
110 volts	1.2 amperes
120 volts	1.2 amperes
127 volts	1.2 amperes
Frequency	60 ± 0.5 Hz
kVA	1.2 (maximum)
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Print Ribbon

P/N 7819690 or equivalent

Prerequisites

Printer attachment—5200 Series (feature 5640) is required.

Cables

Feature 5780, 6.1 meters (20 feet).

The 5262 is a print-band line printer providing high-speed output for the Series/1.

The 5262 line printer provides:

- Printing up to six-part forms

- Vertical spacing at 6 or 8 lines per inch

- Local attachment up to 1525 meters (5000 feet)

- 650 line-per-minute output using a 48-character print belt

- 10 characters per inch (132 characters per line).

The printer meets the needs for a system printer or a work station printer. The 5262 is a customer-setup unit, which allows the user to easily install or relocate the printer.

The 5262 attaches to the Series/1 by means of the IBM Printer Attachment-5200 Series (feature 5640), which can be plugged into either the processor or the I/O expansion unit. Print operations, controlled by a microprocessor located in the attachment feature, are buffered and operate in cycle-steal mode.

The printer accepts single-part continuous forms or multipart continuous forms. Integrated operator controls move and adjust the forms.

Display characteristics

Diagonal measurement
of Cathode-ray tube   305 millimeters (12 in.)
Character capacity   1920 characters
Format   24 rows x 80 characters

Physical characteristics

Video element
Height   330 millimeters (13 in.)
Width   310 millimeters (12.2 in.)
Depth   307 millimeters (12.1 in.)
Weight   8.2 kg (18 lb)

Logic element
Height   70 millimeters (2.8 in.)
Width   345 millimeters (13.6 in.)
Depth   315 millimeters (12.4 in.)
Weight   2.2 kg (4.8 lb)

Keyboard
Height   40 millimeters (1.6 in.)
Width   492 millimeters (19.4 in.)
Depth   210 millimeters (8.3 in.)
Weight   2.5 kg (5.5 lb)

Environmental conditions

Heat output/hour   55 watts (188 BTU)
Cooling   Convection
Operating temperature
                    10 − 40.6°C (50 − 105°F)
Operating humidity 8 − 80%

Power requirements (at full load)

120 volts   0.9 amperes (average)

Frequency   50/60 ± 0.5 Hz
kVA   0.18
Phase   1
Branch circuit   15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

For attachment to a series/1 processor or an
expansion unit, one of the following is required:

- Feature 1310, RS-232-C and RS-422-A
  interface
- Feature 1610, RS-232-C interface
- Features 2091 and 2092, RS-232-C interface
- Features 2095 and 2096, RS-232-C interface
- Features 2095 and D02350, RS-422-A
  interface
- Feature 7850, RS-232-C interface (not
  intended for use with modems).

For attachment to a 4987, one of the following
is required:

- Feature 4700, RS-232-C interface
- Feature 4701, RS-232-C interface
- Feature 4709, RS-232-C interface (not
  intended for use with modems).

Cables

- Power supply, keyboard, and display cables
  are provided
- a 3-meter (10-foot) display cable is available
  as an accessory
- a 4-conductor cable (RPQ D02352) is
  available for attachment of the 316X Model
  12 (RS-422-A interface) to the 3101 8-line
  adapter (RPQ D02350).

Highlights include:

- 12-inch monochrome monitor
- Green (Models 11 and 12) or amber (Models 21 and 22) screen
- ASCII communications
- RS-232-C for remote attachment
- RS-422-A for local attachment up to 1219 meters (4000 feet)
- Advanced screen and edit functions
- 3101, Model 881 (23) and six other emulations.

The 3161 and 3163 ASCII Display Stations operate through asynchronous communications interfaces and use a 7- or 8-bit ASCII code. Line speeds range from 50 to 19,200 bits per second.

The 3161 is a offers such advanced functions as menu setup, definable function keys, split screen, and character and field attribute. The operator may select a 3161 native mode, 3101 mode, or one of many non-IBM emulators.

The 3163 is an advanced editing display that provides multiple screen viewports, partitioning and paging, redefinable keyboard with replaceable function key tops, host-loadable character set, block LRC check, advanced editing field attributes, as well as many advanced screen characteristics such as smooth scrolling and double-high, double-wide characters.

These displays attach to the Series/1 by means of any one of several adapter and attachment cards. Models are selectable to provide RS-422-A interface for local use attachment and RS-232-C interface for remote attachment. The maximum local distance allowed for RS-422-A is 1219 meters (4000 feet) from a Series/1 processor. Series/1 supports Models 11, 12, 21, and 22 for both the 3161 and 3163.

Models	Mode	Interface
11, 21	Character, *or* block	EIA RS-232-C
12, 22	Character, *or* block	EIA RS-232-C, *or* EIA RS-422-A

Both the 3161 and 3163 consist of a video element with a tilt and swivel pedestal, a keyboard element, and a logic element, in a compact design. The replaceable element concept permits the user to set up the display station, and perform problem analysis and resolution.

Video element

A high-quality, 12-inch, green or amber phosphor, anti-glare screen is used. The screen format consists of 24 lines of 80 characters each (1920 characters total). The 25th line provides indicators for operation information such as system status and problem analysis results. A stand that snaps onto the base of the video element is provided and allows the display to be tilted and swiveled. A CRT saver function is offered.

Keyboard element

A 102-key, low-profile keyboard with numeric keypad and cursor control keys provides tactile feedback and selectable tilt angle. The keyboard generates the 24 line-drawing characters and the 128 ASCII characters.

Logic element

The video element rests on the logic element. The keyboard and the video element each connect to the logic element by cable. An auxiliary asynchronous interface allows attachment of another ASCII device, such as the 4201 Proprinter. On the 3163, this interface is for both input and output.

Display characteristics

Diagonal measurement of Cathode-ray tube	356 millimeters (14 in.)
Character capacity	1920 characters
Format	24 rows X 80 characters

Physical characteristics

Video element

Height	322 millimeters (12.7 in.)
Width	333 millimeters (13.1 in.)
Depth	339 millimeters (13.3 in.)
Weight	7.6 kg (16.8 lb)

Logic element

Height	70 millimeters (2.8 in.)
Width	345 millimeters (13.6 in.)
Depth	315 millimeters (15.9 in.)
Weight	2.2 kg (4.9 lb)

Keyboard

Height	40 millimeters (1.6 in.)
Width	492 millimeters (19.4 in.)
Depth	210 millimeters (8.3 in.)
Weight	2.5 kg (5.5 lb)

Environmental conditions

Heat output/hour	55 watts (188 BTU)
Cooling	Convection
Operating temperature	$10-40.6°C$ ($50-105°F$)
Operating humidity	$8-80\%$

Power requirements (at full load)

120 volts	1.2 amperes (maximum)
Frequency	$50/60\pm0.5$ Hz
kVA	0.14
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Note: Menu-selectable character density is not supported by Event Driven Executive or Realtime Programming System.

Prerequisites

For attachment to a series/1 processor or an expansion unit, one of the following is required:

- Feature 1310, RS-232-C and RS-422-A interface
- Feature 1610, RS-232-C interface
- Features 2091 and 2092, RS-232-C interface
- Features 2095 and 2096, RS-232-C interface
- Features 2095 and D02350, RS-422-A interface
- Feature 7850, RS-232-C interface (not intended for use with modems).

For attachment to a 4987, one of the following is required:

- Feature 4700, RS-232-C interface
- Feature 4701, RS-232-C interface
- Feature 4709, RS-232-C interface (not intended for use with modems).

Cables

- Power supply, keyboard, and display cables are provided
- a 3-meter (10-foot) display cable is available as an accessory
- a 4-conductor cable (RPQ D02352) is available for attachment of the 316X Model 12 (RS-422-A interface) to the 3101 8-line adapter (RPQ D02350).

Highlights include:

- 14-inch monochrome monitor
- Green or amber screen
- Menu-selectable character density
- ASCII communications
- RS-232-C for remote attachment
- RS-422-A for local attachment up to 1219 meters (4000 feet)
- Advanced screen and edit functions
- 3101, Model 881 (23) and six other emulations.

The 3162 ASCII Display Station operates through asynchronous communications interfaces and uses a 7- or 8-bit ASCII code. Line speeds range from 50 to 19,200 bits per second. Models available are:

- Model 11, green display, RS-232-C interface and numeric keypad
- Model 12, green display, RS-232-C or RS-422-A interface, and numeric keypad
- Model 21, amber display, RS-232-C interface and numeric keypad
- Model 22, amber display, RS-232-C or RS-422-A interface, and numeric keypad
- Model 31, green display, RS-232-C interface and without numeric keypad
- Model 32, green display, RS-232-C or RS-422-A interface, and without numeric keypad
- Model 41, amber display, RS-232-C interface and without numeric keypad
- Model 42, amber display, RS-232-C or RS-422-A interface, and without numeric keypad.

It offers such advanced functions as menu setup, definable function keys, split screen, and character and field attribute. The operator may select a 3162 native mode, 3101 mode, or one of many non-IBM emulators. The 3162 attaches to the Series/1 by means of any one of several adapter and attachment cards. Models are selectable to provide RS-422-A interface for local use attachment and RS-232-C interface for remote attachment. The maximum local distance allowed for RS-422-A is 1219 meters (4000 feet) from a Series/1 processor.

The 3162 consists of a video element, a keyboard element, and a logic element. The replaceable element concept lets the user set up the display station and perform problem analysis and resolution.

Video element

A high-quality, 14-inch, green or amber, anti-glare screen is used. The menu-selectable screen format consists of either:

- 24 lines of 80 characters (1920 characters)
- 28 lines of 80 characters (2240 characters)
- 24 lines of 132 characters (3168 characters)
- 28 lines of 132 characters (3696 characters).

An additional line on the bottom of the screen provides indicators for operation information, such as system status. A tilt and swivel stand and a CRT saver function are provided.

Keyboard element

Either an 84-key keyboard without numeric keypad, or a 102-key keyboard with numeric keypad and cursor control keys, provide tactile feedback and selectable tilt angle. Both keyboards generate the 24 line-drawing characters and the 128 ASCII characters.

Logic element

The video element rests on the logic element. The keyboard and the video element connect to the logic element by cable. An auxiliary asynchronous interface allows attachment of another ASCII device, such as the 4201 Proprinter.

3164 ASCII Color Display Station specifications

Display characteristics

Diagonal measurement of Cathode-ray tube	356 millimeters (14 in.)
Character capacity	1920 characters
Format	24 rows x 80 characters

Physical characteristics

Video element

Height	390 millimeters (15.4 in.)
Width	380 millimeters (15 in.)
Depth	405 millimeters (15.9 in.)
Weight	14 kg (30.9 lb)

Logic element

Height	70 millimeters (2.8 in.)
Width	345 millimeters (13.6 in.)
Depth	315 millimeters (12.4 in.)
Weight	2.2 kg (4.8 lb)

Keyboard

Height	40 millimeters (1.6 in.)
Width	492 millimeters (19.4 in.)
Depth	210 millimeters (8.3 in.)
Weight	2.5 kg (5.5 lb)

Environmental conditions

Heat output/hour	100 watts (341 BTU)
Cooling	Convection
Operating temperature	$10-40.6°C$ $(50-105°F)$
Operating humidity	$8-80\%$

Power requirements (at full load)

120 volts	2.3 amperes
Frequency	$50/60 \pm 0.5$ Hz
kVA	0.28
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

For attachment to a series/1 processor or an expansion unit, one of the following is required:

- Feature 1310, RS-232-C and RS-422-A interface
- Feature 1610, RS-232-C interface
- Features 2091 and 2092, RS-232-C interface
- Features 2095 and 2096, RS-232-C interface
- Features 2095 and D02350, RS-422-A interface
- Feature 7850, RS-232-C interface (not intended for use with modems).

For attachment to a 4987, one of the following is required:

- Feature 4700, RS-232-C interface
- Feature 4701, RS-232-C interface
- Feature 4709, RS-232-C interface (not intended for use with modems).

Cables

- Power supply, keyboard, and display cables are provided
- a 3-meter (10-foot) display cable is available as an accessory
- a 4-conductor cable (RPQ D02352) is available for attachment of the 316X Model 12 (RS-422-A interface) to the 3101 8-line adapter (RPQ D02350).

Highlights include:

- 14-inch color monitor
- Eight color foreground/background
- ASCII communications
- RS-232-C for remote attachment
- RS-422-A for local attachment up to 1219 meters (4000 feet)
- Advanced screen and edit functions
- 3101 emulation.

The IBM 3164 is a high-function, ASCII display station of the IBM 316X family which offers such features as menu set-up, definable function keys, split-screen, and character and field attributes. It also has functions such as smooth scroll, windowing, paging, redefinable keys, double-size characters, and is compatible with the IBM 3163.

The 3164 ASCII Display Station is a keyboard display that operates through asynchronous communications interfaces and uses a 7-bit or an 8-bit ASCII code. Line speeds range from 50 to 19,200 bits per second.

The 3164 attaches to the Series/1 by means of any one of several adapter and attachment cards, that can be plugged into either the processor or input/output expansion unit. Models are selectable to provide RS-422-A interface for local use attachment and RS-232-C interface for remote attachment. The maximum local distance allowed for RS-422-A is 1219 meters (4000 feet) from a Series/1 processor. Series/1 supports a Model 11 and 12 for the 3164.

Model	Mode	Interface
11	Character, *or* block	EIA RS-232-C
12	Character, *or* block	EIA RS-232-C, *or* EIA RS-422-A

The 3164 consists of a video element with a tilt and swivel pedestal, a keyboard element, and a logic element, in a compact design. The replaceable element concept permits the user to set up the display station, and perform problem analysis and resolution.

Video element

A high-quality, 14-inch, color screen is used. Images can be displayed in eight colors (red, green, blue, yellow, magenta, turquoise, black, and white). The screen format consists of 24 lines of 80 characters each (1920 characters total). A 25th line provides indicators for operation information, such as system status and problem analysis results. A stand that snaps onto the base of the video element is provided and allows the display to be tilted and swiveled. A CRT saver function is offered.

Keyboard element

A 102-key, low-profile keyboard with numeric keypad and cursor control keys provides tactile feedback and selectable tilt angle. The keyboard generates the 24 line-drawing characters and the 128 ASCII characters.

Logic element

The video element rests on the logic element. The keyboard and the video element each connect to the logic element by cable. An auxiliary asynchronous interface allows attachment of another ASCII device, such as the 4201 Proprinter. This interface is for both input and output.

Display characteristics

Diagonal measurement of Cathode-ray tube	305 millimeters (12 in.)
Character capacity	1920 characters
Format	24 rows x 80 characters
Format area	
Height	152 millimeters (6 in.)
Width	229 millimeters (9 in.)

Physical characteristics

Display

Height	298 millimeters (15.3 in.), *or* 356 millimeters (14 in.)
Width	476 millimeters (18.75 in.)
Depth	325 millimeters (12.8 in.)
Weight	21.4 kg (52 lb)

Keyboard

Height	100 millimeters (3.9 in.)
Width	532 millimeters (20.9 in.)
Depth	250 millimeters (9.8 in.)
Weight	7.1 kg (15.5 lb)

Environmental conditions

Heat output/hour	116 watts (399 BTU)
Cooling	Convection
Operating temperature	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Power requirements (at full load)

115 volts	1 ampere
208 volts	0.5 ampere
230 volts	0.5 ampere
Frequency	60 ± 0.5 Hz
kVA	0.08
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

The 4978 Display Station Attachment (RPQ D02038) is required.

Cables

Either RPQ or accessory bill-of-material cables can be ordered to attach 4978s up to 150 meters (500 feet).

- Keyboard cable is provided
- RPQ D02034 provides a 6.1-meter (20-foot) attachment cable
- RPQ D02032 provides a 3-meter (10-foot) cable increment.

Highlights include:

- User-defined keyboard characters, function codes, and display character graphics
- Typematic keys
- Cycle-steal operations and buffered microprocessor control
- 24 lines of data, 80 characters per line
- High-density characters to highlight operator entries.

The 4978 Display Station is an interactive information display device with character graphics. It comes in two models and has a choice of keyboards. A tabletop unit, the 4978 allows local input, operator intervention, and keyboard editing. It attaches to a Series/1 by means of the 4978 Display Attachment Feature (RPQ D02038), which can be plugged into either a processor unit or an I/O expansion unit. Display and keyboard operations are controlled by a microprocessor in the 4978 attachment feature, and operate in cycle-steal mode.

Display screen (RPQ D02055)

The 4978 can display a maximum of 24 eighty-character lines of data. All display data is buffered, and the display is refreshed (regenerated) continuously from the buffer to maintain a constant, easy-to-read display under normal lighting conditions. The Model 2 functions are identical to the Model 1. The differences are that the Model 2 display unit is smaller and has two base sizes. Even though the display unit is smaller, the screen remains 305 millimeters (12 inches), measured diagonally.

An application program can present a display to the operator in formatted or unformatted mode. In formatted mode, the application program designates protected and unprotected data fields. Operator entries can be entered, modified, or erased by keyboard action in unprotected data fields. Operators cannot enter data into protected fields. Protected data fields are primarily used in formatting the screen for structured, tabular data entry. In unformatted mode, the operator enters data on the display screen in a free-form manner.

An audible cursor alarm (RPQ D02060) provides an audible tone to alert an operator to an exception condition that has occurred during 4978 operation.

The Monitor Attachment (RPQ D02222) provides attachment of one or more customer-supplied video monitors. This attachment drives the video monitors, which duplicate the display image being produced by the 4978. The video monitors can be located up to 153 meters (500 feet) from the attachment point without signal amplification.

Keyboard

Keyboard characters, function codes, and display-character graphics may be user-defined and loaded into the attachment from processor storage. Key position codes may be assigned as interrupting program keys, interrupting data keys, data entry keys, or local function keys.

Several keyboards, which support a variety of application needs, are available for the 4978:

Keyboard Extended (RPQ D02056)
Keyboard Basic (RPQ D02057)
Keyboard DAS/C 2-Meter (RPQ D02064)
Keyboard DAS/C 1-Meter (RPQ D02065)
Keyboard — Data Entry (large) (RPQ D02275)
Keyboard — Data Entry (small) (RPQ D02276)
Keyboard Text Entry and Edit (RPQ D02375)

Note: Keyboard DAS/C is for directory assistance.

The keyboards have extensive sets of program function keys. Many of the keys are typematic.

Physical characteristics

5234

Height	325 millimeters (12.8 in.)
Width	248 millimeters (9.8 in.)
Depth	170 millimeters (6.7 in.)
Weight	12 kg (25 lb)

5235

Height	500 millimeters (19.7 in.)
Width	330 millimeters (13 in.)
Depth	170 millimeters (6.7 in.)
Weight	13 kg (29 lb)

5236

Height	230 millimeters (9.1 in.)
Width	535 millimeters (21.1 in.)
Depth	387 millimeters (15.2 in.)
Weight	13 kg (29 lb)

5239

Height	136 millimeters (5.4 in.)
Width	330 millimeters (13 in.)
Depth	170 millimeters (6.7 in.)
Weight	5.6 kg (12.5 lb)

Environmental conditions

Heat output/hour

5234	52 watts (177 BTU)
5235	58 watts (198 BTU)
5236	58 watts (198 BTU)
5239	23 watts (78 BTU)
Cooling	Convection
Operating temperature	
	4−45°C (40−113°F)
Operating humidity	8−80%

Power requirements (at full load)

5234, 5235, 5236

115 volts	0.9 ampere

5239

115 volts	0.2 ampere

Frequency	60±0.5 Hz
kVA	
5234, 5235, 5236	0.1
5239	0.02
Phase	1
Branch circuit	15 amperes

Programming support

Event Driven Executive.

Prerequisites

Data Collection Interactive RPQs are required:

- RPQ D02312 is required for the attachment of the first loop to the system. It includes one master scheduler attachment card and one loop multiplexer card.
- RPQ D02313 is a loop multiplexer card for the attachment of additional stations to the system.
- RPQ D02314 is required for the attachment of the fifth, ninth, and thirteenth loops to the system. It includes one master scheduler attachment card and one loop multiplexer card. If the additional loop attachment cards are not to be installed in the same enclosure as the first four loops, D02312 is required instead of D02314.

Cables

Each unit comes with a power cord with a locking plug.

The maximum distance allowed between a 5230 unit and the processor is 1524 meters (5000 feet) for twinaxial cables, and 610 (2000 feet) for coaxial cables. Connector assembly kits, and crimp and extractor tools are also available.

Highlights include:

- Capability of:
  - Badge reading (punched hole or magnetic stripe badges)
  - Punched card reading
  - Key entry
  - Values recording, such as counts, weights, and temperatures registered by external devices through a 5230 unit
- Choice of several units:
  - 5234 Models 1 and 2 Time Entry Station
  - 5235 Data Entry Station
  - 5236 Data Entry station
  - 5239 Value Read Module
- Up to 63 units, in any combination, can be attached by multiple loops
- Local operation through a maximum of 1525 meters (5000 feet).

The 5230 Data Collection units are a family of devices designed to capture information in a realtime environment.

A number of data collection units are placed in work environments linked by one or more cable loops. These loops attach to the Series/1 through attachment cards called loop multiplexers. The loop multiplexers are in turn controlled by master scheduler attachment cards. Each loop supports up to four entry stations. Each master scheduler card supports up to four loops.

The minimum configuration is one RPQ D02312, which allows the attachment to Series/1 of three 5230 units. The maximum configuration is two RPQ D02312s, twelve RPQ D02313s and two RPQ D02314s, which allow the attachment of 63 units.

5234 Models 1 and 2 Time Entry Station

The 5234 reads badges and records the time of entry. It continuously shows the time of day on a four-position display.

5235 Data Entry Station

The 5235, for card, key badge, and value read entry, is a wall-mounted unit intended for industrial use. It includes keys that can be used to personalize the user's system, a numeric keyboard with two control keys, a mode switch, and an eight-position display. Optional features include:

- Badge Reader Punched Hole (feature #1401)
- Badge Reader Magnetic Stripe (feature #1402)
- Card Reader-96 Columns (feature #1510)
- Card Reader-80 Columns (feature #1520).

5236 Data Entry Station

The 5236 is identical in operation and features to the 5235. The difference is that the 5236 is a tabletop unit intended primarily for use in non-industrial areas.

5239 Value Read Module

The 5239 can be optionally attached to a 5235 or 5236 to allow external values, such as weight, count, and temperature, to be input. The unit provides direct attachment to external devices, an eight-digit value read, four selectable modes of operation, and wall or pedestal mounting.

5235

5236

4982 Sensor Input/Output Unit specifications

Physical characteristics

Height	356 millimeters (14 in.)
Width	216 millimeters (8.5 in.)
Depth	536 millimeters (21.2 in.)
Weight	20.4 kg (50 lb)

Environmental conditions

Heat output/hour	152 watts (522 BTU)
Cooling	Convection
Operating temperature	
	10 – 40.6°C (50 – 105°F)
Operating humidity	8 – 80%

Power requirements (at full load)

115 volts	2 amperes
208 volts	1 ampere
230 volts	1 ampere
Frequency	60 ± 0.5 Hz
kVA	0.2
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
- Realtime Programming System.

Prerequisites

4982 Sensor Input/Output Attachment (feature 6305) is required.

Rack-Mounting Fixture (feature 4540) is required if mounting in an 4997 rack enclosure or an EIA standard 19-inch rack.

Highlights include:

- Analog input
  - Analog to digital converter
  - Analog input control
  - Programmable amplifier-multirange
  - Multiplexer-solid state (16 points per card)
  - Multiplexer-reed relay (8 points per card)
- Analog output (2 points per card)
- Digital input
  - Process interrupt
  - Non-isolated
  - 16 points per card
  - Isolated
- Digital output
  - Non-isolated.

The 4982 provides a flexible, modular approach to attaching user's process I/O applications to the Series/1. Located near the processor in a rack enclosure and occupying half the width of a 19-inch rack enclosure, the 4982 Sensor I/O Unit is a subsystem of the Series/1.

The 4982 attaches to the Series/1 by means of the 4982 Sensor Input/Output Unit Attachment feature, which can be plugged into either the processor or an I/O expansion unit.

The 4982 features are provided in the form of cards, which plug into the eight feature locations of the 4982. The features can be used in any combination except that only one analog input control card and one multirange amplifier card (if used) can be in any one unit. These two cards service all the analog input multiplexer cards.

Each 4982 Sensor I/O Unit, although not restricted to a single sensor I/O type, can contain the following maximum sensor points of each type:

- 128 digital input/process interrupt (DI/PI) points, either isolated or non-isolated
- 128 digital output (DO) points
- 112 solid-state multiplexer analog input (AI) channels (no amplifier multirange card used)
- 96 solid-state multiplexer AI channels (amplifier multirange card used)
- 56 reed-relay multiplexer AI channels (no amplifier multirange card used)
- 48 reed-relay multiplexer AI channels (amplifier multirange card used)
- 16 analog output (AO) points.

Direct program control commands are used for data transfers between the processor data channel and the sensor I/O features.

Analog Input Control

This card (feature 1060) contains a 12-bit (including sign bit) analog-to-digital converter for measuring signals in the ±5 volt range. The card also contains the logic for controlling the sequencing of the other AI subsystem cards. Only two adjustments are required on the card: one for 0-calibration and the other for full-scale calibration. Two diagnostic commands are used to help diagnose the analog input control and amplifier cards. Automatic and program-controlled 0-correction logic is included.

Analog Output

This card (feature 1065) generates two points of analog output with a resolution of 10 bits (including sign). Each output voltage point can be programmed to generate an output voltage up to ±5, ±10, or 0 to +10 volts full scale, with a long-term stability of ±1/2 the least-significant bit (LSB) per 10,000 hours. The maximum output impedance is 1 ohm; the maximum current output is 5 milliamperes at ±10 volts, short circuit protected.

Amplifier-Multirange

This card (feature 1070) is a true differential input instrumentation amplifier with seven programmable input voltage ranges (times 1, 10, 25, 50, 100, 250, and 500). It is required for measuring low-level signals. The amplifier uses switched frequency compensation for wide bandwidth and fast settling. It uses the latest field effect transistor input operational amplifiers with an input impedance of greater than 10 megohms, very low input bias current, low noise, and a common-mode rejection ration of 80 decibels at 10 volts common mode. There are two adjustments on the card: one for the offset voltage adjustment of the input stage and the other for the offset voltage adjustment of the output stage.

Digital Input/Process Interrupt Non-isolated

This card (feature 3525) is a digital input logic card with signal conditioning at the user inputs. The card provides 16 points of digital input for sensing contact closures or logic voltage levels.

The non-isolated DI/PI feature is similar to the isolated DI/PI feature except for the following:

- A process interrupt input is sensed as a negative transition

- Ground reference of all user input points is the sensor I/O unit chassis

- Each of the 16 input points, with high- or low-level capabilities, can detect either user contact closure (contact sense) or user voltage levels (voltage sense)

- No common-mode voltage is allowed.

Digital Input/Process Interrupt Isolated

This card (feature 3532) is a digital input logic card with signal conditioning at the user inputs. The card provides 16 points of optically isolated digital inputs for sensing high- and low-level logic voltage levels in four basic modes of operation:

1. Digital input. Allows 16 bits of unlatched user data to be transferred to the processor. No interrupts are generated.

2. Process interrupt. Allows an interrupt to be generated when a positive transition occurs at any one user input; 16 bits of latched user data can be transferred to the processor. This mode is enabled by program control.

3. External sync. Allows the user to move, into registers, 16 bits of input data and causes an interrupt to be generated. Non-isolated 'external sync' input are and 'sync ready' output available for the user to synchronize parallel data transfers by using the DI/PI feature. External sync mode is enabled by program control.

4. Diagnostics. Input data can be forced to logical 0's or logical 1's, overriding any user input states. Therefore, proper data flow and feature card operation can be checked by programming. In addition, a status word is available to determine or verify the state or mode of the DI/PI card. Diagnostic mode is enabled by program control.

Digital Output Non-isolated

This card (feature 3535) provides 16 points of solid-state, non-isolated digital output. Each point can shunt or switch 0.250 ampere from a 52.8-volt source.

Multiplexer-Reed Relay

This card (feature 4940) uses the *flying capacitor* method of isolation, a technique that gives the card a 200-volt common-mode voltage limit and a common-mode rejection ratio of 120 decibels. There are 8 two-wire channels per card with a 0.64 hertz, low-pass input filter on each input to attenuate normal-mode noise. Because of the polarized capacitor in the input filter, the normal-mode signal on the 5-volt range is limited to -0.5 volt to +5 volts and the normal-mode over-voltage limit is -1 to +6 volts. The input signal can have an equivalent source resistance of 1 kilohm source unbalance. The maximum sequential sampling rate of the relay multiplexer is 200 samples per second. The maximum repetitive sampling rate per point is 15 samples per second. Maximum repetitive sample rate per point to achieve all specifications is 1 sample per second.

Multiplexer-Solid State

This card (feature 4950) is a solid-state multiplexer using MOSFET transistors for switching. There are 16 two-wire inputs on the card. The maximum sequential sampling rate of the multiplexer solid state is 9500 samples per second. The maximum sample rate on low-level signals with 0-correction is 5000 samples per second. The maximum repetitive sample rate per point to achieve all specifications with a 10-microfarad external filter on the input is 100 samples per second. If external noise is not a problem, much faster sampling rates can be obtained by operating without the filter. The maximum voltage that can be applied to either input line under normal operating conditions is 10 volts. The maximum input voltage is ±15 volts including common mode voltage. The input signal can have an equivalent source resistance of 1 kilohm with a 250-ohm source unbalance.

Analog Input-14 Bits

This card (RPQ D02071) provides differential analog input with resolution of either 13 bits plus sign or 14 bits unipolar. The feature converts analog input to a corresponding binary digital value and provides a high resolution AI control for the Series/1. This feature may be selected instead of the Analog Input Control feature.

Multiplexer-Mercury Relay

This card (RPQ D02358) has the same operational specifications as the Multiplexer-Reed Relay (feature 4940). It is designed for use in applications that have a continuous high sampling rate and low-level signal inputs. This card is used instead of the Multiplexer-Solid State (feature 4950) because of its high common-mode voltage.

Physical characteristics

Height	356 millimeters (14 in.)
Width	483 millimeters (19 in.)
Depth	610 millimeters (24 in.)
Weight	40.5 kg (110 lb)

Environmental conditions

Heat output/hour	320 watts (1090 BTU)
Cooling	Forced air
Operating temperature	
	$10-40.6$°C $(50-105$°F)
Operating humidity	$8-80$%

Power requirements (at full load)

115 volts	3.2 amperes
208 volts	1.6 amperes
230 volts	1.6 amperes
Frequency	60 ± 0.5 Hz
kVA	0.32
Phase	1
Branch circuit	15 amperes

Programming support

- Realtime Programming System
- Series/1 Programmable Communications Subsystem Preparation Facility
- Series/1 Programmable Communications Subsystem Extended Execution Support.

Prerequisites

The Programmable Communication Subsystem Controller (feature 1300) is required.

Cables

None required.

Highlights include:

- Accommodates multiple line disciplines in a single communication unit
- Accommodates up to 32 lines per subsystem at data rates of 45 to 9600 bits per second (bps)
- Supports point-to-point nonswitched and switched lines or multipoint lines
- Handles communication requirements for standard IBM protocols and nonstandard protocols
- Allows many communication functions to be performed outside the Series/1 processor.

The 4987 is a programmable communication unit that allows the Series/1 to be used in a wide range of applications. It occupies the full width of a 19-inch rack enclosure and attaches to a Series/1 by means of the Programmable Communications Subsystem Controller, which can be installed in a processor or an I/O expansion unit. The controller includes 11KB of storage for user communication-handling programs.

A special communication-oriented instruction set is provided that allows the following function to be done outside the Series/1 processor:

- Protocol handling
- Control character generation and recognition
- Chaining of I/O operations
- Timer functions
- Auto-polling of multipoint hookups
- Error retry functions
- Break signal processing
- Uppercase/lowercase recognition and generation
- Auto-calling.

The 4987 provides line attachment by means of external modems, direct connection, and current interface. It can accommodate asynchronous or synchronous disciplines at speeds to 9600 bps on either switched or nonswitched facilities. It also provides auto-calling and auto-answering capabilities. Features that are program selectable are:

- Synchronous/asynchronous line type
- Switched/nonswitched facility
- 5, 6, 7, or 8 bits per character
- 1, 1.5, or 2 stop bits per character
- Internal or external clocking
- Speeds of 45 to 9600 bps
- Least-/most-significant bit character orientation
- Parity of odd, even, or none
- Scanning priority sequence of each line
- Longitudinal redundancy check
- Cyclic redundancy check for standard or user-generated polynomials per line.

The 4987 is a cycle-stealing device and consists of the subsystem unit, up to two controller features, and device attachment features. The subsystem unit contains a power supply, provision for two scanner cards, a backplane, indicator panel, and space for 16 device attachment feature cards. The scanner performs the multiplexing and serializing/deserializing functions for the subsystem. An optional second scanner (feature 3600) allows the 16 feature locations in the 4987 to be divided into two eight-feature groups, with up to 16 lines in each. A controller (feature 1300) is required for each scanner.

The 4987 offers a wide variety of programmer and maintenance aids to enhance subsystem reliability, availability, and serviceability. For example, it has program-initiated capability for internal diagnostics, tracing data and/or operations of the 4987, and dumping the contents of the 4987 to the Series/1 for program debug or problem determination.

Device attachment features

Half-Duplex Digital Communications Equipment Attachment (feature 4730)

Provides for attachment of two independent switched or non-switched, synchronous or asynchronous external data sets. If synchronous, it will use external clocking at speeds up to 9600 bps. If asynchronous, it will use internal clocking at speeds from 45 to 1200 bps or 2400, 4800, or 9600 bps.

Full-Duplex Digital Communications Equipment Attachment (feature 4731)

Identical to feature 4730 except that it provides one duplex line instead of two half-duplex lines.

TTY Current Attachment (feature 4734)

Provides two DC current loop attachments for teletypewriters or equivalent devices. Supports two- or four-wire half-duplex operation. A programmable local copy option is also supported in four-wire operation.

Asynchronous Local Attachment (feature 4739)

Provides two interfaces for asynchronous transmission to systems or terminals without the use of modems. Operates at speeds from 45 to 1200 bps and 2400, 4800, and 9600 bps. Operates in half-duplex mode only.

Synchronous Local Attachment (feature 4740)

Provides two interfaces for synchronous transmission to terminals and other systems without the use of modems. Operates in half-duplex mode only with speeds of 600, 1200, 2400, 4800, and 9600 bps.

Autocall Attachment (feature 4743)

Provides for one, half-duplex, digital communication equipment attachment and one EIA RS-366 auto-call attachment. Operation of the half-duplex attachment is the same as for feature 4730. Compatible with Western Electric 801 C or equivalent units.

Audio I/O First Line (RPQ D02337) and Audio I/O Additional Lines (RPQ D02338)

Provides Touch-Tone[1] input and audio input, including the capability to record personalized vocabularies.

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[1]   Trademark of the American Telephone & Telegraph Co.

Device attachment feature cable information

The modem cable (feature 2130) is a 6 meter (20 foot) EIA RS-232-C and CCITT V.24/V.28 interface cable for use with features 4730, 4731, and 4743.

The TTY adapter cable (feature 2066) is a 15 meter (50 foot) interface cable for use with the TTY adapter (feature 4734).

The attachment cable (feature 2131) is a 6 meter (20 foot) current interface 4-wire cable for use with the TTY adapter (feature 4734).

Attachment cable (feature 2132) is a 6 meter (20 foot) local attachment EIA RS-232-C and CCITT V.24/V.28 cable for use with features 4739 and 4740.

Modem cable (feature 2130) is a 6 meter (20 foot) modem interface EIA RS-232-C and CCITT V.24/V.28 cable for use with feature 4743.

Modem cable (feature 2133) is a 6 meter (20 foot) modem interface EIA RS-366 cable for use with feature 4743.

The EIA extension cable (feature 2100) is a 6 meter (20 foot) EIA interface cable extension that can extend total cable length up to:

- 60.9 meters (200 feet) for asynchronous operation (up to 7200 bits-per-second)

- 12.2 meters (40 feet) for asynchronous operation (9600 bits-per-second)

- 12.2 meters (40 feet) for synchronous operation

- 12.2 meters (40 feet) for feature 4731 (asynchronous or synchronous).

Physical characteristics

Height	133 millimeters (5.25 in.)
Width	483 millimeters (19 in.)
Depth	325 millimeters (12.8 in.)
Weight	11.2 kg (25 lb)

Environmental conditions

Heat output/hour	40 watts (136 BTU)
Cooling	Convection
Operating temperature	
	10 − 40.6°C (50 − 105°F)
Operating humidity	8 − 80%

Power requirements (at full load)

115 volts	0.5 ampere
200 volts	0.3 ampere
208 volts	0.3 ampere
230 volts	0.3 ampere
Frequency	60 ± 0.5 Hz
kVA	0.04
Phase	1
Branch circuit	15 amperes

Programming support

- Event Driven Executive
  - Series/1-System/370 Channel Attachment
  - EDX Communications Facility.
- Realtime Programming System
  - Series/1-System/370 Channel Attachment.

These Series/1 programs have a corresponding program support validated with IBM System/370 control programs OS/VS1, OS/VS2, DOS/VS with BTAM, or DOS/VSE 3.0 with BTAM-ES.

Programming considerations

Proper operation of the feature is dependent upon the cooperative processing of programs in both processors. Applications should be implemented in a manner which guarantees synchronization. Refer to the "Programming Considerations" section in the appropriate Channel Attachment Program Product Description manual for details.

Prerequisites

One Series/1-System/370 Channel Attachment (feature 1200) is required for each 4993 unit.

Limitations

One 4993 per 4997 rack enclosure may be installed (an RPQ must be submitted for more than one unit per rack). The unit must be mounted at the bottom of the rack.

Highlights include:

- Maximum data transfer rate of 300,000 bytes per second, in block multiplexer or selector channel mode

- Optional IPL capability by host System/370

- Up to eight Series/1's per System/370 channel.

The 4993 Model 1 and its attachment feature provide storage-to-storage communication between Series/1 and System/370 (Models 135 through 168, and 3031, 3032, 3033, 308X, 3090, 4331, 4341, 4361, and 4381) processors. Data is transferred under control of both processors. The unit attached to a Series/1 channel using its companion Series/1-System/370 Channel Attachment feature, which can be plugged into either a Series/1 processor or an I/O expansion unit. It is connected to a System/370 selector or block multiplexer (except 2870) channel where it appears as a control unit with 32 device addresses.

The 4993 Model 1 Series/1-System/370 Termination Enclosure provides the physical support, mechanical connection, and electrical termination for the System/370 channel interface cables. It is a full-width module that is designed to be mounted in a standard 19-inch enclosure. The enclosure contains the driver and receiver terminators, power source, power on/off control, enable/disable control, disable indicator lamp, and mechanical assembly. The termination enclosure is a single drop on the System /370 I/O interface.
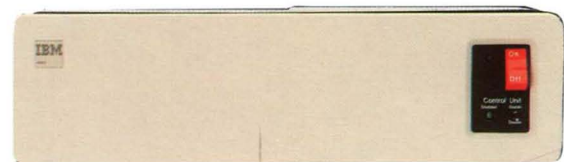
Physical characteristics

Model 1A and 1B

Height	1000 millimeters (39.4 in.)
Width	613 millimeters (24 in.)
Depth	749 millimeters (29.5 in.)
Weight	57 kg (125 lb)

Model 2A and 2B

Height	1780 millimeters (70 in.)
Width	610 millimeters (24 in.)
Depth	749 millimeters (29.5 in.)
Weight	107 kg (235 lb)

Power requirements

None required.

Programming support

None required.

Prerequisites

None required.

Note: Series/1 units do not require the 4997 rack enclosure. Series/1 units may be mounted in an enclosure meeting RS-310-B (ANSI C83.9-1972) dimensional specifications and using the universal mounting rail hole pattern. Units mounted in non-IBM rack enclosures must conform to IBM safety requirements and must free and clear access for IBM service personnel.

Cables

- Customer Access Panel—Integrated Digital I/O cable (feature 1593) for connection of integrated digital I/O non-isolated feature with the customer access panel feature.
- Customer Access Panel—Customer direct Program Control Adapter cable (feature 1594) for connection of customer direct program control adapter feature with the customer access panel feature.
- Teletypewriter Customer Access Panel cable (feature 2059) for the Teletypewriter Adapter feature.

The 4997 Rack Enclosure provides mounting space for IBM Series/1 modular units. It has EIA (RS-310-B) rack-mounting dimensions for housing standard 19-inch (482.6-millimeter) rack units. Four models provide two sizes and a choice of plain or decorative filler covers.

Models 1A and 1B have the capacity for mounting two full-width modular units or comparable combinations of full- and half-width modular units.

Models 2A and 2B have the capacity for mounting four full-width modular units or comparable combinations of full- and half-width modular units. A rack mounting fixture is available for mounting two half-width modular units.

When a system requires space for modular units beyond the capacity of a single rack, multiple racks can be bolted together to form a multiple-bay enclosure.

Plain front filler covers are available for all models. Decorative front filler covers, more suitable for areas of public display, are also available for all models.

A primary power distribution system, including an instant power-off switch, supplies power to all units in the enclosure. A 20-ampere circuit breaker in the power system provides either four outlets (Models 1A and 1B) or eight outlets (Models 2A and 2B).

Auxiliary features

The following features are ordered with processors or I/O expansion units but pertain to rack mounting options.

- Customer Access Panel (feature 1590) — This feature provides an assembly behind a Series/1 rack for mounting optional, quick-disconnect type connectors for I/O equipment. The assembly can accommodate one timer connector, one teletypewriter connector, and up to four connectors for either the Integrated digital Input/Output Non-isolated feature or the Customer Direct Program Control Adapter feature.

- Rack Mounting Fixture (feature 4540) — This feature provides a mounting assembly for half-width rack units, such as the 4952 Model A Processor. One fixture is required to mount one of two half-width units in a 4997 Rack Enclosure or an EIA standard 19-inch rack enclosure. If only one unit is mounted using the Rack-Mounting Fixture feature, the empty space will be covered with a decorative panel similar to the front covers of Series/1 machines.

5   Series/1 programming support

Chapter 5. Series/1 programming support

Series/1 hardware is complemented by an extensive set of system and application programs. These programs provide a variety of support that can assist you in developing both simple and sophisticated Series/1 solutions.

The Series/1 offers a choice of two primary operating systems: the Event Driven Executive and Realtime Programming System. Both operating systems are supplemented by functional system programs and programming languages. In addition to operating system based support, independent functional modules are available to allow you to develop your own tailored solution.

Also available are application packages that run in conjunction with an operating system and application packages that provide dedicated system solutions.

This section describes both system and application programs available with the Series/1.

Note: If multiple versions and releases of a Series/1 program are available, this section discusses only the latest version and release level that was announced at the time this document was printed. Prerequisite programming refers to the latest version and release levels, unless otherwise specified. Subsequent programming announcements will be included in future issues of this Series/1 Digest or a Series/1 Digest Supplement. For information concerning the capabilities of prior versions of Series/1 programming, see your IBM representative.

Series/1 Event Driven Executive

Highlights include:

- Multiprogramming, multitasking supervisor
- Device support includes:
  - Direct access
  - Magnetic tape
  - Printers
  - Terminals
  - System/370 Channel Attach
  - Sensor I/O
  - Communications.
- Flexible operating environment—storage resident, disk or diskette based
- Multiple programming language options, including Series/1 Assembler, EDL, COBOL, FORTRAN, Pascal, and PL/I
- 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
- Online program preparation facility, system generation, and application development
- Session manager that provides an easy-to-use menu of functions with automatic allocation of user work files.

Event Driven Executive (EDX) is the ease-of-use oriented operating system for the Series/1. It is adaptable to a low-entry, diskette-based production system and larger, disk-based development or production systems of moderate complexity.

In keeping with the Series/1 concept of modular offerings, the functions of the Event Driven Executive are available through a number of licensed programs. The Series/1 user may select from these offerings to provide the support for a particular installation.

The Event Driven Executive on the Series/1 can apply to a broad range of applications, such as data entry, remote job entry, distributed processing, and other commercial applications and sensor-based functions such as data acquisition, material and component testing, machine and process control, and shop floor control.

Basic Supervisor and Emulator (5719-XS5)

The IBM Series/1 Event Driven Executive Basic Supervisor and Emulator (Version 5.2) is responsible for managing the overall system operation. All Series/1 systems using the Event Driven Executive operating system require this product. This version supports the expanded capabilities for the high-end 4956 models:

- 16 partitions supported
- 2-megabyte storage supported
- I/O segmentation register support
- Microcode assist for Event Driven Language (EDL).

Other highlights are:

- Improved problem determination aids.
- Disk Immediate-Read support.
- System/program Analysis utility.
- Multiple volume memory disk facility.
- BSC Series/1-to-Series/1 transfer utility.
- Application programs can be initiated:
  - From a user terminal through interaction with the supervisor
  - By another program
  - By outside events, such as an IPL or a sensor input interrupt.
- Job streams of applications can be executed in a batch like manner through the job queue processor facility.
- Multiple users can run multiple copies of the same program concurrently.
- Multiple independent applications including the mix of program preparation and production applications can run concurrently.
- Printed output from multiple applications can be spooled by the system and routed to one or more printers.
- Multiple tasks can be started within an application program.

- Selective base partition for common mapping.
- Performance Analysis Tools.
- Terminals can be dynamically assigned to each application as required.
- The relocating loader allows an application program to use any available main storage area at the time of invocation.
- Storage is managed in 16 partitions with cross-partition services provided for information transfer and supervisor services.
- A comprehensive set of production oriented utilities such as data and terminal management facilities, remote system management, RJE to host systems, and hardware device exercisers.

The supervisor supports multiple, independent, time-dependent, and/or event driven applications with minimum interaction. The supervisor overhead can range from 15 kilobytes (KB) of storage for small production systems to over 64KB for a complex interactive communications system. The supervisor can be scattered over many partitions for effective utilization. The average instruction length of EDL application instructions are from 6 to 8 bytes allowing the generation of very storage-efficient application programs. This low storage overhead makes the Event Driven Executive an excellent base for production systems.

The emulation capability that the supervisor supports refers to the ability of the system to execute programs written in EDL. This high-level, user-oriented, macro instruction language is unique to the structure and functions of the Event Driven Executive, and the instructions are actually translated (or emulated) at execution time. Most system components are written in EDL. This facility which allows for an efficient use of the Series/1, is part of the basis for the design of the operating system.

Event Driven Executive - basic system functions

A set of utilities provides support for production environments such as:

- A queued job stream processing facility that provides batch processing of a series of programs with procedures previously defined and saved on a data set.
- A remote management facility that allows a central site distributed Series/1 management strategy. This utility provides the basis for remote management of distributed Series/1.
- Remote Job Entry facilities to make the Series/1 appear to a host system as a 2780 or 2780 remote work station.
- Device reconfiguration facilities for terminals and other hardware devices.
- Communication trace facilities for BSC, ACCA and EXIO attachments.
- Device message routing facilities.

These utilities are independent load modules capable of running concurrently with other application programs on the system.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

None required.

Minimum hardware requirements

For an operational system, the following are the minimum hardware requirements:

- Series/1 processor with 96KB of storage
- Series/1 disk or diskette unit
- Series/1 display.

For a development system, the following are the minimum hardware requirements:

- Series/1 processor with 128KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Event Driven Executive for the Series/1 System Unit (5719-XJ5)

Event Driven Executive for the Series/1 System Unit (Version 5.2) is a condensed version of the Basic Supervisor and Emulator (5719-XS5).

A supervisor that supports the maximum configuration is supplied as the starter supervisor on a 5.25-inch diskette along with applicable utilities. The BSC Series/1-to-Series/1 Transfer Utility is also shipped with this program product to provide for downloading programs and data from a development Series/1. Event Driven Executive for the Series/1 System Unit is intended for an operational environment or an Event Driven Language (EDL) development system.

Prerequisite programming

Series/1 Input/Output Executive (5719-EM1).

Minimum hardware requirements

For an operational or a development system, the following are the minimum hardware requirements:

- System Unit with:
  - 256KB of storage
  - 20MB disk
  - 1.2MB, 5.25-inch diskette
  - Terminal/host attachment card.
- Monochrome or Color Personal Computer Display and Adapter
- 4201 Proprinter and Adapter.

Program Preparation Facility (5719-XX6)

The IBM Series/1 Event Driven Executive Program Preparation Facility (Version 5) allows a user to compile application programs that use Event Driven Language (EDL) macro instructions. The preparation facility allows:

- Compiling of application programs and Event Driven Executive supervisors

- Accessing supervisor functions from application programs.

The Program Preparation Facility can run concurrently with other programs, including other program preparation activities. The user can also reconfigure and compile new supervisors online.

The Event Driven Executive compiler, available with this product, allows the programmer to access all Event Driven Executive supervisor functions. It supports symbolic file addressing and selection of any terminal device for listing output. It provides greater compilation speeds than the Macro Assembler for those programs containing only Event Driven Language macro instructions.

A set of utilities are provided that provide productivity aids for Series/1 program development and program maintenance such as:

- Both single-line and full-screen text editors for source data entry and modification

- A linkage editor with overlay support

- Interactive debugging facilities

- A program library update facility

- A screen format build facility for use in designing formatted screen images for Series/1 terminals.

These utilities are independent program load modules capable of running concurrently with other application programs on the system.

A programming development productivity aid called the "Session Manager" is provided as part of this product to assist the application programmer in the efficient use of the system for program development. Using full-screen fill-in-the-blank menus, the session manager allocates temporary work files and provides an easy-to-use interface to all the programming development language compilers, assemblers, text editors, linkage editors and utilities.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Event Driven Executive Basic Supervisor and Emulator (5719-XS5).

Minimum hardware requirements

- Series/1 processor with 128KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Event Driven Executive - program development

Macro Assembler (5719-ASA)

The IBM Series/1 Event Driven Executive Macro Assembler allows the user to assemble application programs or program modules written in both Series/1 Event Driven Executive Assembler and Event Driven Language. The program supports:

- Converting source code into object modules
- Expansion of Series/1 Assembler macros as well as Event Driven Language macro instructions.

The Macro Assembler can operate concurrently with the execution of other programs. It converts text data sets containing machine instructions and macro instructions into object modules to be processed by the linkage editor.

Through the use of the Macro Library, applications coded in the Event Driven Language can also be processed by the Macro Assembler, including the reconfiguring or customizing of the Event Driven Executive supervisor. User-generated macro instructions for commonly used routines can be incorporated into the macro library.

The Macro Assembler also provides the user with the facility for generating device support modules or specific routines in support of user exits or customized supervisory functions. These routines can be link-edited with user applications generated in COBOL, the Event Driven Language, FORTRAN, Pascal and PL/I.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Event Driven Executive Basic Supervisor and Emulator (5719-XS5).

Minimum hardware requirements

- Series/1 processor with 128KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Macro Library (5719-LM9)

The IBM Series/1 Event Driven Execution Macro Library is used by the Macro Assembler for:

- Building a basic supervisor and emulator

- Assembling application programs written in the Event Driven Language instruction set and/or the Series/1 instruction set.

Macro instructions supplied with the Macro Library can be supplemented by user coded macro instructions placed in the library.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- Basic Supervisor and Emulator (5719-XS5)
- Macro Assembler (5719-ASA).

Minimum hardware requirements

- Series/1 processor with 128KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Host Preparation Facility (5799-BNA)

An IBM System/370 Host Program Preparation Facility is available for the Series/1. For the Event Driven Executive user, the host facility provides the following support:

- 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-references, and diagnostic messages.

All host components execute with the System/370 OS/VS2 (MVS) operating system.

The Host Preparation Facility prepares Series/1 code for execution with the Event Driven Executive.

Macro Library/Host (5740-LM6)

The IBM Series/1 Event Driven Executive Macro Library/Host is a set of libraries and procedures that reside on a System/370. The program includes:

- A macro library, containing Series/1 instructions
- A data set, containing sample Job Control Language (JCL).

The Macro Library/Host, in conjunction with the System/370 Program Preparation Facilities for Series/1, 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.

Event Driven Executive - program development

Transaction Processing System (5719-TR1)

The Event Driven Executive Transaction Processing System product offers support for developing and managing transaction oriented user application programs. It provides high programmer productivity and use of system functions without the complexity of an operating system interface.

The Transaction Processing System provides support for:

- File management
- Program management
- Storage management
- Error management
- Terminal management
- Multitasking
- Multiple address support
- Security sign-on and access
- Transparent interface to Communication Facility functions.

Using the Communications Facility, the Transaction Processing System supports 3270 passthru and 3270 emulation.

The Transaction Processing System also includes a generalized transaction builder that can provide functions to develop file maintenance functions such as adding, deleting, and updating records without programming. Formats can be created and edited without the use of a programming language. For more sophisticated processing, exits provide access to user written routines in assembler, EDL, COBOL, or PL/I.

The Transaction Processing System has the advantage of allowing a user to develop many interactive applications without the knowledge of the operating system or programming languages.

Transaction Processing System provides native support for the enhanced functions of the 316X

display stations. This support includes multiple viewports, color support, daisy chain terminals, attached 4201 Proprinter, and large-screen capabilities.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Basic Supervisor and Emulator (5719-XS5).

For certain environments and functions, the following Series/1 Event Driven Executive licensed programs may be required:

- Program Preparation Facility (5719-XX6)
- Macro Library (5719-LM9)
- Macro Assembler (5719-ASA)
- Indexed Access Method (5719-AM4)
- Communications Facility (5719-CF2)
- COBOL Compiler and Resident Library (5719-CB5)
- COBOL Transient Library (5719-CB6)
- PL/I Compiler and Resident Library (5719-PL5)
- PL/I Transient Library (5719-PL6)
- Intelligent Workstation Support Programming (5799-TGC)
- Series/1 to PC Connect (5719-CN1).

For the Series/1 System Units, the following licensed programs are required:

- Series/1 Input/Output Executive (5719-EM1)
- Event Driven Executive for the Series/1 System Units (5719-XJ5).

Minimum hardware requirements

- Series/1 processor with 256KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Advanced Remote Job Entry (5719-RJ1)

The Series/1 Event Driven Executive 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 desired line protocol is selected when the Series/1 program is installed. User Remote Job Entry commands are independent of line protocol. The BSC option provides a multileaving RJE (MRJE) work station over a point-to-point (switched or non-switched) connection, appearing to the host as an IBM System/3 with console support. The SDLC option provides an SNA RJE work station over a point-to-point (switched or non-switched) or multipoint connection.

The Series/1 appears to the host as a PU-type 2 with up to four LU type 1's.

The advanced RJE program provides the following support:

MRJE — Multileaving Remote Job Entry (MRJE) support for Binary Synchronous Communications (BSC).

SNA RJE — Multiple Logical Unit Systems Network Architecture (SNA) support for Synchronous Data Link Control (SDLC).

Unattended operation — ARJE allows unattended operation by having ARJE commands on disk/diskette, and support for dynamic punch file allocation and delayed activation.

Full function RJE — In addition to standard RJE capabilities, ARJE has console support with status reporting and journaling, data decompression, and printer form support.

ARJE commands — ARJE commands have been designed for ease of use and are identical for MRJE or SNA RJE operation.

Host Remote Job Entry Subsystems — ARJE supports the following:

BSC	SDLC
OS/VS2 JES2	OS/BS2 JES2
OS/VS2 JES3	OS/BS2 JES3
VM/370 RSCS	DOS/VSE VSE/POWER

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- Basic Supervisor and Emulator (5719-XS5)
- Systems Network Architecture (5719-XX9) is required for SNA operation.

Minimum hardware requirements

- Series/1 processor with 128KB of storage
- Series/1 disk or diskette unit
- Series/1 display.

Remote Manager (5719-RM1)

The IBM Series/1 Event Driven Executive Remote Manager allows Series/1 networks to be managed and operated through the communications and systems management programs available on IBM host processors (System/370, 30XX, and 43XX). Effective network management is made possible with the NetView licensed program and related communications and systems management (C&SM) programs.

The Remote Manager downstream support allows Series/1s that are connected to a connection point Series/1 through the Communications Facility (5719-CF2) to interact with the host network management functions.

The Remote Manager communicates with the following host C&SM programs:

- Network Communications Control Facility (NCCF)

- Network Problem Determination Application (NPDA)

- NetView

- Host Command Facility (HCF)

- Distributed Systems Executive (DSX).

Three major functions are provided by the Remote Manager:

- Alert Processing, the facility to route Series/1 hardware and software error indications to the Network Problem Determination Application (NPDA) or NetView at the host, alerts network operators of real or potential problems with Series/1 network operation.

- Host Operator Facility, allows a host 370 terminal operator to act as a local Series/1 operator. The host operator using the Host Command Facility (HCF) can issue Series/1 commands and invoke system utilities.

Series/1 full-screen application programs, which can be accessed by EDX-managed 3101 type (block mode) terminals can also be accessed by HCF. Applications that use any other device driver cannot be accessed by HCF (for example, the Transaction Processing System, 5719-TR1, and the Communications Facility, 5719-CF2).

The host 3270 terminal operator, using the HCF licensed program and the Remote Manager is able to:

- Display system status, examine error logs, run utilities, start and stop applications in an effort to effect problem determination.

- Act as the console operator on an unattended Series/1.

- Start two HCF sessions at any Series/1 concurrently allowing simultaneous testing and debugging.

- Relay, allows user and system data sets and programs to flow between a Series/1 and a host using Distributed System Executive. Thus, new or changed data or programs may be sent to a Series/1 in a controlled way. Data or programs may be retrieved from a development or production Series/1. Data that originates at the host, or is destined to be processed at the host, may also be transmitted.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- Basic Supervisor and Emulator (5719-XS5)
- System Network Architecture (5719-XX9).

Minimum hardware requirements

- Series/1 processor with 256KB of storage
- Series/1 disk unit or diskette unit
- Series/1 display (for installation only)
- SDLC attachment.

Communication Facility (5719-CF2)

The IBM Series/1 Event Driven Executive Communication Facility (Version 2.1) is a licensed program that manages the flow of information throughout a configuration that may include Series/1s, host computers, personal computers, terminals, and printers. The Communication Facility is oriented toward minimal-storage, low-cost Series/1s.

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 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. The definition of the configuration is dynamic and can be extended and modified at any time.

Communication with a host may be over a leased or switched BSC line operating in multipoint mode; an SNA connection; or a channel attachment. Communication between Series/1s may be over a leased or switched BSC line operating in point-to-point or multipoint mode, a X.25/HDLC packet-switching network, or over a local Communications Controller. Communication with personal computers must be through the Series/1-to-PC Connect Attachment. I/O devices may be 3270 displays and printers; Series/1 displays and printers, which the Communications Facility manages as though they were 3270 devices; or various devices than can be connected to the Series/1 over BSC lines. The installation can add its own support for other devices.

The Communications Facility's message management functions include:

- *Delivering messages* from a computer, a device, or an application program to another computer, device, or application program.
- *Queueing messages* in processor storage, according to sender-assigned priority, for each destination.
- *Handling undeliverable messages* by placing them on a user-defined disk queue.

- *Handling transactions*-special fixed-format messages to be processed by user application programs.
- *Handling log messages,*.

Application development aids include:

- Event Driven Language (EDL) — Extended instructions that allow use of Communications Facility features.
- A 3270 panel design aid — An interactive utility that guides the programmer through creating a screen image.
- Transactions for use by interactive applications to communicate with Series/1 terminals that are being managed as native EDX terminals, rather than as 3270 terminals.

Aids for operating and controlling the network include:

- An interactive utility program that prompts the operator through the process of defining the network.
- Operator commands to allow for on-line control of the network.
- A diagnostic aid utility.
- Utilities that allow a central operator to send files to a remote site, execute programs at the remote site, allocate and delete data sets in the remote computer, and make a terminal at the central site operate as though it were attached to the remote computer.
- Remote IPL.
- A feature that allows a program access to disk files on remote Series/1s as if they were on the local Series/1.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Basic Supervisor and Emulator (5719-XS5).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk or diskette unit
- Series/1 display.

Systems Network Architecture Version 1 (5719-SX1)

The IBM Series/1 Event Driven Executive Support of Systems Network Architecture executes as a separate program within the Event Driven Executive operating system, and coordinates all user application program requests for SNA/SDLC communications. The basic operation 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

- Terminating communications with the host subsystem.

Application programs on the Series/1 are masked from the complexities of SNA transmission and interface at a GET and PUT level for transmitting and receiving messages. Application programs can be written to communicate with an Information Management System (IMS/VS) application program in the host (logical unit type P) or to communicate with a Customer Information Control System (CICS/VS) application program as an equivalent of a 3790 full function logical unit.

Prerequisite programming

Basic Supervisor and Emulator (5719-XS5).

Minimum hardware requirements

- Series/1 processor with 96KB of storage
- Series/1 disk or diskette unit
- Series/1 display
- SDLC attachment.

System Network Architecture Version 2 (5719-XX9)

System Network Architecture Version 2 is an enhancement to System Network Architecture Version 1 (5719-SX1). In addition to the support contained in version 1, this program offers the following features:

- Support for multiple physical units
- Support for more logical units
- Less storage required per partition, and less overall storage required for large networks
- More efficient use of required storage
- Increased user flexibility
- Transparency of support
- Ability to display SNA network status.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Basic Supervisor and Emulator (5719-XS5).

Minimum hardware requirements

- Series/1 processor with 128KB of storage
- Series/1 disk or diskette unit
- Series/1 display
- SDLC attachment card.

Primary System Network Architecture (5719-XT4)

Primary SNA communications support is provided for all devices. This support provides a PU (physical unit) type 4 and PU type 5 image to the downline PU type 2 controllers. It is not attachable as a PU type 4/5 directly to a host.

Primary SNA supports the following controllers:

- IBM 4680 Store System Controller
- IBM 3651 Store Controller (with IBM 3653 or 3683 point-of-sale terminals attached)
- IBM 3684 Point-of-Sale Control Unit (with 3683 point-of-sale terminals attached).
- IBM 3274 Control Units (models 21C, 31C, 41C, 51C, and 61C), using configuration support C or D
- IBM 4701 Finance Communications Controller (Models 001, 002 and 003)
- IBM 4702 Finance Communications Controller Model 001
- IBM 3624 Consumer Transaction Facility (Models 001, 002, 011, and 012)
- IBM 4730 Personal Banking Machine (Models F01 and F02).

Network configuration for Primary SNA is provided by the corequisite program, Network Definition Utility (5719-XT5).

To address the concern of storage limitations, EDX Primary SNA is designed to allow the customer to specify how much of the code is resident at any one time. The code will be swapped in and out as required for execution purposes. The ability of the customer to fine-tune the use of storage will allow the most storage-efficient use of this program.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- Basic Supervisor and Emulator (5719-XS5)
- Network Definition Utility (5719-XT5).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk or diskette unit
- Series/1 display
- SDLC attachment card.

Network Definition Utility
(5719-XT5)

Network Definition Utility is used in conjunction with Primary SNA (5719-XT4). This program provides a user-friendly method of defining the network resource configuration records for primary SNA networks.

Definition of network configuration records is done in full-screen mode. Full-screen mode provides the user with an easy-to-use, interactive method of creating and updating records. By choosing options presented in the menus, the user defines the configuration records for the network and all it's component parts. These same menus can be used to dynamically alter existing network

configuration records for subsequent invocation using Primary SNA. Help screens are available to aid the user if questions should arise.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- Basic Supervisor and Emulator (5719-XS5)
- Primary SNA (5719-XT4).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk or diskette unit
- Series/1 display.

X.25/HDLC Communications Support Program (5719-HD2)

The IBM Series/1 Event Driven Executive X.25/HDLC Communications Support program provides a set of functional modules that allow the Series/1 to appear as a data terminal equipment (DTE) or data circuit-terminating equipment (DCE), using the X.25 interface.

When used as a DTE, the Series/1 can be connected to an X.25 based packet switched network. As a DCE, the Series/1 will communicate with packet-mode DTEs whose protocol conforms to the X.25 interface.

This program will manage the X.25 protocols on behalf of the Series/1 users and support many functions designated as essential services by the CCITT Recommendation X.25. It performs the following functions:

- Assembly/disassembly of packets
- Connection/disconnection of virtual circuits
- Flow control and data packets management.

This program will also enable the Series/1 to communicate with other intelligent terminals or processors where high-level data link control (HDLC) is used as the link access protocol. Supported operational modes are Asynchronous Balanced Mode (ABM) and Normal Response Mode (NRM). The Communications Facility for the Series/1 provides a message path interface to the X.25/HDLC Communications Support program.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Basic Supervisor and Emulator (5719-XS5).

Minimum hardware requirements

- Series/1 processor with 128KB of storage
- Series/1 disk or diskette unit
- Series/1 display
- Communications attachment hardware.

Systems Network Architecture RJE Program (5719-SX2)

The IBM Series/1 Event Driven Executive Systems Network Architecture RJE Program is for those users who want to transmit jobs to and from a host System/370 by using a systems network architecture (SNA) protocol (logical unit type 1). The functions include:

- Submitting jobs to the host
- Transmitting remote job entry (RJE) commands to the host
- Stopping transmission to or from the host.

The SNA RJE program transmits and receives jobs under control of a user terminal work station in a manner consistent with the Remote Job Entry programs in the Utilities. The program requires the installation of the Support of Systems Network Architecture as a prerequisite.

Host subsystems supported are: DOS/VSE POWER, OS/VS1 RES, OS/VS2 JES2 or JES3.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- Basic Supervisor and Emulator (5719-XS5)
- Systems Network Architecture (5719-XX9).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk or diskette unit
- Series/1 display
- SDLC attachment card.

Manufacturing Automation Protocol Application Server (5719-XT1)

Manufacturing Automation Protocol (MAP) [1] is a set of standards based on the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) Reference Model. These standards enable communication and cooperation among computers and other intelligent devices in a multiple-vendor local area network in manufacturing environments.

The IBM Series/1 Event Driven Executive (EDX) MAP Application Server, along with other IBM Series/1 EDX programs, allows EDX-based Series/1s to communicate with other systems in a MAP network.

Highlights of the licensed program include the following:

- A subset of Manufacturing Automation Protocol at the 2.1 level of function
- Institute of Electrical and Electronics Engineers (IEEE) Standard 802.4 (token bus local area network) and IEEE Standard 802.2 (logical link control) via an external network interface unit
- ISO Internet Connectionless Network Service (CLNS), as an "end system"
- ISO Transport Protocol, Class 4
- ISO Session Kernel
- ISO Common Application Service Element (CASE) subset
- A subset of ISO File Transfer, Access, and Management (FTAM) functions
- A Directory Client Service Agent that supports inquiries to a centralized network directory
- MAP Network Management Agent functions
- Reliability, availability, and serviceability aids, such as trace facilities.

Prerequisite programming

- Basic Supervisor and Emulator (5719-XS5)
- Event Driven Executive Communications Facility (5719-CF2)
- Event Driven Executive X.25/HDLC Communications Support (5719-HD2)
- Event Driven Executive Program Preparation Facility (5719-XX6) for installation.

Minimum hardware requirements

- Series/1 processor with 512KB of storage and timer
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer
- Synchronous Communications Adapter (#2080) with cable (#2060)
- A network interface unit that meets the MAP specification of the Layer 2 Interim Network Interface Specification. An interface converter (V.35/RS449) and an RS449 secondary cable are also required.

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[1] MAP is an acronym of General Motors Corporation to identify its Manufacturing Automation Protocol.

Certain device support is provided to the Event Driven Executive user through separate licensed programs.

System/370 Channel Attach Support (5719-CX1)

The IBM Series/1 Event Driven Executive System/370 Channel Attach Program is used in conjunction with the IBM 4993 Model 1 Series/1-System/370 Termination Enclosure and the IBM Series/1-System/370 Channel Attachment (feature number 1200). The program allows the user to develop an Event Driven Executive application program, written in Series/1 Assembler or Event Driven Executive, that will communicate with an application program in a System/370 over a selector or block multiplexer channel.

Communication with the following processors is supported:

- IBM System/370 (Models 135 through 168)

- IBM 3031, 3032, 3033, 3081

- IBM 4331, 4341.

This program has been validated with the following System/370 control programs: DOS/VS, OS/VS1, OS/VS2 (SVS or MVS) and BTAM, or DOS/VSE with BTAM-ES

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Basic Supervisor and Emulator (5719-XS5).

Minimum hardware requirements

- Series/1 processor with 96KB of storage
- Series/1 disk or diskette unit
- Series/1 display
- System/370 channel attachment hardware.

These licensed programs aid the Event Driven Executive user in developing and executing commercial applications on Series/1.

Indexed Access Method (5719-AM4)

The IBM Series/1 Event Driven Executive Indexed Access Method (Version 2) provides data management facilities that support indexed file operations for the Event Driven Executive. Such facilities include:

- The use of a predetermined field called a key that allows the user to build, access, and maintain user-defined records in indexed data sets. The program builds an index of keys that provides a fast access to records in a data set. Both primary (unique) and secondary (duplicate) index keys are supported. (The Sort/Merge program is required for this facility.)
- The support of a high degree of insert/delete activity, providing both direct and sequential access to the data from multiple programs concurrently accessing the same or different indexed data sets.

A single copy of the Indexed Access Method supports multiple programs and tasks sharing the same data files. In a shared environment, data integrity is maintained by record and block level locking to prevent access to an indexed or data record while the record is being modified.

Applications that use the Indexed Access Method support can be programmed in Event Driven Language, Series/1 Assembler, PL/I, or COBOL. The program is also supported by the Sort/Merge program, which will accept Indexed Access Method data sets as input files.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Event Driven Executive Basic Supervisor and Emulator (5719-XS5).

Minimum hardware requirements

- Series/1 processor with 96KB of storage
- Series/1 disk or diskette unit
- Series/1 display.

Sort/Merge (5719-SM2)

The IBM Series/1 Event Driven Executive Sort/Merge licensed program handles the sorting and merging of records from up to eight input data sets into one output data set in either ascending or descending order. The user specifies one or more control fields in the record to be sorted. Sort/Merge:

- Accepts fixed-length or variable-length records in unblocked or block formats (Variable-length records are only supported by the Event Driven Executive Cobol compilers and associated libraries)

- Permits user-written exit routines to handle I/O errors and process records during execution

- Permits deviation from the standards EBCDIC or ASCII collating sequence at program execution time

- Allows multiple sorts to be invoked from the same application

- Routes messages to the operator work station or printer.

Sort/Merge can be initiated either as a batch job or from a user routine written in Series/1 Assembler language, COBOL, PL/I, or Event Driven Language.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Event Driven Executive Basic Supervisor and Emulator (5719-XS5).

Minimum hardware requirements

- Series/1 processor with 96KB of storage
- Series/1 disk or diskette unit
- Series/1 display.

General Purpose Automation Executive-Distributive GPAX-D (5798-FAS)

General Purpose Automation Executive-Distributive GPAX-D is a Series/1 EDX-based facilities automation application. It supports all other equipment manufacturer (OEM) vendors who meet the facilities automation communications network (FACN) protocol. This is typically on a vendor-supplied IBM Personal Computer (PC) front end to their direct digital control (DDC) or programmable logic control (PLC) equipment. These systems are referred to as remote intelligent sub-systems (RIS).

GPAX-D can support a variety of OEM RISs on the same Series/1. The RISs may be in multiple buildings or sites. Multiple GPAX-D systems can also be connected using bisync communications. Information can be shared with all systems (GPAX-Ds and RISs) in the network. GPAX-D provides for monitoring, control, trend analysis, reporting, graphics, data reduction (highs, lows, averages on hourly, daily, weekly, monthly basis), meter/consumption tracking, and more. It is meant not for high-speed process control, but rather for common facilities automation tasks such as energy management, device

optimization, HVAC (heating, ventilation, and air conditioning), lighting schedules, and more.

GPAX-D provides a common user interface for whatever variety of systems attached. The OEM RISs may be used for any suitable purpose while the GPAX-D host is used more in a supervisory mode to move/calculate values taken from multiple sources and to provide the engineer with a powerful tool to view data from all systems at one terminal. GPAX-D is an improved/enhanced version of GPAX (5798-RCZ), originally released in 1981.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite Programming

Basic supervisor and emulator (5719-XS5).

Minimum hardware requirements

- Series/1 processor with 384KB of storage and floating-point
- Series/1 disk unit with 30 megabytes of storage
- Series/1 diskette unit
- Series/1 printer
- Series/1 display with full-screen capability
- Communications attachment.

Store Item Receiving (5719-DSD)

The Store Item Receiving System is an adaptable system designed to meet the direct store delivery receiving and ordering requirements of retail stores. It uses the full functions and productivity features of the Series/1. The Store Item Receiving System provides the user with an interactive, easy-to-use, menu-driven application. The application performs the following functions:

- Preparing for item deliveries
- Receiving and ordering procedures
- Reviewing and closing orders
- Printing management reports
- Editing and updating files
- Close-of-the-day procedures
- Operator training.

Highlights are:

- Supports multiple vendor receiving procedures
- Handles charge (receipts) and credit (returns) orders
- Provides item extensions, using authorized costs and allowances
- Provides item authorization and order validation procedures
- Prints operational and historical reports by vendor and item
- Menu-driven functions with operator security options
- Online and host file editing and updating.

IBM Store Item Receiving is a group of online and batch programs. Menu-driven procedures assist the user during the store receiving process. Store orders can be created, reviewed, closed, or cancelled.

Orders captured by hand-held computer (HHC) and transmitted to the store processor can be handled in a similar manner. (User must supply interface code for their particular HHC device.)

At the end of the day, a file of completed orders is prepared to send to the host for reconciliation of vendor payments and store accounting.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- Basic Supervisor and Emulator (5719-XS5)
- COBOL Transient Library (5719-CB6)
- Index Access Method (5719-AM4)
- Sort/Merge (5719-SM2)
- Transaction Processing System (5719-TR1).

Minimum hardware requirements

- Series/1 processor with 512KB of storage
- Series/1 disk unit
- Series/1 printer
- Series/1 display.

Series/1 Store Item Management (5798-RTE)

The IBM Series/1 Store Item Management is designed to assist retail store management in controlling the flow of merchandise from checkout (point of sale) through replenishment. This program uses daily sale information to establish sales forecasts and maintain inventory levels. Generated store orders and item allocations help maintain full shelves and low back room inventory with reduced manual effort. Workload leveling and direct store delivery functions enhance the productivity of merchandise distribution.

Prerequisite programming

- Basic Supervisor and Emulator (5719-XS5)
- COBOL Transient Library (5719-CB6)
- Index Access Method (5719-AM4).

Minimum hardware requirements

- Series/1 processor with 256KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 printer
- Series/1 display.

Plant Automation Communication System (5798-DRX)

The IBM Plant Automation Communication System (PACS) is an IBM Series/1-based program to assist in the creation of computer applications for directed manufacturing and process control. This program provides a standard application interface to control connected vendor interfaces, manage application data contained in tables and data files, and communicate network information throughout a Series/1 configuration. Major components include:

- Systems Communication (SYSCOM) — Provides "single system image" for program-to-program communications within the PACS/CF network. Application programmer uses logical names to reference other programs.
- Data Manager — Provides for fast response to data requests or updates. Provides unique queueing tools for plant modeling. Tables and/or queues can be either storage or disk resident. Shadow filing is automatic if desired. No data base re-organization is ever required.
- Device Communication (DEVCOM) — Supports the communication to devices on the plant floor. A number of specific devices are supported by the product. A structured architecture provides a simple method of communicating with new devices, using existing modules for most of the interface implementation.

Prerequisite programming

- Basic Supervisor and Emulator (5719-XS5)
- Program Preparation Facility (5719-XX6)
- Communications Facility (5719-CF2).

Minimum hardware requirements

- Series/1 processor with 512KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 printer
- Series/1 display.

Chain Pharmacy System (5798-RGD)

The IBM Series/1 EDX Chain Pharmacy System offers an in-store prescription control application for chain pharmacies. All operations are handled interactively through a display terminal and a printer is used to prepare prescription labels. Functions include:

- Prescription processing
- Patient profile maintenance and drug interaction verification
- Trade-to-generic and generic-to-trade name cross-referencing
- Pricing of prescriptions
- Third-party patient and drug eligibility validation
- Data collection and forwarding to a host system.

The EDX Chain Pharmacy System is designed to provide in-store processing that complements host processing of a multi-store enterprise. When appropriate, a single Series/1 can support multiple store locations with remote terminals. Communications between host and store involving transfer of files and programs is accomplished by standard Event Driven Executive SNARJE Communication (5719-SX2) or standard BSC RJE communication (Program 5719-UT5).

Prerequisite programming

- Basic Supervisor and Emulator Version 3 (5719-XS3)
- Utilities Version 3 (5719-UT5)
- Indexed Access Method Version 2 (5719-AM4)
- Sort/Merge (5719-SM2).

Minimum hardware requirements

- Series/1 processor with 128KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 printer
- Series/1 display.

Series/1 Data Entry System (S1DES) (5796-ZDF)

The IBM Series/1 Data Entry System (S1DES) developed by Software Consulting Service, Inc., is a heads-down, high-volume key-to-disk data entry system providing enhanced productivity for both the implementer and the end user. Highlights include:

- Menu-driven implementation

- Operator interfaces to enhance throughput

- System compatibility between both RPS and EDX

- Extension of the data entry environment through use of exit facility

- Ability to implement communications with host systems (4300, 30XX) for update and verification.

The ease of use characteristics are accomplished via a completely menu-driven implementation eliminating the need to write programs to get jobs online and operational. The menu facility also provides for screen formats and their associated editing definitions. Operator productivity is gained by the extensive use of key assignments to accomplish data entry functions. In addition, notification is made at the time an error occurs, allowing immediate correction and increased throughput.

Standard operating system functions allows for enhanced data integrity and error recovery, as well as transportability of data entry files or definitions between the RPS and EDX operating systems. In addition, files created by S1DES can be directly used by other Series/1 applications.

Prerequisite programming

- Basic Supervisor and Emulator Version 3 (5719-XS3)
- Utilities Version 3 (5719-UT5)
- Program Preparation Facility Version 3 (5719-XX4) for system generation and defining new terminal types.

Minimum hardware requirements

- Series/1 processor with 128KB of storage and timer
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

The IBM Series/1 Realtime Programming System provides:

- Multiprogramming, multitasking supervisor
- Device support includes:
  - Direct access
  - Magnetic tape
  - Printers
  - Terminals
  - Programmable Communications Subsystem
  - System/370 Channel Attach
  - Sensor input/output
  - Communications with remote systems.
- Communications support for a variety of line disciplines
- Task, storage, event and queue management options — enabling support of concurrent complex applications
- Multiple programming language options, including Series/1 Assembler, COBOL, FORTRAN, Pascal, and PL/I
- Online program development and utility functions
- Command language facility with an easy-to-use menu interface for requesting services from the system.

The Realtime Programming System provides a full-function operating system for Series/1 users who wish to develop applications and mixes of applications with moderate to high complexity. The Realtime Programming System contains many system management features generally associated with operating systems on larger processors.

To enable users to tailor the software to their particular needs, the Realtime Programming System offers numerous separately packaged, supplemental programs. These include program development tools, languages, commercial, communications, and additional sensor input/output support.

The Realtime Programming System on the Series/1 can apply to a broad range of applications, including commercial use (distributed or stand-alone), communication applications, including network management, and sensor-based functions (such as process control).

Realtime Programming System (5719-PC7)

The basic supervisor and associated services are provided in a program called the IBM Series/1 Realtime Programming System (Version 7.2). This program provides operating system functions to support realtime operations concurrently with the execution of other batch and on-line programs. The Realtime Programming System allows the generation of both multiple-application systems and smaller, single-application systems.

The Realtime Programming System supports a single Series/1 processor or multiple Series/1 processors. Multiple Series/1 processors are connected in a high-speed ring by the Local Communications Controller.

When the system has multiple processors (nodes), all system functions are available for use. Each node can be dedicated to performing unique work, being a backup node, or a combination of both. Each node can have its own I/O devices and communication lines, or it can share certain types of devices that are attached to the other nodes. Except when the Execute I/O (EXIO) interface is used, the Realtime Programming System manages the logical sharing of distributed devices to enable applications to transparently use devices that are attached to other nodes.

Highlights of the operating system include:

- A text editor, which provides the ability to create and modify text modules that can serve as source input to compilers or job streams for batch operations. Both single line and full screen editing is supported.
- Application programs that can use a range of I/O devices from display terminals, disks, diskettes, and printers to communications subsystems and sensor I/O devices.
- Data management, provided for consecutive, random, partitioned, and indexed files. Disk spooling of printed output is supported.
- Duplex volume support, which is available when utilizing at least two disks, provides automatic and transparent data integrity to the application program and the end user.

- Application programs that can access communications support code in the operating system for communicating with asynchronous (start/stop) or binary synchronous devices, or to SNA systems.
- A command language facility, which provides an interactive command- or menu-oriented interface to terminal users for invoking user or system programs. The command language format is similar to that used in VM/CMS on System/370.
- Command language facility batch support, which is part of the command language facility. It enables users to start jobs and have them run to completion even after an event such as a re-IPL after a power failure.
- I/D split support for user applications enables problem-state applications to expand beyond 64KB. The user's instructions can expand to 64KB with the user's data expandable to multiple data spaces (each up to 64KB).
- A standard operating system is supplied initially, reducing the need to perform system generation in development systems.
- Integrated functions, such as communications manager, remote manager, indexed access method, and sort/merge.

A Base Operating System Feature is available for users who do not require these integrated programming functions.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- There is no prerequisite programming for a base or uniprocessor system.
- For a multiprocessor system, the Uniprocessor feature (#2136) must be ordered also.

Minimum hardware requirements

- Series/1 processor with 192KB of storage (256KB of storage for a multiprocessor system)
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Communications Manager: The communications manager functions support line concentration, message routing, terminal control, and distributed processing. One or more Series/1's 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 input/output devices. Support for non-IBM devices can be incorporated by the user through the use of the 4987 Programmable Communications Subsystem.

Remote Manager: The remote manager functions enable Series/1 networks to be managed and operated through the communications and systems management (C&SM) programs available on IBM host processors (System/370, 30XX, and 43XX). Effective network management is made possible with the NetView licensed program and related communications and systems management programs.

The remote manager communicates with the following host C&SM programs:

- NetView
- Host Command Facility (HCF)
- Distributed Systems Executive (DSX).

Indexed Access Method: The indexed access method provides data management facilities that support indexed file operations.

Such facilities include the use of a predetermined field called a key that enables the user to build, access, and maintain user-defined records in indexed data sets. The program builds an index of keys that provides fast access to records in a data set. Both primary (unique) and secondary (duplicate) index keys are supported. (The sort/merge functions are used for this facility.)

The indexed access method can also provide data consistently by backing out file updates as needed in case of an I/O error.

When used with the Multiprocessing Feature, the following additional functions are available:

- Multiple indexed access methods in a system, each processing files on its own node
- Indexed access methods can be paired in a system. In case of a failure, one indexed access method can assume processing for the failing other method.

Applications that use the indexed access method can be programmed in Series/1 Assembler, PL/I, or COBOL. Also, the sort/merge functions accept indexed access method data sets as input files.

Sort/Merge: The sort/merge functions handle the sorting and merging of records from up to eight input data sets into one data set in either ascending or descending order. The user specifies one or more control fields in the record to be sorted. The sort/merge functions:

- Accept fixed-length or variable-length records in blocked or unblocked formats
- Can be initiated either as a batch job, or from a user routine written in Series/1 Assembler language, COBOL, or PL/I
- Permit user-written exit routines to process records and handle I/O errors during sort/merge execution
- Permit deviation from the standard EBCDIC or ASCII collating sequence during program execution
- Allow multiple sorts to be invoked from the same application
- Route messages to the operator work station or printer.

Realtime Programming System - basic system functions

Advanced Program-to-Program Communication: Advanced program-to-program communication (APPC) provides enhanced SNA support for distributed processing. APPC is the name by which the functions provided by an implementation of the LU type 6.2 and PU type 2.1 architectures are known. APPC provides a single, converged solution to the communications requirements of a growing set of current and future IBM products. As a "universal language" for communication among distributed transaction programs, APPC results in improved connectivity.

Primary SNA Support: This support provides a PU Type 4 and PU Type 5 image to the down-line PU Type 2 controllers. It is, however, not attachable as a PU Type 4 or 5 to a host. Primary SNA supports:

- 3274 Control Unit (Models 21C, 31C, 41C, 51C, 61C) with 3287 printers and 3178, 3278, and 3279 terminals
- 4680 Store System Controller
- 4701 Finance Communications Controller (Models 1, 2, 3) with 4710 printers and 4704 displays
- 4702 Finance Communications Controller (Model 1)
- 3624 Consumer Transaction Facility (Models 1, 2, 11, 12)
- 4730 Personal Banking Machine (Models F01 and F02)
- 3651 Store Controller with 3653 and 3683 Point-of-Sale Terminals
- 3684 Point-of-Sale Control Unit with 3683 Point-of-Sale Terminals.

In addition, this support allows session passthru on a logical unit (LU) basis. This enables the Series/1 to pass messages between a logical unit attached downstream and a logical unit attached upline from the Series/1. Some user code is required to activate this support.

Primary SNA, in conjunction with the Remote Manager function, will pass unsolicited alerts to the host from the 3274, 3651, 4701, 4702, 4730, and 4680 controllers.

IBM Series/1-to-PC Connect Support: Support is included in Realtime Programming System for the IBM Series/1-to-Personal Computer Channel Attachment Feature, which is a high-speed connection between an IBM Series/1 and an IBM Personal Computer. This hardware attachment feature enables multiple IBM Personal Computer local area networks to access the IBM Series/1.

The Series/1-PC Connect complements IBM Personal Computer local area network products by becoming a communication gateway to the host. The host can be any remote Series/1 or System/370 processor with which the communications manager can presently communicate.

The IBM Series/1-PC Connect licensed program (5719-CN1) provides the IBM Personal Computer programming support.

Realtime Programming System for Series/1 System Unit (5719-PJ7)

Realtime Programming System for Series/1 System Unit (Version 7.2) provides a standard Realtime Programming System production operating system for the Series/1 System Units on 5.25-inch diskettes. The diskettes contain the following:

- A prebuilt Realtime Programming System standard system that contains support for a standard configuration of the System Unit, having a full array of device support.
- System utilities that would be used in a production environment.
- A binary synchronous transport utility to send and receive volumes, data sets, and members between the IBM Series/1 host and remote System Unit systems.

The Realtime Programming System active on the System Unit is for application execution. No application development is to be performed on the System Unit. It is assumed that the System Unit environment has access to a host Series/1 (non-System Unit) running Realtime Programming System. This host Series/1 provides the environment for application development, system customization, and distribution of programs and data to the System Unit.

Prerequisite programming

Series/1 Input/Output Executive (5719-EM1).

Minimum hardware requirements

- System Unit with:

  - 256KB of storage
  - 20MB disk
  - 1.2MB, 5.25-inch diskette
  - Terminal/host attachment card.

- Monochrome or Color Personal Computer Display and Adapter

- Proprinter and Adapter.

Realtime Programming System - program development

Program Preparation Subsystem (5719-AS7)

The IBM Series/1 Program Preparation Subsystem (Version 7) provides a group of components that assist in developing and executing user programs. The components are:

- A Macro Assembler, which translates Assembler language source statements to object modules
- An Application Builder, which converts object modules to executable task sets (a process known as link edit in other systems)
- A Macro Preprocessor, which allows the user to develop preprocessed macro programs, thus improving Assembler performance
- A Job Stream Processor, which allows a terminal user to control the execution of one or more programs in an interactive or batch environment
- A set of commands and menus withe the Command Language Facility to aid in program preparation tasks
- A system facility, which provides the ability to generate a customized operating system.

This program is used as the basis for program development in conjunction with the Realtime Programming System. In addition to the Assembler provided with this program, it serves as the interface to the licensed programs that provide high-level language capability. Program development is not supported on the Series/1 System Unit.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Realtime Programming System (5719-PC7).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Job Stream Processor (5799-TEC)

The IBM Series/1 Job Stream Processor is provided for those users who require only the Job Stream Processor portion of the Program Preparation Subsystem. This program provides a convenient method of invoking programs and supplying control information to the system in production job streams.

Prerequisite programming

Realtime Programming System (5719-PC7).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Transaction Processing System (5719-TR6)

The Realtime Programming System Transaction Processing System product offers support for developing and managing transaction oriented user application programs. It provides high programmer productivity and use of system functions without the complexity of an operating system interface.

Transaction Processing System provides support for:

- File management
- Program management
- Storage management
- Error management
- Terminal management
- Multitasking
- Multiple address space support
- Security sign-on and access
- 3270 passthru and 3270 emulation using the Communication Manager
- Switched-line terminal support
- Transparent interface to Communication Manager functions.

Transaction Processing System also includes a generalized transaction builder that can provide functions to develop file maintenance functions such as adding, deleting, and updating records without programming. Formats can be created and edits performed without the use of a programming language. For more sophisticated processing, exits provide access to user-written routines in assembler, COBOL, Pascal, or PL/I. The system is menu-driven and allows access to sequential, direct, and indexed files.

Transaction Processing System has the advantage of allowing a user to develop many interactive applications without the knowledge of the operating system or programming languages.

This program product is available on either 5.25-inch or 8-inch diskettes.

Transaction Processing System provides native support for the enhanced functions of the 316X display stations. This support includes multiple viewports, color support, daisy chain terminals, attached 4201 Printer, and large-screen capabilities.

Prerequisite programming

- Realtime Programming System (5719-PC7).

For certain environments and functions, the following Series/1 Realtime Programming System licensed programs may be required:

- Program Preparation Subsystem (5719-AS7)
- COBOL Compiler and Resident Library (5719-CB7) and Transient Library (5719-CB8)
- PL/I Compiler and Resident Library (5719-PL2) and Transient Library (5719-PL4)
- Pascal Compiler and Object Library (5799-TEQ)
- Programmable Communications Subsystem Preparation Facility (7519-CSO)
- Programmable Communications Subsystem Extended Execution Support (5719-CS2)
- Intelligent Work Station Support Programming RPQ (5799-TGC)
- Series/1 to PC Connect (5719-CN1)
- Series/1 Office Connect (5719-XT3).

The following licensed programs are required when running Transaction Processing System on the Series/1 System Unit:

- Series/1 Input/Output Executive (5719-EM1)
- Realtime Programming System for the Series/1 System Unit (5719-PJ7).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Host Preparation Facility
(5799-BNA)

An IBM System/370 Host Program Preparation Facility is available for the Series/1. For the Realtime Programming System user, the host facility provides the following support:

- 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-references, and diagnostic messages

- An application builder, which prepares object modules for execution by building load modules or task sets that can execute on the Series/1

- A host application load facility, which can be invoked through TSO to transmit Series/1 object code from the System/370 to the Series/1 for execution across BSC lines.

All host components execute with the System/370 OS/VS2 (MVS) operating system.

Communication of programs to and from the Series/1 on a BSC line requires the Native Application Load Facility (5798-RBR) field-developed program in the Series/1. Distribution of programs across SNA lines can be accomplished by using the Remote Maintenance Utility (5799-TEF).

The Host Preparation Facility prepares Series/1 code for execution with the Realtime Programming System Version 7.

Remote Management Utility
(5799-TEF)

This utility facilitates the operation of a remote Series/1 in a distributed data processing system. As a network management tool, the program can:

- Be accessed from a System/370 or another Series/1 and issue Realtime Programming System operator commands
- Transmit, receive, create, reset, or delete a data set on the Series/1
- Schedule programs on a Series/1 for execution, including utilities, storage dumps, and other diagnostic aids useful in a remote management environment
- Shut itself down.

The IBM Series/1 Realtime Programming System SNA Remote Management Utility uses a synchronous data link control (SDLC) protocol in its connection to the controlling host system. A Virtual Telecommunications Access Method (VTAM) application program is also included in this program to provide the controlling code on a System/370.

This utility program resides in a Series/1 and is controlled by instructions from another system; the instructions are transmitted across communications lines. All functions are initiated by an application program in the controlling system.

Prerequisite programming

Realtime Programming System (5719-PC7).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer
- SDLC attachment card.

Programmable Communications
Subsystem Execution Support
(5719-CS2)

The Programmable Communications Subsystem Execution Support runs under control of the Series/1 Realtime Programming System and provides the user with an interface to the 4987 Programmable Communications Subsystem. The execution support consists of:

- Execution support macros

- A loader utility to load the controller storage image program into controller storage.

The macros provide the user with the execution interface to the 4987 Programmable Communications Subsystem through the Realtime Programming System Execute I/O and Read/Write support in Series/1 Assembler Language.

The loader utility provides a facility to load a user controller storage image program from disk or diskette to controller storage. The user can initiate the load from the system console or an application program.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Realtime Programming System (5719-PC7).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer
- 4987 Programmable Communications Subsystem and attachments.

Programmable Communications Subsystem Preparation Facility (5719-CSO)

The IBM Series/1 4987 Programmable Communications Subsystem Preparation Facility is used to support the generation of controller storage image programs for the IBM 4987 Programmable Communications Subsystem. The program provides a macro library for use with the Series/1 4987 Program Preparation Subsystem. The library can also be used for assemblies with the Series/1 Base Program Preparation Facilities.

The macro library provides Series/1 users with the capability of defining and customizing the total protocol for their subsystem. It provides communications instructions for implementing user communications applications with two basic macro types:

- Communications macro instructions

- Communications definition macros.

The communications macro instructions are the vehicle used to code the customized communications programs (called function strings) for each line of the subsystem. They are a highly specialized instruction set designed for the coding of function strings in the 4987 Programmable Communications Subsystem.

The communications definition macros are the vehicle used to define the tables and parameters used by the function strings. They are used to define the control characters for each line or line type, the function strings to be used for each line or line type, and all the pointers necessary to set up the controller storage.

The assembled output from these two macro types is linked together into a load module by the standard facilities of the Base program Preparation Facilities or Program Preparation Subsystem and placed onto a disk or diskette. This load module is referred to as the controller storage image program.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- Realtime Programming System (5719-PC7)
- Program Preparation Subsystem (5719-AS7).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

X.25/HDLC Communications Support Program (5719-HD1)

For Series/1 users who require an X.25 interface, the IBM Series/1 Realtime Programming System X.25/HDLC Communications Support Program is available. This program provides a set of functional modules that allow the Series/1 to appear as a data terminal equipment (DTE) or data circuit-terminating equipment (DCE).

When used as a DTE, the Series/1 can be connected to an X.25 based packet switched network. As a DCE, the Series/1 will communicate with packet-mode DTEs whose protocol conforms with the Recommendation X.25.

This program will manage the X.25 protocols on behalf of the Series/1 users and support many functions designated as essential services by the CCITT Recommendation X.25. It performs the following functions:

- Assembly/disassembly of packets

- Connection/disconnection of virtual circuits

- Flow control and data packets management.

The X.25/HDLC Communications Support will also enable the Series/1 to communicate with other intelligent terminals or processors where high-level data link control (HDLC) is used as the link access protocol. Supported operational modes are:

- Asynchronous Balanced Mode (ABM)

- Normal Response Mode (NRM).

The Communications Manager for the Series/1 provides a message path interface to the X.25/HDLC Communications Support program.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Realtime Programming System (5719-PC7).

Minimum hardware requirements

- Series/1 processor with 224KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

5011

Attachment feature	X.25 interface[2]	ABM Duplex	NRM (primary/secondary)		Physical interface	Maximum speed (bps)
			Half duplex	Duplex		
2080 with EC 326761	Supported	Supported	Supported	Supported	X.21 V.35	48,000 56,000
2090	Supported[3]	Supported[3]	Supported	Supported[3]	V.24	19,200

[2] Requires selection of appropriate physical interfaces for each network application
[3] Two required (2090 must be equipped with EC 336758)

Manufacturing Automation Protocol Communications Server (5719-XT2)

Manufacturing Automation Protocol (MAP) is a set of standards based upon the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) Reference Model. These standards enable communication and cooperation among computers and other intelligent devices in a multiple-vendor local area network in manufacturing environments.

The IBM Series/1 Realtime Programming System MAP Communications Server, along with other IBM Series/1 Realtime Programming System programs, allows Series/1s to communicate with other systems in a MAP network.

In addition, a companion program, IBM System/370 MAP Communications Server FTAM (PRPQ 5799-CGB) allows application programs in the host to communicate with MAP processors, numerical controllers, robots, and other industry devices on the plant floor.

Highlights of the licensed program include the following:

- A subset of Manufacturing Automation Protocol at the 2.1 level of function
- Institute of Electrical and Electronics Engineers (IEEE) Standard 802.4 (token bus local area network) and IEEE Standard 802.2 (logical link control) via an external network interface unit
- ISO Internet Connectionless Network Service (CLNS), as an "end system"
- ISO Transport Protocol, Class 4
- ISO Session kernel
- ISO Common Application Service Element (CASE) subset
- A directory server function that can supply directory data to other systems in the network
- MAP Network Management Agent functions
- Reliability, availability, and serviceability aids, such as trace facilities.

Prerequisite programming

- Realtime Programming System (5719-PC7)
- X.25/HDLC Communications Support (5719-HD1)
- Program Preparation Subsystem (5719-AS7) for installation.

Minimum hardware requirements

- Series/1 processor with 1024KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer
- Synchronous Communications Adapter (#2080) with cable (#2060)
- A network interface unit that meets the MAP specification of the Layer 2 Interim Network Interface Specification. An interface converter (V.35/RS449) and an RS449 secondary cable are also required.

Advanced Remote Job Entry
(5719-RJ6)

The IBM Series/1 Realtime Programming
System Advanced Remote Job Entry provides
an improved RJE facility for users of the
Realtime Programming System. Highlights are:

- Full function RJE console on Series/1
- Logging of console activity to a journal file
- Support for unattended operation
- Status reporting.

The Series/1 serves as a Remote Job Entry work
station to a host System/370, 303X, or 4300. The
RJE program in the Series/1 can operate
concurrently with other applications. Host
connection can be either BSC or SNA/SDLC.
The BSC connection provides a standard
point-to-point multileaving technique (MRJE).
The Series/1 can transmit and receive data
concurrently. Host connection is supported to
OS/VS2 (MVS) using either JES2 or JES3, and
to VM/370 RSCS. The Series/1 is viewed by the
host as a System/3 with console support. The
SNA/SDLC connection uses a logical unit type
1 protocol. The Series/1 is viewed by the host
as multiple logical units, allowing intermixing
of input and output data streams on a
communications line. Host connection is
supported to OS/VS2 (MVS) using either JES2
or JES3, and to DOS/VSE/POWER.

This program product is available on either
5.25-inch or 8-inch diskettes.

Prerequisite programming

Realtime Programming System (5719-PC7).

Minimum hardware requirements

- Series/1 processor with 218KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer
- BSC or SDLC attachment card.

System/370 Channel Attach Support (5719-CA1)

This program is used in conjunction with the IBM 4993 Model 1 Series/1-System/370 Terminal Enclosure and the IBM Series/1-System/370 Channel Attachment (feature number 1200). The program allows the Realtime Programming System user to develop application programs written in Series/1 Assembler that will communicate with an application program in a System/370 over a selector or block multiplexer channel.

Communication with the following processors is supported:

- IBM System/370 (Models 135 through 168)

- IBM 3031, 3032, 3033, 3081

- IBM 4331, 4341.

The Series/1 Channel Attach program has been validated with the following System/370 control programs: DOS/VS, OS/VS1, OS/VS2 (SVS or MVS) and BTAM, or DOS/VSE with BTAM-ES

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Realtime Programming System (5719-PC7).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer
- System/370 channel attachment hardware.

This program facilitates the development and execution of commercial applications on the Series/1 and is available to the Realtime Programming System user.

Sort/Merge (5719-SM1)

The IBM Series/1 Realtime Programming System Sort/Merge licensed program handles the sorting and merging of records from up to eight input data sets into one output data set in either ascending or descending order. The user specifies one or more control fields in the record to be sorted. The licensed program:

- Accepts fixed-length or variable-length records in unblocked or blocked formats

- Can be initiated either as a batch job, or from a user routine written in Series/1 Assembler language, COBOL, or PL/I

- Permits user-written exit routines to handle I/O errors and process records during Sort/Merge execution

- Permits deviation from the standard EBCDIC or ASCII collating sequence at program execution

- Allows multiple sorts to be invoked from the same application

- Routes messages to the operator work station or printer.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

Realtime Programming System (5719-PC7), base operating feature[2]

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

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[2]   This product is integrated into the uniprocessor feature of Realtime Programming System (5719-PC7).

Series/1 Office Connect (5719-XT3)

The Series/1 Office Connect program provides for the exchange of documents among office systems and intelligent work stations. To exchange documents, Personal Services/PC is a prerequisite for the IBM Personal Computer, and Displaywriter Electronic Document Distribution is a prerequisite for the Displaywriter. Series/1 Office Connect also provides mailbox functions for intelligent work station users.

There is no text creation or editing function provided for attached Series/1 fixed function terminals. All document creation and editing is performed on the connected intelligent work stations.

The library facilities provided by Series/1 Office Connect allow a Personal Services/PC 1.2 user to file, search for, retrieve, print, or delete documents stored in the Series/1 library. Fixed function terminal users can also access, view, and print documents stored in this library.

Series/1 Office Connect supports IBM Systems Network Architecture Distribution Services (SNADS) and IBM Document Interchange Architecture (DIA). This allows interchange of documents among products such as:

- IBM Distributed Office Support System/370 (DISOSS/370)

- IBM Personal Services/36

- IBM System/38 Office

- IBM Personal Computer

- IBM 5520 Administrative System

- IBM Displaywriter

- Other IBM Series/1s

- Non-IBM office product work stations, and systems — (custom design transforms are required).

Series/1 Office Connect also allows the exchange of Personal Computer Disk Operating System (DOS) files among IBM Personal Computer users attached to these systems.

The IBM 5219 letter quality printer is supported as a Series/1 print server for all work stations, regardless of their point of connection. The IBM 5219 Printer supports document content architecture revisable or final form documents. An IBM Personal Computer (running Personal Services/PC) attached to one Series/1 may print a letter quality document on an IBM 5219 printer attached to another Series/1.

This program product is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- Realtime Programming System (5719-PC7)
- Series/1 to PC Connect (5719-CN1)
- Transaction Processing System (5719-TR6)
- Program Preparation Subsystem (5719-AS7).

Minimum hardware requirements

- Series/1 processor (4956 Model E or H) with 1MB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Series/1 Data Entry System (S1DES) (5796-ZDE)

The IBM Series/1 Data Entry System (S1DES) developed by Software Consulting Service, Inc., is a heads-down, high-volume key-to-disk data entry system providing enhanced productivity for both the implementer and the end user.

The ease-of-use characteristics are accomplished by a completely menu-driven implementation eliminating the need to write programs to get jobs on-line and operational.

The menu facility also provides for screen formats and their associated editing definitions.

Operator productivity is gained by the extensive use of key assignments to accomplish data entry functions. In addition, notification is made at the time an error occurs, allowing immediate correction and increased throughput.

Use of standard Series/1 operating system functions (Realtime Programming System/Event Driven Executive) allows for enhanced data integrity and error recovery, as well as transportability of data entry files or definitions between the RPS and EDX operating systems. In addition, files created by S1DES can be directly used by other Series/1 applications.

To extend the data entry environment, an "exit" capability has been provided to allow for the unique requirements of individual customer environments.

System highlights

The IBM Series/1 Data Entry System (S1DES) puts productivity and flexibility in a key-to-disk, heads-down data entry environment by providing these characteristics:

- Menu-driven implementation

  There is little or no need for the user to write programs for jobs, screen definitions, formatting or editing.

- Operator interfaces to enhance throughput
  - The system provides extensive use of key assignments.
  - It includes a Help facility.
  - It notifies the operator at the time an error occurs to eliminate the need for re-keying.
- System compatibility
  - Both Realtime Programming System and Event Driven Executive support the system.
  - Jobs can be transported between operating systems.
  - Files can be used by other Series/1 applications.
  - It permits error recovery through use of standard operating system functions.
  - Operators can use terminals for other functions once they finish data entry.
  - Terminals can be attached locally or remotely.
- Extension of the data entry environment through use of exit facility
  - The system provides the capability to implement additional functions on the Series/1.
  - It allows implementation of exits via COBOL, Assembler, or EDL.
- Ability to implement communications
  - The system allows the user to implement communications with Host systems (4300, 30XX) for update and verification.

Prerequisite programming

- Realtime Programming System (5719-PC7)
- Program Preparation Subsystem (5719-AS7) is required on a development system.

Minimum hardware requirements

- Series/1 processor with 256KB of storage and a system timer
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Series/1-PC Connect (5719-CN1)

The Series/1-PC Connect is a Series/1 licensed program that runs on an IBM Personal Computer, IBM Personal Computer XT, or IBM Personal Computer AT. It supports the Series/1-to-Personal Computer Channel Attachment (feature number 4000), a high-speed connection between a Series/1 and an IBM Personal Computer. Series/1-PC Connect complements the IBM PC Network Program, giving IBM Personal Computers on the IBM PC Network and the IBM Token-Ring Network access to Series/1 disks and printers. It also provides access to System/370 applications from the IBM PC Network and the IBM Token-Ring Network.

Highlights are:

- IBM PC Network Program server function extensions

- IBM Personal Computer disk emulation services

- IBM Personal Computer print services

- Local area network independent services

- Interprogram communications

- IBM PC Network SNA 3270 Emulation Program support through Series/1 communications

- Remote management services

The Series/1-PC Connect licensed program is designed to allow IBM PC Network users to communicate with other users and programs outside their own local area network.

Separate IBM PC Networks may be attached either to the same Series/1 or to separate interconnected Series/1s. The Series/1 interconnection is accomplished with the Realtime Programming System communications manager. The communications manager supports several communications protocols, such as bisynchronous, X.25, and the Series/1 Local Communications Controller. The Local Communications Controller can operate on the IBM Cabling System.

Series/1-PC Connect provides the connection between a Series/1 and an IBM Personal Computer attached to a local area network to allow multiple IBM Personal Computer local area networks access to Series/1 communications, disks, and printers.

Series/1-PC Connect complements Personal Computer local area network programs by becoming a communications gateway to the host. The host is any remote Series/1 or System/370 processor that communicates with the Series/1 Communications Manager.

The Series/1-PC Connect Program uses the IBM Personal Computer Disk Operating System (DOS) and the Network Basic Input Output System (NETBIOS) communications interface.

Prerequisite programming

- Personal Computer Disk Operating System Version 3.1 (P/N 6024211)
- Realtime Programming System (5719-PC7), *or*
- Event Driven Executive Communications Facility (5719-CF2).

Minimum hardware requirements

- IBM Personal Computer, IBM Personal Computer XT, or IBM Personal Computer AT with a keyboard, display, and a diskette drive
- IBM Series/1-to-Personal Computer Channel Attachment (#4000)
- Intersystem channel cable (#4001)
- IBM PC Network attachment cards are required in all LAN attached Personal Computers.

Series/1 provides a choice of multiple high-level languages for use with the two operating systems. Both the Event Driven Executive and the Realtime Programming System support COBOL, PL/I, Pascal and FORTRAN language options. COBOL and BASIC compilers developed using Control Program Support modules are also available as stand-alone systems. The compilers and other programs supporting these programming languages are described in this section.
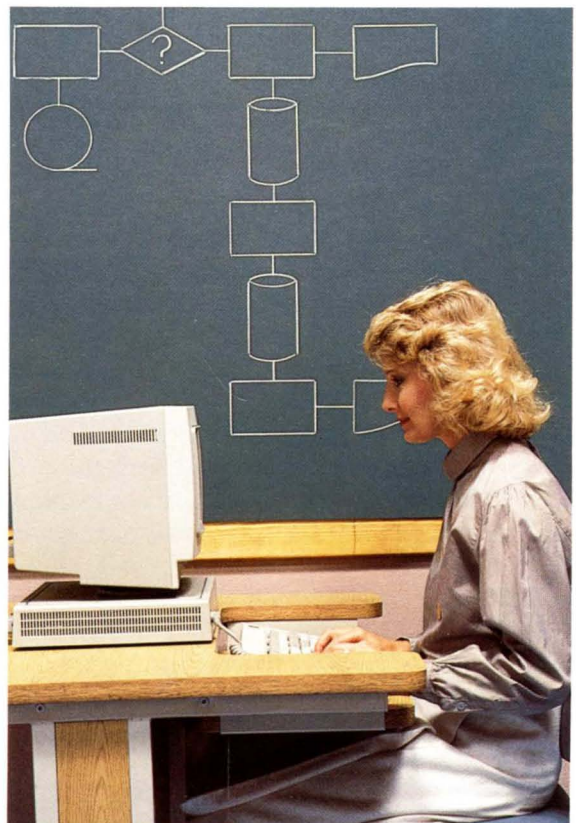
COBOL for Event Driven Executive and Realtime Programming System

These COBOL products provide a high-level programming language oriented toward commercial applications:

- **Event Driven Executive COBOL Compiler and Resident Library Version 2 (5719-CB5)**
- **Event Driven Executive COBOL Transient Library Version 2 (5719-CB6)**
- **Realtime Programming System COBOL Compiler and Resident Library Version 2 (5719-CB7)**
- **Realtime Programming System COBOL Transient Library Version 2 (5719-CB8).**

COBOL compilers are available to users of either the Event Driven Executive or Realtime Programming System operating system. Because COBOL for the Series/1 has a high degree of compatibility with COBOL on other IBM systems, the programmer may, within reasonable guidelines, transfer source programs between the Series/1 and other IBM systems, such as the System/370 and the System/34.

The COBOL compilers generate executable object codes and call library subroutines that interact with the operating system. Provided with the COBOL compiler on each Series/1 operating system is a resident library. The COBOL resident library consists of commonly-used subroutines that are combined with a user program through the application builder or linkage editor to form an object program for subsequent execution on Series/1.

The COBOL transient library (separate licensed program) is used in conjunction with the execution of COBOL user programs. Routines in the transient library are loaded only when needed, thus allowing a more efficient utilization of main storage. These routines are reentrant and can also be executed from a shared area in a user partition, or from a shared task set during object program execution.

Program development and productivity aids include: symbolic debug, flow trace, extensive error checking, and error messages at five severity levels.

COBOL for the Series/1 is designed according to the specifications for American National Standard COBOL, X3.23-1974, as understood and interpreted by IBM as of January, 1981, with the exception of the Rerun clause (which is checked for syntactic validity, only). It exceeds the low intermediate level COBOL as defined in FIPS (Federal Information Processing Standard) Pub 21-1. Some of the features above the low intermediate level include support of sort/merge, indexed I/O (packed decimal data), and various extensions of the nucleus features.

These program products are available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- For Event Driven Executive COBOL Compiler and Resident Library (5719-CB5) and Event Driven Executive COBOL Transient Library (5719-CB6), Basic Supervisor and Emulator (5719-XS5) is required.
- For Realtime Programming System COBOL Compiler and Resident Library (5719-CB7) Realtime Programming System Version 5 (5719-PC5) and Program Preparation Subsystem Version 5 (5719-AS5) are required.
- For Realtime Programming System COBOL Transient Library (5719-CB8) Realtime Programming System (5719-PC7) is required.

Minimum hardware requirements

- For execution of Event Driven Executive COBOL Compiler and Resident Library (5719-CB5) and COBOL Transient Library (5719-CB6), the minimum hardware requirements are the same as the development system requirements for the Basic Supervisor and Emulator.
- For Realtime Programming System COBOL Compiler and Resident Library (5719-CB7) and COBOL Transient Library (5719-CB8), the minimum hardware requirements are the same as the requirements for the Realtime Programming System.

Host COBOL for the Series/1

Series/1 users who have access to a System/370 may compile their COBOL programs on special compilers that execute on the System/370 under control of OS/VS2 (MVS). Two Host COBOL compilers are available:

- **IBM Host COBOL for the Series/1 Event Driven Executive Operating System (5799-TEL)**
- **IBM Host COBOL for the Series/1 Realtime Programming System (5799-TEP).**

The level of COBOL supported by both host compilers is equivalent to that available in COBOL Version 2 for the Event Driven Executive and Realtime Programming System. No source modification is required to transfer from host to native compilation.

Host compilation allows the programmer to be more productive by using the larger system for program development. Highlights include:

- Series/1 object modules produced on System/370

- Interactive compilation capability with access to Structured Programming Facility (SPF) and Time-Sharing Option (TSO) editing

- User options (including source and object listings, cross reference, storage map, statement offset listing, and MAP370 listing).

Prerequisite programming

- For Host COBOL for the Series/1 Event Driven Executive Operating System (5799-TEL), Basic Supervisor and Emulator (5719-XS5) is required.
- For Host COBOL for the Series/1 Realtime Programming System (5799-TEP) Realtime Programming System (5719-PC7) is required.

Minimum hardware requirements

In addition to the Series/1 system requirements for COBOL compilation and execution, the System/370 requires the following:

- System/370 Processing Unit
- System/370 OS/VS2 MVS (Multiple Virtual Storage)
- Communications features for the transfer of object code to a Series/1.

Series/1 PL/I

The following programs are available for Series/1 PL/I:

- **Event Driven Executive PL/I Compiler and Resident Library (5719-PL5)**

- **Event Driven Executive PL/I Transient Library (5719-PL6)**

- **Realtime Programming System PL/I Compiler and Resident Library Version 2 (5719-PL2)**

- **Realtime Programming System PL/I Transient Library Version 2 (5719-PL4).**

Series/1 PL/I is a problem-oriented, high-level language that can be used for programming realtime, scientific, problem-solving, and traditional data processing applications as well as advanced applications, such as transaction processing and data base handling. PL/I is aimed at speeding up application development time by making available a wide range of facilities, including error detection and debugging aids. PL/I is available to users of the Realtime Programming System and the Event Driven Executive as separate products for each operating system.

Series/1 PL/I is a subset of American National Standard PL/I (ANSI 3.53 1976), plus additional language functions to support multitasking applications. Functions vary according to the licensed program version selected for the Series/1. However, both operating systems allow:

- Optimized object code

- List-directed and edit-directed stream I/O

- Indexed Access Method support

- Sort/Merge

- Full screen 4978 and 4979 terminal support

- Communications support.

Series/1 PL/I represents a significant advantage for the Series/1 high-level language user. Entire applications can be written in a high-level language that provides interactive terminal-handling facilities and communications through binary synchronous or start/stop disciplines to other processors and terminals, all using highly-optimized Series/1 code.

Language support is provided through a two-program structure: A compiler, together with a resident library and a transient library.

- The PL/I compiler translates source statements into Series/1 object code.

- The resident library contains frequently used routines that are included in a user program by the application builder or linkage editor.

- The transient library contains less frequently used routines, such as I/O transmission, error handling, and data conversion. These functions are dynamically loaded at execution time, thus permitting storage savings with minimal impact on performance.

This method of dividing the PL/I functions affords the multiple-location Series/1 user with significant economies. The compiler and resident library licensed program can be used at a central source for program development and maintenance, and the object modules, combined with the transient library licensed program, would be used at the outlying locations.

These program products are available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- For Event Driven Executive PL/I Compiler and Resident Library (5719-PL5) Basic Supervisor and Emulator (5719-XS5) is required.
- For Event Driven Executive PL/I Transient Library (5719-PL6) Basic Supervisor and Emulator (5719-XS5) is required.
- For Realtime Programming System PL/I Compiler and Resident Library (5719-PL2) Realtime Programming System (5719-PC7) and Program Preparation Subsystem (5719-AS7) are required.
- For Realtime Programming System PL/I Transient Library (5719-PL4) Realtime Programming System (5719-PC7) is required.

Minimum hardware requirements

- For Event Driven Executive PL/I Compiler and Resident Library (5719-PL5), the minimum hardware requirements are the same as the development system requirements for the Basic Supervisor and Emulator, with an additional 32KB of storage.
- For Event Driven Executive PL/I Transient Library (5719-PL6) the minimum hardware requirements are the same as the operational system requirements for the Basic Supervisor and Emulator.
- For Realtime Programming System PL/I Compiler and Resident Library (5719-PL2) and PL/I Transient Library (5719-PL4), the minimum hardware requirements are the same as the requirements for the Realtime Programming System.

FORTRAN IV Compiler and Object Support Library (5719-FO2)

The Event Driven Executive and Realtime Programming System operating systems both support the FORTRAN IV language. This compiler and object support library program is available for either of the operating systems.

Series/1 FORTRAN IV is a high-level, mathematically-oriented language designed to increase application programming productivity. One of the first high-level languages, it has continued to receive wide acceptance because of its easy-to-learn format and computing rules.

Series/1 FORTRAN requires a complementary set of subroutines called Mathematical and Functional Subroutine Library. In addition, an optional Realtime Subroutine Library, which is supported by the Realtime Programming System only, is available in two versions.

Series/1 FORTRAN IV is a subset of American National Standard FORTRAN, X3.9-1966, and includes the American National Standard Basic FORTRAN, X3.10-1966, with the exception of object time formats, adjustable dimensions, complex data type, G-format specifications, and two-level format parenthesis. Series/1 FORTRAN IV also has many language elements not provided by ANS Basic FORTRAN. These extensions adapt FORTRAN to the Series/1 environments and provide greater programming flexibility.

- Multiple program support
- Logical and relational operations
- Bit-level operations
- Direct access I/O
- Additional Read/Write parameters
- Device-independent I/O
- List-directed I/O
- Single and double precision
- Six-character names
- Expanded character set.

The FORTRAN compiler produces object code, maps, and listings. The code emphasizes compact storage and execution speed. The object support library is a group of subroutines designed to be combined, when needed, with the object modules produced by the compiler to form an object program, executable on the Series/1 under control of the Realtime Programming System or Event Driven Executive supervisor. The library subroutines perform input/output processing, error handling, explicit and implicit service operations and bit manipulation.

FORTRAN-provided diagnostic aids or services assist in program creation and debugging. FORTRAN IV also assists in detecting program data errors and offers several levels of error handling for I/O device errors.

Prerequisite programming

- For Event Driven Executive, Basic Supervisor and Emulator (5719-XS5) is required.
- For Realtime Programming System, Realtime Programming System (5719-PC7) and Program Preparation Subsystem (5719-AS7) are required.

Minimum hardware requirements

- For use with Event Driven Executive, the minimum hardware requirements are the same as the operational requirements for the Basic Supervisor and Emulator.
- For use with Realtime Programming System, the minimum hardware requirements are the same as the requirements for Realtime Programming System.

Mathematical and Functional Subroutine Library

The following programs are available:

- **Event Driven Executive Mathematical and Functional Subroutine Library (5719-LM3)**
- **Mathematical and Functional Subroutine Library Version 2 (5719-LM2).**

This set of subroutines is utilized primarily by FORTRAN IV application programs on the Series/1. The library contains subroutines commonly used for mathematical and data conversion functions. Included in the library are:

- Mathematical functions, including sine, cosine, logarithms and exponentiation functions, maximum and minimum functions, modular arithmetic, and others.
- A commercial subroutine package, containing a library of subroutines that will meet most requirements for decimal data handling. These subroutines, similar to those offered on other IBM systems, provide comprehensive facilities for editing, decimal arithmetic and data compaction, and conversion subroutines for data manipulation.
- Subroutine library services, which allow Assembler language users to initialize and release a library work area and to specify an abnormal termination processing routine that returns control to the user on program interrupts or abnormal execution of system macro instructions.
- Error-checking routines to detect error conditions during processing of mathematical and conversion routines, including checking of illegal arguments and invalid conversion data inputs, testing floating-point divide exceptions, and testing floating-point overflow and underflow conditions.

Program product 5719-LM3 is available on either 5.25-inch or 8-inch diskettes.

Prerequisite programming

- For Event Driven Executive Mathematical and Functional Subroutine Library (5719-LM3), Basic Supervisor and Emulator (5719-XS5) is required.
- For Mathematical and Functional Subroutine Library (5719-LM2) Realtime Programming System (5719-PC7) is required.

Minimum hardware requirements

- For Event Driven Executive Mathematical and Functional Subroutine Library (5719-LM3) the minimum hardware requirements are the same as the operational system requirements for the Basic Supervisor and Emulator.
- For Mathematical and Functional Subroutine (5719-LM2) the minimum hardware requirements are the same as the requirements for the Realtime Programming System.

FORTRAN IV Realtime Subroutine Library (5719-FO4)

The IBM Series/1 FORTRAN IV Realtime Subroutine Library (Version 2) provides users of the Realtime Programming System who are writing application programs in FORTRAN IV or Series/1 Assembler with additional function suitable to a realtime execution environment. Included are:

- Executive function subroutines that provide the ability to start, stop, or delay the execution of programs

- Process I/O subroutines that access analog and digital points for both input and output

- System service interface subroutines that make system services available to the problem programmer. Examples are attaching/detaching tasks, defining/deleting queues, enqueuing/dequeuing, defining/deleting events and resources, and so on

- Time subroutine that determines the current time of day

- Data subroutine that determines the current calendar date.

Prerequisite programming

- Realtime Programming System (5719-PC7)
- Program Preparation Subsystem(5719-AS7).

Minimum hardware requirements

- Series/1 processor with 192KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer.

Series/1 Pascal

IBM Series/1 Pascal is a compatible subset of System/370 Pascal/ VS(5796-PNQ). Two programs are available for the Series/1:

- **Pascal Compiler and Object Library PRPQ for the Event Driven Executive (5799-TER)**
- **Pascal Compiler and Object Library PRPQ for the Realtime Programming System (5799-TEQ).**

Pascal is high-level programming language capable of supporting a wide variety of applications. Series/1 Pascal I/O support includes sequential and random files, display to user terminals, formatting facilities, and many input/output extensions to Standard Pascal. The Series/1 programs are compatible with the proposed International Standards Organization (ISO) standard as of June 1981, with several extensions.

Each Series/1 PRPQ provides a compiler and object library in a single program. For program development the Pascal compilers interfere with the Event Driven Executive session manager and the Realtime Programming System Command Language Facility. Series/1 Pascal includes execution time debugging aids, messages, and tracing. Object code is reentrant. Pascal programs can interface with user programs written in Assembler or Event Driven Language.

Prerequisite programming

- For Pascal Compiler and Object Library PRPQ for the Event Driven Executive (5799-TER), Basic Supervisor and Emulator (5719-XS5) and Program Preparation Facility (5719-XX6) are required.
- For Pascal Compiler and Object Library PRPQ for the Realtime Programming System (5799-TEQ), Realtime Programming System (5719-PC7) and Program Preparation Subsystem (for compile and application build only) (5719-AS7) are required.

Minimum hardware requirements

- Series/1 processor with 256KB of storage
- Series/1 disk unit
- Series/1 diskette unit
- Series/1 display
- Series/1 printer
- Floating-point (for compilation of real numbers).

Additional system support

Store Application Environment, Version 1, Releases 1, 2, and 3 (5719-YT7)

The Store Application Environment Release 1 is an easy-to-install package consisting of a set of Event Driven Executive (EDX) licensed programs for the retail store industry. Release 2 adds a high-level interface to simplify the creation of primary SNA application programs for communicating with IBM 4680s and other retail-oriented devices. Release 3 adds an ease-of-use system interface that shields the customer from the complexities of EDX and simplifies system customization. Parts of this package can be ordered as an option.

Highlights include:

- Release 1
  - An easy-to-install systems software, industry-oriented solution
  - Supports current Series/1 application packages for the distribution and store systems industry
  - Allows application customization.
- Release 2
  - Provides all the functions and characteristics of Release 1, *plus*
  - Primary SNA support for the IBM 4680 and other retail-oriented devices
  - High-level application program interface for primary SNA applications.
- Release 3
  - Provides all the functions and characteristics of Releases 1 and 2, *plus*
  - Allows easy customization of system configurations
  - Eases alteration of system configurations
  - Eases definition of all system configurations at a central location.

Release 1 provides:

- An event-driven operating system
- An SDLC connection to a host as a secondary SNA processor
- Indexed file access
- Sort/merge capability

- Cobol execution support
- A transaction manager with workstation support for:
  - 316X local and dial-up display stations
  - 3101 or equivalent local and dial-up terminals
- Both SDLC and BSC communications with host System/370 systems for 3270 pass-through and emulation support
- Network management and maintenance
- Support for existing Series/1 application packages, such as Store Item Management (5798-RTE) and Store Item Receiving (5719-DSD).

Release 2 supports:

- IBM 4680 Store System Controller
- IBM 3651 Store Controller
- IBM 3684 Point-of-Sale Control Unit.

Release 3 adds the following functions:

- A high-level, transaction-oriented user interface with extensive integrated help
- Easy system definition, initialization, and reconfiguration
- Clear, concise messages that appear as help screens and that provide specific instructions in case of an error
- An easy method for installing Program Temporary Fixes (PTFs)
- Access to the Transaction Processing System (TPS)
- Distributed processing on TPS terminals.

Prerequisite programming

None required.

Minimum hardware requirements

- Series/1 processor (4956 Model H10) with 1 megabyte of storage
- Two 5.25-inch 40-megabyte disk units
- Series/1 5.25-inch 1.2-megabyte diskette unit
- IBM 4202 Proprinter XL
- Two IBM 3161 displays
- Multifunction attachment (feature 1310)
- Feature Programmable Multiline Control and Adapter (Features 2095 and 2096).

Series/1 Interactive Executive (5719-UN1)

The IBM Series/1 Interactive Executive is a multi-user, timesharing, operating system for the IBM Series/1 and is based on UNIX[3] System V as licensed by AT&T Technologies, Inc.

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, in a simple way, a number of program modules.

The IBM Series/1 Interactive Executive supports a wide range of environments and applications area. This includes time-sharing, batch processing, as well as program development.

Tools are provided to facilitate document preparation and the C-language compiler allows for migration of UNIX-based applications to the IBM Series/1.

Highlights are:

- Reentrant code

- Hierarchical file system

- File and record locking

- File protection system

- Swapping

- Flexible command language

- Modular utilities

- Background and foreground processes.

Major subsystems include:

- Programming tools

- Document preparation tools

- File control

- Source code control

- Electronic mail

- System resource accounting.

Prerequisite programming

None required.

Minimum hardware requirements

- Series/1 processor with 512KB of storage and floating-point feature
- Series/1 diskette unit
- Series/1 disk unit
- Series/1 printer
- Series/1 display.

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[3]   Trademark of AT&T Bell Laboratories

Series/1 Input/Output Executive (5719-EM1)

The Series/1 Input/Output Executive runs on the Series/1 System Unit processors to provide support of the 5170 I/O devices to the Series/1 operating systems (Realtime Programming System or Event Driven Executive). These systems operate on the Series/1 processor which is integrated into the 5170.

Series/1 Input/Output Executive supports:

- 5.25-inch, 20- or 30-megabyte fixed disks.

- 5.25-inch, high capacity diskette drives.

- IBM Personal Computer Monochrome Display.

- IBM Personal Computer Color Display.

- IBM Personal Computer Keyboard.

- 4201 matrix printer.

- Asynchronous, binary synchronous, and SDLC interfaces.

- Terminal/Host Attachment Card with four RS-422-A ports; ports 0 – 3 can be used for asynchronous communications providing features of four single line ACCA controllers. Support is provided for 3101 terminals (model 13, character mode, and model 23, character/block mode) and 316X display stations.

Additional support provides most functions of the Series/1 programmer's console on the IBM Personal Computer display and keyboard as well as utilities to install and customize the product. An IBM Personal Computer display and keyboard are prerequisites for the installation and operation of the Series/1 Input/Output Executive.

Prerequisite programming

- Event Driven Executive for the Series/1 System Unit (5719-XJ5), *or*
- Realtime Programming System for the Series/1 System Unit (5719-PJ7).

Minimum hardware requirements

- System Unit with:
  - 256KB of storage
  - 20MB disk
  - 1.2MB, 5.25-inch diskette
  - Terminal/host attachment card
- Personal Computer monochrome or color display and adapter
- 4201 Proprinter and adapter.

Series/1 Intelligent Work Station Version 2 (5799-TNG)

The Series/1 Intelligent Work Station Version 2 provides for the connection of IBM's family of Personal Computers to the IBM Series/1. It supports asynchronous communications between the Personal Computer and the Series/1 in direct-attach and switched-line configurations at speeds of up to 9,600 baud.

Highlights include:

- 3101 Terminal emulation—Allows the Personal Computer to emulate and IBM 3101 Display Terminal in character or block mode.

- Mode switching—Operates in either DOS mode or in terminal emulation mode. It uses a hot key to toggle the computer from one mode to the other. An active DOS program is suspended when the Personal Computer is in terminal emulation mode.

- File transfer—A series/1 application program can initiate the transfer of files between the Series/1 and a Personal Computer. One may switch to DOS mode and use programs from the IBM Assistant Series, the IBM Accounting Assistant Series, the IBM Business Management Series, or the IBM Personal Decision Series

while a file is concurrently being transferred to or from the Series/1. Subroutines for transport data transfer and block checking are provided as part of this program for inclusion in the Series/1 application.

- Direct print—A Series/1 application program may cause printable data to be routed directly to a Personal Computer printer without going through an intermediate file transfer and without operator intervention.

- Outboard formatting—Allows constant data for Series/1 interactive full-screen transactions to be stored on the Personal Computer diskette or disk. This data does not need to be transmitted from the Series/1 each time it is needed.

- Keyboard redefinition—Many of the Personal Computer keys may be redefined to make the keyboard more suitable for an application. This feature allows a single keystroke to generate a string of characters for frequently used commands. Keyboard redefinition is not in effect when switched to DOS mode.

- Color display support—Has four colors in 80 character mode only. The colors are invoked based on the field attributes assigned by the controlling application program.

Series/1 program distribution, licensing, and support

For the IBM Series/1, there are four categories of programming support:

- Licensed program (LP)

- Field-developed program (FDP)

- Installed user program (IUP)

- Programming RPQ (PRPQ).

Licensed Programs

Licensed programs perform an end-use function for the user. Highly specialized task-oriented programs may also be provided as licensed programs.

Licensed programs are distributed through IBM Software Distribution to customers under the terms of the Agreement for IBM Licensed Programs. The majority of Series/1 programs are offered with an option of a continuous monthly charge or a one-time charge with future payments waived. Under either payment option, the licensed program remains the property of IBM and is subject to the provisions of the Agreement for IBM Licensed Programs. For most Series/1 software offerings, there is a one-time process charge to cover the cost of distribution of basic machine-readable material, including service updates. Customers who have multiple licenses for a program and redistribute within their own enterprise may elect to pay only one process charge.

Depending on the product, Central Services may be included as part of the license fee. These services include the correction of design defects and the distribution of these corrections to users of record. The duration of Central Services varies by program. APARS for products supported by the IBM Support Center are submitted electronically by IBM level 2 personnel. APARS for other products are submitted by mail to the address specified in the product's program directory.

Field-Developed Programs/Installed User Programs

Field-developed programs are licensed programs normally developed by IBM branch office personnel to perform end-use, productivity, or transitional functions for the user. Installed user programs are licensed programs that have been produced by or for an IBM system user and used successfully to perform a variety of user functions. FDPs and IUPs are normally offered with a monthly charge for a fixed number of months with future payments waived at the end of this fixed number of months.

FDPs and IUPs may be announced with or without Central Services.

Programming RPQs

To meet individual customer requirements, IBM offers the following customized programming services:

By means of programming RPQs (Request for Price Quotation), customers may request alterations or additions to available IBM programming. These programming RPQs (PRPQs) will be provided for a charge and may be used in conjunction with Series/1 RPQs to optimize solutions to unique data processing problems.

Correction of design and documentation errors in Series/1 programming RPQs is the responsibility of IBM. This service is available for each programming RPQ for a specified and limited time, at no additional charge. Programming RPQ users may submit APARs to request program error correction. Programming corrections will be distributed to all users of record.

6 Series/1 support services

Chapter 6. Series/1 support services

Series/1 support continues to underline IBM's commitment to customer service:

- Customer-servicing techniques based on built-in diagnostic aids

- Round-the-clock and across-the-country service and parts availability

- Extensive training for customer personnel—both formal classes and self-study courses.

As with Series/1 equipment and programming, you select only the particular modules you need for a given installation.

IBM customer engineer support

Maintenance

IBM's serviceability strategies are aimed at minimizing the amount of time and expense incurred to identify and diagnose the failure, repair the defect, verify the correction, and return the system to the customer for use. To support these strategies, IBM customer engineers are provided a number of tools to aid in servicing Series/1.

Integrated maintenance package (IMP)

Maintenance documentation, when included in the Series/1 purchase price, is provided and shipped with each IBM unit.

The integrated maintenance package includes maintenance information manuals, maintenance logic diagrams, theory-diagram manuals, and diagnostic program listings for each unit that provide detailed information for ease of servicing.

Maintenance Analysis Procedure (MAP) charts for the system and I/O attachments are provided to assist the IBM customer engineer in diagnosing machine failures.

IBM has also developed extensive diagnostic programs for use with Series/1. As an example, the system exercises and tests the IBM I/O devices, their associated I/O attachment features, and the processor functions. The mainline tests are used in conjunction with the MAP charts. They identify failures and direct the customer engineer to the probable failing field-replaceable unit (FRU). Auxiliary tests are provided under computer control to assist the customer engineer in performing timings, adjustments, and calibrations.

All these diagnostics are provided to you with your system. They are shipped (on diskette) with the machine and are, therefore, available for use whenever they are needed.

Special diagnostic tools

Four unique maintenance tools have been developed for use by your customer engineer in servicing your Series/1:
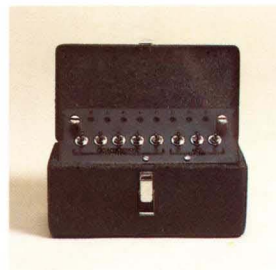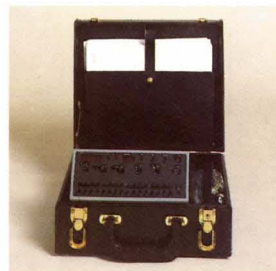
These tools are available for the customer engineer's use and are strategically located in branch offices and remote locations, as appropriate, across the country.

Customer Service Maintenance Console: This panel provides all of the functions of the programmer console, and it is packaged in a portable case that can be easily moved from one system to another. If the customer engineer needs the functions of this console for hardware or program problem diagnosis, but a programmer console is not available on the failing system, the IBM customer engineer will use this console to accomplish the problem diagnosis.

Maintenance Program Load Device: The diagnostic programs that are used to isolate machine failures are distributed to the field on diskette. If there is no diskette unit included in the user's configuration and it is necessary to use the diagnostic programs, the customer engineer service representative can provide a portable Maintenance Program Load Device. The unit is be plugged into any available I/O feature location in the system and can be used to load diagnostic programs from diskette.

Signal Tracing and Recording Device: This device is used by the customer engineer to capture intermittent error conditions and to trace I/O channel operations. This tool can be used to record up to 64 words (128 bytes) of information. The customer engineer can install the box and, if appropriate, leave it unattended to trap the intermittent failure. After the failure has occurred, the recorded information can be read out and used to reconstruct the sequence of events that led up to the failure. Using this information, the customer engineer can more effectively define the failure and then replace the appropriate field-replaceable unit or take other necessary remedial action.

Communications Indicator Panel: This panel provides a visual display of various stages, conditions, and interface lines associated with the communications attachments (for example, data set ready, data terminal ready, request to send, clear to send).

Additional maintenance support

In the event that an IBM customer engineer requires diagnostic support in addition to all of the on-site items, a support structure is available to call upon when needed. Support personnel for each machine type are located in IBM branch offices and/or within the geographic region to provide assistance to the on-site customer engineer.

The customer engineer interfaces with RETAIN (a data base containing known problems) by calling the Boca Raton Service Planning and Support Group for assistance. The customer engineer discusses the failure symptoms with a service planning representative who enters the information into RETAIN. Fixes are verbally communicated to the customer engineer.

The Teleprocessing Support Center provides specialized diagnostic phone assistance and computerized testing of teleprocessing devices (non-SDLC). Plant assistance is provided by the IBM Service Planning and Support Groups, including direct interface to IBM engineering groups as required.

Repair parts are stored in strategically located Field Distribution Centers (FDCs) to support the IBM customer engineers who provide warranty and maintenance agreement (MA) service on Series/1. IBM's Parts Inventory Management System (PIMS) maintains a computerized online inventory of all of the parts-stocking locations to ensure that parts are available.

Maintenance agreement: Series/1 elements undergo extensive testing during and after manufacture to ensure that the equipment you receive will serve you properly. To continue this support, IBM recommends the IBM Maintenance Agreement at the conclusion of your 90-day parts and labor warranty. The IBM MA provides maintenance parts coverage 24 hours a day, seven days a week. You select the labor periods as appropriate for your system. Travel by private auto or scheduled public transportation during hours of MA coverage will not result in any additional charge.

IBM customer engineer support

The minimum monthly maintenance charge (MMMC) provides for labor during any 9 consecutive hours within an 11 — hour window-Monday through Friday. Additional optional periods of labor coverage are available up to 24 hours per day, 7 days per week, for an additional fee.

If you require labor outside the MA coverage period, it is available on a per call, hourly basis. Again, MMMC provides for maintenance parts coverage regardless of the time of day that the part is installed.

Engineering changes: IBM provides engineering changes for Series/1 under the same terms and conditions as is done for other IBM products.

Safety, new production, and quality changes are provided at no charge for parts or labor whether or not a customer has an IBM Maintenance Agreement.

Maintenance reduction changes will also be provided at no additional charge to IBM customers with an MA and will be available to non-MA customers on a charge basis.

On machines with an IBM MA, IBM will order and automatically ship appropriate engineering changes (ECs). The IBM customer engineer will install the changes and update all appropriate documentation and history. There will be no additional charge for this service. On machines without an IBM MA, customers can subscribe to IBM customer engineering memorandums and engineering change announcements, which will notify them of the availability of ECs. Customers can order the ECs as they choose. When the ECs arrive, the customer can notify IBM of their availability and an IBM customer engineer will install the change and update the appropriate documentation. There will be no charge for parts or labor except maintenance reduction ECs.

Other IBM customer engineer support

Physical planning for Series/1 is a customer responsibility. However, IBM customer engineer physical planning assistance can offer significant benefits and should be considered for the first several installations of every Series/1 customer order. This assistance is available for a fee under two offerings:

1. Fixed-price agreement — IBM will provide advice and direction regarding physical planning activities. The customer will receive a *completed* and *personalized* Customer Site Preparation Guide that can be used as a reference for future installations that will normally be done by the customer. The customer will be billed a fixed fee; hence, expenses can be accurately budgeted.
2. Per call — IBM will provide advice, counsel, and clarification of information contained in the *IBM Series/1 Customer Site Preparation Manual*, GA34-0050. The customer will be billed at the hourly rate for the assistance, including travel time and expense.

Teleprocessing systems services

Teleprocessing systems services are available to IBM teleprocessing customers having an IBM processor with an IBM communications adapter and remote IBM terminals serviced under a maintenance agreement.

This work scope includes:

*   Problem determination caused by non-IBM modem/data set failure
*   Standby diagnostic assistance for data communication lines and non-IBM modems/data sets
*   Requests to other vendors by IBM for service on data communication lines and non-IBM modems/data sets
*   Installation coordination for data communication lines and non-IBM modems/data sets.

Special Product Engineering Services

Special Product Engineering Services are offered by IBM to help customers install their IBM Series/1 sensor-based application. The sensor-based subsystem is defined as that portion of the sensor-based system between the customer access area of the sensor-based system and the customer process or equipment, and includes the instrumentation and the interconnections at both ends.

After the customer and the IBM marketing representative have established the application requirements, Special Product Engineering Services will, in conjunction with their offerings, meet with the customer. They will inspect the customer's facilities and review the customer's application plans and functional concepts of the subsystem.

Having established the functional requirements for the subsystem, the customer may then elect to contract with IBM under a fixed-price offering for the type of installation services required. Special Product Engineering Services include:

- Subsystem definition—Definition documentation to meet particular subsystem requirements. Includes description of needed hardware and modifications to the customer's existing equipment as well as installation and checkout instructions.
- Installation guidance service—On-site technical guidance during installation and checkout of the subsystem and, at the customer's option, development of the subsystem installation plan.
- Customized equipment design and procurement—Provide, through subcontractors, special equipment, terminals, and interface panels for use with Series/1.
- Installation management—Define the sensor-based subsystem and, through subcontractors, assume responsibility for the physical installation and checkout of the subsystem.

Sensor-Based System Services

Sensor-Based System Services are offered under a special contract.

Sensor-Based System Services include:

- Instrumentation problem determination—Isolation of the cause of failure to the instrumentation that is attached to this machine to the extent that such isolation can be made at the machine interface.

- Sensor-based diagnostic assistance—Diagnostic assistance or standby on the repair of interconnecting lines and instrumentation that is attached to this machine. Includes running of system tests, interpreting their output and verifying proper signal levels at the machine interface. This service is to be requested of and provided by IBM only when the cause of failure within the interconnecting lines or instrumentation cannot be independently determined.

- Requesting of sensor-based vendor service—Making of arrangements and requests for service directly with vendors, for service of interconnecting lines and instrumentation that is attached to this machine. Customer must previously notify respective vendors that requests for service on the customer's system will be received directly from IBM (not available per call).

- Sensor-based installation coordination—Generation and maintenance of a schedule for installation, system integration, and testing of interconnecting lines and instrumentation that is to be attached to this machine. Includes periodic review of schedule changes with the customer and appropriate notification to affected IBM locations (not available per call).

IBM Support Center

The IBM Support Center (1-800-237-5511) provides defect-oriented support for licensed users, of supported releases of designated IBM licensed programs, experiencing problems. Assistance is provided 24 hours daily, 7 days per week for problem reporting, problem management, status information, problem source identification assistance, identifying known problems, and problem correction assistance. In-depth problem correction support is provided in a call-back mode from 8:30 a.m. to 6 p.m., Eastern time, Monday through Friday (except national holidays). Current and subsequent versions of Event Driven Executive and Realtime Programming System and selected licensed programs supported by Central Service that operate in conjunction with them, are eligible for this service.

The IBM Support Center is designed to meet the customer's responsibility to perform problem determination and problem source identification.

The customer should attempt to identify the source of programming problems by following procedures outlined in the Problem Determination Guide. The National Service Division customer engineer is available for problem determination assistance, and the IBM Support Center provides problem source identification assistance.

When contacting the IBM Support Center, customers need the access code that has been assigned to their installation; this code identifies them as an eligible user of the support center. The access code is normally provided by the customer's IBM marketing representative.

A complete listing of Series/1 software components and their support classifications is included in the IBM *Programming Systems General Information Manual* (PSGIM), G229-2228. An explanation of the IBM Support Center and its functions is included in the IBM *Series/1 Software Service Guide*, GC34-0099.

Series/1 education support includes self-study and classroom courses. Customers may enroll in classroom courses or order self-study courses by calling 1-800-IBM-2468. For additional information on Series/1 education, please call the above toll-free number or consult the *Catalog of IBM Education*, (G320-1244). Course fees are also listed in the IBM *Series/1 Pocket Digest*, GX34-0104.

Realtime Programming System suggested course sequence

Note: It is highly recommended that one person from each Realtime Programming System account attend the Realtime Programmer System system programmer curriculum to provide assistance in designing and generating a Realtime Programming System.

	Operator	Assembler Programmer	COBOL Programmer	PL/1 Programmer	Fortran Programmer	System Programmer
Self-study						
Computer Concepts (A2508)	1	1	1	1	1	1
Programming Design Fundamentals (S2510)	2	2	2	2	2	2
Series/1 Hardware (SS138)		4				8^3
Series/1 Assembler Language Introduction (SS132)		5				8^3
ANS '74 COBOL Language Fundamentals (SS126)			4			
ANS '74 COBOL Programming (SS127)			5			
PL/1 Programming (I0103)				4		
FORTRAN IV Language Fundamentals (SS129)					4	
Communications System Concepts (I0026)						5
3270 Operation and Design (I0031)						7
SNA Fundamentals (32501)						6
S/1 4987 PCS Preparation Facility (MI002)						9^3
S/1 4987 PCS Extended Execution Support (MI004)						10^3
Classroom						
Realtime Programming System Facilities and Operations (S3511)		3	3	3	3	3
ANS '74 COBOL Batch Programming Introduction (D2085)			6			
Series/1 Transaction Processing System Workshop (S3513)		6	7			
Realtime Programming System Generation and Maintenance (S2519)						4
Communications Manager for Series/1 Installation (D2084)						8^1
Series/1 SNA Programming Interface (P2024)						8^2
Series/1 Remote Manager Installation Workshop (S3506)						9^2

[1] Communication Manager topic sequence
[2] SNA and Remote Manager topic sequence
[3] Programmable Communications Subsystem topic sequence

Event Driven Executive suggested course sequence

	Operator	EDX Programmer	Assembler Programmer	COBOL Programmer	PL/1 Programmer	Fortran Programmer	EDX System Programmer
Self-study							
Computer Concepts (A2508)	1	1	1	1	1	1	1[1,2,4]
Programming Design Fundamentals (S2510)	2	2	2	2	2	2	2[1,2,4]
Series/1 Hardware (SS138)			4				3[1,2,4]
Using EDX and EDL on the IBM Series/1 (32919)	3	3	3	3	3	3	5[1,2,4]
Series/1 Assembler Language Introduction (SS132)			5				4[1,2,4]
ANS '74 COBOL Language Fundamentals (SS126)				4			
ANS '74 COBOL Programming (SS127)				5			
PL/1 Programming (I0103)					4		
FORTRAN IV Language Fundamentals (SS129)						4	
Communications System Concepts (I0026)							7[1,2,4]
3270 Operation and Design (I0031)							9[1,2,4]
SNA Fundamentals (32501)							8[1,2,4]
Classroom							
Event Driven Executive EDL Implementation Workshop (S3505)		4					6[1,2,4]
ANS '74 COBOL Batch Programming Workshop (D2085)				6			
Series/1 Transaction Processing System Workshop (S3513)		5[3]		7[3]			
Event Driven Executive Control and Flow Workshop (S3503)							7
Event Driven Executive Communication Facility (S2550)							10[1,4]
Event Driven Executive Communication Facility Additional Topics (S3512)							11[1]
Series/1 SNA Programming Interface (P2024)							10[2]
Series/1 Remote Manager Installation Workshop (S3506)							11[2]
EDL Implementation Workshop Advanced Topics (S3509)		5					7
Map Architecture/Application Interface (S3515)							11[4]
Map Application Server (S3516)							12[4]

[1] Event Driven Executive Communications Facility topic sequence
[2] Series/1 SNA and Remote Manager topic sequence
[3] Event Driven Executive TPS topic sequence
[4] MAP topic sequence

Communications Systems Concepts

I0026, approximately 7 hours

This course introduces communications systems and communications systems products. It defines basic terminology and describes the major characteristics of communications systems applications.

3270 Operation and Design

I0031, approximately 28 hours

This course explains the content and formation of 3270 data streams, remote and local operations, and 3270 configurations and screen design.

PL/I Programming

I0103, approximately 80 hours

This course consists of 23 topics covering the major facilities of PL/I, with several exercises for each topic.

ANS '74 COBOL Language Fundamentals

SS126, approximately 25 hours

This course develops the skills needed to code programs using ANS '74 COBOL.

ANS '74 COBOL Programming

SS127, approximately 36 hours

This course covers language specifications common to systems designed according to the ANS COBOL, X3.23 standard.

FORTRAN IV Language Fundamentals

SS129, approximately 30 hours

This course teaches the basics of FORTRAN IV programming.

Introduction to Series/1 Assembler Language

SS132, approximately 20 hours

This course teaches the basic concepts of assembler using the Series/1 Assembler language as a basis. Basic terminology and concepts are presented in enough detail to prepare the student for taking Series/1 courses requiring language skill.

Series/1 Hardware

SS138, approximately 25 hours

This course allows the student to identify the major components of the Series/1, understand the concept of input/output data transfer on a Series/1, and understand the logic of the Series/1 machine language instructions.

Using Event Driven Executive and Event Driven Language on the Series/1

32919, approximately 30 hours

This course teaches the student to operate the Series/1 under Event Driven Executive. This is accomplished by writing, debugging, and executing programs; using the Event Driven Executive utilities to allocate, create, and maintain files; generating a tailored supervisor, and using and updating the Session Manager.

SNA Fundamentals

32501, approximately 12 to 16 hours

This course teaches fundamentals of SNA, functions of SNA components, and use of SNA commands.

Programmable Communications Subsystem Preparation Facility

MI002, approximately 40 to 60 hours

This course is an instructor guide which can help personnel knowledgeable in data communications conduct their own in-house Programmable Communications Subsystem (PCS) Preparation Facility training. The course also provides materials of instruction to use as an instructor guide for teaching students who require machine level code to plan, correct, and modify programs written in the assembler language, or with the Programmable Communications Subsystem Facility (5719-CS0). Sample lab exercises are provided with the course that can be adapted to the synchronous equipment that is attached to the user's 4987 Programmable Communications Subsystem.

Programmable Communications Subsystem Extended Execution Support

MI004, approximately 30 to 50 hours

This course is an instructor guide which can help personnel knowledgeable in data communications conduct their own in-house training on Programmable Communications Subsystem Extended Execution Support (5719-CS0). Application program lab exercises are to support specific point-to-point synchronous and asynchronous IBM devices (3741 and 3767 terminals) that attach to the 4987 Programmable Communications Subsystem.

Event Driven Executive and Event Driven Language Implementation Workshop

S3505, 3 days

This course is for application programmers who have completed the CBT course (32907), *Using Event Driven Executive (EDX) and Event Driven Language (EDL) on the IBM Series/1.* The lecture and lab presentation allow the student to write, test, and debug a user-oriented application, through the use of static screens, disk read/write operations, multitasking, PF keys, and subroutine calls.

Event Driven Executive Communications Facility Installation Workshop

S2550, 4 days

This course combines lecture and lab to prepare the student to install the Communications Facility under Event Driven Executive.

Event Driven Executive Communications Facility Installation Workshop, Additional Topics

S3512, 4 days

This course combines lecture and lab to prepare the student to use the additional functions available with the Communications Facility program product. These functions include:

- Program dispatcher
- Disk queueing
- Remote disk processing
- Work session controller facility
- Communications Facility I/O control
- Channel attach feature
- PC LAN Connect
- Host Connect via SNA.

Event Driven Executive Control and Flow Workshop

S3503, 3-1/2 days

This course teaches advanced Event Driven Language programming topics and the various problem determination aids available in the Event Driven Executive operating system, as tools in an installation program development effort.

Series/1 Transaction Processing System Workshop

S3513, 3 days

This course teaches how to install, tailor, and implement the Series/1 Event Driven Executive Transaction Processing System licensed program by using lectures and hands-on exercises.

Event Driven Language Implementation Workshop — Advanced Topics

S3509, 2 days

This course is intended for application or system programmers who will use the advanced programming features of the Event Driven Language.

Realtime Programming System Facilities and Operation

S3511, 4 days

This course provides Realtime Programming System users with knowledge of the supervisor, its operator and programmer interfaces, utilities, and program preparation. This is done with an emphasis on hands-on exercises.

Realtime Programming System Generation and Maintenance

S2519, 5 days

This course provides Realtime Programming System system programmers with the knowledge necessary to perform custom system generations and maintenance of complex systems.

Series/1 Transaction Processing System Workshop

S3513, 3 days

This course teaches how to install, tailor, and implement the Series/1 Realtime Programming System Transaction Processing System licensed program by using lectures and hands-on exercises.

Communications Manager for Series/1 Installation Workshop

D2084, 4-1/2 days

This course provides the student with the necessary information to install the basic Communications Manager system for message concentration and routing. It provides the student with additional information for extending the basic support to other environments.

ANS '74 COBOL Batch Programming Workshop

D2085, 3 days

This course consists of lectures and exercises that teach COBOL batch programming skills, and provide practice in their use.

MAP Architecture/Application Interface

S3515, 2 days

This course provides a brief review of Open Systems Interconnect (OSI) and the OSI Reference Model. It also describes the components and services provided by the IBM MAP Communication Server (MCS) or the MAP Application Server (MAS) environments.

MAP Application Server Workshop

S3516, 3 days

This lab and lecture course covers MAP Communication Server (MCS) and MAP Application Server (MAS) installations. The lab consists of MAS start-up and station definition. Once the MAS system is operable, lecture and reinforcing lab exercises are alternated as students code and debug a MAP messing application and MAP FTAM applications.

Series/1 SNA Interface

P2024, 3 days

This is a lab and lecture class intended for experienced programmers. Students learn how to write Series/1 programs for the Event Driven Executive or the Realtime Programming System in order to communicate with host (System/370) application programs in an SNA environment.

Series/1 Remote Manager Installation/Operation

S3506, 2 days

This lab and lecture course teaches the student to install and tailor the Remote Manager licensed program, and verify the installation to a host communications and systems management network.

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