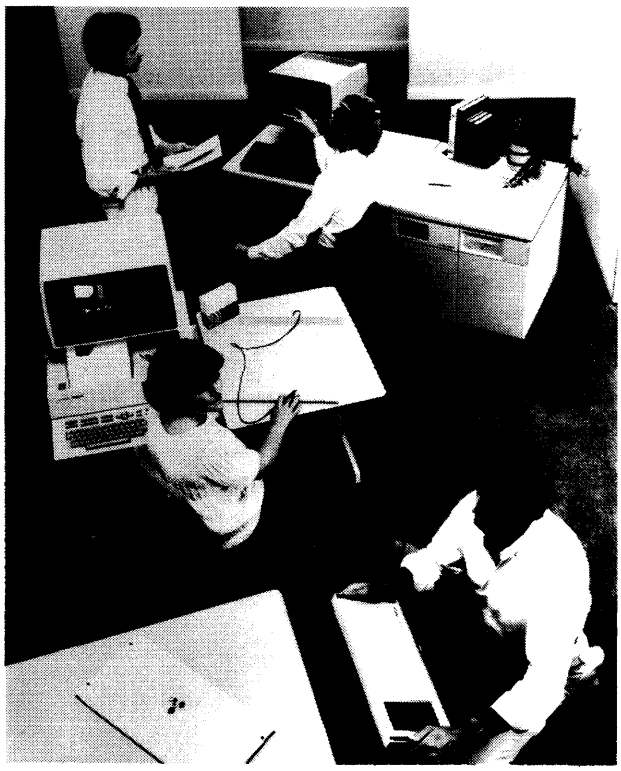
All About Superminis

The lower end of the minicomputer market has recently begun to feel a squeeze as microcomputers have increased in sophistication and popularity; those who need small systems now find that micros can deliver much of the computing power heretofore provided by conventional 16-bit minis at a significant reduction in cost. However, no similar pinch is felt by the machines at the high end of the market—the superminis. In fact, the demand for those more sophisticated systems has grown of late, and more than a score of manufacturers are now striving to fill that demand.

The supermini segment of the market continues to burgeon because the systems are ideally suited for specific applications in crucial areas of industry. Superminis feature a greater word length (usually 32 bits) than other minicomputers, and that feature permits increased throughput and more precise computations—both requisites not only for computation-intensive applications in the scientific, engineering, and technical fields, but also for commercial applications that demand high throughput. Fields such as computer-aided engineering and design, seismic processing, and high-volume commercial transaction processing are areas of expanding endeavor, and superminis are the ideal machines to carry out the sophisticated processing tasks required for those enterprises.



Hewlett-Packard's HP 9000 family comprises three models of 32-bit workstations for engineering and scientific applications. The workstations can be used as standalone systems or in multiuser configurations.

Superminis continue to grow in popularity for scientific, technical, and commercial applications. Through detailed comparison charts, this report presents the salient characteristics of over 60 superminis from 22 vendors. The text of the report provides a guide to the chart entries, discusses the current state of the supermini market, and provides guidelines for selecting supermini systems.

Indications are that the demand for superminis will continue to expand for the next several years as the micros encroach on the lower end of the mini market and new developments in technology make the superminis both more compact and increasingly powerful. Based on a recent survey of more than 7000 small-system users, *Datamation* magazine projects that supermini systems will account for 46.2 percent of the sales in the minicomputer market between late 1983 and early 1985. Venture Development Corporation, an electronics industry consulting firm, sees supermini sales, which accounted for $1.6 billion in 1982, expanding to $4.8 billion by 1986.

This report is designed to bring you, in concise comparison-chart form, an up-to-date compilation of the hardware and software characteristics of the superminis that are currently being marketed in the United States. You will also find information on the current status of the supermini market, detailed explanations of the chart entries, and guidance in selecting a supermini whose characteristics match the requirements of your applications. Additional information on many of the systems listed in this report can be found in our sister publication, DATAPRO REPORTS ON MINICOMPUTERS.

WHAT IS A SUPERMINI?

A supermini, for the purposes of this report, can generally be characterized as a computer that is distinguished by:

- A word length of at least 32 bits
- A main storage capacity of 16 million bytes or less
- A purchase price of about $100,000 and up for a basic configuration, including peripherals and controllers.

The majority of the current superminis use a 32-bit word length. A 32-bit word neatly holds four 8-bit bytes or two of the 16-bit words used in most of the smaller minicomputers. The 32-bit word length has been shown to yield an attractive balance between performance and cost in a broad range of applications. As a result, this word length has become so nearly universal among supermini designers that the terms "superminis" and "32-bit minicomputers" have become virtually synonymous.

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For the sake of completeness, this report covers not only all known 32-bit superminis, but also the 48-bit computers produced by Harris Corporation—the one significant holdout against the 32-bit tide. We have also included the IBM-compatible 32-bit computers produced by Formation; although these computers have been designed specifically to execute the IBM System/370 instruction repertoire, their architecture, performance, and price place them in the same class as the other current superminis.

This report also covers the systems in IBM's 4300 Series, regarded as mainframes in many quarters. These systems employ a 32-bit word length, along with other features of superminis (a maximum memory capacity of 16 megabytes, for example). Moreover, when IBM introduced the 4361 and 4381 in September 1983, the company explicitly referred to the 4300 systems as superminis.

Conversely, to focus attention on the true superminis and to avoid redundancy with other Datapro reports, we have deliberately *excluded* two categories of computers from this report: 1) the high-powered 16-bit minicomputers produced by companies such as Data General, DEC, Hewlett-Packard, and Modcomp; and 2) the 32-bit supermicros produced by Hewlett-Packard, Charles River Data Systems, Plexus Computer, and other manufacturers. These models have been excluded either because they do not feature full 32-bit architecture, despite their 32-bit word lengths, or because they fall below the commonly accepted price range for superminis (a minimum of about $20,000 for the processor and base memory and a price of about $100,000 and above for a basic configured system). We have, however, included the MicroVAX I, the newest and smallest member of DEC's VAX-11 family of 32-bit systems.

SUPERMINI ADVANTAGES

The principal advantages of the superminis are a direct result of their extended word lengths. A longer word length generally leads to:

- *Increased addressability*—If an entire 16-bit word is used to specify a memory address, the maximum number of storage locations that can be directly addressed is only 2^{16} or 65,536. A 32-bit address, by contrast, can specify up to 2^{32} or *4.29 billion* distinct storage locations. Thus, the longer word length greatly increases a system's logical address space (that is, the total amount of storage that can be directly addressed), permitting effective use of both the large physical main storage capacities and the virtual memory facilities that characterize most of the superminis. Virtual memory, in turn, can greatly facilitate the development of programs for execution on multiprogrammed computers by enabling each programmer to act as if he or she had a very large single-level storage space totally at his or her disposal.

- *Increased precision*—A single 32-bit word provides enough precision to satisfy the demands of most scientific and commercial computations, and most of the superminis are also capable of processing double precision (64-bit) operands. Conversely, the common 16-bit minicomputer word length is too short to provide the required precision in many applications, necessitating the use of time-consuming multiple-word operations.

- *Increased instruction sets*—The longer word length typically makes more bits available for specifying the operation code of each instruction, as well as for specifying index registers, multiple accumulators, indirect addressing, and other parameters. Thus, the superminis can—and usually do—have larger and more powerful instruction repertoires than their 16-bit counterparts. As a result, a single supermini instruction can often do the work of several 16-bit instructions.

- *Increased performance*—A 32-bit supermini normally transfers twice as much information to or from main storage during each cycle as a 16-bit minicomputer, and this inherent performance advantage is further enhanced in many cases through storage interleaving, cache memories, and other power-boosting features. The three previously discussed advantages (increased addressability, greater precision, and more powerful instruction sets) also lead directly to increased performance in most applications.

All these supermini advantages can be achieved only through increased hardware complexity, which frequently leads to higher equipment costs. In the past, superminis have had substantially higher price tags than most 16-bit computers, and have proven to be cost-effective only in applications that clearly require one or more of the features cited above. Due to recent developments in on-board technology, however, many new superminis deliver 32-bit performance at a substantially lower price/performance ratio than was previously available. Thus, while superminis still tend to be more expensive than their 16-bit counterparts and can even be unnecessary luxuries if purchased for jobs that can be easily handled by 16-bit systems, those who feel that they need supermini power for their applications will find that they can obtain high performance for a substantially lower outlay than was previously required.

THE SUPERMINI MARKET

Competition in the supermini market began in 1975, when Gould and Perkin-Elmer launched their first 32-bit machines. Each succeeding year has seen increased activity, and 1983 was no exception: most established manufacturers introduced new systems, while new vendors also joined the fray.

The major news in the market was IBM's direct entry through the introduction of the 4361 and 4381 systems. Although IBM has been producing 32-bit machines for quite a while, it did not explicitly identify itself as a supermini vendor until September 1983 with the announcement of the long-awaited additions to the 4300 Series; those machines were touted by the company as

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"powerful superminis" for engineering and scientific applications. The 4361 systems are intended to fill the gap between the 4331 and 4341 systems; the 4361 grouping comprises Model Groups 4 and 5. The 4381 machines are intended to provide a bridge between the 4341 machines and the mainframe 308X family; the 4381 grouping consists of Model Groups 1 and 2. IBM's direct entry into the supermini market will, as usual, force established vendors to compete against the giant's reputation and marketing organization.

Otherwise, the bulk of the year's activity was provided by established supermini vendors. Several brought out multiple models. Harris Corporation, Apollo Computer, and Hewlett-Packard led the pack with three new models each. Harris introduced the low-end H600, the mid-range H700, and the high-end H1000; these machines joined the H800 to round out the company's family of 48-bit computers. Apollo brought out three new 32-bit Domain "nodes": the DN300, DN460, and DN660. Hewlett-Packard began delivery of Models 520, 530, and 540 in its Series 9000 family of 32-bit engineering workstations.

Several vendors introduced two models into their existing lines. Digital Equipment Corporation (DEC) enhanced the popular VAX-11 family with the low-end MicroVAX I and the VAX-11/725, which uses a VAX-11/730 processor and can be employed in single- or multiuser environments. Data General Corporation brought out the Eclipse MV/8000 II, which replaced the MV/6000 as the mid-range system in the Eclipse MV/family; also announced was the Eclipse MV/8000 C, a compact repackaging of the MV/8000 II aimed primarily at the OEM market. Perkin-Elmer Corporation continued to enhance the Series 3200 with the entry-level Model 3205 and the Model 3250XP, which replaces the Model 3250 and is directly upgradable to the high-end Model 3200MPS multiprocessor system (announced in 1982 and delivered in 1983).

Among established vendors introducing single new models, Wang Laboratories introduced the VS85 as the low-end machine in its VS family. Honeywell Information Systems introduced the DPS 6/95, the new top-of-the-line machine in Honeywell's DPS 6 family of superminis. Prime Computer introduced the 9950, the new high-end machine in the company's 50 Series. NCR brought out the 9300. Tandem Computers added the NonStop TXP to its NonStop family of multiprocessor-based, fault-tolerant computers. (The NonStop TXP is available in various multiprocessor configurations; because each configuration is, for all intents and purposes, a different type of system, two NonStop TXP configurations are shown in the comparison charts in this report.)

New entrants into the supermini arena included both established and newly founded companies. One established vendor, MAI/Basic Four, introduced the 8000 Series, consisting of three models: 8010, 8020, and 8030. Modular Computer Systems (Modcomp), maker of the 16-bit Classic II systems, announced the Classic 32/85, the company's first 32-bit system. Pyramid Technologies, a new company, announced the Pyramid 90x, a Unix-based system with RISC (Reduced Instruction Set Computer) architecture.

The number of vendors and available supermini systems will undoubtedly continue to grow in 1984, as new applications demand, and new technologies permit, the creation of systems that are increasingly powerful and cost-effective.

THE COMPARISON CHARTS

The key functional characteristics of over 60 commercially available superminis from 22 manufacturers are presented in the accompanying comparison charts. Most of the information in the charts was supplied or verified by the manufacturers during December 1983 and January 1984. The staff at Datapro Research greatly appreciates the vendors' cooperation in the preparation of these charts.

All of the comparison chart entries are explained in the following paragraphs, together with discussions of their significance to prospective buyers and some guidelines for selecting the most appropriate superminis for specific applications.

WORD LENGTH

Probably the single most important distinguishing characteristic of a computer is its word length, that is, the number of bits (binary digits) that can be stored in or retrieved from main storage during a single cycle. In general, the longer the word, the greater the efficiency and accuracy of a computer's internal operations—and the higher its price tag. Nearly all of the superminis currently on the market have a 32-bit word length. This size neatly accommodates four 8-bit bytes or two of the 16-bit words used in most of the smaller minicomputers, and yields an attractive balance between economy and performance in many applications. Indeed, the 32-bit word length is the most frequently used criterion for distinguishing between the superminis and their smaller relatives. The entries also indicate the presence of additional bits used for parity checking or error correction (for example, the entry "32 + 5" indicates that each word location in main storage consists of 32 data bits and 5 error correction bits).

MAIN MEMORY

The minimum and maximum amount of main storage available for each computer, expressed in thousands of bytes (KB) or millions of bytes (MB). (Remember, each 32-bit word is capable of holding four 8-bit bytes. Most vendors now express storage capacities in terms of bytes rather than words.)

DISK STORAGE CAPACITY

This indicates the minimum and maximum on-line storage capacities offered by the system. The indicated storage capacities are shown in millions of bytes (MB) and indicate the capacity of a single disk drive or the total capacity of two or more (typically, four to eight) drives that can be connected to the system.

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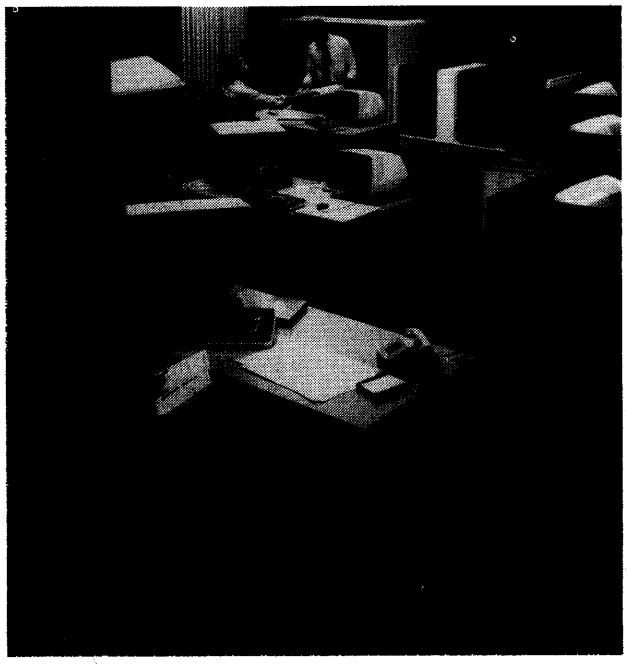

The Eclipse MV/10000 is Data General's high-end supermini. Intended for industrial automation and scientific/engineering applications, the MV/10000 can support up to 192 users. It can accommodate up to 16 megabytes of main memory and 18.2 gigabytes of on-line disk storage.

NUMBER OF WORKSTATIONS SUPPORTED

A very important consideration for many potential computer users is the number of workstations the system can support. Workstations, in this case, can mean most types of devices that can input and/or receive data from the computer. When the computer is used in a business environment, for example, the workstation would normally be a CRT display terminal or teletypewriter, but in a manufacturing or distribution environment, the workstation could be a sensor or transmission unit that simply transmits signals back to the computer for processing.

PRICE RANGE

Ideally, these figures represent the upper and lower prices for system hardware, from the minimum processor complex to a fully configured system. The figures actually presented in the columns can vary according to vendor response. In cases in which only one figure is quoted (e.g., "From $100,000"), the price is usually that of the minimum processor complex only.

TARGET MARKET

This indicates the industries toward which the system is geared. In many cases, the market is indicated in general terms capable of further refinement. For example, "Engineering/scientific" can indicate a variety of submarkets, including computer-aided engineering and design (CAE and CAD, respecively), seismic processing, and computation-intensive applications.

CENTRAL PROCESSOR

Although there are many variations in their internal architecture, the majority of currently available superminis are parallel, binary processors with a fixed word length of 32 bits.

The *number of directly addressable bytes* of main storage is one of the principal features that distinguishes the superminis from the smaller minicomputers. The short word lengths used in most minicomputers impose serious limitations upon the number of bits that can be assigned to hold the address part of each instruction. A typical 16-bit minicomputer instruction might consist of three parts: operation code, address mode field, and the address itself. If 6 bits are assigned to hold the operation code (permitting up to 64 distinct operations) and 2 bits are used to designate the addressing mode (permitting specification of indexing and/or indirect addressing), then only 8 bits are left to hold the address field. Since these 8 bits permit direct addressing of only 256 distinct memory locations, it is clear that other means will need to be employed to access most regions of the computer's main storage. The most common solutions to the problem are the use of multiword instructions, indexing, and/or indirect addressing.

The 32-bit word length used in most of today's superminis effectively removes this limitation. If just 16 of the 32 bits in each instruction word are used to hold the address field, up to 2^{16} or 65,536 distinct memory locations can be addressed. If a full 32-bit word is used to hold the address field, up to 2^{32} or 4.29 billion distinct locations (most of which would necessarily be in virtual memory rather than in real main storage) can be directly addressed.

Virtual memory is a facility that simplifies programming by providing a large addressable space on a high-speed disk storage unit that appears to the user as real main storage, and from which instructions and data are transferred into real main storage locations as required. Specialized hardware and/or software is required to perform the translations between virtual and real storage addresses, and to perform the necessary transfers of instructions and data between auxiliary storage and main storage. The number of addressable bytes of virtual memory is provided in this entry.

Hardware floating-point facilities are included in the standard instruction repertoires of most currently available superminis. A hardware floating point removes the burden of performing floating-point arithmetic from the CPU, and thus enhances system processing speed. In the absence of hardware floating point, floating point arithmetic would have to be performed through time- and space-consuming subroutines in the operating system.

The entries under this heading usually indicate that the system's hardware floating point is single-precision (SP), double-precision (DP), triple-precision (TP), quadruple-precision (QP), or a combination of the foregoing. The precision of the floating point is an indication of the

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number of bits on which it can operate simultaneously, generally expressed in arithmetic increments of 32; for example, a single-precision floating point can operate on 32 bits simultaneously, a double-precision on 64, and so forth.

Battery backup permits an orderly shutdown of the system in the event of an electrical failure or another sudden interruption. If battery backup is not or cannot be implemented, all data in main storage at the time of the interruption can be lost. This entry indicates whether battery backup is standard, optional, or inapplicable to a system.

A *real-time clock or timer* is another essential element in most "time-conscious" systems. A real-time clock enables the program to determine the time of day, while an interval timer usually indicates the amount of time that has elapsed since the occurrence of some significant event. In many cases, the timer can trigger an interrupt signal when a predetermined interval of time has elapsed. The entry indicates whether the clock or timer is standard, optional, or inapplicable to the system.

CPU cycle time, nanoseconds indicates the time that elapses between the CPU's call for data and the delivery of that data from a storage device by the I/O section of the processor.

MIPS indicates how many millions of instructions the computer can execute per second. A MIPS rating is a commonly accepted means of assessing a system's performance.

The *16-/32-bit compatibility* entry indicates the extent of program compatibility between a supermini and the same vendor's 16-bit minicomputers (if any). "Direct" indicates that the vendor claims that the supermini's instruction set is a "compatible superset" of the instruction set used in the vendor's 16-bit computers, so that all programs written for the 16-bit computers can be executed without modification on the supermini. "Via mode bit" indicates that the supermini can be switched from its native operational mode into a "compatibility mode" in which it can execute some, if not all, of the programs written for the vendor's 16-bit computers.

MAIN STORAGE

Bytes fetched per cycle is the number of bytes accessed by main storage in a single read.

Memory access indicates the number of bits transferred per second from auxiliary storage to main memory.

Cycle/access time, nanoseconds indicates two benchmarks of the system's main storage. The *cycle time* is a minimum time interval that must elapse between the starts of two successive accesses to any one storage location. Though cycle time ranks with word length as one of the most significant individual indicators of a computer's performance potential, one cannot assume that the computer with the fastest cycle time will be the best overall performer in a particular application. Other parameters that have an important effect on a computer's performance include the flexibility and power of its instruction repertoire, the number of storage cycles it requires to execute each instruction, and its input/output capabilities. *Access time* is the actual elapsed time between the CPU's request for data and the time when that data is received (read) in memory.

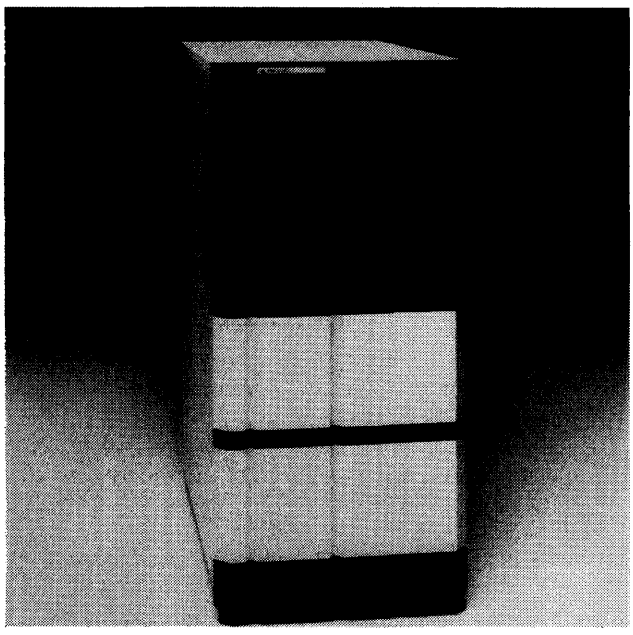
Storage protection is a feature that prevents unauthorized writing in or reading from certain areas of main storage. The protection can be accomplished through hardware, software, or a combination of both. Though unnecessary in simple dedicated systems, an effective storage protection scheme is an essential element in multiprogramming and time-sharing environments. Some of the superminis feature elaborate storage protection schemes that divide the total logical address space into hierarchical segments or "rings" with varying degrees of protection against unauthorized access. The entry indicates whether storage protection is standard, optional, or inapplicable to the system.

Increment size, bytes denotes the size of the add-on units used to increase the system's main memory.

Cache memory is a high-speed storage unit that can significantly increase the performance of a computer by serving as a fast-access buffer between main storage and the central processor or the input/output subsystem. The entry indicates the capacity of the cache memory unit, if applicable to the system.

INPUT/OUTPUT CONTROL

The *number of I/O channels* indicates the maximum combination of high-speed and low-speed channels that can be used to connect peripheral controllers to the CPU. Low-speed lines are used to connect such devices as terminals,



The Pyramid 90x is Pyramid Technology Corporation's first offering in the supermini market. The Pyramid 90x is a Unix-based supermini with RISC (Reduced Instruction Set Computer) architecture.

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printers, and card equipment, while high-speed lines connect mass storage devices like disk and magnetic tape subsystems.

The *data transfer rate,* sometimes referred to as the "I/O bandwidth," is a measure of the computer's ability to transfer data to and from peripheral devices or other external sources through all available I/O channels, buses, and ports. The transfer rate is indicated in thousands or millions of bits per second (K or M bps) or thousands or millions of bytes per second (KB/sec. or MB/sec.).

COMMUNICATIONS

Maximum number of lines indicates how many data communications lines can be handled by a particular system. The types of lines are specified in the next two entries.

Synchronous lines are those featuring synchronous data transmission. In this mode of transmission, bits or characters (composed of 5-8 bits) of data pass through the line in blocks at a relatively constant rate regulated by synchronizing characters at the beginning of each block.

The entries indicate whether synchronous lines are standard, optional, or not applicable to the system; where possible, the maximum speed of each line in bits per second (bps) is noted.

Asynchronous lines feature asynchronous data transmission, in which characters are transmitted individually at irregular rates. A start bit precedes each character, and a stop bit follows it. The entry tells whether asynchronous lines are standard, optional, or inapplicable, and also notes the line speed in bps.

Protocols supported indicates which inter-system communications conventions, if any, are supported through the availability of appropriate hardware and software facilities.

Type of LAN supported indicates local area networks that can be used to link the system to other computer systems within a limited area, such as an office building. An example would be Xerox's Ethernet LAN.

RJE terminals emulated indicates which of the popular remote job entry terminals, if any, the system can be equipped to emulate. Programs that emulate the functions of the IBM 2780, 3780, and Hasp terminals, for example, are available for many of the current superminis.

IBM 3270 emulation indicates whether the system can be equipped to emulate the functions of the widely used IBM 3270 display terminals.

PERIPHERAL EQUIPMENT

These entries provide details on the standard peripheral devices available for use with each computer system.

Disks supported indicates the types of disk media available for use on the system. Most responses indicate a mixture of fixed and removable disk drives. Fixed disk drives include those employing Winchester technology and those using older fixed-media technologies. Removable drives are those that employ disk packs and cartridges. This entry also supplies the storage capacities of the disk devices that are compatible with the system.

Serial printers generally range in speeds from about 30 to 600 or more characters per second (cps), employ various matrix and daisy wheel technologies to print a character at a time, and are frequently able to print bidirectionally (that is, while the print head is moving in either direction across the page). These printers are usually used in smaller configurations, and provide excellent-quality hard-copy reports for far less money than the line-at-a-time printers usually used with larger systems. This entry indicates the speeds of the serial printers available for the system.

Letter-quality printers are low-speed serial printers (generally 30-55 cps) used in office automation applications to produce correspondence-quality documents. This entry provides the speeds of the letter-quality printers available for the system.

Line printers operate at speeds of 100 to 2000 or more lines per minute (lpm) and are used most frequently in large configurations. This entry gives the speeds of the line printers available for use on the system.

Reel-to-reel tape drives indicates the applicability, the transfer rate in thousands of bytes per second (KBS), and the speed in inches per second (ips) of tape drives that accommodate industry-standard ½-inch wide magnetic tape.

Streaming tape drives permit data to be transferred to a tape without the tape's stopping between data blocks; this high-speed transfer makes streaming tape drives valuable as backup media for fixed disks. This entry indicates the speed of the tape in inches per second (ips) and, where applicable, the presence of a start/stop mode that permits the streaming tape drive to emulate conventional tape subsystems.

Cassette/cartridge tape drives indicates the availability and recording densities in bits per inch (bpi) of I/O devices that accommodate low-cost magnetic tape cassettes or cartridges.

Other peripherals supported lists the additional peripheral devices that are available for each system. Typical entries include card readers and punches, plotters, laser printers, and graphics workstations.

SOFTWARE

Software—the programming packages and languages used to direct the computer's operations—is a crucial component of any computer system. When you select a system, it is imperative that you carefully investigate the available software. Areas of investigation should include: operating systems; programming languages; preprogrammed utility packages, such as sorts and file maintenance; and applica-

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tion packages, such as payroll, graphics, CAD/CAM, and others. Prospective buyers should carefully note whether the software they will require is included in the cost of the system or offered at extra cost.

Vendors' claims and promises concerning the availability and capabilities of software should be carefully checked. This is particularly true of software that has been announced but not yet released. Sometimes the delivered product does not live up to its touted capabilities.

An *assembler* is a special-purpose program that uses the computer's power to facilitate the preparation of other programs. It enables the programmer to write his or her own programs in a simplified format that uses mnemonic operation codes and symbolic operand addresses. The assembler program then converts these symbolic instructions into their machine-language equivalents, producing computer programs ready for loading and execution. Entries here indicate the availability of an assembler, a macro assembler, or both. A macro assembler is another software tool to make the programmer's job easier. Macro routines can be called by the programmer and copied right into the program. This saves the programmer from having to recode the routine each time it is used, and also eliminates the possibility of keying errors when that part of the program is entered. As usual, there is a price to pay; macros usually consume large quantities of memory space.

Compilers are software tools that shift part of the program preparation task from the user to the computer itself by converting programs written in a simplified, procedure-oriented language into machine-language object programs. Compilers are now used in virtually all large- and medium-scale computer installations because of their demonstrated ability to slash programming costs—and they are becoming increasingly available for superminis. This widespread availability has resulted from the development of more powerful central processors; compilation is an intricate process that requires the storage space and processing power provided by supermini systems.

Entries in this section of the charts may include widely used high-level programming languages like Cobol (Common Business Oriented Language), RPG (Report Program Generator), Fortran (Formula Translator), Basic (Beginners All-purpose Symbolic Instruction Code), Algol (Algorithmic Language), APL, PL/1, and Pascal, or proprietary languages that are available from a vendor for use on a particular system.

A word of warning here: if you use a language that is unique to a vendor, you may be faced with a problem if you eventually decide to change vendors. Your investment in software may be lost, for the programs generally will not operate on any other system.

The *operating system* facilitates the operation of a computer by handling such functions as: scheduling, loading, and supervising the execution of programs; allocating storage and I/O devices; initiating and controlling I/O operations; analyzing interrupt signals and dealing with errors; handling communications between the system and its human operator; and controlling multiprogramming or time-sharing operations.

This entry indicates the types of operating systems available for the computer. Typical entries describing the available operating systems include: "batch," which means that the system processes one or more jobs sequentially and requires all data to be supplied before initiation; "interactive," which means that the system allows data and parameters to be entered as the job is executing; "real-time," which means that the system responds to external demands on a priority basis; or "time-sharing," which means that the system allows multiple users to access the system and share all its resources at the same time. The operating systems for many of the current superminis are capable of supporting two, three, or all four of the above modes of operation simultaneously.

Operating system implemented in firmware tells whether the language processor and the operating system are contained in microcode. The entries stipulate "fully," "partially," or "no" to indicate the extent of firmware implementation. Implementation of an operating system or language in firmware is advantageous to the user, for it frees more memory space for the user's programs and data. Also, because the microcode is generally contained in read-only memory, it is usually inaccessible to the user; thus, any possibility of the user's tampering with the language processor or operating system is eliminated and chances for error are reduced. Another advantage of firmware implementation is the ability to create more sophisticated and complex system functions at the hardware level. Microcode routines can be substituted for the usual subroutines, thereby increasing system performance.

A *database management system* (DBMS) is a software facility designed to manage and maintain data in a nonredundant structure so that the data will be conveniently available for processing by multiple applications. The DBMS organizes data elements in some predefined structure and keeps track of the relationships among the data elements, thereby facilitating information retrieval and report generation. The availability of an effective DBMS can greatly simplify applications programming tasks and increase the overall value of a data processing system. This entry provides the names of the principal database management systems available for the computer.

Principal industry application indicates the main types of software packages available for the computer's target market. Principal applications for the Engineering/scientific market would include CAD/CAE and power generation; principal applications for the commercial market would include transaction processing, distributed processing, office automation, and general business packages. In some cases, the vendors have supplied the names of specific application packages for their target industries.

Other packages are those software products that are not principal market applications for the system; they are secondary packages that are available for use in the target

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market and collateral markets. For example, a vendor in the commercial market could list an office automation package as the principal industry application and business graphics—useful but not primary for the target market—as the other package.

PRICING & AVAILABILITY

Basic system configuration and price, intended to provide an accurate guide to the cost of the system, ideally shows a processor/peripheral configuration that would typically be used in the vendor's stated target business environment.

Although we requested full configurations and applicable prices, many vendors did not comply. Some provided only processor configurations and prices; others neglected altogether to provide hardware and pricing data. Where components and pricing for processor complexes only were supplied, we have left the information as is; potential buyers should thus be aware that the actual cost of a full system configuration could be many times that of the base processor price provided in the comparison chart. When vendors supplied no information, we developed our own sample configurations. Although we believe each configuration to be realistic and accurate, the reader must realize that, depending upon the configuration and pricing rules imposed by the vendor, the actual price of a workable system could vary from that supplied in the chart.

If you wish to buy two or more computers, it is worth noting that most of the manufacturers offer sizable discounts from their list prices on orders for multiple computers. Discounts of up to 40 percent are not unusual on large orders.

Monthly maintenance of basic configuration provides the amount to be paid per month on a maintenance contract with the vendor for service and repair for the basic configuration.

Date of first delivery indicates when the first production model of each computer was delivered (or is scheduled to be delivered) to a customer.

Number installed to date shows how many systems of each type had been delivered to customers as of December 1983/ January 1984.

COMMENTS

This final entry on the comparison charts is used to explain or amplify the preceding entries and to provide other pertinent information about each system's hardware, software, pricing, applications, or characteristics.

SUPERMINI MANUFACTURERS

Listed below, for your convenience in obtaining additional information, are the full names, addresses, and telephone numbers of the 22 vendors whose products are listed in the specification charts that follow.

Apollo Computer, Inc., 15 Elizabeth Drive, Chelmsford, MA 01824. Telephone (617) 256–6600.

BTI Computer Systems, 870 West Maude Avenue, Sunnyvale, CA 94086. Telephone (408) 733–1122.

Computer Designed Sytems, Inc., 10911 Olson Memorial Highway, Minneapolis, MN 55441. Telephone (612) 545–2855.

Convergent Technologies, 2500 Augustine Drive, Santa Clara, CA 95051. Telephone (408) 727–8830.

Data General Corporation, 4400 Computer Drive, Westboro, MA 01581. Telephone (617) 366–8911.

Digital Equipment Corporation (DEC), 146 Main Street, Maynard, MA 01754. Telephone (617) 897–5111.

Formation, Inc., 823 East Gate Drive, Mt. Laurel, NJ 08054. Telephone (609) 234–5020.

Gould Inc., Computer Systems Division, 6901 West Sunrise Boulevard, P.O. Box 9148, Fort Lauderdale, FL 33310. Telephone (305) 587–2900.

Harris Corporation, Computer Systems Division, 2101 West Cypress Creek Road, Fort Lauderdale, FL 33309. Telephone (305) 974–1700.

Hewlett-Packard, Fort Collins Systems Division, 3404 East Harmony Road, Fort Collins, CO 80525. Telephone (303) 226–3800.

Honeywell Information Systems, Inc., 200 Smith Street, MS461, Waltham, MA 02154. Telephone (617) 895–6000.

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

Management Assistance Inc. (MAI), Basic Four Information Systems Division, 14101 Myford Road, Tustin, CA 92680. Telephone (714) 731–5100.

Microdata Corporation, 17481 Red Hill Avenue, P.O. Box 19501, Irvine, CA 92713. Telephone (714) 250–1000.

Modular Computer Systems, Inc. (Modcomp), P.O. Box 6099, 1650 West McNab Road, Fort Lauderdale, FL 33310. Telephone (305) 974–1380.

NCR Corporation, 1700 South Patterson Boulevard, Dayton, OH 45479. Telephone (513) 445–5000.

Perkin-Elmer Corporation, Data Systems Group, 2 Crescent Place, Oceanport, NJ 07757. Telephone (201) 870–4500.

Prime Computer, Inc., Prime Park, Natick, MA 01760. Telephone (617) 655–8000.

Pyramid Technology Corporation, 1295 Charleston Road, Mountain View, CA 94039. Telephone (415) 965–7200.

Stratus Computer, Inc., 6 Strathmore Road, Natick, MA 01760. Telephone (617) 653–1466.

Tandem Computers, Inc., 19191 Vallco Parkway, Cupertino, CA 95014. Telephone (408) 725–6000.

Wang Laboratories, Inc., One Industrial Avenue, Lowell, MA 01851. Telephone (617) 459–5000. □

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MANUFACTURER & MODEL	Apollo Computer, Inc. Domain Systems DN300	Apollo Computer, Inc. Domain Systems DN460	Apollo Computer, Inc. Domain Systems DN660	BTI Computer Systems BTI 8000
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	.5MB-1.5MB	1MB-4MB	1MB-4MB	1MB-16MB
DISK STORAGE CAPACITY	1.2MB-35.2MB	Not supplied by vendor	Not supplied by vendor	64MB-8GB
NO. WORKSTATIONS SUPPORTED	Not applicable	Not applicable	Not applicable	200
PRICE RANGE	$12,900-$23,400	From $39,500	From $59,000	$110,000-$700,000
TARGET MARKET	Engineering/scientific	Engineering/scientific	Engineering/scientific	General business
CENTRAL PROCESSOR				
No. of directly addressable bytes	16M	256M	256M	500K
Virtual memory	16MB	256MB	256MB	500KB
Hardware floating point	SP, DP	SP, DP	SP, DP	DP
Battery backup	None	None	None	Standard
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	250
MIPS	.7	1.2	1.2	Not supplied by vendor
16-/32-bit compatibility	Not applicable	Not applicable	Not applicable	Basic only
MAIN STORAGE				
Bytes fetched per cycle	2	4	4	Not supplied by vendor
Memory access	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Cycle/access time, nanoseconds	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	667
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	.5M	1M	1M	1M
Cache memory, bytes	None	20K	20K	None
INPUT/OUTPUT CONTROL				
No. of I/O channels	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	32
Data transfer rate	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	67M bps
COMMUNICATIONS				
Max. number of lines	2	3	3	200
Synchronous	Not applicable	Not applicable	Not applicable	No
Asynchronous	Std.; 19.2K bps	Std.; 19.2K bps	Std.; 19.2K bps	Std.; 9600 bps
Protocols supported	3270, HASP, Ethernet with TCP/IP, X.25	3270, HASP, Ethernet with TCP/IP, X.25	3270, HASP, Ethernet with TCP/IP, X.25	2780/3780
Type of LAN supported	Ring	Ring	Ring	Not applicable
RJE terminals emulated	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not applicable
IBM 3270 emulation	Yes	Yes	Yes	Not applicable
PERIPHERAL EQUIPMENT				
Disks supported	Winchester: 34MB, 70MB	Winchester: 58MB, 167MB; Removable: 300MB	Winchester: 58MB, 167MB; Removable: 300MB	Fixed & removable: 64MB-254MB
Serial printers	400 cps	400 cps	400 cps	30/1200 cps
Letter-quality printers	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not applicable
Line printers	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	300-1200 lpm
Reel-to-reel tape drives	1600 bpi	Not supplied by vendor	Not supplied by vendor	800/1600 bpi
Streaming tape drives	25/100 ips	25/100 ips	25/100 ips	Not supplied by vendor
Cassette/cartridge tape drives	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	45 ips
Other peripherals supported	Multibus	Multibus	Multibus	Not applicable
SOFTWARE				
Assembler	Not applicable	Not applicable	Not applicable	Relocatable assembler
Compilers	Fortran, Pascal, C	Fortran, Pascal, C	Fortran, Pascal, C	Cobol, Fortran, Pascal, Basic
Operating system	Multi-tasking	Multi-tasking	Multi-tasking	Multi-tasking
Operating sys. implemented in firmware	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not applicable
Database management system	D3M	D3M	D3M	BTI/FMS
Principal industry application	Scientific, technical	Scientific, technical	Scientific, technical	General business
Other packages	Aux (adaptation of Unix+ System III)	Aux (adaptation of Unix+ System III)	Aux (adaptation of Unix+ System III)	Not applicable
PRICING & AVAILABILITY				
Basic system configuration and price	DN300 computational workstation with .5MB main memory; VDT and keyboard; LAN interface; and operating system license: $12,900	DN460 computational workstation with 1MB main memory, VDT and keyboard, LAN interface, and operating system license: $39,500	DN660 computational workstation with 2MB main memory, color VDT and keyboard, 1MB display memory, LAN interface, and operating system license: $59,000	CPU with 1MB memory; 64MB mass storage unit; cartridge tape drive; 8 comm. lines: $110,000
Monthly maintenance of basic configuration	$120	$397	$546	$827
Date of first delivery	January 1983	January 1984	January 1984	2nd quarter 1982
Number installed to date	See Comments	See Comments	See Comments	40
COMMENTS	Vendor estimates total installation of all systems at 3,000.	Vendor estimates total installation of all systems at 3,000.	Vendor estimates total installation of all systems at 3,000.	A multi-processor system with up to 8 CPUs

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MANUFACTURER & MODEL	Computer Designed Systems, Inc. Adviser 1400/32	Computer Designed Systems, Inc. Adviser 1800/64	Convergent Technologies Megaframe	Data General Corporation Eclipse MV/4000
WORD LENGTH	32+8 bits	64+8 bits	32 bits	32 bits
MAIN MEMORY	256KB-16MB	256KB-16MB	1MB-28MB	1MB-8MB
DISK STORAGE CAPACITY	24GB	54GB	50MB-21.6GB	5GB
NO. WORKSTATIONS SUPPORTED	256	600+	8-128	64
PRICE RANGE	$750,000-$3,200,000	$920,000-$5,600,000	$30,000-$125,000	$30,000-$150,000
TARGET MARKET	Interactive, commercial	Interactive, commercial	General business	Distributed d.p.; office automation
CENTRAL PROCESSOR				
No. of directly addressable bytes	8,000M	16,000M	4M	Not supplied by vendor
Virtual memory	Not supplied by vendor	Not supplied by vendor	4MB	4GB
Hardware floating point	Double precision	Double precision	Software only	SP, DP
Battery backup	Optional	Optional	None	Optional
Real-time clock or timer	Optional	Optional	Standard	Standard
CPU cycle time, nanoseconds	.2	.1	100	400
MIPS	Not supplied by vendor	Not supplied by vendor	.5 to .8	.6
16-/32-bit compatibility	Optional	Optional	Not applicable	Direct
MAIN STORAGE				
Bytes fetched per cycle	8	16	2	Not supplied by vendor
Memory access	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Cycle/access time, nanoseconds	.2	.1	150	Not supplied by vendor
Storage protection	Optional	Optional	Standard	Standard
Increment size, bytes	128K	128K	.5MB or 1MB	1MB or 2MB
Cache memory, bytes	4K	8K	None	None
INPUT/OUTPUT CONTROL				
No. of I/O channels	612	Not supplied by vendor	12	9
Data transfer rate	19.6MB/sec.	24.6MB/sec.	5M-10M bps	5MB/sec.
COMMUNICATIONS				
Max. number of lines	164	228	192	Not supplied by vendor
Synchronous	Optional	Optional	Std.; 19.2K bps	Opt.; 56K bps
Asynchronous	Optional	Optional	Std.; 19.2K bps	Opt.; 9600 bps
Protocols supported	All IBM	All IBM	BSC, SDLC, HDLC, SNA, 3270, 2780/3780, X.25	SDLC, HDLC, 2780/3780, X.25
Type of LAN supported	SNA	SNA	SNA	Eth., SNA, IEEE, Xodiac
RJE terminals emulated	IBM	IBM	IBM 2780/3780, 3770	IBM 2780/3780
IBM 3270 emulation	Yes	Yes	Yes	Yes
PERIPHERAL EQUIPMENT				
Disks supported	3GB	6.2GB	Fixed & removable: 5MB-50MB	Fixed and removable: 50MB-1GB
Serial printers	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	60-340 cps
Letter-quality printers	Not supplied by vendor	Not supplied by vendor	40/45/50 cps	20-55 cps
Line printers	Not supplied by vendor	Not supplied by vendor	Up to 1000 lpm	240-1200 lpm
Reel-to-reel tape drives	Not supplied by vendor	Not supplied by vendor	1600 bpi	800/1600 bpi; 75 ips
Streaming tape drives	Not supplied by vendor	Not supplied by vendor	Start/stop; to 100 ips	1600 bpi; 30 ips
Cassette/cartridge tape drives	Not supplied by vendor	Not supplied by vendor	Not applicable	6400 bpi
Other peripherals supported	Not supplied by vendor	Not supplied by vendor	Not applicable	Laser printer, diskette, paper tape rdr./punch
SOFTWARE				
Assembler	Assembler	Assembler	Assembler	Macro assembler
Compilers	Not supplied by vendor	Not supplied by vendor	Cobol, Fortran 77, Basic, Pascal, C	Cobol, Basic, RPG, ADA, PL/1, Fortran, Pascal, C, DG/L, APL
Operating system	Real-time	Real-time	Time-sharing	Real-time, time-sharing
Operating sys. implemented in firmware	Partially	Partially	No	Not supplied by vendor
Database management system	AVOS-Relational	AVOS-Relational	Third-party	DG/DBMS
Principal industry application	Mfg., distribution	Mfg., distribution	Not supplied by vendor	Distributed d.p., office automation
Other packages	Not supplied by vendor	Not supplied by vendor	Office automation	CEO—office systems; MANAP—mfg.; Trend-view—graphics
PRICING & AVAILABILITY				
Basic system configuration and price	CPU with 256KB memory and 8K cache; power supply; console: $262,000	CPU with 256KB memory and 8K cache; power supply; console: $396,000	Application processor, 1.5MB memory; cluster proc., 256KB memory; file processor, 256KB memory; 100MB disk; 5MB backup disk; 16 PT Terminals; o.s. license: $40,150 (qty. of 100)	CPU with .5MB memory; AOS/RT32 operating system: $25,000
Monthly maintenance of basic configuration	$2,550	$4,100	Not applicable	$128
Date of first delivery	June 1980	March 1981	August 1983	December 1982
Number installed to date	2	2	Several hundred	Not supplied by vendor
COMMENTS	Accelerator gate array tri-port CPU	Accelerator gate array quad-port CPU	Can be expanded by adding more application, cluster, and file processors.	

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MANUFACTURER & MODEL	Data General Corporation Eclipse MV/8000 II	Data General Corporation Eclipse MV/8000 C	Data General Corporation Eclipse MV/10000	Digital Equipment Corp. (DEC) MicroVAX I
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	1MB-8MB	1MB or 4MB	1MB-16MB	256KB-2.5MB
DISK STORAGE CAPACITY	8.5GB	5GB	18.2GB	1.8MB-28.8GB
NO. WORKSTATIONS SUPPORTED	128	128	192	8
PRICE RANGE	$100,000-$300,000	$58,000-$85,000	$150,000-$500,000	From $9,995
TARGET MARKET	Distributed d.p., office automation	OEM	Distributed d.p., office automation	Eng./sci., commercial, distributed d.p., OEM
CENTRAL PROCESSOR				
No. of directly addressable bytes	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	8M
Virtual memory	4GB	4GB	4GB	4GB
Hardware floating point	SP, DP	SP, DP	SP, DP	Software
Battery backup	Optional	Optional	Optional	None
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	220	Not supplied by vendor	140	250
MIPS	1.2	1.2	2.5	Not supplied by vendor
16-/32-bit compatibility	Direct	Direct	Direct	32-bit only
MAIN STORAGE				
Bytes fetched per cycle	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	4
Memory access	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Cycle/access time, nanoseconds	220	220	Not supplied by vendor	500
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	1MB or 2MB	Not applicable	1MB or 2MB	256KB, 512KB
Cache memory, bytes	16K	16K	16K	8K
INPUT/OUTPUT CONTROL				
No. of I/O channels	13	8	23	Not supplied by vendor
Data transfer rate	18MB/sec.	18MB/sec.	28MB/sec.	2.5MB/sec.
COMMUNICATIONS				
Max. number of lines	Not supplied by vendor	16	Not supplied by vendor	Not supplied by vendor
Synchronous	Opt.; 56K bps	Opt.; 56K bps	Opt.; 56K bps	Optional
Asynchronous	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; to 9600 bps
Protocols supported	SDLC, HDLC, 2780/3780, X.25	HASP II, X.25, SDLC, 2780/3780	SDLC, HDLC, 2780/3780, X.25	DNA, 2780/3780, SNA, X.25, CDC, Univac, TTY
Type of LAN supported	Eth., SNA, IEEE, Xodiac	Eth., SNA, IEEE, Xodiac	Eth., SNA, IEEE, Xodiac	Ethernet
RJE terminals emulated	IBM 2780/3780	IBM 2780/3780	IBM 2780/3780	IBM 2780/3780
IBM 3270 emulation	Yes	Yes	Yes	Yes
PERIPHERAL EQUIPMENT				
Disks supported	Fixed & removable: 50MB-1GB	Fixed: 73MB-1GB; removable: 96MB-277MB	Fixed & removable: 50MB-1GB	Winchester: 10MB, 28.8MB
Serial printers	60-340 cps	150/340 cps	60-340 cps	50-240 cps
Letter-quality printers	20-55 cps	55 cps	20-55 cps	30/32 cps
Line printers	240-1200 lpm	230-1200 lpm	240-1200 lpm	Not applicable
Reel-to-reel tape drives	800/1600 bpi; 75 ips	800/1600 bpi; 75 ips	800/1600 bpi; 75 ips	Not applicable
Streaming tape drives	1600 bpi; 30 ips	1600 bpi; 30 ips	1600 bpi; 30 ips	Not applicable
Cassette/cartridge tape drives	6400 bpi	6400 bpi	6400 bpi	Not applicable
Other peripherals supported	Laser printer, diskette, paper tape rdr./punch	Laser printer, diskette, paper tape rdr./punch	Laser printer, diskette, paper tape rdr./punch	Diskettes; alpha, hard copy, graphics terms.
SOFTWARE				
Assembler	Macro assembler	Macro assembler	Macro assembler	Assembler
Compilers	Cobol, Basic, RPG, ADA, PL/1, Fortran, Pascal, C, DG/L, APL	Cobol, Basic, RPG, ADA, PL/1, Fortran, Pascal, C, DG/L, APL	Cobol, Basic, RPG, ADA, PL/1, Fortran, Pascal, C, DG/L, APL	APL, Basic, C, Cobol, Coral 66, Dibol, DSM, Fortran, Pascal, PL/1
Operating system	Real-time, time-sharing	Real-time, time-sharing	Real-time, time-sharing	Batch, rl.-tm., tm.-shr.
Operating sys. implemented in firmware	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Partially
Database management system	DG/DBMS	DG/DBMS	DG/DBMS	Not applicable
Principal industry application	Distributed d.p., office automation	Scientific/technical	Distributed d.p., office automation	Application development, engineering, technical
Other packages	CEO—office systems; MANAP—mfg.; Trend-view—graphics	CEO—office systems; Trendview—graphics; MANAP-manufacturing	CEO—office systems; MANAP-mfg.; Trendview—graphics	General business
PRICING & AVAILABILITY				
Basic system configuration and price	CPU with 1MB memory; AOS/RT32 operating system: $81,000	CPU with 1MB memory; AOS/RT32 operating system: $55,500	CPU with 2MB memory; AOS/RT32 operating system: $154,000	Floor-standing CPU with 512KB memory; 819.2KB diskette; 10MB disk; 32 cps letter-quality printer; 2 workstations: $20,100
Monthly maintenance of basic configuration	$425	$375	$693	Not supplied by vendor
Date of first delivery	July 1983	March 1984	May 1983	March 1984
Number installed to date	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not applicable
COMMENTS				Available in tabletop, floor-standing, or rack-mount version.

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MANUFACTURER & MODEL	Digital Equipment Corp. (DEC) VAX-11/725	Digital Equipment Corp. (DEC) VAX-11/730	Digital Equipment Corp. (DEC) VAX-11/750	Digital Equipment Corp. (DEC) VAX-11/780
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	1MB-3MB	1MB-5MB	2MB-8MB	2MB-32MB
DISK STORAGE CAPACITY	52MB-104MB	20MB-2GB	121MB-19GB	121MB-30GB
NO. WORKSTATIONS SUPPORTED	8	24	128	384
PRICE RANGE	From $24,950	From $21,500	From $47,000	From $145,000
TARGET MARKET	Eng./sci., commercial, OEM, distr. d.p.	Eng./sci., commercial, distr. d.p.	Eng./sci., commercial, distr. d.p.	Eng./sci., commmercial, distr. d.p.
CENTRAL PROCESSOR				
No. of directly addressable bytes	16M	16M	Not supplied by vendor	36M
Virtual memory	4GB	4GB	4GB	4GB
Hardware floating point	SP, DP	SP, DP	SP, DP	SP, DP
Battery backup	Optional	Optional	Optional	Optional
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	270	270	320	200
MIPS	.36	.36	.72	1.06
16-/32-bit compatibility	Via mode bit	Via mode bit	Via mode bit	Via mode bit
MAIN STORAGE				
Bytes fetched per cycle	4	4	8	8
Memory access	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Cycle/access time, nanoseconds	810	810	400	290
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	1MB	1MB	1MB	2MB
Cache memory, bytes	None	None	4K	8K
INPUT/OUTPUT CONTROL				
No. of I/O channels	Not supplied by vendor	Not supplied by vendor	1-5	1-8
Data transfer rate	1.5MB/sec.	1.5MB/sec.	1.5-5MB/sec.	1.5-13.3MB/sec.
COMMUNICATIONS				
Max. number of lines	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Synchronous	Std.; 19.2K bps	Std.; 19.2K bps	Std.; 19.2K bps	Std.; 19.2K bps
Asynchronous	Std.; to 19.2K bps	Std.; to 19.2K bps	Std.; to 19.2K bps	Std.; to 19.2K bps
Protocols supported	SDLC, HDLC, DDCMP, X.25, ADCCP, SNA, DNA, Bisync	SDLC, HDLC, DDCMP, X.25, ADCCP, SNA, DNA, Bisync	SDLC, HDLC, DDCMP, X.25, ADCCP, SNA, DNA, Bisync	SDLC, HDLC, DDCMP, X.25, ADCCP, SNA, DNA, Bisync
Type of LAN supported	Ethernet	Ethernet	Ethernet	Ethernet
RJE terminals emulated	IBM 2780/3780	IBM 2780/3780	IBM 2780/3780	IBM 2780/3780
IBM 3270 emulation	Yes	Yes	Yes	Yes
PERIPHERAL EQUIPMENT				
Disks supported	Fixed: 121MB-456MB; Removable: 10.4MB-205MB	Fixed: 121MB-456MB; Removable: 10.4MB-205MB	Fixed: 121MB-516MB; Removable: 10.4MB-205MB	Fixed: 121MB-516MB; Removable: 10.4MB-205MB
Serial printers	50 cps-240 cps	50 cps-240 cps	50 cps-240 cps	50 cps-240 cps
Letter-quality printers	30/32 cps	30/32 cps	30/32 cps	30/32 cps
Line printers	170 lpm-1250 lpm	170 lpm-1250 lpm	170 lpm-1250 lpm	170 lpm-1250 lpm
Reel-to-reel tape drives	Not supplied by vendor	Not supplied by vendor	800-6250 bpi; 45-125 ips	800-6250 bpi; 45-125 ips
Streaming tape drives	Start/stop; 25/100 ips	Start/stop; 25/100 ips	Start/stop; 25/100 ips	Start/stop; 25/100 ips
Cassette/cartridge tape drives	Not applicable	Not applicable	Not applicable	Not applicable
Other peripherals supported	Laser printer	Laser printer	Laser printer	Laser printer
SOFTWARE				
Assembler	Macro assembler	Macro assembler	Macro assembler	Macro assembler
Compilers	APL, Basic, C, Cobol, Coral 66, Dibol, DSM, Fortran, Pascal, PL/1	APL, Basic, C, Cobol, Coral 66, Dibol, DSM, Fortran, Pascal, PL/1	APL, Basic, C, Cobol, Coral 66, Dibol, DSM, Fortran, Pascal, PL/1	APL, Basic, C, Cobol, Coral 66, Dibol, DSM, Fortran, Pascal, PL/1
Operating system	Batch, rl.-tm., tm.-shr.	Batch, rl.-tm., tm.-shr.	Batch, rl.-tm., tm.-shr.	Batch, rl.-tm., tm.-shr.
Operating sys. implemented in firmware	No	No	No	No
Database management system	VAX-11 DBMS	VAX-11 DBMS	VAX-11 DBMS	VAX-11 DBMS
Principal industry application	Graphics, office automation	Graphics, office automation	Graphics, office automation	Graphics, office automation
Other packages	Third-party	Third-party	Third-party	Third-party
PRICING & AVAILABILITY				
Basic system configuration and price	CPU, 1MB memory; 2 tape drives; 52MB disk subsystem; 32 cps letter-quality printer; 2 workstations; operating system license: $32,030	CPU, 2MB memory; 121MB fixed disk; 1600 bpi tape drive; two 300 lpm printers; hardcopy terminal; 10 workstations; operating system license: $90,390	CPU, 2MB memory; 1MB mem. expansion; 121MB fixed disk; 256MB remov. disk; 2 mag. tape drs., 1600 bpi; two 600 lpm printers; hardcopy term.; 20 workstations; op. sys. lic.: $202,795	CPU, 2MB mem.; 2MB mem. expansion; 516MB fixed disk; two 256MB rem. disks; 4 mag. tape drs.; 1250/910 lpm prt.; 12 ppm laser prt., hardcopy term.; 40 workst.; op. sys. lic.: $462,285
Monthly maintenance of basic configuration	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Date of first delivery	November 1983	May 1982	November 1980	January 1978
Number installed to date	Not applicable	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
COMMENTS				Supports 4MB shared memory subsystem.

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MANUFACTURER & MODEL	Digital Equipment Corp. (DEC) VAX-11/782	Formation, Inc. F4000 Information System	Formation, Inc. F4000–AP Information System	Gould, Inc. Computer Systems Div. Concept 32/27
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	2MB-8MB	256KB-8MB	256KB-8MB	1MB-16MB
DISK STORAGE CAPACITY	121MB-30GB	70MB-5GB	70MB-5GB	80MB-5.4GB
NO. WORKSTATIONS SUPPORTED	384	46	Not supplied by vendor	124
PRICE RANGE	From $320,000	$75,000-$300,0000	$100,000-$300,000	$100,00-$200,000
TARGET MARKET	Eng./sci., commercial, distr. d.p.	OEM and software development	OEM and software development	Scientific
CENTRAL PROCESSOR				
No. of directly addressable bytes	Not supplied by vendor	16M	16M	1.5M
Virtual memory	4GB	16MB	16MB	Not applicable
Hardware floating point	SP, DP	Double precision	Double precision	Double precision
Battery backup	Optional	None	None	Optional
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	200	200	200	150
MIPS	Not supplied by vendor	.225	.4	.76
16-/32-bit compatibility	Via mode bit	32-bit only	32-bit only	Not applicable
MAIN STORAGE				
Bytes fetched per cycle	8	4	4	4
Memory access	Not supplied by vendor	40,000,000	40,000,000	Not supplied by vendor
Cycle/access time, nanoseconds	290	800/200	800/200	600
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	Not supplied by vendor	256KB or 1MB	256KB or 1MB	256KB-1MB
Cache memory, bytes	8K	None	None	None
INPUT/OUTPUT CONTROL				
No. of I/O channels	Not supplied by vendor	4	4	32
Data transfer rate	1.5-13.3MB/sec.	5MB/sec.	5MB/sec.	3.2MB/sec.
COMMUNICATIONS				
Max. number of lines	Not supplied by vendor	100	100	124
Synchronous	Std.; 19.2K bps	Opt.; 19,200 bps	Opt.; 19,200 bps	Opt.; up to 56K bps
Asynchronous	Std.; to 19.2K bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; up to 19.2K bps
Protocols supported	SDLC, HDLC, DDCMP, X.25, ADCCP, SNA, DNA, Bisync	SDLC, BSC, ASCII	SDLC, BSC, ASCII	SDLC, HDLC, X.25
Type of LAN supported	Ethernet	SNA	SNA	Ethernet, Selnet
RJE terminals emulated	IBM 2780/3780	Hasp	Hasp	IBM 2780/3780
IBM 3270 emulation	Yes	Yes	Yes	No
PERIPHERAL EQUIPMENT				
Disks supported	Fixed: 121MB-516MB; Removable: 10.4MB-205MB	Fixed: 100MB, 135MB, 635MB	Fixed: 100MB, 135MB, 635MB	Fixed & removable: 80MB-675MB
Serial printers	50 cps-240 cps	180 cps	180 cps	340 cps
Letter-quality printers	30/32 cps	None	None	Not supplied by vendor
Line printers	170 lpm-1250 lpm	300/600/1000 lpm	300/600/1000 lpm	300/600/1000 lpm
Reel-to-reel tape drives	800-6250 bpi; 45-125 ips	72KB, 200KB	72KB, 200KB	45/75/125 ips
Streaming tape drives	Start/stop; 25/100 ips	None	None	Not supplied by vendor
Cassette/cartridge tape drives	Not applicable	None	None	Not supplied by vendor
Other peripherals supported	Laser printer	Card reader, byte multiplexor	Card reader, byte multiplexor	Card equipment, paper tape, real-time periphs.
SOFTWARE				
Assembler	Macro assembler	Assembler	Assembler	Macro assembler
Compilers	APL, Basic, C, Cobol, Coral 66, Dibol, DSM, Fortran, Pascal, PL/1	Cobol, Fortran, Basic, RPG II, PL1	Cobol, Fortran, Basic, PL1	Fortran 77^{+}, Cobol, Basic, Pascal, C, Ada
Operating system	Batch, rl.-tm., tm.-shr.	Batch, real-time	Multi-tasking	Real-time, time-sharing
Operating sys. implemented in firmware	No	Partially	Partially	No
Database management system	VAX-11 DBMS	TMS; any 370-compatible	TMS; any 370-compatible	Seed, Relgraf
Principal industry application	Graphics, office automation	Program development, on-line applications	Program development, on-line applications	Computation-intensive applications
Other packages	Third-party	IBM 370-compatible packages	IBM 370-compatible packages	Graphics
PRICING & AVAILABILITY				
Basic system configuration and price	2 CPUs, 4MB memory; four 516MB disk drives; four 1600/6250 PE/GCR tape drives; 12 ppm laser ptr.; two 600 lpm ptr.; 60 workst.; op. sys. lic.: $802,755	CPU with 1MB memory; 135MB disk; 72KB tape; 300 lpm printer; console; service processor; 8 workstations: $100,300	CPU and auxiliary processor, 2MB memory; 135MB disk; 72KB tape; 300 lpm printer; console; service processor; 8 workstations: $123,800	CPU with 1MB memory; floppy disk; 80MB disk; 45 ips tape; 300 lpm band printer; CRT; MPX–32 operating system; Fortran 77^{+}: $111,750
Monthly maintenance of basic configuration	Not supplied by vendor	$852	$852	$939
Date of first delivery	April 1982	3rd quarter 1981	1982	May 1980
Number installed to date	Not supplied by vendor	50	50	644
COMMENTS	Based on 8MB shared memory subsystem.	Optional fault-tolerant configuration. Software compatible with IBM 370.	Optional fault-tolerant configuration. Software compatible with IBM 370.	Single-slot CPU

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MANUFACTURER & MODEL	Gould, Inc. Computer Systems Div. Concept 32/6705	Gould, Inc. Computer Systems Div. Concept 32/6780	Gould, Inc. Computer Systems Div. Concept 32/8705	Gould, Inc. Computer Systems Div. Concept 32/8780
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	1MB-16MB	1MB-16MB	1MB-16MB	1MB-16MB
DISK STORAGE CAPACITY	80MB-5.4GB	80MB-5.4GB	80MB-5.4GB	80MB-5.4GB
NO. WORKSTATIONS SUPPORTED	124	124	124	124
PRICE RANGE	$150,00-$400,000	$200,00-$500,000	$300,00-$700,000	$425,000-$1,000,000
TARGET MARKET	Scientific	Scientific	Scientific	Scientific
CENTRAL PROCESSOR				
No. of directly addressable bytes	16M	16M	2M	2M
Virtual memory	Not applicable	Not applicable	Not applicable	Not applicable
Hardware floating point	Double precision	Double precision	Double precision	Double precision
Battery backup	Optional	Optional	Optional	Optional
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	150	150	75	75
MIPS	1.7	3.06	4.66	8.3
16-/32-bit compatibility	Not applicable	Not applicable	Not applicable	Not applicable
MAIN STORAGE				
Bytes fetched per cycle	4	4	4	4
Memory access	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Cycle/access time, nanoseconds	600	600	300	300
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	256KB-1MB	256KB-1MB	256KB-1MB	256KB-1MB
Cache memory, bytes	32K	64K	32K-64K	64K-128K
INPUT/OUTPUT CONTROL				
No. of I/O channels	32	32	32	32
Data transfer rate	3.2MB/sec.	3.2MB/sec.	3.2MB/sec.	3.2MB/sec.
COMMUNICATIONS				
Max. number of lines	124	124	124	124
Synchronous	Opt.; up to 56K bps	Opt.; up to 56K bps	Opt.; up to 56K bps	Opt.; up to 56K bps
Asynchronous	Opt.; up to 19.2K bps	Opt.; up to 19.2K bps	Opt.; up to 19.2K bps	Opt.; up to 19.2K bps
Protocols supported	SDLC, HDLC, X.25	SDLC, HDLC, X.25	SDLC, HDLC, X.25	SDLC, HDLC, X.25
Type of LAN supported	Ethernet, Selnet	Ethernet, Selnet	Ethernet, Selnet	Ethernet, Selnet
RJE terminals emulated	IBM 2780/3780	IBM 2780/3780	IBM 2780/3780	IBM 2780/3780
IBM 3270 emulation	No	No	No	No
PERIPHERAL EQUIPMENT				
Disks supported	Fixed & removable: 80MB-675MB	Fixed & removable: 80MB-675MB	Fixed & removable: 80MB-675MB	Fixed & removable: 80MB-675MB
Serial printers	340 cps	340 cps	340 cps	340 cps
Letter-quality printers	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Line printers	300/600/1000 lpm	300/600/1000 lpm	300/600/1000 lpm	300/600/1000 lpm
Reel-to-reel tape drives	45/75/125 ips	45/75/125 ips	45/75/125 ips	45/75/125 ips
Streaming tape drives	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Cassette/cartridge tape drives	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Other peripherals supported	Card equipment, paper tape, real-time periphs.	Card equipment, paper tape, real-time periphs.	Card equipment, paper tape, real-time periphs.	Card equipment, paper tape, real-time periphs.
SOFTWARE				
Assembler	Macro assembler	Macro assembler	Macro assembler	Macro assembler
Compilers	Fortran 77+, Cobol, Basic, Pascal, C, Ada	Fortran 77+, Cobol, Basic, Pascal, C, Ada	Fortran 77+, Cobol, Basic, Pascal, C, Ada	Fortran 77+, Cobol, Basic, Pascal, C, Ada
Operating system	Real-time, time-sharing	Real-time, time-sharing	Real-time, time-sharing	Real-time, time-sharing
Operating sys. implemented in firmware	No	No	No	No
Database management system	Seed, Relgraf	Seed, Relgraf	Seed, Relgraf	Seed, Relgraf
Principal industry application	Computation-intensive applications	Computation-intensive applications	Computation-intensive applications	Computation-intensive applications
Other packages	Graphics	Graphics	Graphics	Graphics
PRICING & AVAILABILITY				
Basic system configuration and price	CPU with 1MB memory and 32KB cache; floppy disk; 80MB disk; 45 ips tape; 300 lpm band printer; CRT; MPX-32 operating system; Fortran 77+: $161,750	CPU/Internal Processing Unit (IPU) with 1MB memory and 64KB cache; floppy disk; 80MB disk; 45 ips tape; 300 lpm band printer; CRT; MPX-32 operating system; Fortran 77+: $206,750	CPU with 2MB memory and 32KB cache; dual floppy disk; 80MB disk; 45 ips tape; 300 lpm band printer; CRT; MPX-32 operating system; Fortran-77+: $272,000	CPU/IPU with 2MB memory and 64KB cache; dual floppy disk; 80MB disk; 45 ips tape; 300 lpm band printer; CRT; MPX-32 operating system; Fortran 77+: $412,000
Monthly maintenance of basic configuration	$1,468	$1,864	$1,997	$2,953
Date of first delivery	June 1982	June 1982	May 1981	June 1982
Number installed to date	24	7	261	30
COMMENTS	Cache memory has separate banks for data and instructions.	Three-board CPU	Features ECL 10K logic and cache memory up to 64K bytes.	Features CPU/IPU combination with up to 128K bytes of cache memory.

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MANUFACTURER & MODEL	Harris Corporation Computer Systems Div. H600	Harris Corporation Computer Systems Div. H700	Harris Corporation Computer Systems Div. H800	Harris Corporation Computer Systems Div. H1000
WORD LENGTH	48 bits	48 bits	48 bits	48 bits
MAIN MEMORY	768KB-4.5MB	384KB-12MB	768KB-12MB	1.5MB-12MB
DISK STORAGE CAPACITY	80MB-2.4GB	80MB-28GB	80MB-28GB	80MB-26GB
NO. WORKSTATIONS SUPPORTED	32	128	128	192
PRICE RANGE	From $38,000	$49,000-$62,000	$139,000-170,000	$250,000
TARGET MARKET	OEM	Engineering/scientific	Engineering/scientific	Engineering/scientific
CENTRAL PROCESSOR				
No. of directly addressable bytes	12M	12M	12M	12M
Virtual memory	48MB	48MB	48MB	48MB
Hardware floating point	SP, DP	SP, DP	SP, DP	SP, DP, TP, QP
Battery backup	Optional	Optional	Optional	Optional
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	300	300	180	75
MIPS	.7	.8	1.5	4
16-/32-bit compatibility	48-bit only	48-bit only	48-bit only	48-bit only
MAIN STORAGE				
Bytes fetched per cycle	6	6	6	6
Memory access	100M bps	100M bps	100M bps	100M bps
Cycle/access time, nanoseconds	335/250	335/250	335/250	335/250
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	384KB, 768KB, 1.5MB	384KB, 768KB, 1.5MB	768KB, 1.5MB	1.5MB
Cache memory, bytes	6K (optional)	6K (optional)	6K	6K
INPUT/OUTPUT CONTROL				
No. of I/O channels	5	24	31	31
Data transfer rate	19 MB/sec.	19 MB/sec.	19 MB/sec.	19 MB/sec.
COMMUNICATIONS				
Max. number of lines	32	224	224	224
Synchronous	Std.; 56,000 bps	Std.; 56,000 bps	Std.; 56,000 bps	Std.; 56,000 bps
Asynchronous	Std.; 20,000 bps	Std.; 20,000 bps	Std.; 20,000 bps	Std.; 20,000 bps
Protocols supported	CDC 200 UT, 2780/3780, Hasp, Univac 1004, X.25	Same as 600, plus GRTS	CDC, 2780/3780, Hasp, Univac, X.25	CDC 200 UT, 2780/3780, Univac, Hasp, X.25
Type of LAN supported	Ethernet, SNA, RJE	Ethernet, SNA, RJE	Ethernet, SNA, RJE	Ethernet, SNA, RJE
RJE terminals emulated	2780/3780, Hsp, CDC, Un.	Same as 600, plus GRTS	2780/3780, Hsp, CDC, Un.	2780/3780, Hsp, CDC, Un.
IBM 3270 emulation	Yes	Yes	Yes	Yes
PERIPHERAL EQUIPMENT				
Disks supported	Fixed & removable: 10MB-675MB	Fixed & removable: 10MB-675MB	Fixed & removable: 10MB-675MB	Fixed & removable: 10MB-675MB
Serial printers	165 cps	165 cps	165 cps	165 cps
Letter-quality printers	35/55 cps	35/55 cps	35/55 cps	35/55 cps
Line printers	300-1200 lpm	300-1200 lpm	300-1200 lpm	300-1200 lpm
Reel-to-reel tape drives	6250/1600 bpi	6250/1600 bpi	6250/1600 bpi	6250/1600 bpi
Streaming tape drives	PE, 100 ips	PE, 100 ips	PE, 100 ips	PE, 100 ips
Cassette/cartridge tape drives	Not applicable	Not applicable	Not applicable	Not applicable
Other peripherals supported	Card equip., interactive terms., print./plotters	Card equip., interactive terms., print./plotters	Card equip., interactive terms., print./plotters	Card equip., interactive terms., print./plotters
SOFTWARE				
Assembler	Harris Macro assembler	Harris Macro assembler	Harris Macro assembler	Harris Macro assembler
Compilers	Fortran 66, Fortran 77, Cobol, RPG II, Pascal, C	Fortran 66, Fortran 77, Cobol, RPG II, Pascal, C	Fortran 66, Fortran 77, Cobol, RPG II, Pascal, C	Fortran 66, Fortran 77, Cobol, RPG II, Pascal, C
Operating system	Batch, real-time	Batch, real-time	Batch, real-time	Batch, real-time
Operating sys. implemented in firmware	No	No	No	No
Database management system	Total, T-ask, AZ-7	Same as 600, Info, Orac.	Total, Oracle, Info	Total, Oracle, Info
Principal industry application	Engineering/scientific	Engineering/scientific	Engineering/scientific	Engineering/scientific
Other packages	CAD/CAM, software development	CAD/CAM, software development	CAD/CAM, software development	CAD/CAM, software development
PRICING & AVAILABILITY				
Basic system configuration and price	CPU; 1.5 MB memory subsystem; 12MB of virtual memory; Communications Network Processor (CNP) with 2 ports; 115V, 60Hz or 230V, 50Hz power; operating system: $44,900	CPU; 1.5MB memory subsystem; 48MB of virtual memory; CNP with 2 ports; power distribution unit; Opcom terminal; operating system: $62,000	CPU; 1.5MB memory subsystem; 6KB cache; 48MB virt. memory; floating point proc.; maintenance aid proc.; Opcom/maint. aid term.; power distrib. unit; 2-port CNP; op. sys.: $145,000	CPU; 1.5MB memory subsystem; 6KB cache; line frequency clock and interval timer; Opcom/maintenance aid processor terminal; CNP with operator's console; op. sys.: $250,000
Monthly maintenance of basic configuration	Contact vendor for options.	Contact vendor for options.	Contact vendor for options.	Contact vendor for options.
Date of first delivery	Third quarter 1983	Second quarter 1983	First quarter 1980	First quarter 1984
Number installed to date	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
COMMENTS	Complete OEM computer with power supply and fans; ready to plug in.	Modular growth capability.		Based on high-speed ECL circuitry.

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MANUFACTURER & MODEL	Hewlett-Packard Fort Collins Sys. Div. HP9000 Model 520	Hewlett-Packard Fort Collins Sys. Div. HP9000 Models 530 and 540	Honeywell Information Systems, Inc. DPS 6/95	IBM 4321
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	512KB-2.5MB	512KB-2.5MB	2MB-16MB	1MB
DISK STORAGE CAPACITY	270KB-3.5GB	270KB-3.5GB	67MB-4GB	Depends on configuration
NO. WORKSTATIONS SUPPORTED	16 (6 typ.)	16 (6 typ.)	128	Depends on configuration
PRICE RANGE	$35,000-$250,000	$59,000-$250,000	From $105,000	From $64,000
TARGET MARKET	Engineering/scientific	Engineering/scientific	General business	Engineering/scientific, commercial
CENTRAL PROCESSOR				
No. of directly addressable bytes	512M	512M	16M	Not supplied by vendor
Virtual memory	512MB	512MB	No	16MB
Hardware floating point	SP, DP	SP, DP	SP, DP	SP, DP
Battery backup	None	None	Optional	Not supplied by vendor
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	55	55	125	300-1600
MIPS	1 per CPU board	1 per CPU board	Not supplied by vendor	Not supplied by vendor
16-/32-bit compatibility	Not applicable	Not applicable	Direct	Not supplied by vendor
MAIN STORAGE				
Bytes fetched per cycle	4	4	4	4
Memory access	288M bps	288M bps	Not supplied by vendor	Not supplied by vendor
Cycle/access time, nanoseconds	302; 110 pipelined	302; 110 pipelined	500	Not supplied by vendor
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	256KB	256KB	4MB	None
Cache memory, bytes	None	None	8K	None
INPUT/OUTPUT CONTROL				
No. of I/O channels	1-3 (4-20 slots)	1-3 (7-23 slots)	24	2
Data transfer rate	5MB/sec.	5MB/sec.	19.2KB/sec.	Not supplied by vendor
COMMUNICATIONS				
Max. number of lines	144 Async	168 Async	128	Not supplied by vendor
Synchronous	Opt; 56K bps	Opt; 56K bps	92 opt.; 19,200 bps	Std.; to 9600 bps
Asynchronous	Opt; 19.2K bps	Opt; 19.2K bps	4 std.; 92 opt; 9600 bps	Not supplied by vendor
Protocols supported	IBM 2780/3780, UUCP	IBM 2780/3780, UUCP	SDLC, HDLC, SNA, DSA	BSC, SDLC, 3270
Type of LAN supported	Ethernet 1.0	Ethernet 1.0	None	Not supplied by vendor
RJE terminals emulated	IBM 2780/3780	IBM 2780/3780	IBM 2780/3780	Not supplied by vendor
IBM 3270 emulation	No	No	Yes	Yes
PERIPHERAL EQUIPMENT				
Disks supported	Fixed & removable: 270KB-404MB	Fixed & removable: 270KB-404MB	Fixed: 67MB, 256MB; Removable: 80MB	Fixed & removable: 129MB-1.26GB
Serial printers	180 cps	180 cps	100/400 cps	80 cps-450 cps
Letter-quality printers	25/40 cps	25/40 cps	35/55 cps	Not applicable
Line printers	400/480 lpm	400/480 lpm	300/600/900/1200 lpm	230 lpm - 20,040 lpm
Reel-to-reel tape drives	1600 bpi, 45 ips	1600 bpi, 45 ips	800/1600/6250 bpi	556-6250 bpi, 75-200 ips
Streaming tape drives	None	None	Not applicable	200-1600 bpi/12.5-200ips
Cassette/cartridge tape drives	60 ips	60 ips	Not applicable	Not supplied by vendor
Other peripherals supported	Term., Graphics displays, plotters, tablet	Term., Graphics displays, plotters, tablet	650KB diskette; card readers; doc. handlers	Card equipment
SOFTWARE				
Assembler	Not supported	Not supported	Assembler	Not supplied by vendor
Compilers	Basic, C, Fortran 77, Pascal	C, Fortran 77, Pascal	Cobol, Fortran, Basic, Pascal, RPG	Fortran, Cobol, PL/1, RPG II
Operating system	Multiprogramming	Multiprogramming	Real-time	Batch, real-time
Operating sys. implemented in firmware	Partially	Partially	No	Not supplied by vendor
Database management system	Image, Sir, Mistress	Image, Sir, Mistress	DM6	Not supplied by vendor
Principal industry application	EE design	EE design	Manufacturing, distribution, pharmacy	Not supplied by vendor
Other packages	ME, software engineering	ME, software engineering	Office automation, accounting	Not supplied by vendor
PRICING & AVAILABILITY				
Basic system configuration and price	Integrated workstation with color graphics display, single CPU; 480 lpm thermal printer; 16MB disk with cartridge tape; HP-UX op. sys.; C, Fortran, and Pascal langs. : $49,400	Single CPU w/2.5MB memory; 65MB disk w/ cart. tape; 400 lpm impact printer; 1 alpha terminal; 3 graphics term.; HP-UX operating sys.; C, Fortran, and Pascal langs.: $97,151	CPU with: 2MB memory; 80MB disk; printer port; console; Multiple Device Controller; Commercial Instruction Processor; Scientific Instruction Processor; 4 workstation ports: $105,000	CPU, 1MB memory; 258MB disk; two 100 ips streaming tape drives; 650lpm printer; operator console: $130,516
Monthly maintenance of basic configuration	$193	$339	$642	$918.50
Date of first delivery	1st quarter 1983	1st quarter 1983	November 1983	March 1982
Number installed to date	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
COMMENTS	Also available with real-time, multi programming, single-user Basic language system. Can support 3 CPU boards.	Can support 3 CPU boards.		

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MANUFACTURER & MODEL	IBM 4331	IBM 4361	IBM 4341	IBM 4381
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	1MB-4MB	2MB-12MB	1MB-16MB	4MB-16MB
DISK STORAGE CAPACITY	Depends on configuration	Depends on configuration	Depends on configuration	Depends on configuration
NO. WORKSTATIONS SUPPORTED	Depends on configuration	Depends on configuration	Depends on configuration	Depends on configuration
PRICE RANGE	From $82,420	From $150,000	From $81,000	From $370,000
TARGET MARKET	Engineering/scientific, commercial	Engineering/scientific, commercial	Engineering/scientific, commercial	Engineering/scientific
CENTRAL PROCESSOR				
No. of directly addressable bytes	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Virtual memory	16MB	16MB	16MB	16MB
Hardware floating point	SP, DP	SP, DP	SP, DP	SP, DP
Battery backup	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	200-1600	100	115-300	68
MIPS	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
16-/32-bit compatibility	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
MAIN STORAGE				
Bytes fetched per cycle	4	4	8	Not supplied by vendor
Memory access	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Cycle/access time, nanoseconds	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	1MB	2MB, 4MB	1MB-4MB	4MB
Cache memory, bytes	4K	8K-16K	2K-16K	8K-32K
INPUT/OUTPUT CONTROL				
No. of I/O channels	2	4-5	6	12
Data transfer rate	36KB-1.86MB/sec.	186K bps-500KB/sec.	16KB-3MB/sec.	2MB-3MB/sec.
COMMUNICATIONS				
Max. number of lines	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Synchronous	Std.; to 56K bps	Std.; to 56K bps	Opt.; to 56K bps	Opt.; to 56K bps
Asynchronous	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Protocols supported	BSC, SDLC, X.25, 3270	BSC, SDLC, X.25, 3270	BSC, SDLC, X.25, 3270	BSC, SDLC, X.25, 3270
Type of LAN supported	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
RJE terminals emulated	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
IBM 3270 emulation	Yes	Yes	Yes	Yes
PERIPHERAL EQUIPMENT				
Disks supported	Fixed & removable: 129MB-1.26GB	Fixed & removable: 129MB-1.26GB	Fixed & removable: 129MB-1.26GB	Fixed & removable: 129MB-1.26GB
Serial printers	80 cps-450 cps	80 cps-450 cps	80 cps-450 cps	80 cps-450 cps
Letter-quality printers	Not applicable	Not applicable	Not applicable	Not applicable
Line printers	230 lpm - 20,040 lpm	230 lpm - 20,040 lpm	230 lpm - 20,040 lpm	230 lpm - 20,040 lpm
Reel-to-reel tape drives	556-6250 bpi, 75-200 ips	556-6250 bpi, 75-200 ips	556-6250 bpi, 75-200 ips	556-6250 bpi, 75-200 ips
Streaming tape drives	200-1600 bpi/12.5-200ips	200-1600 bpi/12.5-200ips	200-1600 bpi/12.5-200ips	200-1600 bpi/12.5-200ips
Cassette/cartridge tape drives	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Other peripherals supported	Card equipment	Card equipment	Card equipment	Card equipment
SOFTWARE				
Assembler	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Compilers	Fortran, Cobol, PL/1, RPG II	Fortran, Cobol, PL/1, RPG II	Fortran, Cobol, PL/1, RPG II	Fortran, Cobol, PL/1, RPG II
Operating system	Time-sharing	Time-sharing	Time-sharing	Time-sharing
Operating sys. implemented in firmware	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Database management system	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Principal industry application	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Other packages	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
PRICING & AVAILABILITY				
Basic system configuration and price	CPU, 2MB memory; 258MB disk; two 100 ips streaming tape drives; two 650 lpm printers; card read punch; 2 operator consoles: $216,210	CPU, 4MB memory; 258MB disk; four 100 ips streaming tape drives; card read punch; two 650 lpm printers; 2 operator consoles: $362,910	CPU, 12MB memory; 2 operator consoles; 120 cps printer; 2.5GB disk; eight 75 ips tape units; card read punch; two 1200 lpm printers: $892,100	CPU, 16MB memory; 2 color consoles; 120 cps color printer; 2.5GB disk; eight 75 ips tape units; card read punch; three 1200 lpm printers: $1,082,560
Monthly maintenance of basic configuration	$1,805	$3,235	$4,837.50	$4,929
Date of first delivery	1980-1982	1984	1979-1983	1984
Number installed to date	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
COMMENTS	Comprises Model Groups 11 and 2.	Comprises Model Groups 4 and 5.	Comprises Model Groups 9, 10, 1, 11, 2, and 12.	Comprises Model Groups 1 and 2.

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MANUFACTURER & MODEL	MAI/Basic Four Information Systems MAI 8000	Microdata Corporation Sequel	Modular Computer Systems, Inc. (Modcomp) Classic 32/85	NCR Corporation NCR 9300
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	1MB-8MB	512KB-4MB	2MB-64MB	1MB-4MB
DISK STORAGE CAPACITY	144MB-2.28GB	128MB-1GB	13MB-4.8GB	81MB-5GB
NO. WORKSTATIONS SUPPORTED	96	127	Over 256	42
PRICE RANGE	$100,000-$500,000	From $136,000	$150,000-$350,000	$50,000-$400,000
TARGET MARKET	General business	General business	Real-time, sci., factory autom., process contr.	General business
CENTRAL PROCESSOR				
No. of directly addressable bytes	16M	16M	64M	4M
Virtual memory	2.28GB	2GB	1GB	128MB
Hardware floating point	Single precision	Not applicable	SP, DP	Double precision
Battery backup	Standard	Standard	Optional	Optional
Real-time clock or timer	Standard	Standard	Standard	Not supplied by vendor
CPU cycle time, nanoseconds	160	150	100	150
MIPS	1.2	Not supplied by vendor	Not supplied by vendor	.33
16-/32-bit compatibility	32-bit only	No	Direct	Direct
MAIN STORAGE				
Bytes fetched per cycle	4	4	4	4
Memory access	600M bps	53M bps	Not supplied by vendor	Not supplied by vendor
Cycle/access time, nanoseconds	160	300	400	450
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	.5MB	1MB	2M	1MB
Cache memory, bytes	None	None	64K	None
INPUT/OUTPUT CONTROL				
No. of I/O channels	2	16	64	50
Data transfer rate	100MB/sec.	Not supplied by vendor	8MB/sec.	2MB/sec.
COMMUNICATIONS				
Max. number of lines	96 Asynchronous	48	Over 256	42
Synchronous	Standard	Standard	Opt; 250K bps	Std.; 9600 bps
Asynchronous	Standard	Standard	Opt; 19.2K bps	Std.; 19,200 bps
Protocols supported	IBM 2770/3770, 2780/3780	IBM 2780/3780, 2770, 3741, Hasp	IBM 2780/3780, X.25	IBM 2780/3780, SNA, ISO Async, DLC, X.25
Type of LAN supported	B4Net, SNA	None	None	None
RJE terminals emulated	2770/3770/2780/3780	2780/3780, 2770, 3741	IBM 2780/3780	IBM 2780/3780
IBM 3270 emulation	Yes	No	No	Yes
PERIPHERAL EQUIPMENT				
Disks supported	Fixed: 144MB; Removable: 75MB, 285MB	Winchester: 128MB-1GB	Fixed: 10MB, 67MB; Removable: 13.5MB-253MB	Fixed & removable: 27MB-135MB
Serial printers	160 cps	33/180 cps	Not supplied by vendor	120/275 cps
Letter-quality printers	45 cps	33 cps	Not applicable	33 cps
Line printers	150-1000 lpm	150/300/600/1200 lpm	300/600/1000 lpm	360/720/1130/1440 lpm
Reel-to-reel tape drives	175 ips	800/1600 bpi	800/1600 bpi; 75 ips	800/1600 bpi
Streaming tape drives	100 ips	100/50 ips-1600/3200 bpi	100 ips/25 ips; 1600 bpi	Start/stop; 45/200 ips
Cassette/cartridge tape drives	100 ips	Not applicable	Not supplied by vendor	15 ips
Other peripherals supported	High-speed data, RS-232-C I/O	Not applicable	1MB diskette	Card readers, floppy disks
SOFTWARE				
Assembler	None	Macro assembler	Macro assembler	Macro assembler
Compilers	Business Basic, Cobol	Basic	Cobol 74, Fortran 66, Fortran 77, Pascal, Coral 66	Cobol, Basic, Pascal
Operating system	Real-time, multi-tasking	Multi-tasking	Real-time	Multi-tasking
Operating sys. implemented in firmware	Fully	Partially	Partially	Partially
Database management system	Origin	Reality DBMS	Infinity	ITX/DBS
Principal industry application	General purpose interactive business	Manufacturing/dist., general accounting	Factory autom., metallurgy, power generation	General commercial and industrial
Other packages	Office automation, job cost, pharmacy, manufacturing	Office automation	Transaction processing (TSX)	Third-party
PRICING & AVAILABILITY				
Basic system configuration and price	CPU with 1.5MB memory; 288MB disk; 15 EVDT terminals; 300 lpm printer; mag. tape streamer: $108,450	CPU with 512KB memory; 128.7MB disk; 100/50 ips-1600/3200 bpi streaming tape drive; 8 serial ports; operating system: $136,150	CPU with 2MB memory; 67MB disk; tape unit; operating system: $226,500	CPU with 1MB memory; 81MB mass storage; 360 lpm band printer; 7 CRT workstations; operating system; Cobol: $60,780
Monthly maintenance of basic configuration	$723	Not applicable	$2,050	$391
Date of first delivery	October 1983	November 1981	May 1984	June 1983
Number installed to date	Not supplied by vendor	350	Not applicable	Not supplied by vendor
COMMENTS			Compatible with 16-bit Classic line.	Processor employs VLSI (Very Large Scale Integration) technology.

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MANUFACTURER & MODEL	Perkin-Elmer Corporation Data Systems Group 3205	Perkin-Elmer Corporation Data Systems Group 3210	Perkin-Elmer Corporation Data Systems Group 3230	Perkin-Elmer Corporation Data Systems Group 3250XP
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	512KB-4MB	512KB-4MB	1MB-16MB	2MB-16MB
DISK STORAGE CAPACITY	50MB-1.2GB	32MB-72GB	67MB-144GB	67MB-576GB
NO. WORKSTATIONS SUPPORTED	16	32	64	256
PRICE RANGE	$9,950-$40,000	$42,000-$51,000	$74,150-$81,000	$150,000-$218,000
TARGET MARKET	General commercial, scientific	General commercial, scientific	General commercial, scientific	General commercial, scientific
CENTRAL PROCESSOR				
No. of directly addressable bytes	4M	4M	16M	16M
Virtual memory	16MB	16MB	16MB	16MB
Hardware floating point	SP, DP	SP, DP	SP, DP	SP, DP
Battery backup	Optional	Standard	Standard	Standard
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
MIPS	.5	1	2	3
16-/32-bit compatibility	32-bit only	32-bit only	32-bit only	32-bit only
MAIN STORAGE				
Bytes fetched per cycle	4	4	16	16
Memory access	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Cycle/access time, nanoseconds	400	500	500	500
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	.5MB, 1MB	.5MB, 1MB, 2MB	1MB, 2MB	2MB
Cache memory, bytes	None	None	1K	8K
INPUT/OUTPUT CONTROL				
No. of I/O channels	32	1023	1023	1023
Data transfer rate	1.5MB/sec.	8MB/sec.	8MB/sec.	40MB/sec.
COMMUNICATIONS				
Max. number of lines	16	32	128	256
Synchronous	Std.; 19.2K bps	Opt.; 2M bps	Opt.; 2M bps	Opt.; 2M bps
Asynchronous	Std.; 19.2K bps	Std.; 19.2K bps	Std.; 19.2K bps	Std.; 19.2K bps
Protocols supported	ADCCP, SDLC, HDLC, Hasp, IBM 2780/3780, 3270	ADCCP, SDLC, HDLC, Hasp, IBM 2780/3780, 3270	ADCCP, SDLC, HDLC, Hasp, IBM 2780/3780, 3270	ADCCP, SDLC, HDLC, Hasp, IBM 2780/3780, 3270
Type of LAN supported	Ethernet	Ethernet	Ethernet	Ethernet
RJE terminals emulated	IBM 2780/3780, Hasp	IBM 2780/3780, Hasp	IBM 2780/3780, Hasp	IBM 2780/3780, Hasp
IBM 3270 emulation	Yes	Yes	Yes	Yes
PERIPHERAL EQUIPMENT				
Disks supported	Fixed & removable: 32MB-600MB	Fixed & removable: 32MB-600MB	Fixed & removable: 32MB-600MB	Fixed & removable: 32MB-600MB
Serial printers	180 cps	180 cps	180 cps	180 cps
Letter-quality printers	55 cps	55 cps	55 cps	55 cps
Line printers	300/600/1200 lpm	300/600/1200 lpm	300/600/1200 lpm	300/600/1200 lpm
Reel-to-reel tape drives	800/1600/6250 bpi	800/1600/6250 bpi	800/1600/6250 bpi	800/1600/6250 bpi
Streaming tape drives	Not applicable	Not applicable	Not applicable	Not applicable
Cassette/cartridge tape drives	Not applicable	Not applicable	Not applicable	Not applicable
Other peripherals supported	Card reader	Card reader	Card reader	Card reader
SOFTWARE				
Assembler	CAL, CAL Macro	CAL, CAL Macro	CAL, CAL Macro	CAL, CAL Macro
Compilers	Cobol, Fortran, Basic, Pascal, RPG II, C	Cobol, Fortran, Basic, Pascal, RPG II, C	Cobol, Fortran, Basic, Pascal, RPG II, C	Cobol, Fortran, Basic, Pascal, RPG II, C
Operating system	Real-time, multi-tasking	Real-time, multi-tasking	Real-time, multi-tasking	Real-time, multi-tasking
Operating sys. implemented in firmware	No	No	No	No
Database management system	Reliance	Reliance	Reliance, DMS/32	Reliance, DMS/32
Principal industry application	General commercial, scientific	General commercial, scientific	General commercial, scientific	General commercial, scientific
Other packages	Third-party	Third-party	Third-party	Third-party
PRICING & AVAILABILITY				
Basic system configuration and price	CPU with 512KB memory; loader; communications controller; floating point; 50MB disk (25MB fixed/25MB removable); console: $24,950	CPU with 512KB memory; loader; communications controller; 32MB CDD disk; console: $42,000	CPU with 1MB memory; loader; communications controller; battery backup; console: $74,150	CPU with 2MB memory; writable control store; loader; communications controller; battery backup; console: $150,000
Monthly maintenance of basic configuration	$285	$455	$456	$924
Date of first delivery	December 1983	September 1981	March 1981	July 1983
Number installed to date	Not applicable	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
COMMENTS	Can be used in fault-tolerant dual processor configuration.	Can be used in fault-tolerant dual processor configuration.	Can be used in fault-tolerant dual processor configuration.	Can be used in fault-tolerant dual processor configuration.

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MANUFACTURER & MODEL	Perkin-Elmer Corporation Data Systems Group 3200MPS	Prime Computer, Inc. 2250	Prime Computer, Inc. 250-II	Prime Computer, Inc. 450-II
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	2MB-16MB	512KB-4MB	512KB-4MB	1MB-4MB
DISK STORAGE CAPACITY	67MB-576GB	68MB-632MB	64MB-5GB	160MB-5GB
NO. WORKSTATIONS SUPPORTED	256	32	32	64
PRICE RANGE	$185,000-$342,000	From $39,900	From $70,500	From $107,500
TARGET MARKET	General commercial, scientific	Eng./sci., off. autom., distr. d.p.	Eng./sci., off. autom., distr. d.p.	Eng./sci., off. autom., distr. d.p.
CENTRAL PROCESSOR				
No. of directly addressable bytes	16M	64K	64K	64K
Virtual memory	16MB	32MB	32MB	32MB
Hardware floating point	SP, DP	SP, DP	SP, DP	SP, DP
Battery backup	Standard	Optional	Optional	Optional
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
MIPS	5-21	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
16-/32-bit compatibility	32-bit only	Direct	Direct	Direct
MAIN STORAGE				
Bytes fetched per cycle	16	4	4	4
Memory access	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Cycle/access time, nanoseconds	500	230	Not supplied by vendor	Not supplied by vendor
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	2MB	256KB, 512KB, 1MB	256KB, 512KB, 1MB	256KB, 512KB, 1MB
Cache memory, bytes	8K	2K	2K	8K
INPUT/OUTPUT CONTROL				
No. of I/O channels	1023	32	32	32
Data transfer rate	40MB/sec.	2.5MB/sec.	2.5MB/sec.	Not supplied by vendor
COMMUNICATIONS				
Max. number of lines	256	9	40	Not supplied by vendor
Synchronous	Opt.; 2M bps	Std.; to 56K bps	Std.; to 56K bps	Std.; to 56K bps
Asynchronous	Std.; 19.2K bps	Std., to 19.2K bps	Std., to 19.2K bps	Std., to 19.2K bps
Protocols supported	ADCCP, SDLC, HDLC, Hasp, IBM 2780/3780, 3270	Hasp, 2780/3780, HDLC, X.25, SNA	Hasp, 2780/3780, HDLC, X.25, SNA	Hasp, 2780/3780, HDLC, X.25, SNA
Type of LAN supported	Ethernet	Primenet	Primenet	Primenet
RJE terminals emulated	IBM 2780/3780, Hasp	IBM 2780/3780, CDC200 UT	IBM 2780/3780, CDC200 UT	IBM 2780/3780, CDC200 UT
IBM 3270 emulation	Yes	Yes	Yes	Yes
PERIPHERAL EQUIPMENT				
Disks supported	Fixed & removable: 32MB-600MB	Fixed: 62MB, 144MB	Fixed & removable: 61.6MB-630MB	Fixed & removable: 61.6MB-630MB
Serial printers	180 cps	200 cps	200 cps	200 cps
Letter-quality printers	55 cps	55 cps	55 cps	55 cps
Line printers	300/600/1200 lpm	200-1000 lpm	200-1000 lpm	200-1000 lpm
Reel-to-reel tape drives	800/1600/6250 bpi	Not applicable	25K-469K bpi, 45-75 ips	25K-469K bpi, 45-75 ips
Streaming tape drives	Not applicable	25/50/100 ips	Not applicable	Not applicable
Cassette/cartridge tape drives	Not applicable	6400 bpi, 30 ips	6400 bpi, 30 ips	6400 bpi, 30 ips
Other peripherals supported	Card reader	Graphics workstations	Graphics workstations	Graphics workstations
SOFTWARE				
Assembler	CAL, CAL Macro	Macro assembler	Macro assembler	Macro assembler
Compilers	Cobol, Fortran, Basic, Pascal, RPG II, C	Basic, C, Cobol 74, Fortran, Fortran 77, PL/1, RPG II, Pascal	Basic, C, Cobol 74, Fortran, Fortran 77, PL/1, RPG II, Pascal	Basic, C, Cobol 74, Fortran, Fortran 77, PL/1, RPG II, Pascal
Operating system	Real-time, multi-tasking	Batch, real-time	Batch, real-time	Batch, real-time
Operating sys. implemented in firmware	No	Partially	Partially	Partially
Database management system	Reliance, DMS/32	DBMS	DBMS	DBMS
Principal industry application	General commercial, scientific	CAD/CAM, office automation	CAD/CAM, office automation	CAD/CAM, office automation
Other packages	Third-party	Third-party	Third-party	Third-party
PRICING & AVAILABILITY				
Basic system configuration and price	CPU with 2MB memory; Auxiliary Processing Unit (APU); floating point processor; writable control store; loader; communications controller; console: $185,000	CPU with 512KB memory; 68MB fixed disk; 15MB cartridge tape subsystem; 55 cps letter-quality printer; 2 workstations: $44,245	CPU with 512KB memory; 64MB cartridge disk; 200 lpm printer; 4 workstations: $83,380	CPU with 1MB memory; two 80MB disk subsystems; 450 lpm printer; 8 workstations: $133,760
Monthly maintenance of basic configuration	$1,422	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Date of first delivery	December 1982	September 1982	2nd quarter 1981	March 1982
Number installed to date	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
COMMENTS	Can be used in fault-tolerant dual processor configuration.			

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MANUFACTURER & MODEL	Prime Computer, Inc. 550-II	Prime Computer, Inc. 750	Prime Computer, Inc. 850	Prime Computer, Inc. 9950
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	1MB-4MB	1MB-8MB	2MB-8MB	4MB-16MB
DISK STORAGE CAPACITY	160MB-5GB	160MB-5GB	160MB-5GB	300MB-5GB
NO. WORKSTATIONS SUPPORTED	64	96	128	128
PRICE RANGE	From $107,500	From $197,000	From $274,500	From $393,500
TARGET MARKET	Eng./sci., off. autom., distr. d.p.	Eng./sci., off. autom., distr. d.p.	Eng./sci., off. autom., distr. d.p.	Eng./sci., off. autom., distr. d.p.
CENTRAL PROCESSOR				
No. of directly addressable bytes	64K	64K	64K	64K
Virtual memory	32MB	32MB	32MB	32MB
Hardware floating point	SP, DP	SP, DP	SP, DP	QP
Battery backup	Optional	Optional	Optional	Optional
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
MIPS	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
16-/32-bit compatibility	Direct	Direct	Direct	Direct
MAIN STORAGE				
Bytes fetched per cycle	4	8	8	8
Memory access	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	84
Cycle/access time, nanoseconds	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	256KB, 512KB, 1MB	256KB, 512KB, 1MB	256KB, 512KB, 1MB	256KB, 512KB, 1MB, 2MB
Cache memory, bytes	8K	16K	32K	16K
INPUT/OUTPUT CONTROL				
No. of I/O channels	32	32	32	32
Data transfer rate	2.5MB/sec.	8MB/sec.	8MB/sec.	7MB/sec.
COMMUNICATIONS				
Max. number of lines	72	104	136	Not supplied by vendor
Synchronous	Std.; to 56K bps	Std.; to 56K bps	Std.; to 56K bps	Std.; to 56K bps
Asynchronous	Std., to 19.2K bps	Std., to 19.2K bps	Std., to 19.2K bps	Std., to 19.2K bps
Protocols supported	Hasp, 2780/3780, HDLC, X.25, SNA	Hasp, 2780/3780, HDLC, X.25, SNA	Hasp, 2780/3780, HDLC, X.25, SNA	Hasp, 2780/3780, HDLC, X.25, SNA
Type of LAN supported	Primenet	Primenet	Primenet	Primenet
RJE terminals emulated	IBM 2780/3780, CDC200 UT	IBM 2780/3780, CDC200 UT	IBM 2780/3780, CDC200 UT	IBM 2780/3780, CDC200 UT
IBM 3270 emulation	Yes	Yes	Yes	Yes
PERIPHERAL EQUIPMENT				
Disks supported	Fixed & removable: 61.6MB-630MB	Fixed & removable: 61.6MB-630MB	Fixed & removable: 61.6MB-630MB	Fixed & removable: 61.6MB-630MB
Serial printers	200 cps	200 cps	200 cps	200 cps
Letter-quality printers	55 cps	55 cps	55 cps	55 cps
Line printers	200-1000 lpm	200-1000 lpm	200-1000 lpm	200-1000 lpm
Reel-to-reel tape drives	25K-469K bpi, 45-75 ips	25K-469K bpi, 45-75 ips	25K-469K bpi, 45-75 ips	25K-469K bpi, 45-75 ips
Streaming tape drives	Not applicable	Not applicable	Not applicable	Not applicable
Cassette/cartridge tape drives	6400 bpi, 30 ips	6400 bpi, 30 ips	6400 bpi, 30 ips	6400 bpi, 30 ips
Other peripherals supported	Graphics workstations	Graphics workstations	Graphics workstations	Graphics workstations
SOFTWARE				
Assembler	Macro assembler	Macro assembler	Macro assembler	Macro assembler
Compilers	Basic, C, Cobol 74, Fortran, Fortran 77, PL/1, RPG II, Pascal	Basic, C, Cobol 74, Fortran, Fortran 77, PL/1, RPG II, Pascal	Basic, C, Cobol 74, Fortran, Fortran 77, PL/1, RPG II, Pascal	Basic, C, Cobol 74, Fortran, Fortran 77, PL/1, RPG II, Pascal
Operating system	Batch, real-time	Batch, real-time	Batch, real-time	Batch, real-time
Operating sys. implemented in firmware	Partially	Partially	Partially	Partially
Database management system	DBMS	DBMS	DBMS	DBMS
Principal industry application	CAD/CAM, office automation	CAD/CAM, office automation	CAD/CAM, office automation	CAD/CAM, office automation
Other packages	Third-party	Third-party	Third-party	Third-party
PRICING & AVAILABILITY				
Basic system configuration and price	CPU with 1MB memory; two 80MB disk subsystems; two 800 bpi/45 ips tape drives; 450 lpm printer; 12 workstations: $176,140	CPU with 1 MB memory; 160MB fixed disk; 800/1600 bpi, 75 ips tape drive; 750 lpm printer; 55 cps letter-quality printer; 12 workstations: $242,890	CPU with 2MB memory; two 160MB fixed disk drives; four 800/1600 bpi, 75 ips tape drives; 1000 lpm printer; 55 cps letter-quality printer; 24 workstations: $420,530	CPU, 4 MB memory; 300MB disk subsystem; 630MB disk system; four 800/1600 bpi, 75 ips tape drives; 1000 lpm printer; two 55 cps letter-qual. printers; 32 workstations: $570,040
Monthly maintenance of basic configuration	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
Date of first delivery	2nd quarter 1981	1979	2nd quarter 1981	August 1983
Number installed to date	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor
COMMENTS				

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MANUFACTURER & MODEL	Pyramid Technology Corporation Pyramid 90x	Stratus Computer, Inc. Stratus/32	Tandem Computers, Inc. NonStop TXP-2 Processor System	Tandem Computers, Inc. NonStop TXP-16 Processor System
WORD LENGTH	32 bits	32 bits	32 bits	32 bits
MAIN MEMORY	1MB-16MB	2MB-8MB per module	4MB-16MB	32MB-128MB
DISK STORAGE CAPACITY	450MB-over 3.6GB	60MB-7.2GB per module	Over 8GB	Over 64GB
NO. WORKSTATIONS SUPPORTED	128	128 per module	No set limit	No set limit
PRICE RANGE	$100,000-$300,000	From $140,000	From $246,775	From $1,700,000
TARGET MARKET	System bldrs., universities, prog. dev., autom.	Transaction processing	High-volume on-line transaction processing	High-volume on-line transaction processing
CENTRAL PROCESSOR				
No. of directly addressable bytes	16M	8M	32M	256M
Virtual memory	4.3GB	16MB (× 255 users)	2GB	16GB
Hardware floating point	Opt.; SP, DP	None	SP, DP	SP, DP
Battery backup	None	Standard	Standard	Standard
Real-time clock or timer	Standard	Standard	Standard	Standard
CPU cycle time, nanoseconds	125	125	83.3	83.3
MIPS	Not applicable	.9	4	32
16-/32-bit compatibility	32-bit only	32-bit only	Direct	Direct
MAIN STORAGE				
Bytes fetched per cycle	4	2	8 (per processor)	8 (per processor)
Memory access	128M bps	128M bps	128M bps	128M bps
Cycle/access time, nanoseconds	Not supplied by vendor	125/375	116	116
Storage protection	Standard	Standard	Standard	Standard
Increment size, bytes	1MB	2MB	2MB	2MB
Cache memory, bytes	4KB instr.; 32KB data	None	128K	1GB
INPUT/OUTPUT CONTROL				
No. of I/O channels	Not supplied by vendor	14	2	16
Data transfer rate	32MB/sec.	16MB/sec.	5MB/sec.	5MB/sec.
COMMUNICATIONS				
Max. number of lines	128	64/module; 2048/system	252	1792
Synchronous	Not applicable	Std.; to 56K bps	Opt.; 56K bps	Opt.; 56K bps
Asynchronous	Std.; 9600 bps	Std.; to 19.2K bps	Opt.; 19.2K bps	Opt.; 19.2K bps
Protocols supported	RS-232, TCP/IP, BSD 4.2, RFC, ARPA	Async, BSC, Sync, X.25, SDLC, HDLC, X.29, 3270	ADCCP, HDLC, SDLC, 2780/3780, 3270, SNA	ADCCP, HDLC, SDLC, 2780/3780, 3270, SNA
Type of LAN supported	Ethernet, UUCP	Stratalink	Hyperchannel, Fox	Hyperchannel, Fox
RJE terminals emulated	None	IBM 2780/3780, Hasp	IBM 2780/3780	IBM 2780/3780
IBM 3270 emulation	No	Yes	Yes	Yes
PERIPHERAL EQUIPMENT				
Disks supported	Winchester: 75MB, 150MB, 450MB	Winchester: 30MB-448MB; Removable: 287MB	Winchester: 128MB-540MB; Removable: 240MB	Winchester: 128MB-540MB; Removable: 240MB
Serial printers	Not supplied by vendor	Not supplied by vendor	340 cps	340 cps
Letter-quality printers	55 cps	55 cps	55 cps	55 cps
Line printers	1500 lpm	300/600/900 lpm	600/900/1300 lpm	600/900/1300 lpm
Reel-to-reel tape drives	Not applicable	Not supplied by vendor	6250 bpi	6250 bpi
Streaming tape drives	100 ips	100 ips/25ips; 1600 bpi	None	None
Cassette/cartridge tape drives	Not applicable	Not supplied by vendor	None	None
Other peripherals supported	Not applicable	Not supplied by vendor	Fax, OCR, mag. stripe card & bar code rdrs.	Fax, OCR, mag. stripe card & bar code rdrs.
SOFTWARE				
Assembler	Not applicable	Assembler	None	None
Compilers	C, Pascal, Fortran	Cobol, Basic, Fortran, PL/1, Pascal, C	Basic, TAL, Cobol, Fortran	Basic, TAL, Cobol, Fortran
Operating system	Time-sharing	Time-sharing, batch	Multi-processing	Multi-processing
Operating sys. implemented in firmware	No	No	Partially	Partially
Database management system	Third-party	Oracle	Encompass	Encompass
Principal industry application	Technical, scientific, programming	Brokerage, banking, mfg., dist., comp. serv.	Factory & office autom., commer. (banking, etc.)	Factory & office autom., commer. (banking, etc.)
Other packages	Third-party	Third-party	Information deliv./presentation, transaction monitoring, off. autom.	Information deliv./presentation, transaction monitoring, off. autom.
PRICING & AVAILABILITY				
Basic system configuration and price	CPU with 2MB memory; system support processor; intelligent terminal processor; 9-track mag. tape; 450MB disk dr.; console VDT; power supply; C language; op. sys. lic.: $115,000	Duplexed module, 2MB memory; two 30MB disks; VDT; 55 cps letter-quality printer: $136,700	CPU with 4MB memory; cabinet; power supply; Operations and Service Processor (OSP); 45 ips tape drive & controller; Guardian operating system: $246,775	CPU with 32MB memory; cabinet; power supply; Operations and Service Processor (OSP); 45 ips tape drive & controller; Guardian operating system: $1,703,275
Monthly maintenance of basic configuration	$700	$460	Contact vendor	Contact vendor
Date of first delivery	October 1983	February 1982	November 1983	November 1983
Number installed to date	Not supplied by vendor	130	Not applicable	Not applicable
COMMENTS		Single module includes duplexed components and is fault-tolerant. A system can include up to 32 modules.	Can be interconnected with other systems into a worldwide network of up to 4,080 processors through Expand networking software.	Same interconnectability as TXP-2. Can be expanded to single system of 224 local processors, 1.8GB memory, 14MB cache and 896GB disk storage.

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MANUFACTURER & MODEL	Wang Laboratories, Inc. VS 85	Wang Laboratories, Inc. VS 90	Wang Laboratories, Inc. VS 100	
WORD LENGTH	32 bits	32 bits	32 bits	
MAIN MEMORY	1MB-4MB	1MB-4MB	1MB-8MB	
DISK STORAGE CAPACITY	90MB-5.1GB	90MB-5.1GB	90MB-10.2GB	
NO. WORKSTATIONS SUPPORTED	48	48	128	
PRICE RANGE	From $63,000	From $73,000	From $83,000	
TARGET MARKET	Commercial, distributed d.p.	Commercial, distributed d.p.	Commercial, distributed d.p.	
CENTRAL PROCESSOR				
No. of directly addressable bytes	4M	4M	8M	
Virtual memory	96MB	96MB	256MB	
Hardware floating point	SP, DP	SP, DP	SP, DP	
Battery backup	None	None	None	
Real-time clock or timer	Standard	Standard	Standard	
CPU cycle time, nanoseconds	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	
MIPS	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	
16-/32-bit compatibility	Direct	Direct	Direct	
MAIN STORAGE				
Bytes fetched per cycle	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	
Memory access	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	
Cycle/access time, nanoseconds	480	480	480	
Storage protection	Standard	Standard	Standard	
Increment size, bytes	1MB	1MB	1MB	
Cache memory, bytes	32K (optional)	None	32K	
INPUT/OUTPUT CONTROL				
No. of I/O channels	48	48	178	
Data transfer rate	16.6MB/sec.	16.6MB/sec.	16.6MB/sec.	
COMMUNICATIONS				
Max. number of lines	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	
Synchronous	Optional	Optional	Optional	
Asynchronous	Opt.; to 9600 bps	Opt.; to 9600 bps	Opt.; to 9600 bps	
Protocols supported	BSC, SNA, SDLC, Async, TTY, Hasp	BSC, SNA, SDLC, Async, TTY, Hasp	BSC, SNA, SDLC, Async, TTY, Hasp	
Type of LAN supported	Wangnet	Wangnet	Wangnet	
RJE terminals emulated	IBM 2780/3780, 3777	IBM 2780/3780, 3777	IBM 2780/3780, 3777	
IBM 3270 emulation	Yes	Yes	Yes	
PERIPHERAL EQUIPMENT				
Disks supported	Fixed & removable: 70MB-620MB	Fixed & removable: 70MB-620MB	Fixed & removable: 70MB-620MB	
Serial printers	40-222 cps	40-222 cps	40-222 cps	
Letter-quality printers	20-35 cps	20-35 cps	20-35 cps	
Line printers	250/600/1100 lpm	250/600/1100 lpm	250/600/1100 lpm	
Reel-to-reel tape drives	800-6250 bpi, 75 ips	800-6250 bpi, 75 ips	800-6250 bpi, 75 ips	
Streaming tape drives	Not applicable	Not applicable	Not applicable	
Cassette/cartridge tape drives	6400 bpi, 30 ips	6400 bpi, 30 ips	6400 bpi, 30 ips	
Other peripherals supported	Graphics stations, laser printers	Graphics stations, laser printers	Graphics stations, laser printers	
SOFTWARE				
Assembler	Assembler	Assembler	Assembler	
Compilers	Cobol, Fortran, Basic, RPG II, PL/1	Cobol, Fortran, Basic, RPG II, PL/1	Cobol, Fortran, Basic, RPG II, PL/1	
Operating system	Real-time, time-sharing	Real-time, time-sharing	Real-time, time-sharing	
Operating sys. implemented in firmware	Partially	Partially	Partially	
Database management system	Total, VS-DBMS	Total, VS-DBMS	Total, VS-DBMS	
Principal industry application	Office automation, word processing	Office automation, word processing	Office automation, word processing	
Other packages	General business, business graphics	General business, business graphics	General business, business graphics	
PRICING & AVAILABILITY				
Basic system configuration and price	CPU with 1MB memory; 90MB disk; 35 cps letter-quality printer; 2 workstations: $91,000	CPU with 1MB memory; two 75MB disk drives; 180 cps serial printer; 3 workstations: $113,500	CPU with 1MB memory; two 288MB disk drives; 600 lpm band printer; 35 cps letter-quality printer; 8 workstations: $168,500	
Monthly maintenance of basic configuration	$693	$794	$1,672	
Date of first delivery	4th quarter 1983	April 1982	December 1980	
Number installed to date	Not supplied by vendor	Not supplied by vendor	Not supplied by vendor	
COMMENTS	Without cache, supports only 32 workstations and maximum of 2.5GB disk storage.			