

Computer System Product Description

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PREFACE

This publication introduces the hardware and software components of the IBM Instruments Computer System. It consists of three chapters:

Chapter 1 -- "Introduction to the Computer System" -- describes system highlights, hardware features, and the standard and optional software available with the IBM Instruments Computer System.

Chapter 2 -- "Product Characteristics" -- lists pertinent characteristics and capabilities.

Chapter 3 -- "Order Information" -- lists the available features and options along with their identifying code numbers.

Related Publications:

Chromatography Application Program Product Description
(GC22-9188)

To be published:

IBM Instruments Computer System: User's Manual
(GC22-9186)

IBM Instruments Computer System: System Software Manual
(GC22-9191)

IBM Instruments Computer System: BASIC Programming Manual
(GC22-9184)

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CHAPTER 1. INTRODUCTION TO THE COMPUTER SYSTEM

IBM Instruments' Computer System consists of an easy-to-use, high-performance computer, an operating system, various types of support software, application programs, and many input/output (I/O) units and features. It is modular and can be ordered in a variety of configurations to meet the user's particular requirements. An existing System can be expanded by adding available hardware and software units as needed.

Typical uses of the Computer System:

- As a general analytical laboratory data system for a wide variety of laboratory instruments. Five (5) interfaces provide standard attachment points for instruments: one IEEE-488, three RS-232C, and one parallel I/O. An analog sensor I/O feature is optional. Programming support includes graphics, file management, and all attached I/O. The BASIC language (optional) provides the user with a programming tool for writing applications.
- As a chromatography data system. Optional software includes a complete application program for the capture and analysis of chromatographic data. Optional hardware includes an analog interface for connecting chromatographic output to the Computer System. Data and annotated chromatograms can be stored, displayed on the System's standard CRT display in real time, and printed on an optional multicolor printer/plotter.
- As a data system controller for the IBM Instruments LC/9533 Chromatograph. The Computer System can be connected to the LC/9533 to provide an integrated hardware-software system that controls the operation of the LC instrument in addition to capturing and interpreting chromatographic data. Data and annotated results can be viewed on the display, printed on the multicolor printer/plotter (optional), and stored on diskette. Stored data can be used later in post-analysis of results and in user-written applications in BASIC (optional).

Modular units of the Computer System:

- Processor main housing, containing the processor board, the power supply, and up to five (5) optional features, including analog sensor I/O, additional memory, and hard-disk controller.
- Function keypad on the processor main housing
- Cathode ray tube (CRT) display
- Multicolor printer/plotter (optional)
- Diskette drives, either 5¼-inch or 8-inch (optional)
- Alphanumeric keyboard (optional)
- Winchester 5¼-inch hard-disk drives (optional)

A multitasking, real-time operating system controls the Computer System. Its operator interface makes for ease of use by technical support personnel, while its command structure, languages, and utilities make it a powerful tool for experienced personnel to use in scientific computing and laboratory automation.

Figure 1 shows a schematic diagram of the Computer System with several attached modular units.

to instruments, data systems,
or host computers

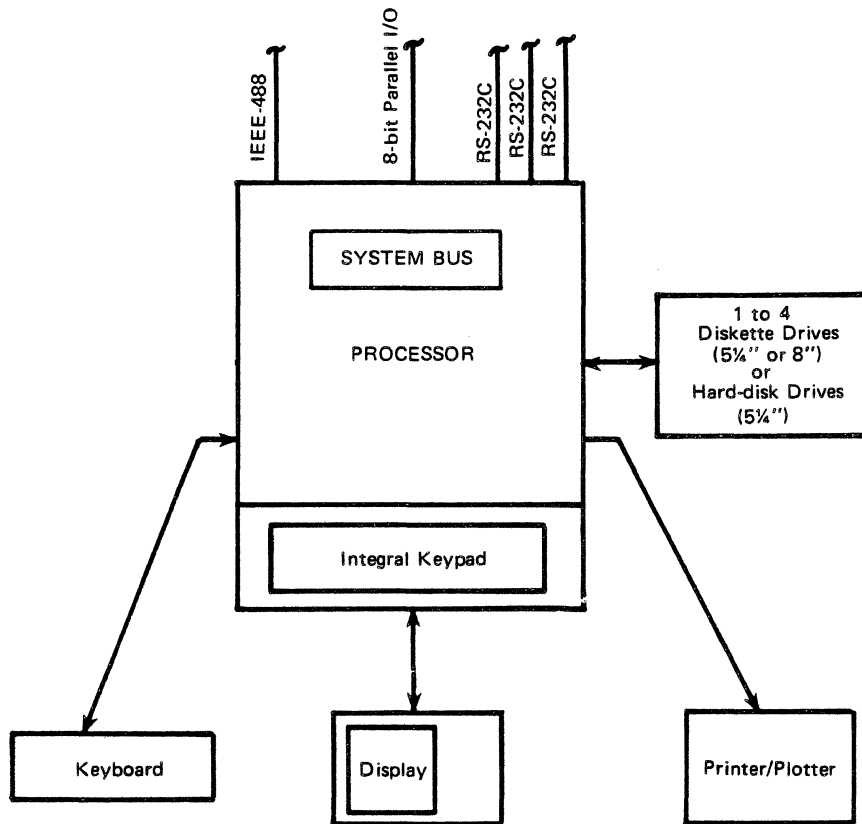


Figure 1. Computer System with Attached Units

SYSTEM HIGHLIGHTS

The Computer System has many hardware and software features that make it attractive to the scientist, lab manager, and instrument user.

Hardware highlights include:

- Compact bench-top system of modular units that saves laboratory space and facilitates system expansion
- Processor system complete with integral I/O connections for easy attachment of peripheral units
- Simple setup with easy assembly and disassembly of main units
- Printer/plotter (optional) with high print resolution suitable for reports and detailed plotting in various colors
- Graphic CRT display, conveniently located on processor main housing, with tilt and rotate features and 10 programmable soft keys for interacting with the System
- Movable keyboard (optional) with 83 keys, including alphanumeric, data entry, numeric keypad, and programmable special functions
- Multifunction keypad for control of instruments and other laboratory devices
- Three RS-232C serial communication ports, IEEE-488 bus, and parallel I/O port are standard for attaching I/O devices
- Analog I/O capabilities
- Processor system based on single large planar board with many of the System's standard features for lower cost and higher reliability
- Choice of diskettes available -- 5¼-inch and 8-inch -- double-density and double-sided for up to 4 megabytes of on-line storage
- Printer/plotter positioned in processor main housing for compact layout and convenient paper handling
- System bus and up to five (5) additional electronic boards can be inserted in the processor main housing for easily increased system capability

-
- Winchester 5¼-inch disk drives (optional) with 5 or 10 megabytes of storage.
 - Processor based on the 68000 8-MHz with 32-bit registers and 16-bit data flow for high processing speed
 - Standard memory: 128K bytes of RAM and up to 128K bytes of ROM
 - Additional memory: 1 megabyte per card in 256K-byte increments
 - Memory address range of 16 megabytes

Software highlights include:

- Operating system resident in read-only memory (ROM)
 - Real-time and multitasking capabilities permit concurrent activities, including simultaneous control of multiple instruments
 - I/O drivers for keypad, keyboard, CRT, printer/plotter, diskettes, IEEE-488, RS-232C, parallel, and analog sensor I/O
 - Sequential and random files
 - Graphics support for CRT and printer/plotter
 - Simple command interface
 - Debugger for debugging assembly language programs
- System diagnostics in ROM
 - Isolate most failures to customer-replaceable units
- Optional BASIC interpreter
- Optional operating system extensions on diskette
 - Macro assembler
 - Linkage Editor/Locator/Library Manager
 - Text editor

-- Disk utilities

- Optional chromatography application program

TYPICAL CONFIGURATIONS

An IBM Instruments Computer System that meets a specific set of user requirements can be ordered by selecting the I/O units and programming support needed. The user can also upgrade the Computer System by simply adding available features to an existing system.

The Base System Unit consists of a processor unit, keypad, and display.

Some typical configurations are:

- General Purpose Computer System, which includes the Base System Unit, printer/plotter, keyboard, and two diskette drives. One or two diskette drives, an analog I/O interface, additional memory, and a hard-disk capability may be added to this configuration.
- Entry Level Chromatography Computer System, which includes the Base System Unit, one 5¼-inch diskette drive, and a sensor I/O attachment. One or two diskette drives, a printer/plotter, a keyboard, and additional memory may be added to this configuration to meet growing needs.
- A fully configured system -- which includes the Base System Unit, printer/plotter, keyboard, diskette and hard-disk drives, additional memory, and analog I/O -- used as a host for entry-level systems, data base processing, and extensive calculations.

COMPUTER SYSTEM HARDWARE UNITS

The configurations differ in the number of units attached to the Base System Unit. The units, however, are the same regardless of the configuration. Figure

2 illustrates a Computer System with all currently announced I/O. Figure 3 illustrates the Base System Unit, consisting of processor unit, keypad, and display only.

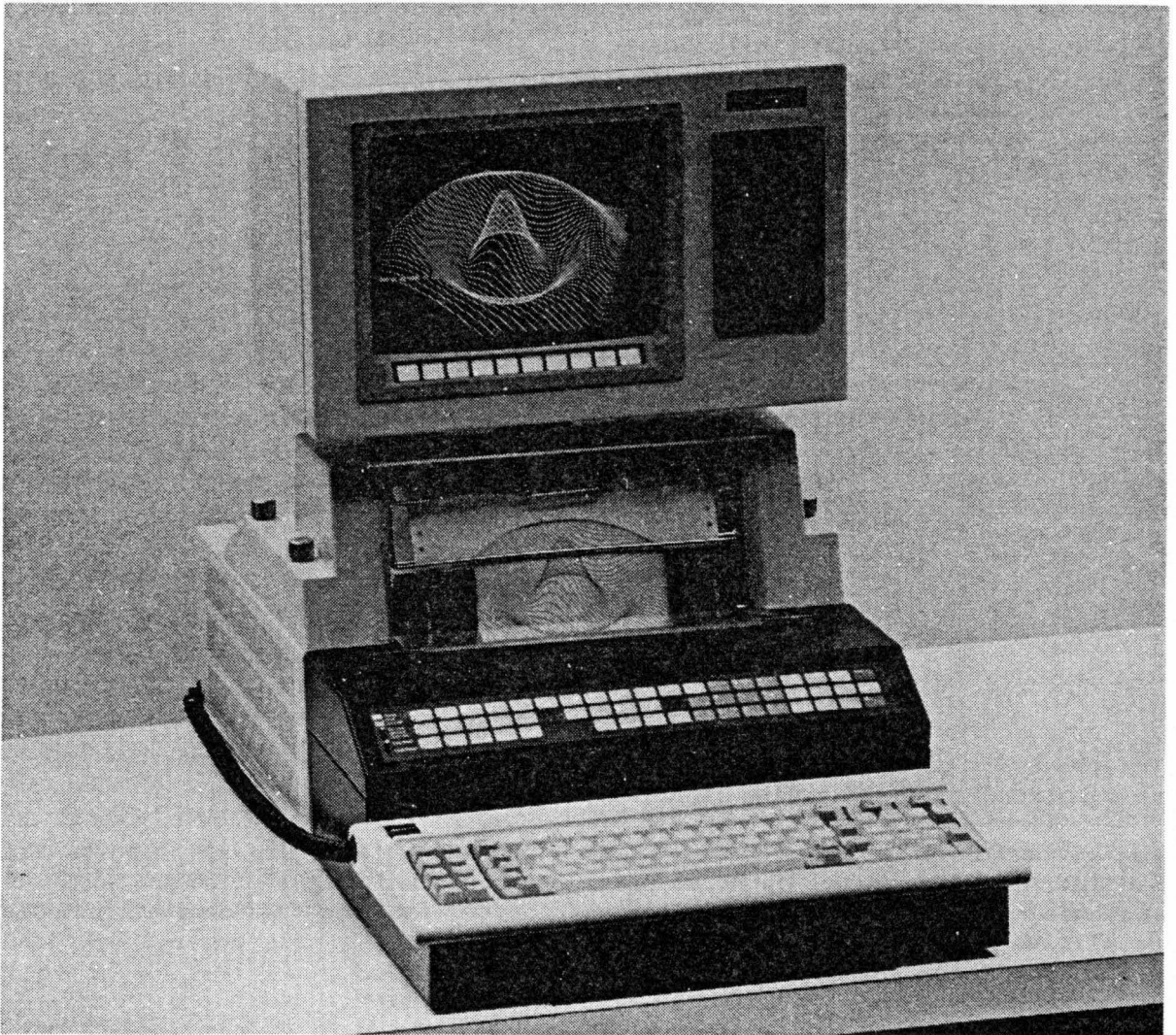


Figure 2. General Purpose Instrument Computer System

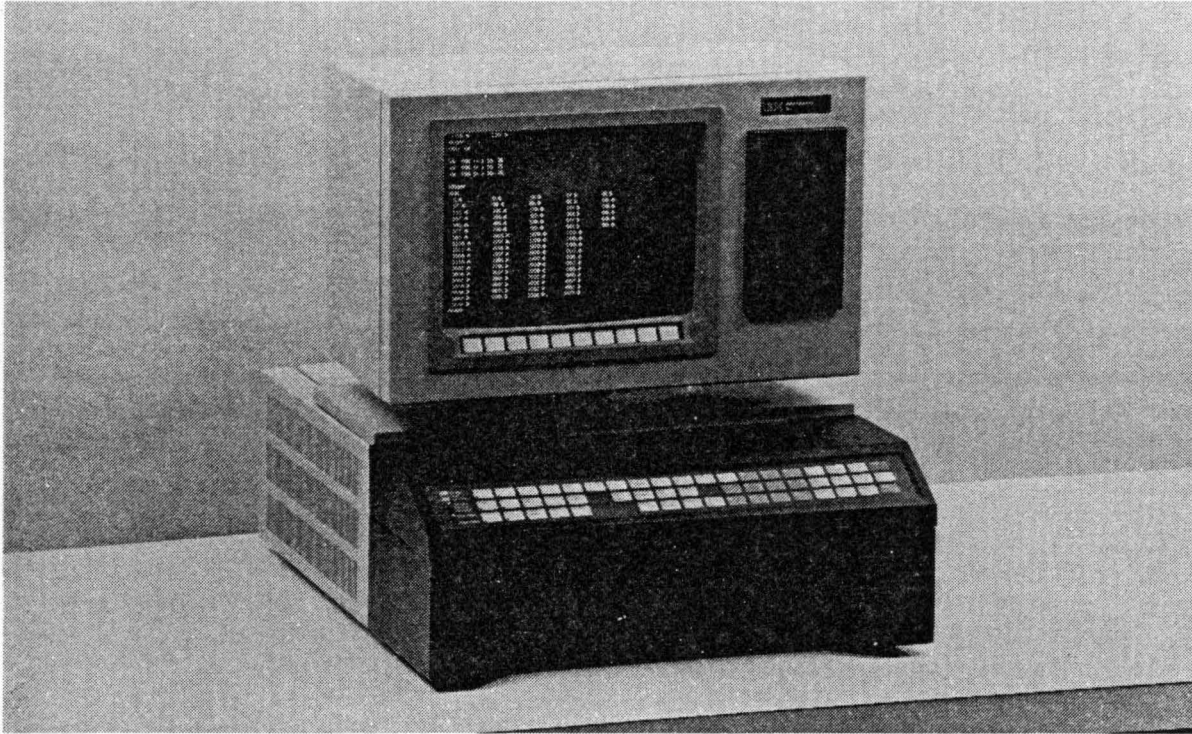


Figure 3. Base System Unit

PROCESSOR UNIT

The processor board resides in the processor unit main housing. The processor unit combines high processing capability and compact size.

The processor unit main housing (as illustrated in Figure 3) supports the display and contains the optional printer/plotter unit. (Refer to the sections "Cathode Ray Tube Display" and "Printer/Plotter" later in this chapter for more details about these components.) It also contains the main power supply and will house up to 5 optional cards.

The processor board contains a 68000 8-MHz processor. This processor uses 32-bit internal and 16-bit data flow. On-board memory consists of 128K bytes of RAM and up to 128K bytes of ROM. Up to 64K bytes of the ROM is contained in a plug-in cartridge. Four direct memory access (DMA) channels are on the board,

along with the independent CRT graphics memory. An important feature of the Computer System is that its processor board also contains controllers for:

- RS-232C ports
- IEEE-488 bus
- parallel I/O port
- system bus
- CRT

This compact design eliminates the need for separate cards for these features and thereby increases overall reliability. (See Figure 4.)

The processor board also contains a real-time clock (with battery backup) and programmable timers. These provide the Computer System with the ability to "time-stamp" events and to synchronize system functions.

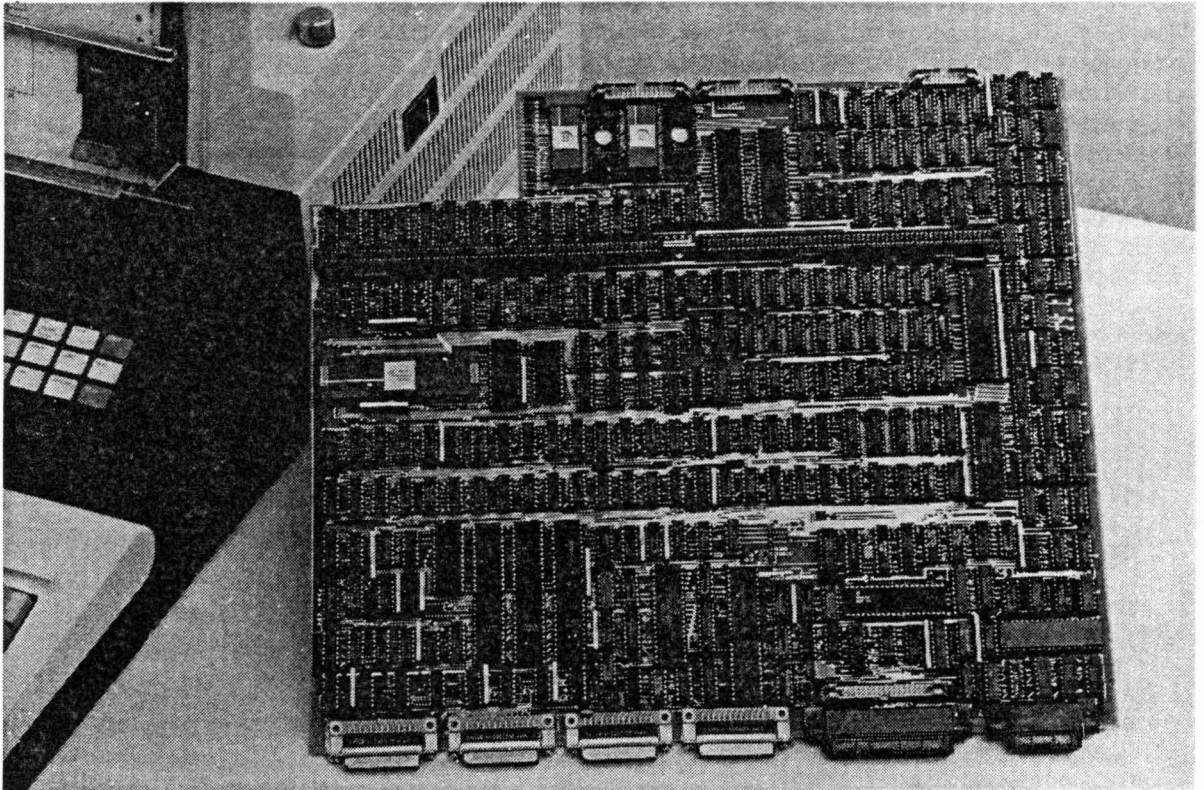


Figure 4. Processor Board

KEYPAD AND SOFT KEYS

The keypad consists of a panel fitted into the upper front of the processor main housing. Pressure-sensitive keys provide quick, direct control of the labeled functions. These keys are arranged in three rows, with color-coding and spacing for ease of use.

The 10 soft keys located just below the CRT display screen are defined by the appropriate software. Function "labels" are displayed at the bottom of the screen itself during operation.

Both of these features, with appropriate programming support, provide for easy interaction between user and system.

KEYBOARD

The IBM Instruments Computer System offers an 83-key keyboard that incorporates the latest keyboard technology, supports the full complement of ASCII characters, and includes Ctrl and Alt keys. There is a numeric pad, cursor-control keys, the alphanumeric keys, and program function keys.

The alphanumeric keys provide for character entry. Alphanumeric keys have a "typamatic" action -- they repeat their character or operation automatically when held down. The numeric keys provide an alternate for number entry. The function keys provide for preprogrammed or user-programmed functions.

The keyboard is attached to the main housing by a flexible cord and can thus be positioned for the convenience of the operator. (See Figure 5.)

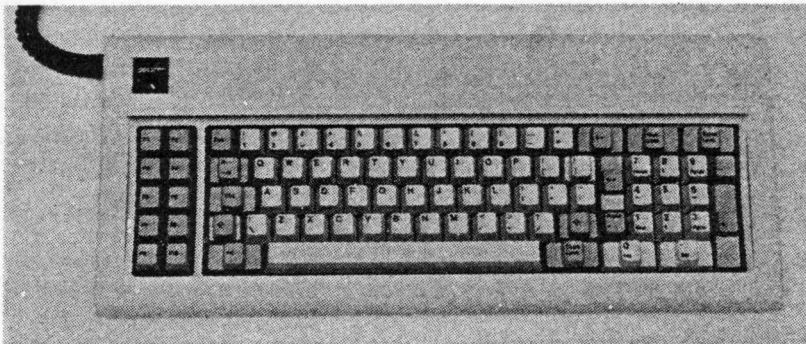


Figure 5. Keyboard

CATHODE RAY TUBE DISPLAY

The Computer System includes a high-resolution raster-scan cathode ray tube (CRT) as a standard I/O unit for display of characters and graphics. This display has a 12-inch (diagonal) green-on-black screen with a capacity of 2400 characters. The characters are arranged in a format of 30 lines of 80 characters each. The display graphics have a high resolution of 768 by 480 pixels, with all points addressable. Characters and graphics can be intermixed. Moreover, the screen can be subdivided into "windows," which display different program outputs on different sections of the screen. The screen can also be scrolled. Figures 6 and 7 show the CRT display and some examples of character and graphic displays.

The functions of the soft keys just below the CRT screen are identified by function labels displayed at the bottom of the screen.

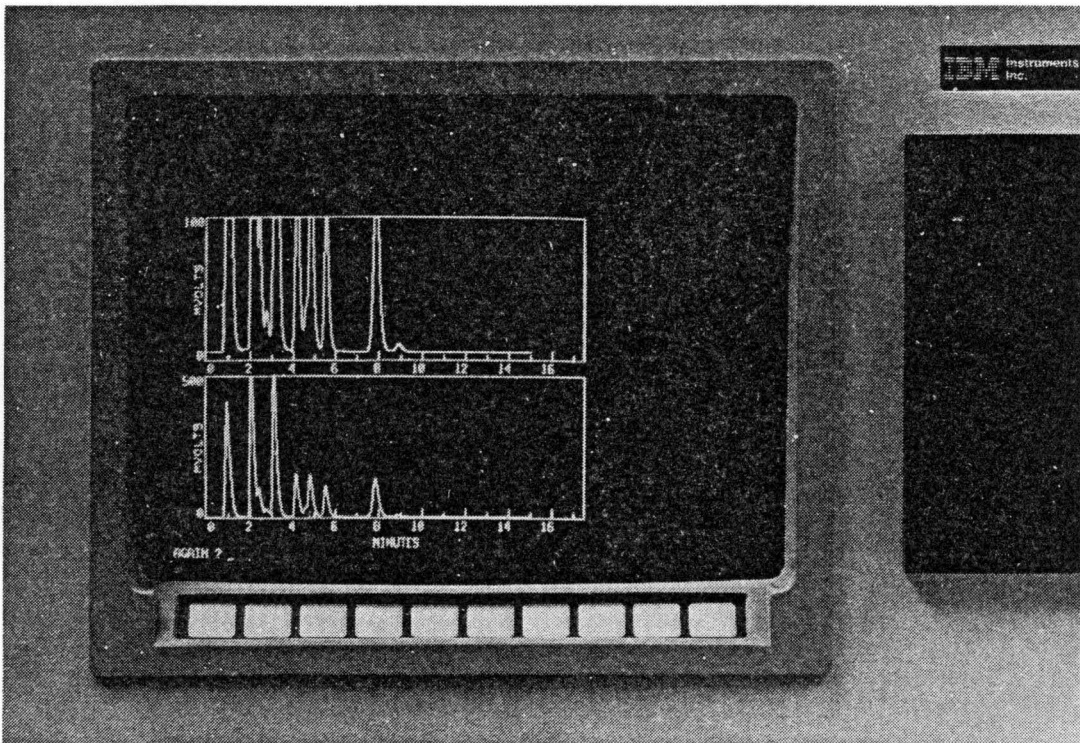


Figure 6. CRT display

DIRECTORY OF DRIVE 4

NAME	T	A	FS	LS	MS	TIME
ADV00585.SYS	01	00	0015	000B	00151	00:00:23 0000/00
BRASIC	BIN	01	00	000C	01C9	00277 00:00:42 0000/00
PIP	BIN	00	00	01C1	01DF	00031 00:00:45 0000/00
EDIT	BIN	00	00	01E0	01F3	00020 00:00:49 0000/00
DISKUTIL	BIN	01	00	01FC	0213	00024 00:00:50 0000/00
BOOT	CHD	01	00	0214	0220	00013 00:00:53 0000/00
GRDEND	BIN	01	00	0221	0230	00022 00:00:56 0000/00
PLGRDND	BIN	01	00	0237	027E	00072 00:01:00 0000/00
DEND	SUB	03	00	027F	027F	00001 00:01:02 0000/00
CHPARTS	BIN	01	00	0200	0203	00020 00:01:05 0000/00
CROW	BIN	01	00	0204	020D	00005 00:01:09 0000/00
ADV00082.SYS	01	00	020E	0350	00142	00:01:16 0000/00
AUTODGC	SUB	03	00	035C	035C	00001 00:01:21 0000/00
LOGO	BR5	04	00	0350	0300	00004 00:01:24 0000/00
STEVE	SUB	03	00	0361	0361	00001 00:00:33 0000/00
STEVE	BR5	04	00	0362	0362	00001 00:00:10 0000/00

00046 SECTORS USED

45

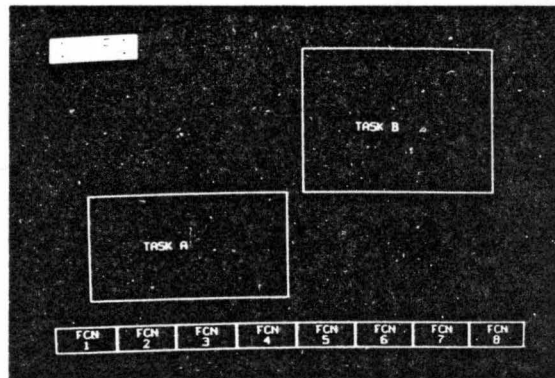
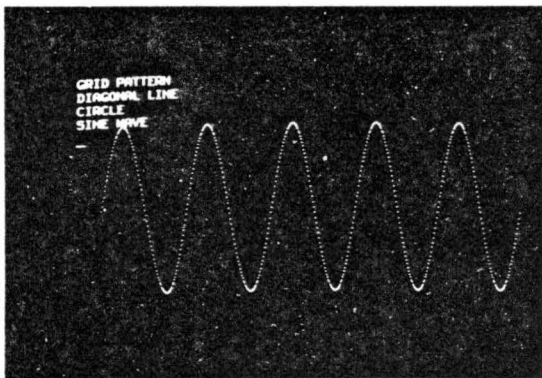
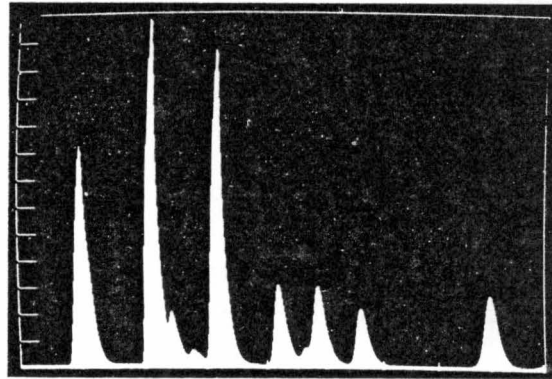


Figure 7. Examples of Displays

PRINTER/PLOTTER

The printer/plotter is a microprocessor-based, dot-matrix printer especially designed to provide both rapid, high-quality printing and high-resolution graphics in a single, integrated unit. A four-color ribbon provides color printing and plot capability. When included in a System, the printer/plotter fits within the main processor unit housing.

Operator controls and indicators for the printer/plotter are mounted on the left-hand side of the keypad for convenience and accessibility.

Some significant performance features of the printer/plotter are:

- Built-in self test and diagnostics.
- Full 96-character, upper and lower case, ASCII set.
- Bidirectional printhead for maximum printer output.
- 8-inch print width with 80, 96, or 132 characters per line
- Uses standard sheet or fan-fold paper

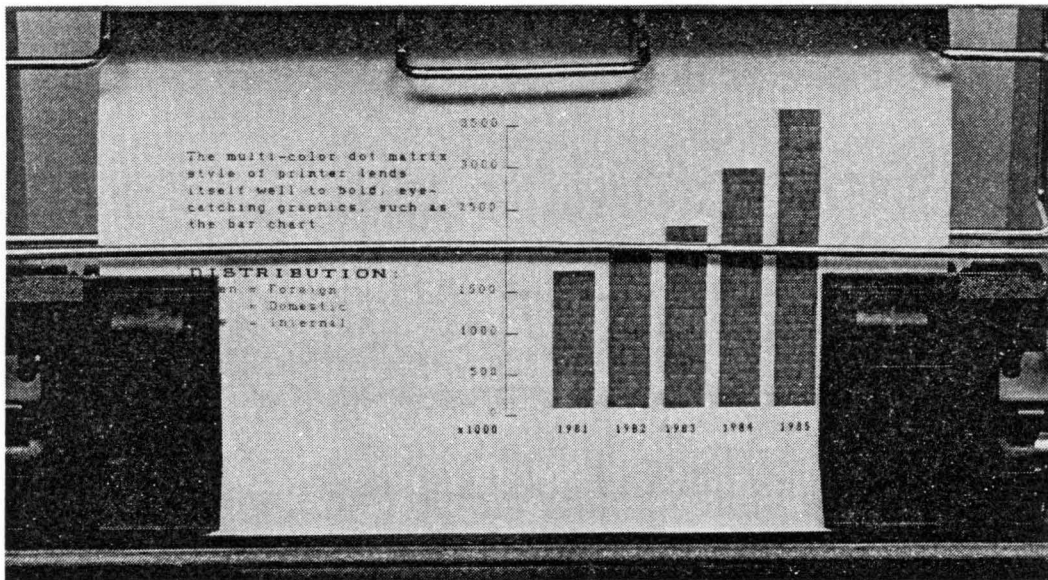
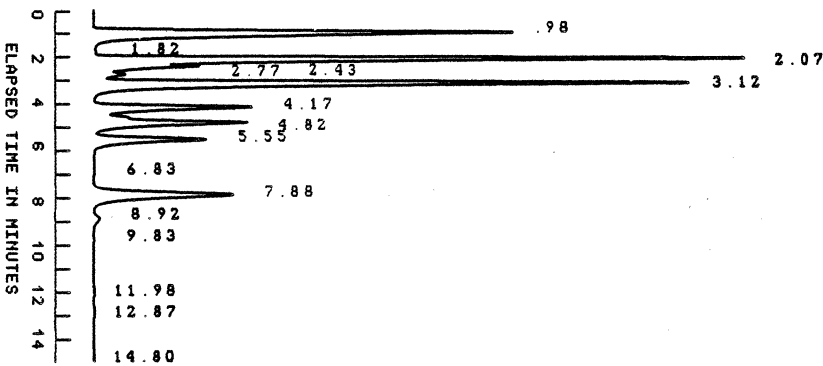


Figure 8. Printer/plotter

- Good-quality, nonfade printing
- Graphics plotted with a horizontal resolution of 200 dots per inch and a vertical resolution of 336 dots per inch.
- Color output
- Selectable fonts, including proportional spacing

SAMPLE CHROMATOGRAM

Retention times for peaks less than 1% or greater than 90% of full scale shown in RED, all others in GREEN.



Data after 8.5 minutes run time magnified x 100

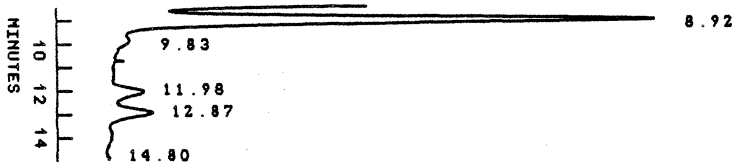


Figure 9. Examples of printer/plotter output (3/4 actual size)

I/O INTERFACES

The IBM Instruments Computer System provides a variety of connections for attaching other instruments and devices. The interfaces are:

- Three RS-232C serial ports
- One 8-bit bidirectional parallel port
- One IEEE-488 bus
- Analog sensor I/O (optional)
- System bus

The RS-232C ports provide serial asynchronous communication between the Computer System and a terminal, a modem, another computer host, or instruments. ASCII communication characters are used, and data is transferred at speeds of up to 19.2 kilobaud.

The IEEE-488 bus provides a standard data transmission and reception port that is especially useful in a lab environment. It is a byte-wide (8 bits) parallel bus with 8 additional lines used for control. Up to 14 devices can be sequentially connected along the bus cable. The System can act as "talker," "listener," or "bus controller." Although the System normally acts as the bus controller, it can relinquish control to another controller on the bus.

The 8-bit parallel port provides a standard data transmission and reception port to the Computer System. It transfers byte-wide data (8 bits in parallel) with handshake between the Computer System and similar ports on other user devices, such as printers, paper-tape readers, photocomposers, and plotters.

The optional analog sensor I/O is representative of function cards that can be mounted in the processor unit main housing. This low-speed card is designed for a range of instrument control and data acquisition requirements typical of many laboratory instruments. It provides four channels of highly stable integrating analog-to-digital conversion at a rate of 30 Hz per channel. Autoranging provides a dynamic range of 10^6 . It also provides additional parallel I/O, RS-232C ports, and pulse and counting capabilities.

DISKETTES

The Computer System can control up to four diskette drives. The diskettes can be either 5¼ inches or 8 inches in diameter, in any combination. Double-sided diskettes are used and double-density is supported. The 5¼-inch diskette stores more than 300K bytes. The 8-inch diskette stores approximately 1 megabyte.

Data can be transferred at rates of up to 500K bits per second.

One 5¼-inch drive may be housed in the CRT for convenient storage of methods and data in an instrument-oriented computer system. Other 5¼-inch drives are housed separately or in pairs.

The 8-inch diskettes are formatted according to the IBM standard. The drives are housed singly or in pairs. Dual drives are recommended to facilitate copying of diskettes.

HARD DISKS

A hard-disk controller card (optional) occupies one slot of the expansion card. This card permits the attachment of up to four 5¼-inch hard-disk (Winchester) drives. Drives of 5- and 10-megabyte capacity are available.

ADDITIONAL MEMORY

A memory card containing up to 1 megabyte of additional RAM in increments of 256K bytes is available as an option. Each card occupies one slot of the expansion card.

COMPUTER SYSTEM SOFTWARE

The Computer System operates under an easy-to-use, real-time, multitasking operating system. The operating system resides in ROM. Optional operating system extensions are available on diskette.

When the Computer System is turned on, the CRT display presents the operator with a menu of possible actions. The operator may also enter these actions (commands) directly instead of following a menu.

COMMAND INTERFACE

The Computer System command interface provides simple, straight-forward control of the system. It provides the operator with the ability to:

- Obtain status information about the system
- Change system parameters and assignments
- Obtain a directory of files on diskettes
- Copy files from one diskette to another
- Send files to the printer
- Run BASIC
- Invoke the editor feature to create new text or to change existing files
- Assemble and link-edit a program and save it for later execution
- Execute a program
- Start preprogrammed activities

The operator commands are simple to learn and do not require an extensive computer background to use. The operating system does not require a full time operator in attendance.

OPERATING SYSTEM FEATURES

The operating system controls all facets of the Computer System. This includes task execution, communication with all I/O devices, storage of data and files on diskette, user program execution, time dependencies and utilization of the processor itself. The operating system itself provides:

-
- Supervisor control. The supervisor delegates resources to tasks -- the basic unit of work in the operating system -- for execution. This includes selection of tasks based on priority and resource availability.
 - I/O drivers. These drivers process and control the flow of data between the processor itself and the attached I/O devices. There are I/O drivers for the keypad, the keyboard, the diskettes, the printer/plotter, the display, the RS-232C ports, the IEEE-488 bus, the analog sensor I/O, and the 8-bit parallel bidirectional port.
 - Support for clocks and timers. The Computer System includes a real-time clock (with battery backup) and programmable timers.
 - Disk file management. This controls the files stored on the diskettes, including such functions as control and allocation of space on diskettes and creation and maintenance of a file directory.
 - Graphics routines. These routines provide the support to generate graphics on the display and the printer/plotter. They may be used through calls in the BASIC language.
 - Debugger. This provides assistance for programmers in debugging their assembly language programs.
 - Diagnostics. The operating system contains a standard package of diagnostics, which test the status of the individual units in the Computer System. Most of the tests are run at power-on, but the operator also can execute them when a problem occurs in the operation of the System. The diagnostics help to isolate the faulty unit, and the operator can then take the appropriate steps to correct the problem.
 - Command interpretation. These routines interpret the commands entered by the user and execute the tasks needed to carry out the command.

File System

The Computer System keeps a directory of the files on each diskette.

File Types

The diskette sectors are linked together with pointers for the sequential files. When a file is stored on a diskette that has been in use for some time, it may be stored in noncontiguous sectors of the diskette. This type of storage permits easy expansion and contraction of files, and most files are stored in this manner. Alternately, a set of contiguous sectors can be set aside for storing a file. These sectors, however, can be used only for the files assigned to them, and the files must not exceed the assigned space. Contiguous file organization is more compact than sequential organization, and contiguous files can be randomly accessed.

Access Codes

The Computer System provides protection of files by means of "access codes." These codes determine whether a file can or cannot be deleted or renamed.

Graphics

The Graphics Software Facility is a set of graphics subprograms that can be called by Computer System BASIC. Important features include:

- Support for graphics on the CRT display and the printer/plotter
- Facilities for defining "windows"
- Generation of lines and characters -- all points on the CRT display are addressable
- Horizontal scrolling on the CRT
- Color output on printer/plotter
- Real-time and spooled output on printer/plotter
- Axis drawing and coordinate transformation
- Screen print key for copying contents of CRT screen on printer/plotter.

BASIC

The BASIC programming language (optional) is supported by the Computer System. BASIC provides the application programmer with an easy-to-use programming language suitable for use in a scientific laboratory environment. BASIC offers commands (used to change, modify, and execute BASIC programs) and language statements (used to write the actual program code). Some of the significant features of Computer System BASIC are:

- Efficient interpreter
- CALL capability to run routines written in Macro Assembler language
- Extensive arithmetic and string-handling functions
- Easy use of files, including loading and running other BASIC programs

Computer System BASIC is usable with any configuration that has a keyboard.

OPTIONAL OPERATING SYSTEM EXTENSIONS ON DISKETTE

The Computer System provides, as options, many features that support user-written programming. These include:

- A text editor
- A macro assembler
- A linkage editor
- Disk utilities

The Text Editor

The text editor feature provides for the creation and editing of program and text files. The editor provides commands that allow an operator to perform

input and output operations, using a "text buffer." It also provides commands that allow the operator to modify data written into the text buffer. Any configuration that has a diskette and keyboard can use the text editor.

Features of the text editor are:

- The editor is invoked by simply typing in its name (EDIT).
- The command structure consists of single-letter command codes that perform a particular editing function.
- Input mode allows the operator to insert text data, add data to existing characters, or replace existing data
- Command stringing allows the operator to stack two or more commands for sequential execution
- Use of the backspace key to function as a "rubout" key to delete characters

Macro Assembler

The two-pass macro assembler defines symbols and builds a symbol table (pass 1) before it generates object code (pass 2). It performs error checking during both passes. The format of the object code is usable in the linkage editor. While assembler language programs are more difficult to write than high-level-languages programs, they permit the most efficient use of the Computer System's resources.

Linkage Editor

The linkage editor has locator and library management features. The linkage editor enables the user to combine several independently assembled or compiled programs into a single program. The locator enables the user to assign storage addresses to link-edited programs, and the library management feature provides access to link-edited programs at a later date.

Disk Utilities

The Computer System has several optional utilities that facilitate management of diskette files. The operator can implement these functions by means of various system commands or utilities or -- in BASIC -- by the LOAD, SAVE, and OPEN commands. These utilities provide general purpose file functions, such as:

- Creating, modifying, and deleting diskette files
- Copying files onto other diskettes, including the copying of an entire diskette
- Displaying and/or printing the directory of the files stored on a diskette
- Printing, displaying, or transmitting the contents of a file
- Combining files
- Files can be read in from diskettes prepared on other systems if the file format is the same
- Data from other instruments or data systems can be read through the communication facilities of the Computer System onto diskette.

The operating system also provides two features of particular interest to the user -- "SUBMIT" files and a spooler.

SUBMIT Files

A useful feature is the SUBMIT file, or a file that contains system commands. Using the editor, the operator can write multiple system commands into a disk file. Later, the SUBMIT command can be used to invoke the file. The operating system executes each command stored in the file as though it had been entered directly from the keyboard. A SUBMIT file thus allows the operator to execute a sequence of commands (usually a repetitive set or one that must be invoked frequently) by means of a single command.

Spooler

Another feature of the operating system designed to assist users provides for "spooling" print data. The system spools (saves) print data on diskette and returns control to the operating system -- and therefore to the user -- without waiting for the printing of each file.

PREPROGRAMMED APPLICATIONS

The Computer System provides a complete set of system functions for the IBM Instruments LC/9533 liquid chromatograph, including control and monitoring of operation, data capture and analysis, and graphic presentation of results. The Computer System also supports -- through the Chromatography Application Program (CAP) -- data capture, and analysis and presentation of results for non-IBM chromatographs. Refer to the publication Chromatography Application Program Product Description, GC22-9188, for further information about this program.

CHAPTER 2. PRODUCT CHARACTERISTICS

This chapter summarizes the main characteristics of the IBM Instruments Computer System and its components.

BASE SYSTEM UNIT

The Base System Unit consists of the processor main housing, CRT display with soft keys, and keypad.

Processor Main Housing

The processor main housing contains the processor board, any optional I/O cards (up to a maximum of 5), the power supply, I/O connectors, and the keypad. (The optional printer/plotter also fits in the housing.)

processor board

The processor board includes the following features:

- 68000 8-MHz microprocessor and supporting electronics
- Clocks/timers
- On-board bus drivers and control
- System Bus off-board drivers
- EPROM control; up to 128K bytes EPROM with 64K replaceable cartridge
- RAM control; 128K bytes RAM
- Address decode; 24-bit addressing (16M bytes)
- CRT control; 64K-bit memory map (graphics)
- DMA; 4 channels at 1 MHz maximum
- Interrupt control; 7 hardware levels; 4 levels with 32 sublevels
- IEEE-488 bus control
- RS-232C serial communication control; three ports
- Parallel I/O control; 4 8-bit groups; 3 groups for specific I/O:
 - Printer/plotter
 - Keypad
 - Keyboard

-
- a) Microprocessor: 68000 8-MHz, with supporting drivers and logic.
- b) Timers: 3 16-bit timers with up to 2 MHz clocking
user-callable -- cascadable
- c) Memory: access time -- 250 nanoseconds
machine cycle time -- 500 nanoseconds
no wait state
- EPROM: 128K bytes
- RAM: dynamic
64K X 1
128K bytes
- d) System Bus: Compatible with VERSAbus*
- e) Expansion card System bus; perpendicular to planar board; provides
connections for optional feature cards
- f) CRT control: 12-inch screen (measured diagonally)
raster scan; characters and graphics
- Characters: 80 per line, 30 lines (the character matrix is
7 by 14 dots in a 9-by-16 frame)
- Graphics: 768 (horizontal) by 480 (vertical) pixels
bit-mapped; separate memory
- g) Diskette control: 4 units; 5¼- and/or 8-inch diskettes
on DMA
Transfer rate: 500K bits/sec
- i) DMA: 4 channels
Transfer rate: 1 MHz/sec
- h) Interrupts: 7 levels of priority; 4 levels expanded to
provide 32 programmable interrupts
- i) IEEE-488 bus: controller, listener, talker
on DMA; up to 1 MHz/sec transfer rate

* VERSAbus is a registered trademark of Motorola Corporation.

k) RS-232C serial: 3 ports
baud rate to 19.2K
asynch, ASCII coded characters
terminal, modem, or terminal/modem with jumpers

l) Parallel I/O: 1 8-bit group with handshake
Programmed I/O

power supply

Power source: 105 to 130 V ac

47 to 63 Hz

Rating: 275 watts

Size: 4.5 X 2 x 12 inches

Outputs:	5 V	30 A
	12 V	5 A
	-12 V	1 A
	15 V	1 A
	-15 V	1 A

Overvolt protection for 5 V rated at 120 percent

Overcurrent protection for all but ± 15 V

Ripple maximum, line and load, 2 percent

Noise maximum 100 mV except ± 15 mV is .1 percent, or 15 mV

CRT Display

The CRT display sits on a bridge over the main processor housing if the printer/plotter is part of the Computer System, and directly on the main processor housing if there is no printer/plotter. The display has a capacity of 2400 characters (80 characters per line and 30 lines). It displays graphics in a frame of 768 by 480 pixels.

Dimensions and Weight

Height	Width	Depth	Weight
26.5 cm	41.5 cm	31.0 cm	9.3 kg
10.4 in	16.3 in	12.2 in	20.5 lb

Soft Keys

Ten "soft" keys are mounted just below the CRT display screen. The function of these keys is defined by the software.

Keypad

The keypad consists of a panel 16 inches x 2.6 inches that fits in the top front of the processor main housing. It contains 57 switch positions, which are identified by a polycarbonate overlay. The function labels shown by the overlay are those defined for the installed application package. For Systems with no application package, a clear overlay is provided, allowing the user to identify the functions by placing labels behind the overlay. Keypad functions may be programmed with BASIC.

The six on the left-hand side of the keypad offer programmable visual-indicator capability. There is also a programmable audio response that can provide feedback to the operator or function as a warning signal.

Switches and indicators for the printer/plotter are mounted on a vertical column on the left-hand side of the panel.

Processor Features

The following optional feature cards can be inserted in the planar board located in the processor main housing:

expansion card

System Bus card with 5 additional card slots; carries SYSBUS to other cards and to external connectors (required for analog sensor I/O, additional memory, and hard-disk controller cards)

analog sensor I/O card

Housed in main chassis
4 analog inputs
30 Hz with autoranging; dynamic range = 10^6
integrating, 13 bits
32-bit parallel I/O
4 RS-232C ports; asynch. terminal/modem
2 16-bit pulse/count
8 LED drivers and 8 debounced-switch inputs

memory expansion card

up to 1 megabyte per card in increments of 256K bytes
500-nanosecond cycle time

disk controller

up to four 5¼-inch hard disks
5- and 10-megabyte formatted disk drives
SA1000 and ST506 interface

KEYBOARD

The 83-key alphanumeric keyboard has a full ASCII character set (upper and lower case) with Ctrl and Alt keys, numeric pad, and 10 programmable function keys. The alphanumeric keys are typamatic; some keys have additional functions when combined with Ctrl and Alt keys. The keyboard is attached to the processor main housing by a flexible, 72-inch cable and can thus be positioned for the convenience of the operator.

Dimensions and Weight

Height	Width	Depth	Weight
4.0 cm	43.7 cm	18.3 cm	2.7 kg
1.6 in	17.2 in	7.2 in	6.0 lb

PRINTER/PLOTTER

This optional unit offers print and graphics capability with a multicolored ribbon. It fits inside the main processor housing behind the Keypad. Paper feeds in from the lower front and exits across the top of the housing. The printer has a separate power supply and power is distributed from the main power entry (see below).

Dimensions and Weight

Height	Width	Depth	Weight
12.5 cm	43.0 cm	19.0 cm	9.3 kg
4.9 in	16.9 in	7.5 in	20.5 lb

Primary Power: 110 V ac, 60 Hz (connected internally to processor main housing power supply)

Performance Characteristics

CHARACTER DENSITY: 10, 12, or 16.8 characters per inch (cpi), enhanced characters of 5 cpi, and proportional spacing are software selectable.

MAXIMUM LINE LENGTH: 80 characters across an 8-inch print width with fixed spacing at 10 cpi; 96 characters at 12 cpi; and 132 characters at 16.8 cpi.

LINES SPACING: Six or eight lines per inch (software-selectable) plus line spacing in 1/48-inch increments under software control for graphics.

PROGRAMMED FUNCTIONS: Software control of the printer is accomplished by use of ASCII control characters. Functions include character-density changes, fixed/proportional spacing, automatic text justification, line spacing size, page lengths, margin positions, graphics data, double width characters, horizontal and vertical tabbing.

PRINT FORMAT: 24 X 9 dot matrix. Upper case characters are 0.090 inch high. True descenders are printed for lower case characters and underscore.

CODING: Full 96 ASCII character set, upper and lower case.

GRAPHICS DOT PLOTTING: Full dot pattern control for graphics plotting. The graphics grid density is 200 horizontal X 336 vertical dots/inch.

RIBBON: Snap-in cartridge with 1/2-inch-wide, four-color nylon ribbon. Color selection is under software control and can be varied within a line.

POWER-ON DIAGNOSTICS: Each time power is applied, a microprocessor memory test is performed automatically; a blinking fault light indicates an error.

PRINT DIAGNOSTICS: Built-in self-test initiated by operator provides visual checks of print quality and paper adjustment.

DISKETTES

The dimensions and weights shown in the table below apply to cabinets containing two drives.

	Height	Width	Depth	Weight
5¼-inch drive	8.5 cm 3.3 in	37.0 cm 14.6 in	21.5 cm 8.5 in	5.2 kg 11.0 lb
8-inch drive	28.0 cm 11.0 in	34.5 cm 13.6 in	58.5 cm 23.0 in	17.7 kg 39.0 lb

Transmission Rates and Capacities

5¼-Inch Diskette

Transmission Rate:

Double Density: 250K bits/sec

Capacity:

322K bytes, formatted

8-Inch Diskette

Transmission Rate:

Single Density: 250K bits/sec

Double Density: 500K bits/sec

Capacity:

.985 Megabyte, formatted

ENVIRONMENTAL RANGE

temperature: 16 to 32 degrees C

relative humidity: 8 to 80%

FACILITIES PLANNING

The Computer System requires no particular facilities other than sufficient bench or desk space and a power outlet of 110 V ac, 60 Hz.

The dimensions and weights listed below do not include a separate drive cabinet (see the subsection "Diskettes"). A minimum clearance of 8 inches between drive cabinet and main processor housing is recommended.

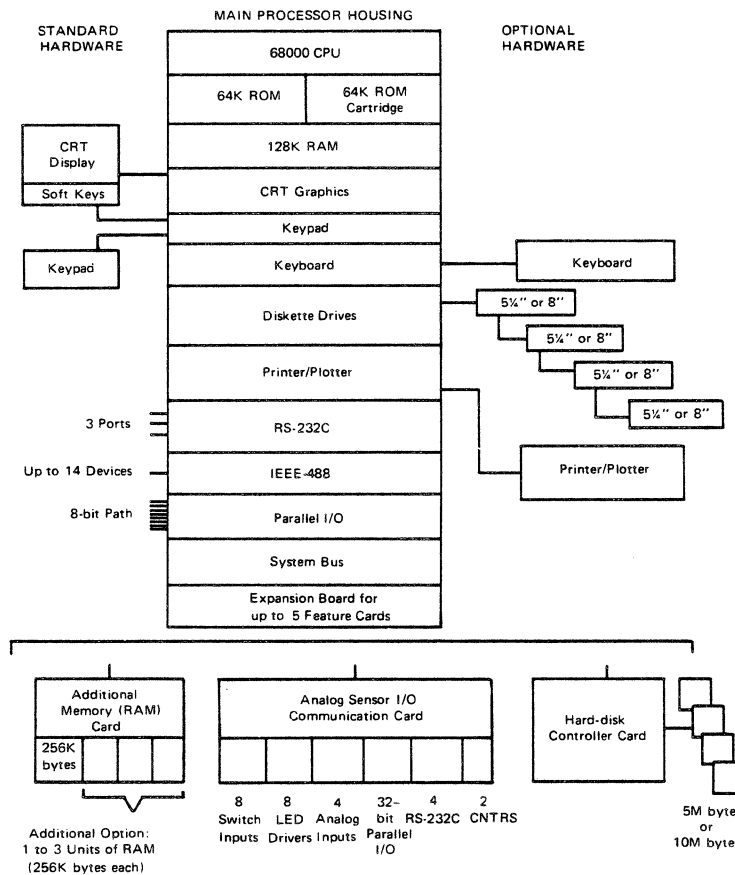
Overall Dimensions

	Height	Width	Depth	Weight
System with keyboard	59 cm 23.2 in	43.7 cm 17.2 in	75 cm 29.5 in	35.8 kg 78.8 lb
Base System Unit	59 cm 23.2 in	43.7 cm 17.2 in	56.6 cm 22.3 in	25.8 kg 56.8 lb

CHAPTER 3. ORDER INFORMATION

This chapter lists the components of the Computer System and the identifying feature numbers to be used in ordering them (see pages 3-2 through 3-4). The components listed are of three types -- standard, specify, and optional. Standard components are those automatically provided with the Base System Unit. A specify component is one that the buyer must choose (specify) from among a group of two or more such components. An optional component is not automatically supplied with the Base System Unit -- the buyer wishing to purchase an optional component must order it as a separate item. The diagram below is a schematic representation of the possible configurations of standard and optional units.

Terms and conditions of purchase, as well as a warranty statement, are given on page 3-5.



HARDWARE

Type of Feature	Feature Number	Description
STANDARD	9000	Base System Unit* Processor Power supply CRT display Soft keys Keypad select: A overlay w/wo PRT control B overlay w/wo PRT control C overlay w/wo PRT control
SPECIFY	F9150	General purpose keypad overlay (All keys blank)
	F9160	Chromatography Application Package (CAP) keypad overlay
	F9170	IBM LC/9533 and CAP keypad overlay

* Orders must include one of the three specify features.

Type of Feature	Feature Number	Description
OPTIONAL		
	F8000	Expansion feature card with 5 slots (Maximum of one)
	F4040	Analog sensor I/O card (See Note 1)
	F1001	Memory expansion card with 256K bytes RAM (See Note 1)
	F1010	Additional 256K bytes RAM (Maximum of 3 per memory expansion card)
	F2501	Hard-disk controller (Requires F6100; see Notes 1 and 3)
	F3000	Keyboard
	F3200	Printer/Plotter (Requires keypad overlay with PRT opening)
	F2000	Single 5¼-inch diskette drive (See Note 2)
	F2020	5¼-inch diskette drive housing with one drive (See Note 2)
	F2021	5¼-inch diskette drive housing with two drives (Requires F1021)
	F2080	8-inch diskette drive housing with one drive double-sided/double-density (see Note 2)
	F2081	8-inch diskette drive housing with two drives (Requires F1030; see Note 2)
	F2505	5¼-inch, 5-megabyte Winchester disk drive (Requires F2501)
	F2510	5¼-inch, 10-megabyte Winchester disk drive (Requires F2501)

SOFTWARE

Type of Feature	Feature Number	Description
STANDARD		Operating System (ROM) Diagnostics (ROM)
OPTIONAL		
	F6010	BASIC programming language
	F6100	Operating System Extensions (See Note 4) Text Editor Macro Assembler Linker/Loader/Librarian Disk Utilities
	F7000	Chromatography Application Program (Requires F4040; see Note 4)

NOTES

- (1) Requires Expansion Feature F8000 and uses one slot.
- (2) A maximum of 4 diskette drives in any combination may be attached to main processor.
- (3) A maximum of 4 hard-disk drives in any combination may be attached to controller.
- (4) Requires at least 1 diskette drive F2000, F2020, or F2080.

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Prices are subject to change without notice. IBM's products and services can be ordered only under the terms and conditions of IBM's applicable agreement or quotation forms. Contact your IBM Instruments representative or your nearest IBM Instruments support center for details or call the following toll-free number: 800-243-7054. (In Connecticut call 800-952-1073.)

WARRANTY

IBM warrants that the Computer System is, at the time of delivery, free from defects in materials and workmanship and that it will conform to official Product Specifications. The period of coverage is 3 months for the computer, features, accessories, and supplies.

Software is delivered "as is" without warranty of any kind. However, IBM warrants the diskette(s) or cassettes on which the software is furnished to be free from defects in materials and workmanship for 3 months from the date of delivery.

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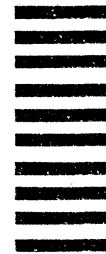
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