IBM System/32

MANAGEMENT SUMMARY

Introduced in January 1975, the System/32 is one of IBM's biggest success stories. Available in 32 models, the System/32 is packaged in a compact, desk-sized cabinet that includes all components of the basic system — the CPU, memory, CRT display with keyboard, printer, disk storage unit, and diskette drive. It can be installed in a standard office setting and requires no special flooring, air conditioning, or power supplies. An optional keylock is available to provide greater security.

The 32 different models in the System/32 are based on their various printing capabilities and disk storage capacities. Over the years of its existance, IBM has made a number of refinements to the System/32 in response to competition, hence the large variety of models. The basic system comes with 16K bytes of MOS main memory and 3.2 million bytes of nonremovable disk storage. Main memory can be increased in 8K-byte increments to a maximum 32K bytes. Disk storage can be had in three additional increments above 3.2 Mbytes; 5.0, 9.1, and 13.7 Mbytes. The size of the disk storage is used to determine the model selected, as is the type of printer.

System/32 users can select from a number of different printers: a unidirectional serial 40 cps unit, bidirectional units with speeds of 40, 80, or 120 cps, or four 132-position line printers with speeds of 50, 100, 155, or 285 lines per minute. Only one printer can be used in a System/32.

The System/32 can be programmed for either batch or interactive processing. Data can be entered in one or two ways: the standard keyboard/CRT or off-line through a 3740 Data Entry System that generates key to diskette data. In addition, optional data communications facilities ➢

Introduced in 1975, the System/32 has been an extremely successful product for IBM with an estimated 15,000-plus systems installed worldwide. Available in 32 packaged models, the System/32 ranges in price from $23,490 to $35,300.

MAIN MEMORY: 16K to 32K bytes.
DISK CAPACITY: 3.2 to 13.7 megabytes.
WORKSTATIONS: Single-station system.
PRINTERS: 40 cps to 285 lpm.
OTHER I/O: Punched card, magnetic card, MICR.

CHARACTERISTICS

MANUFACTURER: International Business Machines Corporation, General Systems Division, 875 Johnson Ferry Road N.E., Atlanta, Georgia 30342. Telephone (404) 231-3000.

MODEL: System/32. There are 32 submodels that vary with internal disk storage capacity and printer type. The System/32 was first announced in January 1975.

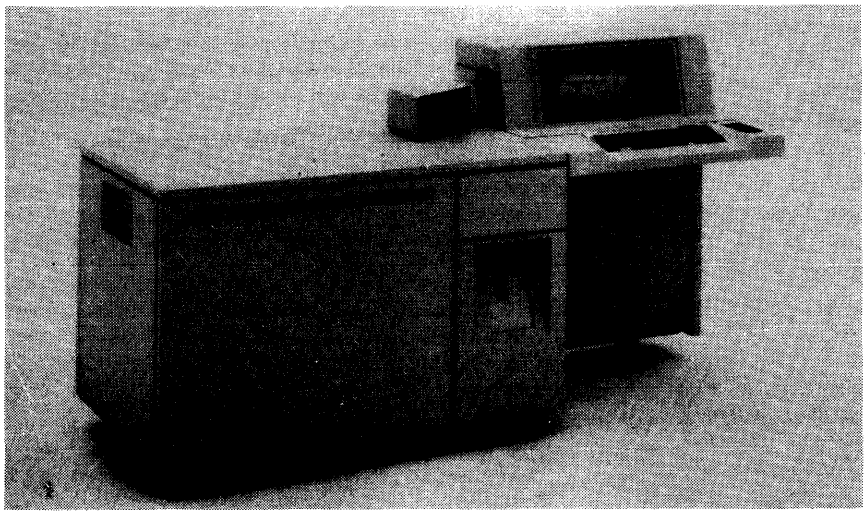
NUMBER INSTALLED TO DATE: Over 15,000 estimated worldwide.

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent one alphanumeric character, one BCD digit, or eight binary bits.

FIXED-POINT OPERANDS: Can range from 1 to 16 digits for source fields and from 1 to 31 digits for result fields. Logical operands can range from 1 to 256 bytes.

FLOATING-POINT OPERANDS: No hardware facilities for floating-point arithmetic are provided. ➢



IBM's highly successful small business computer, the System/32, is a compact, desk-sized system available in 32 different models. Each model has either a serial or line printer, available in several speeds, and four different levels of fixed disk capacity. Using IBM's Industry Application Programs, the System/32 is an ideal system for first-time computer users.

REFERENCE EDITION: This is a mature product line, and no significant further developments are anticipated. Because of its importance, coverage is being continued, but no future update is planned.

IBM System/32

enable the System/32 to operate as a remote terminal or a satellite processor within a communications network using larger IBM computers.

Off-line and back-up storage for additional data is provided by IBM diskettes (or "floppy disks"), which have a capacity of up to 246,272 bytes of data in the standard System/32 format or 303,104 bytes in a special "extended" format. The diskette also serves as one of the principal vehicles for data entry, and has a capacity of 242,944 bytes when data is recorded off-line using an IBM 3740 Data Entry System. Magnetic tape capabilities, however, are noticeably absent from the System/32 product line.

The central processor utilizes bipolar logic and features an 8K-byte MOSFET writable control storage unit to contain the microcode that controls the operation of the system. Data is represented in 8-bit bytes in EBCDIC format. IBM specifies that the average internal (micro-level) machine instruction time is 1 microsecond. Other performance parameters of the System/32 include the ability to overlap input/output processing with internal processing (except for diskette operations), a transfer rate of 889,000 bytes per second between the disk file and main memory, and a 600-nanosecond main memory cycle time.

A System/32 can be equipped with only one communication line to handle half-duplex data transmission in either the binary synchronous (BSC) or Synchronous Data Link Control (SDLC) protocol. In the binary synchronous mode, it can communicate with another System/32, a System/34, a System/3, a System/7, a System/360, a System/370, a 5320 Model 2 Data Collection System, a 3747 Data Converter, a 3741 Model 2 Data Station, or a 3741 Model 4 Programmable Work Station. The SDLC line discipline is a fundamental component of IBM's System Network Architecture for future communications products. SDLC on the System/32 enables it to perform as a remote workstation to larger System/370 computers operating under the DOS/VS, OS/VS1, or OS/VS2 operating system. There is also an enhancement that allows a System/32 to appear as an IBM 3770 Data Communications System and to operate with IBM's CICS/VS communications monitor or IMS/VS data base management system on a System/370.

High reliability is one of the cornerstones of the System/32. IBM has seen to it that there are enough diagnostics supplied with each System/32 to make it virtually maintenance-free. As attested in Datapro's user survey, this philosophy has been very successful for IBM. Not to mention very gratifying to the many satisfied System/32 users who have had minimal maintenance problems. System/32 customers who rent the equipment have access to 24-hours-per-day, 7-days-per-week on-call maintenance service from IBM. Customers who purchase the system receive 5-days-per-week, 9-hours-per-day maintenance service under the Minimum Monthly

INSTRUCTIONS: 4, 5, or 6 bytes long in 2-address format; 3 or 4 bytes long in 1-address format; 3 bytes long in command format. (Each address can be represented by either a 2-byte direct address or a 1-byte "displacement," and all instructions contain a 1-byte operation code and a 1-byte "Q" code.)

In the one-address format, the Q-byte may contain an immediate operand, a mask, a branch condition, or a mode selection. In the two-address format, the Q-byte designates the address length or contains a fixed hexadecimal value. In a command machine instruction, the Q-byte contains a device address and function specification, a jump condition, or a transfer function.

The operation code of all System/32 instructions is divided into three fields composed of either two or four bits. Bits zero and one specify operand one main storage addressing activity for the instruction; bits two and three function similarly for operand two. Bits four through seven define the type of operation to be performed.

INTERNAL CODE: EBCDIC (Extended Binary-Coded Decimal Interchange Code).

MAIN STORAGE

TYPE: MOSFET (metal oxide semiconductor field effect transistor) integrated circuits.

CYCLE TIME: 600 nanoseconds per 1-byte access.

CAPACITY: 16,384 bytes standard in all models; expandable to 24,576 or 32,768 bytes through installation of one or two 8K Additional Storage modules.

CHECKING: A parity bit with each byte, generated during writing and checked during reading.

STORAGE PROTECTION: None.

RESERVED STORAGE: 2K bytes are reserved for SCP (System Control Programming) functions in all models; the remainder of main storage is available for user programming.

CENTRAL PROCESSOR

The System/32 central processing unit is a microprocessor that uses bipolar logic circuits and is physically located on a swing-open gate in the lower left front portion of the cabinet.

The CPU is identical in all submodels. The submodels all have certain integral peripheral units built into the processor housing. These include a printing unit, a keyboard, a single-platter removable disk unit, a diskette unit, and a CRT display. The differences among the various submodels center on the capacity of the nonremovable disk unit and the type and speed of the printer.

CONTROL STORAGE: The microprograms that control the processor's operations are stored in 4K 16-bit words of MOSFET writable control storage.

REGISTERS: Index Registers 1 and 2 (XR1 and XR2) are each two bytes long and are used to hold a base address for base-displacement addressing. The Instruction Address register (IAR) is a two-byte register whose purpose is to hold the address of the first byte of the next sequential instruction. The Address Recall Register (AAR) functions to hold the return address whenever a program branches to a subroutine

IBM System/32

PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION AND SPEED	MANUFACTURER
INTEGRAL WITH PROCESSOR		
Diskette Drive	Reads/writes up to 242,944, 246,272, or 303,104 bytes/diskette depending on format; for more information, see Mass Storage; 31,250 bytes/sec.	IBM
Disk Drive	Nonremovable disk; reads/writes up to 3,210,240, 5,053,440, 9,169,920, or 13, 777, 920 bytes/drive; for more information, see Mass Storage; 889K bytes/sec.	IBM
Serial Printer	Unidirectional, 7 x 7 dot matrix, 132 positions, 64-character set; for more information, see Input/Output Units; 40 cps	IBM
Serial Printer	Same as above, but bidirectional: 40, 80, or 120 cps	IBM
Line Printer	Horizontal belt; 132 positions, 48, 64, or 96 character sets; for more information, see Input/Output Units; 50, 100, 155, 285 lpm (48 character set)	IBM
Display	CRT with 240 alphanumeric characters, 6 lines by 40 characters, 64 EBCDIC or ASCII character set; for more information, see Input/Output Units	IBM
PUNCHED CARD EQUIPMENT		
5496-1	Data Recorder; 96-column, 64-character set, four program levels, buffered I/O areas, 350-card hopper and stacker; reads, punches and prints up to 21 cpm	IBM
129-2	Data Recorder; 80-column, 48- or 64-character set, six program levels, buffered I/O, 500-card hopper and stacker; reads 50 cpm, punches and prints 12 to 50 cpm	IBM
MAGNETIC CARD & MICR EQUIPMENT		
5321	Magnetic Card Reader/Recorder; 102 characters/track, 50 tracks/card, 50-card hopper; not operable within same program as diskette drive, BSCA, or SDLC; read rate, 230 milliseconds/track recording rate, 450 milliseconds/track	IBM
1255	Magnetic Character Reader; intermixed paper and card documents 2.5 to 4.25 inches wide, 5.75 to 8.875 inches long, and 0.003 to 0.007 inch thick; Models 1 & 2—off-line 2-pass digit sort and 6 stackers; Model 3—off-line single-pass digit sort and 12 stackers; not operable within same program as diskette drive, BSCA, or SDLC; 500 documents per minute for Model 1; 750 documents per minute for Models 2 and 3	IBM
PRINTER		
46/40	Ink Jet Document Printer; electrostatic, 117,000 ink droplets/second, integrated magnetic card reader/recorder; for more information, see Input/Output Units; 77 or 92 characters per second	IBM
TERMINALS		
3741 Model 2	Keyboard-to-Diskette Data Entry Station with BSC interface; for more information, see Input/Output Units; 1200, 2000, or 2400 bps remote; 31,250 bytes/sec. local	IBM
3741 Model 4	Same as Model 2 but programmable	IBM
5230	Data Collection system with optional BSC interface; for more information, see Input/Output Units; up to 2400 bps	IBM

IBM System/32

Maintenance Charge, or they can elect round-the-clock service for an additional charge.

The System/32 is known for its ease of operation, and IBM offers a wide variety of Industry Application Programs to help users get started. There are 14 packages available, aimed at users in areas such as distribution, education, medicine, manufacturing, accounting, legal services, and membership organizations. Many of the IAP's are modular, allowing combinations of modules from various IAP's to be used together. All modules can be used on System/32's with 16K to 24K bytes of main memory.

The System/32 has word processing capabilities based on the availability of a letter-writing IAP, a Word Processor/32 program product, magnetic card reader/recorders, ink jet printer, and other options that enhance print style and format generation. Input can be provided from the keyboard or via pre-recorded magnetic cards or diskettes. The System/32's word processing abilities are comparable to most other CRT-based intelligent systems, although this technology has taken great strides in the past few years.

Operating system support for the System/32 is supplied by a 2K-byte System Control Program (SCP) plus a separately priced utility program product that includes a Sort Utility, a Data File Utility, and a Source Entry Utility. The SCP and Sort utility capabilities are similar to those for the System/3 Model 6. For those users who wish to write their own programs, RPG II, the most widely used of the three programming languages now available for the System/32, also provides processing capabilities similar to those of the System/3 Model 6 version, including the Auto Report and RPG II Telecommunications Feature. The other available languages are an assembler with macro capabilities and a FORTRAN IV compiler.

The System/32's design is based largely on components of IBM's earlier System/3 Model 6. Some of the enhancements made on the System/32 that have made it so successful are: (1) increased data entry capabilities through the system's internal diskette drive, (2) a wide range of printing devices, particularly line printers, (3) improved RPG II Operation Control Language (OCL) for greater ease in developing user-written programs, and (4) Industry Application Programs. Conversions between the System/3 and System/32 are fairly easy to accomplish.

The System/34, announced in April 1977, offers a number of significant enhancements over the System/32. In particular, the System/34 can handle up to eight independently functioning users, while the System/32 can handle only one. The System/34 can also operate in a batch mode, and can even include a batch job in its eight-job capacity. It has greater internal storage, disk storage, and nearly eight times the internal processing speed of the System/32. It's also very competitive with the System/32 on price/performance comparisons, and should be

following a test and branch or branch on condition instruction. The ARR is two bytes long.

ADDRESSING: The System/32 has two 16-bit index registers. The contents of either register can be added to a one-byte address (or "displacement") contained in an instruction, permitting base-plus-displacement addressing of any higher storage location within 256 bytes of the base address contained in the register. Two-byte direct addresses may also be used.

INSTRUCTION REPERTOIRE: The System/32 has a repertoire of 158 basic operation codes used for functions, including addition and subtraction of unpacked (1 digit per byte) decimal operands, but no multiply or divide. Also included are an edit instruction and addition, subtraction, and comparison of logical characters. Eleven operation codes are used for input/output processing. Aside from I/O instructions, there are six arithmetic, 11 data handling, one no-operation, one supervisor call, four logical, one branch, one transfer, and one jump instruction.

There are about 300 instructions implemented on the System/32, built around the 158 operation codes presently being utilized. Included in this large instruction set is the scientific set, required if the user implements FORTRAN IV.

INSTRUCTION TIMINGS: The following average times, in microseconds, assume the use of direct (2-byte) operand addresses.

Decimal add (5 digits)	**150.8**
Decimal subtract (5 digits):	**150.8**
Binary (logical) add (5 bytes):	**72.0**
Binary (logical) subtract (5 bytes):	**71.4**
Move (5 bytes):	**42.6**
Compare (5 bytes):	**56.2**
Load or store register (2 bytes):	**19.8 to 25.2**
Add to register (2 bytes):	**26.2 to 38.2**
Jump or condition:	**26.2 to 28.8**

INTERRUPTS: At the end of most I/O operations, the microprocessor issues a signal that the operation has ended and causes the program to branch to a special interrupt handler routine. Interrupts for the disk drive and printer are handled entirely by the hardware, while programs must be provided to handle the keyboard, BSCA, and SDLC interrupts.

PHYSICAL SPECIFICATIONS: The 5320 System Unit, a single desk-size cabinet that houses all components of the System/32, is 70 inches wide, 27 inches deep, and 38 inches high. It weighs 640 pounds.

Power requirements are 208 or 230 VAC ±10 percent, 60 Hertz ±0.5 Hertz in the U.S.; 100, 110, 123.5, 200, 220, or 235 VAC ±10 percent, 50 Hertz ±0.5 in Europe; and 100 or 200 VAC ±10 percent, 60 Hertz ±0.5 Hertz in Japan. The system power requirement is 1.0 KVA, and the permissible operating environment is from 60° to 100° F. and from 8% to 80% relative humidity. Hence, air conditioning is not required for the system except in extreme operating environments, but IBM recommends normal office air conditioning for operator comfort. The system dissipates between 2000 BTU's (Model A) and 2750 BTU's (Model C) of heat per hour. Service area and general machine requirements indicate the need for a floor area of 10.3 feet by 7.2 feet.

INPUT/OUTPUT CONTROL

SIMULTANEOUS OPERATIONS: All System/32 input and output operations are overlapped with each other and

IBM System/32

considered as an alternative to the System/32 for prospective small business computer users.

USER REACTION

Datapro received 48 responses from System/32 users in the 1980 survey of computer users, representing a total of 48 installed systems. Of the 48 systems included, 28 had the minimum 16K bytes of memory, 7 had 24K bytes, 9 had the maximum 32K bytes, and 4 did not specify the amount of memory in their systems.

All respondents were using RPG II to write their applications programs. Most of the programs being used in addition to those developed in-house were IBM Industry Application Programs (IAP). In just about all cases, traditional business applications, such as accounts payable/receivable, personnel, payroll, etc., predominated. Only one user indicated data communications applications.

The average time these systems were installed was 32.8 months, ranging from 4 to over 100 months. Of the 48 users, 24 leased their system from IBM, 7 rented, and 17 purchased their System/32.

Most systems were evenly divided between 9.1 and 13.7 million bytes of disk storage, with only one system reporting 5.0 million bytes.

We've tabulated the results of the 1980 survey, and added an extra column with the results of the 1977 survey for comparison. The results are shown below:

	Excellent	Good	Fair	Poor	WA*	1977 WA*
Ease of operation	28	13	4	0	3.5	3.6
Reliability of mainframe	39	9	0	0	3.8	3.8
Reliability of peripherals	26	8	1	0	3.7	3.6
Maintenance Service:						
Responsiveness	30	17	1	0	3.6	3.6
Effectiveness	33	12	2	0	3.7	3.5
Technical Support:						
Trouble-shooting	18	17	4	1	3.3	N/A
Education	17	18	7	2	3.1	N/A
Documentation	21	19	4	2	3.2	N/A
Operating System	24	19	2	0	3.5	3.3
Compilers and assemblers	24	19	2	0	3.5	3.2
Applications programs	8	16	9	1	2.9	2.7
Ease of programming	24	20	3	0	2.9	3.3
Ease of conversion	10	19	3	4	3.0	3.1
Overall satisfaction	22	22	3	0	3.4	3.3

*Weighted Average on a scale of 4.0 for Excellent.

We contacted 10 of the 48 System/32 respondents around the country for additional comments and information on their applications. A northeastern independent insurance agency has had its System/32 over three years, and is very pleased with it. They use it for the usual financial applications, as well as billing and policy preparation. It also does a lot of the agency's word processing activities, which represents a large part of their workload. According to this user, the System/32 handles with internal processing, except for diskette reading and writing.

CONFIGURATION RULES

Every System/32 is a "packaged" configuration consisting of a single desk-size cabinet that houses the central processing unit, main storage, fixed-disk storage unit, diskette drive, serial or line printer, keyboard console, and display screen. The 32 current models of the System/32 are distinguished by their printing capabilities and disk storage capacities, as shown in the following matrix:

	Disk Storage, megabytes			
Printer	**3.2**	**5.0**	**9.1**	**13.7**
40 cps, unidirectional	**A01**	**A02**	**A03**	**A04**
40 cps, bidirectional	**A11**	**A12**	**A13**	**A14**
80 cps, bidirectional	**A21**	**A22**	**A23**	**A24**
120 cps, bidirectional	**A31**	**A32**	**A33**	**A34**
50 lpm	**B11**	**B12**	**B13**	**B14**
100 lpm	**B21**	**B22**	**B23**	**B24**
155 lpm	**B31**	**B32**	**B33**	**B34**
285 lpm	**C41**	**C42**	**C43**	**C44**

All models have a basic main storage capacity of 16K bytes, which can be expanded to 24K or 32K bytes, and all models can be equipped for data communications by installing either the SDLC or BSCA feature, as described under COMMUNICATIONS CONTROL. Changes from one model to another can be made in the field. Only one input/output unit of each type can be used in a System/32.

MASS STORAGE

DISK STORAGE: A disk unit containing either 3,210,240, 5,053,440, 9,169,920, or 13,777,920 bytes of nonremovable disk storage is an integral component of every System/32. The disk unit consists of either 104, 164, or 298 cylinders of 2 tracks each or 299 cylinders of 3 tracks each. Each track, in turn, contains 60 sectors of 256 bytes each.

All data is recorded on one side of a single fixed disk that is served by two read/write heads mounted on a pivoting access arm. The disk is mounted vertically on the lower left part of the System/32 cabinet, behind the CPU logic and main memory.

The disk rotational speed is 2964 rpm, yielding a nominal data transfer rate of 889,000 bytes per second and an average rotational delay (latency) of 10.1 milliseconds. Head positioning times for the four models, in milliseconds, are as follows:

	Average	Minimum	Maximum
3.2-megabyte unit:	**50.4**	**13**	**121**
5.0-megabyte unit:	**70**	**13**	**180**
9.1-megabyte unit:	**72.5**	**14.2**	**166.9**
13.7-megabyte unit:	**72.5**	**14.2**	**166.9**

INPUT/OUTPUT UNITS

Described below are the peripherals which are integral with the processor; plus the ink jet printer, the 3740 Data Entry System, and the 5230 Data Collection System. For other peripherals, see the Peripherals/Terminals table.

DISKETTE DRIVE: A single drive unit that reads and writes data on flexible diskettes is an integral component of every System/32. The data capacity of each diskette is 242,944 bytes (1898 records of 128 bytes each) when used to exchange data between a System/32 and a 3740 Data Entry System or other IBM equipment. Diskettes to be used exclusively with a System/32 can contain up to 246,272

IBM System/32

it all very well. This agency had replaced a System/3 with their System/32.

A northeastern industrial distributor had its System/32 for over four years, until it converted to a System/34. Because of the company's growth and need for multiple terminals and greater processing power, the System/32 was finally upgraded to the more powerful System/34. The company's DP manager said the System/32 is "an excellent choice as a first computer."

A governmental organization in New York City replaced its use of a service bureau with a System/32 and was very pleased with the system, until its needs increased with business growth. They, too, recently installed a System/34 and are very pleased with the new unit. Nonetheless, the System/32 performed completely to their expectations.

Two users in the midwest, both manufacturing firms, went from a service bureau to a System/32, and were extremely pleased with their systems. Both of these users also outgrew their System/32. One user replaced his System/32 with a competitive model, and shipped the System/32 off to a sister company, where it's now performing happily for its new owners. This user installed a larger system from a competitor because IBM couldn't deliver its proposed system soon enough. The other user installed a System/34 but commented that his company "wouldn't have grown as fast without the System/32."

Two users we contacted in the southwest, a CPA firm and an engineering and construction company, both replaced manual record systems with System/32's. The CPA firm still has its System/32 and is generally pleased with it, although the DP manager commented that IBM is "really not doing anything on the System/32 anymore." Although he observed that IBM's Industry Application Programs are slow, they still do the job for his company. The engineering firm didn't consider anybody else but IBM when choosing their first computer, another typical comment. Only two weeks ago they finally sold their System/32, after five years of satisfied use. They installed a System/34 over a year ago but kept the System/32 for special construction projects.

An architecture firm in the southeast had its System/32 for three years, and the system worked "flawlessly," but was "too expensive." The DP manager told us he started looking at the new crop of microcomputers on the market and selected one several months ago. It's been in since April and working quite well, he added.

Finally, the last two users we contacted both replaced IBM System/3's with a System/32 and are still using their machines today. A southeastern manufacturer was very pleased with his system, but not with the service. He also commented the conversion from System/3 to System/32 was difficult, as did the other user, a western lumber distributor. Overall, both users gave high marks to the system, and were not actively considering any alternatives.

bytes of data in the standard format (128-byte sectors) or 303,104 bytes in "extended" format (512-byte sectors).

Data is read from or written on a diskette at a nominal speed of 31,250 bytes per second. Diskette records can be read at the rate of up to 3400 128-byte records per minute and written and verified at up to 1800 128-byte records per minute.

KEYBOARD: The System/32 keyboard is used by the operator to enter data and control the system's functions. It consists of a standard typewriter keygroup, a 10-key numeric keygroup arranged in adding-machine fashion, and a group of function keys. In addition, the typewriter keys in the top row are dual-defined, providing a total of 24 command keys for controlling program functions.

A small operator panel, located at the right of the keyboard, contains the power on/off switch; LOAD, START, and STOP keys; and indicator lights that signify Keyboard Ready, Processor Check, Thermal Check, and Power Check conditions. The power on/off switch can be replaced by an optional key-operated switch that protects against unauthorized use of the system.

A dual-case keyboard and display is available as an option on all B and C models. This feature provides upper and lower case characters and additional graphics, as well as redefining the character/graphic arrangement of the System/32 keyboard. The ASCII keyboard character set and the integral line printer with 6 or 8 lines per inch spacing are mutually exclusive with this feature.

DISPLAY: A small CRT display screen, located just to the left of the keyboard and printer, is an integral component of every System/32. It can display up to 240 characters of information in 6 lines of 40 characters each. The display is used to provide operator guidance, input verification, and auxiliary output under program control. The System/32 will normally be programmed to display all data entered via the keyboard so that the operator can verify its accuracy before the system acts upon it.

SERIAL PRINTER: A serial matrix printer is an integral component of every System/32 Model A. Four different serial printers are currently available: a unidirectional model rated at 40 characters per second, and three bidirectional models rated at 40, 80, and 120 characters per second. Matrix characters are formed by 8 wires arranged in a vertical array, with each wire printing dots in up to 4 of 7 possible horizontal positions. The character set consists of 64 ASCII or EBCDIC symbols, and there are 132 print positions, spaced 10 to the inch.

LINE PRINTER: A horizontal-belt line printer is an integral component of every System/32 Model B or C. The rated printing speed, in lines per minute, depends upon the specific model and character set chosen, as follows:

	Character Set		
	48	64	96
Models B11, B12, B13, B14	50	50	50
Models B21, B22, B23, B24	100	100	80
Models B31, B32, B33, B34	155	120	80
Models C41, C42, C43, C44	285	225	160

Characters are formed by means of an interchangeable metal print belt with an engraved type font in one of several character sets: 48- or 64-character EBCDIC, 48-character FORTRAN, 64-character ASCII, or 96-character dual-case modified Courier or Artisan. There are 132 print positions, spaced 10 to the inch.

IBM System/32

While it's clear the System/32 is highly regarded by its users, it does have its limitations in growth. In each case, where a bigger system was installed, business growth was the attributing factor, not system failure. Furthermore, the vast majority of users who did upgrade stayed with IBM; another typical trait of System/32 users.□

Feature 4530 provides half-line vertical spacing on B and C models, allowing subscripting and superscripting with the Artisan and modified Courier print belts. This feature cannot be installed on machines with eight lines per inch vertical spacing or the data recorder attachment.

INK JET PRINTER: The 46/40 Document Printer is a stand-alone ink jet printer with its own microprocessor and integrated magnetic card reader/recorder capable of accepting a stack of up to 200 cards prepared on IBM magnetic card typewriters. Formatting and playback printout tasks are performed by the 46/40 while the magnetic card typewriters are used for input keying and initial text editing.

Characters are formed by droplets of ink, directed to the paper at the rate of 117,000 per second. Actual printing speed varies with the pitch selected (all three are standard on the 46/40)—77 characters per second for the 10-pitch and 92 characters per second for 12-pitch and proportional spacing.

A communications option is available for transmission of data recorded on magnetic cards to a host computer or another 46/40. Incoming data can be either printed or recorded onto black magnetic cards in both attended and unattended modes. Transmission speeds range from 600 to 2400 bits per second.

3740 DATA ENTRY SYSTEM: This key-to-diskette system can be used off-line to record data on diskettes for entry into a System/32 via its integral diskette drive. Alternatively, a 3741 Model 2 or Model 4 can communicate directly with a System/32 equipped with the Binary Synchronous Communications Adapter (BSCA).

The basic components of a 3740 Data Entry System are the 3741 Data Station, 3741 Programmable Work Station, and 3742 Dual Data Station. The 3741 Model 1 and 2 Data Stations are alike except that Model 2 includes a binary synchronous communications interface. The 3741 Model 3 and 4 Programmable Work Stations are like the 3741 Models 1 and 2, respectively, with the addition of user programming capability. All models can be equipped with a 40-character-per-second 3713 Printer or a 155-line-per-minute 3717 Printer.

Every 3741 Data Station or Programmable Work Station includes a microprocessor, a CRT unit for data, control, and status display, and a diskette drive; a second drive can be added. The 3742 Dual Data Station provides two operator stations that have independent diskette drives but share the CRT unit and microprocessor.

All models of the 3741 and 3742 provide facilities for recording manually keyed data on diskettes and for verifying previously keyed data. Each diskette can hold up to 1,898 data records, and the records can vary from 1 to 128 characters in length.

5230 DATA COLLECTION SYSTEM: This system is composed of 5234 Time Entry Stations and 5235 Data Entry Stations connected to a 5231 Controller. Time Entry Stations can read punched-hole or magnetic badges. Data Entry Stations can read 80- or 96-column cards and/or hole and magnetic badges. The 5234 also has the facility for keyed numeric entry of up to three 8-digit fields. The 5231 Controller can handle up to 15 time and/or data entry stations in any combination and is nonprogrammable. The 5231 Model 1 provides 96-column punched card output, while the 5231 Model 3 provides 80-column punched card output. The 5231 Model 2 provides diskette output and the facility for transmission over a switched or nonswitched point-to-point BSCA communications line at 600, 1200, 2000 or 2400 bps.

COMMUNICATIONS CONTROL

6301 SYNCHRONOUS DATA LINK CONTROL (SDLC) COMMUNICATIONS: This optional feature, in conjunction with stored-program control, enables a System/32 to communicate with a System/370 Model 115, 125, 135, 145, 155-II, 158, 158MP, 165-II, 168, or 168MP computer via an appropriately equipped 3704 or 3705 Communications Controller. The System/370 must be operating under DOS/VS, OS/VS1, or OS/VS2 VTAM, and the 3704/3705 under NCP/VS.

The SDLC feature enables the System/32 to communicate in half-duplex mode at a speed of up to 7200 bps on a single non-switched point-to-point or multipoint line, or at up to 4800 bps on a switched point-to-point line. This feature will operate in half-duplex mode over switched network (dial) facilities and non-switched or equivalent private communications lines which may be duplex or half-duplex facilities. The System/32 operates as an SDLC secondary station and can share a communications line with other IBM SDLC terminals using the same transmission rate. Data transmission or reception is overlapped with System/32 processing and/or I/O operations other than diskette reading or writing.

Only one SDLC feature can be installed on a System/32, and the SDLC and BSCA features are mutually exclusive. A prerequisite is either one of the IBM integrated modems or the EIA Interface, as described below.

2074 BINARY SYNCHRONOUS COMMUNICATIONS ADAPTER (BSCA): This optional feature, in conjunction with stored-program control, enables a System/32 to function as a processor/terminal communicating with any of the following IBM devices on a switched, nonswitched, or private communications line:

- Another System/32 equipped with the BSCA.
- A 6640 Document Printer equipped with the BSC/EBCDIC feature.
- An IBM Office System 6/430, 6/440, or 6/450 equipped with the BSC/EBCDIC feature.
- An IBM Mag Card II typewriter.
- A System/3, System/7, or System/360 Model 20 computer equipped with a BSCA.
- A System/360 or System/370 computer via an Integrated Communications Adapter, 2701 Data Adapter Unit, or 3704 or 3705 Communications Controller equipped for binary synchronous communications.
- A 3741 Model 2 Data Station or 3741 Model 4 Programmable Work Station.
- A 3747 Data Converter.
- A 5230 Model 2 Data Collection System.

The BSCA feature enables the System/32 to communicate in half-duplex mode at a speed of up to 7200 bps on a single

IBM System/32

non-switched point-to-point or multipoint line, or at up to 4800 bps on a switched point-to-point line. The transmission code may be ASCII, EBCDIC, or EBCDIC Text Transparency, as selected at program compilation time. Data transmission or reception is overlapped with System/32 processing and/or I/O operations other than diskette reading or writing.

On a multipoint line, the System/32 operates as a tributary station. No support is provided for the System/32 to operate as a control station on a multipoint line; therefore, communication with other devices which do not provide control station capability must be done on a point-to-point line only.

Like the SDLC, the BSCA will operate in half-duplex mode over dial (switched network) facilities, and in half-duplex mode over non-switched or equivalent private communication lines which may be duplex or half-duplex facilities.

The BSC devices at all termination or drop points of a data link to which the System/32 is connected must use the same transmission rate, code, and clocking source (modem or business machine). When used on a multipoint line, the System/32 operates as a BSC tributary station; it is not supported for operation as a control station. Therefore, communications with other BSC devices which do not have control station capability must be accomplished via a non-switched point-to-point line.

Only one BSCA feature can be installed on a System/32, and the BSCA and SDLC features are mutually exclusive. A prerequisite is either one of the IBM integrated modems or the EIA Interface, as described below. Neither the SDLC nor BSCA can operate within the same program as card I/O, the 5321 Mag Card Unit, the 1255 Magnetic Character Reader, or the diskette drive.

INTEGRATED MODEMS: IBM offers a choice of five integrated modems for use with a System/32 equipped with either the SDLC or BSCA feature. Their characteristics follow:

#5500—1200 bps, non-switched.
#5501—1200 bps, switched network with Auto Answer.
#5600—2400 bps, non-switched point-to-point.
#5602—2400 bps, non-switched multipoint tributary.
#5610—2400 bps, switched network with Auto Answer.

Only one integrated modem can be installed in a System/32, and the Processing Unit Expansion feature is required when any one of the three 2400 bps modems is chosen.

SWITCHED NETWORK BACKUP (SNBU) FEATURE: Available with (7952) or without (7951) an Auto Answer capability, SNBU provides for backup attachment of the System/32 to the public switched network when one of the 2400 bps integrated modems (#5600 or #5602) is used on a non-switched line as the prime communications link. SNBU can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1, and OS/VS2 in certain configurations or with TCAM/VTAM under OS/VS1 or OS/VS2. One SNBU can be installed on a System/32. SNBU with auto-answer is mutually exclusive with SNBU and SDLC. This feature requires the 2074 BSCA, a 5600 or 5602 Integrated Modem, and a 5733 Processing Unit Expansion feature.

EIA INTERFACE: This feature #3701 can be chosen as an alternative to the IBM integrated modems for use with a System/32 equipped with either the SDLC or BSCA feature. It provides a cable and interface that meet the EIA RS-232-C specifications and permit the attachment of an external modem supplied by IBM or another vendor. If the modem does not provide its own clocking, the Internal Clock feature (#4703), which provides a clocking speed of 600 or 1200 bps, is also required.

SOFTWARE

OPERATING SYSTEM: The System/32 System Control Program (SCP) includes a supervisor that occupies 2K bytes of main memory and provides the basic facilities that permit selective loading of programs from the disk, control all input/output operations, provide a program roll-out/roll-in capability, and provide support for data communications transmission.

Communications between the user and the SCP is provided through an Operation Control Language (OCL). These statements provide the system with information on how a job should be executed, such as the names of files to be processed, where the files are located, and what program to load. Normally, the collection of OCL statements required to direct the execution of a job is stored in procedures in disk storage and can be invoked by entering simple commands through the operator keyboard. Procedures are also supplied for execution of the utility programs that accompany the System Control Program and for the Industry Application Programs available to System/32 users. New procedures can be developed for user-written applications programs and specialized operations. The System/32 OCL has the capability to prompt the operator to supply required parameters or to specify default values for missing OCL parameters, as well as a logical IF statement that initiates execution of jobs based on conditions tested by the OCL.

Control of all I/O operations is provided by SCP data management routines. Support is provided for the CRT display, the keyboard (including the capability to recognize and interpret special function and command keys), the printer, and the disk unit. The diskette is supported by a Load/Dump utility only. Disk files can be organized in sequential, indexed sequential, or direct fashion.

A roll-out/roll-in capability is provided to suspend processing programs in order to allow an inquiry to be made into the file. The executing program is rolled out to disk storage, the inquiry program is executed, and the interrupted processing program is then returned (rolled in) to main memory to resume processing.

The SCP maintains a system history area on the disk that contains a log of recently executed OCL statements and system activities. The contents of the history area may be displayed on the operator console and printed if desired to provide a record of system processing activity.

The overlay linkage editor facility converts relocatable object modules, produced by the Basic Assembler, into a unified and executable program. Overlay structures may be created automatically or as designated by the user.

The current levels of SCP (Versions 5 and 6) include these enhancements: automatic generation, revision, and formatting of documents; input via keyboard, prerecorded magnetic cards, or diskettes; scientific macros; job stream support; and improved data management and library techniques.

Device support provided for the 1255 MICR Reader by the System/32 SCP (Version 6) is in the form of a subroutine similar to that provided on System/3 Models 12 and 15. Included in the services provided are data management and device control. The subroutine can be used with user-written RPG II or Basic Assembler programs.

LANGUAGES: System/32 users currently can avail themselves of three languages: Basic Assembler, RPG II, and FORTRAN IV.

System/32 Basic Assembler Language and Macro Processor Program Product (5725-AS1) supports all features of the

IBM System/32

System/32 and includes mnemonic operation codes, symbolic referencing of storage addresses, automatic storage assignment, address displacement calculation, operand field expressions, source identification sequence fields, cross-reference listings, and error checking with diagnostic messages.

Macro capability is provided for the following SCP facilities: disk functions, printer operations, keyboard and display screen access, and binary synchronous communications.

RPG II (Report Program Generator; 5725-RG1) allows the programmer, using up to six different preprinted coding forms, to prepare a set of specifications that describe the form of the input data, the calculations to be performed, and the format of the desired output. RPG II for the System/32 offers essentially the same features as the System/3 Model 6 RPG II, with variations in the data management facilities for the support of System/32 input/output devices.

The RPG II Auto Report Feature is a precompiler that reduces the coding effort required to prepare report programs. A single Auto Report output field specification written by the programmer can result in the generation of RPG II statements with various output specifications. Auto Report also provides a COPY statement that permits RPG II source statements to be copied from a disk library into source programs that are about to be compiled.

The RPG II Telecommunications Feature facilitates the transmission and reception of binary synchronous data over voice-grade or high-speed communications lines.

(See "Communications Software" for further details.)

IBM System/32 FORTRAN IV (5725-F01) contains the features defined in ANSI standard X3.10-1966 and the language extensions supported by IBM 1130 Basic FORTRAN IV.

IBM extensions to FORTRAN IV include the following: list-directed input/output for card devices, printer, display screen, keyboard, and sequential disk files; debug statements (DEBUG, AT, TRACE ON, TRACE OFF) that trace program flow and check validity of subscripts; a GENERIC statement that enables the user to specify a single generic name for a FORTRAN-supplied function that has several subprograms; interprogram communication statements (INVOKE, GLOBAL, and PROGRAM), that allow FORTRAN main programs to be loaded successively into main storage and executed; relational operation symbols (EQ., NE., GT., LT., GE., LE.), which are used in the relational expression of a logical IF statement to execute or skip an associated statement depending on whether the expression is true or false, respectively; and names of up to six characters for variables, arrays, functions, and subroutines.

UTILITIES: Programs supplied with the SCP assist the user in preparing and maintaining his disk files. The programs provided include Disk Initialization, Alternate Track Assignment, Alternate Track Rebuild, File and Volume Display, and File Delete. In addition, a set of routines is provided to permit copying of data, programs, and procedures from the diskette to the disk file and to transfer such information from the disk file to the diskette to provide back-up files and off-line storage.

System/32 Utilities Program Product (5725-UT1): In addition to the file management utilities supplied with the SCP control program, IBM offers a System/32 Utilities Program Product that provides basic data base management capabilities. This separately priced program product consists of three programs: Data File Utility (DFU), Sort, and Source Entry Utility (SEU).

The Data File Utility (DFU) program provides the following data base management functions: data file creation and maintenance, data file inquiry, and data file list. All three functions utilize catalogued RPG II File Description and Input Specifications so that the operator need enter only the name of the file and the name of the catalogued RPG II specifications. The utility prompts the operator to enter additional information required to tailor the program to the user's processing requirements.

The Data File Creation and Maintenance function of DFU operates only on indexed sequential files and provides facilities for creating and updating user data files.

The Data File Inquiry function of DFU allows inquiries into indexed sequential files.

The Data File List function of DFU provides a report-writing capability for listing and summarizing selected information from indexed or sequential files.

The System/32 SORT Utility provides basically the same functions as the System/3 sort. Disk files can be sorted in ascending or descending sequence. The program accepts files organized in sequential, indexed, or direct order. SORT also automatically allocates disk space for a work file.

The Source Entry Utility (SEU) program can be used to create and maintain user-written OCL procedures, RPG II source code statements, and SORT source code statements. The SEU is accompanied by SORT, RPG II, and Auto Report format descriptions to aid the user in entering source statements correctly. Functions include the capability to move statements within source or procedure members in new members, to insert up to 99 new statements into an already-existing member, and to delete selected statements.

System/32 File Conversion Utility (5725-UT2): This utility accepts input from and provides output to a 5321 Mag Card Unit or fixed disk. If fixed disk is employed, file access may be either sequential, direct, indexed sequential, or LDAM (linked direct access method).

COMMUNICATIONS SOFTWARE: Communications software for the System/32 consists of the RPG II Telecommunications Feature, which provides support for transmission and reception of binary synchronous data over voice-grade or high-speed communications lines, and the two utilities described in this section.

The RPG II Telecommunications Feature permits a System/32 to operate in any of the following communications modes: receive only, transmit only, receive with conversational reply, or alternate transmit only, receive with conversational reply, or alternate transmit and receive file. The feature permits a System/32 executing program written in RPG II to function as a terminal in one of three types of networks: point-to-point switched, point-to-point nonswitched, or multipoint. The System/32 Binary Synchronous Communications support also includes a system utility that permits communications characteristics, such as the line type, line speed, terminal address, and number of error retries, to be specified at program execution time.

Employing the Telecommunications Feature, a System/32 can communicate with another System/32 with RPG II; a System/34 with RPG II and Assembler; a System/3 with ML/MP, CCP, or RPG II; a System 7 with MSP/7; a System/360 or 370 with BTAM, TCAM/NCP, CICS/DOS, or CICS/OS; a System/370 with VTAM/NCP, CICS/VS, or IMS/VS; a System/360 Model 20 with BSCA IOCS; a 3741 Model 2 or 4; a 3747; or a 5231 Model 2 in receive mode only and supported as a 3741 Model 2 or 4.

IBM System/32

The System/32 SNA/SDLC Batch Work Station System Utility sends and receives batch data between a System/32 and a System/370 operating under the Virtual Telecommunications Access Method (VTAM), the Network Control Program (NCP/VS), and DOS/VS POWER VS, CICS/DOS/VS, OS/VS1 Remote Entry Service (RES), OS/VS2 Job Entry Subsystem 2 (JES 2), CICS/OS/VS, or IMS/VS. The utility program operates with SDLC protocol and enables System/32 computers to perform as remote workstations to System/370 Models 115 through 168 that are equipped with 3704 or 3705 Communications Controllers operating under NCP/VS.

This utility program permits the System/32 to transmit jobs to a System/370 computer and receive output from the central system upon completion of the job. In addition, the System/32 can receive multiple jobs, including control language and data, from a System/370 computer for execution at the local site. The batch workstation utility also includes provisions for compressing blanks and duplicate characters to ensure more efficient data transmission and to expand compressed data transmitted from the central system. A minimum of 7 buffers, each 256 bytes in size, is provided.

Programming systems support is under DOS/VS, OS/VS1, OS/VS2, or any of these operating systems under VM/370. Data security and privacy features for a remote workstation on a 370 under VTAM, NCP, POWER/VS, RES, JES2, CICS/VS, or IMS/VS are applicable to this utility. The utility will run on a System/32 with 24K bytes of memory and BSCA under the Systems Control Program 5725-SC1; the diskette drive is not supported.

System/32 Multi-Leaving Remote Work Station System Utility (MRJE/WS) permits a System/32 to function as an RJE workstation for submission of jobs to a System/370 under control of HASP II version 3.1 or 4, ASP version 2.6 or 3.1, OS/VS1 RES, OS/VS2 JES2 or JES3, or VM/370 with the Remote Spooling Communications subsystem.

Under control of the System/32 SCP and utilizing the BSCA, this utility communicates with a 370 over a point-to-point switched or nonswitched communication line. The keyboard/display acts as the workstation console, and nonremovable disk storage simulates card I/O operation.

DATA COLLECTION SUPPORT PRODUCT FOR 5230 SYSTEM: This program product (5725-M3A) accommodates 80- or 96-column card, diskette, and/or BSC teleprocessing inputs. Its function is to edit, verify, format, and consolidate data from an IBM 5230 Data Collection System. The data, once processed, is transferred to payroll, inventory management, production status, and costing master files. These master files are used in the IBM Manufacturing Management Accounting System in such areas as product costing, inventory, requirements planning, capacity planning, and production control. The system will operate on any model of the System/32 and requires the utilities program product for operation.

WORD/PROCESSOR/32: This program product (5725-XX1) utilizes the 5321 Mag Card Unit and enhancements to the System/32 to provide word processing capabilities. Word processing functions for automatic generation, revision, and formatting of documents can be entered from the System/32 console/keyboard or via prerecorded magnetic cards or diskettes. Documents are generated on the system printer, with options available for upper and lower case printing, and half-spacing for producing right-justified text. System/32's in use for data processing can utilize existing data files for document creation. Production statistics are an automatic by-product of this program product. This product requires a 16K-byte System/32 with 3.2 megabytes of disk storage and a 50-lpm line printer.

SYSTEM/32 LETTER WRITING APPLICATION: Designed for the user who needs to print large volumes of personalized letters, this program product (5725-XX2) provides upper and lower case printing and allows automatic insertion of name, address, salutation, title, and limited phrases within the body of the letter. Files can be generated through the System/32 keyboard or entered via diskettes prepared on an IBM 3740 Data Entry System. The program is written in RPG II and any 16K System/32 with a line printer can utilize it.

SYSTEM/32 JOB ANALYSIS SYSTEM (JAS/32): This program product (5725-XX3), employing the critical path method, helps management to plan, schedule, and control project-oriented work. JAS/32, through its nine standard reports, shows the critical path activities and their paths, related to cost, resources, and duration.

SYSTEM/32 SUBROUTINE LIBRARY—MATHEMATICS (SL-MATH): These subroutines assist in matrix and numerical mathematics including array operations, linear equations, roots of functions, differentiation, interpolation, and approximation. Three linear programming optimization subroutines handle standard linear problems using the dual revised simplex method, the bounded revised simplex method, and a capacitated network flow problem.

SL-Math is written in FORTRAN IV and is a subset of SL-Math for the 1130 and 1800. The subroutines require a 16K- to 24K-byte System/32 operating under SCP version 6 or above. The System/32 must include at least 3.2 megabytes of disk storage and a control storage increment (feature 1500).

SYSTEM/32 STATISTICAL SYSTEM: This program product enables the user to perform stepwise linear regression analysis, factor analysis, analysis of variance, and polynomial curve fitting.

The program runs under SCP Version 6 or above and is written in FORTRAN IV. The product requires a 16K-byte System/32 with control storage increment (Feature 1500) and 3.2 megabytes of disk storage.

SYSTEM/32 SHIPPING CONTROL FOR SUPPLIERS TO THE AUTOMOTIVE INDUSTRY: This program product (5725-M44) is an operator-oriented, batch or interactive system for original replacement market manufacturers and suppliers of automotive equipment. The system provides computerized solutions for many problems associated with the planning, controlling, and reporting of shipping dock transactions. Requirements for both release orders and discrete quantity orders are met by the generation of a variety of planning reports, shipping documentation, and completed transaction reports. An IBM System/32 Model A12 is the minimum system required to run this product.

SYSTEM/32 RELEASE CONTROL FOR SUPPLIERS TO THE AUTOMOTIVE INDUSTRY: This program product (5725-M45) is designed to operate in conjunction with 5725-M44 or as a stand-alone product. The application is operator-oriented and designed to maintain accurate release information which may be used to improve management planning of shipments, fabrication activities, and material acquisitions. The product will run on a System/32 Model A12 or above.

INDUSTRY APPLICATION PROGRAMS (IAP's)

The current System/32 software complement includes 14 Industry Application Programs that provide routines to perform the data processing functions required by small

IBM System/32

businesses in the selected industry areas. Each IAP package also includes detailed operator instructions and the OCL procedures required for execution of the programs. All IAP's are written by RPG II and are distributed on IBM-owned diskettes. Various techniques are provided for tailoring the programs to satisfy specialized user requirements.

SYSTEM/32 MEMBERSHIP AND MAILING LIST SYSTEM (5725-K11): These programs provide the capability to establish interrelated data files to handle membership dues, accounting, publication accounting, information exchange, and event participation accounting. The programs prepare invoices for membership dues and for publications, maintain lists for chapter memberships, product dynamic listings of the membership base for analysis, and handle receipts of dues and publication payments.

Membership identification cards, 3 x 5 information cards, and membership rosters can be produced. Mailing functions include label preparation and mailing lists based on user-specified criteria, circulation and postal zone summary reports, and agency distribution of publications. The ANALYZE command permits interrogation of the data base to produce selective membership mailings, dynamic membership lists, and statistical profiles of the organization membership.

If only membership dues administration and mailing functions are desired, a minimum System/32 configuration can accommodate approximately 13,000 to 15,000 members.

SYSTEM/32 CONSTRUCTION MANAGEMENT ACCOUNTING SYSTEM (CMAS): This industry application package consists of the following four programs: Job Costing (5725-M61), Accounts Payable (5725-M62), Payroll (5725-M63), and General Ledger (5725-M64). These programs provide a wide variety of accounting and management reports for single- or multi-company organizations. Reports produced by the Payroll program, in addition to paychecks and employee earnings statements, include payroll registers containing totals of employee hours worked and data on deductions and gross and net pay, a labor cost report for each job, and reports on workmen's compensation and insurance and union contributions. Job Cost Analysis produces reports on actual cost of materials, labor, subcontracting activities, and overhead compared to estimated costs. The system also provides a selection of financial management reports associated with general ledger accounting. Facilities for tailoring the programs permit the system to accommodate company growth. Use of the Construction Management Accounting System requires the System/32 System Control Program and the Utilities Program Product.

SYSTEM/32 HOSPITAL FINANCIAL MANAGEMENT SYSTEM (HFMS): This system is designed to handle the information processing needs of small hospitals with capacities ranging from 50 to 150 beds. Four programs are included in the package: Patient Billing (5725-H11), Accounts Receivable (5725-H12), Payroll (5725-H13), and General Ledger/Accounts Payable (5725-H14). The programs produce daily census reports on patient statistics, admissions and outpatient visits, and standard accounts receivable/payable and payroll transactions.

SYSTEM/32 MANUFACTURING MANAGEMENT ACCOUNTING SYSTEM (MMAS): Nine programs are included in this IAP: Production Status and Costing (5725-M31), Payroll (5725-M32), Accounts Payable (5725-M33), Accounts Receivable (5725-M34), Inventory Management (5725-M35), Product Definition and Costing (5725-M36), General Ledger (5725-M37), Sales Analysis (5725-M38), and Order Entry and Invoicing (5725-M39). MMAS is aimed at those industries in the manufacture and fabrication of both ferrous and non-ferrous metals, and in the manufacture of machinery, household and office furniture, and related products. The system is written in RPG II and runs on a 16K System/32 under System Control Program 5725-SC1 Version 2. The Data File and Source Entry Utilities are required.

SYSTEM/32 DISTRIBUTION FINANCIAL ACCOUNTING SYSTEM (DFAS): Includes General Ledger (5725-D61), Accounts Payable (5725-D62), and Payroll (5725-D63) applications. General Ledger permits either a 12-month or 13-period fiscal year and provides an income statement and balance sheet as standard reports. The Accounts Payable application provides a purchase journal, a cash disbursements journal, an open payables report, a cash requirements report, and a vendor analysis report. In addition, check-writing and reconciliation are also provided. The Payroll application is an hourly/salary/executive payroll that handles regular, overtime, premium, vacation, and sick pay. It can be run weekly, bi-weekly, semi-monthly, and monthly. These application packages are written in RPG II and run under the System Control Program 5725-SCI. The System/32 Utilities and a minimum 16K processor are required.

SYSTEM/32 CLIENT ACCOUNTING AND FINANCIAL REPORTING SYSTEM (CAFRS): This IAP (5725-C21) is designed for certified public accounts, bookkeepers, or small accounting firms as an aid in solving the problems of client accounting. Data can be entered through the keyboard or by a cassette created on a 3740 Data Entry System. Standard types of accounting reports such as journals, ledger, trial balance, and financial statements can be generated. Other supporting analyses and lists, as well as additional comparison reports, are also available to the user. This IAP requires a minimum 16K System/32 and the System/32 Utilities. CAFRS is written in RPG II.

MEDICAL GROUP MANAGEMENT SYSTEM: This IAP (5725-H15) provides a balance-forward accounts receivable system for a medical group of from 3 to 15 doctors. Patients are billed on a monthly basis, and third parties (insurance companies) can be billed as required. Options exist to provide a detailed appointment list showing patient appointment information and patient charge slips, and a practice analysis system that provides statistical reports for each doctor on a calendar year basis.

SYSTEM/32 MANAGEMENT SYSTEM FOR LAW FIRMS: This IAP (5725-F52) is designed to aid law firms in effectively controlling their time and disbursement accounting, billing, and accounts receivable. The Billing Information Memo and other reports such as Unbilled Time and Disbursements, Matter Billing Summary, and Aged Accounts can be printed weekly, monthly, or on demand to provide the necessary information to make the necessary billing decisions. This IAP runs on a minimum System/32 with 16K memory.

DISTRIBUTORS MANAGEMENT ACCOUNTING SYSTEM (DMAS): This IAP consists of separately priced modules including Billing (5725-D41), Accounts Receivable (5725-D43), Inventory Control (5725-D45), and Sales Analysis (5725-D47). DMAS is generalized and designed for numerous types of businesses in the distribution industry. Payroll, Accounts Payable, and General Ledger modules may be added from DFAS (5725-D6X). DMAS will run on either a 16K- or 24K-byte System/32. Performance improvements in the larger-memory versions of each system come from the reduction of overlays, incorporation of larger blocking factors, and use of dual I/O areas.

SYSTEM/32 LUMBER DEALERS MANAGEMENT ACCOUNTING SYSTEM (LDMAS): This IAP is composed of a Billing module (5725-D4F), an Accounts Receivable module (5725-D4B), an Inventory Control module (5725-D4D), and a Sales Analysis module (5725-D49). The

IBM System/32

user may elect to purchase any or all modules. The Billing application prepares estimates and can handle selection of six different prices per item, dependent on customer code; these prices are in addition to the list price. The Inventory Control Application provides both last and average cost figures for inventory valuation as well as inventory distribution by value. The Accounts Receivable application permits the user to change a customer from open item to balance forward or the reverse at the end of the month or accounting period. The Sales Analysis application produces daily and monthly reports by customer, as well as four-way reporting of profit margins.

This IAP requires a System/32 with either 16K or 24K bytes of memory, 5 megabytes of disk storage, and a printer with 132 positions. The system is written in RPG II and runs under the System Control Program, 5725-SC1 (Version 5 or above). The System/32 Utilities are also required. An LDMAS user may elect to purchase the DFAS Payroll, Accounts Payable, and General Ledger modules.

SYSTEM/32 FOOD DISTRIBUTORS MANAGEMENT ACCOUNTING SYSTEM (FDMAS): Like LDMAS, FDMAS is composed of a Billing module (5725-D6A), an Accounts Receivable module (5725-D66), an Inventory Control module (5725-D68), and a Sales Analysis module (5725-D6C). The Billing module features an open orders file in customer or item order that allows either case labels or a packing list in warehouse (slot) sequence. The Accounts Receivable module offers balance forward or open item selectable by account with late charges on monthly statements. The Inventory Control module supplies last cost and burden cost, full maintenance of broken case quantities, and warehouse location by slot. The Sales Analysis module provides sales and profitability figures by salesman, customer, item, and item class.

All programs in FDMAS are written in RPG II and can coreside with the Accounts Payable, Payroll, and General Ledger modules of DFAS. Both 16K- and 24K-byte versions of FDMAS are available. Version 5 or above of the System/32 SCP is required, as is the System/32 Utilities program product.

SYSTEM/32 STUDENT ADMINISTRATION SYSTEM: This application consists of three interrelated programs written in RPG II, available for separate purchase. The Student Records module (5725-E31) is a prerequisite for the other modules and generates student profiles, class rosters, course curriculum lists, instructor lists, and instructor/room schedules.

The Student Accounting module (5725-E32) manages and reports attendance data on a daily basis, including absences unresolved from prior days. This module also contains programs that analyze report marks and prepare report cards. The Student Scheduling module (5725-E33) provides scheduling for up to four terms in a school year and up to 24 periods in a day. Module options include student free time requests and instructor selection. Scheduling for the next year and rescheduling remaining terms of the current year are other features.

The Student Administration System requires a 24K-byte System/32 with a 5-megabyte disk storage capacity. The system is written in RPG II and requires the Utilities program product.

SYSTEM/32 MOTOR FREIGHT ACCOUNTING SYSTEM (MFAS): This application (5725-T21) offers small and medium-sized general freight and specialty carriers a package of programs to help analyze and refine numerous revenue accounting functions. These include such business operations as freight bill entry and daily reports, accounts receivable, interline payments, owner operator accounting, and shipment analysis. MFAS prints statements for direct customer billing, freight payment plans, transport clearing houses, inbound and outbound terminal summaries, and undelivered freight reports. MFAS operates under SCP on a 24K-byte System/32. The application is written in RPG II and requires the Utilities program product.

SYSTEM/32 FINANCIAL INSTITUTIONS CUSTOMER ACCOUNTING SYSTEM: This IAP consists of four modules: Customer Information File (5725-F11), Demand Deposit Accounting (5725-F12), System Savings Accounting (5725-F13), and Installment Loan Accounting (5725-F14). The system makes it possible for small commercial banks with 5 to 25 million dollars in deposits to handle savings and checking account information now processed by correspondent banks, other data services, or manual means.

This application requires either a 24K- or 32K-byte System/32 operating under SCP Version 6 or above with System Utilities installed.

PRICING

POLICY: IBM offers the System/32 on a purchase or rental basis. Two rental policies are available, the standard Monthly Availability Charge (MAC) and the System/32 Term Availability Plan (TAP).

The current Agreement for Lease or Rental of IBM Machines provides users with a single contract on which they can specify mixtures of rental and leased equipment, each with various terms. CPU's rented under the plan can be terminated or downgraded on 90 days' notice, and all other rented equipment can be terminated or downgraded on 30 days' notice. Base terms and extension terms are specified for each piece of equipment obtained through a leasing agreement. The basic lease term is two years, followed by one-year extension terms.

SOFTWARE: System/32 users receive the basic System Control Program at no additional cost. All other IBM software, including RPG II, Basic Assembler, FORTRAN IV, the 5320 Program Support Product, and the Industry Application Program, is separately priced. The IAP's are supplied on IBM-owned diskettes, include documentation, operator manuals, and instructional materials, and are maintained by IBM.

EQUIPMENT: The following systems illustrate the limits of non-communications-oriented System/32 configuration possibilities. No software is included in the indicated prices.

MINIMUM SYSTEM: Consists of 5320 Model A01 System Unit, including 16K bytes of main storage, 3.2 million bytes of disk storage, diskette drive, 40-cps unidirectional serial printer, keyboard, and display. Monthly rental, $988 (1-year lease) or $899 (TAP). Purchase price, $23,490, maintenance service $168 per month.

EXPANDED SYSTEM: Consists of 5320 Model B33 System Unit with 32K bytes of main storage, 9.1 million bytes of disk storage, diskette drive, 155-lpm line printer, keyboard, and display. Monthly rental, $1,660 (1-year lease) or $1,517 (TAP). Purchase price, $30,486, monthly maintenance $228.

LARGE SYSTEM: Consists of 5320 Model C44 System Unit with 32K bytes of main storage, 13.7 megabytes of disk storage, diskette drive, 285-lpm line printer, keyboard, display, 129-2 data recorder, BSCA, and 3741-2 data station with data recorder attachment feature. Monthly rental, $2,677 (1-year lease) or $2,228 (TAP). Purchase price, $48,421, monthly maintenance $426.50.■

IBM System/32

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental*	Monthly Lease*
BASIC SYSTEM					
5320	System Unit (includes CPU, 16K bytes of main storage, fixed-disk storage unit, diskette drive, printer, keyboard, and display)	$23,490	$168.00	$ 988	$ 899
		23,910	168.00	1,085	987
		26,100	178.00	1,202	1,094
Model A01	40 cps unidirectional printer, 3.2 MB disk storage	27,500	189.00	1,280	1,165
Model A02	40 cps unidirectional printer, 5.0 MB disk storage				
Model A03	40 cps unidirectional printer, 9.1 MB disk storage	23,670	173.00	1,051	957
Model A04	40 cps unidirectional printer, 13.7 MB disk storage	24,090	173.00	1,148	1,045
		26,280	183.00	1,265	1,152
Model A11	40 cps bidirectional printer, 3.2 MB disk storage	27,680	194.00	1,343	1,223
Model A12	40 cps bidirectional printer, 5.0 MB disk storage				
Model A13	40 cps bidirectional printer, 9.1 MB disk storage	23,820	178.00	1,108	1,010
Model A14	40 cps bidirectional printer, 13.7 MB disk storage	24,240	178.00	1,205	1,098
		26,430	188.00	1,322	1,205
Model A21	80 cps bidirectional printer, 3.2 MB disk storage	27,830	199.00	1,400	1,276
Model A22	80 cps bidirectional printer, 5.0 MB disk storage				
Model A23	80 cps bidirectional printer, 9.1 MB disk storage	23,970	183.00	1,165	1,063
Model A24	80 cps bidirectional printer, 13.7 MB disk storage	24,930	183.00	1,262	1,151
		26,580	193.00	1,379	1,258
Model A31	120-cps bidirectional printer, 3.2 MB disk storage	27,980	204.00	1,457	1,329
Model A32	120-cps bidirectional printer, 5.0 MB disk storage				
Model A33	120-cps bidirectional printer, 9.1 MB disk storage	26,870	193.00	1,190	1,086
Model A34	120-cps bidirectional printer, 13.7 MB disk storage	27,290	193.00	1,287	1,174
		29,480	203.00	1,404	1,281
Model B11	50 lpm line printer, 3.2 MB disk storage	30,880	214.00	1,482	1,352
Model B12	50 lpm line printer, 5.0 MB disk storage				
Model B13	50 lpm line printer, 9.1 MB disk storage	26,940	203.00	1,280	1,169
Model B14	50 lpm line printer, 13.7 MB disk storage	27,360	203.00	1,377	1,257
		29,550	213.00	1,494	1,364
Model B21	100 lpm line printer, 3.2 MB disk storage	30,950	224.00	1,572	1,435
Model B22	100 lpm line printer, 5.0 MB disk storage				
Model B23	100 lpm line printer, 9.1 MB disk storage	27,090	213.00	1,370	1,252
Model B24	100 lpm line printer, 13.7 MB disk storage	27,510	213.00	1,467	1,340
		29,700	223.00	1,584	1,447
Model B31	155 lpm line printer, 3.2 MB disk storage	31,100	234.00	1,662	1,518
Model B32	155 lpm line printer, 5.0 MB disk storage				
Model B33	155 lpm line printer, 9.1 MB disk storage	31,290	239.00	1,598	1,460
Model B34	155 lpm line printer, 13.7 MB disk storage	31,710	239.00	1,695	1,548
		33,900	249.00	1,812	1,655
Model C41	285-lpm line printer, 3.2 MB disk storage	35,300	260.00	1,890	1,726
Model C42	285-lpm line printer, 5.0 MB disk storage				
Model C43	285-lpm line printer, 9.1 MB disk storage	393	2.50	38	35
Model C44	285-lpm line printer, 13.7 MB disk storage	8,775	26.00	310	282
		393	2.50	38	35
1005	Additional main storage; 8192 bytes (maximum of 2)	1,770	6.00	92	84
1100	MICR reader/sorter attachment	1,000	1.00	32	29
1500	Control storage increment for FORTRAN IV	600	0.50	15	14
3200	Data recorder attachment	72**	—	72**	72**
3400	Upper/lower case keyboard/display (B Models only)	2,800	4.00	94	86
4530	Half-line vertical space printing (B Models only)				
4655	Keylock	178	—	—	—
4900	Mag card unit attachment (B and C Models only)	178	—	—	—
		178	—	—	—
5552	48-character FORTRAN print belt (B & C models only)	178	—	—	—
5910	64-character EBCDIC print belt	178	—	—	—
5911	48-character EBCDIC print belt	178	—	—	—
5912	64-character ASCII print belt				
5913	96-character modified Courier print belt				
5914	96-character Artisan print belt				
PUNCHED CARD EQUIPMENT					
129-2	Data recorder; 80-column alphanumeric reader/print/punch; no verification	4,290	79.50	214	—
1020	Accumulate feature	612	3.50	27	—
1025	Accumulate program feature	153	1.50	5	—
3610	Expansion feature	306	—	10	—
3950	Variable length feed	759	11.00	36	—
6065	Reading board extension	16	—	—	—
8201	3741/5320 attachment	1,395	13.00	89	—
5496-1	Data Recorder; 96-column alphanumeric reader/printer/punch	4,205	85.50	242	—
7061	Self-checking number modulus 10 feature	497	1.00	41	—
7062	Self-checking number modulus 11 feature	497	1.00	41	—
7850	2772/3741/5320 attachment	1,215	23.50	64	—

*Rental prices include equipment maintenance.
**Single use charge.

IBM System/32

		Purchase Price	Monthly Maint.	Monthly Rental*	Monthly Lease*
MAGNETIC CARD EQUIPMENT					
5321	Mag card reader/recorder	10,710	55.00	273	217
PRINTERS					
46/40	Ink jet document printer; 77/92 cps (stand-alone device)	29,000	135.00	760	670
—	Communications option	5,400	—	135	120
MICR EQUIPMENT					
1255-1	MICR reader/sorter; 5 sort pockets, 1 reject stacker; 500 dpm	39,090	332.00	1,065	—
1255-2	MICR reader/sorter; 5 sort pockets, 1 reject stacker; 750 dpm	44,740	531.00	1,295	—
1255-3	MICR reader/sorter; 10 sort pockets, 2 select/reject stackers; 750 dpm	60,920	699.00	1,705	—
4380	51-column card sorting feature	661	—	16	—
4520	High-order zero & blank selection feature	1,445	6.00	37	—
6303	5320 attachment	5,880	4.50	157	—
7060	Self-checking number/improved recognition feature	2,350	2.50	61	—
TERMINALS					
3741-2	Data Station	4,240	64.50	292	249
3741-4	Programmable Work Station	5,760	84.50	406	371
1350	Application Control Language Translator for Model 4	818	12.50	55	47
1680	Expanded Communications feature (expanded buffer, transmit select fields and records, receive data and insert constants, and unattended print mode)	641	2.00	40	35
3200	Data Recorder Attachment feature	1,285	7.00	78	67
3892	Expansion feature for printer or disk	335	3.00	12	10
4002	Feature Group A; includes verify, production statistics, field totals, self-checking number, and disk initialization capability	377	1.00	21	18
4655	Keylock feature	36	—	—	—
4975	Additional 4K bytes of storage	196	5.00	19	15
5450	Operator ID Card Reader feature	351	3.00	21	18
5500	1200-bps Integrated Modem, non-switched	660	3.50	20	17
5501	1200-bps Integrated Modem, switched with auto answer	880	5.50	29	25
5901	Alphanumeric keyboard with numeric key arrangement similar to adding machine	132	0.50	5	4
6123	Record Insert feature	164	0.50	6	5
6677	Second Disk Drive	1,170	2.50	75	64
7705	Synchronous Clock feature	164	0.50	6	5
7850	Terminal Identification feature	335	0.50	12	10
8111	Matrix Printer Attachment feature	164	1.00	6	5
8121	Expansion feature for 3715 Printer or disk	641	7.50	40	35
8123	Expansion feature for 3717 Printer or disk	462	1.50	24	21
COMMUNICATIONS FEATURES					
2074	Binary synchronous communications adapter	2,520	10.50	127	116
3701	EIA interface	420	4.50	12	11
4703	Internal clock	816	0.50	6	6
5500	1200 bps integrated modem, non-switched	660	5.00	21	19
5501	1200 bps integrated modem, switched with auto answer	880	7.00	28	26
5600	2400 bps integrated modem, non-switched point-to-point	2,240	12.00	87	80
5602	2400 bps integrated modem, non-switched multipoint tributary	2,490	13.50	95	87
5610	2400 bps integrated modem, switched with auto answer	2,550	14.50	96	88
5733	Processing unit expansion (prerequisite for 5600, 5602, and 5610)	224	0.50	8	8
6301	Synchronous data link control (SDLC) communications	3,080	15.50	157	143
7951	Switched network backup	250	3.50	11	10
7952	Switched network backup with auto answer	375	5.00	19	17

*Rental prices include equipment maintenance. The 3741 and its features have a two-year lease period under ETP MLC
**Single use charge.

IBM System/32

SOFTWARE PRICES

		Initial Charge	Monthly License Charge
PROGRAM PRODUCTS			
5725-RG1	System/32 RPG II	—	$ 37
5725-UT1	System/32 Utilities Program (Data File Utility, SORT, and Source Entry Utility)	—	17
5725-M3A	IBM 5230 Data Collection System Support for System/32	$500	34
5725-XX1	Word Processor/32	—	181
5725-F01	System/32 FORTRAN IV	—	75
5725-UT2	System/32 File Conversion Utility	—	57
5725-XX2	System/32 Letter Writing Application	—	35
5725-M44	System/32 Shipping Control for Suppliers to the Automotive Industry	—	67
5725-M45	System/32 Release Control for Suppliers to the Automotive Industry	—	73
5725-XX3	System/32 Job Analysis System	—	77
5725-XM1	System/32 Subroutine Library—Mathematics	—	62
5725-XA1	System/32 Statistical System	—	62
5725-AS1	System/32 Basic Assembler Language and Macro Processor	—	102
INDUSTRY APPLICATION PROGRAMS			
5725-K11	System/32 Membership and Mailing List System	—	107
	System/32 Construction Management Accounting System:		
5725-M61	Job Costing	—	44
5725-M62	Accounts Payable	—	56
5725-M63	Payroll	—	77
5725-M64	General Ledger	—	44
	System/32 Hospital Financial Management System:		
5725-H11	Patient Billing	—	32
5725-H12	Accounts Receivable	—	27
5725-H13	Payroll	—	66
5725-H14	General Ledger/Accounts Payable	—	42
	System/32 Manufacturing Management Accounting System:		
5725-M36	Product Definition & Costing	—	44
5725-M35	Inventory Management	—	48
5725-M32	Payroll	—	48
5725-M31	Production Status & Costing	—	48
5725-M39	Order Entry & Invoicing	—	58
5725-M38	Sales Analysis	—	48
5725-M34	Accounts Receivable	—	38
5725-M33	Accounts Payable	—	37
5725-M37	General Ledger	—	37
	System/32 Distribution Financial Accounting System:		
5725-D61	General Ledger	—	37
5725-D62	Accounts Payable	—	37
5725-D63	Payroll	—	48
5725-C21	System/32 Client Accounting and Financial Reporting System	—	129
5725-H15	Medical Group Management System	—	124
5725-F52	System/32 Management System for Law Firms	—	248
	System/32 Distributors Management Accounting System		
5725-D41	Billing	—	64
5725-D45	Inventory Control	—	58
5725-D43	Accounts Receivable	—	44
5725-D47	Sales Analysis	—	58
	System/32 Lumber Dealers Management Accounting System		
5725-D4F	Billing	—	64
5725-D4D	Inventory Control	—	58
5725-D4B	Accounts Receivable	—	44
5725-D49	Sales Analysis	—	58
	System/32 Food Distributors Management Accounting System		
5725-D6A	Billing	—	64
5725-D68	Inventory Control	—	58
5725-D66	Accounts Receivable	—	44
5725-D6C	Sales Analysis	—	58
	System/32 Student Administration System		
5725-E31	Student Records	—	81
5725-E32	Student Accounting	—	90
5725-E33	Student Scheduling	—	108

IBM System/32

SOFTWARE PRICES

		Initial Charge	Monthly License Charge
INDUSTRY APPLICATION PROGRAMS (Continued)			
5725-T21	System/32 Motor Freight Accounting System	—	201
	System/32 Financial Institutions Customer Accounting System		
5725-F11	Customer Information File	—	88
5725-F12	Demand Deposit Accounting	—	79
5725-F13	Savings Accounting	—	78
5725-F14	Installment Loan Accounting	—	90
5725-XA2	Retail Data Preparation Program	—	78